MACHAKOS COUNTY KCSE TRIAL AND PRACTICE EXAM 2015

Kenya Certificate of Secondary Education (K.C.S.E.)

121/1

MATHEMATICS

Paper 1

2½ hours

SECTION I (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Evaluate without using a calculator. (3 Marks)

$$\frac{\frac{5}{6} of \left(4\frac{1}{3} - 3\frac{5}{6}\right)}{\frac{5}{12} x \frac{3}{25} + 1\frac{5}{9} \div 2\frac{1}{3}}$$

2. Without using a calculator or mathematical tables simplify. (3 Marks)

$$\sqrt{\frac{0.504 \, x \, 14.3 \, x \, 910}{0.28 \, x \, 1.17 \, x \, 28.6 \, x \, 7}}$$

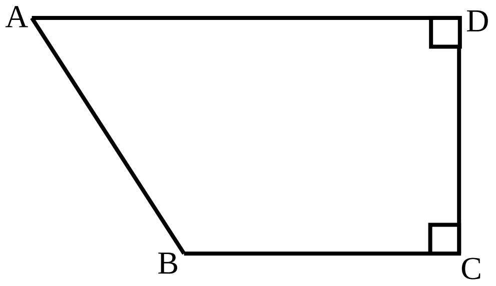
3. Find the value of x if (3 Marks)

$$\left(\frac{27}{8}\right)^{x+7} = \left(\frac{4}{9}\right)^{-3x}$$

4. Three sirens wail at intervals of thirty minutes, fifty minutes and thirty minutes. If they wail together at 7.18 a.m. on Monday, what time and day will they wail together? (3 Marks)

5. A two-digit number is such that the sum of the ones digit and the tens digit is 10. If the digits are reversed, the number exceeds the original number by 54. Find the number. (3 Marks)

6. The figure below shows quadrilateral ABCD in which AB = 6cm. BC = $\frac{1}{2}$CD, CD = DA and angle ADC = angle BCD = 90^0.



Calculate the area of the quadrilateral ABCD. (4 Marks)

7. The interior angle of a regular polygon is 108^0 larger than the exterior angle. How many sides has the polygon? (3 Marks)

8. A salesman is paid a salary of Sh. 10,000 per month. He is also paid a commission on sales above Sh. 100,000. In one month he sold goods worth Sh. 500,000. If his total earning that month was Sh. 56,000. Calculate the rate of commission. (3 Marks)

9. A cylinder of radius 14cm contains water. A metal solid cone of base radius 7cm and height 18cm is submerged into the water. Find the change in height of the water level in cylinder. (3 Marks)

10. Simplify the following. (3 Marks)

$$\frac{2x-4}{12-3x^2} - \frac{1}{3x+6}$$

11. A mother is now $2\frac{1}{2}$ times as old as her daughter Mary. Four years ago the ratio of their ages was 3:1. Find the present age of the mother. (3 Marks)

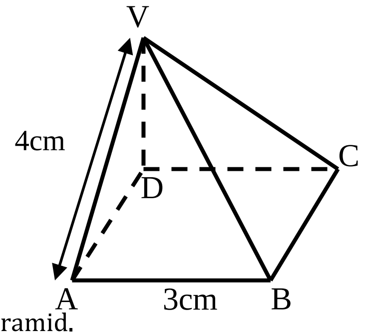
12. The line which joins the point A (3, k) and B (-2, 5) is parallel to the line whose equation is
5y + 2x – 7 = 0. Find the value of k. (3 Marks)

13. A Kenyan bank buys and sells foreign currencies at the exchange rates shown below.

	Buying (KShs.)	Selling (KShs.)
1 Uuro	147.86	148.00
1 US Dollar	74.22	74.50

An American arrived in Kenya with 20 000 Euros. He converted all the Euros to Kenya shillings at the bank. He spent KShs. 2,512,000 while in Kenya and converted the remaining Kenya shillings into US Dollars at the bank. Find the amount in Dollars that he received. (3 Marks)

14. The diagram below represents a right pyramid on a square base of side 3cm. The slant edge of the pyramid is 4cm.



(a) Draw a labelled net of the pyramid. (2 Marks)
(b) On the net drawn, measure the height of a triangular face from the top of the pyramid. (1 Mark)

15. Using logarithms tables only, evaluate. (4 Marks)

$\sqrt[3]{\frac{849.6 \, x \, 2.41}{3941}}$

16. Use reciprocal and square tables to evaluate, to 4 significant figures, the expression. (3 Marks)

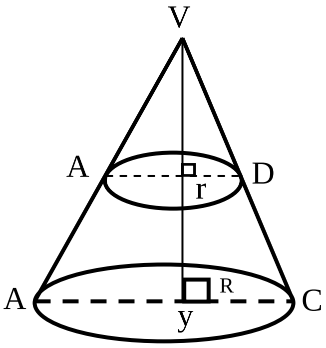
$\frac{1}{0.3654} - 4.151^2$

SECTION II (50 MARKS)

Answer only five questions in this section in the spaces provided.

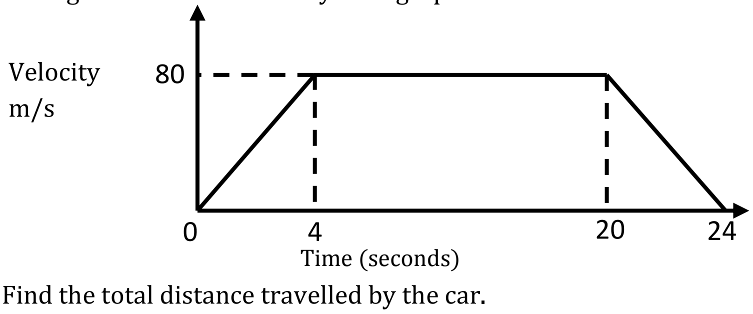
17. A group of people planned to contribute equally towards buying land at a price of Shs 180,000. However 3 members of the group withdrew from the project. As a result, each of the remaining members were to contribute KShs. 3000 more.
(a) Find the original number of members in the group. (6 Marks)
(b) How much would each person have contributed if the 3 people had not withdrawn. (2 Marks)
(c) Calculate the percentage increase in the contribution per person caused by the withdrawal. (2 Marks)

18. The figure below shows a cone from which a frustum is made. A plane parallel to the base cuts the cone two thirds way up the vertical height of the cone to form frustum ABCD. The top surface radius of the frustum is labelled r and the bottom radius R.



(a) Find the ratio r:R. (1 Mark)
(b) Given that r = 7cm, find R. (2 Marks)
(c) If the height VY of the original cone is 45cm. Calculate to the nearest whole number the volume of the frustum. (Take $\pi = \frac{22}{7}$) (4 Marks)
(d) The frustum represents a bucket which is used to fill a rectangular tank measuring 1.5m long, 1.2m wide and 80cm high with water. How many full buckets of water are required to fill the tank. (3 Marks)

19. (a) The figure below is a velocity time graph for a car.



(i) Find the total distance travelled by the car. (2 Marks)
(ii) Calculate the deceleration of the car. (2 Marks)
(b) A car left Nairobi towards Eldoret at 7.12 a.m. at an average speed of 90km/h. At 8.22 a.m, a bus left Eldoret for Nairobi at an average speed of 72km/hr. The distance between the two towns is 348km. Calculate:
(i) the time when the two vehicles met. (4 Marks)
(ii) the distance from Nairobi to the meeting place. (2 Marks)

20. The following distribution shows the marks obtained by 82 students in a Mathematics test.

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Frequency	3	18	13	14	17	12	5

(a) State the modal class. (1 Mark)

(b) Calculate to 2 decimal places:

(i) the mean mark (4 Marks)

(ii) the difference between the median and the mean marks. (5 Marks)

21. John bought 3 brands of tea; A, B and C. The cost price of the three brands were Sh. 25, Sh. 30 and Sh. 45 per kilogram respectively. He mixed the three brands in the ratio 5:2:1 respectively. After selling the mixture, he made a profit of 20%.

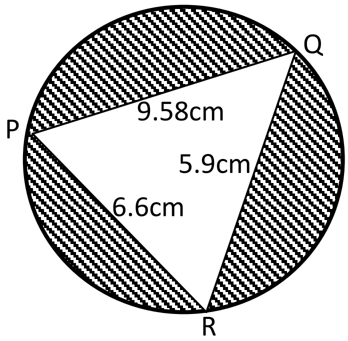
(a) How much profit did he make per kilogram of the mixture? (4 Marks)

(b) After one year the cost price of each brand was increased by 10%.

(i) For how much did he sell one kilogram of the mixture to make a profit of 15%? (Give your answer to the nearest 5 cents) (3 Marks)

(ii) What would have been his percentage profit if he sold one kilogram of the mixture at Sh. 45. (3 Marks)

22. Triangle PQR is inscribed in the circle. PQ = 7.8cm, PR = 6.6cm and QR = 5.9cm.



Find;

(a) size of angle QPR (3 Marks)

(b) the radius of the circle. (3 Marks)

(c) the area of the shaded region. (4Marks)

23. P, Q and R are three villages such that PQ = 10km, QR = 8km and PR = 4km are connecting roads.

(a) Using a scale of 1cm to represent 1km, locate the relative positions of the three villages. (2 Marks)

(b) A water tank T is to be located at a point equidistant from the three villages. By construction locate water tank T and measure its distance from R. (2 Marks)

(c) Determine the shortest distance from T to the road PQ by construction. (2 Marks)

(d) Determine the area enclosed by the roads PQ, QR and PR by calculation. (3 Marks)

24. Triangle PQR has vertices at P (2,3), Q(1,2) and R(4,1), while triangle $P^IQ^IR^I$ has vertices P^I(-2,3),Q^I(-1,2), R^I(-4,1)

(a) (i) Draw triangle PQR and $P^IQ^IR^I$ on the grid provided. (2 Marks)

(ii) Describe fully a single transformation which maps triangle PQR onto triangle $P^IQ^IR^I$. (1 Mark)

(b) (i) On the same grid, draw triangle $P^{II}Q^{II}R^{II}$ the image of PQR under a reflection on the line $y + x = 0$ (2 Marks)

(ii) Describe fully a single transformation which maps triangle $P^{II}Q^{II}R^{II}$ onto triangle PIQIRI. (1 Mark)

MACHAKOS COUNTY KCSE TRIAL AND PRACTICE EXAM 2015

Kenya Certificate of Secondary Education (K.C.S.E.)

121/2
MATHEMATICS
Paper 2
2½ hours

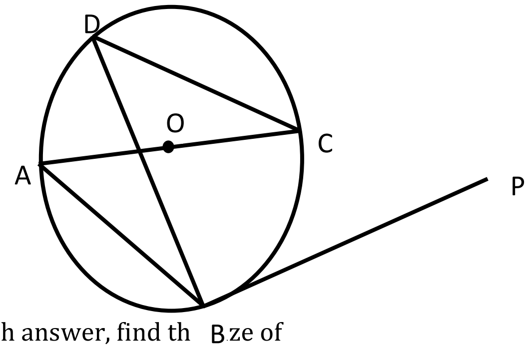
SECTION I – 50 MARKS

Answer all questions in this section.

1. The length and breadth of a metal sheet are measured to the nearest centimetre and recorded as 25cm and 16cm respectively.
   (a) Find the maximum possible error in the area of the sheet. (1 Mark)
   (b) Calculate to one decimal place the percentage error in the area of the sheet. (2 Marks)
2. The number of bacteria in a colony was originally 3 millions. This number doubled itself after every one hour. Calculate the number of bacteria generated in the colony during the 7th hour. (2Marks)
3. Solve for θ in the equation.
   $6\ \text{Cos}^2\theta - \text{Sin}\theta - 4 = 0$ in the range $0^0 \le \theta \le 180^0$ (3 Marks)
4. The equation of a circle is $x^2 - 8x + y^2 + 12y + 16 = 0$
   Determine the coordinates of the centre of the circle and its radius. (2 Marks)
5. A quantity P is partly constant and partly varies as the square of Q when Q = 2, P = 40 and when Q = 3, P = 65. Determine the value of P when Q = 4. (4 Marks)
6. The table below shows the masses of 40 students in a form 4 class.

Mass (kg)	Frequency
40 - 44	4
45 - 49	10
50 - 54	15
55 - 59	8
60 - 64	3

   (a) State the modal class. (1 Mark)
   (b) Calculate the median mass (2 Marks)
7. Under a transformation whose matrix
   $$T = \begin{pmatrix} a-2 & -2 \\ a & a \end{pmatrix}$$
   a figure whose area is 2.5cm² is mapped onto a figure whose area is 10cm². Find two possible values of a and hence write down two possible matrices for T. (4 Marks)
8. (a) Expand and simplify the binomial expression. (1 Mark)
   $$\left(2 - \frac{1}{2}y\right)^5$$
   (b) Use the first four terms of the simplified expression in (a) above to evaluate to 5 significant figures.
   (1.98)5. (2 Marks)
9. Solve for x in the equation log (x – 1) = log 12 – log (x – 2) (3 Marks)
10. The figure below shows a circle centre O and AOC is a straight line. PB is a tangent to the circle at and angle PBC = 35⁰.



Giving reasons for each answer, find th ze of

(a) Angle BDC (1 Mark)
(b) Angle ACB (2 Marks)

11. Solve the simultaneous equation. (3 Marks)

$$\frac{x-1}{y+1} = \frac{1}{4}$$
$$\frac{x+1}{y-1} = \frac{2}{3}$$

12. Wambua invested Sh. 6400 at 15% per annum compound interest for 3 years. Muinde invested twice that amount at $12\frac{1}{2}$% per annum simple interest for the same period of time. Find whose investment earned more interest and by how much. (4 Marks)

13. Make x the subject of the equation. (3 Marks)

$$3y = y + \frac{p}{q+\frac{1}{x}}$$

14. Given the column vectors.

$$\underset{\sim}{a} = \begin{pmatrix}1\\-2\\1\end{pmatrix}, \underset{\sim}{b} = \begin{pmatrix}6\\-3\\9\end{pmatrix}, \underset{\sim}{c} = \begin{pmatrix}-3\\2\\3\end{pmatrix} \text{ and that } \underset{\sim}{p} = 2\underset{\sim}{a} - \tfrac{1}{3}\underset{\sim}{b} + \underset{\sim}{c}$$

express $\underset{\sim}{p}$ as a column vector and hence calculate its magnitude to 3 significant figures. (3 Marks)

15. The gradient function of a curve is given by $\frac{dy}{dx} = 2x - 4$

Determine;

(a) the equation of the curve given the curve passes through point (0,3) (2 Marks)

(b) the coordinates of the turning point of the curve. (1 Mark)

16. A particle starts from 0 and moves in a straight line so that its velocity V ms^{-1} after t seconds is given by $v = 3t - t^2$. The distance of the particle from 0 at time t seconds is s metres.

(a) Express s in terms of t and c where c is a constant. (1 Mark)

(b) Calculate the time taken before the particle returns to 0. (3 Marks)

SECTION II – 50 Marks

Answer only 5 (Five) questions in this section.

17. Kennedy bought three cows and twenty-five goats spending a total of Sh. 75000. If he had bought two cows and thirty three goats, he would have saved Sh. 5400. Kennedy later sold all his animals at a profit of 40% per cow and 50% per goat.

Determine;

(a) the cost at which he bought each animal. (5 Marks)

(b) the total amount of money Kennedy received after selling all the animals. (5 Marks)

18. Under a transformation represented by a matrix m a point p (x, y) is mapped onto P^I, (x^I,y^I) where

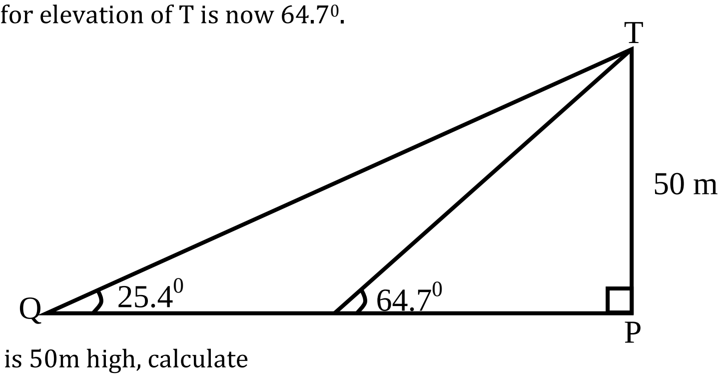
$$\begin{pmatrix}x^I\\y^I\end{pmatrix} = \begin{pmatrix}3x-2y\\x+3y\end{pmatrix}$$

(a) Write down the matrix for m. (2 Marks)

(b) Find the inverse of m. (3 Marks)

(c) The points A^I (16,-2) B^I (-8, 1), C^I (8,-1) and D^I (9,-8) are the images of A, B, C and D respectively under M. Determine the coordinates of A, B, C and D. (5 Marks)

19. The figure below shows the position of a boat Q which is observed sailing directly towards the pier P at the base of a vertical cliff PT. The angle of elevation of the top of the cliff from Q is 25.4^0. After 14 seconds the boat is at point R, and the angle for elevation of T is now 64.7^0.



If the cliff is 50m high, calculate

(a) The distance PQ (2 Marks)

(b) The distance QR (4 Marks)

(c) The speed of the boat in km/h (4 Marks)

20. Two towns on the earth's surface are located at P (07^0N,30^0E) and Q (13^0S,30^0E). A pilot plans to fly from P to Q the shortest route between the two towns.

(a) Calculate the shortest distance between P and Q in km. (5 Marks)

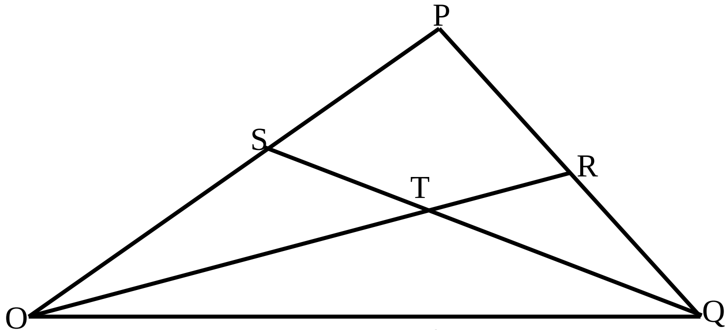
(b) Find the distance in nautical miles (nm) (3 Marks)

(c) The speed of the aircraft is 360 knots. Determine how long it takes to fly from P to Q. (2 Marks)

21. Veterinary researchers were experimenting with a new drug on fowls in a research station. A sample of fowls which were known to have the disease was used. In this sample 30 fowls were treated with the drug and the remaining 18 fowls were not treated.

(a) Calculate the probability that a fowl selected at random from the sample is
(i) treated with the drug (1 Mark)
(ii) not treated with the drug (1 Mark)
(b) The probability that a fowl treated with the drug will die is $\frac{1}{10}$, while the probability that one which is not treated will die is $\frac{7}{10}$.
Calculate the probability that a fowl picked at random from the sample is
(i) treated with the drug and will die (2 Marks)
(ii) not treated with the drug and will die (2 Marks)
(iii) treated with the drug and will not die (2 Marks)
(iv) not treated with the drug and will not die (2 Marks)

22.



In the figure above, OPQ is a triangle in which $\underset{\sim}{OS} = \frac{3}{4}\underset{\sim}{OP}$ and $\underset{\sim}{PR} : \underset{\sim}{RQ} = 2:1$
Line OR and SQ meet at T.
(a) Given that $\underset{\sim}{OP} = \underset{\sim}{p}$ and $\underset{\sim}{OQ} = \underset{\sim}{q}$, express the following vectors in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$.
(i) $\underset{\sim}{PQ}$ (1 Mark)
(ii) $\underset{\sim}{OR}$ (2 Marks)
(iii) $\underset{\sim}{SQ}$ (1Mark)
(b) You are further given that ST = mSQ and OT = nOR. Determine the values of m and n. (6 marks)

23. (a) Using a ruler and compasses only, construct triangle ABC such that AB = AC = 4.3cm and angle ABC = 30^0.
(b) Measure BC (1 Mark)
(c) A point p is always on the same side of BC as A. Draw the points of P such that angle BAC is always twice angle BPC. (2 Marks)
(d) Drop a perpendicular from A to meet BC at D. Measure AD. (2 Marks)
(e) Calculate the area of triangle ABC. (2 Marks)

24. Two variables A and B are connected by the equation.
A = kBn
Where k and n are constants.
The table below gives values of A and B.

A.	1.5	1.95	2.51	3.20	4.50
B.	1.59	2.51	3.98	6.31	11.5

(a) Find a linear equation connecting A and B (2 Marks)
(b) On square paper draw a suitable straight line graph to represent the relation in (a) above (scale 1cm to represent 0.1 units on both axis) (5 Marks)
(c) Use your graph to estimate the values of k and n in to one decimal place. (3 Marks)

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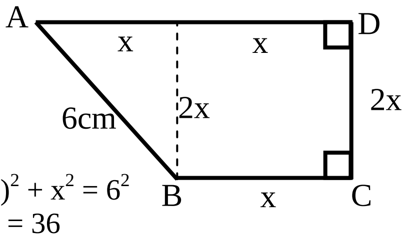
Kenya Certificate of Secondary Education (K.C.S.E.)

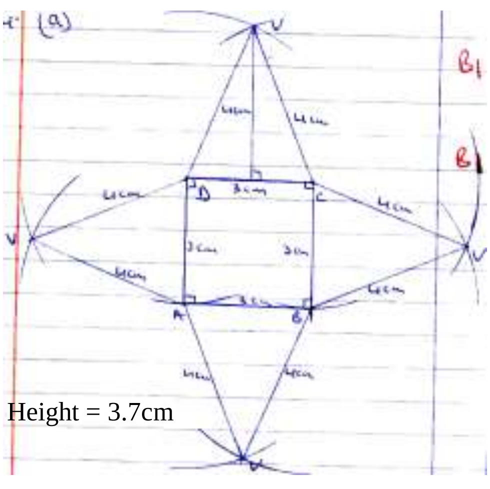
121/1

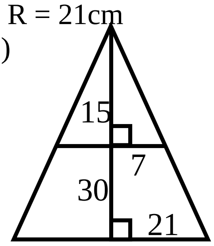
MATHEMATICS

Paper 1

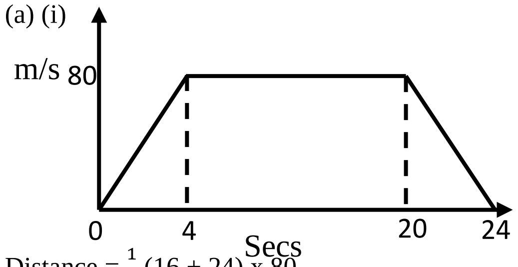
2½ hours

1.	$\frac{\frac{5}{6}\ of\ \left(\frac{13}{3}-\frac{23}{6}\right)}{\frac{5}{12}\ x\ \frac{3}{25}+\frac{14}{9}\ x\ \frac{3}{7}}$ = $\frac{\frac{5}{6}x\frac{3}{6}}{\frac{1}{20}+\frac{2}{3}}$ = $\frac{\frac{5}{12}}{\frac{43}{60}}$ = $\frac{5}{12}$ x $\frac{60}{43}$ = $\frac{25}{43}$	M1 M1 A1	5	x + y = 10 (10y + x) – (10x + y) = 54 9y - 9x = 54 y – x = 6 x + y = 10 -x + y = 6 2y = 16 y = 8 x = 2 Number is 28	M1 M1 A1
					3
		03			
2.	$\sqrt{\frac{\overset{18}{\cancel{504}}\ x\ \overset{1}{\cancel{143}}\ x\ 910\ x\ 10}{\underset{1}{\cancel{28}}\ x\ 117\ x\ \underset{2}{\cancel{286}}\ x\ 7}}$ = $\sqrt{\frac{\overset{9}{\cancel{18}}\ x\ \overset{130}{\cancel{910}}\ x\ 10}{117\ x\ \underset{1}{\cancel{2}}\ x\ \underset{1}{\cancel{7}}}}$ = $\sqrt{\frac{9\ x\ 13\ x\ 100}{117}}$ = $\sqrt{100}$ = 10	M1 M1 A1	6	 $(2x)^2 + x^2 = 6^2$ $5x^2 = 36$ x = 2.683 Area = $\frac{1}{2}$(x + 2x)(2x) = $\frac{1}{2}$(3 x 2.683) (2 x 2.683) = 21.595467 ≈ 21.60 units	M1 A1 M1 A1
		03			04
3.	$\left(\frac{3^3}{2^3}\right)^{x+7} = \left(\frac{2^2}{3^2}\right)^{-3x}$ $\left(\frac{3}{2}\right)^{3(x+7)} = \left(\frac{3}{2}\right)^{6x}$ 3(x + 7) = 6x 3x + 21 = 6x x = 7	M1 M1 A1	7	Inter. ∠ = x Exter. ∠ = y x + y = 180^0 x – y = 108^0 2x = 288 x = 144^0 ∴ext. ∠36^0 No. of sides = $\frac{360}{36}$ = 10 sides	B1 M1 A1
		03			
4.	30 = 2 x 3 x 5 50 = 2 x 5^2 35 = 5 x 7 L.C.M = 2 x 3x 5^2 x 7 = 1050 mins 17 hrs 30 mins Time = 7.18 +17.30 2448 ⇒ 12.48 a.m. Tuesday	B1 M1 A1	8	Let the commission be x% $\frac{x}{100}$ (500000 – 100000) = 4000x 4000x + 10000 = 56000 x = 12.5%	M1 M1 A1
			9	Vol. cylinder ⇒ $\pi(14^2)$h Vol. cone ⇒ $\frac{1}{3}\pi(7^2)$ x 18 $\pi(14^2)$h = $\frac{1}{3}\pi(7^2)$ x 18 h = $\frac{1}{3}$ x 7^2 x 18 x $\frac{1}{14^2}$ h = 1.5cm	M1 M1 A1
		03			

10.	$\frac{2x-4}{12-3x^2}$ - $\frac{1}{3x+6}$ $\frac{2(x-2)}{3(2-x)(2+x)}$ - $\frac{1}{3(x+2)}$ - $\frac{2}{3(2+x)}$ - $\frac{1}{3(x+2)}$ = - $\frac{1}{x+2}$	M1 M1 A1
		03
11.	Present 4 yrs ago Daugther ⇒ x x – 4 Mother ⇒ 2.5x 2.5x – 4 $\frac{x-4}{2.5x-4} = \frac{1}{3}$ 3x – 12 = 2.5x – 4 0.5x = 8 x = 16 Mother = 2.5 x 16 = 40 years	M1 A1 B1
		3
12.	5y + 2x – 7 = 0 y = -$\frac{2}{5}$x + $\frac{7}{5}$ Gr. Line = -$\frac{2}{5}$ $\frac{k-5}{3--2} = \frac{-2}{5}$ k – 5 = -2 k = 3	B1 B1 A1
		03
13.	20000 x 147.86 = 2,957,200 $\frac{2957200-2512000}{74.50}$ = 5975.84	M1 M1 A1
		03
14.	(a)  (c) Height = 3.7cm	

15	No. Log 849.6 2.9292 2.41 0.3820+ 3.3112 3941 3.5956- $\bar{1}.7156$ ÷ 3 8.039 x 10^{-1} $\bar{1}.9052$ = 0.8039	M1 M1 M1 A1
16	$\frac{1}{0.3654}$ - 4.151^2 $\frac{1}{0.3654}$ ⇒ 2.737 4.151^2 ⇒ 17.231 2.737 – 17.231 = -14.494	B1 M1 A1
17	(a) Original members = x Original each = $\frac{180000}{x}$ Later each = $\frac{180,000}{x-3}$ $\frac{180,000}{x-3}$ - $\frac{18000}{x}$ = 3000 $\frac{60}{x-3}$ - $\frac{60}{x}$ = 1 60x – 60x + 180 = x^2 – 3x x^2 – 3x – 180 = 0 (x – 15) (x + 12) = 0 x = 15 (b) $\frac{180,000}{15}$ = 12000 (c) Increase = 3000 $\frac{3000}{12000}$ x 100 = 25%	B1 B1 M1 M1 M1 A1 M1 A1 M1 A1
18	(a) r : R = 1:3 (b) $\frac{7}{R} = \frac{1}{3}$ R = 21cm (c)  Vol. Big cone = $\frac{1}{3}$ x $\frac{22}{7}$ x 21^2 x 45 = 20790cm^3 Vol. Small cone = $\frac{1}{3}$ x $\frac{22}{7}$ x 7^2x 15 = 770cm^3 Vol. of frustrum = 20790 – 770 = 20020cm^3 (d) Vol. tank = 150 x 120 x 180 Buckets = $\frac{150 \times 120 \times 80}{20020}$ = 71.93 ≅ 72 full buckets	B1 M1 A1 M1 M1 M1 M1 A1 B1

19. (a) (i)



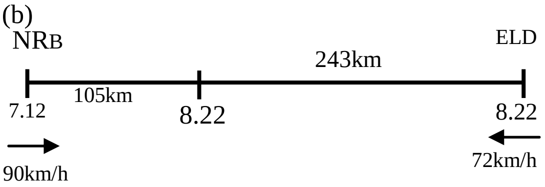
Distance = $\frac{1}{2}$ (16 + 24) x 80 M1

= 1600m A1

(ii) $-\frac{80}{4}$ M1

= - 20m/s^2 A1

(b)



B1

Relative distance = 348 – $\left(90x\frac{7}{6}\right)$ M1

= 243km

Relative speed = 162km/hr

Time taken = $\frac{243}{162}$hrs M1

= 1.5 hrs A1

Time = 8.22 + 1hr 30 mins M1

= 9.52 a.m. A1

(c) 90 x $2\frac{2}{3}$km = 240km

10

20. (a) (i) Modal class = 30 – 39 B1

Marks	x	f	fx	cf
20-29	24.5	3	73.5	3
30-39	34.5	18	621	21
40-49	44.5	13	578.5	34
50-59	54.5	14	763	48
60-69	64.5	17	1096.5	65
70-79	74.5	12	894	77
80-89	84.5	5	422.5	82
			4449	

B1 B1

Mean = $\frac{4449}{82}$ M1

= 54.2561

≅ 54.26 A1

(ii) Median = 49.5 + $\frac{41-34}{14}$ x 10 B1

= 54.5

Diff = 54.5 – 54.26 M1

= 0.24 A1

21 (a) A : B : C

25=: 30/= : 45/=

5 : 2 : 1

100% = $\frac{(5\ x\ 25)+\ (30\ x\ 2)+\ (45\ x\ 1)}{5+2+1}$ = 28.75/=

20% profit

= $\frac{20}{100}$ x 28.75 = 5.75/=

(b) A = 27.5/=

B = 33/=

C = 49.5/=

∴ 100% = $\frac{(27.5\ x\ 5)+\ (33\ x\ 2)+\ (49.5\ x\ 1)}{5+2+1}$ = 31.625

% Profit = 1.15 x 31.625

= 36.36875

≅ 36.50

(c) 45 – 36.50

= 8.50

% Profit = $\frac{8.5}{36.5}$ x 100

= 23.29%

22. (a) $5.9^2 = 7.8^2 + 6.6^2 – 2(7.8)(6.6)$ Cos P M1

Cos P = $\frac{69.59}{102.96}$ M1

P = 47.48^0 A1

(b) $\frac{5.9}{Sin47.48^0}$ = 2R M1

R = $\frac{5.9}{2Sin47.48^0}$ M1 A1

= 4.002cm M1

(c) Area of ∆ = $\frac{1}{2}$ x 7.8 x 6.6 Sin 47.48^0 M1

= $18.97cm^2$

Area of circle = 3.142 x 4.002^2 M1

= 50.32

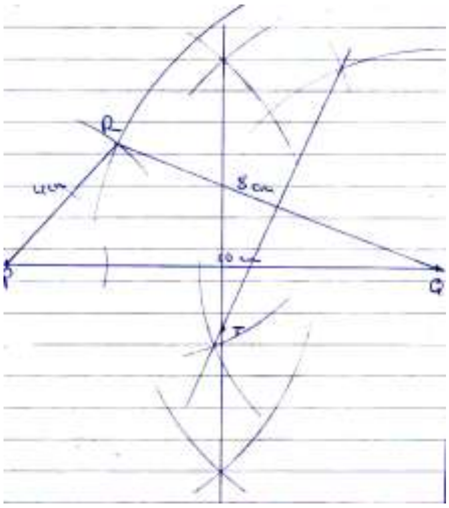
Shaded area = 50.32 M1

-18.97 A

31.35cm^2

23. (a) B1

B1



(b) Construction of any 2 ⊥ side bisectors B1

✓Location of T

Distance RT = 5.2km B1

(c) Drop ⊥ from T to PQ B1

Distance = 1.5km

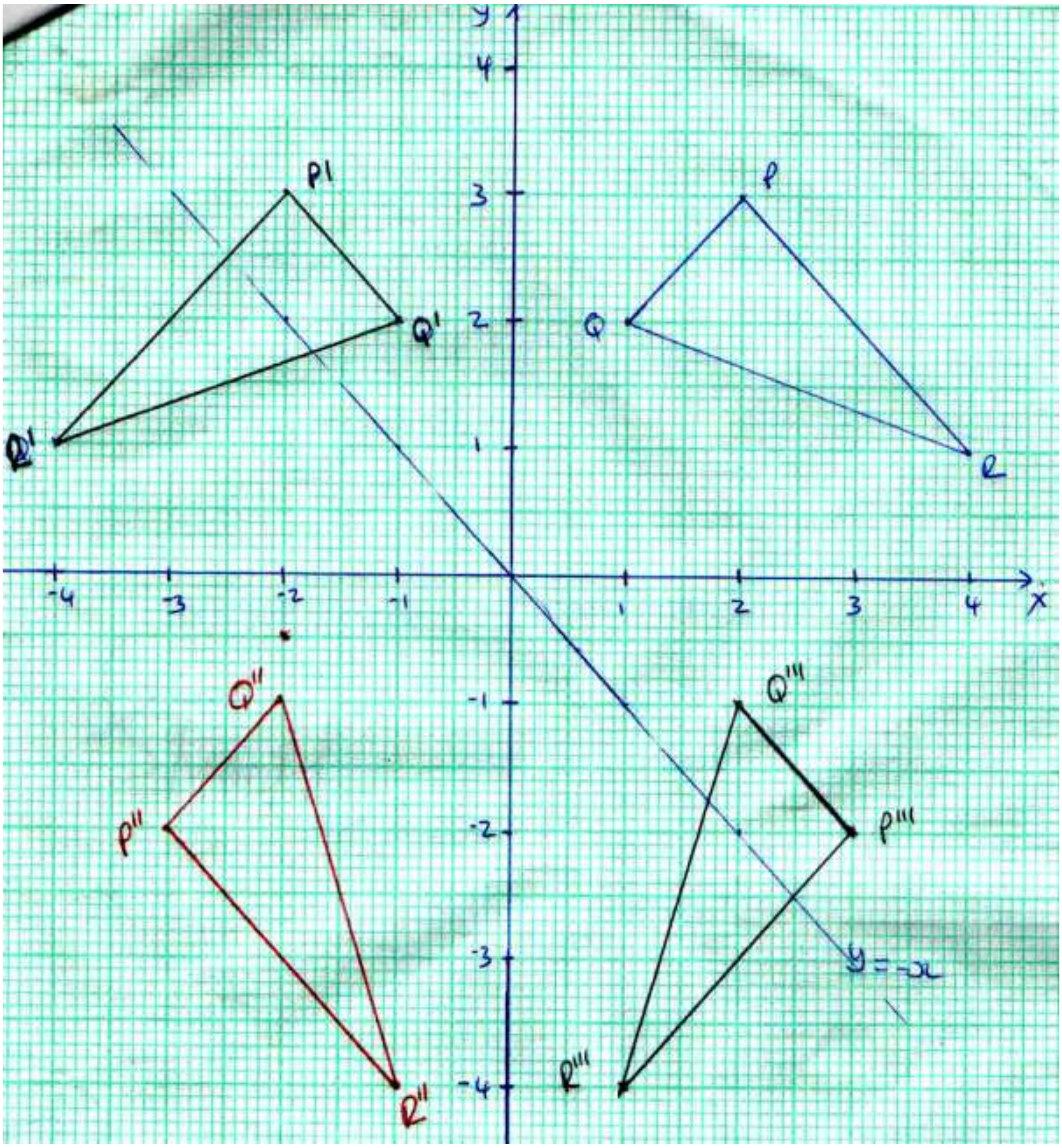
(d) S = $\frac{10+8+4}{2}$ B1

= 11km

A = $\sqrt{11(11-10)\ (11-8)(11-4)}$ B1

= 15.19868km^2 M1

≅ 15.20km^2 A1

24	(a) (i) ✓PQR drawn	B1
	✓$P^IQ^I R^I$ drawn	B1
	(ii) Reflection on the line y – axis (or x = 0)	B1
	(b) (i) $P^{II}(-3,-2)$ $Q^{II}(-2,-1)$ $R^{II}(-1,-4)$	B1
	✓ $\Delta P^{II}Q^{II}R^{II}$ drawn	B1
	(ii) Negative quarter turn about (0,0) OR (270^0) turn about (0,0) OR – 90^0 turn about (0,0)	B1
	(c) $P^{III}(3,-2)$ $Q^{III}(2,-1)$ $R^{III}(1,-4)$	B1
	✓$\Delta P^{III}Q^{III}R^{III}$ drawn	B1
	(d) PQR and $P^IQ^IR^I$ PQR and $P^{II}Q^{II}R^{II}$	B1
	$P^IQ^IR^I$ and and $P^{III}Q^{III}R^{III}$ $P^{II}Q^{II}R^{II}$ and $P^{III}Q^{III}R^{III}$	B2
		

MACHAKOS COUNTY KCSE TRIAL AND PRACTICE EXAM 2015

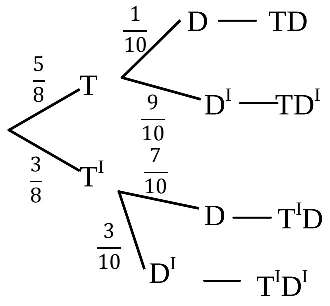
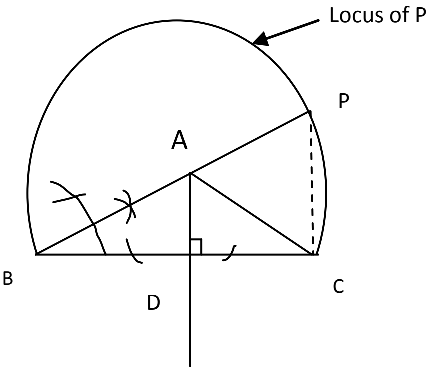
Kenya Certificate of Secondary Education (K.C.S.E.)

121/2
MATHEMATICS
Paper 2
2½ hours

1.	(a) Working area = 25 x 16 = 400cm^2 Maximum area = 25.5 x 16.5cm^2 = 420.75 cm^2 Minimum area = 24.5 x 15.5 = 379.75cm^2 Max. possible error = 420.75 – 400 or 400 – 379.75 = ± 20.75 (b) % error in area = $\frac{\text{Absolute error}}{\text{Working } area}$ x 100 = $\frac{20.75}{400}$ x 100 = 5.1%	B1 M1 A1
2.	This is a GP with 1st term ,a = 3 million and common ratio, r = 2 Required is the 7th term of GP $Tn = ar^{n-1}$ 7th term, $T_7 = ar^{7-1} = ar^6$ $= 3 \times 2^6$ = 3 x 64 = 192 million	M1 A1
3.	$Cos^2\theta + Sin^2\theta = 1$ $Cos^2\theta = 1 – Sin^2\theta$ $6(1 – Sin^2\theta) – Sin\ \theta - 4 = 0$ $6Sin^2 0 + Sin\ \theta - 2 = 0$ Let y = Sin θ ⇒ $6y^2 + y – 2 = 0$ $6y^2 – 3y + 4y – 2 = 0$ 3y(2y – 1) + 2(2y – 1) = 0 (3y + 2) (2y – 1) = 0 3y + 2 = 0 3y = -2 $y =- \frac{2}{3}$ or 2y – 1 = 0 2y = 1 $y = \frac{1}{2}$ Sin θ = $\frac{-2}{3}$ or ½ Hence θ = 30^0, 150^0	M1 M1 A1
4.	$x^2 – 8x + y^2 + 12y = -16$ $x^2 – 8x + 16 + y^2 + 12y + 36 = -16 + 16 + 36$ Expressions as perfect squares $(x – 4)^2 + (y + 6)^2 = 36$ $(x – a)^2 + (y – b) = r^2$ a = 4 b = - 6 r = $\sqrt{36}$ = 6 Centre(4,-6) and radius = 6 units	M1 A1
5.	$P = L + KQ^2$ where K and L are constants 40 = L + 4K ----------(i) 65 = L + 9K ----------(ii) -25 = - 5K K = 5 Subst. for K in eqn (i) L + 20 = 40 L = 20 Hence $P = 20 + 5Q^2$ when Q = 4 $P = 20 + 5 (4)^2$ = 100	B1 M1 M1 A1
6.	(a) Modal class is 50 – 54 (b) Median = $49.5 + \left(\frac{\frac{45}{2}-14}{15}\right)5$ = 51.5kg	B1 M1 A1
7.	Determinant of T = Area scale factor Det. T = $\frac{10}{2.5}$ = 4 Hence a(a – 2) – (-2a) = 4 $a^2 – 2a + 2a = 4$ $a^2 = 4$ a = ± 2 When a = 2, T = $\begin{pmatrix} 0 & -2 \\ 2 & 2 \end{pmatrix}$ When a = -2, T = $\begin{pmatrix} -4 & -2 \\ -2 & -2 \end{pmatrix}$	M1 A1 B1 B1
8	(a) $\left(2-\frac{1}{2}y\right)^5 = 32 – 40y + 20y^2 – 5y^3 + \frac{5}{8}y^4 - \frac{1}{32}y^5$ (b) Non (1.98) = (2 – 0.02) = 2 - $\frac{1}{2}$(0.04) Substitute y = 0.04 ∴ $\left\{2-\frac{1}{2}(0.04)\right\}^5 = 32 – 40(0.04) + 20\ (0.04)^2 - 5(0.04)^3$ $(2-0.02)^5$ = 32 - 1.6 + 0.032 – 0.00032 $(1.98)^5$ = 30.43168 = 30.432 (5 s.f)	B1 M1 A1
9	Log (x-1) = Log 12 – Log (x – 2) = Log $\left(\frac{12}{x-2}\right)$ x – 1= $\frac{12}{x-2}$ (x – 1) (x – 2) = 12 $x^2 – 3x + 2 = 12$ $x^2 – 3x – 10 = 0$ $x^2 + 2x – 5x – 10 = 0$ x(x + 2) – 5(x + 2) = 0 (x – 5) (x + 2) = 0 x – 5 = 0 x = 5 x + 2 = 0 x = -2 Drop the –ve value x = 5	M1 M1 A1

10.	(a) ∠BDC = ∠PBC = 35^0 (∠s in a alt seg.) In ∠ABC, ∠ABC = 90^0 (∠in semicircle) and ∠BAC = ∠BDC = 35^0 s (∠s in same seg.) ∴ ∠ACB = 180 – (90 + 35) (∠sum of Δ) = 55^0	B1 B1 B1
		03
11.	Cross – multiply both equation we have 4x – 4 = y + 1 => 4x – y = 5 3x + 3 = 2y – 2=> 3x – 2y = -5 4x – y = 5 3x – 2y = -5 8x – 2y = 10 $\underline{3x - 2y = -5}$ - 5x = 15 x = 3✓ Substitute for x in equation (i) 12 – y = 5 y = 7 ✓	B1 M1 A1
12.	Wambua: Amount = 6400 $\left(1 + \frac{15}{100}\right)^3$ = 6400$(1.15)^3$ = Sh. 9734 Interest = 9734 – 6400 = Sh. 3334 Muinde: Interest = 12800 = $\frac{25}{200}$ x 3 = Sh. 4800 Muinde's investment by (4800 – 3334) = Sh. 1466	B1 B1 A1
		A1
13.	3y$\left(q + \frac{1}{x}\right)$ = y$\left(q + \frac{1}{x}\right)$ + P 3qy + $\frac{3y}{x}$ = qy + $\frac{y}{x}$ + P 3qy – qy = $\frac{y}{x}$ - $\frac{3y}{x}$ + P 2qy = P - $\frac{2y}{x}$ $\frac{2y}{x}$ = P – 2qy x = $\frac{2y}{P-2qy}$ or x = $\frac{-2y}{2yq-P}$	M1 M1 A1
		03
14.	$\underset{\sim}{p} = 2\underset{\sim}{a} - \frac{1}{3}\underset{\sim}{b} + \underset{\sim}{c}$ $= 2\begin{pmatrix}1\\-2\\1\end{pmatrix} - \frac{1}{3}\begin{pmatrix}6\\-3\\9\end{pmatrix} + \begin{pmatrix}-3\\2\\3\end{pmatrix}$ $= \begin{pmatrix}2 & -2 & +-3\\-4 & --1 & +2\\2 & -3 & +3\end{pmatrix} = \begin{pmatrix}-3\\-1\\2\end{pmatrix}$ $\lvert\underset{\sim}{P}\rvert = \sqrt{(-3)^2 + (-1)^2 + 2^2}$ $= \sqrt{9 + 1 + 4}$ $= \sqrt{14} + \lvert\underset{\sim}{P}\rvert = 3.74$	M1 A1 B1

15	(a) dy = (2x – 4)dx $\int dy = \int(2x - 4)dx$ y = $\frac{2x^2}{2}$ - 4x + C = x^2 - 4x + C Passes through point (0,3) when x = 0, y = 3 C = 3 Required equations is y = x^2 – 4x + 3 (b) $\frac{dy}{dx}$ = 0 2x – 4 = 0, x = 2 Substitute x = 2 in the equation. y = 2^2 – 4(2) + 3 = 4 – 8 + 3 = -1 Hence turning point is (2,-1)	M1 A1 B1
16.	(a) $\frac{ds}{dt}$ = (3t – t^2) $\int ds = \int 3t - t^2)\, dt$ S = $\frac{3}{2}t^2$ - $\frac{1}{3}t^3$ + C (b) when t = 0, s = 0 0 = $\frac{3}{2}$(0) - $\frac{1}{3}$ $(0)^3$+ C C = 0 S = $\frac{3}{2}t^2$ - $\frac{1}{3}t^3$ $t^2\left(\frac{3}{2} - \frac{1}{3}t\right)$ = 0 $t = 4.5\ seconds$	B1 M1 A1
17.	(a) Let cost of a cow be x Let cost of a goat be y $\left.\begin{array}{l}3x + 25y = 75000x\ 2\\ 2x + 33y = 69600\ x\ 3\end{array}\right\}$ Both 6x + 50y = 150000 $\underline{6x + 99y = 208800}$ - - 49y = -58800 y = 1200 3 x 30000 = 75000 3x = 45000 x = 15000 Cow = Sh. 15000; Goat = Sh. 1200 (b) SP for cows = $\frac{140}{100}$ x 15000 x 3 = Sh. 63000 SP for goats = $\frac{150}{100}$ x 1200 x 25 = Sh. 45000 Amount received = 63000 + 45000 = Sh. 108000	B1 M1 A1 M1 A1 M1 M1 A1 M1 A1

18.	(a) M maps P(x,y) onto PI(x^I,y^I) $m\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}x^I\\y^I\end{pmatrix} = \begin{pmatrix}3x-2\\x+3y\end{pmatrix}$ $M = \begin{pmatrix}3&-2\\1&3\end{pmatrix}$ (b) Det. m = (3 x 3) – (-2x1) = 11 $M^{-1}=\frac{1}{11}\begin{pmatrix}3&2\\-1&3\end{pmatrix}$ (c) M (A, B, C,D) = (A^I, B^I, C^I,D^I) (A, B, C,D) = M^{-1} = (A^I, B^I, C^I,D^I) $\frac{1}{11}\begin{pmatrix}3&2\\-1&3\end{pmatrix}\begin{pmatrix}16&-8&8&9\\-2&1&-1&-8\end{pmatrix}$ $=\frac{1}{11}\begin{pmatrix}44&-22&22&11\\-22&11&-11&-33\end{pmatrix}$ $=\begin{pmatrix}4&-2&2&1\\-2&1&-1&-3\end{pmatrix}$ Hence A (4,-2), B(-2, 1), C(2,-1), D(1,-3)	M1 A1 M1 A1 B1 M1 M1 A1 B2
19	(a) From Δ PQT, PQ = $\frac{50}{\text{Tan } 25.4}$ = 105.3m (b) From Δ PRT, PR = $\frac{50}{\text{Tan } 64.7}$ = 23.63m QR = PQ – PR = 105.3 – 23.63 QR = 81.67m (c) Distance = $\frac{81.67}{1000}$km; Time = $\frac{14}{60 \ x \ 60}$ hr Speed = $\frac{81.67}{1000}$ x $\frac{60 \ x \ 60}{14}$ = 21km/hr	M1 A1 M1 A1 M1 A1 B1 B1 M1 A1
20.	(a) Angle subtended between P and Q on great circle 7 + 13 = 20^0 Radius of arc PQ = 6370km Distance of arc PQ = $\frac{20}{360}$ x 2 x $\frac{22}{7}$ x 6370 = 2224km (4 s.f.) (b) Distance in Nautical Miles PQ = 60 x 20 = 1200Nm (c) Speed of aircraft = 360nm/hr Time taken = $\frac{1200}{360}$ = $3\frac{1}{3}$ hr or 3h 20 min	M1 A1 B1 M1 A1 M1 M1 A1 M1 A1
21.	(a) Total number of fowls in sample 30 + 18 = 48 (i) P (Treated) = $\frac{30}{48} = \frac{5}{8}$ (ii) P (not treated) = $\frac{18}{48} = \frac{3}{8}$ (b)  (i) P(TD) = $\frac{5}{8}$ x $\frac{1}{10}$ = $\frac{1}{16}$	B1 B1 M1 A1
	(ii) P(T^ID) = $\frac{3}{8}$ x $\frac{7}{10}$ = $\frac{21}{80}$ (iii) P(TD^I) = $\frac{5}{8}$ x $\frac{9}{10}$ = $\frac{9}{16}$ (iv) P(T^ID^I) = $\frac{3}{8}$ x $\frac{3}{10}$ = $\frac{9}{80}$	M1 A1 M1 A1 M1 A1
22	(a) (i) PQ = PO + OQ = - p + q or q – p (ii) OR = OP + PR = p + $\frac{2}{3}$(-p + q) = $\frac{1}{3}$p + $\frac{2}{3}$q (iii) SQ = SO + OQ = -$\frac{3}{4}$OP + OQ = -$\frac{3}{4}$p +q or q - $\frac{3}{4}$p (b) OT = n($\frac{1}{3}$p + $\frac{2}{3}$ q) From DOST OT = OS + ST = $\frac{3}{4}$p + m($\frac{3}{4}$p + q) $\frac{n}{3}$p + $\frac{2n}{3}$q = $\left(\frac{3}{4} - \frac{3}{4}m\right)$p + mq $\frac{n}{3} = \frac{3}{4} - \frac{3m}{4}$ 4n + 9m = 9…………………. (i) $\frac{2n}{3}$ = m, M = $\frac{2n}{3}$ ……………....(ii) $4n + 9\left(\frac{2n}{3}\right) = 9$ 4n + 6n = 9 10n = 9 n = $\frac{9}{10}$ M = $\frac{2}{3}$ x $\frac{9}{10}$ = $\frac{3}{5}$	B1 M1 A1 B1 B1 M1 M1 M1 M1 Both A1
23	 (b) Measurement, BC = 7.5cm (c) ∠BAC is angle at centre while ∠BPC is angle at circumference and BC is a chord. ∴ ∠BAC = 2∠BPC (d) AD = 2.2cm (e) Area ∠ABC = $\frac{1}{2}$ x BC x AD = $\frac{1}{2}$ x 7.5 x 2.2 = 8.25cm^2	

24

(a) $A = KB^n$

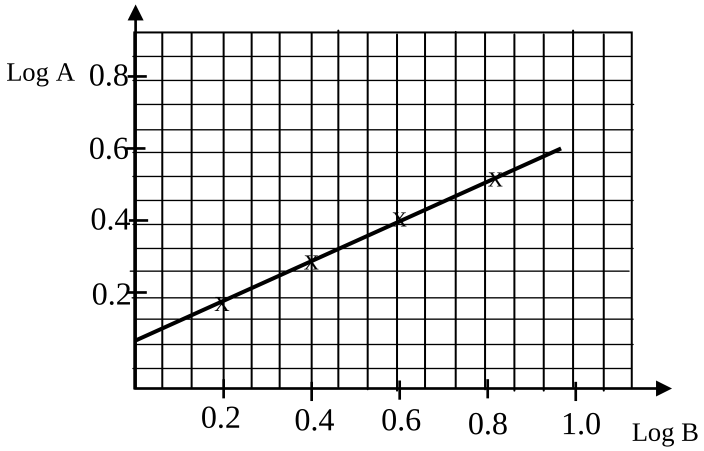
Log A = Log KBn

= Log k + log KB^n

= nlogB + LogK

(b)

Log	0.18	0.29	0.40	0.51	0.65
Log	0.20	0.40	0.60	0.81	1.06



(c) Gradient of line $= \frac{0.65-0.18}{1.06-0.2} = 0.5465$

n = 0.5

Hence Log K = 0.07

K = $10^{0.07}$ = 1.175

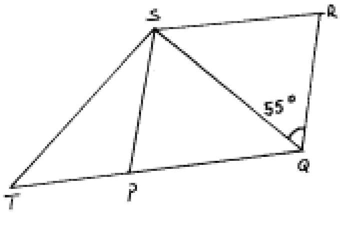
= 1.2 (1 d.p)

CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015
Kenya Certificate of Secondary Education

121/1
MATHEMATICS ALT A
PAPER 1
JULY/AUGUST, 2015
TIME: 2½ HOURS
SECTION I: (50 MARKS)

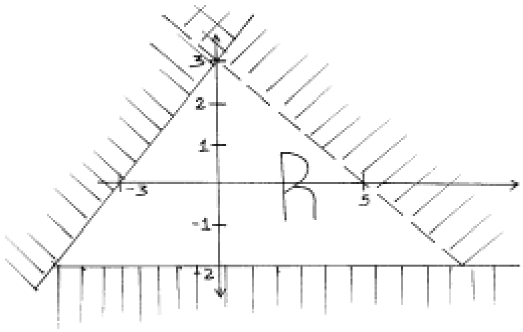
Answer all the questions in this section in the spaces provided.

1. Evaluate: $\frac{44 - -28}{12 \times -2} - \frac{8^2 \times -12 - 24}{96 \div -12 \times 9}$ (3 marks)
2. A basket ball team play 10 matches in a tournament. The following are scores in each match.
   9, 15, 17, 16, 7, 20, 21, 15, 10, 12
   Determine:
   (a) the mode. (1 mark)
   (b) the median. (2 marks)
3. A wholesaler sold a cell phone to a retailer making a profit of 20%. The retailer later sold the cell phone for Ksh.3120 making a profit of 30% calculate the amount of money the wholesaler had paid for the cell phone. (3 marks)
4. Given that Cos $(\chi + 20°) = 0.7660$, find χ for $0° \leq \chi \leq 360°$. (3 marks)
5. (a) Express 1050 in terms of its prime factors. (1 mark)
   (b) Determine the smallest positive number such that 1050p is a perfect square. (2 marks)
6. The exterior angle of a regular polygon is $(\chi - 50)°$ and the interior angle is $(2\chi + 20)°$. Find the number of sides of the polygon. (3 marks)
7. A line P passes through the point (-2, 5) and has a gradient of $\frac{-3}{4}$. Another line Q is perpendicular to P and meets it at a point where $y = \frac{1}{2}$ find equation of Q. (4 marks)
8. Simplify the expression completely.
   $\frac{(\chi + 2y)(\chi - 2y) - (\chi - 2y)^2}{\chi^2 - 4y^2}$ (3 marks)
9. The mass of two similar solid are 324g and 768g. Find
   (a) height of the smaller solid if the height of the bigger solid is 20cm. (2 marks)
   (b) the surface area of the smaller solid if the surface area of the bigger solid is $40cm^2$. (2 marks)
10. A cylindrical pipe 5 metres long has an internal diameter 28 millimetres and an external diameter of 42 millimetres. The density of the material that makes the pipe is $1.45g/cm^3$. Calculate the mass of the pipe in kilograms.
    $\left(Take\ \pi = \frac{22}{7}\right)$. (4 marks)
11. Simplify: $\frac{32^{\frac{-1}{5}} \times 8100^{\frac{3}{4}}}{8^{\frac{-1}{2}} \times 5^{\frac{1}{2}} \times 4^{o} \times 4^{\frac{1}{4}}}$. (3 marks)
12. In the figure below PQRS is a rhombus, ∠SQR = 55°, ∠QST is a right angle and TPQ is a straight line.



    Find the size of the angle STQ. (3 marks)
13. The mass of a mixture A of beans and maize is 72kg. The ratio of beans to maize is 3: 5 respectively. Find the mass of maize in the mixture. (3 marks)
14. A square toilet is covered by a number of whole rectangular tiles of sides 60cm by 48cm. Calculate the least possible area of the room in square metres. (3 marks)

15. Form the inequalities represented by region R.



16. A point C is on a line PQ where PQ = 9cm. C divides PQ such that $PC = \frac{4}{7}PQ$.

    By construction locate C. (3 marks)

SECTION B: (50 MARKS)

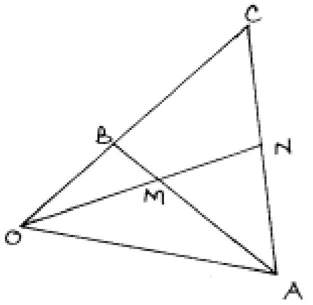
Answer any FIVE questions from this section in the spaces provided.

17. A construction company requires to transport 288 tonnes of stones to sites P and Q. The company pays 48,000 to transport 48 tonnes of stones for every 28km. Joyce transported 96 tonnes to site P, 49km away.
    (a) Find how much she was paid. (3 marks)
    (b) Joyce spends Ksh.6000 to transport every 8 tonnes of stones to site P. Calculate her total profit. (3 marks)
    (c) Kimani transported the remaining stones to site Q, 84km away. If he made 44% profit, find his transport cost. (4 marks)
18. (a) A square carpet is laid on the floor of a room so that one of its sides is against a side of a room. If leaves strips of uncovered floor 1m wide along the two opposite sides and 2m wide along the remaining side. If the area of the room is 64m^2, find the dimensions of the carpet. (6 marks)
    (b) Solve the equation: $\frac{y+3}{24} = \frac{1}{y-2}$. (4 marks)
19. A trader bought 8 cows and 12 goats for a total of Ksh.294,000. If he had bought 1 more cows and 3 more goats he would have spend Ksh.337,500.
    (a) Form two equations to represent the above information. (2 marks)
    (b) Use matrix method to determine the cost of a cow and that of a goat. (4 marks)
    (c) The trader sold the animals he had bought making a profit of 40% per low and 45% per goat.
    (i) Calculate the total amount of money he received. (2 marks)
    (ii) Determine his profit in Kenya shillings. (2 marks)
20. A truck left town X at 11.45am and travelled towards town Y at an average speed of 60km/hr. A car left town X at 2.15pm on the same day and travelled along the same road at an average speed of 100km/hr. The distance between the two towns is 500km.
    (a) Calculate the time of the day when the car overtook the truck. (4 marks)
    (b) The distance from Y when the car overtook the truck. (3 marks)
    (c) After overtaking the bus, both vehicles continued towards Y at their original speeds. Find how long the car had to wait at town Y before the truck arrived. (3 marks)
21. The displacement S metres of a moving particle after t seconds is given by

    $S = 2t^3 - 5t^2 + 4t + 2$

    Determine
    (a) the velocity of the particle when t = 2. (3 marks)
    (b) the value(s) of t when the particle is momentarily at rest. (3 marks)
    (c) the displacement when the particle is momentarily at rest. (2 marks)
    (d) the acceleration of the particle when t = 5. (2 marks)

22. In the figure below, $\underset{\sim}{OA} = \underset{\sim}{a}$, $\underset{\sim}{OB} = \underset{\sim}{b}$ and $\underset{\sim}{OC} = 3\underset{\sim}{OB}$.



   (a) Express in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.
      (i) AB (1 mark)
      (ii) $\underset{\sim}{\tilde{A}}C$ (1 mark)
   (b) Given that $\underset{\sim}{AM} = \frac{3}{4}\underset{\sim}{AB}$ and $\underset{\sim}{AN} = \frac{1}{2}\underset{\sim}{AC}$, express $\underset{\sim}{OM}$ and $\underset{\sim}{ON}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$. (4 marks)
   (c) Hence show that O, M and N are collinear. (4 marks)

23. Triangle ABC has vertices A (1, 2), B (2, 3) and C (4, 1) while triangle $A^1B^1C^1$ has vertices A^1 (1, -2), B^1 (2, -3) and C^1 (4, -1).
   (a) Draw triangle ABC and $A^1B^1C^1$ on the same grid. (2 marks)
   (b) Describe fully a single transformation that maps triangle ABC onto triangle $A^1B^1C^1$. (2 marks)
   (c) On the same grid draw triangle $A^{11}B^{11}C^{11}$ the image of triangle ABC under a reflection in line $Y = -\chi$. (2 marks)
   (d) Draw $\Delta A^{111}B^{111}C^{111}$ such that it can be mapped onto triangle ABC by a negative quarter turn about the origin. (2 marks)
   (e) Find the matrix of transformation that maps triangle ABC onto triangle $A^{111}B^{111}C^{111}$. (2 marks)

24. Arc of a circle of radius 40cm subtends an angle of 126° at the centre of the circle.
   (a) Calculate:
      (i) the length of the arc. (2 marks)
      (ii) the area of the sector. (2 marks)
   (b) The sector is folded to form a cone.
   Calculate:
      (i) the radius of the base of the cone. (2 marks)
      (ii) the height of the cone. (2 marks)
      (iii) the capacity of the cone in litres. (2 marks)

CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015

121/2
MATHEMATICS ALT A
PAPER 2
JULY/AUGUST, 2015
TIME: 2½ HOURS

SECTION I: (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Simplify: $\dfrac{2\frac{1}{4} - 1\frac{2}{3}}{\frac{1}{6} - \left(\frac{-1}{3}\right)^2} - \frac{5}{8} \text{ of } 3$. (4 marks)

2. (a) Expand $(2 + \chi)^4$. (1 mark)
   (b) Use the expansion in (a) above to. Find the value $(2.01)^4$ to 4d.p.

3. Solve for y in the equation. (3 marks)
   $\text{Log}_{10}(3y + 2) - 1 = \text{Log}_{10}(y - 4)$.

4. Make P the subject of the formula. (3 marks)
   $E + \chi = \chi + \sqrt{\dfrac{P - 3u}{y - 3\chi P}}$.

5. Points P, Q and R are points on the circumference of a circle. If PQ = PR = 13cm and QR = 10cm, what is the radius of the circle. (3 marks)

6. Find the radius and the centre of the circle whose equation is: (3 marks)
   $3\chi^2 + 3y^2 - 6\chi + 12y + 3 = 0$.

7. Find C that divide AB externally in the ratio 5: 2, given that
   A (3, -6, 9) and B (-15, 3, 12). (3 marks)

8. A two digit number is formed from the first four prime numbers.
   (a) Draw the table to show the possible out comes. (2 marks)
   (b) Calculate the probability that a number chosen from the two digits is even number. (2 marks)

9. A dam containing 4158m^3 of water is to be drained. A pump is connected to a pipe of radius 3.5cm and machine operate for 8 hours per day. Water flows through the pipe at the rate of 1.5m per second. Find the number of days it takes to drain the dam. (4 marks)

10. The population of two town Kana and Jane for three years were as follows:

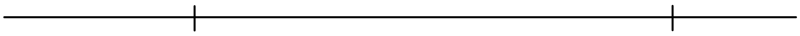
Kana	40,000,	48000,	56000
Jane	40,000,	48000,	57600

    Calculate the difference in population of the two after six years.

11. The gradient of a curve at any point given by $2\chi - 1$. Given that the curve passes through point (1, 5). Find the equation of the curve. (3 marks)

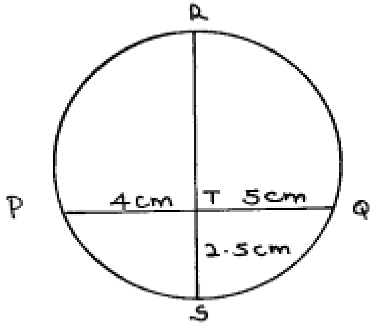
12. Simplify: $\dfrac{3}{\sqrt{7} - \sqrt{2}} - \dfrac{2}{\sqrt{7} + \sqrt{2}}$. (3 marks)

13. Given that AB = 6cm construct locus of P such that angle ∠APB = 90. (2 marks)



14. A car valued at Ksh.500,000 in January 2008. Each year, it value depreciates at 12%p.a. Find after how long would the value depreciate to Ksh.250,000. (3 marks)

15. In below figure PT = 4cm and TQ = 5cm and TS = 2.5cm find TR by calculation. (2 marks)



16. Given that 2 ≤ A ≤ 4 and 0.1 ≤ B ≤ 0.2. Find the minimum value of $\dfrac{AB}{A - B}$. (3 marks)

SECTION B: (50 MARKS)

Answer any FIVE questions from this section in the spaces provided.

17. Two towns A and B lie on the same parallel of latitudes 60°N. If the longitudes of A and B are 42°W and 29°E respectively.

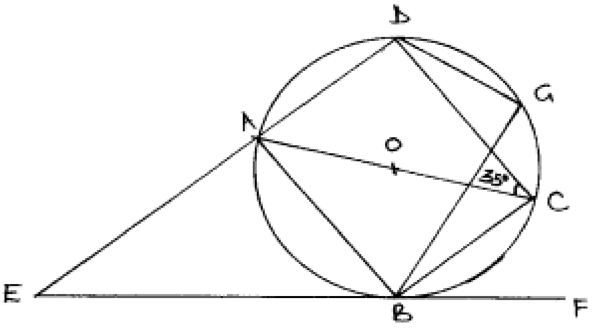
(a) Find the distance between A and B in nautical miles along the parallel of latitude. (2 marks)

(b) Find the local time at A if at B is 1.00pm. (2 marks)

(c) Find the distance between A and B in km. $\left(Take\ \pi = \frac{22}{7}\ and\ R = 6370\ km\right)$. (2 marks

(d) If C is another town due South of A and 10010km away from A, Find the co-ordinate of C. (4 marks)

18. In the figure below AOC is a diameter of the circle centre O. AB = BC and $\angle ACD = 35°$, EBF is a tangent to the circle at B. G is a point on minor arc CD.



Calculate the size of the following angles giving reasons in each case.

(a) $\angle BCD$. (2 marks)

(b) Obtuse angle BOD. (2 marks)

(c) $\angle BAD$. (2 marks)

(d) $\angle CGD$. (2 marks)

(e) $\angle AEB$. (2 marks)

19. (a) Complete the table below for the function $y = 3\chi^2 - 2\chi - 1$ for $-3 \le \chi \le 4$.

χ	-3	-2	-1	0	1	2	3	4
$y = 3\chi^2 - 2\chi - 1$		15				7		

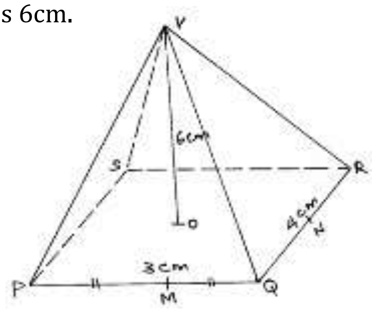
(2 marks)

(b) Draw the graph of $y = 3\chi^2 - 2\chi - 1$. (3 marks)

(c) Draw the line $y = 3\chi + 1$ on the same axis hence find the values of χ for which $y = 3\chi + 1$ and $y\ 3\chi^2 - 2\chi - 1$ are equal. (3 marks)

(d) Write down the simplified quadratic equation whose roots are the solutions of the simultaneous equation in (c) above. (2 marks)

20. The diagram below shows a right pyramid VPQRS with V as the vertex and a rectangular base PQRS. PQ = 3cm, QR = 4cm. The height of the pyramid is 6cm.
PM = MQ and OQ = NR.



(a) Calculate.

(i) the length PV. (3 marks)

(ii) the angle between face VPQ and the base. (2 marks)

(b) (i) the slant height VM and VN. (2 marks)

(ii) What is the surface area of the pyramid? (3 marks)

21. On the same axes, draw this graph of $y = 2\ \text{Sin}\ \chi$ and $y = 3\ \text{Sin}\ (\chi + 30°)$ for the domain $-360° \le \chi \le 360°$. (5 marks)
From your graph determine.

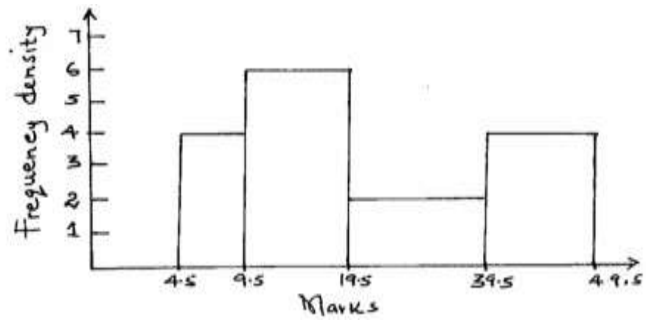
(a) the period of each of the functions. (1 mark)

(b) the amplitude of each of the functions. (1 mark)

(c) the solution to $2\ \text{Sin}\ \chi = 3\ \text{Sin}\ (\chi + 30°)$. (1 mark)

(d) the transformation that maps the graph of $y = 2\ \text{Sin}\ \chi$ onto the graph of $y = 3\ \text{Sin}\ (\chi + 30°)$. (2 marks)

22. The diagram below shows a histogram marks obtained in a certain test.



(a) Develop a frequency distribution table for the data if the first class 5-9 has a frequency of 8. (3 marks)
(b) Estimate the mean. (3 marks)
(c) Calculate interquatile range. (4 marks)

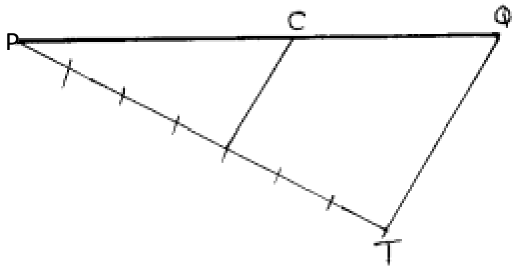
23. The cost C, of producing n items varies partly as n and partly as the inverse of n.
To produce two items it cost 50Sh and to produce six items it costs 70Sh.
Find
(a) the constants of proportionality and hence write the equation connecting C and n. (5 marks)
(b) the cost of producing 12 items. (2 marks)
(c) the number of items produced at a cost of 106Sh. (3 marks)

24. An auto spare dealer sells two types of lubricant A and B in his shop. While purchasing type A cost Sh.40 per 100ml tin and type B cost Sh.60 per 100ml tin. He decided to buy at least 30 tins altogether of type A and B with Sh.1500 available. He decides that at least one third of the tins should be of type B. He buys χ tins of type A and y tins of type B.
(a) Write down three inequalities, which represent the above information. (3 marks)
(b) On a graph paper, draw a graph to show the three inequalities (a) above. (3 marks)
(c) Determine how many tins of each type that he should buy to maximize his profit if he makes a profit of Sh.10 of each type A and a profit of Sh.20 on each type B tin. (2 marks)
(d) Calculate maximum possible profit. (2 marks)

CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015
121/1
MATHEMATICS
PAPER 1

1.	$\frac{72}{-24} - \frac{64 \times -12 - 24}{\frac{-96}{12} \times 9}$ $-3 - \frac{-768 - 24}{-8 \times 9}$ $-3 - \frac{-792}{-72}$ -3 – 11 = -14	
2	(a) 15 (b) $\frac{15 + 15}{2}$ 15	
3	1.2χ 1.3 x 1.2χ = 3120 χ = 2000	
4	Cos (χ + 20) = Cos 40° χ + 20 = 40° χ = 20° Or χ + 20 = 320° χ = 300°	
5	$2 \times 3 \times 5^2 \times 7$ B1 P = 2 x 3 x 7 M1 42 A1	
6	χ - 50 + 2χ + 20 = 180 M1 3χ = 210° χ = 70 70 – 50 = 20 No of side $\frac{360}{20}$ M1 = 18 A1	
7	$5 = \frac{-3}{4}\chi - 2 + C \Rightarrow 5 - \frac{-3}{2} = \frac{7}{2}$ M1 $y = \frac{-3}{4}\chi + \frac{7}{2}$ $\frac{1}{2} = \frac{-3}{4}\chi + \frac{7}{2}$ $-3 = \frac{-3}{4}\chi \quad \chi = 4$ M1 $\left(4, \frac{1}{2}\right)$ $\perp \frac{1}{2} = \frac{4}{3} \times 4 + C$ B1 $\frac{1}{2} - \frac{16}{3} = C = \frac{3 - 32}{6}$ $y = \frac{4}{3}\chi - \frac{29}{6}$ A1	

8	$\frac{(\chi - 2y)[\chi + 2y - (\chi - 2y)]}{(\chi - 2y)(\chi + 2y)}$ M1 $\frac{\chi - \chi + 2y + 2y}{\chi + 2y} = \frac{4y}{\chi + 2y}$ B1 A1
9	324: 768 27: 64 V.R 3: 4 L.R M1 (a) 20 $\frac{20 \times 3}{4} = 15$ A1 (b) 9: 16 $\frac{40 \times 9}{16} = 22.25$ M1 y 40 A1
10	$\frac{22}{7} \times 2.1 \times 2.1 - \frac{22}{7} \times 1.4 \times 1.4$ M1 7.7 x 500 M1 Volume $\frac{7.7 \times 500 \times 1.45}{1000}$ M1 5.5825kg A1
11	$\frac{2^{-5 \times \frac{1}{5}} \times 3^3 \times 2^{\frac{1}{2}} \times 5^{\frac{1}{2}} \times 2^{\frac{3}{2}}}{5^{\frac{1}{2}} \times 2^{\frac{1}{2}}}$ M1 $2^{\frac{-1}{2}} + \frac{1}{2} + \frac{3}{2}^{\frac{1}{2}} \times 3^3$ B1 $2^{\frac{3}{2}} \times 3^3 \; or \; 54$ A1
12	∠QSR = 55° ⇒ ∠QRS = 180 - 110° M1 ∠SPQ = ∠QRS = 70° ⇒ ∠TPS = 110° ∠PST = 90 - 55° = 35° M1 Angles of triangle TPS 180 – 35 - 110° = 35° A1
13	$\frac{5}{8} \times 72 = 45kg$ $M1$ $A1$
14	| 48 | 60 2 | 24 | 30 $2^4 \times 3 \times 5 = 240$ M1 2 | 12 | 15 2 | 6 | 15 2 | 3 | 15 2.4 x 2.4m² B1 3 | 1 | 5 5.76m² A1 5 -2 ≤ y
15	$y < \frac{-3}{5}\chi + 3$ B1 y ≤ χ - 3 B1

16	
17	(a) $\frac{48000\ \times 96 \times 49}{48 \times 28}$ $M1$ *Numerator* $M1$ $Deno\min ator$ = 168,000 A1 (b) $6000\times\frac{96}{8}$ M1 168,000 – 72,000 M1 = 96000 A1 (c) $48000\times\frac{192}{48}\times\frac{84}{28}$ = 576,000 A1 $Transport\ \cos t = \frac{576{,}000\times 100}{144}$ M1 = 400,000 A1
18	a) χ^2 $2(\chi + 2) + 2\chi$ Or $(\chi + 2)(\chi + 2) = 64$ M1 $\chi^2 + 2(\chi + 2) + 2\chi = 64$ $\chi^2 + 4\chi - 60 = 0$ M1 $(\chi - 6)(\chi + 10) = 0$ $(\chi - 6)(\chi + 10) = 0$ M1 $\chi = 6$ or -10 $\chi = 6$ or -10 A1 Length = 6m $\chi = 6$m B1 (b) $(y + 3)(y - 2) = 24$ M1 $y^2 + y - 30 = 0$ M1 $(y + 5)(y - 6) = 0$ M1 y = -5 or 6 A1
19	(a) Cow cost Ksh.χ, goat cost Ksh.y $8\chi + 12y = 294{,}000$ B1 $9\chi + 15y = 337500$ B1 (b) $\begin{pmatrix}8 & 12\\ 9 & 15\end{pmatrix}\begin{pmatrix}\chi\\ y\end{pmatrix}=\begin{pmatrix}294{,}000\\ 337500\end{pmatrix}$ M1 $\begin{pmatrix}\chi\\ y\end{pmatrix}=\frac{1}{12}\begin{pmatrix}15 & -12\\ -9 & 8\end{pmatrix}\begin{pmatrix}294{,}000\\ 337{,}500\end{pmatrix}$ M1 $\begin{pmatrix}\chi\\ y\end{pmatrix}=\begin{pmatrix}30{,}000\\ 4{,}500\end{pmatrix}$ M1 Cow Ksh.30,000, goat Ksh.4,500 A1 (i) $\frac{140}{100}\times 8\times 30{,}000+\frac{145}{100}\times 12\times 4500$ M1 = 414,300 A1 (ii) 414,300 – 294,000 M1 = 120,300 A1
20	(a) Truck has covered $60\times 2\frac{1}{2}$ M1 = 150km $T = \frac{150}{40} = 3.45\min$ M1 = 01415 + 3.45 M1 = 18.00hrs/6.00pm A1 (b) $2\frac{1}{2}\times 100 = 250km$ M1 500 – 250 M1 = 250km A1 (c) Car took 2hrs Car reached at 1845hrs or 6.45pm B1 For both Truck reached at 1935hrs or 7.35pm 1935 – 1845 M1 = 50 minutes A1
21	(a) $\frac{ds}{dt} = 6t^2 - 10t + 4$ M1 t = 2 $V = 6 \times 2^2 - 10 \times 2 + 4$ M1 = 4m/s A1 (b) $6t^2 - 10t + 4 = 0$ M1 $6t^2 - 4t - 6t + 4 = 0$ $2t(3t - 2) - 2(3t - 2) = 0$ $(3t - 2)(2t - 2) = 0$ M1 $t = \frac{2}{3}$ or 1 A1 (c) S = 3 metres or B1 $3\frac{1}{27}$ metres B1 (d) a = 12t – 10 M1 $= 50m/s^2$ A1
22	(a) (i) $\underset{\sim}{b} - \underset{\sim}{a}$ B1 (ii) $3\underset{\sim}{b} - \underset{\sim}{a}$ B1 (b) $OM = \underset{\sim}{a} + \frac{3}{4}(\underset{\sim}{b} - \underset{\sim}{a})$ M1 $\frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}$ A1 $OM = \underset{\sim}{a} + \frac{3}{4}(\underset{\sim}{b} - \underset{\sim}{a})$ M1 $\frac{1}{2}\underset{\sim}{a} + \frac{3}{2}\underset{\sim}{b}$ A1 (c) $\underset{\sim}{ON} = K\underset{\sim}{OM}$ $\frac{1}{2}\underset{\sim}{a} + \frac{3}{2}\underset{\sim}{b} = K\left(\frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}\right)$ M1 K = 2 A1 $\underset{\sim}{ON} = 2\underset{\sim}{OM}$ $\underset{\sim}{ON} \mathbin{//} \underset{\sim}{OM}$ B1 O is common B1 Hence O, M, N are collinear

<u>23</u>

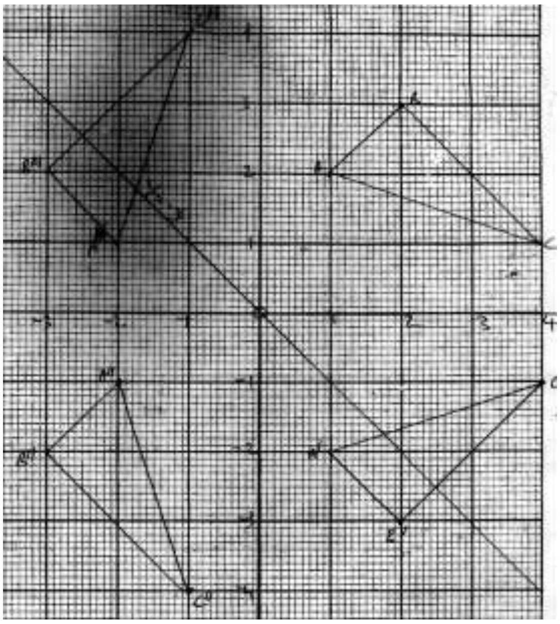
(a)	ΔABC ✓ drawn	B1
	$\Delta A^1B^1C^1$ ✓ drawn	B1
(b)	Reflection, line y = 0 or χ-axis	B2
(c)	Line y = -χ drawn	B1
	$\Delta A^{11}B^{11}C^{11}$ ✓ drawn	B1
(d)	$\Delta A^{111}B^{111}C^{111}$ ✓ drawn	B2
(e)	Using the unit square	

$$m = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \quad \text{M1A1}$$

Alternative

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 1 & 2 & 4 \\ 2 & 3 & 1 \end{pmatrix} = \begin{pmatrix} -2 & -3 & -1 \\ 1 & 2 & 4 \end{pmatrix} \text{M1}$$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} A1$$



<u>24</u>

(a) (i) $\frac{126}{360} \times \frac{22}{7} \times 2 \times 40$ M1

= 88cm A1

(ii) $\frac{126}{360} \times \frac{22}{7} \times 40 \times 40$ M1

= 1760cm^2 A1

(b) (i) $2 \times \frac{22}{7} \times r = 88$ M1

r = 14cm A1

(ii) $h = \sqrt{40^2 - 14^2}$ M1

= 37.47cm A1

(iii) $\frac{1}{3} \times \frac{22}{7} \times \frac{14 \times 14 \times 37.47}{1000}$ M1

= 7.669 litres A1

CENTRAL KENYA NATIONAL SCHOOLS JOINT MOCK - 2015
121/2
MATHEMATICS
PAPER 2

1.

$\frac{9}{4} - \frac{5}{3} = \frac{27-20}{12} = \frac{7}{12}$ B1

$\frac{1}{6} - \frac{1}{9} = \frac{3-2}{18} = \frac{1}{18}$ B1

$\frac{7}{12} \times \frac{18}{1} = \frac{21}{2}$ B1

$\frac{21}{2} - \frac{15}{8} = \frac{84-15}{8} \quad \frac{69}{8} = 8\frac{5}{8}$ A1

2

(a) $2^4 + 4 \text{ x } 2^3\chi + 6 \text{ x } 2^2\chi^2 + 4 \text{ x } \chi^3 + \chi^4$

$16 + 32\chi + 24\chi^2 + 8\chi^3 + \chi^4$ M1

(b) $2.01 = 2 + \chi \quad \chi = 0.01$

$16 + 0.32 + 0.0024 + 0.000008$

16.3224 A1

3

$Log_{10}(3y+2)$ - $Log_{10}^{10} = Log_{10}(y+4)$ M1

$\frac{3y+2}{10} = y - 4$

3y + 2 = 10y – 40 M1

7y = 42, y = 6 A1

4

$E = \sqrt{\frac{P-3u}{y-3\chi P}}$ M1 Squaring

$E^2 = \frac{P-3u}{y-3\chi P}$

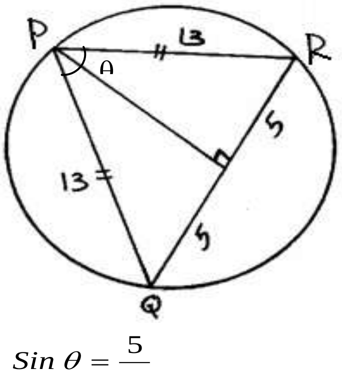
$E^2y - 3E^2\chi P = P - 3u$

M1M1 Collecting terms of P

$E^2y + 3u = P + 3E^2\chi P$

$\frac{E^2y + 3u}{1 + 3E^2\chi} = \text{P}$ A1

5



$Sin\ \theta = \frac{5}{13}$

22.62 x 2 = 45.24° M1

$\frac{P}{Sin\ P} = 2R$

$\frac{10}{Sin\ 45.24} = 2R$ M1

2R = 14.083

R = 7.042 A1

6

$\chi^2 + y^2 - 2\chi + 4y = \frac{-3}{3}$

$\chi^2 - 2\chi + \left(\frac{2}{2}\right)^2 + y^2 + 4y + \left(\frac{4}{2}\right)^2 =$

$\frac{-3}{3} + \left(\frac{2}{2}\right)^2 + \left(\frac{4}{2}\right)^2$ M1

$(\chi - 1)^2 + (y + 2)^2 = -1 + 1 + 4$

$(\chi - 1)^2 + (y + 2)^2 = 2^2$ M1

7

AC: CB = 2AC = 5CB

5: -2 $\quad -2(\underset{\sim}{c} - \underset{\sim}{a}) = 5(\underset{\sim}{b} - \underset{\sim}{c})$

$-2\underset{\sim}{c} + 2\underset{\sim}{a} = 5\underset{\sim}{b} - 5\underset{\sim}{c}$

$3\underset{\sim}{c} = 5b - 2\underset{\sim}{a} \quad \underset{\sim}{c} = \frac{5}{3}\underset{\sim}{b} - \frac{2}{3}\underset{\sim}{a}$ B1

$\underset{\sim}{C} = \frac{5}{3}\begin{pmatrix}-15\\3\\12\end{pmatrix} - \frac{2}{3}\begin{pmatrix}3\\-6\\9\end{pmatrix}$ B1

$\begin{pmatrix}-25\\5\\20\end{pmatrix} - \begin{pmatrix}2\\-4\\6\end{pmatrix} = \begin{pmatrix}-23\\9\\14\end{pmatrix}$

(-23, 9, 14) A1

8

	2	3	5	7	B1
2	22	32	52	72	
3	23	33	53	73	B1
5	25	35	55	75	
7	27	37	57	77	

(b) $\frac{4}{16}$ *or* $\frac{1}{4}$ A1

9

$4158 \times 10^6 = \frac{22}{7} \times 3.5^2 \times 150 \times 8 \times 60 \times 60 \times d$ M1

$\frac{4158 \times 10^6}{\frac{22}{7} \times 3.5^2 \times 150 \times 60 \times 60} = 25\ day$ M1 A1

10

Kana d = 8000, a = 40,000 M1

40,000 + 5 x 8000 = 80,000

Jane r = 1.2 M1

$40000(1.2^5) = 40000 \text{ x } 2.488$

99533 M1

19533 A1

11

$\frac{dy}{d\chi} = 2\chi - 1 \quad y = \chi^2 - \chi + C$ M1

5 = 1 – 1 + C C = 5 M1

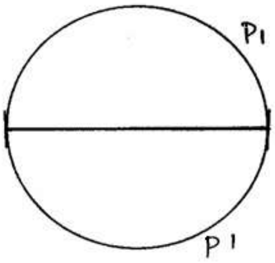
$Y = \chi^2 - \chi + 5$ A1

12

$$\frac{3\left(\sqrt{7}+\sqrt{2}\right)-2\left(\sqrt{7}-\sqrt{2}\right)}{\left(\sqrt{7}-\sqrt{2}\right)\left(\sqrt{7}+\sqrt{2}\right)}=\frac{3\sqrt{7}+3\sqrt{2}-2\sqrt{7}\ 2\sqrt{2}}{7-2}$$

$$\frac{\sqrt{7}+5\sqrt{2}}{5}$$ A1

13



14

$$A=P\left(1-\frac{V}{100}\right)^{n}$$

$$250{,}000=500{,}000\left(1-\frac{12}{100}\right)^{n}$$ M1

$0.5 = 0.88^n$ log 0.5 = n log 0.88 M1

$$n=\frac{Log\ 0.5}{Log\ 0.88}=5.422\ yrs$$ A1

15

4 x 5 = 2.5 x χ M1

$$\chi=\frac{20}{2.5}=8cm$$ A1

16

$$\frac{2(0.1)}{4-0.1}=\frac{0.2}{3.9}$$ B1 M1

$$\frac{0.2}{3.9}=\frac{2}{39}$$ A1

17

(a) 71 x 60 x Cos 60 M1
= 2130n.m A1

(c) 71 x 4mins = 284min
4hrs = 44min B1
1300 – 4hrs 44min A1
= 8.16am

(c) $$\frac{\theta}{360}\times 2R\ Cos\ \theta\times\frac{22}{7}$$

$$\frac{71}{360}\times 2\times 6370\times Cos\ 60\times\frac{22}{7}$$

= 3948.39KM

(d) $$\frac{\theta}{360}\times 2\times\frac{22}{7}\times 6370=10010$$ B1

$$\theta=\frac{10010\ \times 7\times 360}{2\times 22\times 6370}$$ M1

= 90° M1
(30°S, 42°W) A1

18

(a) ∠BCD = 35° + 45° B1
= 80°
∠.S in a semi-circle $\frac{180^{o}-90^{o}}{2}=45^{o}$

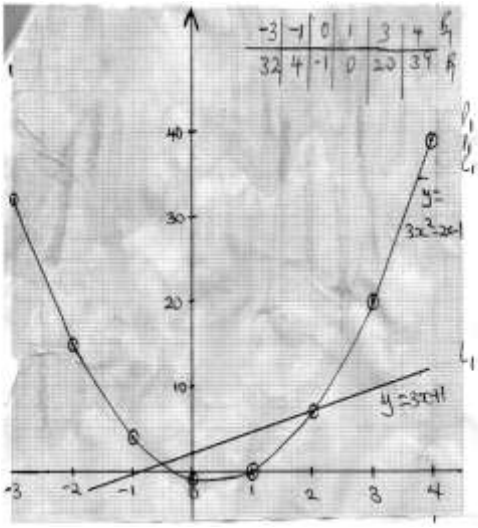
(b) ∠BOD = 2 ∠BCD
= 2 x 80°
= 160°
∠.S sub at centre of a circle is cirm.B1

(c) ∠BAD = 180° - ∠BCD B1
= 180° - 80°
= 100° B1
Opp. ∠.S of cyclic quad are supp.

(d) ∠CGD = 180°- ∠CAD B1
= 180° - 55°
= 125°
Opp. ∠.S of cyclic quad are supp. B1

(e) ∠AEB = 180° 0 (100° - 45°) B1
= 35°
Sum of interior angles of D is supp. B1

19



(b) y = 3χ + 1

χ	0	2
y	4	7

χ_1 = -0.5 ± 0.1 – B1
χ_2 = 2 ± 1 B1

(d) $$\left(\chi+\frac{1}{2}\right)(\chi-2)=0$$ M1

$$\chi^{2}-2\chi+\frac{1}{2}\chi-1=0$$

$$\chi^{2}-\frac{3}{2}\chi-1=0$$ A1

20

(a) (i) $$OP=\frac{1}{2}\left(\sqrt{3^{2}+4^{2}}\right)=2.5$$ M1

$$=\sqrt{6^{2}+2.5^{2}}=6.964$$ M1A1

20 (ii) $Tan\ \theta = \frac{6}{2} = 3$ M1

$Tan^{-1}\ \theta = 6.3$ A1

$\theta = 71.56°$

(b) (i) Slant height VM

$6^2 + 2^2$

$= \sqrt{40} = 6.325$ A1

$VN = \sqrt{6^2 + 1.5^2}$ A1

$= 6.185$

20 (ii) Area of PQRS + 2(PQV) + 2(VQR)

$(3 \text{ x } 4) + \left(\frac{1}{2} \times 2 \times 6.325 \times 3\right) + \left(2 \times \frac{1}{2} \times 6.188 \times 4\right)$

$= 12 + 18.98 + 24.74$

$= 55.72$

21 .(a)

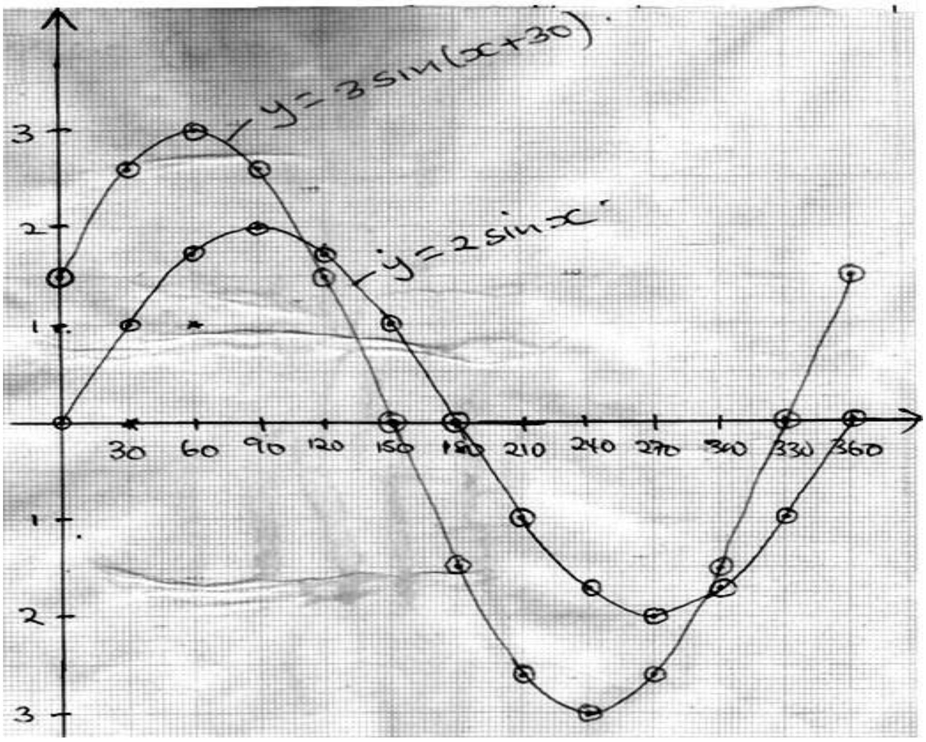
χ°	0	30	60	90	150	210	240	270
y = 2 Sin χ	0	1.0	1.73	2.0	1.0	-1.0	-1.73	-2.0
(χ + 30)	30	60	90	120	180	240	270	300
y = 3 Sin (χ + 30)	1.5	2.6	3.0	2.6	0	-2.6	-3.0	-2.6

B1

χ°	300	330	360	180	120
y = 2 Sin χ	9.73	-1.0	0	0	1.73
(χ + 30)	330	360	390	210	
y = 3 Sin (χ + 30)	-1.5	0	1.5	-1.5	01.5

B1

B1



(a) 360 both

(b) (i) 2 and 3

(c) 111° ± 1 and 294° ± 1 B1

(d) $\begin{pmatrix} -30 \\ 0 \end{pmatrix}$ Translation of $\begin{pmatrix} -30 \\ 0 \end{pmatrix}$ followed by stretch s.f 1.5 $B1$ $B1$

22. (a)

Class	5 - 9	10 - 19	20 - 39	40 - 49	B1	10 – 19 f = 24
Frequency	8	24	16	16	B1 B1	20 - 39 f = 16 40 – 49 f = 16

(b)

χ	7	14.5	29.5	44.5			
f	8	24	16	16			
fχ	56	348	472	712	$\Sigma f\chi = 1588$	B1	✓fχ

$$Mean = \frac{\Sigma f\chi}{\Sigma f} = \frac{1588}{64} = 24.8125$$ M1 ✓ subst
A1

(c)

	5 - 9	10 - 19	20 - 39	40 - 49
f	8	24	16	16
cf	8	32	48	68

$\frac{1}{4} \times 64 = 16$ M1 ✓exp LQ

L$Q = 9.5 + \frac{16-8}{24} \times 10$ M1 ✓exp VQ

$9.5 + \frac{1}{3} \times 10 = 12.83$

U$Q = 19.5 + \frac{48-32}{16} \times 20$

39.5

Interquatile range M1

39.5 – 12.83 A1

= 26.67

23. (a) $C = Kn + \frac{h}{n}$ B1

$$\left.\begin{aligned} 70 &= 6K + \frac{h}{6} \\ 50 &= 62K + \frac{h}{2} \end{aligned}\right\}$$ M1

420 = 36K + h

<u>- 100 = 4K + h</u>

320 = 32K K = 10 h = 60 A1

$C = 10n + \frac{60}{n}$ A1

(b) $C = 10 \times 12 + \frac{60}{12}$ B1

C = 120 + 5 = 125 A1

(c) $106 = 10n + \frac{60}{h}$ B1

106n = 10n^2 + 60 $\Rightarrow$ 5n^2 - 53n + 30 = 2

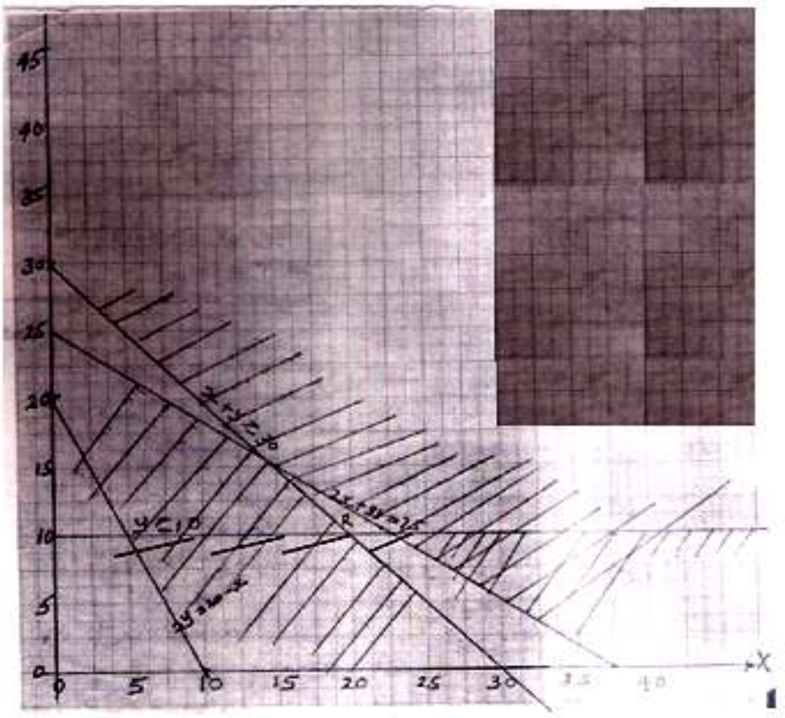
$\frac{53 \pm \sqrt{2809 - 4 \times 5 \times 30}}{2 \times 5} = \frac{53 \pm 47}{10} = \frac{100}{10} = 10$ M1A1

24

(i) $\chi \geq 30$ ✓1

(ii) $2\chi + 3y \leq 75$ ✓1

(iii) $y \geq 10$



Each inequality Drawn B1

B1

B1

$10\chi + 2y = C$ Drawn or B1 trial and error

$y \geq 10$

$10\chi + 2y = C$

$C = 20$

$\chi = 21, y = 11$ B1

(iv) $21 \text{ x } 10 + 11 \text{ x } 20 = 210 + 220 = 430$ M1

A1

10

KIRINYAGA CENTRAL SUB-COUNTY JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education

121/1
MATHEMATICS
PAPER 1
JULY/AUGUST, 2015
TIME: 2½ HOURS

SECTION I: (50 MARKS)

Answer all the questions in the section.

1. Evaluate without using Mathematical tables or the calculator. (2 marks)

$$\sqrt{\frac{153 \times 0.18}{0.68 \times 0.32}}$$

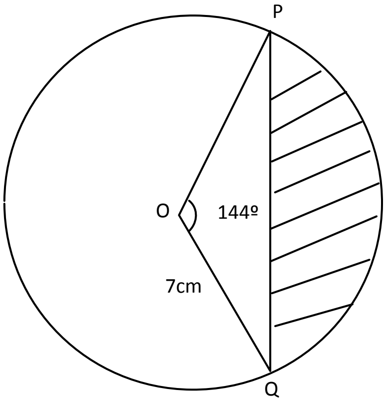
2. Reduce the following expression onto a single fraction. (3 marks)

$$\frac{4\chi - 5}{2} - \frac{2\chi - 1}{6}$$

3. Solve the equation log 3(χ + 3) = 3 log 3 + 2. (3 marks)
4. Use tables of square roots and reciprocals tables to evaluate: (3 marks)

$$\frac{10}{\sqrt{0.625}} + \frac{4}{\sqrt{164}}$$

5. A point P has the coordinates (1, 2, 3). If $\underset{\sim}{PQ} = 5\underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k}$, find.
   (a) the coordinates of point Q. (2 marks)
   (b) the modulus of $\underset{\sim}{PQ}$. (1 mark)
6. The figure below shows a circle centre O diameter 7cm. Angle POQ = 144°.



Calculate the area of the shaded region. (4 marks)

7. Point B is 30m away from point A at a bearing of 150°. Point C is 25m from A at a bearing of 120°. Find how far C is from B. (3 marks)
8. The currency exchange rates of a given bank in Kenya are as follows.

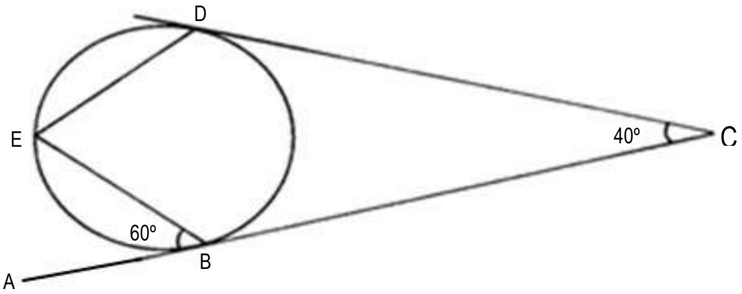
Currency	Buying	Selling
1 Sterling pound	135.50	135.97
1 US pound	72.23	72.65

A tourist arrived in Kenya with 5000US dollars which he converted to Kenya shillings upon arrival. He spent Ksh.214,500 and converted the remaining to sterling pounds. How many pounds did he receive? (3 marks)

9. Find the equation of a perpendicular bisector of line PQ, in the form y = mχ + C. If the coordinates of P and Q are (-2, 6) and (4, -2) respectively. (3 marks)
10. Make n the subject of the formulae in: (3 marks)

$$A = P\left(1 + \frac{r}{100}\right)^{n}$$

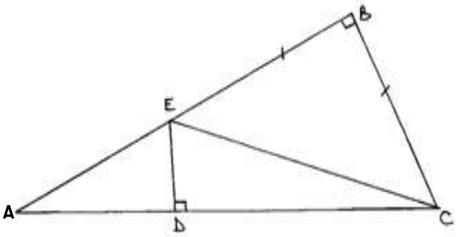
11. In the figure below lines ABC and DC are tangents to the circle at B and D respectively. Angle ACD = 40° and angle ABE = 60°.



Find the size of angle:
(i) CBD. (1 mark)
(ii) CDE. (1 mark)
(iii) BED. (1 mark)
(iv) ABD. (1 mark)

12. A map has a scale of 1:25000 on this map; a square piece of land is represented by an area of 2cm^2. Calculate the actual area, in hectares of the plot. (3 marks)

13. In triangle ABC below, angle ABC = 90°, angle ACB = 60°, angle ADE = 90°, AB = 4cm and BC = BE.



Calculate:
(a) BC. (1 mark)
(b) CE. (1 mark)
(c) DC. (1 mark)

14. A particle moves in a straight line from a fixed point. Its velocity Vms^{-1} after t seconds is given by V = 9t^2 - 4t + 1. Calculate the distance travelled by the particle during the third second. (3 marks)

15. (a) Fid the value of χ given that $\begin{pmatrix} x & 1-x \\ x+2 & -x \end{pmatrix}$ is a singular matrix. (2 marks)

(b) If $A = \begin{pmatrix} 2 & 4 \\ 3 & -5 \end{pmatrix}$ and $x = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$, find Z given that AZ = χ. (2 marks)

16. From the roof of a house, a boy can see an avocado tree which is 20m away from the house. He measures the angle of elevation of the top of the tree as 21° and the angle of depression of the bottom of tree as 31°. Find the height of the avocado tree. (3 marks)

SECTION II: (50 MARKS)

Answer only ANY FIVE questions in this section.

17. A matatu left town K at 7.00am and travelled towards town M at an average speed of 60km/hr. A car left town M at 9.00am and travelled towards K at an average speed of 80km/hr. The distance between the two towns is 324km. Find.
(a) the time each vehicle arrived at their destination.
(i) Matatu. (2 marks)
(ii) Car. (2 marks)
(b) (i) The distance the matatu covered before the car started to move from town M to town K. (1 mark)
(ii) The time the two vehicles met on the way. (3 marks)
(c) How far the car was from town K when they met? (2 marks)

18. (a) The numerator of the fraction $\frac{p}{q}$ is increased in the ratio 3:2 while the denominator is decreased in the ratio 2: 3.

If the resulting fraction is $\frac{27}{28}$, find

(i) the fraction $\frac{p}{q}$ in its simplest form. (3 marks)

(ii) the percentage change in the fraction. (2 marks)

(b) A piece of work can be done by 30 men in 12 days. They work for 4 days after which 6 of the men leave. How long will it take the remaining men to complete the job if they work at the same rate? (3 marks)

(c) Given that the cost of maize is Sh.30 per kg and that of beans is Sh.50 per kg, find the cost of 1kg of a mixture of maize and beans if they are in the ratio of 3: 2 respectively. (2 marks)

19. A boat P leaves part A (45°N, 50°W) and sails at an average speed of 10 knots. It sails due east along a parallel of latitude to B (45°N, 42°W) and then sails due north to C (48°N, 42°W). Another boat Q leaves D (55°N, 10°W) at the same time as P leaves A. It sails due west and then due south to meet boat P at C.

(a) How long does it take boat P to reach point C? (4 marks)

(b) If boat Q sails at the same speed as boat P, how long does the former take to reach point C. (4 marks)

(c) At what speed would boat Q have to sail to reach point C at the same time as boat P. (2 marks)

20. (a) Complete the table below for the equation $y = \chi^2 - 6\chi + 5$.

χ	0	1	2	3	4	5	6
χ^2	0		4	9		25	
-6χ	0	-6			-24		-36
5	5	5	5	5	5	5	5
y	5					0	

(2 marks)

(b) Draw the graph of $y = \chi^2 - 6\chi + 5$ using the values in the table. (3 marks)

(c) Use the graph to solve the equations.

(i) $\chi^2 - 6\chi + 5 = 0$ (1 mark)

(ii) $\chi^2 - 6\chi + 7 = 0$ (2 marks)

(iii) $\chi^2 - 6.5\chi + 5 = 0$ (2 marks)

21. In an agricultural research station, the lengths of a sample of leaves were measured and recorded as shown in the frequency distribution table below.

Length in (cm)	3.0 – 3.4	3.5 – 3.9	4.0 – 4.4	4.5 – 4.9	5.0 – 5.4	5.5 – 5.9	6.0 – 6.4	6.5 – 6.9	7.0 – 7.4
No. of leaves	1	4	9	14	12	10	6	3	1

(a) State the modal class. (1 mark)

(b) Calculate the median (4dp). (3 marks)

(c) Using an assumed mean of 5.2, find:

(i) Mean (4dp). (3 marks)

(ii) Standard deviation (4dp). (3 marks)

22. Construct triangle PQR such that PQ = 7cm, QR = 6cm and RP = 5cm. (1 mark)

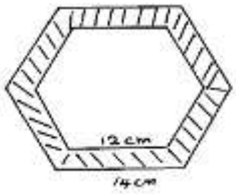
(a) Construct the locus of point X which is equidistant from Q and R. (1 mark)

(b) Construct the locus of M which is equidistant from PR and QR.
Mark with letter M the point where this locus meets PQ. Measure QM. (3 marks)

(c) Construct the locus of Y such that PY = 4cm. (1 mark)

(d) Shade the region in which T lies given that $QT \geq TR$ and $\angle PRT \geq \angle QRT$ and $PT \leq 4$cm. (4 marks)

23. The diagram below (not drawn to scale) shows the cross-section of a regular hexagonal solid metal prism length 20cm.



Calculate:

(a) the area of the shaded region. (5 marks)

(b) the volume of the material used to make the metal in cm^3. (2 marks)

(c) If the density of the metal prism is $3.5g/cm^3$. Find its mass in kg. (3 marks)

24. (a) Write down the first three terms of the sequence whose n^{th} term is $5n - 2$. (1 mark)

(b) The 3rd term of a geometric sequence is 18 and the 6th term is 486. Find the 1st term and the common ratio. (3 marks)

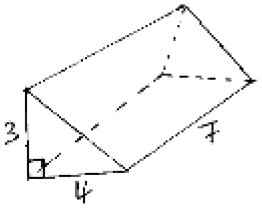
(c) The first and the last term of an AP with 34 terms are 8 and -190 respectively.
Find the sum of the first 34 terms. (3 marks)

(d) The 2nd, 4th and 7th term of an AP are the first 3 consecutive terms of a GP. Find the common ratio if the term is 2. (3 marks)

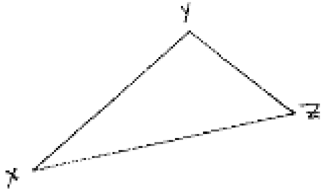
KIRINYAGA CENTRAL SUB-COUNTY JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education
121/2
MATHEMATICS
PAPER 2
JULY/AUGUST, 2015
TIME: 2½ HOURS

SECTION I: (50 MARKS)
Answer all the questions in the section.

1. Evaluate: $\dfrac{\frac{1}{2}\ of\ 3\frac{1}{2} + 1\frac{1}{2}\left(2\frac{1}{2} - \frac{2}{3}\right)}{\frac{3}{4}\ of\ 2\frac{1}{2} \div \frac{1}{2}}$ (3 marks)
2. Simplify: $\dfrac{512^{\frac{4}{3}} \times 27^{\frac{-2}{3}}}{128^{2} \times 9^{-2}}$ (3 marks)
3. The height and radius of a cone are measured as 21cm and 14.0cm respectively. Taking π = 3.142, find the percentage error in the volume of the cone. (3 marks)
4. Use logarithms to 4 decimal places to evaluate: (4 marks)
$\left(\dfrac{0.7841 \times \sqrt{0.1356}}{Log\ 84.92}\right)^{\frac{1}{3}}$
5. A bag contains 3 red and 5 green marbles. Two marbles are picked at random from the bag one at a time without replacement. Find the probability that two marbles picked will be of different colours. (3 marks)
6. The figure below shows a triangular prism. The measurements are in cm.



Draw the net of the prism and hence find the total surface area. (3 marks)
7. List all the integral values of χ which satisfy the inequalities. (3 marks)
$\dfrac{4 + \chi}{-3} > 3\chi + 2 > -13$
8. The equation $2\chi^2 - 12\chi + 2y^2 + 28y = -44$ represents a circle. Determine the coordinates of the centre and the length of it's diameter. (4 marks)
9. Expand $(1 + 2\chi)^8$ in ascending powers of χ up to and including the term in χ^3. Hence evaluate $(1.02)^8$. (4 marks)
10. Express in surd form and simplify by rationalizing the denominator. (3 marks)
$\dfrac{1 + Cos\ 30^o}{1 - Sin\ 60^o}$
11. Find the quadratic equation whose roots are $\frac{-3}{4}$ and $\frac{2}{3}$ and write it in the form $a\chi^2 + b\chi + c = 0$ where a, b and c are integers. (3 marks)
12. Three angles of a polygon are 125°, 140° and 160°. The remaining angles are 145° each. Calculate the sum of the interior angles of the polygon. (3 marks)
13. XYZ is a triangle. Draw the locus of a point M such that angle XYZ is equal to angle XMZ and Y must lie on the locus of M. (3 marks)



14. The G.C.D of three numbers is 30 and their L.C.M is 900. If two of the numbers are 150 and 60, what are the other three possible third numbers? (3 marks)
15. In a race of 100km, John beats James by 10km and beats David by 13km. By how much will James beat David in a race of 120km assuming all run at constant speeds throughout? (3 marks)

16. The table below shows the height of 50 athletes in a college.

Height (cm)	Number of athletes
150 – 159	2
160 – 169	9
170 – 179	12
180 – 189	16
190 – 199	7
200 – 209	4

Calculate the median height of the athletes. (3 marks)

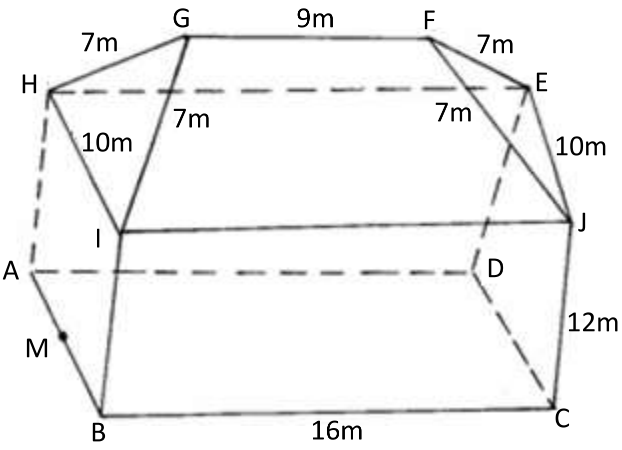
SECTION II: (50 MARKS)
Answer only ANY FIVE questions in this section.

17. Jane is a teacher who has been recruited to reach. She starts with an annual salary of Sh.792000. At end of every year her salary increases by 15% of the previous year.
    (a) Find the salary she gets in her fourth year in the job. (3 marks)
    (b) In which year will she earn Sh.1,831,944. (3 marks)
    (c) Find the total she will have earned in ten years. (4 marks)
18. (a) Complete the table below for the functions y = 3 Cos χ and y = Sin 2χ.

$\chi°$	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
$2\chi°$		-300			-120		0			180			360
3 Cos $\chi°$							3.0						-3.0
Sin $2\chi°$							0.0						0.0

(2 marks)
    (b) On the same axes, draw the graphs of y = 3 Cos χ and y = Sin 2χ for $-180° \le \chi \le 180°$. (5 marks)
    (c) Use the graphs in (b) above to find:
    (i) the values of χ such that 3 Cos χ - Sin 2χ = 0. (2 marks)
    (ii) the difference in the values of y when $\chi = 45°$. (1 mark)
19. (a) Draw ΔPQR whose vertices are P (1, 1), Q (-3, 2) and R (0, 3) on the grid provided.
    (b) Find and draw the image of ΔPQR under the transformation whose matrix is $\begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix}$ and label the image $P^1Q^1R^1$.
    (2 marks)
    $P^1Q^1R^1$ is then transformed into $P^{11}Q^{11}R^{11}$ by the transformation with the matrix $\begin{pmatrix} -1 & 0 \\ 1 & 3 \end{pmatrix}$. (2 marks)
    (c) Find the co-ordinates of $P^{11}Q^{11}R^{11}$ and draw $P^{11}Q^{11}R^{11}$. (3 marks)
    (d) Describe fully the single transformation which maps PQR onto $P^{11}Q^{11}R^{11}$ find the matrix of this transformation.
    (3 marks)
20. In a triangle AOB, $\underset{\sim}{OA} = \underset{\sim}{a}$ and $\underset{\sim}{OB} = \underset{\sim}{b}$. M is the mid-point of AB and N is a point on OB such that ON: NB = 1: 2. AN and OM intersect at P.
    (a) Express $\underset{\sim}{AB}$, $\underset{\sim}{OM}$ and $\underset{\sim}{AN}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$. (3 marks)
    (b) If $\underset{\sim}{OP} = s\,\underset{\sim}{OM}$ and $\underset{\sim}{AP} = t\,\underset{\sim}{AN}$ express $\underset{\sim}{OP}$ in two different ways and find the values of s and t. (6 marks)
    (c) Hence state the ratio AP: PN. (1 mark)
21. (a) P, Q and R are three quantities such that P varies directly as the square of Q and inversely as the square root of R.
    (i) Given that P = 12 when Q = 24 and R = 36, find P when Q = 27 and R = 121. (3 marks)
    (ii) If Q increases by 10% and R decreases by 25%, find the percentage increase in P. (4 marks)
    (b) If Q is inversely proportional to the square root of P and P = 4 when Q = 3.
    Calculate the value of P when Q = 8. (3 marks)

22.



The figure above shows the structure of a building under construction. HA = IB = JC = ED = 12m and BC = AD = IJ = HE 16m; and AB = DC = HI = EJ = 10m and HG = IG = FJ = FE = 7m and GF = 9m.

Calculate:

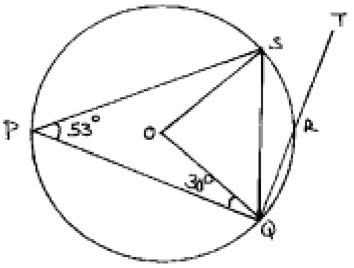
(a) the angle face GHI makes with base ABCD. (3 marks)

(b) vertical height of ridge GF above base ABCD. (3 marks)

(c) angle face GFJI makes with ABCD. (3 marks)

(d) M is midpoint of AB. What is the projection of MF to the base ABCD? (1 mark)

23. In the figure below O is the centre of the circle. Angle SPQ = 53° and angle PQO = 30°.



(a) Giving reasons find the size of angles:

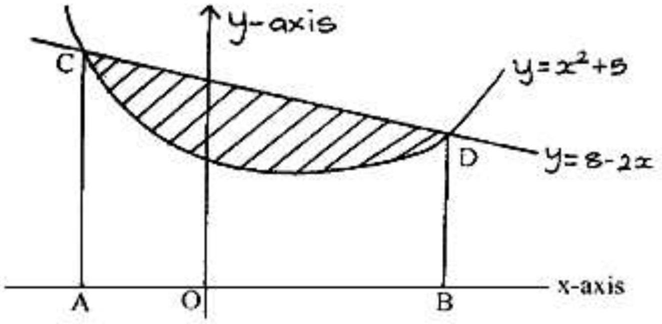
(i) SOQ. (2 marks)

(ii) PSO. (3 marks)

(iii) SRT. (2 marks)

(b) If the radius of the circle is 14cm, find the area of the quadrilateral OQPS. (3 marks)

24. The diagram below, not drawn to scale shows part of the curve $y = \chi^2 + 5$ and the line $y = 8.2\chi$. The line intersects the curve at points C and D. Lines AC and BD are parallel to the y-axis.



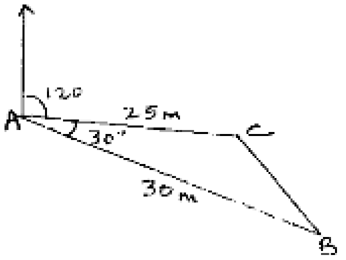
(a) Determine the coordinates of C and D. (4 marks)

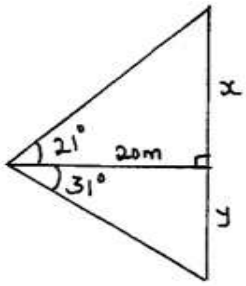
(b) Use integration to calculate the area bounded by the curve and the χ-axis between the points C and D. (3 marks)

(c) Calculate the area enclosed by the lines CD, CA, BD and the χ-axis. (3 marks)

(d) Hence determine the area of the shaded region. (1 mark)

KIRINYAGA CENTRAL SUB-COUNTY JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education
121/1
MATHEMATICS
PAPER 1
JULY/AUGUST, 2015
TIME: 2½ HOURS

1	$\sqrt{\left(\frac{153\times0.18\times104}{0.68\times0.32\times104}\right)}=\sqrt{\left(\frac{153\times18\times100}{68\times32}\right)}$ M1 $=\sqrt{\left(\frac{9\times9\times25}{4\times4}\right)}$ $=\frac{9\times5}{4}$ $11\frac{1}{4}$ *or* 11.25 A1	6	Area of minor sector $POQ=\frac{144}{360}\times\frac{22}{7}\times3.5\times3.5$ M1 $=15.4\text{cm}^2$ Area of $\Delta POQ=\frac{1}{2}\times3.5\times3.5\times Sin\,144^o$ M1 $=3.6\text{cm}^2$ Area shaded = 15.6 – 3.6 M1 $=11.8\text{cm}^2$ A1
2	$\frac{3(4\chi-5)-(2\chi-1)}{6}$ M1 $\frac{12\chi-15-2\chi+1}{6}$ $\frac{10\chi-14}{6}$ M1 $\frac{5\chi-7}{3}$ A1	7	 Cosine rule BC = 30^2+25^2 - 2(30) (25) Cos 30º M1 = 188.49 $BC=\sqrt{188.49}$ M1 = 13.729m A1
3	Log (3χ + 9) = $Log\,3^3+\log 100$ Log (3χ + 9) = log 2700 M1 3χ = 2691 χ = 897		
4	$\frac{10}{0.7906}+\frac{4}{12.806}$ $\frac{1}{0.7906}=0.1265\times10=1.265$ M1 $\frac{1}{12.806}=0.7806\times10^{-1}=0.07806$ M1 10 x 1.265 = 12.65 4 x 0.07806 $=\frac{0.31224}{12.96224}$ A1	8	5000 x 72.23 = 361,150 M1 361,150 – 214500 = 146,650 $=\frac{146{,}650\times1}{135.97}$ M1 = £1078.55 A1
5	(a) $\begin{pmatrix}\chi\\y\\z\end{pmatrix}-\begin{pmatrix}1\\2\\3\end{pmatrix}=\begin{pmatrix}5\\1\\2\end{pmatrix}$ M1 $\begin{pmatrix}\chi\\y\\z\end{pmatrix}=\begin{pmatrix}5\\1\\2\end{pmatrix}+\begin{pmatrix}1\\2\\3\end{pmatrix}=\begin{pmatrix}6\\3\\5\end{pmatrix}$ $\therefore$ Q at (6, 3, 5) A1 (b) $/PQ/=\sqrt{5^2+1^2+2^2}$ $=\sqrt{30}$ = 5.477 B1	9	Gradient = $\frac{-2-6}{4--2}=\frac{-4}{3}$ $\therefore Gradient\ of\ \underline{h}=\frac{3}{4}$ $Mid\ point\left(\frac{-2+4}{2},\frac{6-2}{2}\right)=(1,\ 2)$ M1 $\frac{y-2}{\chi-1}=\frac{3}{4}$ M1 $y=\frac{3}{4}\chi+\frac{5}{4}$ A1

10	$\left(1+\frac{r}{100}\right)^n = \frac{A}{P}$ M1 $n\log\left(1+\frac{r}{100}\right) = \log\left(\frac{A}{P}\right)$ M1 $n = \frac{\log\left(\frac{A}{P}\right)}{\log\left(1+\frac{r}{100}\right)}$ A1
11	(i) $\frac{180-40}{2} = 70^0$ (Base angles of isosceles Δ) B1 (ii)∠BDE = ∠ABE = 60º (angle in alternate segment) B1 60º + 70º = 130º (iii)∠BED = ∠CBD = 70º (Angle in alternate segment) B1 (iv) ∠ABD = 60º + 50º = 110º B1
12	1cm → 25000cm $1cm^2 \rightarrow (25000)^2\ cm^2$ $2cm^2 \rightarrow (25000)^2 \times 2cm^2$ M1 $= 125 \times 10^7\ cm^2$ $= \frac{125 \times 10^7}{10^4} m^2 = 125000\ m^2$ M1 $= \frac{125000}{10,000} ha = 12.5ha$ A1
13	(a) $BC = \frac{4}{Tan\ 60^o} = 2.3094$ B1 (b) $CE = \sqrt{2.3094^2 + 2.3094^2}$ = 3.26598 = 3.2660 B1 (c) DC = 3.2660 Cos 15º = 3.1547 B1
14	$V = \frac{ds}{dt} = 9t^2 - 4t + 1$ $\therefore S = \int_2^3 (9t^2 - 4t + 1)dt$ $[3t^3 - 2t^2 + t]_2^3$ M1 $= [3(3)^3 - 2(3)^2 + 3] – [3(2)^3 - 2(2)^2 + 2]$ M1 = (18 – 18 + 3) – (24 – 8 +2) = 66 – 18 = 48m A1
15	(a) $-\chi^2 = (1 - \chi)(\chi + 2)$ M1 $-\chi^2 = \chi + 2 - \chi^2 - 2\chi$ $0 = 2 - \chi$ $\chi = 2$ A1 (b) $\begin{pmatrix}2 & 4\\3 & -5\end{pmatrix}\begin{pmatrix}a\\b\end{pmatrix}=\begin{pmatrix}6\\-2\end{pmatrix}$ M1 (2a + 4b = 6) x 3 (3a – 5b = -2) x 2 6a + 12b = 18 6a – 10b = -4 – 2b = 22 b = 11 ∴a = -19 $Z = \begin{pmatrix}-19\\11\end{pmatrix}$ A1
16	 $Tan\ 21^o = \frac{\chi}{20}$ χ = 20 tan 21 = 7.677 M1 $Tan\ 31 = \frac{y}{20}$ y = 20 tan 31M1 = 12.017 ∴ Height of tree = χ + y = 7.677 + 12.017 = 19.694 A1
17	**SECTION II**: (a) (i) $Time = \frac{D}{5}$ $= \frac{324}{60} = 5.4hrs$ M1 = 5hrs 24min 7.00 5.24 A1 12:24pm (ii) $Time = \frac{324}{80}$ = 4.05hrs = 4hrs 3min M1 9.00 + 4.03 13.03hrs or 1:03pm A1 (b) (i) Distance = S x T = 60 x 2 = 120km B1 (ii) Common distance between the two vehicles 324 – 120 = 204km Relative speed = 60 + 80 = 140kmh M1 Time taken to cover common distance $\frac{204}{140} = 1.457hrs = 1hr\ 27\min$ M1 Time of meeting 9.00 + 1.27 A1 $10:270m$ (c) Distance from K 120km + 60 x 1.457 M1 120km + 37.42km 207.42km A1
18	(a)(i) $New = \frac{\frac{3}{2}P}{\frac{2}{3}q} = \frac{27}{28}$ M1 $\frac{P}{q} = \frac{27}{28} \times \frac{2}{3} \div \frac{3}{2}$ M1 $= \frac{27}{28} \times \frac{2}{3} \times \frac{2}{3} = \frac{3}{7}$ A1 (ii) $\frac{\frac{27}{28} - \frac{3}{7}}{\frac{3}{7}} \times 100$ M1 $= \frac{15}{28} \times \frac{7}{3} \times 100 = 125\%$ A1

(b) 30 men take 12 days

1 man takes 30 x 12 = 360 days

30 men in 1 day $\frac{1}{12}$ of the work

in 4 days $= \frac{1}{12}\times 4 = \frac{1}{3}$ M1

Remaining work = $\frac{2}{3}$

1 man takes 360 days

24 men take $\frac{360}{24} = 15\ days$ M1

15 days – 1 of the work

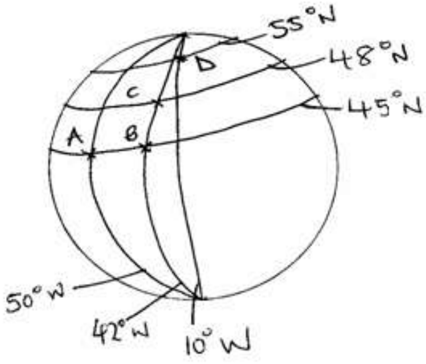
? - $\frac{2}{3}$ of the work

$= 15 \times \frac{2}{3} = 10\ days$ A1

(c) $\frac{3}{5}\times 30 + \frac{2}{5}\times 50$ M1

= 18 + 20 = Sh.38 A1

19



(a) d = 8 x 60 Cos 45 = 339.4nm (AB) M1

BC d = 3 x 60 = 180nm M1

Total d = 519.4nm

$$t = \frac{519.4}{10} = 51.94hrs$$ M1A1

(b) d = 32 x 60 Cos 55 = 1101.3nm M1

d = 7 x 60 = 420nm M1

total d = 1521.3nm

$$t = \frac{1521.3}{10} = 152.13hrs$$ M1A1

(c) d = 1521.3nm

t = 51.94hrs

$$S = \frac{1521.3}{51.94}$$ M1

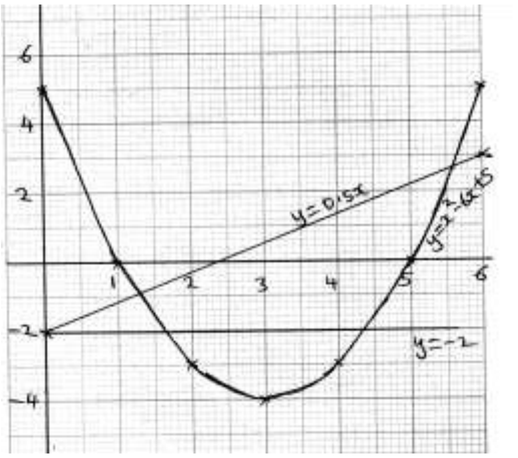
= 29.29 knots A1

20

(a)

χ	0	1	2	3	4	5	6
χ^2	0	1	4	9	16	25	36
-6χ	0	-6	-12	-18	-24	-30	-36
5	5	5	5	5	5	5	5
y	5	0	-3	-4	-3	0	5

b)



(c) (i) χ = 1, 5 B1

(ii) y = χ^2 - 6χ + 5

<u>0 = χ^2 - 6χ + 7</u> - L1

y = -2

χ = 1.65, 4.35 ± 0.1 B1

(iii) y = χ^2 - 6χ + 5

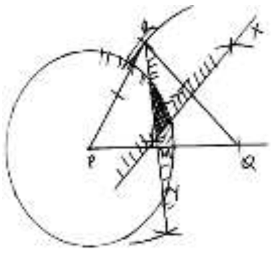
<u>0 = χ^2 - 6.5χ + 5 –</u>

y = 0.5χ L1

χ	Y
0	0
6	3

χ = 1.3, 5.6 ± 0.1 B1

22



B1 - triangle

B1 – bisector of QR

B1B1 – bisector of ∠PRQ

- Locating M

B1 – Circle centre P accept arc in the Δ

B1B1B1 for shading the 3 inequalities.

B1 for marking T

(b) QM = 3.8cm ± 0.1 B1

23

(a) Angle at the centre $\frac{360}{60} = 60^o$ B1

Shaded Area= $6\left(\frac{1}{2}\times 14^2\ Sin\ 60^o - \frac{1}{2}\times 12^2\ Sin\ 60^o\right)$ M1M1

= 6(98 x 0.866 – 720 x 0.866) M1

= 135.096cm^2 A1

(b) Volume = (135.096 x 20)cm^2 M1

= 2701.92cm^3 A1

(c) Mass = density x volume

= 3.5g/cm^3 x 2701.92cm^3 M1

= 9456.72g

= 9.45672kg B1

= 9.457kg A1

21

CLASS	χ	f	$d = A = 5.2$ $\chi - A$	fd	d^2	fd^2	cf
3.0 – 3.4	3.2	1	-2.0	-2.0	4	4	1
3.5 – 3.9	3.7	4	-1.5	-6.0	2.25	9	5
4.0 – 4.4	4.2	9	-1.0	-9.0	1	9	14
4.5 – 4.9	4.7	14	-0.5	-7.0	0.25	3.5	28
5.0 – 5.4	5.2	12	0	0	0	0	40
5.5 – 5.9	5.7	10	0.5	5	0.25	2.5	50
6.0 – 6.4	6.2	6	1.0	6	1	6	56
6.5 – 6.9	6.7	3	1.5	4.5	2.25	6.75	59
7.0 – 7.4	7.2	1	2.0	2.0	4	4	60
		$\sum f = 60$		$\sum f\text{d} = 6.5$	$\sum f\text{d}^2 = 44.75$		
		B1		B1	B1		

(a) 4.5 – 49. B1

(b) Median

$$\frac{30 + 31}{2} = 30.5^{th}\ value$$

30.5 – 28 = 2.5

$\therefore$ Median = $4.95 + \frac{2.5}{12} \times 0.5$ M1

= 4.95 + 0.10417

= 5.05417

= 5.0542 A1

(c) (i) $Mean\ (\bar{\chi}) = A + \left(\frac{\Sigma fd}{\Sigma f}\right) = 5.2 + \left(\frac{-6.5}{60}\right)$ M1

= 5.2 – 0.1083

= 5.099177 (5dp) A1

(ii) $S.d = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)}^2$

$= \sqrt{\frac{44.75}{60} - \left(\frac{-6.5}{60}\right)}^2$ M1

$= \sqrt{0.74583 - 0.01176}$

$= \sqrt{0.73407}$

= 0.8568 (4dp) A1

24

(a) 5(1) – 2 = 3
5(2) – 2 = 8 } 3, 8 and 13 B1
5(3) – 2 = 13

(b) ar^2 = 18 and ar^5 = 486

$\frac{ar^5}{ar^2} = \frac{486}{18}$ M1

r^3 = 27

r = 3 A1

a(3)^2 = 18

a = 2 B1

(c) -190 = 8 + (34 – 1) d M1

33d = -198

d = -6

$S_{34} = \frac{34}{2}\{2(8) + 33(-6)\}$ M1

= 17(16 – 198)

= 17 x (-82)

= -3094 A1

(d) 2nd = a + d, 4th = a + 3d, 7th = a + 6d

$\therefore \frac{a + 3d}{a + d} = \frac{a + 6d}{a + 3d}$ M1

a^2 + 6ad + 9d^2 = a^2 + 7 ad + 6d^2

3d^2 - ad = 0

3d – a = 0

a = 3d

3d = 2

$d = \frac{2}{3}$ A1

$r = \frac{2 + 3\left(\frac{2}{3}\right)}{2 + \left(\frac{2}{3}\right)} = \frac{4}{2\frac{2}{3}} = 4 \times \frac{3}{8} = \frac{3}{2} = 1.5$ B1

KIRINYAGA CENTRAL SUB-COUNTY JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education
121/2
MATHEMATICS
PAPER 2
JULY/AUGUST, 2015
TIME: 2½ HOURS

1.

Numerator $\frac{1}{2}\ of\ \frac{7}{2}+\frac{3}{2}\left(\frac{5}{2}-\frac{2}{3}\right)$

$\frac{1}{2}\ of\ \frac{7}{2}+\frac{3}{2}\left(\frac{15-4}{5}\right)$

$\frac{1}{2}\ of\ \frac{7}{2}+\frac{3}{2}\left(\frac{4}{6}\right)$

$\frac{1}{2}\times\frac{7}{2}+\frac{3}{2}\times\frac{11}{6}$

$\frac{4}{7}+\frac{11}{4}=\frac{18}{4}$ M1

Denominator $=\frac{3}{4}\times\frac{5}{2}\times\frac{2}{1}=\frac{15}{4}$ M1

$=\frac{18}{4}\div\frac{15}{4}$

$=\frac{\cancel{18}^{6}}{\cancel{4}_{1}}\times\frac{\cancel{4}^{1}}{\cancel{15}_{5}}=\frac{6}{5}=1\frac{1}{5}$ A1

2

$$\frac{512^{\frac{4}{3}}\times 27^{\frac{-2}{3}}}{128^{2}\times 9^{-2}}=\frac{\left(2^{9}\right)^{\frac{4}{3}}\times\left(3^{3}\right)^{\frac{-2}{3}}}{\left(2^{7}\right)^{2}\times\left(3^{2}\right)^{-2}}$$ M1

$$=\frac{2^{12}}{2^{14}}\times\frac{3^{-2}}{3^{-4}}$$ M1

$$=\frac{1}{4}\times\frac{9}{1}=2\frac{1}{4}$$ A1

3

Max value $= 3.142 \times 21.5^2 \times 14.05 \times \frac{1}{3}$

$= 68.2.0224\text{cm}^3$ M1

Min value $= 3.142 \times 21.5^2 \times 13.95 \times \frac{1}{3}$

$= 6139.9786\text{cm}^3$

Actual value $= 3.142 \times 21.0^2 \times 14.0 \times \frac{1}{3}$

$= 6466.2360\text{cm}^3$

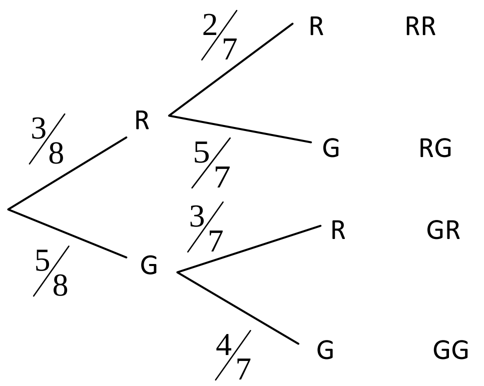
% error $=\frac{6802.0224-6139.9786}{6466.2360}\times 100$ M1

$= 10.2385\%$ A1

4

No	Log
0.7841	$\bar{1}.8944$
$0.1356^{½}$	$\frac{\bar{1}.1323}{2}=\frac{\bar{1}.5662}{1.4606}$
Log 84.92 = 1.929	$\frac{0.2853}{\bar{1}.1753}$ $\frac{\bar{3}}{3}+\frac{2.1753}{3}=\bar{1}.7251$
0.5310	$\bar{1}.7251$

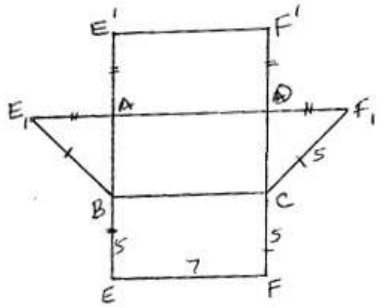
5



$$\left(\frac{3}{8}\times\frac{5}{7}\right)+\left(\frac{3}{8}\times\frac{3}{7}\right)=\frac{15}{56}+\frac{15}{56}$$ M1

$$=\frac{30}{56}=\frac{15}{28}$$

6



6.B1 ✓ If EF = BC = AD
= EF^1 and other sides of rectangle
B1and triangular must fit as one folds.
- Labelling of vertices.
Area of shape = 96cm^2

7.

$$\frac{4+3}{-3} > 3\chi + 2$$

$4 + \chi < (3\chi + 2) - 3$

$10\chi < -10$ B1

$\chi < -1$

$3\chi + 2 > -13$ B1

$3\chi > -15$

$-5 < \chi < -1 \therefore$ values -4, -3, -2 $\frac{B1}{3}$

8.

$2\chi^2 - 12\chi + 2y^2 + 28y = -44$

$\chi^2 - 6\chi + y^2 + 14y = -22$

$\chi^2 - 6\chi + M + y^2 + 14y + N = -22 + M + N$

$M = (-6 \div 2)^2 = 9$; and $N = (14 \div 2)^2 = 49$

$\chi^2 - 6\chi + 9 + y^2 + 14y + 49 = 36$ M1

$(\chi - 3)^2 + (y + 7)^2 = 6^2$

Centre (3, -7) radius = 6 A1

$\therefore$ diameter = 12 units $\frac{B1}{3}$

9

$(1 + 2\chi)^8 = 1 + 8 \text{ x } 2\chi + 28(2\chi)^2 + 56(2\chi)^3 +$ B1

$= 1 + 16\chi + 112\chi^2 + 448\chi^3$ B1

Sin Ca $(1 + 2\chi)^8 = (1.02)^8$

$2\chi = 0.02$

$\chi = 0.01$

$1.02^8 = 1 + 16(0.01) + 112(0.01)^2 + 4.48(0.01)^3$ B1

$= 1 + 0.16 + 0.0112 + 0.000448$

$= 1.171648$ B1

$= 1.1716$

10

$$\frac{1 + \frac{\sqrt{3}}{2}}{1 - \frac{\sqrt{3}}{2}} = \frac{2 + \sqrt{2}}{2} \div \frac{2 - \sqrt{3}}{2}$$ M1

$$= \frac{2 + \sqrt{3}}{2 - \sqrt{3}}$$

$$= \frac{\left(2 + \sqrt{3}\right)\left(2 + \sqrt{3}\right)}{\left(2 - \sqrt{3}\right)\left(2 + \sqrt{3}\right)}$$ M1

$$= 7 + 4\sqrt{3}$$

11

$$\left(\chi + \frac{3}{4}\right)\left(\chi - \frac{2}{3}\right) = 0$$ M1

$$\chi^2 - \frac{2}{3}\chi + \frac{3}{4}\chi - \frac{6}{12} = 0$$ M1

$12\chi^2 - 8\chi + 9\chi - 6 = 0$

$12\chi^2 + \chi - 6 = 0$

12

$125^{\circ} + 140^{\circ} + 160^{\circ} + 145^{\circ}(N - 3) = (2N - 4)90^{\circ}$ M1

$425 + 145N - 435 = 180N - 360^{\circ}$

$-35N = -350^{\circ}$

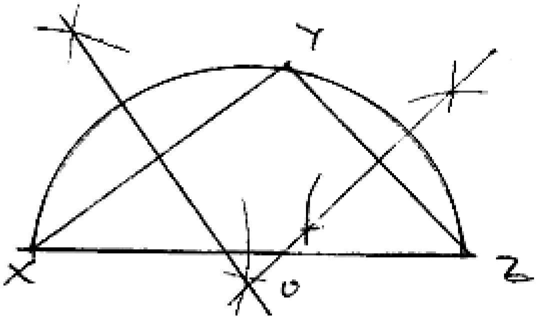
n = 10 sides A1

Sum of interior angles $\Rightarrow (2(10) - 4)90^{\circ}$

$= 16 \text{ x } 90^{\circ}$ B1

$= 1440^{\circ}$ 3

13



$\perp$Bisector of two sides

B1 Centre of circle

B1 Sector drawn with

B1 $\gamma = 0X = 0Y = 0Ƶ$. Circle should not go beyond XƵ on lower sides.

14

G.C.D = 30 $\Rightarrow 2 \text{ x } 3 \text{ x } 5$

L.C.M = 900 $\Rightarrow 2^2 \text{ x } 3^2 \text{ x } 5^2$

1st Number 150 $\Rightarrow$

2nd Number 60 $\Rightarrow 2^2 \text{ x } 3 \text{ x } 5$

3rd Number 60 $\Rightarrow$ 90, 180, 450 $\frac{A1}{3}$

15

Fraction done by James = $\frac{90}{100}$

Fraction done by David = $\frac{87}{100}$

For 120km, James does $\Rightarrow \frac{90}{100} \times 120$

David does $\Rightarrow \frac{87}{100} \times 120$

James = 108km

David = 104.4km

James beats David by 3.6km $\frac{A1}{3}$

16

Height in (cm)	f	C£
150 – 159	2	2
160 – 169	9	11
170 – 179	12	23
180 – 189	16	39
190 – 199	7	46
200 - 209	4	50

$$Median = 179.5 + \frac{(25 - 23)}{16}10$$ M1

$= 180.75$ $\frac{A1}{3}$

17

SECTION II:

(a) 1^{st} year salary = Sh.792000

2^{nd} year salary = $\frac{115}{100} \times 792000$

3^{rd} year salary = $\left(\frac{115}{100}\right)^2 \times 792000$

4^{th} year salary = $\left(\frac{115}{100}\right)^3 \times 792000$ M1

= 1.15^3 x 792000 M1

= Sh.1.204533 A1

(b) $\Delta = P\left(1 + \frac{\gamma}{100}\right)^n$

1831944 = 792000 x 1.15^n M1

$$\frac{1831944}{792000} = 1.15^n$$

2.3130606 = 1.15^n

Log 2.3130606 = n log 1.15

0.364189 = 0.0606978n M1

$$n = \frac{0.364187}{0.0606978} = 6.0000033$$

$\simeq$ 6yrs A1

(c) Amount earned

792000 + 1.15 x 792000 + 1.15^2 x 792000 + --- M1

n = 10

a = 792000

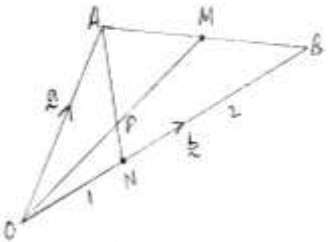
γ = 1.15

$S_{10} = \frac{792000[1.15^{10} - 1]}{(1.15 - 1)}$ M1

$= \frac{792000[4.0455577 - 1]}{0.15}$ M1

= Sh.16,080,545 $\frac{A1}{10}$

20



(a) AB = AO + OB

$= -\underset{\sim}{a} + \underset{\sim}{b}$

$= \underset{\sim}{b} - \underset{\sim}{a}$

$\underset{\sim}{OM} = \underset{\sim}{OA} + \underset{\sim}{AM}$

$= \underset{\sim}{QA} + \frac{1}{2}\underset{\sim}{AB}$

$= \underset{\sim}{a} + \frac{1}{2}(\underset{\sim}{b} - \underset{\sim}{a})$

$= \underset{\sim}{a} + \frac{1}{2}\left(\underset{\sim}{b} - \frac{1}{2}\underset{\sim}{a}\right)$

$= \frac{1}{2}\underset{\sim}{a} + \frac{1}{2}\underset{\sim}{b}$

20

$\underset{\sim}{AN} = \underset{\sim}{AO} + \underset{\sim}{ON}$

$= -\underset{\sim}{a} + \frac{1}{3}\underset{\sim}{b}$

$= \frac{1}{3}\underset{\sim}{b} - \underset{\sim}{a}$

(b) $\underset{\sim}{OP} = S\,\underset{\sim}{OM}$

$= S\left(\frac{1}{2}\underset{\sim}{a} + \frac{1}{2}\underset{\sim}{b}\right)$

$\frac{1}{2}S\underset{\sim}{a} + \frac{1}{2}S\underset{\sim}{b}$ ------ (i)

$\underset{\sim}{OP} = \underset{\sim}{OA} + \underset{\sim}{AP}$

$= \underset{\sim}{a} + t\left(\frac{1}{3}\underset{\sim}{b} - \underset{\sim}{a}\right)$

$= \underset{\sim}{a} + \frac{1}{3}t\underset{\sim}{b} - t\underset{\sim}{a}$

$= a(1 - t) + \frac{1}{3}t\underset{\sim}{b}$ ----- (ii)

$\frac{1}{2}S = 1 - t$

$\frac{1}{2}S = \frac{1}{3}t$

$1 - t = \frac{1}{3}t$

t = 3 – 3t

4t = 3

$t = \underline{\underline{\frac{3}{4}}}$

$\frac{1}{2}S = \frac{1}{3}t$

$\frac{1}{2}S = \frac{1}{3}\left(\frac{3}{4}\right)$

$\frac{1}{2}S = \frac{1}{4}$

$S = \underline{\underline{\frac{1}{2}}}$

(c) $AP = \frac{3}{4}AN$

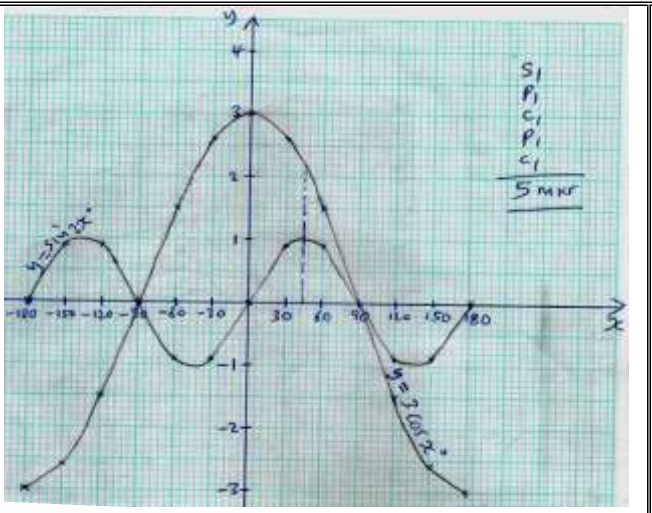
AP: PN = 3: 1

18

(a)

χ°	-180°	-150°	-120°	-90°	-60°	-30°	0°	30°	60°	90°	120°	150°	180°
2χ°	-360	-300	-240	-180	-120	-60	0	60	120	180	240	300	360
3 Cos χ°	-3.0	-2.6	-1.5	0.0	1.5	2.6	3.0	2.6	1.5	0.0	-1.5	-2.6	-3.0
Sin 2χ°	0.0	0.9	0.9	0.0	-0.9	-0.9	0.0	-0.9	0.9	0.0	-0.9	-0.9	0.0

b)



(c) (i) 3 Cos χ - Sin 2χ = 0

3 Cos χ = Sin 2χ

B1

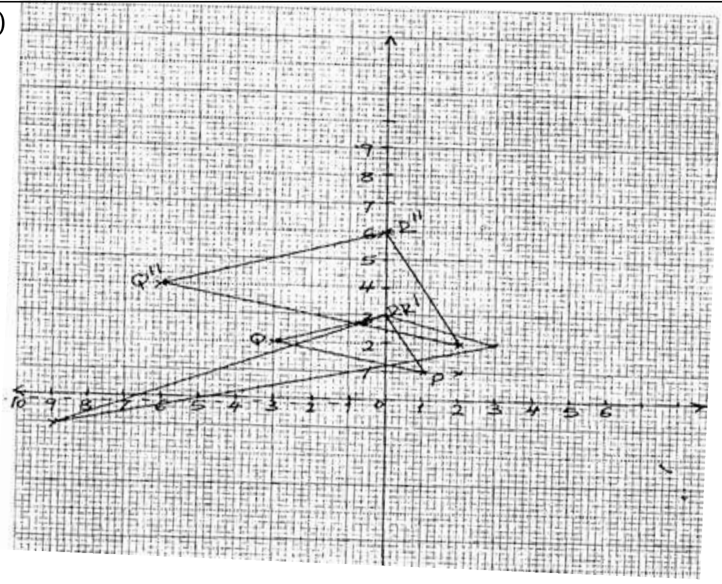
χ = -90º and 90º

B1

(ii) 2.2 – 1 = 1.2

B1

19 a)



(b)

$$\begin{pmatrix}3&0\\1&1\end{pmatrix}\begin{pmatrix}P&Q&R\\1&-3&0\\1&2&3\end{pmatrix}=\begin{pmatrix}P^1&Q^1&R^1\\3&-9&0\\2&-1&3\end{pmatrix}$$

B1 – for triangle

B1 Coordinates

B1 For triangle

B1 and coordinates

(c)

$$\begin{pmatrix}\frac{2}{3}&0\\\frac{-2}{3}&2\end{pmatrix}\begin{pmatrix}3&-9&0\\2&-1&3\end{pmatrix}=\begin{pmatrix}P^{11}&Q^{11}&R^{11}\\2&-6&0\\2&4&6\end{pmatrix}$$

Coordinates P^{11} (2, 2) Q^{11} (-64) R^{11} (0,6)

B1

B1 For triangles

B1 and coordinates

(d) It an enlargement centre origin (0, 0) scale factor 2 B1 for triangles

$$\begin{pmatrix}\frac{2}{3}&0\\\frac{-2}{3}&2\end{pmatrix}\begin{pmatrix}3&0\\1&1\end{pmatrix}=\begin{pmatrix}2&0\\0&2\end{pmatrix}$$

B1 For triangles

B1 and coordinates

21

(i) $P = K\dfrac{Q^2}{\sqrt{R}}$, K – constant

$$K = \frac{P\sqrt{R}}{Q^2} = \frac{12\times\sqrt{36}}{24^2} = \frac{1}{8}$$

$$Hence\ P = \frac{1}{8} - \frac{Q^2}{\sqrt{R}}$$

When Q = 27, R = 121

$$P = \frac{1}{8}\times\frac{27^2}{\sqrt{121}} = \frac{729}{88}$$

A1

(ii) $Q_1 = 1.21Q^2$

$$R_1 = 0.866025403\ \sqrt{R}$$

$$P_1 = K\times\frac{1.21Q^2}{\sqrt{0.75R}} = 1.397187651\ K\frac{Q^2}{\sqrt{R}}$$

$$New\ change = \frac{(1.397187651 - 1)\frac{KQ^2}{\sqrt{R}}}{\frac{KQ^2}{\sqrt{R}}}\times 100\%$$

= 39.7187651%

Hence increase of 39.72%A1

(iii) $Q = K\dfrac{1}{\sqrt{P}}$

$$K = Q\sqrt{P}$$

$$= 3\sqrt{4}$$ M1

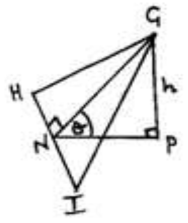
$$= 6\ Eqn = Q = 6\frac{1}{\sqrt{P}}$$

$$P = \left(K\frac{1}{Q}\right)^2$$ M1

$$= \left(6\times\frac{1}{8}\right)^2 = \left(\frac{6}{8}\right)^2 = \frac{9}{16}$$ A1

22

(a)



$$NP = \frac{16-9}{2} = 3.5m$$

$$GN = \left(7^2 - 5^2\right)^{\frac{1}{2}} = \sqrt{24}$$

$$Cos\ \theta = \frac{3.5}{4.899} = 0.7144$$

$\Rightarrow \underline{\underline{\theta = 44.40º}}$ A1

(b) h = ?

$$Sin\ 44.40 = \frac{h}{4.899}$$ M1

h = 4.899 Sin 44.40

= 3.4276507

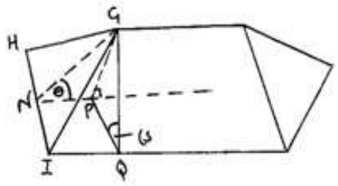
≃ 3.428m

A1

H = 3.428 + 12 = $\underline{\underline{15.428m}}$

B1

c

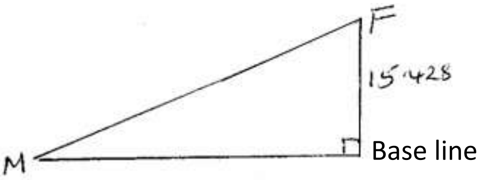


PQ = 5m; PQ = 3.428m M1

$$Tan\ \beta = \frac{3.428}{5} = 0.6856$$ M1

⇒β = 34.44º A1

d)



$$\Pr ojection\ of\ MF = 16 - 3.5 = 12.5m \qquad \frac{B1}{10}$$

$$Or\ \ 9 + 3.5 = 12.5m$$

23

(a) (i) ∠SOQ = 2∠SPQ = 106º

B1

Angle at the centre subtended by QS B1

(ii) $\angle OQS = \angle OSQ = \dfrac{180^o - 106^o}{2}\ 37^o$ B1

Base angles in an isosceles Δ

∠ºPSO = 180º - (53º + 30º + 37º + 37º = 23º B1

Sum angles of a triangle B1

(iii) ∠SRT = ∠SPQ = 53º B1

Exterior angles of a cyclic quadrilateral B1

(b) Area of OQPS M1

$$= Sin\ 60^o\left(\frac{1}{2}\times 22.36\times 25.77\right) - \left(\frac{1}{2}\times 14^2\times Sin\ 106^o\right)$$ M1

= (249.51 – 94.20) A1

= 155.31cm^2

24

(a) $\chi^2 + 5 = 8 - 2\chi$

$\chi^2 + 2\chi - 3 = 0$

$(\chi + 3)(\chi - 1) = 0$

$\chi = -3$ or 1

When $\chi = -3$, y = 14

When $\chi = 1$, y = 6

Coordinates

C(-3, 14) and D(1, 6)

(b) $$\int_{-3}^{1}\left(\chi^2 + 5\right)d\chi$$

$$= \left[\frac{\chi^2}{3} + 5\chi + c\right]_1^3$$ M1

$$= 32\frac{1}{3}\ square\ units$$ M1

(c) Area under line y = 8 - 2χ

$$= \left(8\chi - \frac{2\chi^2}{2}\right)_{-3}^{1}$$

$$\left(8(1) - 1^2\right) - \left(8(-3) - (-3)^2\right) = 40$$

(d) Shaded area $= 40\ 32\dfrac{1}{2} = 7\dfrac{2}{3}$

NANDI NORTH SUB-COUNTY JOINT PRE-MOCK EXAMINATIONS 2015

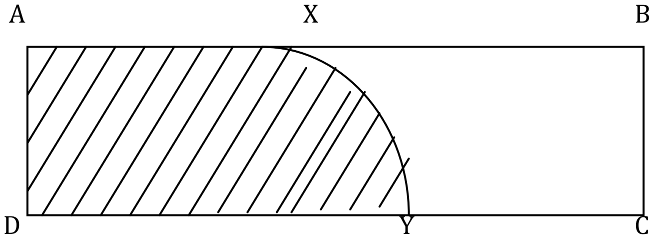
Kenya Certificate of Secondary Education (K.C.S.E.)

121/1
MATHEMATICS
Paper 1
2½ hours

SECTION 1: (50 MARKS)

Answer ALL Questions in this section

1. The marked price of a car in a dealer's shop was Ksh. 450,000/=. Nasieku bought the car at 7% discount. The dealer still made a profit of 13%. Calculate the amount of money the dealer had paid for the car. (3mks)
2. Evaluate: (3mks)
$$\frac{\frac{1}{2} + 2\frac{4}{5} \text{ of } 8 \div 6(2 \times 4\frac{2}{5})}{\frac{2}{4} \text{ of } 6(8 \div 3\frac{1}{3})}$$
3. A man was born in 1956. His father was born in 1928 and the mother three years later. If the man's daughter was born in 1992 and the son 5 years earlier, find the difference between the age of the man's mother and that of his son. (3mks)
4. Solve for x in the equation:
$\text{Log}_8(x + 6) - \text{Log}_8(x - 3) = \frac{1}{3}$ (3mks)
5. Solve the simultaneous equations:
$\frac{x}{2} + \frac{y}{3} = \frac{-13}{6}$, $\frac{2y}{3} - x = 11$ (4mks)
6. Simplify: $\frac{12x^2 - 27}{4 - (2x + 1)}$ (3mks)
7. Find the angle the line $3y = 2x + 6$ makes with the x-axis. (3mks)
8. The curved surface area of a cylindrical container is 880cm². Calculate to one decimal place the capacity of the container in litres given that the height is 17.5cm. (Take $\pi = \frac{22}{7}$).
9. State all the integral values of a which satisfy the inequality $\frac{3a + 2}{4} \leq \frac{2a + 3}{5} \leq \frac{4a + 15}{6}$ (4mks)
10. Line L_1 passes through the points A (1, -2) and B(3, -4). Find the equation of the line L_2 passing through the mid-point of AB and perpendicular to L_1, leaving your answer in the form $ax + by + c = 0$. (4mks)
11. 1.5 litres of water (density 1g/cm³) is added to 5 litres of alcohol (density 0.8g/cm³). Calculate the density of the mixture. (3mks)
12. A map of a certain town is drawn to a scale of 1:50,000 on the map, the railway quarters cover an area of 10cm². Find the area of the railway quarters in hectares. (2mks)
13. ABCD is a rectangle. AB = 10cm, AD = AX = 6cm and XY is an arc of a circle centre D.



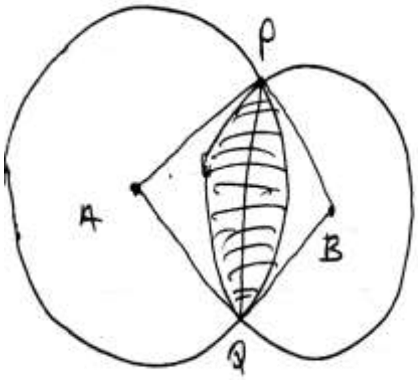
Calculate the area of the shaded region. (Take π= 3.142) (3mks)

14. If $\cos \propto = \frac{15}{17}$, find without using tables or calculators $\sin \propto$ and $\tan \propto$. (3mks)
15. Express 1.441441……….. in the form p/q where p and q are integers. (q # o) (3mks)
16. Leonorah Jerop was on top of a cliff 30m high sees two boats P and Q out at sea. Both boats were in the same line and the angle of depression from Leonorah to P was 42^0 and the angle of depression from Leonorah to Q was 27^0. Calculate the distance then between the two boats. (3mks)

SECTION II (50 MARKS)

Answer any five questions in this section

17. The figure below shows two circles of radii 10.5cm and 8.4cm and with centres A and B respectively. The common chord PQ is 9cm.



(a) Calculate angle PAQ. (2mks)
(b) Calculate angle PBQ. (2mks)
(c) Calculate the area of the shaded part. (6mks)

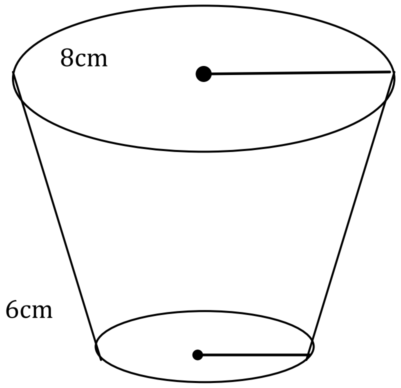
18. Every Sunday Barmao drives a distance of 80km on a bearing of 074^0 to pick up her sister Afandi to go to church. The church is 75km from Afandi's home on bearing of $S50^0E$. After church they drive a distance of 100km on a bearing of 260^0 to check on their friend Akoth before Barmao drives to Afandi's home to drop her off then proceed to her house.

(a) Using a scale of 1cm to represent 10km, show the relative positions of these places. (4mks)
(b) Use your diagram to determine:
(i) The true bearing of Barmao's home from Akoth's house. (1mk)
(ii) The compass bearing of the Akoth's home from Afandi's home. (1mk)
(c) (i) The distance between Afandi's home and Akoth's home. (2mks)
(ii) The total distance Barmao travel every Sunday. (2mks)

19. The vertices of triangle PQR are P(O,O), Q(6,0) and R(2,4).

(a) Draw triangle PQR on the grid provided. (1mk)
(b) Triangle P'Q'R' is the image of a triangle PQR under an enlargement scale factor, ½ and centre (2,2). Write down the co-ordinates of triangle P'Q'R' and plot on the same grid. (2mks)
(c) Draw triangle P"Q"R" the image of triangle P'Q'R' under a positive quarter turn, about points (1,1) (3mks)
(d) Draw triangle P"'Q"'R"' the image of triangle P"Q"R" under reflection in the line y = 1. (2mks)
(e) Describe fully a single transformation that maps triangle P"'Q"'R"' onto P'Q'R'. (2mks)

20. A pail is in the shape of a container frustrum with base radius 6cm and top radius 8cm. The slant height of the pail is 30cm as shown below. The pail is full of water.



(a) Calculate the volume of water. (6mks)
(b) All the water is poured into a cylindrical container of circular radius 7cm, if the cylinder has the height of 35cm; calculate the surface area of the cylinder which is not in contact with water. (4mks)

21. (a) A bus travelling at 99km/hr passes a check-point at 10.00a.m. and a matatu travelling at 132km/h in the same direction passes through the check point at 10.15a.m. If the bus and the matatu continue at their uniform speeds, find the time the matatu will overtake the bus. (6mks)
(b) Two passenger trains A and B which are 240m apart and travelling in opposite directions at 164km/h and 88km/h respectively approach one another on a straight railway line. Train A is 150 metres long and train B is 100 metres long. Determine time in seconds that elapses before the two trains completely pass each other. (4mks)

22. (a) Solve the equation: $\frac{x + 3}{24} = \frac{1}{x - 2}$ (4mks)

(b) A rectangular room is 4m longer than its width. If its area is 12m^2, find its dimensions and hence the perimeter of the room. (6mks)

23. Using a ruler and a pair of compasses only, construct triangle ABC, such that AB = 5cm, BC = 6cm and AC = 6.4cm. Locate the locus of P such that it is equidistant from the sides AB, BC and AC. Measure the shortest distance, r between side AB and the centre P using length r and centre P. Draw a circle. Measure CP. (10mks)

24. QRST is a rhombus. The equations of QR, RS and TS are $2x + y = 7$, $x = 1$ and $2x + y = -1$ respectively. Determine:-

(a) The co-ordinates of Q and S. (4mks)

(b) The co-ordinates of m, the point of intersection of the diagonals. (2mks)

(c) The co-ordinates of R and T. (4mks)

NANDI NORTH SUB-COUNTY JOINT PRE-MOCK EXAMINATIONS 2015

Kenya Certificate of Secondary Education (K.C.S.E.)

121/2
MATHEMATICS
Paper 2
2½ hours

SECTION 1: (50 MARKS)

Answer ALL Questions in this section

1. Using logarithms, evaluate (4mks)

$$\sqrt[3]{\frac{4.684 \log 314.2}{\tan 87^0}}$$

2. Make x the subject of the formula: (3mks)

$$A = \sqrt{\frac{1 - x}{1 + x}}$$

3. A surveyor gave the length and width of a rectangular plot as 80m and 55m respectively. Find his percentage error in the area of the rectangular plot. (3mks)
4. Find the radius and centre of the circle whose equations is $2x^2 + 2y^2 - 6x + 10y + 9 = 0$. (4mks)
5. Simplify:

$$\frac{2}{2\sqrt{3} + \sqrt{2}} - \frac{2}{2\sqrt{3} - \sqrt{2}}$$

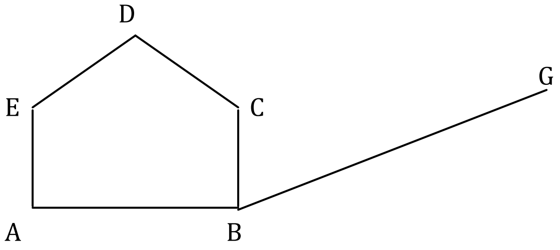
Giving your answer in surd form with a rational denominator. (3mks)

6. Expand $\left(x + \frac{a}{x^2}\right)^6$ in descending powers of x up to the term independent of x. If this independent term is 1215, find the value of a. (4mks)
7. The sum of Shs. 50,000 is invested in a financial institution that gives 12%p.a. The interest is compounded quarterly. Find the total investment after 3 years. (3mks)
8. If $\frac{p + 3q}{2p - q} = \frac{3}{4}$ find the ratio p : q. (3mks)
9. The angles of a triangle are in the ratio 8 : 7 : 3. If the longest side of the triangle is 5.4cm. Calculate the length of the shortest side. (3mks)
10. Solve for k in the following equation:
$125^{k+1} + 5^{3k} = 630$ (3mks)
11. Six men take 28 days working for 10 hours a day to pack 4480 parcels. How many more men working 8 hours a day will be required to pack 2500 parcels in 4 days? (3mks)
12. A bird flies from its nest to some food in three stages. The routes are described by the following vectors.

$$\begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix}, \quad \begin{pmatrix} 7 \\ 10 \\ 5 \end{pmatrix} \text{ and } \begin{pmatrix} 4 \\ -2 \\ -7 \end{pmatrix}$$

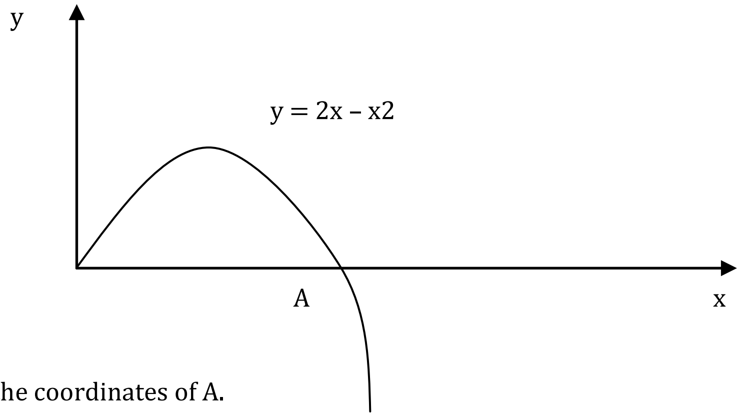
Find the distance between the bird's nest and where the food is. (3mks)

13. The size of an interior angle of a regular polygon is $3x^0$ while exterior is $(x - 20)^0$. Find the number of sides of the polygon. (3mks)
14. In what ratio must "Murang'a" coffee costing sh. 25g per 100g be mixed with "Kisii" coffee costing sh. 17.50 per 100g, so that by selling the mixture at sh. 25 per 100g, a profit of 25% is made? (3mks)
15. In the figure below, ABCDE is a cross-section of a solid. The solid has a uniform cross-section. Given that BG is a base edge of the solid, complete the sketch, showing the hidden edges with broken lines.



(2mks)

16.



Find the coordinates of A. (3mks)

SECTION II (50 MARKS)

Answer any five questions in this section

17. Mr. Chesingei earned an annual basic salary of Kenya pounds 12360 when the rates of taxation were as in the table below.

Monthly income (pounds)	Rates (%)
1 – 484	10
485 – 940	15
941 – 1396	20
1397 – 1852	25
1853 and above	30

Apart from the basic salary, he is entitled to a house allowance of Kshs. 12,000 and medical allowance of Kshs. 6,000 per month.

(a) Calculate Chesingei's monthly taxable income in Kenya pounds. (3mks)

(b) Calculate Chesinge's monthly net income if he is given a tax relief of Ksh. 980 per month. Give your answer in Kenyan shillings. (5mks)

(c) How much more tax should he have paid per month in Kenya pounds if his monthly salary is increased by Ksh. 2500. (2mks)

18. The table below shows the distribution of marks scored by 100 candidates of Cheptiret Boys High school in an examination.

Marks	1– 10	11 – 20	21 – 30	31 – 40	41–50	51–60	61–70	71–80	81–90	91–100
No. of candidates	2	5	8	19	24	18	10	6	5	3

(a) Draw a cumulative frequency curve to illustrate the information above. (4mks)

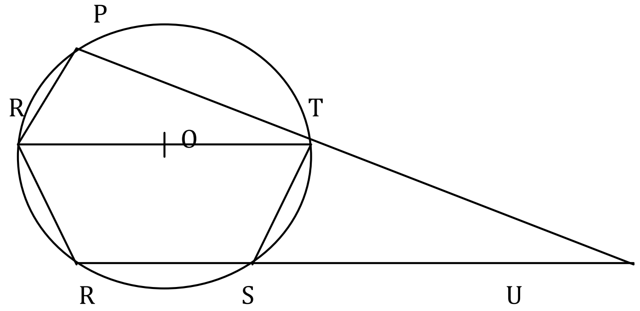
(b) From your graph, find:

(i) Median (2mks)

(ii) Inter-quartile range (2mks)

(iii) Pass mark if 70% of the students passed. (2mks)

19. The figure below shows a circle centre O in which QOT is a diameter. <QTP = 46^0, TQR = 75^0 and SRT = 38^0, PTU and RSU are straight lines.



Calculate the following angles giving a reason in each case.

(a) <RST (2mks)

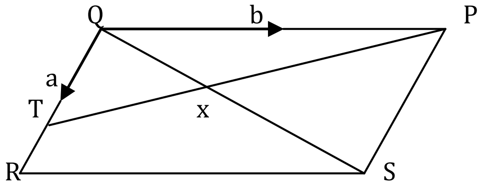
(b) <SUT (2mks)

(c) <PST (2mks)

(d) Obtuse <ROT (2mks)

(e) <SQT (2mks)

20. In the figure below, QT = a and QP = b.



(a) Express the vector PT in terms of a and b. (1mk)

(b) If PX = kPT, express QX in terms of a, b and k, where k is a scalar. (3mks)

(c) If QR = 3a and RS = 2b, write down an expression for QS in terms of a and b. (1mk)

(d) If QX = tQS, use your result in (b) and (c) to find the value of k and t. (4mks)

(e) Find the ratio PX : XT. (1mk)

21. The law $E = KX^n$ gives an expression for the energy E joules stored in a spring for the extension xcm. The table below shows the value of E and the corresponding value of X.

xcm	2	2.5	3	3.5	4	5
E (joules)	108	169	243	330	432	675

Determine graphically the values of k and n. Write the equation connecting E and X. (10mks)

22. The first term of an Arithmetic Progression (AP) is 200. The sum of the first 10 terms of AP is 24500.

(a) (i) Find the common difference. (2mks)

(ii) Given that the sum of the first n terms of the AP is 80100, find n. (2mks)

(b) The 3rd, 5th and 8th terms of another AP, form the first three terms of a Geometric Progression (GP). If the common difference of AP is 5, find:-

(i) The first term of the GP. (4mks)

(ii) The sum of the first 12 terms of the GP, to four significant figures. (2mks)

23. e table below, giving the values correct to 2 decimal places. (3mks)

x^0	0	30	60	90	120	150	180	210	240	270	300	330	360
Sin2x													
3cosx-2													

(b) On the grid provided, draw the graphs of y = sin 2x and y = 3cosx – 2 of $0^0 \leq x \leq 360^0$; on the same axes. Use the scale of 1cm to represent 30^0 on the x-axis and 2cm to represent 1 unit on the y-axis. (5mks)

(c) Use the graph in (b) above to solve the equation:

3 cos x – sin 2x = 2

24. The probabilities of Makori, Newton and Patrick going to school on Monday are $^6/_7$, $^7/_8$ and $^8/_9$ respectively. Find the probability that:-

(a) They will all go to school on Monday. (2mks)

(b) None of them will go to school on Monday. (2mks)

(c) At least one of them will go to school on Monday. (3mks)

(d) At most one of them will go to school on Monday. (3mks)

NANDI NORTH SUB-COUNTY JOINT EVALUATION 2015 PRE MOCK

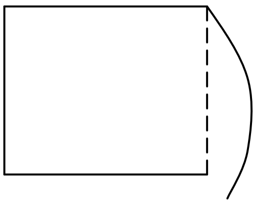
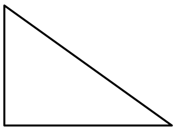
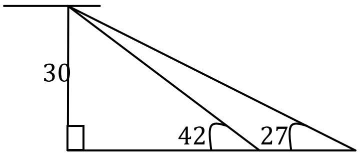
Kenya Certificate of Secondary Education (K.C.S.E.)

121/1

MATHEMATICS

Paper 1

NO	WORKING				
1	100% = 450,000 93% ? $\frac{93 \times 450000}{100} = 418,500$ 113% = 418500 100% ? $\frac{100 \times 18500}{113} = 370353.9823$	M1 M1 A1	5.	$6(x/3 + 6(y/3) = (-13/6)6$ $3(2y/3) – (x)3 = (11)3$ $\left.\begin{array}{l} 3x + 2y = -13 \\ 2y – 3x = 33 \end{array}\right\}$ $3x + 2y = -13$ $\underline{– 3x + 2y = 33}$ $4y = 20$ $y = 5$ $10 – 3x = 33$ $-3x = 23$ $X = -7^{2}/_{3}$	
2	$½ + {}^{14}/_{5}$ of $8 \div 6\ (2 \times {}^{22}/_{5})$ $½ + {}^{14}/_{5}$ of $8 \div 6 \times {}^{44}/_{5}$ $½ + {}^{112}/_{5} \div 6 \times {}^{44}/_{5}$ $½ + {}^{112}/_{5} \div {}^{1}/_{6} \times {}^{44}/_{5}$ $½ + {}^{112}/_{30} \times {}^{44}/_{5}$ $\frac{1}{2} + \frac{2464}{75} = \frac{75 + 4928}{150}$ $= \frac{5003}{150}$ Denominator ${}^{2}/_{4}$ of $6\ (8 \div {}^{10}/_{3})$ ${}^{2}/_{4}$ of $6\ (8 \div {}^{3}/_{10})$ $½$ of $6 \times {}^{12}/_{5}$ $3 \times {}^{3}/_{10} = {}^{36}/_{5}$ $\frac{5003}{150} \div \frac{36}{5}$ $\frac{5003}{150} \times \frac{5}{36}$ $= \frac{5003}{1080}$	M1 A1 M1 A1	6.	$\frac{3(4x^2 – 9)}{4 – (2x + 1)}$ $= \frac{3(4x^2 – 9)}{4 – 2x – 1}$ $\frac{3(4x^2 – 9)}{3 – 2x}$ $\frac{3(2x – 3)(2x + 3)}{(2x – 3)}$ $\frac{3(2x + 3)}{-1} = -6x - 9$	M1 M1 A1
		04			
3	Man 1956 Father 1928 Mother 1931 Daughter 1992 Son 1987 1987 – 1931 = 56 years	M1 M1 A1	7.	$y = {}^{2}/_{3}x + {}^{6}/_{3}$ $y = 0.6667x + 2$ $\tan \theta = 0.6667$ $\theta = 33.7^{0}$	M1 M1 A1
		03			
4	$\text{Log}_8(x+6) – \log_8(x-3) = {}^{1}/_{3} \log_8 8$ $\text{Log}_8(x+6) – \log_8(x-3) = \log_8 8^{1/3}$ $\text{Log } 8\frac{(x + 6)}{(x – 3)} = \log_8 8^{1/3}$ $\frac{x + 6}{x – 3} = 8^{1/3}$ $\frac{x + 6}{x – 3} = ?$ $x + 6 = 2(x – 3)$ $x + 6 = 2x – 6$ $x – 2x = -6 – 6$ $-x = -12$ $x = 12$		8.	Curved surface = $2\pi rh$ $2\pi rh = 880$ $2 \times {}^{22}/_{7} \times 17.5r = 880$ $\frac{44 \times 17.5r}{7} = 880$ $r = \frac{880 \times 7}{44 \times 17.5}$ $r = 8cm$ $V = \pi rh$ $= ({}^{22}/_{7} \times 8 \times 8 \times 17.5)cm^3$ $= 24640cm^3$ $1000cm^3 => 1l$ $24640\ cm^3\ ? = \frac{24640 \times 1}{1000}$ = 24.64 litres	B1 M1 A1

9	$\frac{3a+2}{4} \leq \frac{2a+3}{5} \leq \frac{4a+15}{6}$ $\frac{3a+2}{4} < \frac{2a+3}{5}$ $20(\frac{3a+2}{4}) < (\frac{2a+3}{5})20$ 15a + 10 < 8a + 12 15a – 8a < 12 – 19 7a < 2 $a < {}^{2}/_{7}$ $\frac{2a+3}{5} < \frac{4a+14}{6}$ $30(\frac{3a+2}{4}) < 30(\frac{4a+15}{5})$ 12a + 18 < 2a + 75 12a – 20a < 75 – 18 -8a < 57 $a > {}^{57}/_{8}$ $a = 7\,{}^{1}/_{8}$ $-7{}^{1}/_{8} \leq a \leq {}^{2}/_{7}$ -7, -6, -5, -4, -3, -2, -1, 0		13	Radius DX  DX = $\sqrt{AD^2 + AX^2}$ $= \sqrt{6^2 + 6^2}$ $\sqrt{72}$ $6\sqrt{2}$ Sin = $\frac{OPP}{1+4}$ $= \frac{6}{662}$ Sin O = $\frac{1}{6l}$ $\frac{62}{2}$ A = ½ bh + ½ ab sin o (½ x 6 x 6) + ½ x 6 x 6 x 2 = 18 + 9 x 1.4141 = $30.74cm^2$	
		03			
10	L1 A(1,-2) B(3, -4) Gr = $\frac{-2 - -4}{1 - 3} = \frac{-2 + 4}{-2} = \frac{2}{-2} = -1$ Pair of L_2 $(\frac{1+3}{2}, \frac{-2+4}{2})$ $(\frac{4}{2} \quad \frac{-6}{2})$ (2, -3) y = mx + c y = x + c -3 = 2 + c c = -5 y = x – 5 -x + y + 5 = 0		14	Cos θ $\sqrt{17^2 - 15^2}$  $= \sqrt{289 - 225}$ $= \sqrt{64} = 8$ Sin θ = $\frac{8}{17}$ Tan θ = $\frac{8}{15}$	
		03			
11	D = $\frac{M}{V}$ Water => 1 = $\frac{m}{1.5L}$ 1 lit = $1000cm^3$ 1.5 lit ? $\frac{1.5 x 1000}{1}$ = $1500cm^3$ 1 = $\frac{m}{1500}$ = 1500g Alcohol => 0.8 = $\frac{m}{5 lit}$ 1 lit = $1000cm^3$ 5 lit = ? = 5000 cm^3 0.8 = $\frac{m}{5000}$ m = 0.8 x 5000 m = 4000g mass => 4000 + 1500 = 5500 volume => 5000 + 1500 = $6500cm^3$ D = $\frac{5500}{6500}$ = $0.8462g/cm^3$		15	r = 1.441441 10r = 14.41441 100r = 144.1441 1000r = 1441.441 1000r = 1441.441 r = 1.441 999r = 1440 999r = 1440 r = $\frac{1440}{999}$ r = $\frac{160}{111}$	
12.	L.S.F. = $\frac{50000}{1}$ = 50,000 A.S.F. = $(50,000)^2$ = 50000^2 X $10cm^2$ 50000 x 50000 x 10 $\frac{25000000000}{100000000}$ = 250ha		16	tan 42^0 = $\frac{30}{k}$  k = $\frac{30}{\tan 42}$ k = 33.32 tan 27 = $\frac{30}{L}$ L = $\frac{30}{\tan 27}$ L = 58.88 58.88 – 33.32 = 25.56m	

17

(a) < PAQ = PAM + RAM

< PAM = sin θ = $\frac{4.5}{10.5}$ = 0.4286

$\sin^{-1}$ (0.4286) = 25.38^0

<QAM = <PAM = 25.38

<LAP = 25.38 x 2 = 50.76

(b) PBQ = < PBM + < QBM

< PBM = sin = 48 = 0.5357

$\sin^{-1}$ (0.5357) = 32.39^0

<PBM = <QBM = 32.39^0

<pbq = 32.39^0 x 2 = 64.78

(c) Area of segment = area of a section – area of D

$[\frac{50.76}{360}$ x 3.14 x $(10.5)]^2$ – (½ x 10.5 sin 50.76)

= 48.84 – 42.69 = 6.15cm^2

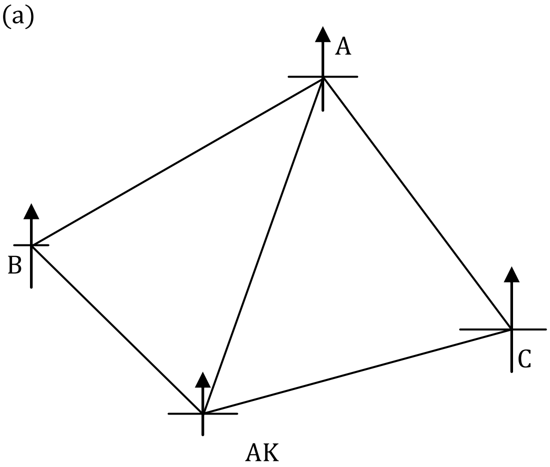
$[\frac{64.78}{360}$ x 3.14 x $(8.4)]^2$ – (½ x 10.5 sin 50.76)

= 39.89 – 31.92 = 7.97

= (6.15 + 7.97)cm^2 = 14.12cm^2

18

(a)



(b) (i) 320^0

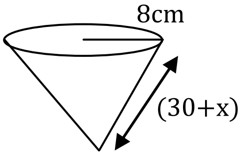
(ii) 215^0

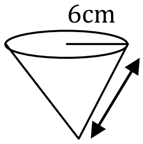
(c) (i) 7.4cm

7.4 x 10 = 74m

(ii) 80 + 75 + 100 + 74 + 80 = 409

20





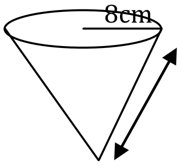
$\frac{8}{30 + x} = \frac{6}{x}$

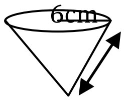
6(30 + x) = 8x

180 + 6x = 8x

180 = 2x

x = 90





$h_1 = \sqrt{120^2 - 8^2}$

= $\sqrt{14400 - 64}$

= $\sqrt{14336}$ = 119.75cm

$h_2 = \sqrt{90^2 - 6^2}$

= $\sqrt{8100 - 36}$

= $\sqrt{8064}$ = 89.80cm

Large

$^1/_3$ x $^{22}/_7$ x 8 x 8 x 119.73= 8027.61

Small

$^1/_3$ x $^{22}/_7$ x 8 x 8 x 119.73= 3394.29

Volume of frustrum

8027.61 – 3394.29= 4633.32cm^3

(b) V = πr^{2}L

= $^{22}/_7$ x 7 x 7 x L = 4633.32

154L = 4633.32

L = $\frac{4633.32}{154}$

L = 30.09

35 – 30.09

= 4.9cm

21

(a) Time difference = ¼ r

Speed => 132 – 99 = 33km/h

Distance diff.

Bus => 99 = $\frac{D}{¼}$

D = 19 = 24.75km

S = $\frac{D}{T}$

3 = $\frac{24.75}{1}$

T = $\frac{24.75}{33}$= 0.75OURS => 45 mins

10.15

+ 45

11.00a.m.

(b) Speed => 164 + 88 = 252km/h

Distance => 240 + 150 + 100 = 490m

Speed = $\frac{252,000}{3600}$ = 70m/s

70 = $\frac{490}{T}$

T = $\frac{490}{7}$ = 7 secs

22

(a) $\frac{x + 3}{24} = \frac{1}{x - 1}$

24 $(\frac{x-1}{24})$ (x+3) = 24(x-2)$\frac{1}{x-2}$

(x – 2) (x + 3) = 24

x^2 + 3x – 2x – 6 = 24

x^2 + x – 30 = 0

p = -30 s = 1

numbers 6, -5

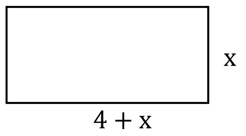
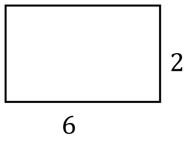
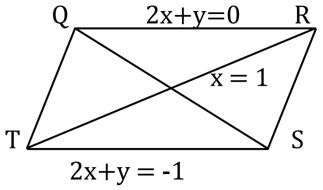
x^2 + 6x – 5x – 30 = 0

x(x+6) – 5(x+6) = 0

x – 5 = 0 x + 6= 0

x = 5 x = -6

x = 5 or -6

	(b)  x (4+x) = 12 $x^2 + 4x = 12$ $x^2 + 4x - 12 = 0$ p = -12 s = 4 numbers 6 and -2 $x^2 + 6x - 2x - 12 = 0$ x(x+6) – 2 (x+6) = 0 (x – 2) (x + 6) = 0 x = 2 or x = -6 x = 2  Perimeter (6x2) + (2x2) 12 + 4 = 16m		(b) (1, -3) (1, 5) $(\frac{1+1}{2}, \frac{-3+5}{2})$ $(^2/_2, ^2/_2)$ (1, 1) (c) R 2x + 1 = 7 2x = 6 x = 3 R (3,1) T 2x + 1 2x = -2 X = -11 T(-1, 1)	
23	CP = 3.4cm ± 0.1			
24	 (a) When x = 1 At Q 2(1) + y = 2 2 + y = 7 y = 5 Q(1,5) At S 2(1) + y = -1 Y= -3 S(1,-3)			

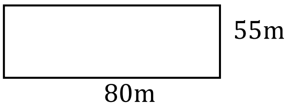
NANDI NORTH SUB-COUNTY JOINT EVALUATION 2015 PRE MOCK

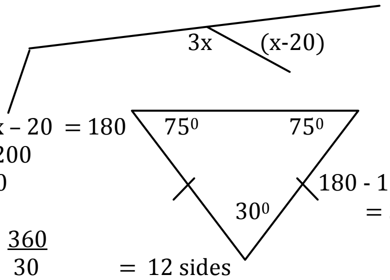
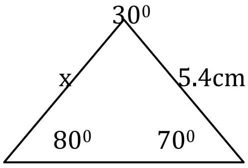
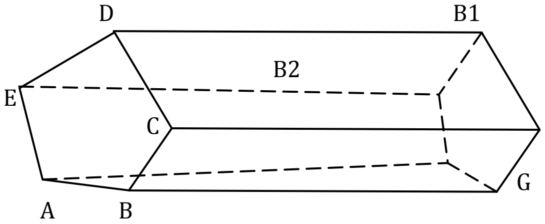
Kenya Certificate of Secondary Education (K.C.S.E.)

121/2

MATHEMATICS

Paper 2

1	$\log 314.2 = 2.4972$ $\tan 87^0 = 19.0811$ $\sqrt[3]{\frac{4.684 \times 2.3972}{19.0811}}$ No. Std. form Log 4.684 4.684×10^0 0.6706 2.4972 2.4972×10^0 $\underline{0.3975}$ + 1.0681 19.0811 1.90811×10^1 $\underline{1.2806}$ - 1.7875 $\frac{\bar{1}.7875}{3}$ $= \frac{\bar{1}}{3} + \frac{0.7875}{3}$ $= \frac{\bar{3}}{3} + \frac{2.7875}{3}$ $= \bar{1}.9292$ 8.496 x 10-1 = 0.8496	M1 M1 M1 A1
		04
2	$(A)^2 = \left(\sqrt{\frac{1-x}{1+x}}\right)$ $(1+x)\ (A)^2 = \left(\frac{1-x}{1+x}\right)(1+x)$ $A^2 + A^2x = 1 - x$ $A^2x + x = 1 - A^2$ $x(A^2 + 1) = 1 - A^2x$ $x(A^2 + 1) = 1 - A^2$ $x = \frac{1 - A^2}{A^2 + 1}$	M1 M1 A1
		03
3	 Max. 80.5 x 55.5 = 4467.75m² Min. 79.5 x 54.5 = 4332.72m² $\frac{4467.75 - 4332.75}{2}$ $= \frac{135}{2} = 67.5$ Actual => 80 x 55 = 4400m² $\frac{67.5}{44\cancel{00}} \times 1\cancel{00} = 1.5341\%$	M1 M1 A1
4	$x^2y^2 - 2ax - 2by + a^2 + b^2 - r^2 = 0$ $2x^2 + 2y^2 - 6x - by + 9 = 0$ $x^2 + y^2 - 3x + 5y + 4.5 = 0$ $-2ax = -3x \quad -2by = 5y$ $-2a = -3 \quad -2b = 5$ $a = 1.5 \quad b = -2.5$ centre (1.5, -2.5) $a^2 + b^2 - r^2 = 4.5$ $(1.5)^2 + (-2.5)^2 - r^2 = 4.5$ $2.25 =+ 6.25 - r^2 = 4.5$ $8.5 - r^2 = 4.5$ $- r^2 = 4.5 - 8.5$ – $r^2 = -4$ – $r^2 = 4$ – $r = \underline{+}\, 2$ – $\underline{r = 2cm}$	M1 M1 M1 A1
5	$\frac{2}{(2\sqrt{3} + \sqrt{2})} - \frac{2}{(2\sqrt{3} + \sqrt{2})}$ $= \frac{2(2\sqrt{3} + \sqrt{2})}{(2\sqrt{3} + \sqrt{2})} - \frac{2(2\sqrt{3} + \sqrt{2})}{(2\sqrt{3} + 5^2)}$ $= \frac{4\sqrt{3} + 2\sqrt{2} - 4\sqrt{3} - 2\sqrt{2}}{(2\sqrt{3} + \sqrt{2})\ (2\sqrt{3} + \sqrt{2})}$ $= \frac{-4\sqrt{2}}{(4\sqrt{9} - 2\sqrt{6} + 2\sqrt{6} - \sqrt{4}}$ $= \frac{-4\sqrt{2}}{12 - 2}$ $= \frac{-4\sqrt{2}}{10}$ $= \frac{-3\sqrt{2}}{5}$	M1 M1 A1
6	$\left(x + \frac{a}{x^2}\ 6\right)$ terms without the coefficient $x^6, x^5 (^a/_{x^2}), x^4(^a/_{x^2})^2, x^3(^a/_{x^2})^3, x^2(^a/_{x^2})4, x(^a/_{x^2})^5, (^a/_{x^2})^6$ coefficient when a = 6 1, 6, 15, 20, 15, 6, 1 $1.x^6\ 6.\ x^5\ (^a/_{x^2}\ 15.x^4(^a/_{x^2})^2$ $+20.x^3(^a/_{x^2})^3+15.x^2(^a/_{x^2})^4+6.x(^a/_{x^2})5+1.(^a/_{x^2})^6$ $= x^6 + \frac{6x^5a}{x^2} + \frac{15x^4a^2}{x^4} + \frac{20x^3a^3}{x^6} + \frac{15x^2a^4}{x^8} + \frac{6xa^5}{x^{10}} + \frac{a}{x^{12}}$ $x6 = 6x^3a + 15a^2$ $15a^2 = 1215$ $a^2 = \frac{1215}{15}$ $a^2 = 81$ $a = \underline{+}\, 9 \quad a = 9$	
7	$A = P(1 + \frac{r}{10})^n$ $A = 50000 \quad (1 + \frac{3}{100})^6$ $= 50000\ (1.03)^6$ $= 50000 \times 1.1941 \quad = 59705$	M1 M1 A1

8.	$\frac{p + 3q}{2p - q} = \frac{3}{4}$ =3(2p – q)= 4(p + 3q) = 6p – 3q = 4p + 12q = 6p – 4p = 12q + 3q = 2p = 15q p = 15 q = 2 p:q = 15:2	M1 M1 A1	13	 3x + x – 20 = 180 4x = 200 X = 50 180 - 150 = 30 $\frac{360}{30}$ = 12 sides	
9	$\frac{8}{18}$ x 180 = 80^0 $\frac{7}{18}$ x 180 = 70^0 $\frac{3}{18}$ x 180 = 830^0  $\frac{5.4}{\text{Sin}80} = \frac{x}{\sin 70}$ x = $\frac{5.4 \sin 70^0}{\sin 80^0}$ x = 5.15cm $\frac{y}{\text{Sin}30^0} = \frac{x}{\sin 80^0}$ y = $\frac{5.4 \sin 30}{\sin 80}$ = 2.74cm shortest = 2.74cm	M1 M1 A1	14	m : k = 1 : n m = 25 k = 17.50 B.P => 25 + 17.50n S.P => 25 + 25n 100% = 25 + 17.50n 125% = 25 + 25n 125 (25 + 17.50n) = 100(25 + 25n) 25 + 17.50n = $\frac{100}{125}$ (25 + 25n) 25 + 17.50n = $^{4}/_{5}$ (25 + 25n) 25 + 17.50n + 20 + 20n 25 – 20 = 20n – 17.50n 5 = 2.5n n = 2 m:k = 1:2	
10	$5^{3(k+1)} + 5^{3k} = 5^1$ x 126 $5^{3k+3} + 5^{3k} = 5^1$ x 126 $5^{3k}. 5^3 + 5^{3k} = 5^1$ x 126 $5^{3k}(5^3 + 1) = 5^1$ x 126 $5^{3k}(126) = 5^1 (126)$ $5^{3k} = 5^1$ 3k = 1 K = $^{1}/_{3}$	M1 M1 A1	15		
11	Men days hrs parcels 6 28 10 4480 x 4 8 2500 6 x 28 x 10 = 4480 X x 4 x 2500 1680 = 4480 32x = 2500 32x x 4480 = 1680 x 2500 32x = $\frac{1680 \times 2500}{4480}$ 32x = 937.5 x = 29.296875 = 30 30 – 6 = 24	M1 M1 A1	16	A(x, 0) = 2x – x^2 0 = 2x – x^2 x^2 = 2x X = 2 A(2,0)	
12	$\begin{pmatrix}7\\10\\5\end{pmatrix} \quad \begin{pmatrix}3\\-2\\-1\end{pmatrix} = \begin{pmatrix}4\\12\\6\end{pmatrix}$ $\begin{pmatrix}4\\-2\\-7\end{pmatrix} \quad \begin{pmatrix}4\\10\\5\end{pmatrix} \quad \begin{pmatrix}0\\-12\\-12\end{pmatrix}$ $\sqrt{4^2 + 12^2 + 6^2} + \sqrt{0^2 + (-12)^2 + (-12)^2}$ $\sqrt{(16 + 144 + 36)} + \sqrt{0 + 133 + 144}$ $\sqrt{196} + \sqrt{288}$ 14 + 16.97 = 30.97	M1 M1 A1	17	(a) Taxable income Basic slary + allowances Basic = 12,360 Allowances: HA = $\frac{12000}{20}$ = 600 MA = $\frac{6000}{20}$ = 300 Taxable income = 12360 + 600 + 300 = 13260 (b) 1st slab = $\frac{10}{100}$ x 4.84 = 48.4 Slab 2 = $\frac{15}{100}$ x 4.56 = 68.4 Slab 3 = $\frac{20}{100}$ x 4.56 = 91.2 Slab 4 = $\frac{25}{100}$ x 4.56 = 144 Slab 5 = $\frac{30}{100}$ x 11408 = 3422.4 Total tax = 48.4 + 68.4 + 91.2 + 144 + 3422.4 = 3774.4 Subtract relief 3774.4 x 20 = 75488	

18.

(a)

Upper limits	10.5	20.5	30.5	40.5	50.5	60.5	70.5	80.5	90.5	100.5
C.f	2	7	15	34	58	76	86	92	97	100

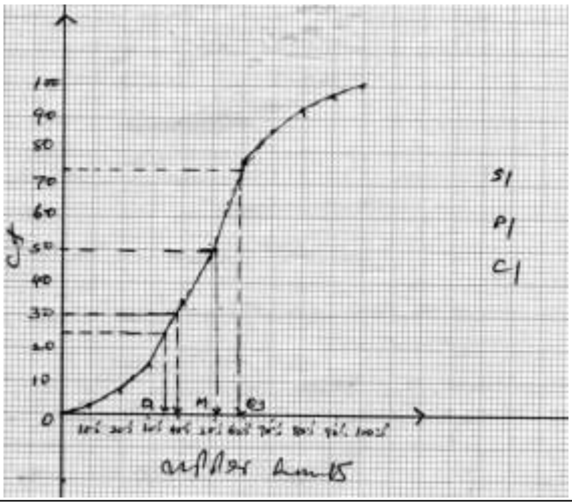
(b) Median = 50.5 + 2 = 52.5

(c) Q3 = 60.5 + 4

Q1 = 64.5

I.Q.R. = Q3 = Q1

64.5 – 52.5 = 12



(c) $\overrightarrow{QR} = 3a$ $\overrightarrow{RS} = 2b$

$\overrightarrow{QS} = \overrightarrow{QR} + \overrightarrow{RS}$

QS = 3a + 2b

(d) QX = t (3a + 2b)

=> b + k(a – b) = t(3a + 2b)

b + ak – bk = 3at + 2bt

b – 2bt + bk + ak – 3a = 0

b(b – 2t – k) + a(k – 3t) = 0

1 – 2t – k = 0 and k – 3t = 0

=> k = 3t

1 – 2t – 3t = 0

1 – 5t = 0

5t = 1 $t = ^1/_5$

k = 3t

$k = 3 x ^1/_5 = ^3/_5$

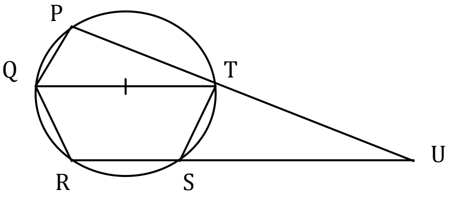
(e) $PX = ^3/_5PT$

$XT = ^2/_5PT$

$PX : XT = ^3/_5PT : ^2/_5PT$

= 3:2

19



(a) $<RST = 180 – 75 = 105^0$ B1

Cyclic angles add up to 180^0.

(b) $<SUT = 180 – (82 + 75) = 23^0$ B1

Angles of a triangle add up to 180^0

(c) $<PST = 44^0$ B1

Angles subtended by the same chord i.e. chord PT

are equal. B1

The angle $PQT = 44^0$

(d) Obtuse of <ROT B1

$75^0 x 2 = 150^0$

Chord RT subtended $<RQT = 75^0$ B1

Same chord RT subtends <ROT at the centre

Hence $75 x 2 = 150^0$ B1

(e) $180 – (44 + 46 + 15 + 37) = 38^0$

Cyclic angles add up to 180^0. B1

SQOT

$<SQP + <PTS = 180^0$ B1

B1

20

(a) $\overrightarrow{PT} = \overrightarrow{PQ} + \overrightarrow{OT}$

= - b + a

= a – b

(b) $PX = K\overrightarrow{PT}$

=> PX = K(a – b)

$\overrightarrow{OX} = \overrightarrow{QP} + \overrightarrow{PX}$

= b + k (a – b)

22

(i) T1 = 200 = 9

$Sn = ^n/_2 [2a + (n – 1)d]$

$S_{10} = ^{10}/_2 [2a + (10 – 1)d]$

24500 = 5 (2 x 200 + 9d)

4900 = 400 + 9d

9d = 4500

d = 500

(ii) $Sn = ^n/_2 [2a + (n – 1)d]$

$80100 = ^{10}/_2 [400 + 500(n-1)]$

$80100 = ^{10}/_2 [400 + 500 – 500$

160200 = n(500n – 100)

1602 = n(5n – 1)

$5n^2 – n = 1602$

$5n^2 – n = 1602 = 0$

$n = \frac{-b + b^2 – 4ac}{2a}$

$= \frac{1 \pm 1 + 20 x 1602}{10}$

(iii) $\frac{1 + 179}{10}$

$n = \frac{180}{2}$ n = 90

(b) $T_3 = a + 2d$ $T_1 = a$

$T_5 = a + 4d$ $T_2 = ar$

$T_8 = a + 7d$ $T_3 = ar^2$

$T_3 = a + 10$ $\frac{a + 20}{a + 10} = \frac{a + 35}{a + 20}$

$T_5 = a + 20$

$T_8 = (a + 35)$

$(a + 20)^2 = (a + 10) (a + 35)$

$a^2 + 40a + 400 = a^2 + 45a + 350$

40a – 45a = 350 – 400

-5a = - 50

a = 10

$r = \frac{30}{20}$ r = 1.5

$Sn = \frac{a(rn – 1)}{r – 1}$

$= \frac{10 (1.5^{12} – 1)}{0.5}$

= 20 (128.7463) = 2574.93

= 2,575

21

$E = KX^n$

$\text{Log } E = \log X^n + \log K$

$\text{Log } E = n\log X + \log K$

X	2	2.5	3	3.5	4	5
E	108	169	243	330	432	675
Log X	0.3010	0.3979	0.4771	0.5441	0.6021	0.6990
Log E	2.0334	2.2279	2.3856	2.5185	2.6355	2.8293

Log K = 1.4

m

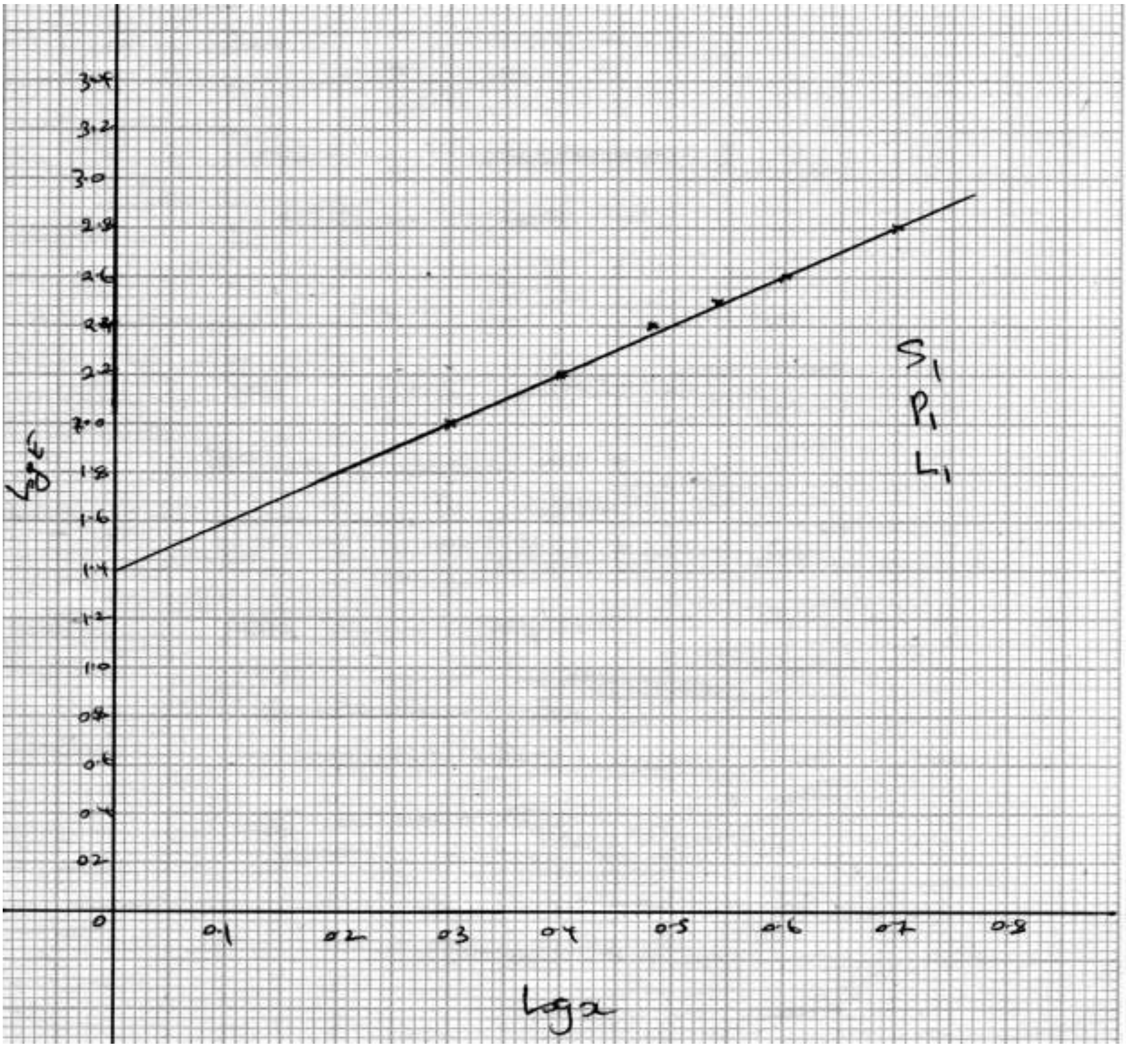
k log 1.4

2.512×10^1

K = 25.12

$$n = \frac{2.0334 - 2.8293}{0.3010 - 0.6990} = \frac{-0.7959}{-0.398} = 1.9997$$

$$= 2$$



KURIA EAST JOINT EXAMINATION COUNCIL 1015

Kenya Certificate of Secondary Education (K.C.S.E.)

121/1

MATHEMATICS

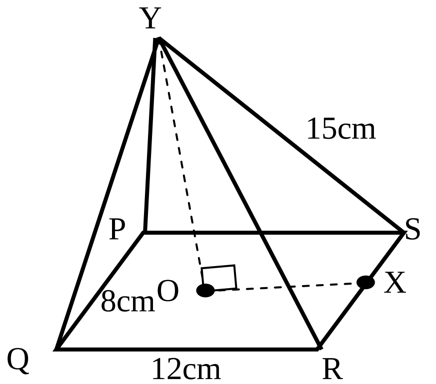
Paper 1

SECTION I (50 Marks)

1. Points S(-2,2) and T (-3,7) are mapped onto S^1(4,-10) and T^1 (0,10) by an enlargement. Calculate the enlargement scale factor. (3 Marks)
2. Given that $\frac{1}{2x} = (0.732) + \sqrt[3]{85.3}$, use mathematical tablets to find the value of x in standard form correct to 3 significant figures. (3 Marks)
3. Simplify $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (3 Marks)
4. All prime numbers less than ten are arranged in ascending order to form a number.
   (a) Write down the number formed. (1 Mark)
   (b) Express the number in (a) above in expanded form. (2 Marks)
5. A two digit number is such that the one's digit is four more than the tens digit, and the sum of the digits is 14. Find the number. (3 Marks)
6. Marwa bought a refrigerator on hire purchase by paying monthly installments of KSh. 2000 per month for 40 months and a deposit of KSh. 12,000. If this amounted to an increase of 25% of the original cost of the refrigerator, what was the cash price of the refrigerator? (3 Marks)
7. Find the integral values of x which satisfy the inequality. (3 Marks)
   $3(1 + x) < 5x - 11 < x+45$
8. Without using calculator, evaluate.
   $\left(\frac{7}{3}\left[\frac{2}{5} of 1\frac{2}{3} - \frac{1}{2}\left(\frac{1\frac{2}{3}-2\frac{1}{2}}{\frac{1}{3}-\frac{19}{27}}\right)^{\frac{1}{2}} + \frac{2}{3}\right]\right)^{\frac{1}{2}}$ leaving the answer as a mixed fraction. (4Marks)
9. During a certain month, the exchange rates in a bank were as follows;

	Buying (KSh)	Selling (KSh)
1USD	91.65	91.80
1 Euro	103.75	103.93

   A tourist left Kenya to the United States with KSh. 1,000,000.At the airport he exchanged all the money to dollars and spent 190 dollars on air ticket. While in US he spent 4500 dollars for upkeep and proceeded to Europe. While in Europe he spent a total of 2000 Euros. How many Euros did he remain with? (3 Marks)
10. A school decided to make a beautiful picnic site to be used by students and teachers as a resting point. The site was designed to be triangular in shape measuring 40 metres, 60 metres and 80 metres. Calculate the area of the picnic site. (Answer correct to 1 d.p) (3 Marks)
11. A regular *n*-sided polygon has its interior angle equal to 4 times its exterior. Find *n*. (3 Marks)
12. The ratio of the lengths of the corresponding sides of two similar rectangular petrol tanks is 3:5. The volume of the smaller tank is 8.1m^3. Calculate the volume of the larger tank. (3 Marks)
13. ABCD is a rhombus. A is the point(2,1) and C is the point (4,7). Find the equation of the diagonal BD in the form ax + by = c (3 Marks)
14. A woman walks directly from point A towards the foot of a tall building 240m away. After covering 180m, he observes that the angle of elevation of the top of the building is 45^0. Determine the angle of elevation of the top of the building from A. (3 Marks)
15. The G.C.D. and L.C.M of three numbers are 3 and 1008 respectively. If two of the numbers are 48 and 72, find the least possible value of the third number. (3 Marks)
16. An ant moved from Y to X the midpoint of RS through P in the right pyramid below.



   Draw the net of the pyramid showing the path of the ant hence find the distance it moved. (4 Marks)

SECTION II (50 Marks)

Answer any Five Questions in this section

17. Three warships A, B and C are at sea such that ship B is 500km on a bearing N30E from ship A. Ship C is 700km from ship B on a bearing of 120^0. An enemy ship D is sighted 800km due south of ship B.

(a) Taking a scale of 1cm to represent 100km, locate the positions of ships A,B, C and D. (4 Marks)

(b) Find the bearing of:

(i) Ship A from D (1 Mark)

(ii) Ship D from C (1 Mark)

(c) Use scale drawing to determine the distance between

(i) D and A (1 Mark)

(ii) C and D (1 Mark)

(d) Measure angle DAC and angle BCD (2 Marks)

18. (a) A rectangular tank of base 2.4m by 2.8m and a height of 3m contains 3600 litres of water initially. Water flows into the tank at the rate of 0.5 litres per second. Calculate:

(i) The amount needed to fill the tank (2 Marks)

(ii) The time in hours and minutes required to fill (3 Marks)

b) Pipe A can fill an empty tank in 3 hours while pipe B can fill the same tank in 6 hours. When the tank is full, it can be emptied by pipe C in 8 hours. Pipes A and B are opened at the same time when the tank is empty. If one hour later pipe C is also opened, find the total time taken to fill the tank. (5 Marks)

19. A solid is made up of a conical frustum and a hemispherical top. The slant height of the frustum is 8cm and its base radius is 4.2cm. If the radius of the hemispherical top is 3.5cm.

(a) Find the area of:

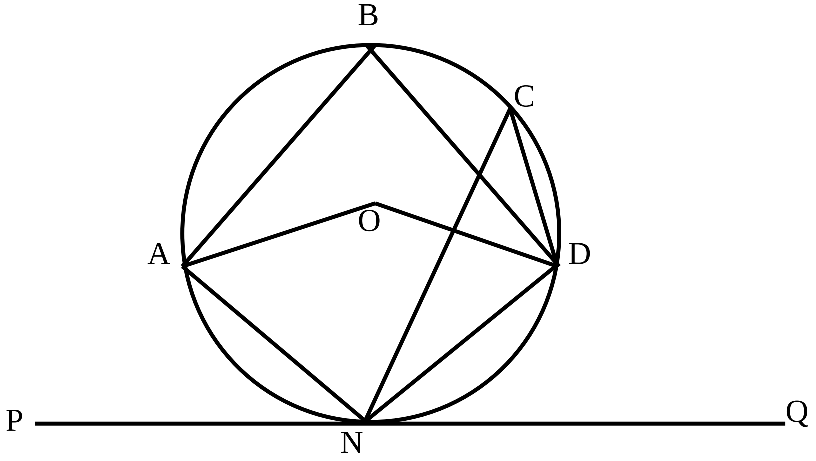
(i) the circular base. (2 Marks)

(ii) the curved surface of the frustum (3 Marks)

(iii) the hemispherical surface (3 Marks)

(b) A similar solid has a total surface area of $81.51cm^2$. Determine the radius of its base. (2 Marks)

20. In the figure below, O is the centre of the circle. PQ is a tangent to the circle at N. Angle NCD is 10^0 and angle ANP is 30^0.



Giving reasons;

(a) Angle DON (2 Marks)

(b) Angle DNQ (2 Marks)

(c) Angle DBA (2 Marks)

(d) Angle ONA (2 Marks)

(e) Angle ODN (2 Marks)

21. Two quantities P and Q are connected by the equation $P = KQ^n$. The table below gives the values of P and Q

P	1.2	1.5	2.0	2.5	3.5	4.5
Q	1.58	2.25	3.39	4.74	7.86	11.5

(a) State the linear equation connecting P and Q. (1 Mark)

(b) Using a scale of 1cm to represent 0.1 units in both axes, draw a suitable straight line graph on the grid provided. (5Marks)

(c) Use your graph in (b) above to determine the approximate values of K and N. (2 Marks)

(d) From the graph, find the value of Q when P = 3 (2 Marks)

22. The displacement h metres of a particle moving along a straight line after t seconds is given by $h = 2t^3 + \frac{3}{2}t^2 + 3t$

(a) Find its initial acceleration (3 Marks)

(b) Calculate;

(i) The time when the object was momentarily at rest (3 Marks)

(ii) Its displacement by the time it comes to rest (2 Marks)

(c) Calculate the maximum speed attained (2 Marks)

23. (a) Complete the table below for graphs of y = sin x and y = 2sin(x+30) (2 Marks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
Sin x	0		0.87			0.5			-0.87			-0.5	
2sin(x+30)	1	0.5		1.74		0	-1				-1		

(b) Using a suitable scale on the grid below draw the graphs of y = sin x and y = 2sin (x+30) for $0 \leq x \geq 360^0$(4 Marks)

(c) State the transformations that would map y = sin x onto y = 2sin(x+30) (2 Marks)

(d) Find the values of x which satisfy the equation sin x – 2sin(x+30) = 0 (2 Marks)

24. A bus moving at a speed of 80km/h is being overtaken by a car moving at 100km/h in a clear section of a road. Given that the bus is 21m long and the car is 4m long.

(a) How much time (in seconds) will elapse before the car can completely overtake the bus? (3 Marks)

(b) How much distance (in metres) will the car travel before it can completely overtake the bus? (2 Marks)

(c) Given that as soon as the car completed overtaking the trailer, a bus heading towards the trailer and the car and moving at a speed of 90km/h became visible to the car driver. It took exactly 18 seconds for the car and the bus to completely by pass each other from the moment they first saw each other.

(i) How far was the tail of the bus from tail of the car at the instance they first saw each other giventhat the bus is 12 metres long? (3 Marks)

(ii) How far a part was the trailer and the bus just immediately after the car and the bus had passed each other? (2 Marks)

KURIA EAST JOINT EXAMINATION COUNCIL 1015

Kenya Certificate of Secondary Education (K.C.S.E.)

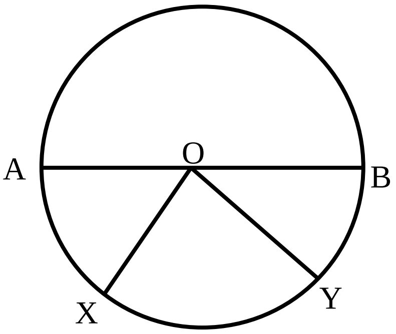
121/2

MATHEMATICS

Paper2

SECTION A. (50 MARKS)

1. The cost of maize floor and millet flour is KSh. 40 and KShs. 52 respectively. Calculate the ratio in which they were mixed if a profit of 15% was made by selling the mixture at 52.90 per kilogram. (3 Marks)
2. In the figure below XY = 8cm and O is the centre of the circle.



Determine the area of the circle if angle AOX = 15^0 (3 Marks)

3. OA = 3i + 4j – 6k and OB = 2i + 3j + k are two position vectors. P divides a line AB in the ratio 3:-2. Write down the coordinates of P. (3 Marks)
4. The table below show tax rates on a certain year.

Income (K£ p.a)	Rate (KSh. per £)
1 – 4200	2
4201-8000	3
8001-12600	4
12601	5

Robi earns a basic salary of KSh. 20,000 per month, she is given allowances amounting to KSh. 5000. She is housed by her employer therefore pays a nominal rent of Sh. 700 per month and is entitled to a personal relief of Sh. 1200 per month. Calculate;

(i) Her taxable income in Kenya pounds per year. (2 Marks)

(ii) Her gross tax per month. (2 Months)

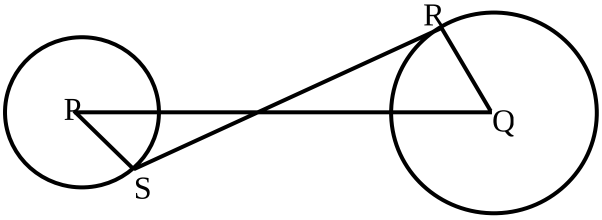
5. Rationalize the denominator and simplify (3 Marks)

$$\frac{\sqrt{3}}{\tan 60 - 1}$$

6. Solve for x in (3 Marks)

$3\log_3 x + 4 = \log_3 24$

7. The transformation represented by the matrix $\begin{bmatrix} x-1 & x \\ 1 & 2x \end{bmatrix}$ maps a triangle whose vertices are **A (-1, 2) B (4, 1)** and **C (1,-4)** onto a straight line. Find the possible values of x. (3 Marks)
8. Expand$\left(2 + \frac{1}{4}x\right)^6$, hence find the value of $(2.025)^6$ rounded off to 3 decimal places. (4 Marks)
9. The resistance to the motion of a car is partly constant and partly varies as the square of the speed. At 40km/h the resistance is 530 and at 60km/h it is 730N. What will be the resistance at 70km/h (4 Marks)
10. By completing the square, solve for x in the equation $\mathbf{2x^2 - 6 = x}$ (3 Marks)
11. A die has two of its faces numbered 3. Calculate the probability of obtaining a 1 or a 3 on a single cast. (3 Marks)
12. Solve the equation $4\cos(3x - 10)^0 = -3.0640$ for $0^0 \leq x \leq 180^0$ (3 Marks)
13. The top of a table is regular pentagon. Each side of the pentagon measures 40.0cm. Find the maximum percentage error in calculating the perimeter of the top of the table. (3 Marks)
14. The points P(8,4) and Q(2,2) are the ends of a diameter of a circle. Find the equation of the circle. (3 Marks)
15. In the diagram below, PQ = 10cm, and the radius of the circle centres P and Q are 2cm and 4cm respectively, calculate the length of the transverse common tangent SR. (3 Marks)

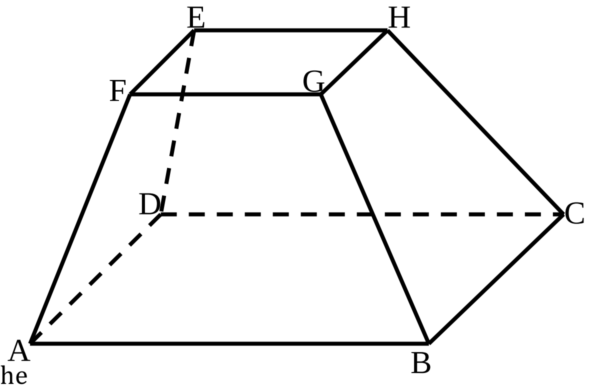


16. Line $\mathbf{y = \frac{3}{5}}x$ is parallel to diameter LM of circle $\mathbf{x^2 + y^2 + 6x - 8y = 0}$. Find the equation of the tangent to the circle at L. (4 Marks)

SECTION II (50 MARKS)

Answer any Five Questions in this section

17. The figure below shows a frustum ABCDEFGH of a right pyramid such that AB = 9cm, BC = 12cm, FG = 6cm GH = 8cm and the height of the frustum is 10cm.



Find the

(a) Height of pyramid (2 Marks)

(b) Length of

(i) AC (2 Marks)

(ii) AH (2 Marks)

(c) Calculate the angle between:

(i) Line AH and the plane ABCD (2 Marks)

(ii) The planes ABHE and ABCD (2 Marks)

18. A and B are two points on the latitude 40^0N. The two points lie on the longitude 20^0W and 100^0E respectively.

(a) Calculate:-

(i) The distance from A to B along a parallel of latitude. (3 Marks)

(ii) The shortest distance from A to B along a great circle. (4 Marks)

(b) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along parallel latitude, which one arrived earlier and by how long. Give your answer to the nearest minute. (Take R = 6370 km and $\pi = \frac{22}{7}$) (3 Marks)

19. The following table shows the distribution of marks obtained by 50 students of Matare Secondary School.

Marks	45-49	50-54	55-59	60-64	65-69	70-74	75-79
No. of Students	3	9	13	15	5	4	1

(a) By using an assumed of 62, calculate:

(i) The mean (5 Marks)

(b) The variance (3 Marks)

(c) The standard deviation (2 Marks)

20. Matrix **S** represents a reflection on line y = x, matrix **T** represents a rotation through positive 90^0 centre (0,0). A triangle whose vertices are A(-2,0), b(1,-2) and C(0,1) is subjected to these transformations, such that: the triangle $A^1B^1C^1$ is the image of ABC under transformation matrix **S** and that $A^{11}B^{11}C^{11}$ is the image of $A^1B^1C^1$ under transformation matrix **T**.

(a) Plot the three triangles on the grid provided below. (4 Marks)

(b) Find a single matrix that will map $A^{11}B^{11}C^{11}$ onto ABC. (3 Marks)

(c) Describe the matrix in (b) above. (1 Mark)

(d) If triangle ABC is sheared, shear factor 2 with the y – axis invariant, find the coordinates of the image. (2 Marks)

21. Transmasra Sugar Company has 36 hectares of land. The company decides to prepare the land for planting wheat and maize. The labour cost of planting maize is KSh. 300 per hectare while it costs KSh. 900 to plant a hectare of wheat. Maize takes 3 labourers per hectare while wheat takes 6 labourers per hectare. Atleast 72 labourers are to be hired and KSh. 15,000 is to be spent for labour costs. The company hopes to make a profit of KSh. 2,000 per hectare of maize and KSh. 4,500 per hectare of wheat. *Let the number of hectares for maize be x, Let the number of hectares for wheat be y*

(a) Write down inequalities representing the above information. (3 Marks)

(b) On the grid provided, draw the inequalities by shading unwanted regions (4 Marks)

(c) Use the graph to:-

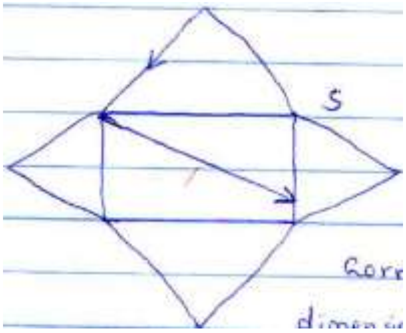
(i) determine the number of hectares of maize and wheat that should be prepared in order for the company to maximize profit. (2 Marks)

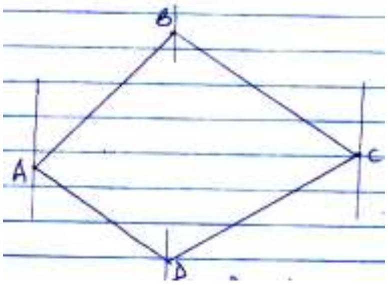
(ii) Calculate the maximum profit (1 Mark)

22. (a) Using a ruler and pair of compasses only, construct parallelogram ABCD in which AB = 7CM, BC = 5cm and angle CBA = 45^0. (4 Marks)
    (b) From a point T, 3cm from D on DC, construct the locus of a point Q, 3.5cm from T to intersect AD and DC at V and W respectively. Measure angle VTW. (4 Marks)
    (c) Find the area of the minor sector TVW in cm^2 (2 Marks)
23. The thirteen term of an arithmetic progression is 27. Given that the seventh term equals to three times the second term, find
    (a) The first term and the common difference of the progression. (4 Marks)
    (b) The sum of the first three even numbered terms of the progression. (3 Marks)
    (c) It's given that $(b-\frac{9}{4})$, b and $(b + 3.375)$ are the 2nd,3rd , and 4th terms of a geometric progression. Determine the value of b. (3 Marks)
24. The equation of a curve is given by $y = 11x - x^2$.
    (a) Determine coordinates of the stationary point. (3 Marks)
    (b) By integration, determine the actual area bounded by the curve $y = 11x - x^2$ and the line $y = 2x$ (4 Marks)
    (c) Find the equation of the normal to the curve at $x = 2$ (3 Marks)

KURIA EAST DISTRICT JOINT EXAMINATION COUNCIL
kenya certificate of secondary education (k.c.s.e.)
PAPER 1 MARKING SCHEME

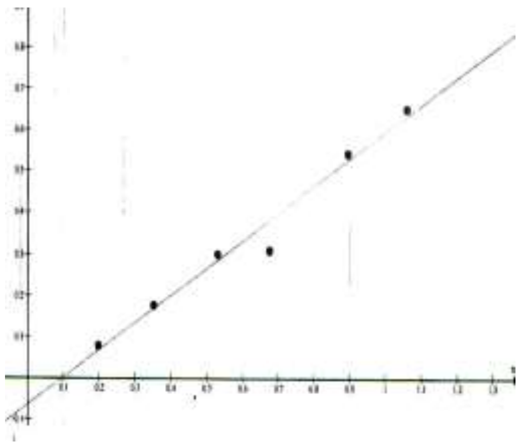
1.	$\sqrt{(4^2+-20^2)} \div \sqrt{(C-1^2+-5^2)}$ $= \sqrt{\frac{416}{26}}$ $= 4$	M1 M1 A1
		3
2.	$(7.32\ x10^{-1})^3 = 392.2 \text{ x } 10^{-3}$ $= 3922 + 4.402$ $= \frac{1}{2}\text{x} = 4.7942$ 2x = 0.2086 x = 0.104	M1 M1 A1
		3
3.	$\frac{(3x-2a)(4x+39)}{(3x+\ 2a)(3x-2a)}$ $= \frac{4x+3a}{3x+2a}$	M2 A1
4.	(a) 2357 (b) 200 + 300 + 50 + 7	A1 M1A1
		3
5.	y – x = 4 y + x = 14 y = 4 + x 4 + x + x = 14 2x = 10 thus x = 5 and y = 9 = 59	M1 M1 A1
6.	2000 x 40 = 80,000 + 1200 = 92000 $\frac{100}{125}$ x 92,000 = KSh. 73,600	B1 M1 A1
		3
7.	3(1+x) < 5x – 11<x + 45 3(1+x) <-11 < x + 45 = -2x < - 14 3 + 3x < 5x – 11 = x> 7 5x - 11< x + 45 = 4x <56 7<x<14 (8,9,10,11,12,13)	M1 M1 A1
		3
8.	$\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(-\frac{5}{6}\div-\frac{10}{27}\right)^{\frac{1}{2}}\right]\right)^{\frac{1}{2}}$ $\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(\frac{9}{4}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ $\left(\frac{7}{3}\left[\frac{2}{3}-\ \frac{2}{3}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ $\left(\frac{7}{3}\left[\frac{4}{3}-\frac{3}{4}\right]\right)^{\frac{1}{2}}$ $\left(\frac{49}{36}\right)^{\frac{1}{2}}$ $\frac{7}{6} = 1\frac{1}{6}$	

9	$\frac{1000,000}{91.80} = 10,893.25$ 10,893.25 – (190+4500) = 6203.25 6203.25 x 91.65 = 568,278.86 $\frac{568,527.86}{103.93} = 5,470.30$ 5470.30 – 2000 = 3,470.30	
10	S = $\frac{40+60+80}{2}$ = 90 Area = $\sqrt{90(90-40)(90-60)(90-80)}$ Area = $\sqrt{1350000}$	
11	4x + x = 180 x = 36 $\frac{360}{36}$ = n n = 10 sides	M1 M1 A1
12	l.s.f = $\frac{3}{5}$ v.s.f = $\frac{27}{125}$ $\frac{8.1}{v} = \frac{27}{125}$ v = 37.5m^3	M1 M1 A1
13	Midpoint = (3,4) Gradient of AC = 3 Gradient of perpendicular line = $-\frac{1}{3}$ $\frac{y-4}{x-3} = -\frac{1}{3}$ 3y + x = 5	M1 M1 A1
14	$\frac{h}{60}$ = Tan 45, h = 60 tan 45 Tan θ = $\frac{60 \tan 45}{240}$ θ = 14.04^0	M1 M1 A1
15	48 = 2^4 x 3 72 = 2^3 x 3^2 1008/2^4 x 3^2 = 7 Least no is 7 x 3 = 21	M1 M1 A1
16	 Correct labelling, equal dimensions shown, proper construction Distance = 15 + $\sqrt{(144+16)}$	

17.	 Parallel lines passing A and B B located D located C located b. (i) Ship A from D N35W or 325^0 (ii) Ship D from C, S55W or 235^0 c. (i) 441km (ii) 755km d. Angle DAC = 610, angle BCD = 67^0±2	M1 M1 M1 M1 A1 A1 A1 A1 M2
		10
18.	(a) (i) Capacity of the tank = 2.4 x 2.8 x 3 x 1000 = 20160L Amount = 20160 – 3600 = 16560 Litres (ii) Time taken to fill = $\frac{16560}{0.5}$ =$\frac{16560}{\mathbf{0.58x60x60}}$ =9hr 12 min (b)In 1hr, pipe A and B fill $\frac{1}{3}+\frac{1}{6}=\frac{1}{2}$ in 1 hr pipe C empties $\frac{1}{8}$ of the tank the next hour all pipes open, amount in tank increases by $\frac{1}{2}$ - $\frac{1}{8}$ = $\frac{3}{8}$ Time taken to fill the remaining half of the tank is $\frac{1}{2} \div \frac{3}{8}$ = $\frac{1}{2}$ x $\frac{8}{3}$ = $\frac{4}{3}$ hrs Total time = 1 + $\frac{4}{3}$ = 2hrs 20 mins	M1 A1 M1 M1 A1 M1 M1 M1 M1 A1
		10
19.	(a)i)πr^2=3.142x4.2²=55.42cm² (ii)πRL $-$ πrl L=x+8 $\frac{4.2}{3.5}$=$\frac{8+x}{x}$ X=40=3.142x4.2x4.8-(3.142x3.5x40) =193.6cm² (iii)hemisphere= $2\pi r^2$=2x3.142x3.5 =77cm² (b)total area=55.44+193.6+77=326.04 1s.f²=a.s.f $\frac{326.04}{81.51}$=$\sqrt{4}$ $\frac{4.2}{2}$=r R=2.1 cm	M1A1 M1 M1 A1 M1 A1 M1 M1 A1

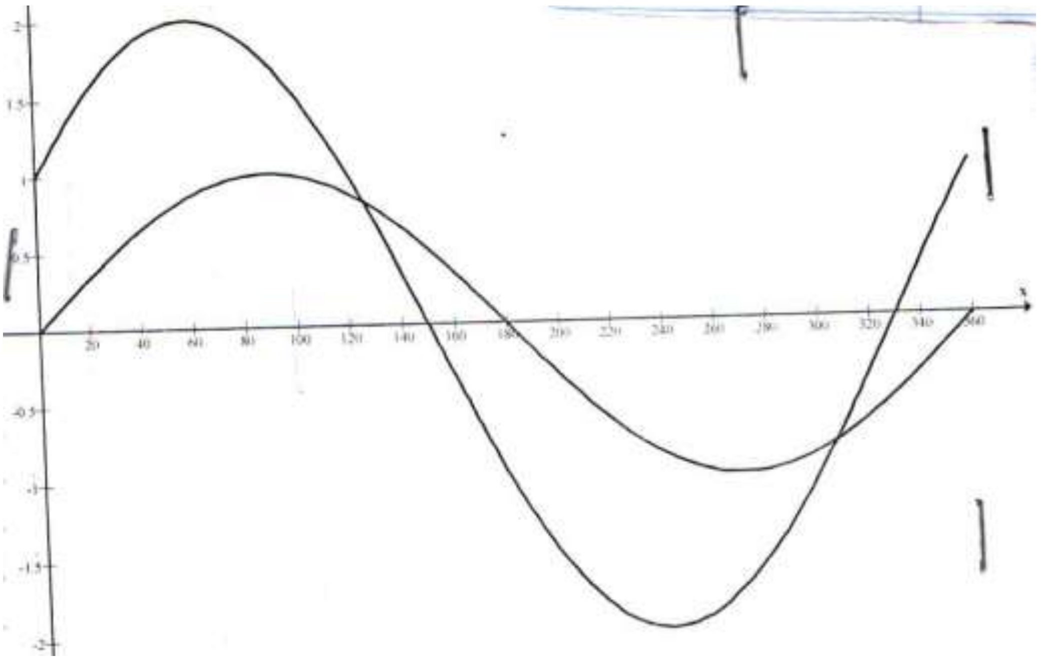
20	(i) ∠DON = 20^0 angle at centre is twice angle at the circumference (ii) ∠DNQ = 10^0 angle between chord and tangent is equal to angle in the alternate segment subtended by the same chord. (iii) ∠ONA = 60^0 base angles of an isosceles triangle (iv) ∠DBA = 40^0 angle at the centre ∠AOD = 80^0 is twice angle at Circumference (v) ∠ODN = 80^0 base angles of an isosceles triangular	
21	(a) log p = n log Q + log k (b)	

Log P	0.0792	0.1761	0.3010	0.3118	0.5441	0.6532
Log Q	0.1987	0.3522	0.5302	0.6758	0.8954	1.0607

	 (c) log k = -0.06 k = 0.87 . n gradient = 0.3585 (d) log 3 = 0.4771 Log Q = 0.8 Q = 6.31	
22	$\frac{dh}{dt}$ = v = -6t2 + 3t + 3, $\frac{dv}{dt}$ = a = -12t + 3 at 0, a = 3m/s² (b)(i) $\frac{dh}{dt}$ = 0, -6t² + 3t + 3 = 0 (2t + 1) (t – 1) = 0, t = - ½ or t = 1 Thus t = 15 (ii) h = 2t³ + $\frac{3}{2}$t² + 3t at t = 1, h = -2 + $\frac{3}{2}$ +3 = 2.5m (c) $\frac{dh}{dt}$ = a = -12t + 3 = 0 t = 0.25s v = -6 + 0.252 + 3 x 0.25 + 3 = 3.375m/s	

23.

x	0	30	90	120	150	180	210	240	270	300	330	360
Sin x	0	0.5	1	0.87	0.5	0	-0.5	0.87	-1	-0.87	-0.5	0
2 sin (x + 30)	1	1.74	1.74	1	0	-1	-1.74	-2	-1.74	-1	0	1



(c) Translation $\begin{pmatrix} -30 \\ 0 \end{pmatrix}$ then stretch parallel to y – axis stretch factor 2

(d) 1320 and $312^0 \pm 2$

24 r.s = 100 – 80 = 20km/h

$\rightarrow \frac{20 \ x \ 1000}{60 \ x \ 60}$

$= \frac{50}{9}$m/s

Time=$\frac{total \ distance}{r.s}$

Time=$\frac{(4+21)}{\frac{50}{9}}$

Time=4.55

(b)distance=time taken x car speed

Distance=$\frac{4.5x100x1000}{60x6}$ =125m

(c)i)r.s=90+100=190km/hr=$\frac{190x100}{60x60}$=$\frac{475}{9}$

Distance=r.s x time=$\frac{475}{9}$x18

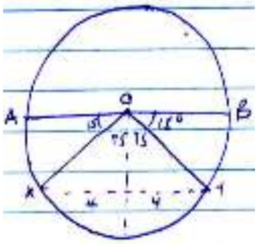
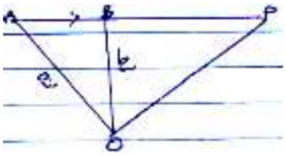
Distance=r.s x time =950m

ii) distance,trailer & car –length,bus

= $\frac{50}{9}$x18-12

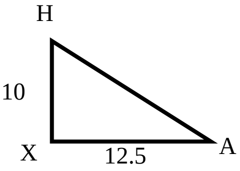
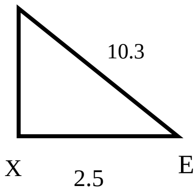
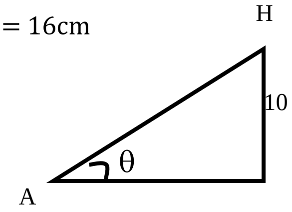
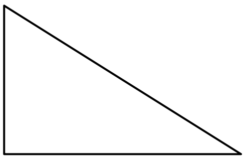
=88m

KURIA EAST DISTRICT JOINT EXAMINATION COUNCIL
kenya certificate of secondary education (k.c.s.e.)
PAPER 2 MARKING SCHEME

1.	B.P $\frac{52.90}{1.15} = 46$ Let maize flour be x millet y $\frac{40x+52y}{x+y} = 46$ 40x + 52y = 46x + 46y $\frac{6y}{6y} = \frac{6x}{6y}$ x:y 1:1	M1 M1 A1
2.	Sin 75 = $\frac{4}{r}$ r = $\frac{4}{Sin\ 75}$ = 4.1411 πr^2 $\frac{22}{7}$ x 4.1411^2 53.8959cm^2  	M1 A1
3.	 OP = $\frac{-2a}{T} + \frac{3b}{T}$ $-2\begin{pmatrix}3\\4\\-6\end{pmatrix} + 3\begin{pmatrix}2\\3\\1\end{pmatrix} = \begin{pmatrix}0\\1\\15\end{pmatrix}$ P(0,1,15)	M1 M1 A1
4	(i) 20,000 + ($\frac{15}{100}$ x 20,000) + 5000 – 700 = 27,300 $\frac{27300}{20}$ x 12 = K£16,3580	M1 A1
	(ii) 4200 x 2 = 8400 3800 x 3 = 11400 4600 x 4 = 18400 3780 x 5 = 18900 57,100 = $\frac{57100}{12}$ = 4,758.33	M1 A1
5.	$\frac{\sqrt{3}}{\tan 60-1}$ $\frac{\sqrt{3}}{\sqrt{3}-1}$ x $\frac{\sqrt{3}+1}{\sqrt{3}+1}$ $\frac{3+\sqrt{3}}{3+\sqrt{3}-\sqrt{3}-1}$ $\frac{3+\sqrt{3}}{2}$ $\frac{3}{2} + \frac{\sqrt{3}}{2}$	B1 B1 B1
6.	3Log$_3$ x + Log$_3$81 = Log$_3$24 x^3 x 81= 24 x^3 = $\frac{24}{81}$ x^3 = $\frac{8}{27}$ x = $\sqrt[3]{\frac{8}{27}}$ = $\frac{2}{3}$	M1 M1 A1

7.	2 x (x – 1) – x = 0 2x^2 – 3x = 0 X(2x – 3) = 0 x = 0 2x = 3 x = $\frac{3}{2}$	M1 M1 A1
8.	1, 6, 15, 20, 15, 61 $-2^6.\left(\frac{1}{4}x\right)^0 + 6.2^5\left(\frac{1}{4}x\right)^1 + 15.2^4\left(\frac{1}{4}x\right)^2 + 20.2^3$ $+15.2^2\left(\frac{1}{4}x\right)^5 + 6.2^1\left(\frac{1}{4}x\right)^2 + 1.2^0\left(\frac{1}{4}x\right)^6$ $- 64 + 48x + 15x^2 + \frac{5}{2}x^3 + \frac{15}{64}x^4 + \frac{3x^5}{256} + \frac{x^6}{4096}$ $\frac{1}{4}$x = 0.025 x = 0.1 64 + (48 x 0.1) + (15 x 0.1^2) + $\frac{5}{2}$(0.1^3) + $\frac{15}{64}$(0.1)^4 + $\frac{3}{256}$ x 0.1^5…. 68.95270 68.953	B1 B1 M1 A1
9.	Resistance = r Speed = s r x s^2 + c r = ks^2 + c 530 = 1600k + c 730 = 3600k + c -200 = -2000k k = $\frac{-200}{-2000} = \frac{1}{10}$ c = 530 – $\left(1600\ x\ \frac{1}{10}\right)$ = 370 r = $\frac{1}{10}s^2 + 370$ r = $\frac{1}{10}$ x 70^2 + 370 = 860	M1 M1 M1 A1
10	2x^2 – x – 6 = 0 $\frac{2x^2}{2} - \frac{x}{2} = \frac{6}{2}$ $x^2 - \frac{x}{2} + \frac{1}{16} = 3 + \frac{1}{16}$ x^2 - $\frac{1}{4}$x - $\frac{1}{4}$x + $\frac{1}{16} = \frac{49}{16}$ $\left(x - \frac{1}{4}\right)^2 = \frac{49}{16}$ x = ± $\sqrt{\frac{49}{16}} + \frac{1}{4}$ = ±$\frac{7}{4} - \frac{1}{4}$ x$_1$= 2 x$_2$ = -1.5	M1 M1 B1
11.	P(1) = $\frac{1}{6}$ P(3) = $\frac{2}{6}$ $\frac{1}{6} + \frac{2}{6} = \frac{3}{6}$ = $\frac{1}{2}$	M1 M1 A1

12	4cos (3x – 10) =- $\frac{3.0605}{4}$ Cos (3x – 10) = -0.4766 3x – 10 = Cos^{-1} (-0.766) 3x – 10 = 140^0 3x – 100 220, 500, 580 3x = 150^0, 230, 510, 590 x = 50^0, 76.67^0, 170^0	M1 M1 B1
13.	Actual perimeter (40.0 x 5) = 200 Max perimeter (40.05 x 5) = 200.25 Min perimeter (39.95 x 5) = 199.75 A.E = $\frac{Max\ P-Min\ P}{2}$ = $\frac{200.25-199.75}{2}$ = 0.25 % error $\frac{0.25}{200}$ x 100 = 0.125%	M1 M1 A1
14.	Centre $\left(\frac{8+2}{2},\frac{4+2}{2}\right)$ (5,3) Radius $\binom{8}{4}$- $\binom{5}{3}$ = $\binom{3}{1}$ $\sqrt{3^2+1}$ $\sqrt{10}$ $(x-5)^2+(y-3)^2=\left(\sqrt{10}\right)^2$ (x^2 – 10x + 25) – (y^2-6y+9 = 10 x^2 + y^2 – 10x – 6y + 24 = 0	M1 M1 B1
15	4 + 2 = 6 10^2 – 6^2 = SR 100 – 36 = SR $\sqrt{64}$ = 8	M1 M1 A1
16	x^2 + 6x + y^2 - 8y = 0 x^2 + 6x + 9 + y^2 – 8y + 16 = 9 + 16 $(x+3)^2$ + $(y-4)^2$ = 25 Centre (-3,4) Radius = 5 Gradient of tangent $\frac{3}{5}$ - m_2 = -1 m^2 = - $\frac{5}{3}$ -$\frac{5}{3}$(x,y) (-3,4) $\frac{y-4}{x+3}$ = -$\frac{5}{3}$ y – 4 =- $\frac{5}{3}$-5 y = -$\frac{5}{3}$x - 1	M1 M1 M1 A1
17.	(a) $\frac{12}{8}=\frac{10+h}{h}$ 80 + 8h = 12h $\frac{80}{4}=\frac{4h}{4}$ h = 20 + 10 = 30	

	(b) (i) AC $\sqrt{9^2+12^2}=\sqrt{225}=15$ (ii) AH FH = $\sqrt{6^2}+8^2\ \frac{\sqrt{5^2+20^2}}{\sqrt{25+400}}$ FH = 10cm = 20.62cm Same height 30^2+75^2 HC = 30.92 – 20.62 $\sqrt{900+56.25}$ H = 10.3cm = 30.92cm   AH = 16cm (c) (i)  Sin θ = $\frac{10}{16}$ Sin θ = 0.6250 θ = Sin^{-1}(0.6250) = 38.68^0 (ii) 	
18	(a) $\frac{120}{360}$ = x $\frac{22}{7}$ x 6370 cos 40 = 10,224.139km In nm 60 x 120 cos 40 Alternative = 5,515.51999 (ii) $\frac{100}{360}$ x $\frac{22}{7}$ x 6370 = 5361.1111km Alt. $\frac{5561.111}{1.853}$ = 3001.1393 nm (b) P – 400 knots great circle =3001.1393 Q - 600 knots parallel 5515.51999 Time taken $\frac{3001.1393}{400}$ = 7 hr 30 min $\frac{5515.51999}{600}=9\ hr\ 11\ min$ P arrived 9 hr 11 min <u>-7 hr 30 min</u> 1 hr 40 min	

19

Class	x	f	t = x – 62	Ft	ft²
40-49	47	3	-15	-45	675
50-54	52	9	10	-90	900
55-59	57	13	-5	-65	325
60-64	62	15	0	0	0
65-69	67	5	5	25	125
70-74	72	4	10	40	400
75-79	77	1	15	15	225

$\Sigma f = 50 \quad \Sigma ft = -120 \quad \Sigma ft^2 = 2650$

(i) The mean

$t = \frac{-120}{50}$

$= -2.4$

$x = -2.4 + 62$

$= 59.6$

(b) Variance

$\frac{2650}{50} - (-2.4)^2$

$53 – 5.76$

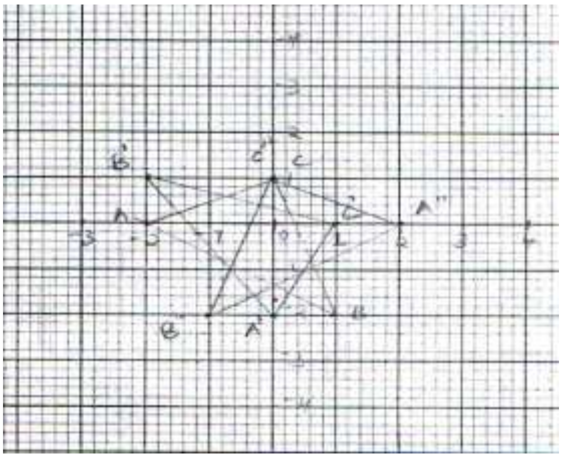
47.24

(c) The standard deviation

$\sqrt{47.24}$

$= 6.8731$

20



$$T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix}$$

$S = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ = A1 (0,-2) B(-2,1) c (1,0)

$A^{I}\ B^{I}\ C^{I}$ $\qquad$ $A^{II}\ B^{II}\ C^{II}$

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 \\ -2 & -2 & 1 \end{bmatrix}$$

$A^{II}(2, 0)\ B^{II}(-1,-2)\ C^{II}(0,1)$

21

a) I) $x + y \leq 36$	B1
ii) $300x + 900y \leq 15000$	
$x + 3y \leq 50$	B1
iii) $3x + 6y \geq 72$	
$y \geq 0$	
$x \geq 0$	B1
b) Graph	
c) $Objective\ function\ 2000x + 4500y$	
Search line$20x + 45y = 325$	
$(29, 7)$	
$29\ hectares\ of\ maize$	
$7\ hectares\ of\ wheat$	B1
	B1
ii) $(29x300) + (900x7) = sh\ 1500$	

22

Line AB

Construction < CBA 45⁰

Locating C

Correct parallegram

$<VTW=82^0 \underline{+} 1^o$

$$\frac{82}{360} x \frac{22}{7} x 3.5^2 = 8.7694cm^2$$

23	(a) a + (n – 1) d a + 12d 2nd a + d 1.5d + 12d 7th a + 6d 13.5d = 27 13th a t 12d d = 2 a + 6d = 3a + 3d a = 1.5 x 2 $\frac{-2a}{-2} = \frac{3d}{-2}$ a = 1.5d (b) a + (n – 1)d A = 3 D = 2 3,5,7,9,11,13,15, 17,19,21,23 None (c) (b - $\frac{9}{4}$)b, (b + 3.375) $\frac{b}{(b-\frac{9}{4})} = = \left(b + \frac{3.375}{b}\right)$ b^2 = (b - $\frac{9}{4}$) (b + $\frac{27}{8}$) b2 = b2 + $\frac{27}{8}$b - $\frac{9}{4}$b - $\frac{243}{32}$ $\frac{9}{8}$ b = $\frac{243}{32}$ b = $\frac{243}{32}$ x $\frac{8}{9}$ = 6.75			$gradient\ of\ normal$ $M1, M2 = -1$ $7xm2 = -1$ $m_2 = -\frac{1}{7}$ Eqn $\frac{y-18}{x-2} = -\frac{1}{7}$ $y - 18 = -\frac{1}{7}x + \frac{2}{7}$ $y = -\frac{1}{7}x + 18\ ^2/_7$ $y = -\frac{1}{7}x + \frac{128}{7}$
24	a) $y = 11x - x^2y = 11(5.5) - (5.5^2)$ $\frac{dy}{dx} = 11 - 2x = 30.25$ $x - 2x = 0(5.5, 30.25)$ $x = 5.5$ b) $11x - x^2 = 2x$ $x^2 + 2x - 11x = 0$ x^2-9x=0 $x(x - 9) = 0$ $x = 9$ $\int_0^9 (11x - x^2) \int_0^9 2x$ $\left[\frac{11x^2}{2} - \frac{x^3}{3}\right] - 9\ ]_0^9$ $(445.5 - 243) - 81 = 121.5 sq.units$ c) $when\ x = 2\ y = (11x2) - 2^2$ $= 18$ (2,18) $gradient\ of\ tangent$ $y = 11x - x^2$ $\frac{dy}{dx} = 11 - 2x$ $at\ x = 2$ $11 - 4 = 7$			

KAHURO/KIHARU DISTRICT JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education
121/1
MATHEMATICS ALT A
PAPER 1
JULY/AUGUST, 2015
TIME: 2½ HOURS

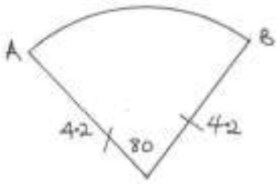
SECTION I: (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. The signals have been set to flash at interval of 15 minutes, 24 minutes if they all flash at 8.13am when will they flash together. (2 marks)
2. Solve for m in the equation: (3 marks)
   $3^{4(m+1)} + 3^{4m} = 246$
3. Use logarithm to evaluate: (4 marks)
   $$\sqrt[3]{\frac{(0.08294)^2 \times (39.24)^3}{8458}}$$
4. Evaluate: (3 marks)
   $$\frac{\frac{1}{2}\ of\ 3\frac{1}{2} + 1\frac{1}{2}\left(2\frac{1}{2} - \frac{2}{3}\right)}{\frac{3}{4}\ of\ 2\frac{1}{2} \div \frac{1}{2}}$$
5. A Kenyan Bank buys and sells foreign currencies as shown below.

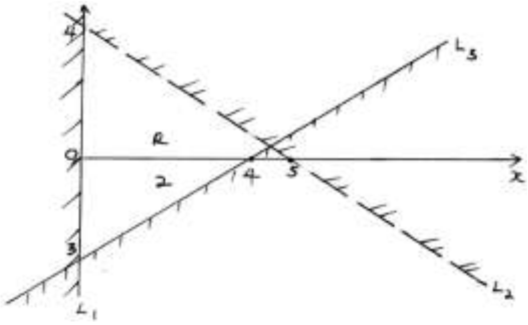
	Buying (Ksh.)	Selling (Ksh.)
1 Euro	84.15	84.26
50 Japanese Yen	65.37	65.45

   A Japanese travelling from France arrives in Kenya with 5000 Euros. He converts all the 5000 Euros to Kenya Shillings at the bank. While in Kenya he spends a total of Ksh.289,850 and then converts the remaining Ksh. to Japanese Yen at the bank. Calculate the amount in Japanese Yen that he receives. (4 marks)
6. Find the equation of a line passing through (2, 1) and perpendicular to the line which makes an angle of 45º with the χ-axis. (3 marks)
7. Use the tables of reciprocals and square roots to evaluate. (3 marks)
   $$\frac{0.1}{0.0351} + \sqrt{0.498}$$
8. Convert $0.\dot{1}2\dot{3}$ into a fraction. (3 marks)
9. Find the perimeter of the figure below. Give your answer correct to 4s.f. (2 marks)



10. The interior angle of a regular polygon is $6\frac{1}{2}$ times the exterior angle. How many sides has the polygon. (3 marks)
11. Simplify:
    $$\frac{3a^2 - 48}{48 - 24a + 3a^2}$$
    (3 marks)
12. A solid metal cuboid 1.5m long, 0.4m wide and 0.25m high is made of material of density 7.5g/cm^3. Calculate its mass in kg. (3 marks)
13. Thirty two men working at the rate of 9hrs a day can complete a piece of work in 7 days. How many more men working at the rate of 8hrs a day would complete the same work in 6 days? (3 marks)
14. Ruto is $2\frac{1}{4}$ times as old as his son. Five years ago, the ratio of their ages was 8:3. What will be their ages 6 years from now? (4 marks)
15. Two similar cylinders have diameter of 7cm and 21cm. If the larger cylinder has a volume of 6237cm^3. Find the heights of the two cylinders. (4 marks)

16. Find the inequalities that define the region R shown in the figure below. (3 marks)

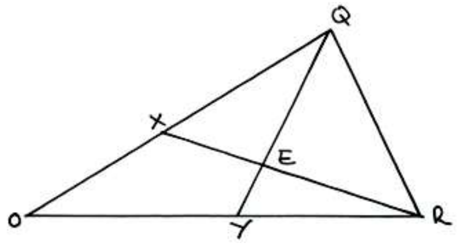


SECTION B: (50 MARKS)

Answer any FIVE questions from this section.

17. A salesman is paid a commission of 2% on goods worth over Ksh.100000. He is also paid a monthly salary of Ksh.12000. In a certain month, he sold 360 pairs of shoes at Ksh.500 each pair.
(a) Calculate the salesman's earning that month. (3 marks)
(b) The following month, his monthly salary was increased by 10%. His total earnings that month were Ksh.17600. Calculate
(i) The total amount of money received from the sales of the shoes that month. (5 marks)
(ii) The number of pairs of shoes sold that month. (2 marks)

18. In the figure below $\underset{\sim}{OQ} = \underset{\sim}{q}$ and OR = $\underset{\sim}{r}$. Point X divides $\underset{\sim}{OQ}$ in the ratio 1:2 and Y divides OR in the ratio 3:4. Lines XR and YQ intersect at E.



(a) Express in terms of $\underset{\sim}{q}$ and $\underset{\sim}{r}$.
(i) $\underset{\sim}{XR}$. (1 mark)
(ii) $\underset{\sim}{YQ}$. (1 mark)
(b) If $\underset{\sim}{XE} = m\underset{\sim}{XR}$ and $\underset{\sim}{YE} = n\underset{\sim}{YQ}$, express $\underset{\sim}{OE}$ in terms of
(i) $\underset{\sim}{r}$, $\underset{\sim}{q}$ and m. (1 mark)
(ii) $\underset{\sim}{r}$, $\underset{\sim}{q}$ and n. (1 mark)
(c) Using the results in (b) above, find the values of m and n. (6 marks)

19. From town P, a town Q is 60km away on a bearing South 80º East. A third town R is 100km from P on the bearing South 40º West. A cyclist travelling at 20km/h leaves P for Q. He stays at Q for one hour and then continues to R. He stays at R for 1½ hrs and then returns directly to P.
(a) Calculate the distance of Q from R. (3 marks)
(b) Calculate the bearing of R from Q. (4 marks)
(c) What is the time taken for the whole round trip? (4 marks)

20. (a) Complete the table given below for the equation $y = -2\chi^2 + 3\chi + 3$ for the range $-2 \leq x \leq 3.5$ by filling in the blank spaces. (2 marks)

χ	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5
y		-6		1						-2		-11

(b) Use the values from the table above to draw the graph of $y = -2\chi^2 + 3\chi + 3$. (3 marks)
(c) Use your graph to:
(i) Determine the integral values of χ in the graphs range which satisfy the inequality $2\chi^2 - 3\chi - 3 \geq 3$. (3 marks)
(ii) Solve $-2\chi^2 + 2\chi + 5 = 0$. (2 marks)

21. A sector of a circle of radius 40cm subtends an angle of 26º at the centre of the circle. $\left(Take\ \pi = \frac{22}{7}\right)$.
(a) Calculate
(i) the area of the sector. (2 marks)
(ii) the length of the arc. (2 marks)
(b) The sector is folded to form an inverted right cone. Calculate
(i) the base radius of the cone. (2 marks)
(ii) To one decimal place, the vertical height of the cone. (2 marks)
(c) Calculate the capacity of the cone in litres. (2 marks)

22. The table below shows marks obtained by 100 candidates at Eastside High School in a Biology examination.

Marks	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 - 84	85 - 94
Frequency	6	14	24	14	χ	10	6	4

(a) Determine the value of χ. (2 mark)
(b) State the modal frequency. (1 mark)
(c) Calculate the median mark. (4 marks)
(d) Calculate the mean mark. (3 marks)

23. (a) A racing cyclist completes the uphill section of a mountain course of 75km at an average speed of (V + 20)km/h. Given that the difference between the time is one hour, form and solve an equation in V. Hence,
(i) find the total time taken to complete the uphill and the downhill sections of the course. (4 marks)
(ii) Calculate the cyclists average speed over the 150km. (2 marks)
(b) A train moving at an average speed of 72km/hr takes 15 seconds to complete cross a bridge that is 80m long.
(i) Express 72km/hr in metres per second. (2 marks)
(ii) Find the length of the train. (2 marks)

24. (a) After t seconds, a particle moving along a straight line has a velocity of Vm/s and an acceleration of (5 – 2t)m/s^2. the particles initial velocity is 2m/s.
(i) Express V in terms of t. (3 marks)
(ii) Determine the velocity of the particle at the beginning of the third second. (2 marks)
(b) Find the time taken by the particle to attain maximum velocity and the distance it covered to attain the maximum velocity. (5 marks)

KAHURO/KIHARU DISTRICT JOINT EXAMINATION - 2015
Kenya Certificate of Secondary Education
121/2
MATHEMATICS ALT A
PAPER 2
JULY/AUGUST, 2015
TIME: 2½ HOURS

SECTION I: (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Kamoni bought four pens and three books for a total of Shs.17 while Jane bought five similar pens and two books for Shs.16. Find the cost of a pen and an exercise. (3 marks)
2. A shopkeeper mixes rice worth Kshs.47 and Kshs.55 per kg, how many kilograms of each should be used to obtain 24kg of the mixture worth Kshs.52 per kg. (3 marks)
3. Solve for χ in
   $\mathrm{Log}_2 (\chi^2 - 9) = 3 \log_2 2 + 1$ (3 marks)
4. John deposits Shs.24000 in a fixed account. After 4 years the money accumulated to Kshs.45,000. If the bank paid compound interest of r% p.a compounded semi annually find r. (3 marks)
5. If $4\chi^2 + 3\chi - 20 + K$ is a perfect square find value of K. (3 marks)
6. A triangle whose area is 6.5cm^2 is mapped onto a triangle whose area is 13cm^2 by a matrix
   $\begin{pmatrix} \chi + 4 & 6 \\ 5 & \chi \end{pmatrix}$. Find the possible values of χ. (4 marks)
7. Given that χ is an acute angle and $Cos\ \theta = \frac{2\sqrt{5}}{5}$ find without Mathematical tables or calculator tan (90 - θ).
   (2 marks)
8. The diameter AB of a circle passes through points A (-4, 1) and B(2, 1). Find the equation of the circle and leave your answer in the form $\chi^2 + y^2 + a\chi + by = c$ where a, b and c are constants. (4 marks)
9. Expand $\left(1 + \frac{\chi}{4}\right)^5$ up to the term in χ^4. Hence evaluate $(0.95)^5$ giving your answer correct to 4s.f. (3 marks)
10. Two variables are such that A is partly constant and partly varies as the square root of B. Given that A = 27 when $B = \frac{1}{4}$ and A = 18; when B = 25, find A when $B = 12\frac{1}{4}$. (3 marks)
11. A curve passes through the point (3, -3), if its gradient function is $5\chi^2 + 1$, find its equation. (2 marks)
12. Pipe A can fill an empty water tank in 3hrs while Pipe B can fill the same tank in 6hrs. When the tank is full it can be emptied by Pipe C in 8hrs. Pipe A and B are opened at the same time when the tank is empty. If one hour later Pipe C is also opened, find the total time taken to fill the tank. (3 marks)
13. Make χ the subject of the formula:
    $\sqrt{\frac{(2\chi + r)^2}{4}} = \chi + r$ (3 marks)
14. The 16th term of an A.P. is seven times the 8th term. The sum of the first ten terms is -35. Find the first term and the common difference. (4 marks)
15. The following were recorded on a field note book by a surveyor. Taking the base line as 550M find the area in M^2.
    (3 marks)

		B			
		550	120	TO	A
C	150	450			
		250	90	T O	D
E	60	40			
		F			

16. Given that $\frac{1}{1 + \sqrt{2}} - \frac{3}{1 - \sqrt{2}} = P + Q\sqrt{R}$ find the values of P, Q and R. (4 marks)

SECTION B: (50 MARKS)

Answer any FIVE questions from this section.

17. The table below shows the rates at which income tax is charged on annual income.

Annual taxable income (K£)	Rates (Shs. Per K£)
1 – 2800	3
2801 - 4600	5
4601 – 7200	6
7201 – 9000	7
9001 – 11800	9
11801 – 13600	10
Over 13600	12

A company employee earns a gross monthly salary of Ksh.18600. He is housed by the company and as a result, his taxable income is increased by 15%. If the employee is married and claims a monthly family relief of Shs.250, calculate

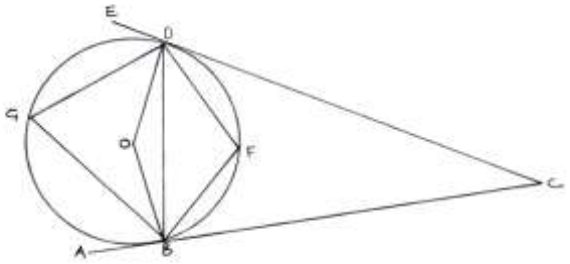
(a) his taxable income. (2 marks)
(b) his net salary per month. (8 marks)

18. (a) Complete the table below for the function $y = \text{Sin } 2\chi$ and $y = 3 \text{ Cos } \chi$ for $-180º \leq x \leq 180º$. (2 marks)

χº	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
Sin 2χ	0			0	-0.87				0.87	0			0
3 Cos χ	-3	-2.6		0		2.6					-1.5		

(b) On the same axes, draw the graph of $y = \text{Sin } 2\chi$ and $y = 3 \text{ Cos } \chi$ $-180º \leq x \leq 180º$. (5 marks)
(c) Use the graph in (b) above to find:
(i) the value of χ such that $3 \text{ Cos } \chi - \text{Sin } 2\chi = 0$. (1 mark)
(ii) the difference in value of y when $\chi = 45º$. (1 mark)
(iii) Range of values of χ such that $3 \text{ Cos } x > 1.5$. (1 mark)

19. In the diagram below ∠EDG = 36º, ∠ABG = 42º line EDC and ABC are tangents to the circle at D and B respectively.

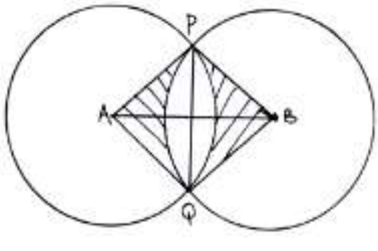


Calculate by giving reason.

(a) ∠DGB. (2 marks)
(b) Obtuse ∠DOB. (2 marks)
(c) ∠GDB. (2 marks)
(d) ∠DCB. (2 marks)
(e) ∠DFB. (2 marks)

20. The position of two towns are A (30ºS, 20ºW) and B (30ºS, 80ºE) find
(a) the difference in longitude between the two towns. (1 mark)
(b) (i) the distance between A and B along parallel of latitude in km (take radius of the earth as 6370km and $\pi = \frac{22}{7}$). (3 marks)
(ii)in nm. (2 marks)
(c) Find local time in town B when it is 1.45pm in town A. (4 marks)

21. In the figure below A and B are centres of the circle intersecting at point P and Q, angle PBQ = 97.2º while PAQ = 52º, PB = 4cm while AP = 10cm.



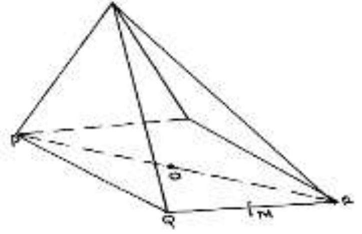
Determine:-

(a) the length AB. (3 marks)
(b) the area of sector APQ. (2 marks)
(c) the area of the quadrilateral, APBQ. (3 marks)
(d) area of the shaded region. (2 marks)

22. ABCD is a quadrilateral with vertices A (3, 1), B (2, 4), C (4, 3), D (5, 1).
(a) Draw the image $A^1B^1C^1D^1$ image of ABCD under transformation matrix $M\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}$ and write down the co-ordinates. (4 marks)
(b) A transformation represented by $P\begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix}$ maps $A^1B^1C^1D^1$ onto $A^{11}B^{11}C^{11}D^{11}$ determine the co-ordinates of the image and draw $A^{11}B^{11}C^{11}D^{11}$. (3 marks)
(c) Determine the single matrix of transformation which maps ABCD onto $A^{11}B^{11}C^{11}D^{11}$ and describe the transformation. (3 marks)

23. (a) Without using a set square or a protractor, construct triangle ABC such that AB = AC = 5.4cm and angle ABC = 30º. (3 marks)
(b) Measure BC. (1 mark)
(c) A point P is always on the same side of BC as A. Draw the locus of P such that angle BAC is always twice angle BPC. (2 marks)
(d) Calculate the area of triangle ABC. (2 marks)
(e) Draw a perpendicular from A to meet BC at D. Measure AD. (2 marks)

24. The figure below represent a right pyramid with vertex V and a rectangular base PQRS.
VP = VQ = VR = VS = 18cm and QR = 12cm, M and O are midpoints of QR and PR respectively.



Find:
(a) the length of the projection of VP on the plane PQRS. (3 marks)
(b) size of angle between VP and plane PQRS. (3 marks)
(c) size of angle between plane VQR and PQRS. (4 marks)

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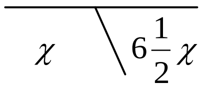
JULY/AUGUST, 2015
TIME: 2½ HOURS

1	2 | 15 24 M1 Lcm 2 | 15 12 Lcm = 2^3 x 3 x 5 2 | 15 6 8 x 15 = 90 minutes 3 | 15 3 8.13 + 1½hrs 5 | 5 3 1.30 | 1 1 9.43am A1	8.	Let χ = 0.123123 1000χ = 123.123 999χ = 123 M1 $\chi = \frac{123}{999}$ M1 $= \frac{41}{333}$
2	$3^{4m}\ 3^4 + 3^{4m} = 246$ M1 Let $3^{4m} = y$ 81y + y = 246 82y = 246 M1 y = 3 $3^{4m} = 3^1$, m = ¼ A1	9	$\left(\frac{80}{360} \times \frac{22}{7} \times 8.4\right) + 8.4$ M1 14.27CM A1
3	No | Log 0.08294 | $\bar{2}.9188 \times 2 = \bar{3}.8376$ M1 39.24 | 1.5937 x 3 = <u>4.7811</u> M1 <u>±</u> <u>2.6187</u> 84.58 | 3.7273 <u>3.9273 -</u> $\bar{2}.6914 \div 3 = \bar{1}.5638$ M1 = 0.3662 A1	10	 $6\frac{1}{2}\chi + \chi = 180$ M1 $7\frac{1}{2}\chi = 180$ χ = 24 A1 No of sides $\frac{360}{24} = 15\ sides$ B1
4	$\frac{7}{4} + 1\frac{1}{2}\left(\frac{11}{6}\right)$ $\frac{7}{4} + \frac{11}{4} = 1\frac{8}{4}\ or\ \frac{9}{2}$ M1 $\frac{3}{4} \times \frac{5}{2} \times \frac{2}{1} = \frac{15}{4}$ M1 $\frac{18}{\cancel{4}} \times \frac{\cancel{4}}{15} = 1\frac{1}{5}$ A1	11	$\frac{3(a^2 - 16)}{48 - 12a - 12a + 3a^2}$ $\frac{\cancel{3}(a + 4)(a - 4)}{\cancel{3}(4 + a)(4 - a)}$ $= \frac{a + 4}{a - 4}$
5	5000 x 84.15 = 420750 M1 Remainder - <u>289859</u> <u>130900</u> M1 $\frac{130900 \times 50}{65.45}$ M1 100,000 Yen A1	12	Volume = 150 x 40 x 25 M1 = 150,000cm^3 M = D x V 7.5 x 150,000 M1 $= \frac{1125{,}000gm}{1000}$ 1125kg A1
6	Tan 45° = 1 m_1 x m_2 = -1 m_2 = -1 y = mχ + c m = -1 (2, 1) (χ, y) 1 = (-1 x 2) + c M1 c = 3 y = -χ + 3 A1	13	$\frac{9}{8} \times \frac{7}{6} \times 32 = 42\ men$ M1 42 – 32 = 10 M1 = 10 men A1
7	$\frac{1}{0.0351} = 28.49,\ \sqrt{0.498} = 0.70569$ 0.1 x 28.49 + $\sqrt{0.498}$ 2.849 + 9.70569 3.55469	14	Son χ $Ruto\ \frac{9}{4}\chi$ $\frac{\frac{9}{4}\chi - 5}{\chi - 5} = \frac{8}{3}$ $\frac{27}{4}\chi - 15 = 8\chi - 40$ 27χ - 60 = 32χ - 160 -5χ = -100 χ = 20 $Ruto\left(\frac{9}{4} \times 20\right) + 6 \quad \left.\begin{matrix} 51 \\ 26 \end{matrix}\right\}$ Son 20 + 6

15

$L.S.F = \frac{7}{21} = \frac{1}{3}$ B1

$V = \pi r^2 h$

$= \frac{22}{7} \times (10.5)^2 h = 6237$ M1

h = 18cm A1

$\frac{1}{3} \times 18$

= 6cm

16

$L_1 = \chi \geq 0$

L_2 (0, 4) (5, 0)

$\frac{0-4}{5-0} = \frac{-4}{5}$

$\frac{y-0}{\chi - 5} = \frac{-4}{5}$

$5y = -4\chi + 20$

$5y < -4\chi + 20$

$y < \frac{-4}{5} + 4$

L_3 (0, -3) (4, 0)

$\frac{-3-0}{0-4} = \frac{-3}{-4} = \frac{3}{4}$

$\frac{y-0}{\chi - 5} = \frac{3}{4}$

$4y = 3\chi - 12$

$y = \frac{3}{4}\chi - 3$

$y \geq \frac{3}{4}\chi - 3$

17

(a) $Commission \frac{2}{100} \times (500 \times 360)$ M1

= 3600

Total pay 12000 + 3600 M1

Shs.15600 A1

(b) (i) $\frac{110}{100} \times 12000 = 13200$ M1

17600 – 13200 M1

= 4400

$\frac{2}{100}\chi = 4400$

$\chi = 4400 \times \frac{100}{2}$ M1M1

= 222000 A1

(ii) $\frac{222000}{500} = 440\, pairs$ M1

18

(a) (i) $r - \frac{1}{3}q$ B1

(ii) $q - \frac{3}{7}r$ B1

(b) (i) $\underset{\sim}{OE} = \underset{\sim}{O\chi} + \underset{\sim}{\chi E}$

$= \frac{1}{3}\underset{\sim}{q} + m\left(\underset{\sim}{r} - \frac{1}{3}\underset{\sim}{q}\right)$ B1

$= \left(\frac{1}{3} - \frac{1}{3}m\right)\underset{\sim}{q} + m\underset{\sim}{r}$

(ii) $\underset{\sim}{OE} = \underset{\sim}{OY} + \underset{\sim}{YE}$

$= \frac{3}{7}\underset{\sim}{r} + n\left(\underset{\sim}{q} - \frac{3}{7}\underset{\sim}{r}\right)$

$= \left(\frac{3}{7} - \frac{3}{7}n\right)\underset{\sim}{r} + n\underset{\sim}{q}$

(c) $\left(\frac{1}{3} - \frac{1}{3}m\right)\underset{\sim}{q} + m\underset{\sim}{r} = \left(\frac{3}{7} - \frac{3}{7}n\right)\underset{\sim}{r} + n\underset{\sim}{q}$

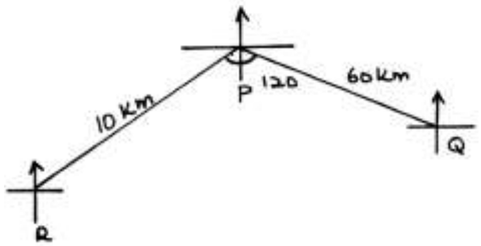
$\frac{1}{3} - \frac{1}{3}m - n$

$\frac{3}{7} - \frac{3}{7}n - m$

$\frac{1}{3} - \frac{1}{3}\left(\frac{3}{7} - \frac{3}{7}n\right) = n$

$\frac{4}{21} = \frac{6}{7}n, \quad n = \frac{2}{9}$

19



$P^2 = 100^2 + 60^2 - 2(100)(60) \cos 120$ M1

$P^2 = 13600 - 12000 \cos 120$ M1

$P^2 = 19600$

P = 140km A1

(b) $\frac{140}{Sin\ 120} = \frac{100}{Sin\ Q}$ M1

$Sin\ Q = \frac{100\ Sin\ 120}{140}$ M1

= 38.2° A1

Bearing 270 – 38.2 = 241.8 B1

(c) Time from P to R $= \frac{60}{20} = 3hrs$

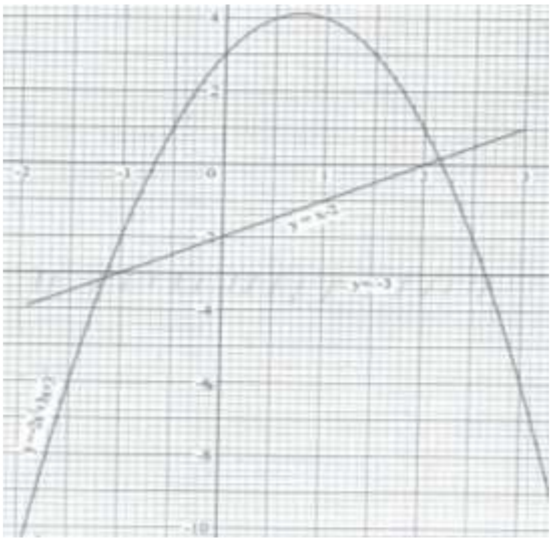
Time from Q to R $= \frac{140}{20} = 7hrs$

From R to P $= \frac{100}{20} = 5hrs$

Taken travelling = 3 + 7 + 5 = 15hrs

20 a

χ	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5
y	**-11**	-6	**-2**	1	**3**	**4**	**4**	**3**	**1**	**-2**	**-6**	-11



c) (i) $-1.15 \leq x \leq 2.65$

-1, 0, 1, 2

(ii) $y = \chi - 2$

$\chi = -1.15$ or $\chi = 2.15$

22

(a) $6 + 14 + 24 + 14 + \chi + 10 + 6 + 4 = 100$ M1

$\chi = 100 - 78$

$\chi = 22$ A1

(b) Modal frequency 24

B1

(c) CF: 6 20 44 58 80 90 96 100 B1for C.F

$$Median\ 44.5 + \frac{6}{14} \times 10$$ M1M1

$= 48.79$ A1

Mid point (χ)	f	$f\chi$
19.5	6	117
29.5	14	413
39.5	24	948
49.5	14	693
59.5	22	1309
69.5	10	695
79.5	6	477
89.5	4	358

Σf 100 $\Sigma f\chi$ 5010

$$Mean\ \frac{\Sigma f\chi}{\Sigma f} = \frac{5010}{100}$$ M1

$= 50.10$

21

(a) (i) Area

$$\frac{26}{360} \times \frac{22}{7} \times 40^2$$ M1

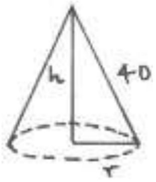
$= 363.17\text{cm}^2$ A1

(ii) Arc length

$$\frac{26}{360} \times \frac{22}{7} \times 80$$ M1

18.159A1

(b) (i)



$2\pi\gamma = 18.159$

$$\frac{22}{7} \times 2r = 18.159$$ M1

$\gamma = 2.889\text{cm}$ A1

(ii) $h^2 = 40^2 - (2.889)^2$ M1

$h = 39.9$ A1

(c) $$\frac{1}{3} \times \frac{22}{7} \times (2.889)^2 \times 39.9$$ M1

$$= \frac{348.876\,cm^3}{1000}$$

$= 0.3489$ litres A1

23

(a)(i) $$\frac{75}{V} - \frac{75}{V + 20} = 1$$ M1 alternative

$V^2 + 20V - 1500 = 0$ forming equation

$(V - 30)(V + 50) = 0$ M1

$V = 30$ $V = -50$ A1

$$\frac{70}{30} - \frac{70}{(30 + 20)} = 4\ hours$$ B1

(ii) $$\frac{750}{4} = 37.5km/h$$ M1A1

(b) (i) $$\frac{7200}{60 \times 60} = 20m/s$$ M1A1

$$15 = \frac{80 + \chi}{20}$$ M1

$300 = 80 + \chi$

$300 - 80 = \chi$

$= 220$ metres A1

24

(a) (i) $a = 5 - 2t$

$$V = \int (5 - 2t)dt = 5t - t^2 + C$$

$V = 5(0) + (0)^2 + C = 2$ M1

$t = 0$ $C = 2$

$V = 5t - t^2 + 2$ A1

(ii) $t = 2$

$V = 5(2) - (2)^2 + 2$ M1

$= 8\text{m/s}$ A1

24

b) $a = 5 - 2t = 0$

$t = 2.5$ seconds A1

$$S = \int_0^{2.5} \left(5t - t^2 + 2\right)dt$$

$$= \left[\frac{5}{2}t^2 - \frac{t^3}{3} + 2t\right]_0^{2.5}$$ M1

$$\left[\frac{5}{2}(2.5)^2 - \left(\frac{2.5}{3}\right)^3 + 2(2.5) - \frac{5}{2}(0)^2 - \left(\frac{10}{3}\right)^3 + 2(0)\right]$$

15.42 metres

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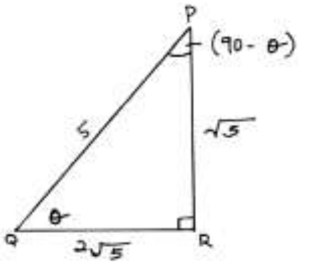
MATHEMATICS ALT A
PAPER 2
JULY/AUGUST, 2015
TIME: 2½ HOURS

1	2(4P + 3B = 17) $\underline{3(5P + 2B = 16)}$ $8P + 6B = 34$ B1formation of equation $\underline{15P + 6B = 48}$ M1✓ attempt to eliminate 1 $-7P = -14$ P = 2 8 + 3B = 17 3B = 9 B = 3 Pen Shs. 2, book = 3 A1
2	$\frac{55\chi + 47y}{\chi + y} = \frac{52}{1}$ 55χ - 52χ = 52y – 47y χ: y = 5:3 $\frac{5}{\cancel{8}} \times \cancel{24}^3$ $\frac{3}{\cancel{8}} \times \cancel{24}^3$ M1 15kgs and 9kgs
3	$Log_2(\chi^2 - 9) = Log_2(8 \times 2)$ $\chi^2 - 9 = 16$ M1 $\chi^2 = 25$ M1 χ = ± 5 A1
4	$45{,}000 = 24{,}000\left(1 + \frac{\gamma}{100} \times \frac{1}{2}\right)^8$ M1 $1.875 = \left(1 + \frac{r}{200}\right)^8$ $0.08175 = \frac{\gamma}{200}$ M1 γ = 16.35% A1
5	$4\chi^2 + 32\chi - 20 + K = (2\chi + c)^2$ $4\chi^2 + 32\chi - 20 + K = 4\chi^2 + 4\chi c + c^2$ M1 4c = 32 c = 8 A1 -20 + K = 64 K = 84 B1
6	$\det\ (A.S.F) = \frac{13}{6.5} = 2$ B1 χ (χ - 4) – 30 = 2 M1 $\chi^2 + 4\chi - 32 = 0$ χ(χ + 8) – 4(χ + 8) = 0 χ = 4 χ = -8
7	 $PR^2 = 5^2 - (2\sqrt{5})^2$ PR = $\sqrt{5}$ B1 $Tan\,(90 - \theta) = \frac{2\sqrt{5}}{\sqrt{5}}$ M1 = 2 A1
8	$Centre\ \left(\frac{-4+2}{2}, \frac{1+1}{2}\right) = (-1,1)$ B1 $Radius = \sqrt{0^2 + 6^2} = \frac{6}{2}$ B1radius $(\chi + 1)^2 + (y - 1)^2 = 3$ M1 $\chi^2 + 2\chi + 1 + y^2 = 2y + 1 = 9$ $\chi^2 + y^2 + 2\chi - 2y = 7$ A1
9	$\left(1 + \frac{\chi}{4}\right)^5 = 1 + \frac{5}{4}\chi + \frac{5}{8}\chi^2 + \frac{5}{16}\chi^3 + \frac{5}{256}\chi^4$ B1 $(1 - 0.05)^5 = \frac{\chi}{4} = 0.05 = -0.2$ $(0.95)^3 = 1 + \frac{5}{4}(-0.2) + \frac{5}{8}(-0.2)^2 +$ M1 $\frac{5}{16}(-0.2)^3 + \frac{5}{256}(-0.2)^4$ 1 – 0.25 + 0.025 + ---- = 0.7738 A1
10	$A = a + K\sqrt{B}$ - 27 = a + ½K $\underline{18 = a + 5K}$ M1 $9 = -4.5K$ K = -2 27 = a - ½(-2) a = 28 Law A = 28 – 2K A1 $= 28 - 2 \times \sqrt{\frac{49}{4}}$ = 28 = 21 B1
11	$\frac{dy}{d\chi} = 5\chi^2 + 1$ $y = \frac{5\chi^3}{3} + \chi + C$ $-3 = \frac{5}{3}(3)^3 + 3 + C$ C = -51 $y = \frac{5\chi^3}{3} + \chi - 51$
12	In 1 hour $A \rightarrow \frac{1}{3}$ $B \rightarrow \frac{1}{6}$ $C \rightarrow \frac{1}{8}$ AH $\left(\frac{1}{3} + \frac{1}{6} - \frac{1}{8}\right) = \frac{3}{8}$ $\frac{8}{3} = 2\frac{2}{3}\ hours$

13

$$\frac{(2\chi + \gamma)^2}{4} = (\chi + \gamma)^2$$ M1

$$4\chi + 4\chi\gamma + \gamma^2 = 4\chi^2 + 8\chi\gamma + 4\gamma^2$$ M1

$$4\chi\gamma = 3\gamma^2$$

$$\chi = \frac{-3\gamma}{4}$$ A1

14

a + 15d = 7a + 49d

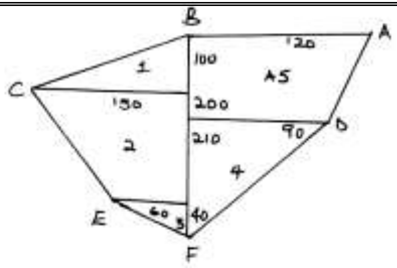
34d + 6a = 0 ----- (i) B1

$$S_{10} = \frac{10}{2}(2a + (10-1)d = -35,\ 2a + 9d = -7$$ B 1

6a + 34d = 0 - M1

$$\frac{6a + 34d = -21}{7d = 21}$$ d = 3 a = -17

15



Area 1 = ½ x 150 x 100 = 7500

$$A2 = \frac{150 + 60}{2} \times 410$$ = 43050 M1

A3 = ½ x 60 x $\cancel{4}^{2}0$ = 1200

A4 = ½ x 90 x 250 = 11250 M1

$$A5 = \frac{90 + 120}{2} \times 300$$ = 31500

94500m^2 A1

16

$$\frac{1}{1+\sqrt{2}} - \frac{3}{1-\sqrt{2}} = \frac{1(1-\sqrt{2}) - 3(1+\sqrt{2})}{(1+\sqrt{2})(1-\sqrt{2})}$$ M1

$$\frac{1 - \sqrt{2} - 3 - 3\sqrt{2}}{1 - 2}$$

$$\frac{-2 - 4\sqrt{2}}{-1}$$

$$= 2 + 4\sqrt{2}$$

A1

P = 2 Q = 4 R = 2

17

(a) Taxable income $\frac{18600 \times 1.15}{120} \times 12$

K£ 12834

(b) 1st

$$\left.\begin{array}{l} 2800 \times 3 = 8400 \\ 1800 \times 5 = 9000 \end{array}\right\}$$

$$\left.\begin{array}{l} 2600 \times 6 = 15600 \\ 1800 \times 7 = 12600 \end{array}\right\}$$

$$\left.\begin{array}{l} 2800 \times 9 = 25200 \\ 1034 \times 10 = \underline{10340} \end{array}\right\}$$

Total tax $\underline{81140}$

$$Tax\ per\ month\ \frac{81140}{12} = 6762$$

Net tax = 18600 – (6762 + 250)

= 12088

19

(a)∠DGB = 78° Alternate segment B1B1

(b)∠DOB = (78 x 2) = 156°∠ subtended at the centre B1B1

(c)∠GDB = (90 – 36) = 54° ∠ chord and tangent B1B1

(d)∠DCB = 180 – (2 x 78) = 24°∠ in a triangle B1B1

(e)∠DFB = 180 – 78 = 102°∠ opp. angle in cyclic quadrilateral B1B1

20

(a)Longitude difference θ = 20 + 80= 100° B1

(b)(i) $D = \frac{100}{360} \times 2\Pi \times 6370$ Cos 30 M1M1

= 9628.25km A1

(ii) D = θ x 60 Cos α

= 100 x 60 Cos 30 M1

= 5196.15 A1

(c) θ = 20 + 60

= 80° B1

15° → 1 hour

$$\frac{80}{15} = 5\frac{1}{3}\ hours$$ M1

= 5 hours 20 minutes A1

1.45

<u>5.20</u>

7.05pm B1

21

(a) Length AB ⇒ $Cos\ 26 = \frac{y}{10}$ M1

y = 8.988

$$Cos\ 48.6 = \frac{\chi}{4}$$

χ = 2.643 M1

AB = 8.988 + 2.643

= 11.633cm A1

(b) Area of sector APQ

$$\frac{52}{360} \times 3.142 \times 10^2$$ M1

45.38cm^2 A1

(c) Area PAQ + PBQ

Area of PAQ = ½ Sin 52 x 10^2 M1

= 39.4cm^2

PBQ = ½ Sin 97.2 x 4^2 M1

= 7.937

Area 39.4 + 7.937

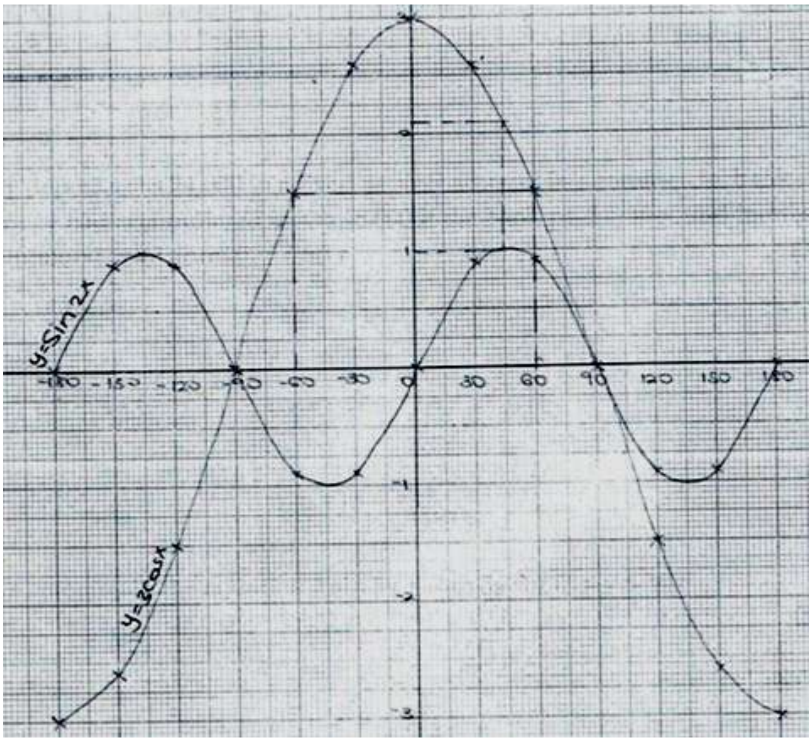
= 47.34 A1

(d) $$(45.38 - 39.4) + \left(\frac{97.2}{360} \times 3.142 \times 4^2 - 7.937\right)$$ M1

5.98 + 5.636 = 11.616cm^2 A1

18

χº	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180	
Sin 2χ	0	**0.87**	**0.87**	0	-0.87	**-0.87**	**0**	0.87	**0.87**	**0**	-0.87	-0.87	**0**	B1
3 Cos χ	**-3.00**	-2.60	**-1.50**	0	**1.50**	-2.60	**3.00**	**2.60**	**1.50**	**0**	**-1.50**	**-2.60**	**-3.00**	B1

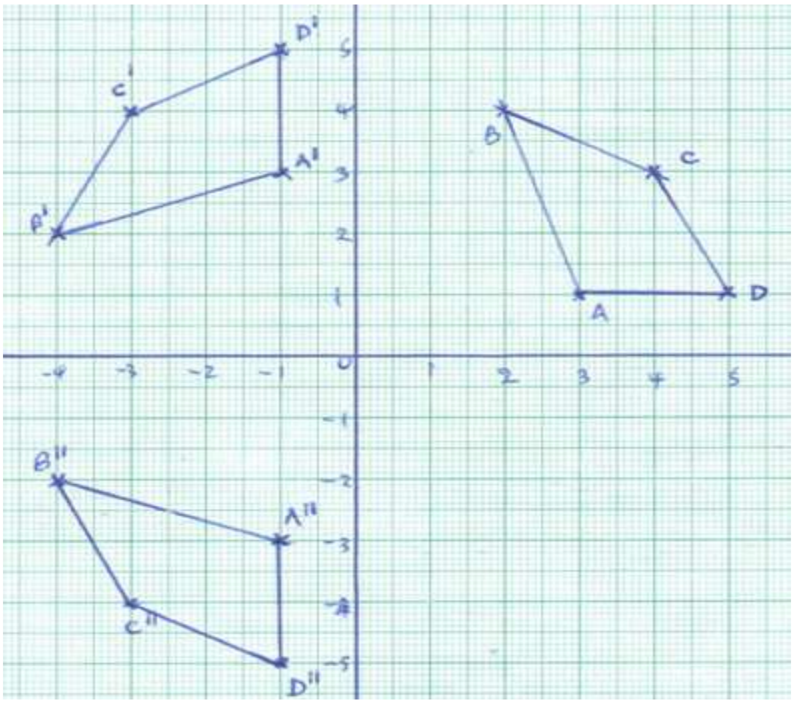


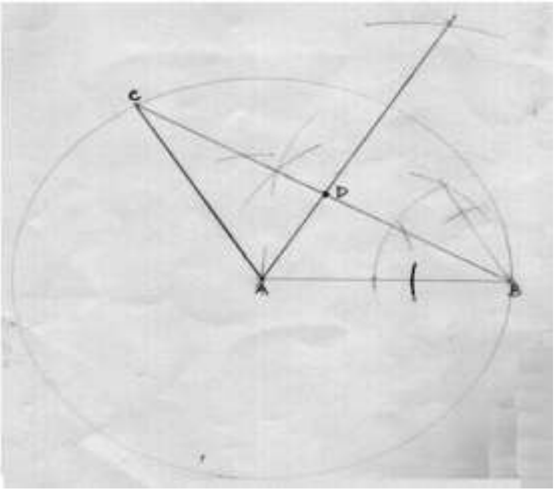
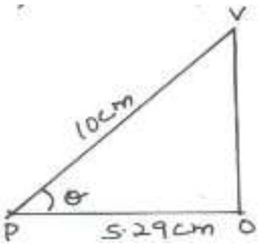
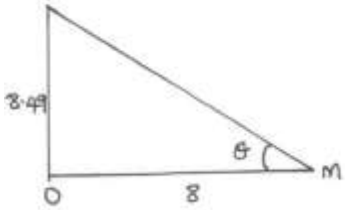
(i) -90° or 90° B1

(ii) 2.1 ± 1 = 1.1 ± 0.1 B1

(iii) -60°< χ< 60° B1

22



	$\begin{pmatrix}0&-1\\1&0\end{pmatrix}\begin{pmatrix}A&B&C&D\\3&2&4&5\\1&3&3&1\end{pmatrix}\begin{pmatrix}A^1&B^1&C^1&D^1\\-1&-4&-3&-1\\3&2&4&5\end{pmatrix}$ $\begin{pmatrix}0&0\\1&-1\end{pmatrix}\begin{pmatrix}A^1&B^1&C^1&D^1\\-1&-4&-3&-1\\3&2&4&5\end{pmatrix}\begin{pmatrix}A^{11}&B^{11}&C^{11}&D^{11}\\-1&-4&-3&-1\\-3&-2&-4&-5\end{pmatrix}$ Matrix $\rightarrow \begin{pmatrix}0&0\\1&-1\end{pmatrix}\begin{pmatrix}0&0\\1&-1\end{pmatrix}\rightarrow\begin{pmatrix}0&1\\1&0\end{pmatrix}$ Reflection along y = χ	B1 for ABCD B1 pr B1 coordinates of $A^1B^1C^1D^1$ B1 $A^1B^1C^1D^1$ drawn B1 for multiplication B1 coordinates $A^{11}B^{11}C^{11}D^{11}$ B1 image drawn M1 multiplication A1 single matrix B1 ✓ describing 10	
23	 Area = ½ x 9.2 x 2.8 = 12.88cm²		
24	(a) $PR^2 = 16^2 - 12^2$	M1	
	$PR^2 = 256 - 144$	M1	
	PR = 10.58cm	A1	
	(b)  $Cos\ \theta = \frac{29}{10}$	B1 M1 A1	✓ for identification
	θ = 58.05°		
	(c) 		
	$VO^2 = 10^2 - 5.29^2$	B1	✓ angle identification
	VO = 8.49	B1	
	$Tan\ \theta = \frac{8.49}{8}$	M1	
	θ = 46.69°	A1	

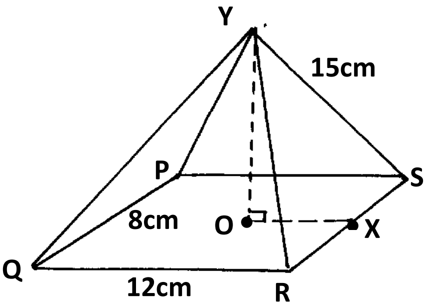
MOKASA JOINT EVALUATION EXAMINATION
121/1
MATHEMATICS
Paper 1
March, 2015
2½ Hours
Kenya Certificate of Secondary Education

Paper1 section 1(50marks)

1. Points S(-2,2) and T(-3,7) are mapped onto S^1(4,-10) and T^1(0,10) by an enlargement . Calculate the enlargement scale factor. (3marks)
2. Given that $\frac{1}{2x} = (0.732)^3 + \sqrt[3]{85.3}$, use mathematical tables to find the value of x in standard form correct to 3 significant figures (3marks)
3. Simplify $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (3 marks)
4. All prime numbers less than ten are arranged in ascending order to form a number.
   (a) Write down the number formed (1 mark)
   (b) Express the number in (a) above in expanded form (2 marks)
5. A two digit number is such that the one's digit is four more than the tens digit, and the sum of the digits is 14. Find the number (3 marks)
6 Paul bought a refrigerator on hire purchase by paying monthly instalments of Ksh. 2000 per month for 40 months and a deposit of Ksh. 12,000. If this amounted to an increase of 25% of the original cost of the refrigerator, what was the cash price of the refrigerator? (3 marks)
7. Find all the integral values of x which satisfy the inequality (3 marks)
   $3\ (1 + x) < 5x - 11 < x + 45$
8. Without using calculator, evaluate
   $\left(\frac{7}{3}\left[\frac{2}{5} of 1\frac{2}{3} - \frac{1}{2}\left(\frac{1\frac{2}{3}-2\frac{1}{2}}{\frac{1}{3}-\frac{19}{27}}\right)^{\frac{1}{2}} + \frac{2}{3}\right]\right)^{\frac{1}{2}}$ leaving the answer as a mixed fraction. (4 marks)
9. During a certain month, the exchange rates in a bank were as follows;

	Buying (Ksh.)	Selling (Ksh.)
1 US $	91.65	91.80
1 Euro	103.75	103.93

   A tourist left Kenya to the United States with Ksh.1 000,000.On the air port he exchanged all the money to dollars and spent 190 dollars on air ticket. While in US he spent 4500 dollars for upkeep and proceeded to Europe. While in Europe he spent a total of 2000 Euros. How many Euros did he remain with? (3marks)
10. A school decided to make a beautiful picnic site to be used by students and teachers as a resting point. The site was designed to be triangular in shape measuring 40 metres, 60 metres and 80 metres. Calculate the area of the picnic site. (Answer correct to 1 d.p) (3 marks)
11 A regular *n*-sided polygon has its interior angle equal to 4 times its exterior. Find *n.* (3 marks)
12. The ratio of the lengths of the corresponding sides of two similar rectangular petrol tanks is 3:5.The volume of the smaller tank is 8:1m^3.Calculate the volume of the larger tank. (3 marks)
13. ABCD is a rhombus. A is the point (2, 1) and C is the point (4, 7). Find the equation of the diagonal BD in the form ax + by = c. (3marks)
14. A man walks directly from point A towards the foot of a tall building 240m away. After covering 180m, he observes that the angle of elevation of the top of the building is 45^0.Determine the angle of elevation of the top of the building from A. (3 marks)
15. The G.C.D. and L.C.M. of three numbers are 3 and 1008 respectively. If two of the numbers are 48 and 72, find the least possible value of the third number. (3 marks)
16. An ant moved from Y to X the midpoint of RS through P in the right pyramid below



Draw the net of the pyramid showing the path of the ant hence find the distance it moved. (4marks)

SECTION II (50 marks)

ANSWER ANY FIVE

17. Three warships A,B and C are at sea such that ship B is 500km on a bearing N30E from ship A. Ship C is 700km from ship B on a bearing of 120°.An enemy ship D is sighted 800km due south of ship B.

a) Taking a scale of 1cm to represent 100km, locate the positions of ships A, B, C and D. (4 marks)

b) Find the bearing of:
  - i) Ship A from D (1 mark)
  - ii) Ship D from C (1 mark)

c) Use scale drawing to determine the distance between
  - i) D and A (1 mark)
  - ii) C and D. (1 mark)

d) Measure angle DAC and angle BCD (2 marks)

18. a) A rectangular tank of base 2.4m by 2.8m and a height of 3m contains 3600litres of water initially. Water flows into the tank at the rate of 0.5litres per second. Calculate:
  - i) The amount needed to fill the tank (2marks)
  - ii) The time in hours and minutes required to fill (3marks)

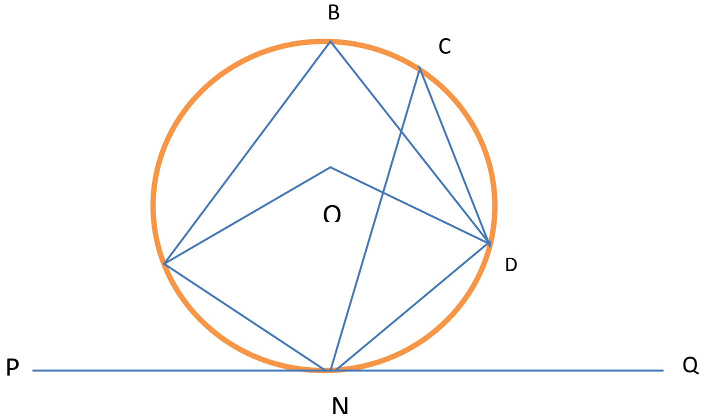
b). Pipe A can fill an empty tank in 3hours while pipe B can fill the same tank in 6hours .When the tank is full, it can be emptied by pipe C in 8hours .Pipes A and B are opened at the same time when the tank is empty .If one hour later pipe C is also opened, find the total time taken to fill the tank. (5marks)

19. A solid is made up of a conical frustum and a hemispherical top. The slant height of the frustum is 8cm and its base radius is 4.2cm.If the radius of the hemispherical top is 3.5cm

a) Find the area of:
  - i) the circular base. (2 marks)
  - ii) the curved surface of the frustum (3 marks)
  - iii) the hemispherical surface (3marks)

b) A similar solid has a total surface area of 81.51cm².Determine the radius of its base. (2marks)

19. In the figure below, O is the center of the circle. PQ is a tangent to the circle at N. Angle NCD is 10° and angle ANP is 30°



Giving reasons find;

a) Angle DON (2marks)

b) Angle DNQ (2marks)

c) Angle DBA (2marks)

d) Angle ONA (2marks)

e) Angle ODN. (2marks)

20. Two quantities P and Q are connected by the equation P= **KQ**ⁿ. The table below gives the values of P and Q

P	1.2	1.5	2.0	205	3.5	4.5
Q	1.58	2.25	3.39	4.74	7.86	11.5

a) State the linear equation connecting P and Q (1 mark)

b) Using a scale of 1cm to represent0.1 units in both axes, draw a suitable straight line graph on the grid provided (5 marks)

c) Use your graph in b) above to determine the approximate values of **K** and **n.** (2 marks)

d) From the graph, find the value of Q when P=3 (2 marks)

22. The displacement h metres of a particle moving along a straight line after t seconds is given by h=-2t³+$\frac{3}{2}$t² + 3t.
  - a) Find its initial acceleration (3 marks)
  - b) Calculate;
  - i) The time when the object was momentarily at rest (3 marks)

ii) Its displacement by the time it comes to rest (2 marks)

c) Calculate the maximum speed attained (2 marks)

23. a) Complete the table below for graphs of y=sinx and y=2sin(x+30) (2 marks)

x	o	30	60	90	120	150	180	210	240	270	300	330	360
sin x	0		0.87			0.5			-0.87			-0.5	
2sin (x+30)	1	0.5		1.74		0	-1				-1		

b) Using a suitable scale on the grid below draw the graphs of y = sin x and y = 2sin (x +30) for $0 \leq x \geq 360^0$ (4 marks)

c) State the transformations that would map y= sinx onto y=2sin(x+30). (2 mark)

d) Find the values of x which satisfy the equation sin x – 2sin (x +30) =0. (2 marks)

24. A trailer moving at a speed of 80km/h is being overtaken by a car moving at 100km/h in a clear section of a road. Given that the bus is 21m long and the car is 4m long.

a) How much time (in seconds) will elapse before the car can completely overtake the bus? (3 marks)

b) How much distances (in metres) will the car travel before it can completely overtake the bus? (2 marks)

c) Given that as soon as the car completed overtaking the trailer, a bus heading towards the trailer and the car and moving at a speed of 90km/h became visible to the car driver. It took exactly 18 seconds for the car and the bus to completely by pass each other from the moment they first saw each other.

i. How far was the tail of the bus from the tail of the car at the instance they first saw each other given that the bus is 12 metres long? (3 marks)

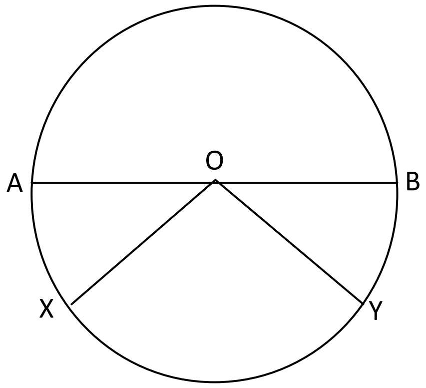
ii. How far a part was the trailer and the bus just immediately after the car and the bus had passed each other? (2 marks)

MOKASA JOINT EXAMINATIONS
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
MARCH/APRIL 2015
TIME: 2 ½ HOURS

SECTION A- 50 MARKS

1. The cost of maize flour and millet flour is Ksh.40 and Khs.52 respectively. Calculate the ratio in which they were mixed if a profit of 15% was made by selling the mixture at Ksh.52.90 per kilogram. (3marks)
2. In the figure below XY= 8cm and O is the centre of the circle



Determine the area of the circle if angle AOX=15^0 (3marks)

3. **OA=3i+4j-6k** and **OB=2i+3j+k** are two position vectors. P divides a line AB in the ratio 3:-2. Write down the coordinates of P. (3marks)
4. The table below show tax rates on a certain year

Income (K£ p.a)	Rate (Ksh.per £)
1 – 4200	2
4201 -8000	3
8001 – 12600	4
12601 and above	5

Rose earns a basic salary of ksh. 20,000 per month, she is given allowances amounting to ksh.5000.She is housed by her employer therefore pays a nominal rent of sh. 700 per month and is entitled to a personal relief of Ksh. 1200 per month. Calculate;

i) Her taxable income in Kenya pounds per year. (2marks)
ii) Her gross tax per month. (2marks)

5. Rationalize the denominator and simplify (3marks)

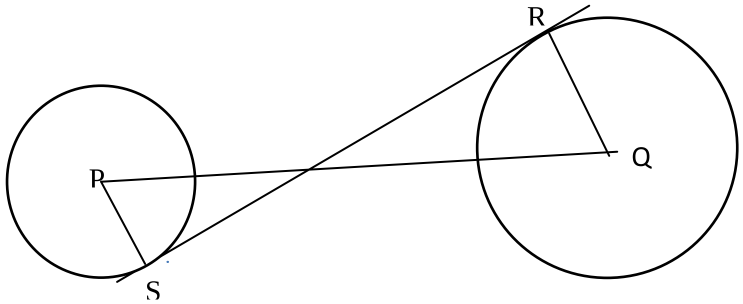
$$\frac{\sqrt{3}}{\tan 60 - 1}$$

6. Solve for x in (3marks)

$$3\log_3 x + 4 = \log_3 24$$

7. The transformation represented by the matrix $\begin{bmatrix} x-1 & x \\ 1 & 2x \end{bmatrix}$ maps a triangle whose vertices are A (-1, 2), B (4, 1) and C (1,-4) onto a straight line. Find the possible values of x. (3marks).
8. Expand $(2 + \frac{1}{4}x)^6$, hence find the value of $(2.025)^6$ rounded off to 3 decimal places. (4marks)
9. The resistance to the motion of a car is partly constant and partly varies as the square of the speed. At 40km/h^{-1} the resistance is 530 and at 60kmh^{-1} it is 730N. What will be the resistance at 70kmh^{-1} (4marks)
10. By completing the square, solve for x in the equation $2x^2 - 6 = x$. (3marks)
11. A die has two of its faces numbered 3.Calculate the probability of obtaining a 1or a 3 on a single cast. (3marks)
12. Solve the equation $4cos(3x - 10)^0 = -3.0640 \ for \ 0^0 \leq x \leq 180^0$ (3marks)
13. The top of a table is regular pentagon. Each side of the pentagon measures 40.0cm. Find the maximum percentage error in calculating the perimeter of the top of the table. (3marks)
14. The points P(8,4) and Q(2,2) are the ends of a diameter of a circle. Find the equation of the circle. (3marks)

15. In the diagram below, PQ = 10cm,and the radius of the circle centers P and Q are 2cm and 4cm respectively, calculate the length of the transverse common tangent SR. (3marks)

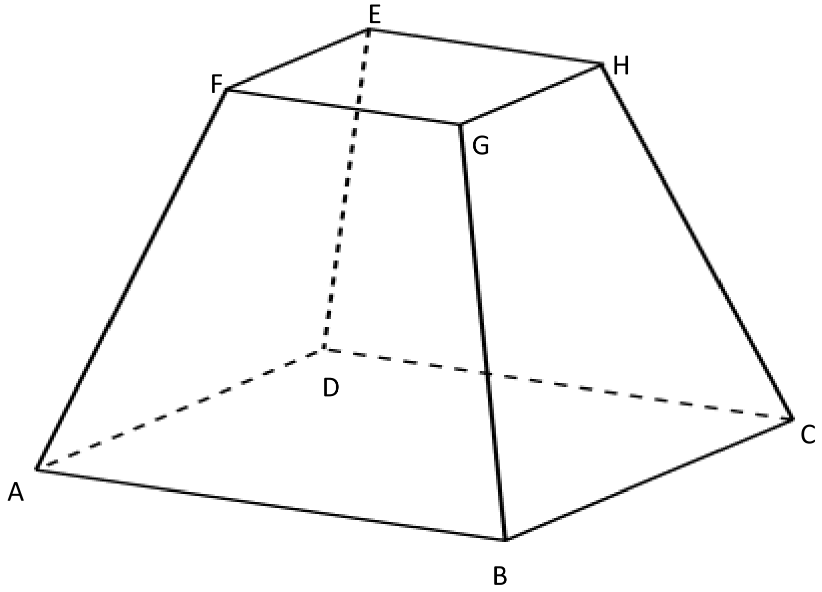


16. Line $y=\frac{3}{5}x$ is parallel to diameter LM of circle $x^2+y^2+6x-8y=0$. Find the equation of the tangent to the circle at L.

(4marks)

SECTION B 50 MARKS

17. The figure below shows a frustum ABCDEFGH of a right pyramid such that AB=9cm,BC=12cm,FG=6cm,GH=8cm and the height of the frustum is 10cm.



Find the
- a) Height of the pyramid (2marks)
- b) Length of
- i) AC (2marks)
- ii) AH (2marks)
- c) Calculate the angle between:
- i) Line AH and the plane ABCD (2marks)
- ii) The planes ABHE and ABCD (2marks)

18. A and B are two points on the latitude 40^0N. The two points lie on the longitudes 20^0 W and100^0 E respectively.
- a) Calculate:
- i) The distance from A to B along a parallel of latitude. (3marks
- ii) The shortest distance from A to B along a great circle. (4marks)
- (a) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along parallel latitude, which one arrived earlier and by how long. Give your answer to the nearest minute (Take R = 6370 km and $\pi = {}^{22}/_{7}$). (3marks)

19.The following table shows the distribution of marks obtained by 50 students.

Marks	45-49	50-54	55-59	60-64	65-69	70-74	75-79
No of Students	3	9	13	15	5	4	1

a) By using an assumed mean of 62, calculate:
- (i) The mean (5marks)
- b) The variance (3marks)
- c) The standard deviation (2marks)

20. Matrix **S** represents a reflection on line y = x, matrix **T** represents a rotation through positive 90^0 centre (0,0).A triangle whose vertices are A(-2,0), B(1,-2) and C(0,1) is subjected to these transformations, such that :the triangle $A^IB^IC^I$ is the image of ABC under transformation matrix **S** and that $A^{II}B^{II}C^{II}$ is the image of $A^IB^IC^I$ under transformation matrix **T**.

a) Plot the three triangles on the grid provided below. (4marks)

b) Find a single matrix that will map $A^{II}B^{II}C^{II}$ onto ABC. (3marks)

c) Describe the matrix in b) above. (1mark)

d) If triangle ABC is sheared, shear factor 2 with the y-axis invariant, find the coordinates of the image. (2marks)

21. Sigei's Flower Achievers Company has 36 hectares of land. The company decides to prepare the land for planting wheat and maize. The labour cost of planting maize is Ksh. 300 per hectare while it costs Ksh 900 to plant a hectare of wheat. Maize takes 3 labourers per hectare while wheat takes 6 labourers per hectare. Atleast 72 labourers are to be hired and Ksh. 15,000 is to be spent for labour costs. The company hopes to make a profit of Ksh 2,000 per hectare of maize and Ksh 4,500 per hectare of wheat. *let the number of hectares for maize be* x

let the number of hectares for wheat be y

(a) Write down inequalities representing the above information (3marks)

(b) On the grid provided, draw the inequalities by shading unwanted regions (4marks)

c) Use the graph to:

(i) determine the number of hectares of maize and wheat that should be prepared in order for the company to maximize profit (2marks)

(ii) Calculate the maximum profit (1mark)

22. a) Using a ruler and a pair of compasses only, construct parallelogram ABCD in which AB=7cm, BC=5cm and angle CBA=45°. (4marks)

b) From a point T, 3cm from D on DC, construct the locus of a point Q, 3.5cm from T to intersect AD and DC at V and W respectively. Measure angle VTW. (4marks)

c) Find the area of the minor sector TVW in cm^2 (2marks)

23. The thirteenth term of an arithmetic progression is 27.Given that the seventh term equals to three times the second term, find

a) The first term and the common difference of the progression. (4marks)

b) The sum of the first three even numbered terms of the progression. (3marks)

c) It's given that (b- $\frac{9}{4}$),b and (b+3.375) are the 2nd,3rdand 4thterms of a geometric progression. Determine the value of b. (3marks)

24. The equation of a curve is given by $y = 11x - x^2$

(a) Determine coordinates of the stationary point. (3marks)

(b) By integration, determine the actual area bounded by the curve $y = 11x - x^2$ and the line $y = 2x$ (4marks)

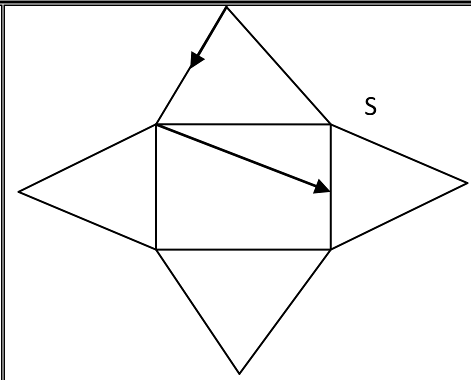
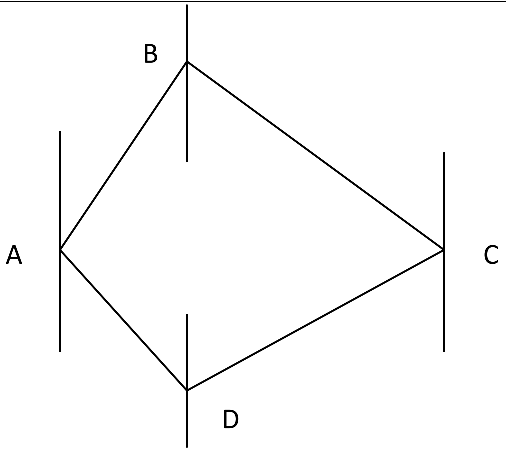
(c) Find the equation of the normal to the curve at $x = 2$ (3marks)

MOKASA JOINT EVALUATION EXAMINATION
121/1
MATHEMATICS
Paper 1
2½ Hours
Kenya Certificate of Secondary Education

Paper1 **section 1**(50marks)

1.	$\sqrt{\ }\ (4^2+-20^2) \div \sqrt{\ }\ (-1^2+5^2)$ $=\sqrt{\frac{416}{26}}$ =4	M1 M1 A1
2	$(7.32X10^{-1})^3=392.2x10^{-3}$ =.3922+4.402 $=\frac{1}{2x}$ =4.7942 2x =.2086 X =.104	M1 M1 A1
3.	$\frac{(3x-2a)(4x+3a)}{(3x+2a)(3x-2a)}$ $=\frac{4x+3a}{3x+2a}$	M2 A1
4.	a) 2357 A1 b) 2000+300+50+7 M1A1	
5.	y-x=4 Y+x=14 Y=4+x 4+x+x=14 2x=10 thus x=5 and y=9 =59	M1 M1 A1
6.	$2000\times 40=80{,}000+1200=92000$ $\frac{100}{125}\times 92{,}000 = Ksh.73{,}600$	
7	3 (1 + x) < 5x – 11 < x + 45 3 (1 + x) < - 11 < x + 45 =2x < -14 M1 3 + 3x < 5x – 11 =x > 7 5x – 11 < x + 45 =4x < 56 M1 x < 14 7 <x < 14 (8, 9, 10, 11, 12, 13)	
8	$\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(-\frac{5}{6}\div-\frac{10}{27}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ M1 $\left(\frac{7}{3}\left[\frac{2}{3}-\frac{1}{2}\left(\frac{9}{4}\right)^{\frac{1}{2}}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ M1 $\left(\frac{7}{3}\left[\frac{2}{3}-\frac{3}{4}+\frac{2}{3}\right]\right)^{\frac{1}{2}}$ $\left(\frac{7}{3}\left[\frac{4}{3}-\frac{3}{4}\right]\right)^{\frac{1}{2}}$ M1 $\left(\frac{49}{36}\right)^{\frac{1}{2}}$ $\frac{7}{6}=1\frac{1}{6}$	M1 M1 M1 A1

9	$\frac{1000000}{91.80}=10{,}893.25$ $10{,}893.25-(190+4500)=6203.25$ $6203.25\times 91.65=568{,}278.86$ $\frac{568{,}527.86}{103.93}=5{,}470.30$ $5470.30-2000=3{,}470.30$	
10	$s=\frac{40+60+80}{2}=90$ $area=\sqrt{90(90-40)(90-60)(90-80)}$ $area=\sqrt{1350000}$ $area=1{,}161.9m^2$	
11	$4x+x=180$ M1 $x=36$ $\frac{360}{36}=n$ M1 $n=10$ sides A1	
12	l.s.f= $\frac{3}{5}$, v.s.f= $\frac{27}{125}$ M1 $\frac{8.1}{v}=\frac{27}{125}$ M1 $V=37.5m^3$ A1	
13	Midpoint=(3,4) M1 Gradient of AC=3 Gradient of perpendicular line= $\frac{-1}{3}$ M1 $\frac{y-4}{x-3}=\frac{-1}{3}$ 3y+x=5 A1	
14	$\frac{h}{60}$ = tan45,h=60tan45 M1 Tanθ = $\frac{60\tan 45}{240}$ M1 Θ=14.04⁰ A1	
15	$48=2^4x3$ M1 $72=2^3x3^2$ $1008/2^4x3^2=7$ M1 Least no is 7x3=21 A1	

16	 Distance=15+ $\sqrt{(144+16)}$ =27.649cm A1	
17	 Parallel lines passing A and B/1 mk B located/1mk C located/1mk b. i) Ship A from D N35W or 325^0 A1 ii) Ship D from C ,S55W or 235^0 A1 c) i) 441km A1 ii) 755km A1 d) angle DAC=6I^0,angle BCD=67^0 ±2 M2	
18	a)i) capacity of the tank=2.4x2.8x3x1000 =20160L M1 Amount =20160-3600 =16560litres A1 ii) Time taken to fill = $\frac{16560}{0.5}$ M1 $\frac{16560}{0.5x60x60}$ M1 =9hr 12min A1 b) In 1hr,pipe A and B fill $\frac{1}{3}+\frac{1}{6}=\frac{1}{2}$ of the tank M1 in 1hr pipe C empties $\frac{1}{8}$ of the tank M1 the next hour all pipes open ,amount in tank increases by $\frac{1}{2}-\frac{1}{8}=\frac{3}{8}$ M1 time taken to fill the remaining half of the tank is $\frac{1}{2}x\frac{3}{8}=\frac{4}{3}hrs$ M1 total time=1+ $\frac{4}{3}=2hrs20\min s$ A1	

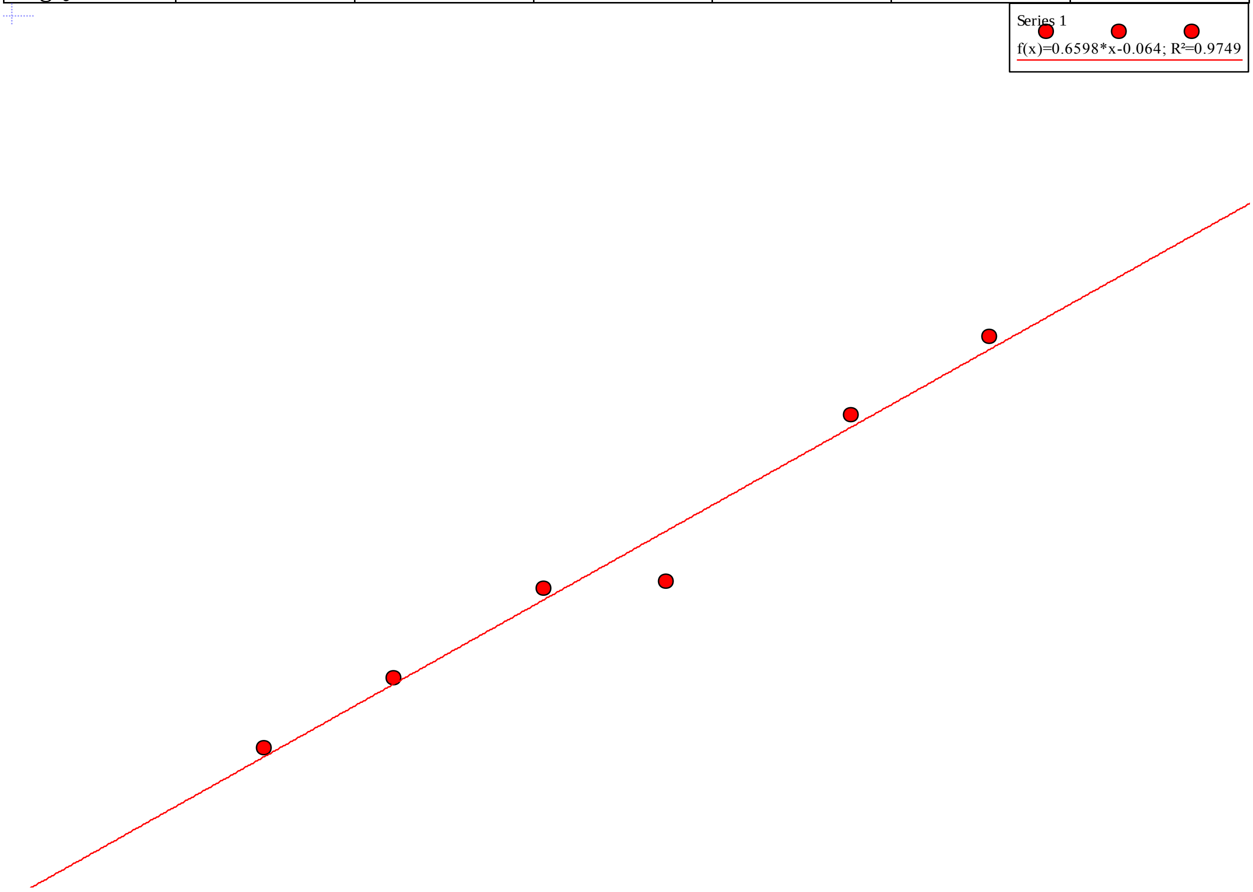
19	19.a)i) πr^2=3.142x4.2^2=55.42cm^2 M1A1 ii) πRL-πrl L=x+8 M1 $\frac{4.2}{3.5}=\frac{8+x}{x}$ M1 X=40: 3.142x4.2x4.8-(3.142x3.5x40) =193.6cm^2 A1 iii) hemisphere=2πr^2=2x3.142x3.5 M1 =77cm^2 A1 b) total area =55.44+193.6+77=326.04 M1 l.s.f^2=a.s.f $\frac{326.04}{81.51}=\sqrt{4}$ M1 $\frac{4.2}{2}=r$ r=2.1cm A1	
20	i) $\langle DON$ =20^0 angle at centre is twice angle at the circumference B1A1 ii) <DNQ=10^0 angle between chord and tangent is equal to angle in the alternate segment subtended by the same chord B1A1 iii)<ONA=60^0 base angles of an isosceles triangle B1A1 iv)<DBA=40^0 angle at the centre <AOD=80^0 is twice angle at the circumference. B1A1 v) <ODN=80^0 base angles of an isosceles triangle. B1A1	
22	$\frac{dh}{dt}$ =v=-6t^2+3t+3, $\frac{dv}{dt}$ =a=-12t+3 at t=0,a=3m/s^2 M1A1 b) i) $\frac{dh}{dt}$ =0, -6t^2+3t+3=0 M1 (2t+1)(t-1)=0,t=- $\frac{1}{2}$ or t=1 thus t=1s M1A1 ii) h =-2t^3+ $\frac{3}{2}$ t^2+3t at t =1,h=-2+ $\frac{3}{2}$ +3 M1 =2.5 m M1A1 c) $\frac{dv}{dt}=a=-12t+3=0$ M1 t=.25s v=-6x0.25^2+3x0.25+3=3.375m/s A1	

21

a)logP=nlogQ+logk

b)

logP	0.0792	0.1761	0.3010	0.3118	0.5441	0.6532
logQ	0.1987	0.3522	0.5302	0.6758	0.8954	1.0607



P1S1L1

c) logk=-0.06 A1

k=0.871.n=gradient=0.3585 MIA1

d) log3=0.4771

logQ=0.8 M1

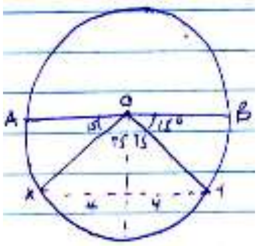
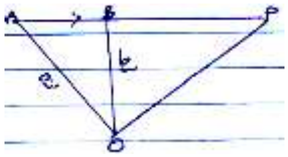
Q=6.31 A1

23

X	0	30	90	120	150	180	210	240	270	300	330	360	
sinx	0	0.5	1	0.87	0.5	0	-0.5	-0.87	-1	-0.87	-0.5	0	
2sin(x+30)	1	1.74	1.74	1	0	-1	-1.74	-2	-1.74	-1	0	1	T2

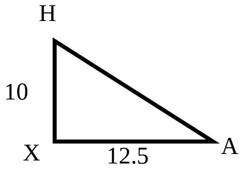
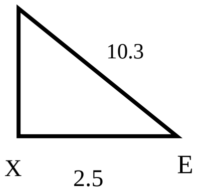
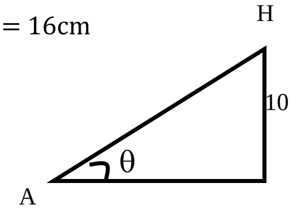
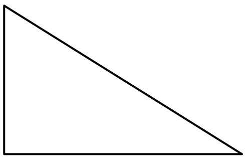
	f(x)=sin(x) f(x)=2sin(x+30) P1C1S1B1 c) translation ($\binom{-30}{0}$) then stretch parallel to y-axis stretch factor 2 B1A1 d) 132^0 and $312^0 \pm 2$ B2		
24	$r.s = 100 - 80 = 20km/h$ $\Rightarrow \frac{20\times1000}{60\times60}$ $\Rightarrow \frac{50}{9} m/s$ $time = \frac{total, dist}{r.s}$ $time = \frac{(4+21)}{50/9}$ $time = 4.5s$	c. i	$rs = 90 + 100 = 190km/h \Rightarrow \frac{190\times1000}{60\times60} = \frac{475}{9} m/s$ $dis\tan ce = rs \times time \Rightarrow \frac{475}{9} \times 18$ $dis\tan ce = rs \times time = 950m$
		c.ii	$= dis\tan ce, trailer \& car - length, bus$ $= \frac{50}{9} \times 18 - 12M1$ $= 88mA1$
b	$dis\tan ce = time, taken, x, carsspped$ $dis\tan ce = 4.5 \times \frac{100\times1000}{60\times60}$ $\Rightarrow 125m$		

MOKASA JOINT EVALUATION EXAMINATION
121/1
MATHEMATICS
Paper 1

1.	B.P $\frac{52.90}{1.15} = 46$ Let maize flour be x millet y $\frac{40x+52y}{x+y} = 46$ 40x + 52y = 46x + 46y $\frac{6y}{6y} = \frac{6x}{6y}$ x:y 1:1	M1 M1 A1
2.	Sin 75 = $\frac{4}{r}$ r = $\frac{4}{Sin\ 75}$ = 4.1411 πr^2 $\frac{22}{7}$ x 4.1411^2 53.8959cm^2  	M1 A1
3.	 OP = $\frac{-2a}{T} + \frac{3b}{T}$ $-2\begin{pmatrix}3\\4\\-6\end{pmatrix} + 3\begin{pmatrix}2\\3\\1\end{pmatrix} = \begin{pmatrix}0\\1\\15\end{pmatrix}$ P(0,1,15)	M1 M1 A1
4	(i) 20,000 + ($\frac{15}{100}$ x 20,000) + 5000 – 700 = 27,300 $\frac{27300}{20}$ x 12 = K£16,3580	M1 A1
	(ii) 4200 x 2 = 8400 3800 x 3 = 11400 4600 x 4 = 18400 3780 x 5 = 18900 57,100 = $\frac{57100}{12}$ = 4,758.33	M1 A1
5.	$\frac{\sqrt{3}}{\tan 60-1}$ $\frac{\sqrt{3}}{\sqrt{3}-1}$ x $\frac{\sqrt{3}+1}{\sqrt{3}+1}$ $\frac{3+\sqrt{3}}{3+\sqrt{3}-\sqrt{3}-1}$ $\frac{3+\sqrt{3}}{2}$ $\frac{3}{2} + \frac{\sqrt{3}}{2}$	B1 B1 B1
6.	3Log$_3$ x + Log$_3$81 = Log$_3$24 x^3 x 81= 24 x^3 = $\frac{24}{81}$ x^3 = $\frac{8}{27}$ x = $\sqrt[3]{\frac{8}{27}}$ = $\frac{2}{3}$	M1 M1 A1

7.	2 x (x – 1) – x = 0 2x^2 – 3x = 0 X(2x – 3) = 0 x = 0 2x = 3 x = $\frac{3}{2}$	M1 M1 A1
8.	1, 6, 15, 20, 15, 61 $-2^6.\left(\frac{1}{4}x\right)^0 + 6.2^5\left(\frac{1}{4}x\right)^1 + 15.2^4\left(\frac{1}{4}x\right)^2 + 20.2^3$ $+15.2^2\left(\frac{1}{4}x\right)^5 + 6.2^1\left(\frac{1}{4}x\right)^2 + 1.2^0\left(\frac{1}{4}x\right)^6$ $-64 + 48x + 15x^2 + \frac{5}{2}x^3 + \frac{15}{64}x^4 + \frac{3x^5}{256} + \frac{x^6}{4096}$ $\frac{1}{4}$x = 0.025 x = 0.1 64 + (48 x 0.1) + (15 x 0.1^2) + $\frac{5}{2}$(0.1^3) + $\frac{15}{64}$(0.1)^4 + $\frac{3}{256}$ x 0.1^5.... 68.95270 68.953	B1 B1 M1 A1
9.	Resistance = r Speed = s r x s^2 + c r = ks^2 + c 530 = 1600k + c 730 = 3600k + c -200 = -2000k k = $\frac{-200}{-2000} = \frac{1}{10}$ c = 530 – $\left(1600\ x\ \frac{1}{10}\right)$ = 370 r = $\frac{1}{10}s^2 + 370$ r = $\frac{1}{10}$ x 70^2 + 370 = 860	M1 M1 M1 A1
10	2x^2 – x – 6 = 0 $\frac{2x^2}{2} - \frac{x}{2} = \frac{6}{2}$ $x^2 - \frac{x}{2} + \frac{1}{16} = 3 + \frac{1}{16}$ x^2 - $\frac{1}{4}$x - $\frac{1}{4}$x + $\frac{1}{16} = \frac{49}{16}$ $\left(x - \frac{1}{4}\right)^2 = \frac{49}{16}$ x = $\pm\sqrt{\frac{49}{16}} + \frac{1}{4}$ = $\pm\frac{7}{4} - \frac{1}{4}$ x_1= 2 x_2 = -1.5	M1 M1 B1
11.	P(1) = $\frac{1}{6}$ P(3) = $\frac{2}{6}$ $\frac{1}{6} + \frac{2}{6} = \frac{3}{6}$ = $\frac{1}{2}$	M1 M1 A1

12	4cos (3x – 10) =- $\frac{3.0605}{4}$ Cos (3x – 10) = -0.4766 3x – 10 = Cos^{-1} (-0.766) 3x – 10 = 140^0 3x – 100 220, 500, 580 3x = 150^0, 230, 510, 590 x = 50^0, 76.67^0, 170^0	 M1 M1 B1
13.	Actual perimeter (40.0 x 5) = 200 Max perimeter (40.05 x 5) = 200.25 Min perimeter (39.95 x 5) = 199.75 A.E = $\frac{Max\ P-Min\ P}{2}$ = $\frac{200.25-199.75}{2}$ = 0.25 % error $\frac{0.25}{200}$ x 100 = 0.125%	 M1 M1 A1
14.	Centre $\left(\frac{8+2}{2},\frac{4+2}{2}\right)$ (5,3) Radius $\binom{8}{4}$- $\binom{5}{3}$ = $\binom{3}{1}$ $\sqrt{3^2+1}$ $\sqrt{10}$ $(x-5)^2+(y-3)^2=\left(\sqrt{10}\right)^2$ (x^2 – 10x + 25) – (y^2-6y+9 = 10 x^2 + y^2 – 10x – 6y + 24 = 0	 M1 M1 B1
15	4 + 2 = 6 10^2 – 6^2 = SR 100 – 36 = SR $\sqrt{64}$ = 8	M1 M1 A1
16	x^2 + 6x + y^2 - 8y = 0 x^2 + 6x + 9 + y^2 – 8y + 16 = 9 + 16 (x+3)^2 + (y – 4)^2 = 25 Centre (-3,4) Radius = 5 Gradient of tangent $\frac{3}{5}$ - m$_2$ = -1 m^2 = - $\frac{5}{3}$ -$\frac{5}{3}$(x,y) (-3,4) $\frac{y-4}{x+3}$ = -$\frac{5}{3}$ y – 4 =- $\frac{5}{3}$-5 y = -$\frac{5}{3}$x - 1	 M1 M1 M1 A1
17.	(a) $\frac{12}{8} = \frac{10+h}{h}$ 80 + 8h = 12h $\frac{80}{4} = \frac{4h}{4}$ h = 20 + 10 = 30	

	(b) (i) AC $\sqrt{9^2+12^2}=\sqrt{225}=15$ (ii) AH FH = $\sqrt{6^2}+8^2\ \frac{\sqrt{5^2+20^2}}{\sqrt{25+400}}$ FH = 10cm = 20.62cm Same height 30^2 + 75^2 HC = 30.92 – 20.62 $\sqrt{900+56.25}$ H = 10.3cm = 30.92cm   AH = 16cm (c) (i)  Sin θ = $\frac{10}{16}$ Sin θ = 0.6250 θ = Sin^{-1}(0.6250) = 38.68^0 (ii) 	
18	(a) $\frac{120}{360}$ = x $\frac{22}{7}$ x 6370 cos 40 = 10,224.139km In nm 60 x 120 cos 40 Alternative = 5,515.51999 (ii) $\frac{100}{360}$ x $\frac{22}{7}$ x 6370 = 5361.1111km Alt. $\frac{5561.111}{1.853}$ = 3001.1393 nm (b) P – 400 knots great circle =3001.1393 Q - 600 knots parallel 5515.51999 Time taken $\frac{3001.1393}{400}$ = 7 hr 30 min $\frac{5515.51999}{600} = 9\ hr\ 11\ min$ P arrived 9 hr 11 min -7 hr 30 min 1 hr 40 min	

19

Class	x	f	t = x – 62	Ft	ft²
40-49	47	3	-15	-45	675
50-54	52	9	10	-90	900
55-59	57	13	-5	-65	325
60-64	62	15	0	0	0
65-69	67	5	5	25	125
70-74	72	4	10	40	400
75-79	77	1	15	15	225

$\Sigma f = 50 \quad \Sigma ft = -120 \quad \Sigma ft^2 = 2650$

(i) The mean

$t = \frac{-120}{50}$

$= -2.4$

$x = -2.4 + 62$

$= 59.6$

(b) Variance

$\frac{2650}{50} - (-2.4)^2$

$53 – 5.76$

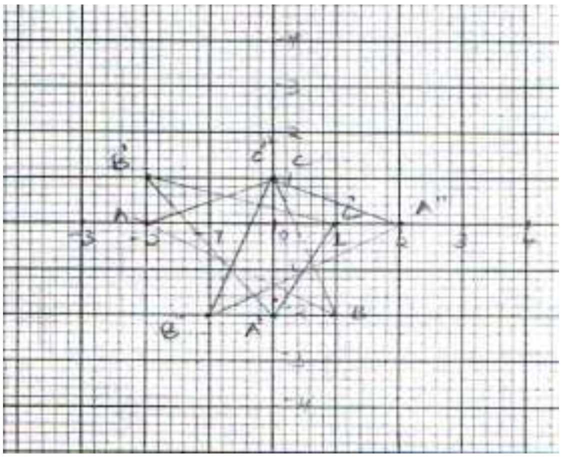
47.24

(c) The standard deviation

$\sqrt{47.24}$

$= 6.8731$

20



$$T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \end{bmatrix} = \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix}$$

$S = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ = A1 (0,-2) B(-2,1) c (1,0)

$A^I\ B^I\ C^I \qquad A^{II}\ B^{II}\ C^{II}$

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -2 & 1 \\ -2 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 2 & -1 & 0 \\ -2 & -2 & 1 \end{bmatrix}$$

$A^{II}(2, 0)\ B^{II}(-1,-2)\ C^{II}(0,1)$

21	a) I) $x + y \leq 36$	B1
	ii) $300x + 900y \leq 15000$	
	$x + 3y \leq 50$	B1
	iii) $3x + 6y \geq 72$	
	$y \geq 0$	
	$x \geq 0$	B1
	b) Graph	
	c) $Objective\ function\ 2000x + 4500y$	
	Search line$20x + 45y = 325$	
	$(29, 7)$	
	$29\ hectares\ of\ maize$	
	$7\ hectares\ of\ wheat$	B1
		B1
	ii) $(29x300) + (900x7) = sh\ 1500$	

22

Line AB

Construction < CBA 45^0

Locating C

Correct parallegram

<VTW=$82^0 \pm 1^o$

$\frac{82}{360} x \frac{22}{7} x 3.5^2 = 8.7694cm^2$

23	(a) a + (n – 1) d a + 12d 2nd a + d 1.5d + 12d 7th a + 6d 13.5d = 27 13th a t 12d d = 2 a + 6d = 3a + 3d a = 1.5 x 2 $\frac{-2a}{-2} = \frac{3d}{-2}$ a = 1.5d (b) a + (n – 1)d A = 3 D = 2 3,5,7,9,11,13,15, 17,19,21,23 None (c) (b - $\frac{9}{4}$)b, (b + 3.375) $\frac{b}{(b-\frac{9}{4})} = = \left(b + \frac{3.375}{b}\right)$ b^2 = (b - $\frac{9}{4}$) (b + $\frac{27}{8}$) b2 = b2 + $\frac{27}{8}$b - $\frac{9}{4}$b - $\frac{243}{32}$ $\frac{9}{8}$ b = $\frac{243}{32}$ b = $\frac{243}{32}$ x $\frac{8}{9}$ = 6.75			$gradient\ of\ normal$ $M1, M2 = -1$ $7xm2 = -1$ $m_2 = -\frac{1}{7}$ Eqn $\frac{y-18}{x-2} = -\frac{1}{7}$ $y - 18 = -\frac{1}{7}x + \frac{2}{7}$ $y = -\frac{1}{7}x + 18\,{}^{2}/_{7}$ $y = -\frac{1}{7}x + \frac{128}{7}$
24	a) $y = 11x - x^2 y = 11(5.5) - (5.5^2)$ $\frac{dy}{dx} = 11 - 2x = 30.25$ $x - 2x = 0(5.5, 30.25)$ $x = 5.5$ b) $11x - x^2 = 2x$ $x^2 + 2x - 11x = 0$ x^2-9x=0 $x(x - 9) = 0$ $x = 9$ $\int_0^9 (11x - x^2) \int_0^9 2x$ $\left[\frac{11x^2}{2} - \frac{x^3}{3}\right]$ -9] 9 0 $(445.5 - 243) - 81 = 121.5 sq. units$ c) $when\ x = 2\ y = (11x2) - 2^2$ $= 18$ (2,18) $gradient\ of\ tangent$ $y = 11x - x^2$ $\frac{dy}{dx} = 11 - 2x$ $at\ x = 2$ $11 - 4 = 7$			

KASSU JOINT EVALUATION TEST (J.E.T)
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
Mathematics
Paper 1
2 ½ Hours
June 2015

1. Evaluate without using tables or calculator. (3 marks)

$$\frac{\frac{1}{4} \text{ of } 2 + 3\frac{3}{4} \div 3/8 - 4\frac{1}{2} \times 3\ 1/3}{2\ 4/5 \times 13/7 - 4 \div 2/3 + 3/5 \text{ of } 15}$$

2. Using tables evaluate. (3marks)
$\frac{1}{34.52} + \sqrt[3]{0.787} + (0.934)^3$
3. A tourist arrived in Kenya with US Dollars 3000 which he exchanged into Kenya shillings. He spent Ksh. 75000 on hotel accommodation and Ksh.42500 on travel and other expenses. He changed the remaining money into sterling pounds. Calculate how much money in sterling pounds that he remained with using the following rates. (Leave your answer to the nearest 1£)

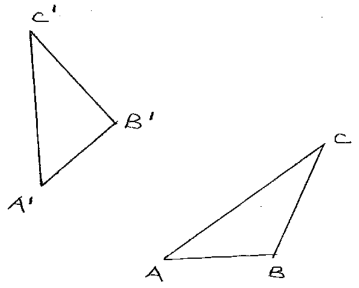
	Buying(Kshs)	Selling(Kshs)
1 US dollar($)	78.45	78.95
1 Sterling pound(£)	120.27	121.04

(3marks)

4. Solve for y in the equation $8^{(2y-1)} \times 32^y = 16^{(y+1)}$. (3marks)
5. Solve the equation: (3marks)

$$\frac{\mathbf{1\,(x+3)+x}}{\mathbf{x\,(x+3)}} = \frac{\mathbf{11}}{\mathbf{28x}}$$

6. Determine the equation of the normal to the curve $y = 3x^2 - 4x + 1$ at the point (2, 5). (3marks)
7. Given that **AB** = $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and **CD** = $\begin{pmatrix} K-1 \\ 15 \end{pmatrix}$ are parallel, find the value of K and hence evaluate |**CD**| (3marks)
8. Make **a** the subject of the formula:
$x = y + \sqrt{x^2 + a^2}$ (3marks)
9. Find the equation of a straight line which is equidistant from the points A (2, 3) and B (6, 1). Express your answer in the form $\frac{x}{a} + \frac{y}{b} = 1$ where a and b are constant. (3marks)
10. The GCD and LCM of three numbers are 3 and 1008 respectively. If two of the numbers are 48 and 72 respectively, find the least possible value of the third number. (3 marks)
11. Kamau salary increased from Ksh 16,800 to 18,00 in the month of April. State the ratio in which it changed. What was the percentage change in his salary? Leave you percentage answer to 4. s. figures. (3marks)
12. If tan X = $^4/_3$, find the value of $\sin^2 X + \cos X$ without using tables or calculator. (3marks)
13. The area of a rhombus is 60cm^2. Given that one of its diagonal is 15cm long. Calculate the perimeter of the rhombus. (3 marks)
14. If x is a positive integer find all the integral values of x given that: (3marks)
$-3 < 2x + 4 < -3x + 9$
15. Solve for x in $\log_3(4 + 3x) + 3\log_3 3 - 2 = \log_3(x + 6)$ (3marks)
16. The figure below shows triangle ABC and its image $A^1B^1C^1$ after the transformation. Describe the transformation fully. (3 marks)



SECTION II

17. Consider points A (50^0N, 30^0E) and B (50^0N, 150^0W) (Take $\pi = {}^{22}/_7$) and radius of the earth R = 6370 km. Find:
    (a) The distance between A and B along a parallel of latitude in:
    (i) Kilometres (km) (3 marks)
    (ii) Nautical miles (nm) (2 marks)
    (b) The shortest distance from A to B in nautical miles. (3 marks)
    (c) An aircraft takes 54 hours to fly between the two towns A and B along the great circle. Calculate its speed in knots correct to 2 significant figures. (2 marks)
18. A curve whose equation is $2y = 6\text{-}12x+9x^2\text{-} 2x^3$ turns at points A and B.
    a) Find the coordinates of a and b (5marks)
    b) Determine the nature of points A and B (3marks)
    c) Sketch the curve (2marks)
19. Income tax is charged on annual income at the rate shown below.

Taxable income K£p.a	Rate Ksh/£.
1-2300	2
2301- 4600	3
4601- 6900	5
6901- 9200	7
9201- 11500	9
11501 and over	10

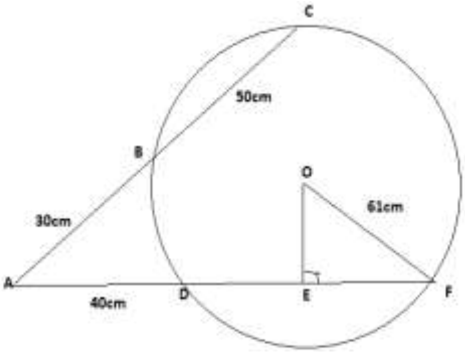
Mr. Kipsoroi earn a basic salary of Ksh.15,000 per month and lives in a company house for which he pays nominal rent of Ksh.1250 per month. He enjoys personal relief of Ksh.1056 per month and insurance relief of Ksh.270 per month. Calculate;
(a) His taxable income in K£.p.a. (3 marks)
(b) The amount of tax he pays per month in Kenya shillings. (5 marks)
(c) His net monthly salary in shillings. (2 marks)

20. The frequency distribution table below shows the marks scored by 117 form four candidates of Sanga High School.

Marks	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79
No. of students	13	14	18	20	23	17	12

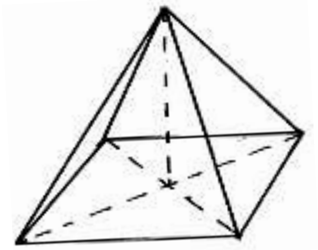
(a) Draw a cumulative frequency curve of the distribution. (5marks)
(b) Use you graph to determine:
(i) The median (2 marks)
(ii) Quartile deviation (3 marks)

21. In the figure below OF is the radius of the circle centre O chords EDC and CB are extend to meet at A and OE is perpendicular to DF at E. OF = 61cm, AB= 30cm, BC = 50cm, AD= 40cm.



a) Calculate the length of
i) DF (2marks)
ii) OE (2marks)
b) Calculate correct to 1dp
i) Size of angle EOF (2marks)
ii) The length of the minor arc DF (3marks)

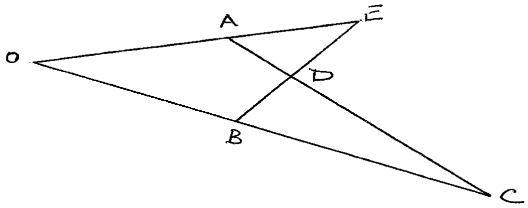
22. ABCDE is a right pyramid on a horizontal square base of side 10 cm. The slant edges are all 8 cm long. Calculate;



(a) The height of the pyramid (3 marks)

(b) The angle between;
(i) A slant face and the base (2 marks)
(ii) A slant edge and the base (2 marks)
(c) The angle between the planes ABE and DCE (3 marks)

23. In the figure below **OE** = **a**, **OB** = **b**, OA: AE = 2: 3
(a) Express AC and BE in terms of **a** and **b**. (2 marks)
(b) **DC** and k**AC** and **BD** = m**BE**. Determine the values of k and m by expressing DC in two ways. (6 marks)
(c) Find the ratio of AD: DC. (2 marks)



24. A theatre has seating capacity of 250 people. The charges are shs. 100 for ordinary seat and shs 160 for special seat. It cost shs 16000 to stage a show and the theatre must make a profit. There are never more than 200 ordinary seats and for a show to take place, at least 50 ordinary seats must be occupied; the number of special seats is always less than twice the number of ordinary seats.
(a) Taking X to be number of ordinary seats and y to be the number of special seats, write down all the inequalities representing the above information (2 marks)
(b) On the grid provided, draw a graph to show the inequalities in (a) above (4marks)
(c) Determine the number of seats of each type that should be booked in order to maximize the profit (2 marks)
(d) Calculate this maximum profit (2marks)

KASSU JOINT EVALUATION TEST (J.E.T)
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
Mathematics
Paper 2
2 ½ Hours
June 2015

SECTION A

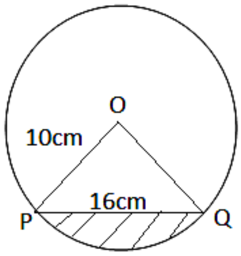
1. Evaluate using logarithm (4 marks)

$$\sqrt{\frac{4.283x(0.009478)^2}{\log 9.814}}$$

2. Calculate the density of the material used to make a concrete culvert of mass 1million grams, internal diameter 0.72m, thickness 70mm and length $2\times10^{-3}km$ (giving the answer in kgm^{-3} and in standard form) (3 marks)

3. Simplify $\frac{3}{\sqrt{5}-2}+\frac{1}{\sqrt{5}}$ leaving the answer in the form $a+b\sqrt{c}$, where a, b and c are rational numbers (3 marks)

4. The figure below shows a circle center O, radius 10 cm. The chord PQ = 16cm. Calculate the area of the unshaded region. (3 marks)



5. Solve the equation $3x^2 + x - 4 = 0$ by the method of completing the square. (3 marks)

6. Two towns A and B are 200m apart. From the top of A, the angle of elevation of the top of B is 15^0. From the top of B, the angle of depression of the bottom of A is 40^0. Find the height of A. (3 marks)

7. The first, the third and the seventh term of an increasing arithmetic progression are three consecutive terms of a geometric progression. If the first term of the arithmetic progression is 10, find the common difference of the arithmetic progression (3 marks)

8. Peter operates a printing firm and the cost of printing a book is partly constant and partly varies as the number as pages. If a book has 200 pages, the cost in sh 400 and if it has 100 pages, the cost is sh 240. Find the cost of printing a book with 400 pages. (3 marks)

9. A and B are two matrices. If A = $\begin{pmatrix}1&2\\4&3\end{pmatrix}$ find B given that
$A^2 = A + B$ (3 marks)

10. Find the constant term in the expansion $\left(3x-\frac{1}{2x}\right)^8$. Hence state it's value (3 marks)

11. Given that x = 31.01, y = 12.9 and w = 0.0023. Calculate the percentage error of $\frac{y}{xw}$, give your answer to 4 dp. (3 marks)

12. Evaluate $\int_{-1}^{3}(2x+3)dx$ (3 marks)

13. A merchant blends 350kg of tea costing Sh. 84 kg with 140kg of tea costing Sh. 105 per kg. At what price must he sell the mixture to gain 25% (3 marks)

14. Solve for x given that;
$3\sin(3x - 20^0) = -2$ for $0^0 \leq x \leq 180^0$ (4 marks)

15. $4x^2- 10x + 4y^2+ 12y-1 = 0$ represents a circle centre C (a, b) and of radius K. Find the values of a, b and K. (3 marks)

16. ABC is an equilateral triangle. P is a variable point on the same side of AB as C, and on the same plane such that angle APB $=60^o$. Use a ruler and a pair of compasses only to construct the locus of P. Describe the locus of P fully. (3 marks)

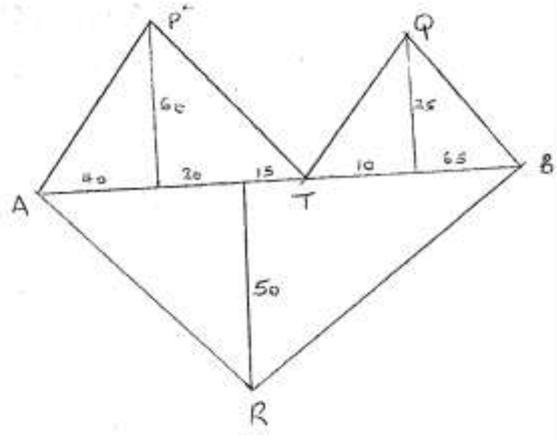
SECTION B

17. Four buildings A, B, C and D stand on a level ground such that B is 240m on a bearing of 60^0 from A. C is south east of B and east of A. D is 320m from C on a bearing of 150^0 from A.

a) i) Use scales of 1 cm rep 40m draw accurately the points ABCD. (3 marks)
ii) Use the drawing to find the direction of B and D. (1 mark)

b) The height of building A is 200m and that of B is 80m. Determine the angle of depression of the top of building B from the top of building A. (3 marks)

c) Enter the layout of Kamau's plot shown below in a surveyor's book. (Unit in metres) (3 marks)



18. The table shows the marks obtained by 40 candidates in an examination

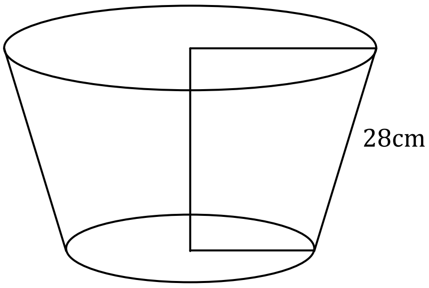
Marks	5-14	15-29	30-34	35-44	45-49
Frequency	2	12	7	15	x

(a) Find the value of x (2 marks)

(b) On the grid provided below draw a histogram to represent the data (5 marks)

(c) By drawing a straight line on the graph above determine the median mark (3 marks)

19. The diagram below shows a bucket with top diameter 30cm and bottom diameter 20cm. The height of the bucket is 28cm.

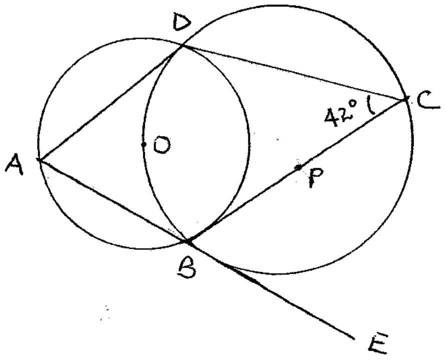


Find;

(a) The capacity of the bucket in litres. (5 marks)

(b) The area of the metal sheet required to make 100 such buckets, taking 10% extra overlapping and wastage. (5 marks)

20. (a)



Giving reasons, determine the size of:

a) Angle CBD (2 marks)

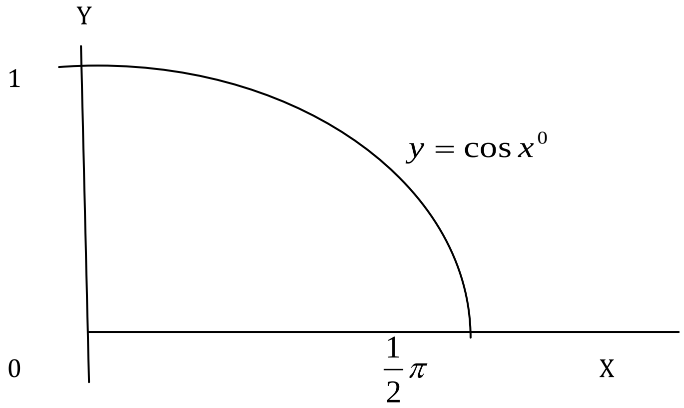
b) Angle ODB (2 marks)

c) Angle BAD (2 marks)

d) Angle ABC (2 marks)

e) Angle ODA (2 marks)

21. A car leaves town X for town Y 120 km away at an average speed of 80 km/hr at 8.30 a.m. At the same time a bus leaves town Y for town X at an average speed of 60 km/hr. At 8.45 a.m., a cyclist leaves town Y for town X at an average speed of 30 km/hr.
    (a) Calculate the time when the bus meets the car to the nearest minute. (3 marks)
    (b) Calculate the distance between the car and the bus by the time the cyclist meets the car. (4 marks)
    (c) If the bus upon reaching town X stops for 10 minutes then starts its journey back to Y, Calculate how far from X the bus meets the cyclist. (3 marks)
22. Two bags A and B contain identical balls except for the colours. Bag A contains 4 red balls and 2 yellow balls. Bag B contains 2 red balls and 3 yellow balls.
    a) If a ball is drawn at random from each bag, find the probability that both balls are of the same colour. (4 marks)
    b) If two balls are drawn at random from each bag, one at a time without replacement, find the probability that:
    i) The two balls drawn from bag A or bag B are red (4 marks)
    ii) All the four balls drawn are red (2 marks)
23. The figure below shows a cross-section of a tunnel.



Determine the difference in area of the cross section if trapeziums rule rather than mid ordinate rule was used using six strips to estimate the area. (10 marks)

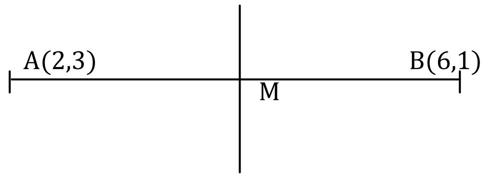
24. (a) Draw the graph of the function below on the grid provided
    $y = 2x^2 - 7x - 2$ for the values of $-1 \leq X \leq 6$ (5 marks)

    (b) From your graph determine the roots of the function. $2x^2 - 7x - 2 = 0$. (1 marks)
    (c) By drawing a suitable graph of function $y = 2x - 7$ on the same axis, solve the simultaneous equations $y = 2x^2 - 7x - 2$ and $y = 2x - 7$. (4 marks)

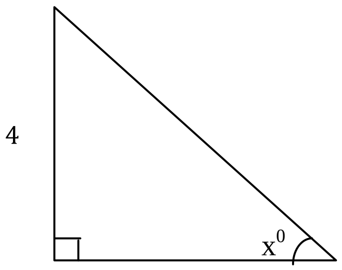
KASSU JET

MATHS PAPER 1
MARKING SCHEME
PAPER 1

1	$\frac{2/4 + 15/4 x 8/3 - 9/2 x 10/3}{14/5 x 10/7 - 4 x 3/2 + 9}$ $\frac{\frac{1}{2} + 10 - 15}{4 - 6 + 9} = \frac{-4\frac{1}{2}}{7}$ -9/2 x 1/7 = -9/14	
2	$\frac{1}{34.52} + \sqrt[3]{0.787} + (0.934)^3$ $\frac{1}{3.452 x 10} + \sqrt[3]{\frac{787}{1000}} + \left(\frac{9.34}{10}\right)^2$ 0.2901 x 0.1 + 9.233 x 0.1 + 814.8 x 0.001 0.02901 + 0.9233 + 0.8148 = 1.76711	
3.	I US$ = Ksh. 78.45 3000US$ = ksh. (3000 x 76.45) = Ksh.23350 Reminder = Ksh (235350 – 75000 – 42000) = Ksh 117850 Ksh 121.04 = 1₤ Ksh 117850 = ₤ $\frac{117850}{121.04}$ = ₤ 973.65 = ₤ 974	B1 M1 $\frac{A1}{3}$
4.	$2^{3(2y-1)}$ x $2^{5y} = 2^{4(y+1)}$ $2^{(6y-3+5y)} = 2^{4y+4}$ ∴ 11y -3 = 4y + 4 7y = 7 y = 1	
5.	$\frac{1(x+3) + x}{x(x+3)} = {}^{11}/_{28}x^1$ $\frac{2x+3}{x+3} = \frac{11}{28}$ 56 x + 84 = 11 x 33 45 x = 51 x = $\frac{-51}{45}$ = $-1^2/_{15}$	
6.	$\frac{dy}{dx}$ = 6x – 4 At x = 2, gradient of tangent dy = 6(2) – 4 = 8 Gradient of normal = - $^1/8$ Equation of normal is $\frac{y-5}{x-2} = -{}^1/8$ 8(y – 5) = - 1 (x – 2) 8y – 40 = - x + 2 8y = - x + 42 x + 8y = 42 y= $\frac{-1}{8}x + \frac{21}{4}$	

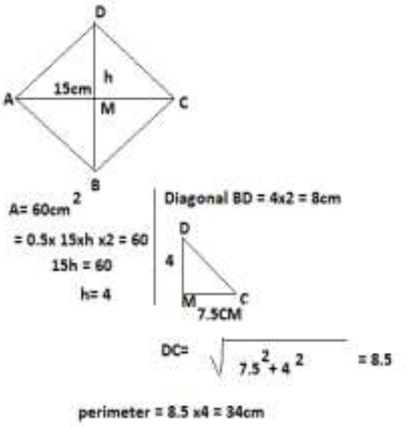
7.	. M $\frac{3}{5} = \frac{k-1}{15}$ 5 m = 15 m = 3 $\begin{pmatrix}9\\15\end{pmatrix} = \begin{pmatrix}k-1\\15\end{pmatrix}$ 9 = k – 1 k = 10 /CD/ = $\begin{pmatrix}9\\15\end{pmatrix}$ $\sqrt{9^2 + 15^2} = \sqrt{306}$ = 17.49	
8.	**x = y + $\sqrt{x^2 + a^2}$** x – y = $\sqrt{x^2 + a^2}$ $(x - y)^2 x^2 + a^2$ $(x - y)^2 x^2 = a^2$ $\pm \sqrt{(x - y + x)(x - y - x)}$ = a $\pm \sqrt{(2x - y)(-y)}$ = a $\pm \sqrt{(y^2 - 2xy)}$ = a	
9.	 M $\left(\frac{2+6}{2}, \frac{3+1}{2}\right)$ M (4, 2) Gradient of line AB = $\frac{1-3}{6-2}$ = - ½ Gradient of perpendicular to AB = 2 Equation of perpendicular = $\frac{y-2}{x-4} = 2$ y – 2 = 2(x + 4) y – 2 = 2x + 8 - $\frac{2x}{10} + \frac{y}{10} = \frac{10}{10}$ $\frac{x}{(-5)} + \frac{y}{10} = 1$	
10.	GCD = 3 LCM = 1008 = 2^4X3^2X7 48 = 2^4X3 72 = 2^3X3^2 X = 3X7 = 21	
11.	16 400 18 800 164 : 188 $\frac{18 800-16 400}{16 400} x 100$ 82 : 94 41 : 47 = 14.63%	

12.



$h^2 = 4^2 + 3^2$
$h^2 = 25$
$h = 25 = \sqrt{5} = 5$
$\sin x = \frac{4}{5}$
$\cos x = \frac{3}{5}$
$\sin x^2 + \cos x = \frac{(4)2}{5} + \frac{3}{5}$
$= \frac{16}{25} + \frac{3}{5}$
$= \frac{16}{25} + \frac{15}{25} = \frac{31}{25} = \frac{1^6}{25}$

13



A= 60cm^2
= 0.5x 15xh x2 = 60
15h = 60
h= 4

Diagonal BD = 4x2 = 8cm

DC= $\sqrt{7.5^2 + 4^2}$ = 8.5

perimeter = 8.5 x4 = 34cm

14

$-3 < 2x + 4 < -3x + 9$

$-3 < 2x + 4$
$-3x + 7 < 2x + 4$
$-7 < 2x$
$-7 < 2x$
-3.5
-3,

$2x + 4 < -3x + 19$
$5x < 5$
$x < 61$

-3, -2, -1, 0, 1

16

17

(a) (i) Kilometres (km)
$\left(\frac{180}{360}\ x\ 2\ x\ {}^{22}/_{7}\ x\ 6370 \cos 50\right)$ km
12868.60795 km
(ii) 60 x 80 cos 50 = 6942.106185 nm
(b) 80 x 60 = 4800 nm

(c) $\left(\frac{4800}{54}\right)\frac{n}{h}\ or\ knot$
= 88.888
= 89 knots

19

20.

Marks	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79
No. of students	13	14	18	20	23	17	12
cf	13	27	45	65	88	105	117

(a) Use you graph to determine:
(i) The median (2 mks)
46.5
Q1 = 31
Q3 = 59.5
(ii) Quartile deviation (3 mks)
59.5 – 31 = 28.5

23.

(a) Express AC and BE in terms of a and b. (2 mks)
AC = AO + OC = -a + 2b

BE = BO + OE = -b + $^5/_2$a

(b) DC and kAC and BD = mBE. Determine the values of k and m by expressing DC in two ways. (6 mks)
DC = K (-a + 2b) = -K + 2kb
BD = mBE = m (-b + $^5/_2$a)
-mb + $^5/_2$ma
DC = DB + BC
mb – $^5/_2$ma + b
-Ka + 2Kb = mb – $^5/_2$ma + b
K = $^5/_2$m.
2K = m + 1
2 x $^5/_2$m = + 1
5m = m + 1
4m = 1
m = ¼

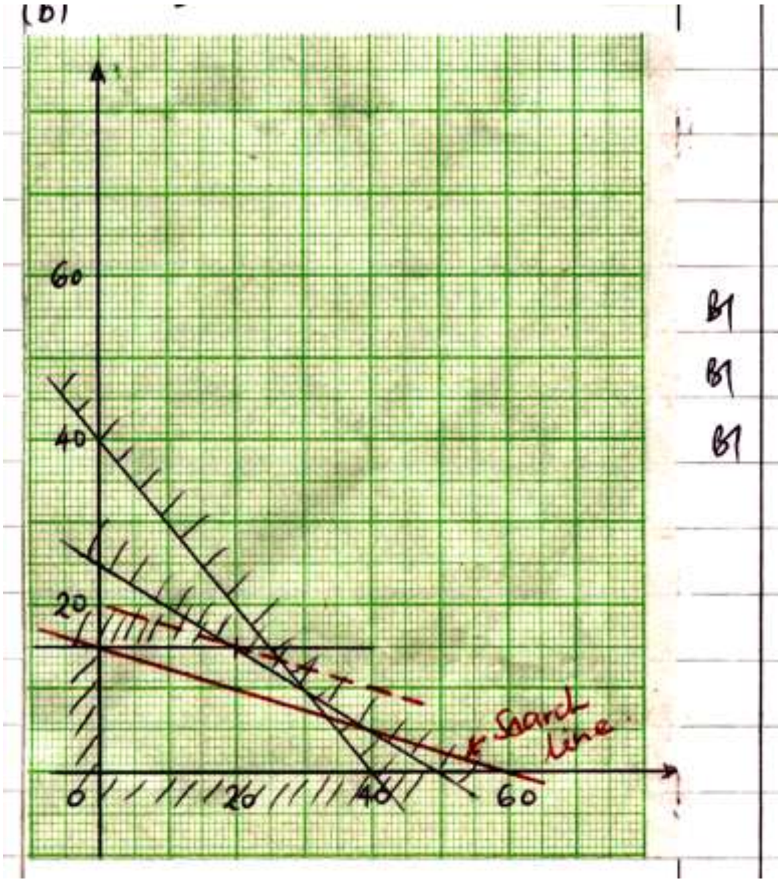
(c) Find the ratio of AD : DC. (2 mks)
DC = $^5/_8$ AC
$\frac{DC}{AC} = {}^5/_8$
AD : DC = 3 : 5

a) $5x + 10y \le 250$

$x + 2y \le 50$ ……… ①

$x + y \le 40$ ………. ②

$Y \le 15$ ………… ③



i) $1000x + 400y = \text{profit}$

ii) (20,10)

$20{,}000 + 40{,}000 = p$

$P = 60{,}000$

$1000x + 4000y = 60{,}000$

$X + 4y = 60$ …search line

$\therefore$ # installed in

$\left.\begin{array}{l}\text{Type } x = 20\\ \text{Type } y = 15\end{array}\right\}$

iii) Max. profit = $1000 \times 20 + 4000 \times 15 =$ ksh 80,000

KASSU JET

MATHS PAPER 2
MARKING SCHEME
PAPER 2

1.	No Log 4.283 0.6317 0.009478 $\bar{3}$.9767 x 2 5.9534 – 0.99184.5851 – 1.9964 – 4.5887 ÷ 2 – 1.97 x 10^{-2} 2.2944 – 0.0197	
2	Density $= \frac{mass}{volume}$ density= $\frac{1\times10^{6}\times10^{-3}}{0.3475}$ Volume=Al= $\pi(R^2 - r^2)l$ $= 2.878 \times 10^{3} kgm^{-3}$ ✓ $= \pi(R+r)(R-r)l$ $= 2\pi(0.43+0.36)(0.43-0.36)$ ✓ $= 2\pi(0.79)(0.07)$ $= 0.347460147 \approx 0.3475m^3$ ✓	
3		
4	$16^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \cos \Theta$ $256 = 200 - 200 \cos \Theta$ $56 = -2 \cos \Theta$ $\Theta = \cos^{-1} (-0.28)$ $= 180^0 - 73.74^0$ $= 106.26^0$ Area of shaded region $= \frac{106.26}{360}\pi r^2 - \frac{1}{2} r^2 \sin 106.26^0$ $= 100(\frac{106.26}{360} \times 3.142 - \frac{1}{2}\sin 106.26)$ $= 100(0.9274 - 0.48)$ $= 100 \times 0.4474 = 44.74$ cm^2	
5		
6	x= 200tan 15 = 53.59cm Y = 200tan 40 = 167.8cm 167.8- 53.59 = 114.21cm	
7	a, a + 2d, a + bd $\frac{a + 2d}{aa + 2d} = \frac{a + bd}{}$ (a + 2d) 2 = a (a + bd) a2 + 4ad + 4d2 = a2 + bad 4d2 – 2as = 0 2d(d – a) = 0 2d = 0 or 2d – a = 0 ❖ d = $\frac{a}{2}$ Thus d = $\frac{10}{2}$ = 5	
8	400 = a + 200b 240 = a + 100b 160 = 100b 1.6 = b 400 = a + 200 (1.6) 400 + a + 320 a = 80 C = 80 + 400 (1.6) C = 720	
9		
10	$1(3x)8\ (^1/_{2x})^0 + 8(3x)^7 (-^1/_{2x})^1 + 28(3x)^6 (-^1/_{2x})2 + 56(3x)^5 (-1/_{2x})^3 + 70(3x)^4 (-^1/_{2x})4$ +……… Constant term is 5th term $= \frac{70 \times 81\cancel{x^4}}{16\cancel{x^4}}$ $= \frac{70 \times 81}{16}$ = 354.375	
11.	$\frac{12.9}{31.01\ x\ 0.0023}$ A. Values Min Max 12.9 12.85 12.95 31.01 31.005 31.015 0.0023 0.00225 0.00235 Min Qu = $\frac{12.85}{31.01\ x\ 0.0025}$ = 176.3045335 Acl. A. = $\frac{12.9}{31.005\ x\ 0.00225}$ = 180.8673219 Max Q = $\frac{12.95}{31.005\ x\ 0.00225}$ = 185.6331416 Absolute error = $\frac{185.6331416-176.3045335}{2}$ = 4.664304054 % error = $\frac{4.664304054}{180.8673219}$ x 100 = 2.5789	

12

13 Cost per kg of mixture without profit

$= \frac{(350 \times 84) + (140 \times 105)}{350 + 140}$

$= \frac{44100}{490}$

= Ksh. 90

Price at 25% profit = 1.25 x 90

= Ksh 112.5

14 $3 \sin (3x - 20^0) = -2$

$\text{Sin } (3z - 20^0) = -{}^2/_3$

$3x - 20 = Sin^{-1} \left({}^2/_3\right)$

$3x - 20 = 41.8103149$

$3x - 20 = 221.81^0$

$3x = 241.81^0$

$x = 80.60^0$

$3x - 20 = 318.19^0$

$3x = 338.19^0$

$x = 112.73^0$

15 $X^2 - \frac{5X}{2} + (\frac{-5}{4})^2 + y^2 + 3y + 1.5^2 = \frac{1}{4} + \frac{25}{16} + \frac{9}{4}$

$(x - \frac{5}{4})^2 + (y + \frac{3}{2})^2 = \frac{65}{16}$

$C\ (\frac{5}{4}, \frac{-3}{2})$

r= 2. 0156

16 Constant angle loci. The locus of P is the major arc of a circle subtended by an angle of 240° at the centre of the circle.

17

18

18. a) $36 + x = 40$

$x = 40 - 36$

$x = - 4$

b)

Limit	4.5-14.5	14.5-29.5	29.5-34.5	34.5-44.5	44.5-49.5
f	2	12	7	15	4
w	10	15	5	10	5
Frequency density	0.2	0.8	1.4	1.5	0.8

19

20 (a) **Angle CBD** **(2 mks)**

<CBD = 90 – 42 = 48⁰

Angle sum of a triangle

(b) **Angle ODB** **(2 mks)**

<ODB = 180 – 42

$= \frac{138}{2} = 69^0$

Angles of an isosceles triangle

(c) **Angle BAD** **(2 mks)**

<BAD = ½ x 138 = 64⁰

Angle at the centre is twice one at the circumference

(d) **Angle ABC** **(2 mks)**

<ABC = 42⁰

Alternate segment angles

(e) **Angle ODA** **(2 mks)**

<ODA = 360 – (64 + 222)

21 a)Time when bus meets CRr= $\frac{\text{Distance apart}}{\text{Relative speed}}$

$= \frac{120 \text{ km}}{140 \text{ km/h}}$ = 51 minutes 43 sec

= 52 minutes

- 8.30 am + 52 min

= 9.22 am

b) Time car meets cyclist = $\frac{\text{Distance apart}}{\text{Relative speed}}$

$= \frac{120}{110}$ = 1hr, 6min

(107.27 – 80.45) = 26.82 km apart

c) $\frac{115 \times 30}{60}$ = 57.5km

Distance apart = (120 – 57.5) = 62.5 km

Time taken to meet = $\left(\frac{62.5}{90}\right)$ hrs

Distance from x = $\left(\frac{62.5}{90} \times 60\right)$ km

= 41.67 km

22 a). P (RR) ${}^4/_6 \times {}^2/_5$

$= {}^6/_{30}$

P (YY) = ${}^2/_6 \times {}^3/_5$

P (Same colour) $= {}^8/_{30} + {}^6/_{30}$

$= {}^7/_{15}$

b). i). P ($R_A R_A$) $= {}^4/6 \times {}^3/_5$

$= {}^2/_5$

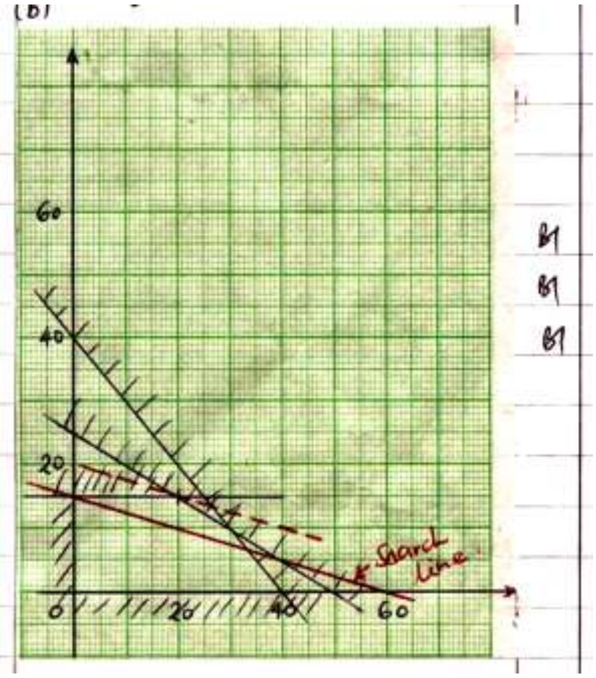
P ($R_A R_A$) $= {}^2/_5$ S x ¼ $= {}^1/_{10}$

23 $$h = \frac{1}{2}\pi \div 6 = \frac{1}{12}\pi$$

Trapezium rule

mid-ordinate rule

x	y_0, y_6	$y_{middles}$
	x_{mid}	y_{mid}
0	1.000	
${}^{\pi}/_{24}$	0.991	
${}^{\pi}/_{12}$	0.996	
${}^{3\pi}/_{24}$	0.924	

	$\pi/6$ 0.866 $5\pi/24$ 0.793 $\pi/4$ ✓(all values ofx) 0.707 $7\pi/24$ 0.609 $\pi/3$ 0.500 $9\pi/24$ 0.383 $5\pi/12$ 0.259 $11\pi/24$ 0.131✓(all y) $\pi/2$ 0.000 ✓(all y values) ✓(all x values) $\sum y_{mid} = 3.831$ $\sum y_{0,} y_6 = 1.000$ $2\sum y_{mid} = 2(3.298) = 6.596$ ✓ By trapezium rule $A = \frac{1}{2}h\{(y_{0+}y_6) + 2\sum y_{mid}\}$ By Mid-ordinate rule $= \frac{1}{2} \times \frac{\pi}{12}\{1 + 6.596\}$✓ $A = h\sum y_{mid}$ $= \frac{\pi}{24}\{7.596\}$ $= \frac{\pi}{12}\{3.831\}$✓ =0.9943sq.units ✓ =1.003✓ Difference in area =1.003-0.9943 =0.0087 sq.units		24	 a) 5x + 10y ≤ 250 x + 2y ≤ 50 ……… ① x + y ≤ 40 ………. ② Y ≤ 15 ………… ③

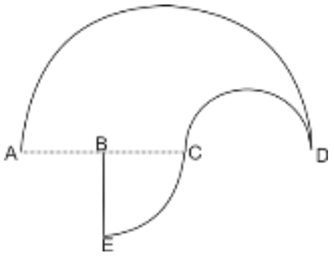
MWINGI CENTRAL SUB-COUNTY JOINT EVALUATION EXAMS 2014
121/1
MATHEMATICS ‘ALTA’
PAPER 1
TIME: 2 ½ HOURS
JULY/AUGUST 2015

*Answer **All** the questions in this section in the spaces provided.*

1. Evaluate without using a calculator (3marks)

$$\frac{{}^2/_3 \text{ x} \left(1{}^3/_7 - {}^5/_8\right)}{{}^3/_4 + 1{}^5/_7 \div {}^4/_7 \text{ of } 2{}^1/_3}$$

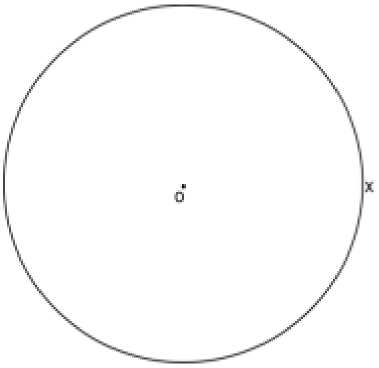
2. Calculate the perimeter of the figure below, given that AB = BC = BE = 3.3cm (3marks)



3. The ratio of Mueni’s earnings to Kilonzo’s earning is 5:3. If Mueni’s earnings is increased by 17% her new figure becomes Kshs. 18,000. Find the corresponding percentage change in Kilonzi’s earnings if the sum of their new earnings is Kshs. 24,600. (3marks)
4. A square room is covered by a number of whole rectangular slabs of sides 60cm by 42cm. Calculate the least possible area of the room in square metres (3marks)
5. The size of an interior angle of a regular polygon is 14 times that of its exterior angle. Determine the number of sides of the polygon (2marks)
6. Simplify the expression (3marks)

$$\frac{a^2 - b^2}{a^2 + ab - a - b}$$

7. A rectangular locker top cover has dimensions 62cm by 28cm. Find the volume traced by the top cover of the locker when its moved 60^0 about its fixed point and horizontal position (3marks)
8. Factorise completely the expression. (3marks)
$3x^2y^2 - 8xy - 51$
9. Below is a circle centre O and a point x is on the circumference. Construct a tangent to the circle through x. A point B lies along the tangent and is 2.8cm from the point x. Join point O to B and measure the angle <Box and the length of $\overline{OB}$ (4marks)

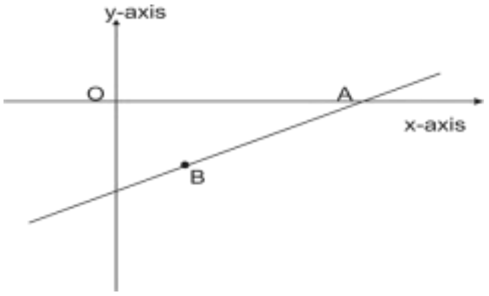


10. A Biology class collected seed pods and weighted them to the nearest gramme. The frequency distribution table is given below.

Mass (g)	No. of seed pods
10-13	20
14-17	26
18-21	32
22-25	40
26-29	35
30-33	24
34-37	23

Calculate the Mean Mass (4marks)

11. A trader bought 360 trays of eggs at shs. 120 per tray. He later discovered that 8% of the eggs were bad and could not be sold. If he has to make a profit of 25%, how much should he sell the good eggs per tray. (3mks)
12. On the diagram below, the line whose equation is $7y - 3x + 30 = 0$ passes through the points A and B. Point A is on the *x*-axis while point B is equidistant from *x*- and *y*-axes.



Calculate the co-ordinates of the point A and B (3marks)

13. In June, Kioko donated $^1/_6$th of his salary to a childrens' home while Mutethya donated $^1/_5$th of her salary to the same children's home. Their total donation for June was Kshs. 14,820. In July Kioko donated $^1/_8$th of his salary to the children's home. Their total donation for July was Kshs. 8,675. Calculate Kioko's monthly salary (4marks)
14. A Kenyan company received US Dollars 150,000. The money was converted into Kenya shillings in a bank which buys and sells foreign currencies as follows:

	Buying (In Kenya shillings)	Selling (In Kenya shillings)
I US Dollar	77.24	77.44
I Sterling pound	121.93	122.27

a) Calculate the amount of money, in Kenya shillings, the company received (1mark)

b) The company exchanged the Kenya shillings calculated in (a) above, into sterling pounds to buy a car from Britain. Calculate the cost of the car to the nearest sterling pound (2marks)

15. Y is due East of another point X, a third point Z lies to the North side of XY. A scout stands at Z which is 7km from X and 8km from Y. If XY = 9km find by scale drawing the bearing of X and Y from the scout at Z. (3marks)

16. Simplify: $\frac{3}{\sqrt{5}-2} + \frac{1}{\sqrt{5}}$ leaving the answer leaving the answer in the form a+ b $\sqrt{c}$.

Where a, b and c are rational number (3marks)

SECTION II (50 MARKS)

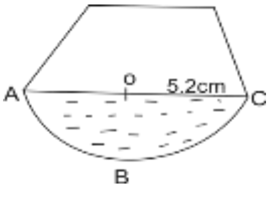
Attempt any **five** questions in this section

17. The distance between towns M and N is 280km. A car and a lorry travel from M to N.
The average speed of the lorry is 20km/h less than that of the car. The lorry takes 1h 10min more than the car to travel from M to N.

a) If the speed of the lorry is *x*km/h, find *x* (6marks)

b) The lorry left town M at 8.15am. The car left town M later and overtook the lorry at 12.15pm. Calculate the time the car left town M (4marks)

18. The diagram below shows a cross-section of a bottle. The lower part ABC is a hemisphere of radius 5.2cm and the upper part is a frustrum of a cone. The top radius of the frustrum is one third of the radius of the hemisphere. The hemisphere part is completely filled with water as shown in the diagram.



(a) Determine the height of the frustrum part (5marks)

(b) Find the surface area of the frustrum part of the bottle (5marks)

19. (a) The product of the matrices.

$$\begin{pmatrix} 2 & -9 \\ -1 & y \end{pmatrix} \text{ and } \begin{pmatrix} 6 & 17 \\ 3 & y-2 \end{pmatrix}$$

Is a singular matrix. Find the value of y (4marks)

(b) In a certain week, a businessman bought 18 bicycles and 16 radios for a total of Kshs. 113,640. In the following week, he bought 14 bicycles and 12 radius for a total of Kshs. 87,480. Using matrix method, find the price of each bicycle and each radio that he bought. (3marks)

(c) In the third week, the price of each bicycle was reduced by 10% while the price of each radio was raised by 10%. The businessman bought as many bicycles and as many radios as he had bought in the first two weeks. Find by matrix method, the total cost of the bicycles and radios that the businessman bought in the third week. (3marks)

20. In triangle ABC, BC = 3.2cm, AC = 4.8cm and angle ABC = 120^0.

(a) Construct the triangle and a circumscribed circle and measure its radius (4marks)

(b) If BC is the base of the triangle, calculate correct to one decimal place.

(i) The perpendicular height of the triangle (2marks)

(ii) The area of the minor segment substended by the Chord AC (3marks)

(iii) The size of angle ABC (1mark)

21. (a) Using the trapezium rule with intervals of 0.5 of a unit, estimate the area of the region bounded by the curve $y = 4x^3 + 2x^2 - 5$, the lines $y = 0$, $x = 1$ and $x = 3$ (5marks)

(b) Calculate:

(i) The area of the region in (a) above by integration (3marks)

(c) Express the error in (a) above as a percentage of the area obtained in (b) above (2marks)

22. The displacement, S metres, of a moving particle after t seconds is given by $S = 40t^3 - t^2 + 3t + 3$. Determine:

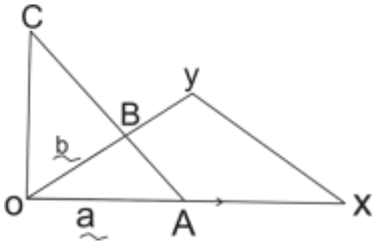
(a) The velocity of the particle when t= 3 seconds (3marks)

(b) The value of t when the velocity of the particle is $4MS^{-1}$ (3marks)

(c) The displacement when the particle velocity is $4MS^{-1}$ (2marks)

(d) The acceleration of the particle when t = 3 seconds (2marks)

23. In the figure below OY = 20B, OX = $^5/_2$ OA, OA = $\underset{\sim}{a}$ and OB = $\underset{\sim}{b}$



a) Express the following in terms of a and b

(i) AB (1mark)

(ii) XY (1mark)

(b) Given that AC = 6AB, express OC & XC interms of a and b (4marks)

(c) Show the points X, Y and C are collinear (2marks)

(d) State the ratio in which C divides XY (2marks)

24. The frequency table shows masses, to the nearest kilogramme of fish caught by a fisherman in a day.

Mass (Kg)	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
No. of fish	6	20	12	10	5	6	2	1

(a) Draw a histogram to represent the above information (5marks)

(b)

(i) State the class in which the median mass lies (1mark)

(ii) Draw a vertical line in the histogram, showing where the median mass lies (1mark)

(iii) Calculate the median mass in kilogrammes of the fish caught (3marks)

MWINGI CENTRAL JOINT EXAMINATION
Kenya Certificate of Secondary Education

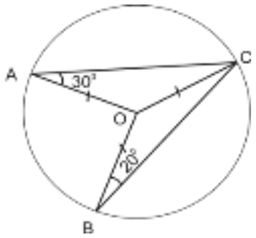
121/2
MATHEMATICS
PAPER 2
TIME: 2 ½ HOURS
JULY/AUGUST 2015

Answer **All** the questions in this section in the spaces provided.

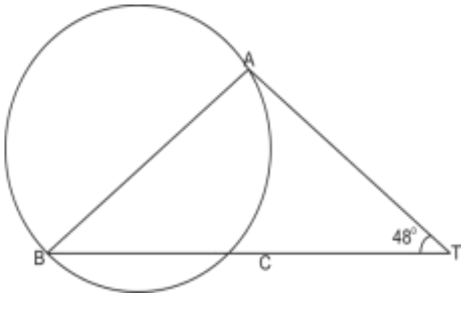
1. Use logarithms to evaluate, correct to 4 decimal places. (4marks)

$$4\sqrt{\frac{3.45 + 2.62}{786 \times 0.0007}}$$

2. Tap P can fill a tank in 2 hours and tap Q can fill the same tank in 4 hours. Tap R can empty the tank is 3 hours.
a) If tap R is closed, how long would it take taps P and Q to fill the tank? (2marks)
b) Calculate how long it would take to fill the tank when the three taps P, Q and R are left running. (2marks)
3. Make P the subject of the formula $\frac{1}{R} = \frac{1}{P} + \frac{1}{Q}$ (3marks)
4. Solve the inequality $2x + 3 > 5x - 3 > -8$ and represent your answer on the number line (4marks)
5. In the figure below, 0 is the centre of the circle. Find <AOB (2marks)



6. Two dice are tossed together.
   a) Draw a probability space to show all the possible outcomes (2marks)
   b) Find the probability that the sum of the two upper faces will be 9 (1mark)
7. The image of P(0,2), under an enlargement with a scale factor 3 is P' (4,6). Find the centre of enlargement (3mark
8. Simplify the expression $\frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} - \sqrt{2}}$, giving your answer in the form $a + b\sqrt{c}$ (3marks)
9. Find the relative error in the difference between 26.0cm and 14.2cm (3marks)
10. In the figure below, AT is a tangent to the circle at A. Angle ATB = 48^0, BC = 5cm and CT = 4cm. Calculate the length AT. (3marks)



11. (a) Expand $(1-x)^5$ up to the term in x^3 (1mark)
    (b) Use the expansion in (a) to approximate the value of $(0.98)^5$ correct to 3 decimal places (2marks)
12. (a) Draw a regular pentagon of side 4cm (1mark)
    (b) On the diagram drawn, construct a circle which touches all the sides of the pentagon (2marks)
13. Point T is the mid-point of a straight line AB. Given that the position vectors of A and T are $i - j + k$ and $2i + 1½\, k$ respectively, find the position vector of B in terms of i, j and k. (3mks)
14. If the local time of town A (52^0N, 0^0) is 12.00noon. Find the local time of town B(1^0S, 37^0E) (3mks)
15. Line AB is the diameter such that the coordinates of A and B are (-1, 1) and (5,1) respectively. Find the equation of the circle. (3marks)
16. Solve for x: $4\sin(x + 20)^0 = 3$ for $0^0 \leq x \leq 360^0$ (3marks)

SECTION II (50 MARKS)

Answer only five (5) questions in the section in the spaces provided

17. The table below shows income tax rates for a certain year.

Monthly income in Kenya Shillings (Kshs.)	Tax rate in each shilling
0-10164	10%
10165-19740	15%
19741-29316	20%
29317-38892	25%
Over 38892	30%

A tax relief of Kshs. 1162 per month was allowed. In a certain month of the year, an employee's taxable income in the fifth band was Kshs. 2108.

a) Calculate:

i) Employees total taxable income in that month (2marks)

ii) The tax payable by the employee in that month (5marks)

b) The employees income includes a house allowance of Kshs. 15,000 per month. The employees contributed 5% basic salary to a cooperative society. Calculate the employees net pay for that month. (3marks)

18. Three quantities R, S, T are such that R varies directly as S and inversely as the square of T.

(a) Given that R = 480 when S = 150 and T = 5, write an equation connecting R, S and T (4marks)

(b) (i) Find the value of R when S = 360 and T = 1.5 (2marks)

(ii) Find the percentage charge in R if S increases by 5% and T decreases by 20% (4marks)

19. (a) Solve the equation $\frac{x-1}{1} = \frac{1}{2x\text{-}3}$ (4marks)

(b) The length of a floor of a rectangular hall is 9m more than its width. The area of the floor is 136m^2.

(i) Calculate the perimeter of the floor (4marks)

(ii) A rectangular carpet is placed on the hall leaving an area of 64cm^2. If the length of the carpet is twice its width, determine the width of the carpet (2marks)

20. (a) Complete the table below for the equation

$y = x^2 + 3x\text{-}6$, given $-6 \le x \le 4$ (2marks)

X	-6	-5	-4	-3	-2	-1	0	1	2	3	4
Y	12			-6			-6				22

(b) Using a scale of 1cm to represent 1 unit in the x-axis and 2 units in the y-axis, draw the graph of $y = x2 + 3x\text{-}6$ (4marks)

(c) Use your graph to solve the quadratic equation.

i) $x^2 + 3x - 6 = 0$ (1mark)

ii) $x^2 + 3x - 2 = 0$ (3marks

21. The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r,

a) Express r in terms of a (3marks)

b) Given that the sum of the three terms is 14;

i) Calculate the values of a and r and hence write down two possible sequences each up to the 4th term (5marks)

ii) Find the product of the 50th terms of the two sequences (2marks)

22. A square S has vertices at A(0, 01, B (2, 0), C(2,2) and D(0,2)

a) On a graph paper, draw the square S and its image5 under a transformation whose matrix is; (3mks)

$$A = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$$

(b) S" is the image of S under a transformation whose matrix is B =

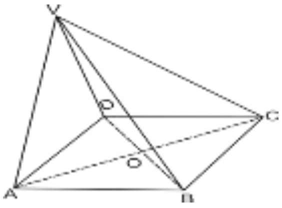
$$\begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$$

Describe fully the transformation which would map S to S" (4marks)

(c) Draw the image S"" of S under a transformation whose matrix is AB. Hence describe a single transformation which maps S to S"" (3marks)

23. The diagram below shows a right pyramid with a horizontal rectangular base ABCD and vetex V. The area of the base is 60cm^2 and the volume of the pyramid is 280cm^3.

(a) The period of $y = \sin 2x$ (1mark)



(a) Calculate the height of the pyramid (2marks)

(b) Given that the ratio of the sides AB: BC is 3:5, find the length of:
  i) AB (2marks)
  ii) BC (2marks)

(c) Find the length of the slanting height (2marks)

(d) Calculate the angle between the planes VCB and ABCD (2mks)

24. Mr. Joses has two lorries A and B used to transport atleast 42 tonnes of potatoes to the market. Lorry A carries 4 tonnes of potatoes per trip while lorry B carries 6 tonnes of potatoes per trip. Lorry A uses 2 litres of fuel per trip while lorry uses 4 litres of fuel per trip. The two lorries are to less than 32 litres of fuel. The number of trips made by lorry A should be less than the number of trips made by lorry B. Lorry A should make more than 4 trips.

a) Taking X to represent the number of trips made by lorry A and Y to represent the number of trips made by lorry B, write the inequalities to represent the above information (4marks)

b) On the grid provided, draw the inequalities and shade the unwanted regions (4marks)

c) Use the graph drawn in (b) above to determine the number of trips made by lorry A and by lorry B to deliver the greatest number of potatoes (2marks)

MWINGI CENTRAL SUB-COUNTY JOINT EVALUATION EXAMS 2015
121/1
MATHEMATICS ‘ALTA’
PAPER 1
TIME: 2 ½ HOURS
JULY/AUGUST 2015

1.

$$\frac{\frac{2}{3} \text{ x} \left(\frac{10}{7} - \frac{5}{8}\right)}{\frac{3}{4} + \frac{12}{7} \div \left(\frac{4}{\cancel{7}} \text{ x } \frac{\cancel{7}}{3}\right)}$$

$$\frac{\frac{2}{3} \text{ x } \frac{45}{56}}{\frac{3}{4} + \left(\frac{\cancel{12}}{7} \text{ x } \frac{3}{\cancel{4}}\right)}$$ √1

$$\frac{\left(\frac{15}{28}\right)}{\frac{3}{4} + \frac{9}{7}}$$

$\frac{15}{28} \div \frac{57}{28}$ √1

$\frac{15}{28} \text{ x } \frac{28}{57}$

$= \frac{15}{57}$

$= \frac{5}{19}$ √1

2.

Perimeter
3.14 x 8.4 x ½ = 13.2cm
3.14 x 4 x ½ = 6.28cm √1
$\frac{90}{360}$ x 3.14 x 4.4 = 3.45cm √1
2.2 x 2 = 4.4cm √1
Total 27.33cm √1

3.

M:K = 5:3
Initially Mueni $\frac{5}{8}$ x 24 600 = Kshs. 15375
Kilonzo 24600 – 15375 = Kshs. 9225
24600 – 18000 = Kshs. 6,600 √1
6600 – 9225 = -2625
Percentage change $\frac{-2625}{9225}$ x 100% = -28.5%
√1 √1 √1

4.

60 = 2 x 2 x 3 x 5
42 = 2 x 3 x 7
LCM = 2^2 x 3 x 5 x 7
LCM = 420cm
In metre $\frac{420}{100 \text{ x } 100}$ = 420 x 420 = 17.6m^2

5.

X+14x = 180
X = 12^0 ✓1
Sides $\frac{360}{12}$ = 30 sides ✓1

6.

$\frac{(a+b)\ (a-b)}{a(a-1) + b(a-1)}$ √1

$\frac{\cancel{(a+b)}\ (a-b)}{(a-1)\ \cancel{(a+b)}}$ √1

$= \frac{a-b}{a-1}$ √1

7.

Volume $\frac{22}{7}$ x 28 x 28 x 62 x $\frac{60}{360}$ √1
√1
=25461.3cm^3 √1

8.

$3x^2y^2 + 8xy – 51$
$3x^2y^2 – 9xy + 17xy – 51$ √1
3xy (xy -3) + 17 (xy – 3) √1
(xy-3) (3xy + 17) √1

10.

Mass	X	No. of seedpods	Fx
10-13	11.5	20	230
14-17	15.5	26	403
18-21	19.5	32	624
22-25	23.5	40	940
26-29	27.5	35	962.5
30-33	31.5	24	756
34-37	35.5	23	816.5
	Total	200	4732

Mean $\overline{X} = \frac{4732}{200}$
$\overline{X} = 23.66$ √1

11.

New price 1.25 x 360 x 120 = Shs. 54 000 √1
Good trays $\frac{92}{100}$ x 360 = 331.2 √1
Price = $\frac{54000}{331.2}$ = Kshs. 163.0 √1

12.

Ty – 3x+ 30 = 0
Point A, 7(0) -3x + 30 = 0
X = 10
A (10, 0) √1
Ty-3(-y) + 30 = 0
Log = -30 √1
y = -3
B(3, -3) √1

13

$\frac{1}{6}x + \frac{1}{5}y = 14820 \longrightarrow 5x + 6y = 444600$ √1

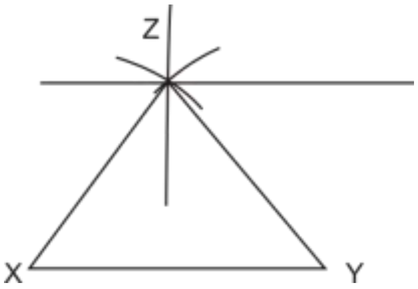
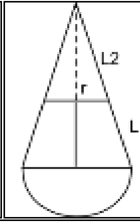
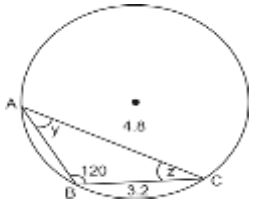
$\frac{1}{8}x + \frac{1}{12}y = 8675$ √1 $\longrightarrow 12x + 8y = 832800$ √1

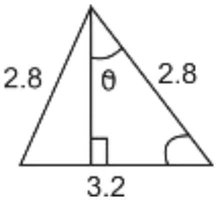
20x + 24y = 1778400
36x + 24y = 2498400 ✓1
16x = 720 000
X = 45 000 (Kioko) ✓1
$\frac{1}{6}(45000) + \frac{1}{5}y = 14820$
$\frac{1}{5}y = 7320$
y = 36 600.00 (Mutethya)

14.

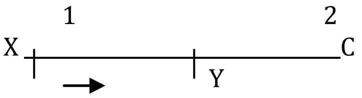
a) 150000 x 77.24 = Kshs. 11,586 000 ✓1

b) $\frac{11586000}{122.27}$ = 94757.5 ✓1
= £94758 ✓1

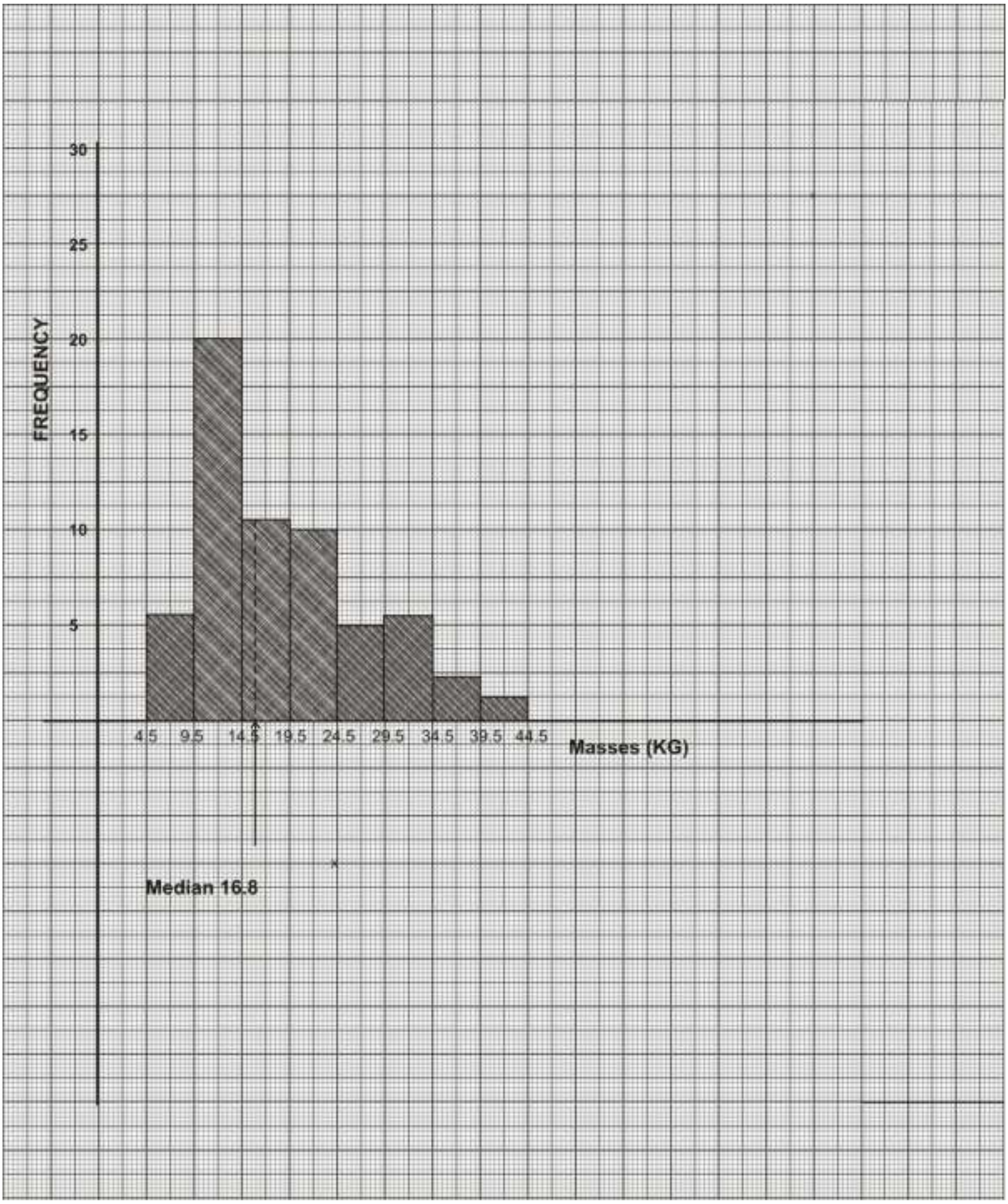
15.	 Bearing of Y from Z is $138^0 \div 1^0$ Bearing of x from Z is $212^0 \div 1^0$		a)	Volume of core large $\frac{1}{3}\pi R^2 (h+x)$ Volume of core small $\frac{1}{3}\pi (R^2 (h+x) - r^2h)$ Volume of frustrum = Volume of hemisphere $\frac{2}{3}\pi R^3 = \frac{2}{3} x\ 3.14 x\ 5.2^3 = 294.3$ $\frac{h+x}{h} = \frac{5.2}{1/3 (5.2)} = \frac{3}{1}$, So x = 2h $h = \frac{294.3}{3.14 (3 x\ 5.2^3 - (\frac{8.2}{3})2}$ h = 3.6cm
16.	$\frac{3}{\sqrt{5}-2} + \frac{1}{\sqrt{5}}$ $\frac{3}{\sqrt{5}-2} x \frac{\sqrt{5}+2}{\sqrt{5}+2}$ ✓1 $\frac{3\sqrt{5} + 6}{1}$ $= 6 + 3\sqrt{5} + \frac{1}{\sqrt{5}}$ $=6 + \sqrt{5} (3 + \frac{1}{5})$ ✓1 $=6 + \frac{16}{5}\sqrt{5}$ A= 6, b = $\frac{16}{5}$ C = 5 ✓1		b)	Surface area of fustrum πRπ – πrl $L = \sqrt{10.8^2 + 52 . 22} =$ $L1 \sqrt{116.64 + 27.04} = 11.99$ $L2 = \sqrt{(1.733^2 + 3.6)^2} = 3.99$ S.A = 3.14 (5.2 x 12 - 12 - 1.733 x 4) = 174.3cm^2
			19	$\begin{pmatrix}2 & -9\\ -1 & y\end{pmatrix}\begin{pmatrix}6 & 17\\ 3 & y-2\end{pmatrix}$ $=\begin{pmatrix}-15 & 52 - 9y\\ 3y-6 & y2-2y-17\end{pmatrix}$ $12y^2 - 180y + 567 = 0$ $4y^2 - 60y + 189 = 0$ $x = \frac{60+ \sqrt{3600-3024}}{8}$ x = $\frac{84}{8}$ or $\frac{36}{8}$ = 10.5 or 4.5
17	Speed of car (x+20) km/hr a)Speed of lorry - xkh/hr $\frac{280}{x} - \frac{280}{x+20} = 1\frac{1}{6}$ ✓2 280 (x+20) = 280(x) = 7/6 (x^2+20x) 1680 x + 33600 – 1680x = $7x^2 + 140x$ ✓2 $7x^2 + 140x - 33600 = 0$ $x^2 + 20x - 4800 = 0$ ✓1 (x+80) (x-60) = x= 60kh/hr ✓1		b)	18b + 16r = 113640 14b + 12r = 87480 ✓1 $\begin{pmatrix}18 & 16\\ 14 & 12\end{pmatrix}\begin{pmatrix}b\\ r\end{pmatrix}\begin{pmatrix}113640\\ 87480\end{pmatrix}$ ✓1 Det 216 – 224 = -8 $\begin{pmatrix}-12/8 & +16/8\\ +14/8 & -18/8\end{pmatrix}\begin{pmatrix}113640\\ 87480\end{pmatrix}$ -170460 + 174960 = 4500 198870 – 196830 = 2040 ✓1 Bicycle shs. 4,500 ✓1 Radio shs. 2040
	b)Time taken $\frac{280}{60}$ = 4hr, 40min Arrival time 8.15am for the lorry 4.40 ✓1 12.55pm During overtaking distance travelled ✓1 60 x 4 = 240km 280 – 240 = 40km For car $\frac{40}{80}$ = 30mins ✓1 Time 12.15pm – 3 hours =9.15am ✓1		c.	(90/100 x 4500) & (110 x 2040) =4050 Radio shs. 2244 $(32\ \ 28)\begin{pmatrix}4050\\ 2244\end{pmatrix}$ = shs. 129600 62832 = shs. 192432
18			20	a)  Radius = $\frac{4.8}{\text{Sin } 120}$ = 2R = 5.54 R = 2.8cm

<table>
<tr><td>b)</td><td>(i) $\frac{4.8}{\text{Sin } 120} = \frac{2}{y}$
$Y = \frac{3.2 \sin 120}{4.8}$
Y = 35 Z = 25 ✓1
A = ½ x 3.2 x 4.8 sin 25 = ½ x 3.2 x h
3.25 = 1.6h
H = 2.0cm ✓1</td><td></td></tr>
<tr><td>ii)</td><td>Sector


Sinθ = $\frac{1.6}{2.8}$ ✓1
θ=34.8
Sector 2θ = 69.7
$\frac{69.7}{360}$ x 3.14 x 2.8^2 = 4.8cm^2 ✓1
Area of triangle
½ x 2.8 x 2.8 sin 69.7 = 3.7cm^2
Area = 4.8 – 3.7 = 1.1cm^2 ✓1</td><td></td></tr>
<tr><td>iii)</td><td><ACB> = 25^0 √1</td><td></td></tr>
<tr><td>21.
a)</td><td>Y = 4x3 + 2x2 – 5<table><tr><td>X</td><td>1</td><td>1.5</td><td>2.0</td><td>2.5</td><td>3</td></tr><tr><td>Y</td><td>1</td><td>13</td><td>35</td><td>70</td><td>121</td></tr></table>A = ½ h (y0 + yn) + 2 (y1 + y2 + y3)
A = ½ x 0.5 (1 +121) + 2 (13 + 35 + 70)
A = 0.25 (122 + 236)
A = 89.5</td><td></td></tr>
<tr><td>b)</td><td>Y = 4x^3 + 2x^2 -5
(4x^3 2x^2 – 5) dx
$\frac{4\ x4}{4} + \frac{2x3}{3} = \frac{5x}{1}$ + C ✓1
=(3^4 + 2) (3^3) – 5 (3) + c) (1 ¼ + 2 (1) – 5(1) +c)
=(81 + 18 – 15) – (1 + 2/3 – 5) ✓1
=84 -1 - 3,333
=84.3.33
=87.33 ✓1</td><td></td></tr>
<tr><td>c)</td><td>Error
2.17 x 100% = 2.48% ✓1
87.33) ✓1</td><td></td></tr>
<tr><td>22</td><td>S = 40t3 – t2 + 3t + 3</td><td></td></tr>
<tr><td>a)</td><td>$\frac{ds}{dt}$ = 120t^2 = 2t + 3
V = 120 (3)2 -2(3) + 3
V = 1080 – 6 + 3
V = 1077m/s</td><td></td></tr>
<tr><td>b)</td><td>120t^2 – 2t + 3= 4
t = $\frac{2+ \sqrt{4\text{-}4\ (120)(\text{-}1)}}{240}$ √1
t = $\frac{2+ 22}{240} = \frac{24}{240}$ or $-\frac{20}{240}$ √1
t = 1/10 seconds</td><td></td></tr>
</table>

c)	S = 40$\left(\frac{1}{1000}\right)$ - $\frac{1}{100}$ + 3$\left(\left(\frac{1}{10}\right)\right)$+ 3 ✓1 S = 0.04 – 0.01 + 0.3 + 3 S = 3.34 – 0.01 ✓1 S = 3.33m	
d)	$\frac{dv}{dt}$ = 120t^2 - 2t + 3 a = 240t – 2 ✓1 a = 240 (3) – 2 = (720 – 2) a = 718m/s^2 ✓1	
23. a. i	$\overrightarrow{OA} + \overrightarrow{AB} = \overrightarrow{OB}$ AB = 0B - 0A = $\underset{\sim}{b} – \underset{\sim}{a}$	
ii	$\overrightarrow{OX} + \underline{\overrightarrow{XY}} = \underline{\overrightarrow{0Y}}$ XY 0Y OX = 2$\underset{\sim}{b}$ – 5/2 $\underset{\sim}{a}$	
b.	$\overrightarrow{AC} = 6\overrightarrow{AB}$ = 6 ($\underset{\sim}{b}$ – $\underset{\sim}{a}$) (l) OC $\overrightarrow{OA} + \overrightarrow{AC} = \overrightarrow{OC}$ $\overrightarrow{OC}$ = $\underset{\sim}{a}$ + 6$\underset{\sim}{b}$ – 6$\underset{\sim}{a}$ $\overrightarrow{OC}$ = 6$\underset{\sim}{b}$ - 5$\underset{\sim}{a}$	
	$\underline{\overrightarrow{XC}}$ OX + XC = OC $\overrightarrow{XC} = \overrightarrow{OC} – \overrightarrow{OX}$ 6$\underset{\sim}{b}$ – 5$\underset{\sim}{a}$ - $^5/_2\underset{\sim}{a}$ $\overrightarrow{XC}$ = 6$\underset{\sim}{b}$ = $\frac{15}{2}\underset{\sim}{a}$	
c)	$\overrightarrow{XY}$ = 2$\underset{\sim}{b}$ – 5/2$\underset{\sim}{a}$ & $\overrightarrow{XC}$ = 6$\underset{\sim}{b}$ – 15/2 $\underset{\sim}{a}$ XC = 3XY Scalar multiple is 3 or 1/3 share point X	
d)	$\overrightarrow{XY}$ = 2$\underset{\sim}{b}$ – 5/3 $\underset{\sim}{a}$ $\overrightarrow{XC}$ = 6$\underset{\sim}{b}$ – 15/2 $\underset{\sim}{a}$  Then $\frac{\overrightarrow{XY}}{XC} = \frac{1}{3}$ So ratio is 1:2	

24


FREQUENCY
30
25
20
15
10
5
4.5
9.5
14.5
19.5
24.5
29.5
34.5
39.5
44.5
Masses (KG)
Median 16.8

MWINGI CENTRAL SUB-COUNTY JOINT EVALUATION EXAMS 2015
121/1
MATHEMATICS 'ALTA'
PAPER 1
TIME: 2 ½ HOURS
JULY/AUGUST 2015

1.

Number	Log	
3.45 + 2.62		
6.07	0.78319	
786	2.89542 +	-
0.0007	$\bar{4}.84509$	
	$\bar{1}.74151$	
	1.04168 ÷ 4	
1.82146	0.26042	

M1 M1 M1

$\sqrt[4]{\frac{3.45 + 2.62}{786 \times 0.0007}} = 1.8215$ A1

2.
(a)
Tap P fills ½ of the tank in 1 hour
Tap Q fills ¼ of the tank in 1 hour
Tap R empties $^1/_3$ of the tank in 1 hour M1

In 1 hour P and Q fills ½ + ¼ = ¾

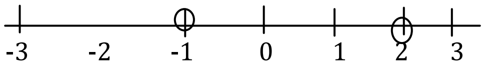
1h – ¾ of the tank is filled
$^4/_4$ of the tank will be filled in A1

$^4/_4$ ÷ ¾ = $^4/_4$ x $^4/_3$ = $^4/_3$ hours M1

b) In 1 hour all will fill ($^1/_2$ + ¼ - $^1/_3$) = $^5/_{12}$
Time to fill the tank will be A1
$^{12}/_{12}$ ÷ $^5/_{12}$ = $^{12}/_5$ hours or 2 $^2/_5$h

3.
Subject P $\frac{1}{R} = \frac{1}{P} + \frac{1}{Q}$
PQR to get PQ = QR + PR M1
PQ – PR = QR
P(Q-R) = QR M1
Q-R
$P = \frac{QR}{Q-R}$ A1

4.
$2x + 3 > 5x - 3 > -8$
$2x + 3 > 5x - 3$ (i) B1
$5x - 3 > -8$ (ii)
Inequality (i) $3x < 6$ B1
$x < 2$
Inequality (ii) $5x > -5$
$x > -1$ B1
$-1 < x < 2$



A1

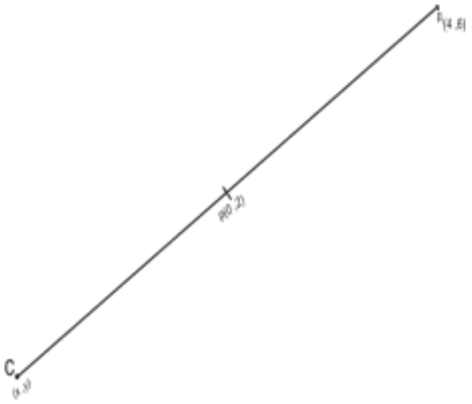
5.
<AOC = 120^0
<BOC = 140 B1
<AOB = 360 – (120 + 140)
= 100^0 A1
Alternatively <ACB = 50^0 02
<AOB = 2ACB
= 100^0
Alternatively <ACB = 50^0
<AOB = 2ACB A1
= 100^0

6.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

b) P (9) = $^4/_{36}$ = $^1/_9$

7



4-x = 3
$\frac{0 - x}{}$ = 3
0 – x
4 – x = -3x
X = -2

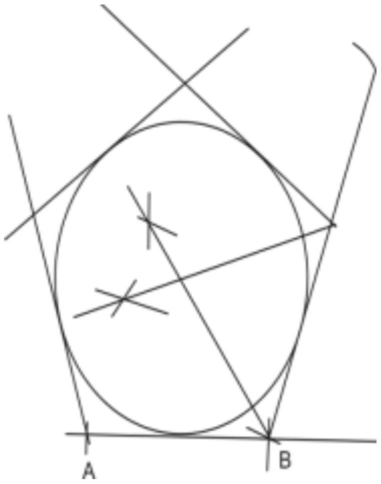
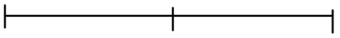
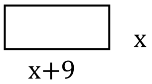
$\frac{6-y}{2-y}$ = 3
6 - y = 6 3y
y = 0
c = (-2, 0)

8
$\frac{(\sqrt3 - \sqrt2)\ (\sqrt3 - \sqrt2)}{(\sqrt3 - \sqrt2)\ \sqrt3 - \sqrt2)}$

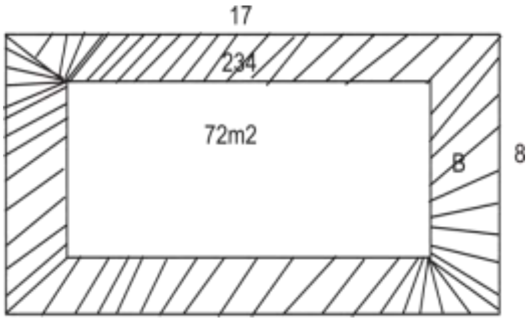
$\frac{3 - \sqrt6\ -\ \sqrt6 + 2}{1}$
5 - 2√6

9
Limits are 26.0 ± 0.05 cm M1
14.2 ± 0.05 cm
i.e. 26.05 or 25.95
14.25 or 14.15
Max. Difference: 26.05 – 14.15 = 11.9cm
Min. Difference: 25.95 – 14.25 = 11.7cm M1
Working Difference = 26.0 – 14.3 = 11.8cm
Absolute error = 11.9 – 11.8 = 0.1cm
Relative error = $\frac{0.1}{11.8}$ = 0.0084746 A1
= 0.0085 (4dp)

10
AT² = BT x CT
AT² = 9 x 4
AT² = 36
AT = √36
= 6cm

11.	a) $(1-x)^5$ 1 5 10 10 5 1 $I -5x + 10x^2 - 10x^3 +..$ $x = 0.02$ $1-5(0.02) + 10(0.02)^2 - 10(0.02)^3 +..$ $1-0.1 + 0.004 - 0.00008 + ..$ $= 0.90392$ $= 0.904$ (3dp)	
12		
13	 A T B $\begin{pmatrix}1\\-1\\1\end{pmatrix}$ $\begin{pmatrix}2\\0\\3/2\end{pmatrix}$ $\begin{pmatrix}x\\y\\z\end{pmatrix}$ $\frac{X+1}{2} = 2$, $\frac{y-1}{2} = 0$ $\frac{z+1}{2} = 3/2$ X+1 = 4, y – 1 = 0 and z + 1 = 3 X= 3 y = 1 z = 2 OB = 3i + j + 2k	B1 M1 A1
14	Diff. in longitude is $(37^0 + 0^0) = 37^0$ Diff. in time is 4 x 37 = 148min 2h 28min Local time of B is 2h 28min a lead of that of A From noon add 2h 28min to get 12.00 + 2h 28min = 2.28pm	M1 M1 A1
15	Centre is the mid-point of AB i.e. $\frac{-1+5}{2}$, $\frac{1+1}{2}$ = (2, 1) Radius $= \sqrt{(5-2)^2 + (1-1)^2}$ $\sqrt{3^2}$ = 3 units Equation of circle $(x-2)2 + (y-1) = 32$ $= (x-2)^2 + (y-1)^2 = 9$	M1 M1 A1
16	$4\sin(x + 20)^0 = 3$ Sin (x + 20) ¾ $X + 20 = 48.59^0, 131.41^0$ $X = 28.59^0, 111.41^0$	M1 M1 A1
17.	(a) (i) Taxable income = 38892 + 2108= shs. 41,000 (ii) $10164 \times \frac{10}{100} = 1016.40$ $9576 \times \frac{15}{100} = 1436.40$ $9576 \times \frac{20}{100} = 1915.20$ + $9576 \times \frac{25}{100} = 2394.00$ Rem $2108 \times \frac{30}{100} = 632.40$ 7394.40 Less Relief 1162.00 Kshs. 6232.40 b) Total deductions 41 000 15 000 Basic salary = 26 000 $\frac{5}{100}$ x 26 000 = 1 300 + payee 1 300 + 6232.40 = 7532.40 Net pay 41 0000 – 7532.40 = Kshs. 33476.60	
18.	$R \alpha \frac{S}{T^2}$ $R = \frac{KS}{T^2}$ $480 = \frac{150k}{25}$ $K = \frac{480 \times 25}{150}$ = 80 K = 80 $R = \frac{80S}{T^2}$	B1 M1 A1 B1
b)	(i) $R = \frac{80 \times 360}{2.25}$ = 12,800 (ii)$R_0 = \frac{Ks0}{T_0^2}$ $R_1 = \frac{Ks_1}{T_1^2}$ $S_1 = \underline{1.05}$ So, $T1 = 0.8T_0$ $R\ 1 = \frac{K05kS0}{0.64To^2}$ | $\frac{1.6401Ro - Ro}{Ro} \times 100$ $R_1 = 1.6406R_0$ | = 64.06%	M1 A1 M1 M1 A1
	(i)  x(x+9) = 136 x2 + 9x – 136 = 0 $\frac{-9 \pm \sqrt{81 + 4(136)}}{2}$ $x_1 2 = \frac{-9 \pm 25}{2}$ X= 8 or x = -17 Width = 8 Length 17 P = 2(8 + 17) = 50m	

iii)



x(2x) = 72

$2x^2 = 72$

$x^2 = 36$

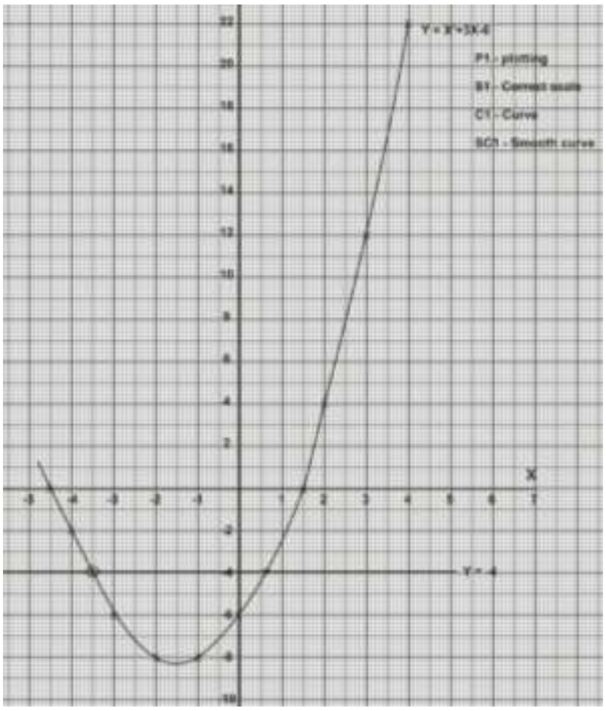
x= ±6

With is 6m

20 a)

X	-6	-5	-4	-3	-2	-1	0	1	2	3	4
Y	12	4	-2	-6	-8	-8	-6	-2	4	12	22

b)



c) i)From the graph

x= -4.4 or x = 1.4 ±0.5. The points (circles) should be clearly on the graph

ii) $y = x^2 + 3x – 6$

$\underline{0 = x^2 + 3x – 2}$

y = -4

x = -3.6 or x = 0.6 ± 0.5

21\. a) 1st three terms area, ar ar^2

Product a x ar x ar^2 = 64

$a^3r^3 = 64$

$r^3 = \frac{64}{a^3}$

r = 4/a

b) i) Sum a + ar + ar2 = 14 M1

but R = 4/a

a+ a)4/a) + a (4/a)2 = 14 M1

a+4+16/a = 14

a^2-10a + 16 = 0 A1

a^2-2a-8a+16 = 0

a(a-2) -8 (a-2) = 0

a=8 or a = 2 B1

When a = 2, r = 2 when a = 8 r = ½

For a = 2: sequence; 2, 4, 8, 16 A1

For a 8: sequence; 8, 4, 2, 1

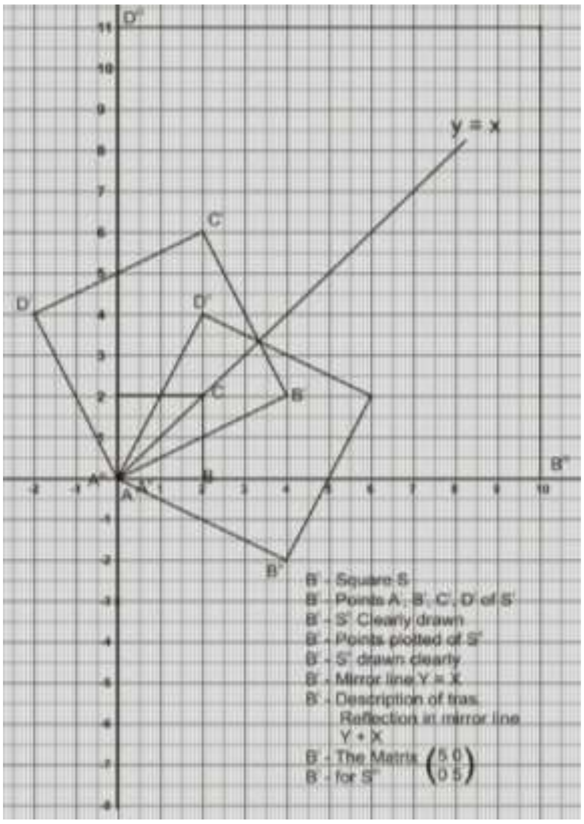
ii) 50th terms are ar^{49} and ar^{49}

$2(2)^{49}$ and $8(^1/_2)^{49}$ M1

Product $2(2)^{49}$ x 8 $(^1/_2)^{49}$ A1

= 16

22



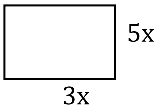
23 a) 1/3 Ah = 280

1/3 x 60h = 280

20h = 280

H = 14cm

b)



3x.5x = 60

$15x^2 = 60$

x2 = 4

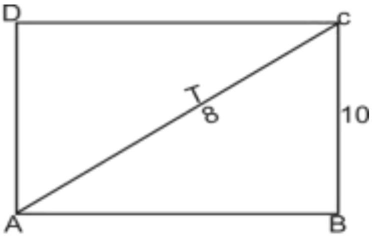
x = ±2

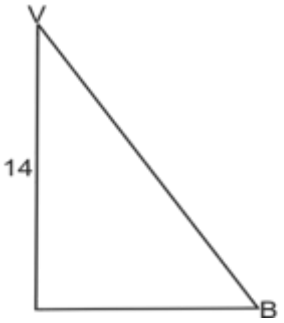
i)AB = 3 x 2

= 6cm

ii)BC = 5 x 2

= 10cm



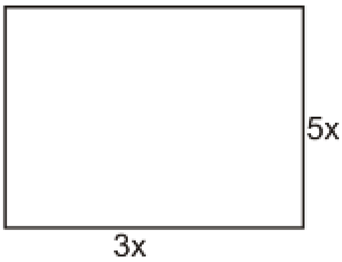


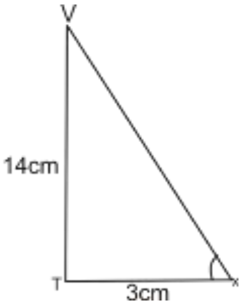
$VB = \sqrt{14^2 + 4^2}$

$= \sqrt{212}$

=14.56cm

d)



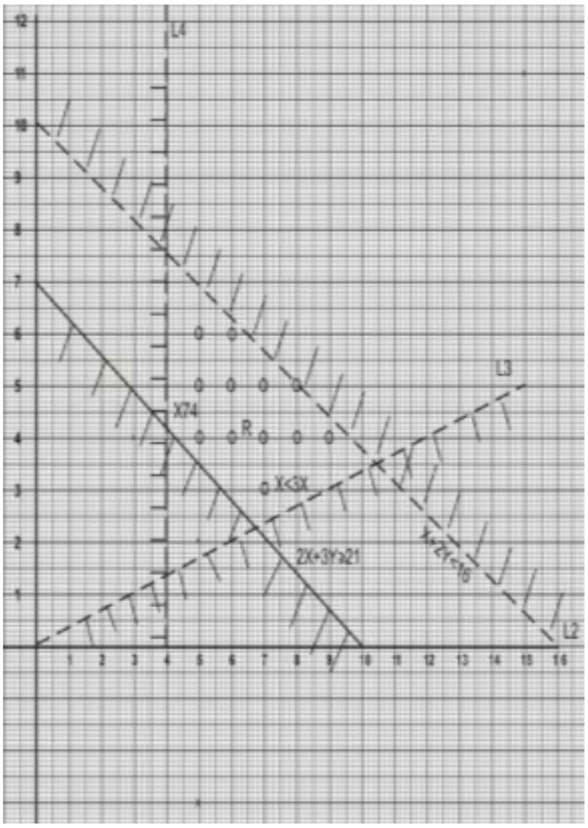


<VXT = $\tan^{-1}(14/3)$

= 77.91^0

24.	a) $4x + 6y > 42 - \ell 1$ $2x + 4y < 32 - \ell 2$ $X < 3y - \ell 2$ $x > 4 - \ell 4$	B1 B1 B1 B1

b)



c) Points from graph (8,4) (8,3) and (7,5)

(7,5) gives greatest value 4 x 7 + 5 x 6 = 58 Trips

Class	X	F	CF
5-9		6	6
10-14		20	26
15-19		12	38
20-24		10	48
25-29		5	53
30-34		6	59
35-39		2	61
40-44		1	62

(h) Median $\frac{62}{2} = 31$

(i)Class

So Class 15-19 1mk

(ii)$14.5 + (\frac{5.5}{12} \times 5) = 16.79$ 3mks

KAMDARA JET– 2015

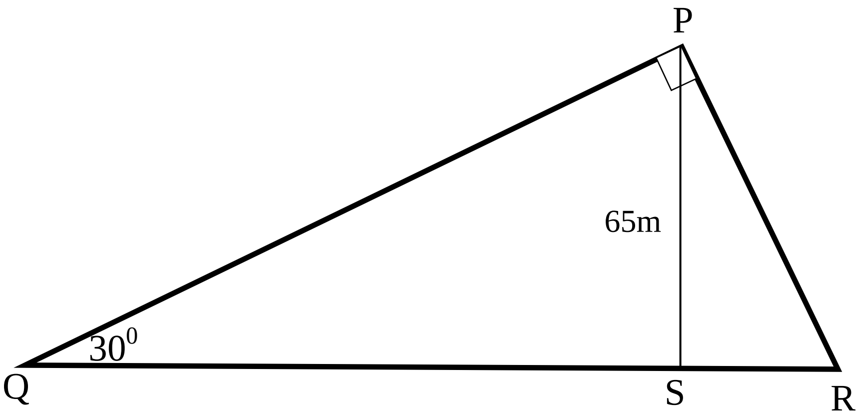
121/1
MATHEMATICS
PAPER 1
JULY/AUGUST 2015
TIME: 2 ½ HOURS

SECTION I (50 MARKS)

Answer all questions

1. Without using tables or calculator, evaluate (3mks)
$$\frac{\sqrt{7056}}{7 \times 15 \div 3 - (9 + 14)}$$

2. The price of foodstuff generally increased by 20% at the beginning of a drought season and reduced by 30% during harvest season. Express the new price as a ratio of the original price in its lowest form (3 mks)
3. Use reciprocal and square root tables to evaluate $\frac{\sqrt[3]{0.27}+12}{0.126}$ (3mks)
4. The exterior angle of a regular polygon is 24^0. Determine the sum of the interior angles. (3mks)
5. Solve 4x -3 ≤ 6x -1< 3x + 16 and represent your answer in a number line (3mks)
6. The figure below represents a right-angled triangular plot of land PQR. PS is perpendicular to BC. If angle PQR = 30^0 and PS = 6.5cm, find the area of the plot. (4mks)



7. Solve for x in the equation $3^{x+1} + 3^x + 3^0 = 109$ (3mks)
8. Using a ruler and a pair of compasses only, construct a trapezium PQRS in which PQ = 6cm and angle PQR = 105^0, QR = 4cm, RS = 5cm and RS is parallel to PQ, hence locate point A on line PQ such that angle PAS = 90^0. (4mks)
9. Simplify $\frac{3t^2-12}{3-(1+t)}$ (3mks)
10. A straight line through the points A (2,1) and B (4,m) is perpendicular to the line whose equation is 3y = 5-2x. Determine the value of m. (4mks)
11. A liquid spray of mass 384 g is packed in a cylindrical container of internal radius 3.2 cm. Given that the density of the liquid is 0.6g/cm^3, calculate to 2 decimal places the liquid in the container (3mks)
12. If $\sin x = \sqrt{2} - 1$ where x is an acute angle, find in the form $a + b\sqrt{c}$,
    a) $\cos(90 - x)$ (2mks)
    b) $\tan x$ (1mk)
13. If $x{:}y = 9{:}11$, find the ratio of $(5x - 3y){:}(2x + 3y)$. (3mks)
14. Timmons sold a TV set costing Ksh. 47,000 at a profit of 20%. He earned a commission of $22\frac{1}{2}$% on the profit. Find the commission he earned. (2mks)
15. A car uses 1 litre of petrol for every 8 kilometres. The car was to travel 480 kilometres and had 15 litre of petrol at the beginning of the journey. Each litre of petrol cost sh. 112.00. How much did it cost for the extra petrol added? (3mks)
16. An enlargement with centre (-2,3) maps (1,0) onto (4,-3). What is the image of (-3,-6) with the same centre of enlargement (3mks)

SECTION II (50MKS)

Answer <u>any</u> five questions from this section in the spaces provided.

17 The height of a wooden solid cone is 45cm and its curved surface area is four times the area of the base. Calculate:

a) The radius of of the base (4mks)
b) The total surface area of the cone. (3mks)
c) The volume of the cone (3mks)

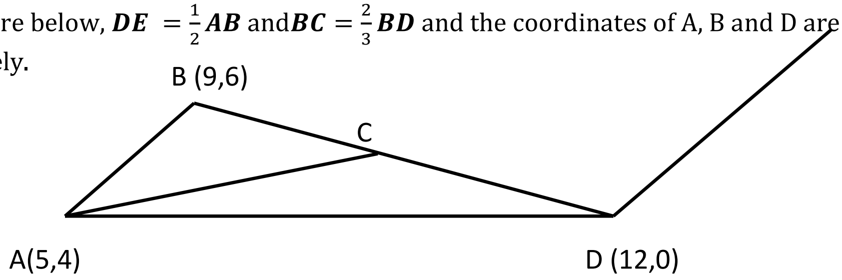
18. A trader sold his article at sh. 4800 after allowing his customers 20% discount on marked price of the article. In so doing he made a profit of 20%. After selling three – quarters of his stock, a new product entered the market and therefore he sold the remaining stock at 10% loss.

Calculate:

a) The marked price of the article (3mks)
b) The price at which the trader bought the article (2mks)
c) The percentage profit if he sold the article without allowing discount. (3mks)
d) The percentage profit he made from the total sales. (2mks)

19. a) Draw on graph paper triangle ABC, whose vertices are A(0,12), B(6,0) and C(12,18). Draw the line of symmetry for triangle ABC and write down its equation (2mks)
b) Draw A'B'C', the image of ABC, under reflection in the line y - x = 0 (3mks)
c) Write down the coordinates of the two points which are invariant under this transformation (2mks)
d) Determine the centre of rotation which maps A'B'C' onto ACB (3mks)

20. In the figure below, $\boldsymbol{DE} = \frac{1}{2}\boldsymbol{AB}$ and$\boldsymbol{BC} = \frac{2}{3}\boldsymbol{BD}$ and the coordinates of A, B and D are (5, 4), (9, 6) and (12, 0) respectively.



a) Find the column vectors:
i) BD
ii) BC
iii) CD
iv) AC

b) Given that AC = kCE, where k is a scalar,
Find:
i) The value of k
ii) The ratio in which C divides AE

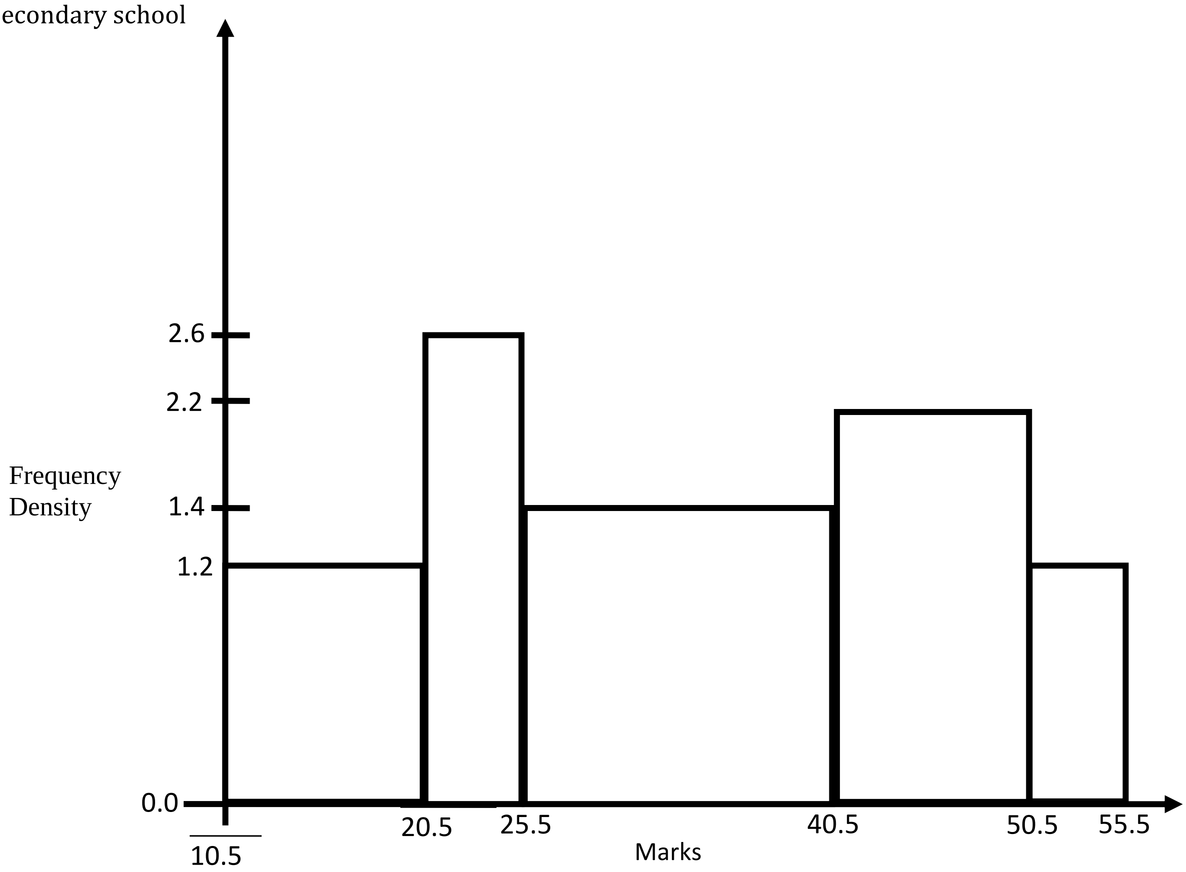
21. Kamdara and Jet are two towns 320 kilometres apart. A bus left A at 8.00 am travelling at 60km/h for town B. After forty minutes, a saloon car left A travelling in the same direction as the bus at a speed of 80km/h.

a) How far from B did the saloon car catch up with the bus? (4mks)
b) At what time did it catch up with the bus? (2mks)
c) When the saloon caught up with the bus it got a break – down and had to be repaired before proceeding to B at the same speed. If they both reached at B at the same time, find how long it took to repair the saloon? (4mks)

22. Three people Kariuki, Juma and Mulure are having their homes situated within the town. Mulure's home is 9km away from Juma's home on a bearing of 150^0. Kariuki's home is on a bearing N30^0E from Mulure's home and on a bearing of 135^0 from Juma's home.

a) Draw a sketch to show the relative position of the three homes (2mks)
b) Use your sketch to calculate the:
i) Distance of Kariuki's home from Juma's home (3mks)
ii) Distance of Mulure's home from Kariuki'e home (3mks)
iii) Bearing of Juma's home from Kariuki's home (2mks)

23. The diagram below shows a histogram representing marks obtained in maths test by form one of St. Teresa Boys Secondary school



a) Develop a frequency distribution table for the data (4mks)

b) State the modal frequency. (1mks)

c) Estimate the mean using and assumed mean of 33 (5mks)

24. Matrix T is given by $\begin{pmatrix} 4 & 7 \\ 5 & 5 \end{pmatrix}$ (2mks)

a) Find T^{-1}

b) Aquinas High School purchased 8 bags of rice and 14 bags of sugar for sh. 106,000.Buru Buru Girls High school purchased 10 bags of rice and 10 bags of sugar for sh. 95,000. Each bag of rice cost Sh.R and a bag of sugar coat sh. S.

i) Form matrix equation to represent the information above (1mk)

ii) Use the matrix T^{-1} to find the prices of one bag of each item. (4mks)

c) The price of beans later went up by 5% and that of sugar remained constant. Buru Buru Girls bought the same quantity of rice but spent total amount of sh. 87,250 on the two items. State the new ratio of rice to sugar. (3mks)

KAMDARA JET– 2015
121/2

MATHEMATICS

PAPER 2
July/August 2015
2 ½ hrs

*Answer **all** the questions in this section in the spaces provided*

1. Use logarithms in all steps to evaluate: $\dfrac{2.53^2 \times 83.45}{\sqrt{0.4562}}$ (4mks)

2. Find the range of value of $\dfrac{76.8 \times 16}{40.18 \div 20.6}$ (3mks)

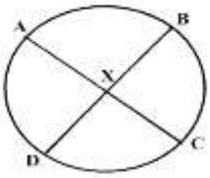
3. A quantity T is partly constant and partly varies as the square root of S.
   a) Using constants a and b write down an equation connecting T and S (1 mk)
   b) If S=16 when T=24 and S=36 when T=32,Find the values of the constants a and b (2 mks)

4. Given that $A = \pi(R - r)(R + r)$, Make R the subject of the formula (3mks)

5. Without using tables or calculator, solve for x.

   $\frac{1}{2}\log_3 729 - 2\log_3 x + 1 = 0$ (3mks)

6. In the diagram below, X is the point of intersection of the chords AC and BD of the circle such that AX = 8cm, XC = 4cm and XD = 6cm.



   (a) Find the length of XB. (2mks)
   (b) Given that the area of triangle AXD = 6cm^2. Find the area of triangle BXC. (2mks)

7. Two grades of Kenyan coffee costing sh. 200 and sh. 250 per kg respectively are mixed in the ratio 3:5 by weight. The mixture is then sold at ksh. 240 per kg. Find the percentage profit on the cost. (3mks)

8. A shear parallel to the x-axis maps point (1,2) onto a point (5, 2) .Determine the shear factors and hence state the shear matrix (invariant line is y = 0) (3mks)

9. a) Expand and simplify the binominal expression (2+ 2y)^5 in ascending powers of y (2mks)
   b) Use the expansion up to the fourth term to evaluate (2.02)^5 correct to 4 decimal places. (2mks)

10. Without using a calculator or mathematical tables, express $\frac{cos\ 30^0}{\tan 45^0 + \sqrt{3}}$in surd form and simplify

    Leaving your answer in the form a+ b √c where a, b, and c are rational numbers (3mks)

11. Find the equation of the normal of the curve. $y = x^5 + 3x^2 + 5x$at the point (1, 3) (3mks)

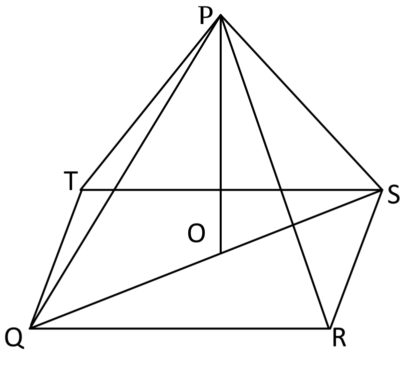
12. Give that x^2 + 6x +y^2 – 8y - 11= 0 is the equation of a circle, find the centre and the radius of the circle. (3mks)

13. If **r** = 3**i** – **j** + **k** and **t** = **j** + 2**k**. P = **r** -2 **t** find |**P**| to 4 s.f. (3mks)

14. Solve for x in the equation $3cos^2x + sin\ x + 1 = 0 \qquad 0 \leq x \leq 360^0$(4mks)

15. An object of an area 4cm^2 is mapped onto an area 64cm^2 under the transformation of matrix$\begin{pmatrix} n & 7 \\ -1 & n \end{pmatrix}$. Find the possible values of *n*. (2mks)

16. In the figure below, PQRST right pyramid on a rectangular base. Point O is vertically below P, QR = 24cm, RS = 10cm and RP = 26cm. Calculate the angle the plane RSP makes with the base. (3mks)



Section II (50 marks)

*Answer any **five** questions in this section*

17. Two tanks of equal volume are connected in such a way that one tank can be filled by pipe A in 1 hour 20 minutes. Pipe B can drain one tank in 3hours 36 minutes but pipe C alone can drain both tanks in 9 hours. Calculate:
    (a) The fraction of one tank that can be filled by pipe A in one hour. (2mks)
    (b) The fraction of one tank that can be drained by both pipes B and C in one hour. (4mks)
    (c) Pipe A closes automatically once both tanks are filled. Assuming that initially both tanks are empty and all pipes opened at once, calculate how long it takes before pipe A closes. (4mks)
18. The first three terms of a geometric series are $2x, x-8$ and $2x+5$ respectively.
    a) Find the possible values of x. (4mks)
    b) For the value of x being an integer, find:
    i) The value of the eleventh term (3mks)
    ii) The sum of the first 15 terms (3mks)
19. A man sold a plot of land for sh. 160,000 and invested the money in a bank which pays 12% p.a. compounded semi-annually. After 2 years, he withdrew sh. 100,000 and the left the rest for a further 3 years.
    a) How much did she leave in the bank at the end of 2 years? (4mks)
    b) How much did he have in the bank at the end of 5 years? (4mks)
    c) Calculate the total interest made for the whole period. (2mks)
20. a) Complete the table below for the functions $y = 3\sin(2x-30^0)$ and $y = \cos(x+60^0)$ for $-180^0 \leq x \leq 180^0$(2mks)

X	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
$3\sin(2x-30^0)$	-1.50	1.50	3.00			-3.00		1.50	3.00	1.50	-1.50		
$\cos(x+60^0)$		0.00		0.87	1.00	0.87	0.50	0.00			-1.00		

    (b) Draw the graph of the functions on the same axes on the grid provided. (5mks)
    (c) Use your graph to solve
    (i) $3\sin(2x-30^0) = 0.8$ (1mk)
    (ii) $3\sin(2x-30^0) - \cos(x+60^0) = 0$ (1mk)
    (iii) $\cos(x+60^0) = -0.2$ (1mk)
21. Every evening before the end of preps, Eunice either reads a novel or solves a mathematical problem. The probability that she reads a novel is$\frac{4}{5}$. If she read a novel, there is a probability of $\frac{3}{4}$ that she will fall asleep. If he solves a mathematical problem, there is a probability of $\frac{1}{4}$ that she will fall asleep. Sometimes the teacher on duty enters Eunice's classroom. When Eunice is asked whether she had been asleep, there is a probability of only $\frac{1}{5}$ that she will admit that she had been asleep and a probability of $\frac{3}{5}$ that she will claim to have been asleep when she had not been asleep
    By use of a tree diagram, find the probability that
    a) She sleeps and admits (4 mks)
    b) She sleeps and does not admit (2 mks)
    i. She does not sleep but claims that she had been asleep (2 mks)
    ii. She does not sleep and says that she has not been asleep (2 mks)
22. a) Complete the table of the functions $y = 1 + x - 2x^2$ (2mks)

x	-3	-2	-1	0	1	2	3
$-2x^2$	-18			0	-2		
3	3	3	3	3	3	3	3
y	-18	-7			0		

    b) Draw the graph of the function $y = 3 + x - 2x^2$on the graph paper provided. (3mks)
    c) Use your graph to find the value for x in the equation $3 + x - 2x^2 = 0$ (2mks)
    d) By drawing a suitable line graph on the same graph find the value for **x** which satisfies the equation
    $2 + 2x - 2x^2 = 0$ (3mks)
23. A particle **P** moves in a straight line so that its velocity, V m/s at time $t \geq 0$ seconds t is given by
    $V = 28 + t - 2t^2$. Find
    a) The time when p is momentarily at rest. (3mks)
    b) The speed of **P** at the instant when the acceleration of the particles is zero. (4mks)
    c) Given that **P** passes through the point O of the line when t = 0, find the distance of **P** from **O** when **P** is momentarily at rest. (3mks)
24. An aircraft leaves town P (30°S, 17°E) and moves directly northwards to Q(60°N, 17°E). It then moved at an average speed of 300 knots for 8 hours westwards to town R. Determine;
    a) The distance PQ in nautical miles. (3mks)
    b) The position of town R. (3mks)
    c) The local time at R if local time at Q is 3.12p.m (2mks)
    d) The total distance moved from P to R in kilometers. Take 1 nautical; = 1.853 kilometres. (2mks)

KAMDARA JET– 2015

121/1
MATHEMATICS
PAPER 1
JULY/AUGUST 2015
TIME: 2 ½ HOURS

Qs	SOLUTIONS		
1	$\frac{\sqrt{7056}}{7\times15\div3-(9+14)}$ $\frac{\sqrt{2\times2\times2\times2\times3\times3\times7\times7}}{7\times15\div3-23}$ $\frac{\sqrt{2^4\times3^2\times7^2}}{7\times5-23}$ $\frac{2^2\times3\times7}{35-23}$ $\frac{2^2\times3\times7}{12}=7$	10	$y\ =\ 5/3-2/3x$ $gradient\ (m1)\ =\ -2/3$ $gradient\ m2\ =\ 3/2$ $\underline{1-\ m\ =\ 3}$ $2-\ 4\quad 2$ $2-2m\ =\ -6$ $2m\ =\ 8$ $m\ =\ 4$ $\underline{y\ -\ 1\ \ =\ 3}$ $x-2\quad 2$ $2y-2\ =\ 3x-6$ $2y\ =\ 3x-4$ $y\ =\ 3/2x\ -\ 2$
2	$New\ price=120\%\ Old\ price$ $New=70\%\ of(\ 120\%\ of\ old\ price$ $New=0.7\times1.2=0.84\ OP$ $NP=0.84OP$ $NP:OP=0.84:1=21:25$	11	$Volume=\frac{384}{0.6}=640$ $\frac{22}{7}\times3.2\times3.2\times h=640$ $h=640\times\frac{7}{22}\div3.2\div3.2$ $=19.89cm$
3	$\sqrt[3]{270}\times\sqrt[3]{10^{-3}}=$		
4	$No\ of\ sides=\frac{360}{24}=15$ $No\ of\ tiangles=15-2=13$ $Sum\ of\ angle=13\times180=2{,}340^0$	12	
5	$4x-3\ \ \geq\ 6x-1\quad 6x\ -1\ <\ 3x\ +\ 16$ $4x-6x\ \geq\ -1\ +3\qquad 6x-3x\ <\ 16\ +\ 1$ $2x\geq2\qquad\qquad 3x\ <\ 17$ $x\ \geq1\qquad\qquad x\ <\ 17/3$ $x\ <\ 52/3$ $1\geq x\ \ 52/3$ $Integral\ solutions$ $1,2,3,4,5$	13	$\frac{x}{y}=\frac{9}{11}\quad\rightarrow x=9k\ and\ y=11k$ $\{5(9k)-3(11k)\}:\{2(9k)+3(11k)\}$ $(45k-33k):(18k+33k)$ $12k:51k$ $=4:17$
6	$QS=\frac{6.5}{\tan30}=112.58m$ $SR=\frac{65}{\tan60}=37.53$ $QR=112.58+37.53=150.11m$ $Area=\frac{1}{2}\times150.11\times65=4878.575\ m^2$	14	$Profit=\frac{20}{100}\times47{,}000=Sh.9{,}400$ $Commission=\frac{45}{200}\times9{,}400=Sh.2{,}115$
		15	$Total\ Litres\ Required=\frac{480}{8}=60litres.$ $Extra\ Required\ litres=60-15=45km$ $Cost\ of\ fuel=45\times112=Sh.5{,}040$
7	$3(3^x)+3^x+1=109$ $4(3^x)=108$ $3^x=27=3^3$ $x=3$	16	$k=\frac{4--2}{1--2}=\frac{6}{3}=2$ $\frac{x--2}{-3--2}=2$ $x+2=-2\quad x=-4$ $\frac{y-3}{-6-3}=2$ $y-3=-18\quad y=-15$ $Image=(-4,-15)$
8.			
9	$\underline{3(t^2-2^2)}$ $3-1-t$ $\underline{3(t+\ 2)\ (t-2)}$ $2-t$ $\underline{-3\ (t\ +\ 2)\ (2-t)}$ $(2-t)$ $=\ -3\ (t\ +\ 2)$		

17

$CSA = \pi rl \quad and \quad circular\ base = \pi r^2$

$l^2 = 45^2 + r^2$

$\pi r \times (2025 + r^2)^{\frac{1}{2}} = 4\pi r^2$

$2025 + r^2 = (4r)^2 = 16r^2$

$15r^2 = 2025$

$r^2 = 135 \quad r = 11.62$

$Base\ area = \pi r^2 = \frac{22}{7} \times 135$

$= 424.29cm^2$

$Total\ SA = 4 \times 424.29 + 424.29$

$= 2{,}121.45cm^2$

$Volume = \frac{1}{3} \times \frac{22}{7} \times 135 \times 45$

$6{,}364.3cm^3$

18

$SP = 80\%\ of\ Marked\ Price$

$Marked\ price = 4800 \times \frac{100}{80}$

$= Sh6{,}000$

$Selling\ Price = 120\% = 4800$

$Cost\ price = 4800 \times \frac{100}{120}$

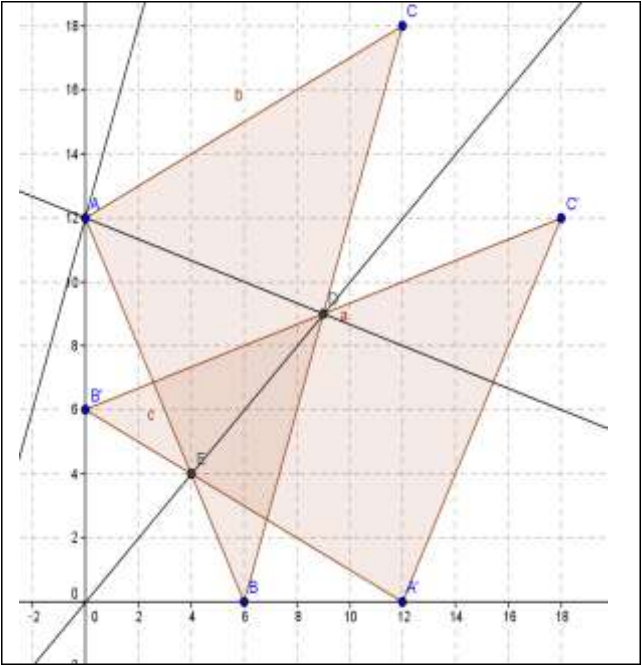
$= Sh.4{,}000$

$Profit\ without\ discount = 6000 - 4000 = 2000$

$Percentage\ profit = \frac{2000}{4000} \times 100$

$= 50\%$

19



20

$BD = \begin{pmatrix}12\\0\end{pmatrix} - \begin{pmatrix}9\\6\end{pmatrix} = \begin{pmatrix}3\\-6\end{pmatrix}$

$BC = \frac{2}{3}\begin{pmatrix}3\\-6\end{pmatrix} = \begin{pmatrix}2\\-4\end{pmatrix}$

$CD = \frac{1}{3}\begin{pmatrix}3\\-6\end{pmatrix} = \begin{pmatrix}1\\-2\end{pmatrix}$

$AC = AB + BC$

$AB = \begin{pmatrix}9\\6\end{pmatrix} - \begin{pmatrix}5\\4\end{pmatrix} = \begin{pmatrix}4\\2\end{pmatrix}$

$AC = \begin{pmatrix}4\\2\end{pmatrix} + \begin{pmatrix}2\\-4\end{pmatrix} = \begin{pmatrix}6\\-2\end{pmatrix}$

21

$Time\ taken = \frac{x - 40}{60} = \frac{x}{80}$

$80x - 3200 = 60x$

$20x = 3200$

$x = 160km$

$320 - 160 = 160km$

$Time\ taken = \frac{160}{80} = 2hrs$

$Time = 8.40 + 2.00 = 10.40am$

$Bus\ took = \frac{160}{60} = 2hrs\ 40\ min$

$Saloon\ took = \frac{160}{80} = 2hrs$

$Repair\ time = 2hr\ 40min - 2hrs = 40min$

22

23

Class	*i*	fd	x	f	x-A	fd
10.5-20.5	10	1.2	15.5	12	-17.5	-210
20.5-25.5	5	2.6	23	13	-10	-130
25.5 – 40.5	15	1.4	33	21	0	0
40.5 – 50.5	10	2.2	45.5	22	12.5	275
50.5 – 55.5	5	1.2	53	6	20	20
Total				74		55

B1 B1 B1 B1 B1 B1 B1

$Modal\ Frequency = 22$

$Mean = 33 + \frac{55}{74}$

$Mean = 33 + 0.7432 = 33.7432$

24

$Det = 20 - 35 = -15$

$Inverse = -\frac{1}{15}\begin{pmatrix}5 & -7\\-5 & 4\end{pmatrix} = \begin{pmatrix}-\frac{1}{3} & \frac{7}{15}\\ \frac{1}{3} & -\frac{4}{15}\end{pmatrix}$

$8R + 14S = 106{,}000$

$10R + 10S = 95{,}000$

$4R + 7S = 53{,}000$

$5R + 5S = 47{,}500$

$\begin{pmatrix}4 & 7\\5 & 5\end{pmatrix}\begin{pmatrix}R\\S\end{pmatrix} = \begin{pmatrix}53{,}000\\47{,}500\end{pmatrix}$

$\begin{pmatrix}-\frac{1}{3} & \frac{7}{15}\\ \frac{1}{3} & -\frac{4}{15}\end{pmatrix}\begin{pmatrix}4 & 7\\5 & 5\end{pmatrix}\begin{pmatrix}R\\S\end{pmatrix} = \begin{pmatrix}-\frac{1}{3} & \frac{7}{15}\\ \frac{1}{3} & \frac{4}{15}\end{pmatrix}\begin{pmatrix}53{,}000\\47{,}500\end{pmatrix}$

$\begin{pmatrix}R\\S\end{pmatrix} = \begin{pmatrix}4{,}500\\5{,}000\end{pmatrix}$

$R = Sh.4{,}500 \quad and\ S = Sh.5{,}000$

$New\ price = \frac{105}{100} \times 4{,}500 = Sh.4{,}725$

$10 \times 4{,}725 + 5000s = 87250$

$5000s = 40{,}000$

$S = 8$

$Ratio = 10 : 8 = 5 : 4$

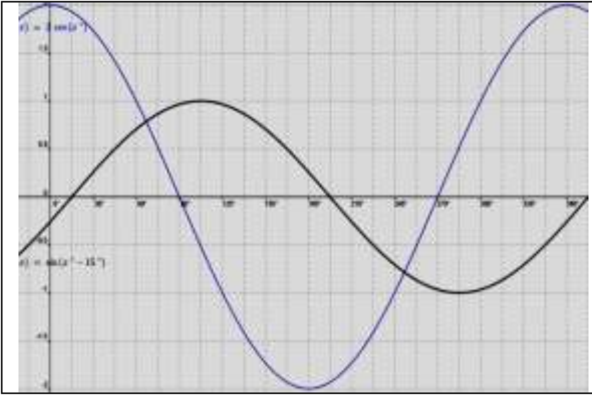
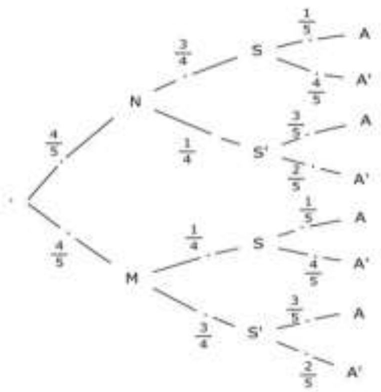
KAMDARA JET– 2015

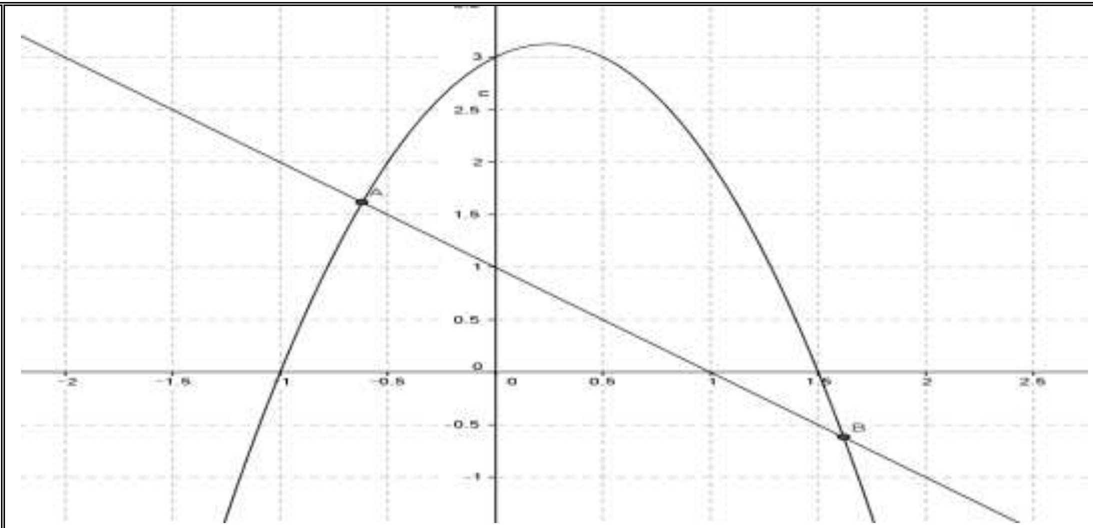
121/2
MATHEMATICS
PAPER 2
JULY/AUGUST 2015
TIME: 2 ½ HOURS

<table>
<tr><td></td><td><table><tr><th>No</th><th>log</th></tr><tr><td>2.53</td><td>0.4031
2
0.8062</td></tr><tr><td>83.45</td><td>1.9214
2.7276</td></tr><tr><td>0.4562</td><td>1.6592
2
1.8296</td></tr><tr><td>= 7.901x10²
= 790.1</td><td>2.8980</td></tr></table></td><td>M1
M1
M1
A1</td></tr>
<tr><td>2</td><td>$Maximum\ value = \frac{76.85 \times 16.5}{40.175 \div 20.65}$
$= 651.766$
$Minimum\ Value =$
$\frac{76.75 \times 15.5}{40.185 \div 20.75}$
$\frac{19747775}{32148} = 614.277$
$614.277 \leq Value \leq 651.766$</td><td>M1
M1
A1</td></tr>
<tr><td>3</td><td>$P = \frac{kr}{\sqrt{q}}$
$P = \frac{k(1.4r)}{\sqrt{(0.64q)}}$
$P = \frac{1.4kr}{0.8\sqrt{q}}$
$P = \frac{1.75kr}{\sqrt{q}} - \frac{kr}{\sqrt{q}} = 75\%$</td><td>M1
M1
A1</td></tr>
<tr><td>4</td><td>$R^2 - r^2 = \frac{A}{\pi}$
$R^2 = r^2 + \frac{A}{\pi}$
$R = \pm \sqrt{r^2 + \frac{A}{\pi}}$</td><td>M1
M1
A1</td></tr>
<tr><td>5</td><td>$Log 7291/2 – \ log\ x2\ +\ log\ 3 =\ log\ 1$
$\frac{27}{x^2} \times 3 = 1$
$X2 = 81$
$X =\ 9$</td><td>M1
M1
A1</td></tr>
<tr><td>6</td><td>$6y = 8 \times 4 = 32$
$y = \frac{32}{6} = 5\frac{1}{3} cm$
$lsf\ = \frac{2}{3}$
$asf\ = \frac{4}{9} area = \frac{4}{9} \times 6 = \frac{8}{3} cm^2$</td><td>M1
A1
M1
A1</td></tr>
</table>

7.	$Cost\ of\ Mixture = \frac{3}{8} \times 200 + \frac{5}{8} \times 250$ $= 231.25$ $Profit = 240 - 231.25 = 8.75$ $Percentage = \frac{8.75}{231.25} \times 100 = 3.784\%$	M1 M1 A1
8.	$\begin{pmatrix} m & 1 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} m+2 \\ 2 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$ $m + 2 = 5$ $m = 3$ $\begin{pmatrix} 3 & 1 \\ 0 & 1 \end{pmatrix}$	M1 A1 B1
9.	$32 + 5(2)^4 2y + 10(2)^3(2y)^2 + 10(2)^2(2y)^3$ $+5(2)(2y)^4 + (2y)^2$ $32 + 160y + 320y^2 + 320y^3 + 160y^4 + 32y^5$ $y = 0.01$ $32 + 1.60 + 0.032 + 0.00032$ 33.63232	M1 A1 M1 A1
10	$\frac{\frac{\sqrt{3}}{2}}{1+\sqrt{3}}$ $\frac{\sqrt{3}}{2(1+\sqrt{3})} \times \frac{1-\sqrt{3}}{1-\sqrt{3}}$ $\frac{\sqrt{3}-3}{2(1-3)}$ $\frac{\sqrt{3}-3}{-4} = \frac{3}{4} - \frac{\sqrt{3}}{4}$	B1 M1 M1 A1
11	$\frac{dy}{dx} = 5x^4 + 6x + 5$ $At\ x = 1$ $Mc = 5 + 6 + 5 = 16$ $\frac{y-3}{x-1} = 16$ $y - 3 = 16x - 16$ $y = 16x - 13$	B1 M1 A1
12	$x^2 + 6x\ + K + y^2 + - 8y\ + L – 11 = K\ + L$ $x^2\ +\ 6x\ + 9\ +\ y2 -\ 8y\ + 16$ $= 11\ + 9\ + 16$ $(X + 3)^2\ +\ (y -\ 4)2\ =\ 36$ $Center\ (-3, 4)$ $Radius\ 6\ units$	M1 M1 A1
13	$P = 3i - j + k - (j + 2k)$ $= 3i - 3j - 3k$ $\lvert P \rvert = \sqrt{9+9+9} = \sqrt{27} = 3\sqrt{3}$	M1 A1 B1

14	$cos^2\vartheta = 1 - \sin^2\vartheta$ $3(1 - sin^2\vartheta) + \sin\vartheta + 1 = 0$ $3sin^2\vartheta + \sin\vartheta + 4$ $\sin\vartheta = \frac{1+\sqrt{1+48}}{6} = \frac{1 \pm 7}{6} = -1$ $\vartheta = 225^0 or\ \vartheta = 315^0$	M1 M1 A1 B1
		4
15	$Area\ ratio\ is\ 16$ $n2 + 7\ =\ 16$ $n2\ - 9\ = 0\qquad n = 3\ or\ -3$	M1 A1
16	$Base\ diagonal\ = \sqrt{(24^2 +\ 10}2)\ = 26$ $OP\ = \sqrt{(26^2 - 13^2)} = 22.52$ $\frac{22.52}{12}\ =\ tan\ \theta$ $Angle\ between\ the\ base\ and\ plane$ $RSP\ and\ the\ base\ = 61.950$	M1 M1 A1
17	$In\ 1\min = \frac{1}{80}$ $In\ 1\ hour = \frac{3}{4}$ $B\ aloe\ in\ a\ min = \frac{1}{216}$ $In\ 1\ hour = \frac{5}{18}$ $C\ in\ both\ in\ 1\min = \frac{1}{540}$ $C\ \ in\ 1\ tank\ in\ 1\ min = \frac{1}{270}$ $In\ 1\ hour = \frac{2}{9}$ $Both\ in\ 1hrs = \frac{2}{9} + \frac{5}{18} = \frac{1}{2}$ $In\ 1\ hr\ all\ taps\ opened = \frac{3}{4} - \frac{1}{2} = \frac{1}{4}$ $Both\ tank = \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$ $Total\ time = 8\ hours$	M1 A1 M1 M1 M1 A1 M1, M1 M1 A1
18	$\frac{x-8}{2x} = \frac{2x+5}{x-8}$ $(x-8)^2 = 2x(2x+5)$ $x^2 - 16x + 64 = 4x^2 + 10x$ $3x^2 + 26x - 64 = 0$ $3x^2 + 32x - 6x - 64 = 0$ $x(3x+32) - 2(3x+32) = 0$ $(x-2)(3x+32) = 0$ $x = 2\ or\ x = \frac{-32}{3}$ $a = 3, T2 = -6, T3 = 9$ $r = -\frac{6}{3} = -2$ $T11 = 4(-\frac{3}{2})^{10} = 230.66$ $S15 = \frac{4\left\{1 - \left(-\frac{3}{2}\right)^{15}\right\}}{1 + \frac{3}{2}}$ $= \frac{4(1 + 437.894)}{\frac{5}{2}} = 702.2$	M1 M1 M1 A1 M1 M1 A1 M1 M1 A1

19	$Amount = 160{,}000(1.06)^4$ $= 201{,}996$ $Left = 201{,}996 - 100{,}000$ $= 101{,}996$ $A = 101996 \times 1.06^6$ $Sh. 144{,}68$ $Total\ Amount$ $= 144{,}68$ $+ 100{,}000$ $- 160{,}000$ $= Shs. 84{,}683$	
20		
21	 (a) $(NSA) or\ P(MSA)$ $= \left(\frac{4}{5} \times \frac{3}{4} \times \frac{1}{5}\right) + \left(\frac{1}{5} \times \frac{1}{4} \times \frac{1}{5}\right)$ $= \frac{13}{100}\ or\ 0.13$ (b) $P(NSA') or\ P(MSA')$ $= \left(\frac{4}{5} \times \frac{3}{4} \times \frac{4}{5}\right) + \left(\frac{1}{5} \times \frac{1}{4} \times \frac{4}{5}\right)$ $= \frac{52}{100}\ or\ 0.52$ (c) $P(NS'A) or\ P(MS'A)$ $= \left(\frac{4}{5} \times \frac{1}{4} \times \frac{3}{5}\right) + \left(\frac{1}{5} \times \frac{3}{4} \times \frac{3}{5}\right)$ $= \frac{21}{100}\ or\ 0.21$ (d) $P(NS'A') or\ P(MS'A')$ $= \left(\frac{4}{5} \times \frac{1}{4} \times \frac{2}{5}\right) + \left(\frac{1}{5} \times \frac{3}{4} \times \frac{2}{5}\right)$ $= \frac{14}{100}\ or\ 0.14$	B2 M1 A1 M1 A1 M1 A1 M1 A1

22	 $y = 1 - x$ $x = -0.62 + 0.1 \quad x = 1.62 \pm 0.1$	
23	$2t^2 - t - 28 = 0$ $2t^2 - 8t + 7t - 28 = 0$ $2t(t-4) + 7(t-4) = 0$ $(2t+7)(t-4) = 0$ $t = 4\ sec$ $\frac{dy}{dx} = 1 - 4t$ $4t = 1$ $t = \frac{1}{4}\ sec$ $V = 28 + \frac{1}{4} - 2\left(\frac{1}{4}\right) 28\frac{1}{8}\ m/s$ $S = -\frac{2}{3}t^3 + \frac{1}{2}t^2 + 28t + 0$ $At\ t = 4$ $S = 28 \times 4 + \frac{1}{2} \times 16 - \frac{2}{3} \times 64 = 77\frac{1}{3}\ metres$	M1 M1 A1 M1 A1 M1 A1 M1 M1 A1
24	$lat\ diff = 60 - 30 = 30$ $distance = 30 \times 60 = 1800\ nm$ $Distance = 8 \times 300 = 2400nm$ $(x + 17)60 \cos 60 = 2400$ $x + 17 = \frac{2400}{30} = 80$ $x = 63^0$ $Position\ of\ R(60^0N, 63^0)$ $Lang\ Diff = 17 + 63 = 80$ $Time\ Diff = 80 \times \frac{4}{15} = 5hrs\ 20\ min$ $Local\ Time = 15\ hr\ 20\ min - 5hr\ 20\ min$ $9.52\ a.m$ $Distance = 1800 + 2400 = 4200$ $4{,}200 \times 1.853 = 7{,}782.6\ km$	M1 A1 M1 M1 A1 B1 M1 A1 M1 A1

MERU FORM 4 JOINT EVALUATION TEST

121/1
MATHEMATICS
PAPER 1
JULY/AUGUST 2015
TIME: 2 ½ HOURS

SECTION 1 (50 MARKS)

Answer ALL the questions in this section.

1. Evaluate using logarithms (4 Marks)

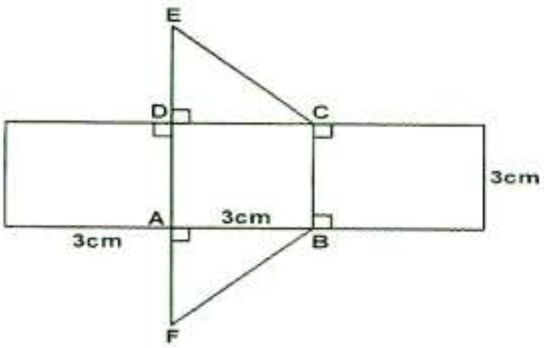
   $\sqrt[5]{\frac{6.231}{242.7}}$

2. Use the prime factors of 3136 and 2744 to evaluate: (3 Marks)

   $\frac{\sqrt{3136}}{\sqrt[3]{2744}}$

3. A rectangular slab of glass measures 8cm by 3cm by 2cm and has a mass of 5.5kg. Calculate the density of glass in g/cm^3. (3 Marks)

4. The figure below shows a net of a solid which is not drawn to scale.



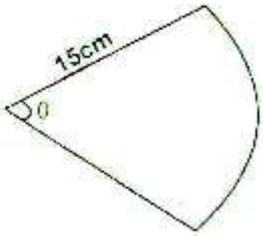
   (a) Sketch the solid ABCDEF with ABCD as the base. (2 Marks)
   (b) Calculate its volume. (2 Marks)

5. A trader at Chuka town sells a school shirt at Sh. 725 and makes 45% profit. During clearance sale he reduced the price of the shirt by 20%. What percentage profit did he make. (3 Marks)

6. Fine the value of x in the equation: (3 Marks)

   $27^x + 33^{x-1} = 108$

7. The figure below shows a sector of a circle of radius 15cm. Calculate the area of the sector given than angle $\theta = 2.4$ radians. (2 Marks)



8. Simplify the expression completely: (3 Marks)

   $\frac{12x^2-6xy+4y^2}{18x^2-2y^2}$

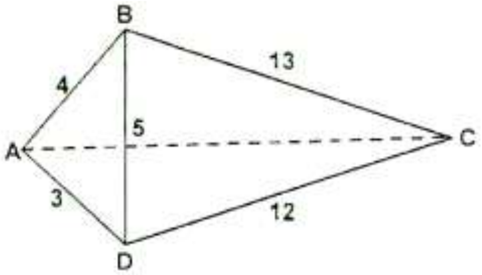
9. A ship sails from harbour P on an bearing 030^0 for 900km until it reaches harbour Q. It then alters its direction to a bearing of 340+ and sails from 1200km to harbour R. Calculate the distance between harbours P and R. (3 Marks)

10. A regular polygon has the sum of its interior angles as 1800^0.
    (i) How many sides are there in the polygon? (2 Marks)
    (ii) How many triangles can be made by joining one of its vertices with all other vertices with straight lines. (1 Mark)

11. Without using a calculator evaluate $\frac{-8 \div 11 - 2}{4 \div 16\ of -2\ x\ 51 \div 33}$ giving your answer as a mixed fraction. (3 Marks)

12. Solve the inequality $3 - x < x \leq \frac{2x+5}{3}$ and state the integral values satisfying the solution. (3 Marks)

13. The figure below shows the section of a wedge. AB = 4cm, BC = 13cm, CD = 12Ccm, AD = 3cm and BD = 5cm.



Given that angle ADC = 90^0, find the volume of the solid and the length of AC. (4 Marks)

14. Using reciprocal tables only evaluate $\frac{30}{0.01492}+\frac{12}{16.58}$ correct to 4 S.F (3 Marks)

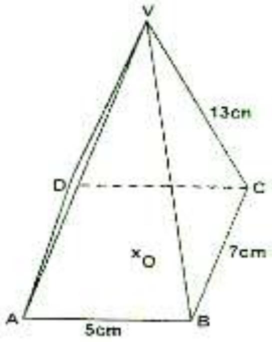
15. The cost per kg of Sony Sugar is KSh. 60 and the cost per kg of Imported Sugar is KSh. 80. The two brands of Sugar are mixed and sold at a profit of 30% above the cost. If 1kg of the mixture was sold at KSh. 84.50, determine the ratio in which the two brands were mixed. (3 Marks)

16. The points $P^1(5,4)$ and $Q^1(6,1)$ are the images of P and Q respectively under translation. Given that the co-ordinates of P and (2,3), find the co-ordinates of Q. (3 Marks)

SECTION II – 50 MARKS

Answer only FIVE questions from this section.

17. The figure below is a right rectangular based pyramid VABCD where AB = 5cm, BC = 7cm, VC = 13cm and O is a point on the base of the pyramid vertically below V.



Calculate

(a) AC (2 Marks)

(b) VO, the height of the pyramid. (2 Marks)

(c) the angle between the edge VB and the plane ABCD. (3 Marks)

(d) the angle between the planes VBC and ABCD. (3 Marks)

18. The table below shows the distribution of marks of 100 form three students in a mathematics examination.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
No. of students	2	8	15	18	17	14	10	8	6	2

(a) Using the scale of 1cm represent 10 marks and 1cm to represent 5 students draw a cumulative frequency curve to represent the above information on the provided grid.

(b) Using your graph, estimate the

(i) Median (1 Mark)

(ii) Semi-interquartile range (3 Marks)

(iii) number of students who passed if pass mark was 43% (2 Marks)

19. (a) A lamp shade is in the form of a frustum of a cone of diameter 21cm and 28cm. Its height is 10cm. Calculate the volume of the lampshade. (5 Marks)

(c) Two circles each of radius 5cm intersects such that the distance between their centres is 6cm. The length of the common chord joining the two points of intersection is 8cm. Calculate the area of intersection. (5 Marks)

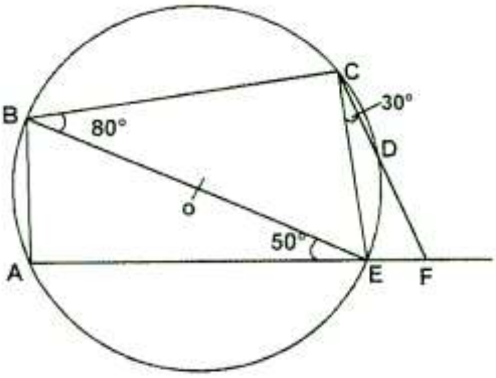
20. Use a ruler and a pair of compasses only for all construction in this question.

(a) Construct qualilateral PQRS such that PQ = 5cm, PS = 5cm and SR = 4.5cm, angle SPQ = 750^0 and angle PSR = 90^0. (4 Marks)

(b) Drop a perpendicular from S to meet line PQ at N. Measure SN and calculate the area of the triangle SPN. (3 Marks)

(c) Construct a circle passing through vertices P, Q and R of quadrilateral PQRS. Measure the radius of the circle. (3 Mark)

21. In the figure below, O is the centre of the circle. Angle AEB = 50^0, angle EBC = 80^0 and angle ECD = 30^0. Giving reasons calculate:



(a) Angle CDE (2 Marks)
(b) Angle DFE (2 Marks)
(c) Obtuse angle COE (2 Marks)
(d) Angle ADE (3 Marks)

22. The length and the width of a rectangular are (6x-1) and (x – 2) respectively. If the length and width are each increased by 4cm the new area is thrice that of the initial rectangle.
(a) Find the dimension of the initial rectangle. (6 Marks)
(b) By what percentage does the area of the rectangle increase after the change. (2 Marks)
(c) What is the difference in size between the length and the width of the initial rectangle. (2Marks)

23. A,B,C and D are four schools where B is 84km north of A an C is on a bearing of N65^0W from A at a distance of 60km. D is on a bearing of N20^0W from C and at a distance of 30km.
Use a scale drawing to show relative positions of A,B,C and D using a scale of 1cm to represent 10km. (5 Marks)
Find;
(a) the distance and bearing of B from C. (2 Marks)
(b) the bearing and distance of D from B. (2 Marks)
(c) the bearing of A and D. (1 Mark)

24. The velocity of a particle after t seconds is given by V = t2 – 4t + 4m/s. Determine the;
(a) initial velocity of the particle. (2 Marks)
(b) time taken the particle is momentarily at rest. (3 Marks)
(c) acceleration of the particle at t = 4. (2 Marks)
(d) displacement of the between t = 1 seconds and t = 13 seconds. (3 Marks)

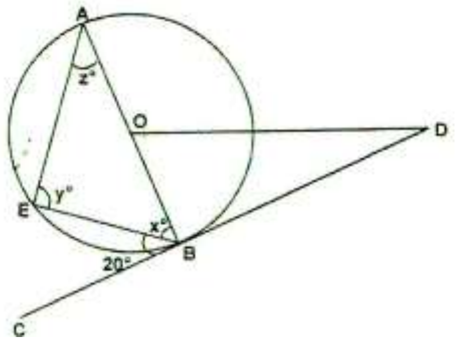
MERU FORM 4 JOINT EVALUATION TEST

121/2
MATHEMATICS
PAPER 2
JULY/AUGUST 2015
TIME: 2 ½ HOURS

SECTION I (50 MARKS)

Answer ALL questions in this section.

1. The seventh term of an arithmetic progression is 15 while twice the third is 94. Calculate the first term and the common difference of the progression. (3 Marks)
2. The sides of a triangle were measured to 1dp as 6.4cm, 7.3cm and 8.2cm respectively. Calculate the percentage error in its perimeter. (3 Marks)
3. In the figure below AB is the diameter, CD is a tangent to the circle at B and angle CBE is 200. Calculate the angles labelled x, y and z. (3 Marks)



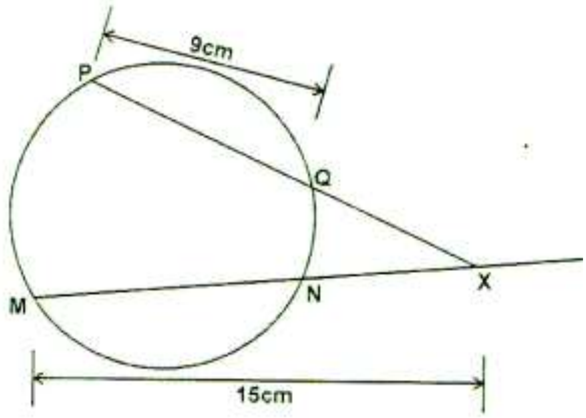
4. Simplify the fraction. (3 Marks)
$$\frac{\left(2\sqrt{3}-\sqrt{6}\right)^2}{3-2\sqrt{2}}$$
5. The table below shows masses of marbles in a certain lab.

Mass(g)	Number of marbles
20.0-20.4	5
20.5-20-9	7
21.0-21.4	16
21.5-21.9	10
22.0 – 22.4	14
22.5 – 22.9	13

Estimate the median using calculation. (4 Marks)

6. Given that Sin θ = $\frac{5}{13}$, determine the value of tan (90 - θ) without using a calculator or mathematical tables. (2 Marks)
7. Points P(2,3) and Q (4,5) are mapped into P^1(12,14) and Q^1 (22,24) respectively by a transformation matrix T. Find the matrix T.
8. Expand and simplify $(2 - y)^5$ and use the first four terms to find the approximate value of $(1.8)^5$ to 2 decimal places. (4 Marks)
9. AB is a diameter of a circle. Given that the coordinates of A and B are (-2,2) and (-2,6) respectively, find the equation of the circle in the form $ax^2 + by^2 + cx + dy + e = 0$ (3 Marks)
10. Solve for x in the equation. (3 Marks)
$2\text{Log}_{10}x + \text{Log}_{10}5 = 1 + 2\text{Log}_{10}4$.
11. Given that $\begin{pmatrix} 2x & 2 \\ -7x & (x-4) \end{pmatrix}$ is a singular matrix find the possible values of x. (3 Marks)
12. A fire engine left the fire station at 9.15 a.m and travelled with an average speed of 64km/h. At 10.10 a.m, an ambulance left the fire station and caught up with fire engine at 11.40 am. Find the average speed of ambulance to the nearest whole number. (3 Marks)

13. Find the length NX in the figure below that PQ = 9cm, PX = 12cm and MX = 15cm. (2 Marks)



14. In August 2014, a tourist visited Mombasa with 240 sterling pounds which she changed to Kenya Shillings at the rate of KSh. 112.00 per sterling pound. She spent KSh. 1000.00 on accommodation and a half of what remained on entertainment. The balance she converted to Sterling pounds at the rate of KSh. 113.50 per pound. How many Sterling pounds did she have left? (4 Marks)

15. Jane bought five Physics books and six Mathematics books for a total of Sh. 2440. Her friend Gakii bought two Physics books and three Mathematics books more than Jane and spent Sh. 3560.00.
Calculate the cost of each Mathematics book. (3 Marks)

16. Give that **a** = 6**i**, **b** = 5**i** – 3**j** and **c** = 3**i** + **j**, find scalars h and k such that h**a** + k**b** = c (3 Marks)

SECTION II – 50 MARKS

Answer only FIVE questions from this section.

17. (a) The n^{th} term of a series is given by 6 – 4n.
(i) Write down the first four terms of the series. (2 Marks)
(ii) Find the sum of the first 16 terms of the series. (3 Marks)
(iii) Find the 25^{th} term. (3 Marks)
(b) A colony of bees was found to have 100 bees at the beginning. Thereafter, the number doubled every two days. How many bees will be in the colony after 14 days? (3 Marks)

18. Weather records indicate that the probability of rain falling in Chuka town in March, July and September are$\frac{9}{10}$, $\frac{4}{10}$ and $\frac{1}{20}$ respectively. Calculate the probability that in a certain year:
(i) There will no rain in March, July and Sepemmber. (3 Marks)
(ii) There will be rain in March, July and September. (2 Marks)
(iii) There will be rain in at least 2 of the 3 months i.e. March, July and September. (3 Marks)
(iv) There will be rain in at most 2 of the 3 months i.e. March, July and September. (2 Marks)

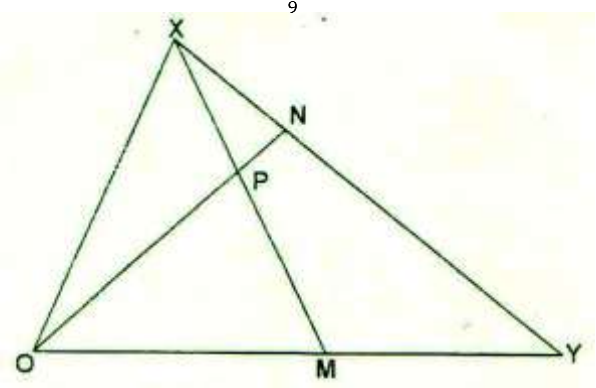
19. (a) In a certain year income tax was charged at the rates shown below.

Income (K£p.a)	Rate of tax KSh. per K£
1-5808	2
5809-11280	3
11281-16752	4
16753 – 22224	5
Above 2224	6

Mrs. Munene earns a basic salary of KSh. 15000.00, a house allowance of KSh. 8,000.00 and a commuter allowance of KSh. 2,000.00 per month. She pays a health insurance scheme at Sh. 320 per month and she is entitled to a personal relief of Sh. 1156.00 per month.
Determine
(i) Her annual taxable income in K£ (2 Marks)
(ii) The income tax she pays per year after relief. (4 Marks)

(b) A taxi businessman borrows Sh. 650,000.00 from a bank to buy a taxi valued at the same amount.
The bank charges interest at 24% p.a. compounded quarterly. Calculate the compound interest paid to the bank after 1 ½ years rounded to the nearest shilling. (4 Marks)

20. In the diagram below **OX = x** and **OY = y,** M and N are points on OY and XY respectively where OM = $\frac{1}{3}$OY and XN = $\frac{2}{5}$XY. Lines XM and ON interest at P such that OP = $\frac{5}{9}$ON.



(a) Express in terms of vector x and y.

(i) **XY** (1 Mark)

(ii) **ON** (2 Marks)

(iii) **XM** (1 Mark)

(b) Express **XP** and **PM** in terms of **x** and **y** (5 Marks)

(c) State the ratio XP:PM (1 Mark)

21. (a) Complete the table below by filling the blank spaces.

X^0	0^0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0	135^0	150^0	165^0	180^0
Sin θ	3			0			-3		-1.5				3
Cos θ			1.73		2				1		0		

(b) On the grid provided draw on the same axis the graph of y = 3Cos 2x and y = 2 Sin $(x + 30)^0$ for $0^0 \leq x \leq 180^0$. Use a scale 1cm to represent 1500 on the x-axis and 2cm to represent 1 unit on the y – axis.

(4 Marks)

(c) Use your graph to

(i) Solve for x when 2Sin $(x+30)^0$ – 3Cos $2x^0 = 0$ (2 Marks)

(ii) Estimate the range of x when 2Sin $(x+30)^0 \geq$ 3Cos2x giving your answer to the nearest degree. (1 Mark)

22. Two variables P and T are related by the formula P = yT^x where x and y are constants. The table below gives some values of the independent variable T and the corresponding values of the dependent variable P.

T	2	3	4	5	7
P	44.9	118.7	236.8	404.5	907

(a) Complete the table below correct to 2 decimal places for log T and log P. (2 Marks)

Log T	0.30				
Log P	1.65				

(b) Given that the two variables P and T satisfy the linear equation in the form of Log = p log y + xlogT, plot log p against T in the grid provided. Hence draw a line of best fit.

(*Use a scale of 2cm:0.1 units in the axis and 2cm : 0.5 units in the y axis)*

(c) Use your linear graph to obtain, correct to 1 d.p

(i) Constants x and y (3 Marks)

(ii) P when T = 6 (2 Marks)

23. (a) Complete the table given below for y = x3 – 4x2 + x + 6 for -2< x < 4. (3 Marks)

x	-2	-1	0	1	2	3	4
x^3		-1	0			27	64
$-4x^2$	-16	-4	0		-8		-64
x		-1	0	1			4
6	6	6	6	6	6	6	6
y		0	6				10

(b) On the grid provided draw the graph of $y = x^3 - 4x^2 + x + 6$ for -2< x <4. Use of a scale of 2cm to represent 1 unit on the x-axis and 1cm to represent 2 units on the y axis. (3 Marks)

(c) Use your graph to solve the equation $x^3 - 4x^2 + x = 6$ (1 Mark)

(d) By drawing a suitable straight the line estimate the roots of the equation. (3 Marks)

24. (a) X is directly proportional to the square y. What is the percentage change in x if y increases by 25%. (5 Marks)

(b) The mass of a solid metal ball varies jointly as a specific variable S and the cube of its diameter. When the diameter is 6cm S = 7.5 and the mass is 850g. Find the mass of the ball of S = 10.5 and diameter 8cm giving your answer to the nearest whole number. (5 Marks)

MERU FORM 4 JOINT EVALUATION TEST

121/1
MATHEMATICS
PAPER 1
JULY/AUGUST 2015
TIME: 2 ½ HOURS

1.

No.	Log
6.231	0.7946
÷242.7	2.3850 –
	$\bar{2}.4096$
	$\bar{2}.4096÷5$
	$= \frac{\bar{5}}{5} + \frac{3.4096}{5}$
0.4807	$= \bar{1}.6819$

2. $\frac{\sqrt{3136}}{\sqrt[3]{2744}}$

$\left.\begin{array}{l}3136 = 2^6 \text{ x } 7^2 \\ 2744 = 2^3 \text{ x } 7^3\end{array}\right\}$

$\Rightarrow \frac{\sqrt{2^6 x 7^2}}{\sqrt[3]{2^3 - 7^3}}$

$= \frac{2^3 \text{ x } 7}{2 \text{ x } 7} = 2^2$

$= 4$

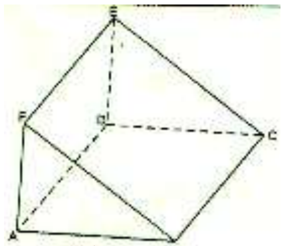
3. Volume = 8 x 3 x 2cm2

$D = \frac{M}{V}$

$= \frac{5.5 \text{ x } 1000 g/cm^3}{8 \text{ x } 3 \text{ x } 2}$

$= 114.5833 g/cm^3$

4. (a)



(b) Volume $= \frac{1}{2}$ x 3 x 3 x 3

5. x is buying price

$\frac{145x}{100} = 725$

$x = \frac{725 \text{ x } 100}{145} =$ Sh 500

Selling price $\frac{80}{100}$ x 725

= Sh. 580

% profit $= \frac{80}{500}$ x 100 = 16%

6. $3^{3x} + 3^{3x-1}$ 108 Let $t = 3^{3x}$

$t = \frac{t}{3} = 108$

3t + t = 324

$t = 81 = 3^{3x}$

$3^{3x} = 3^4$

3x = 4

$x = \frac{4}{3}$

$= 1\frac{1}{3}$ or 1.333

7. $A = \frac{1}{2}$ x 2.4 x 15 x 15

$= 270 cm^2$

8. $N = 12x^2 - 12xy - 4xy + 4y^2$

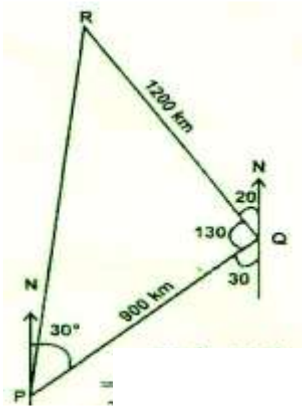
$= (12x - 4y)(x-y)$

$= 4(3x - y)(x-y)$

D = 2(9x2 – y2) = 2(3x + y)(3x-y)

$\frac{4(3x-y)(x-y)}{2(3x+y)(3x-y)} = \frac{2(x-y)}{3x+y}$

9.



$(PR)^2 = 900^2 + 1200^2 - 2(900)(120^0) \text{ Cos } 130$

= 2250000 + 1388421.2

= 3638421.4

PR = 1907.4646km

= 1907.46

10. (a) (2n – 4)90 = 1800

2n – 4 = 20

2n = 24

n = 12

(b) $\frac{1800}{180}$ = 10 triangles

11. $N = \frac{-8-2}{11} = \frac{-8-22}{11} = \frac{-30}{11}$

$D = \frac{4}{-32} \text{ x } \frac{51}{33} = \frac{-1}{8} \text{ x } \frac{51}{33}$

$= \frac{-1}{8} \text{ x } \frac{17}{11} = \frac{-17}{88}$

$= \frac{-30}{11} \text{ x } \frac{-88}{17} = \frac{240}{17}$

$= 14\frac{2}{17}$

12. 3 – x < x

3 < 2x

$1\frac{1}{2} < 2x$

$x \leq \frac{2x+5}{3}$

$x \leq 5$

$1.5 < x \leq 5$

x = 2, 3, 4 and 5 (integral values)

13. $\overline{AC}^2 = 3^2 + 12^2$ (⊥ angles Δ)
$\overline{AC} = \sqrt{153}$
$= 12.37$
Volume = $\frac{1}{3}$(Base Area) x Height
$= \frac{1}{3}(\frac{1}{2}$ x 3 x 4) x 12
$= 24cm^3$

14. Reciprocal of 0.0192 = 100 x 0.6701
$\frac{1}{16.58} = \frac{1}{10}$ x 0.6031
30 x 100 x 0.6701 + 12 x $\frac{1}{10}$ x 0.6031
$2010.3 + 0.7231^0 = 2011.02$
= 2011

15. Let mass of Sony sugar be xkg @ Sh. 60
Let mass of imported sugar be ykg @ Sh. 80
$\frac{60x+80y}{x+y} = 84.5 \text{ x } \frac{100}{130}$
60x + 80y = 65(x+y)
15y = 15x
$\frac{x}{y} = \frac{15}{3} = \frac{3}{1}$
∴ x : y = 3 : 1

16. $\binom{2}{3} + \binom{x}{y} = \binom{5}{4}$
$\binom{x}{y} = \begin{pmatrix} 5 & -2 \\ 4 & -3 \end{pmatrix} = \binom{3}{1}$

∴OQ is $\binom{3}{0}$
⇒Q (3,0)

SECTION II

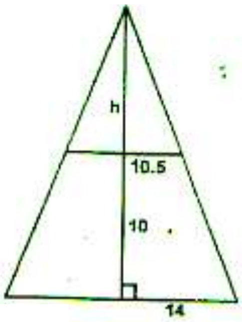
17. (a) AC = $\sqrt{5^2 + 7^2}$
(b) VO = $\sqrt{13^2 - 4.301^2}$
= 12.27
(c) BD = AC = 8.602
BO = $\frac{1}{2}$x8.602 = 4301
∠VBO = θ
Cos θ = $\frac{4.301}{13}$ = 0.3308
θ = Cos^{-}(0.3308) = 70.68
(d) VM = $\sqrt{MO^2 - VO^2} = \sqrt{2.5^2 + 12.27^2}$
$= \sqrt{156.8029}$
= 12.52
∠VMO = d
Cos d = $\frac{2.5}{12.52}$ = 0.1997
d = Cos-1(0.1997) = 78.48^0

18. (a)

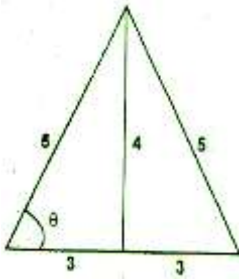
(a) Cumulative frequency
2,10,25,43,60,74,84,92,98,100
On Graph
(b) (i) Median = 44 Marks
(ii) Q3 – Q1 = 61 – 30.5 = 30.5
Semi-inter quartile range = $\frac{30.5}{2}$
= 15.25
(c) 43% → 48th student
100 – 48 passed
= 52±2

19

(a) h = $\frac{h+10}{14}$
14h = 10.5h + 105
3.5h = 105
h = 30

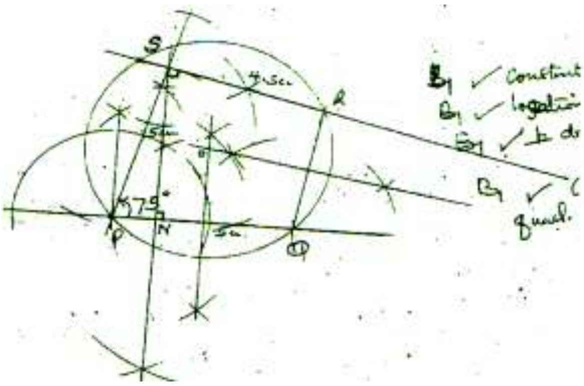


(b) $\frac{1}{3}$x $\bar{x}$x 142 x 40 - $\frac{1}{3}$ xx1$\overline{0}$.5^{2}x 30
= 8210 – 3463.6
= 4746.4
(c) Sin θ = $\frac{4}{5}$
θ = 53.13



Area = $2\left(\frac{106.26}{360}\ x \text{ x } 5^2 - \frac{1}{2}x5^2Sin106.26\right)$
= 2(23.18 – 12.00)
= 22.36

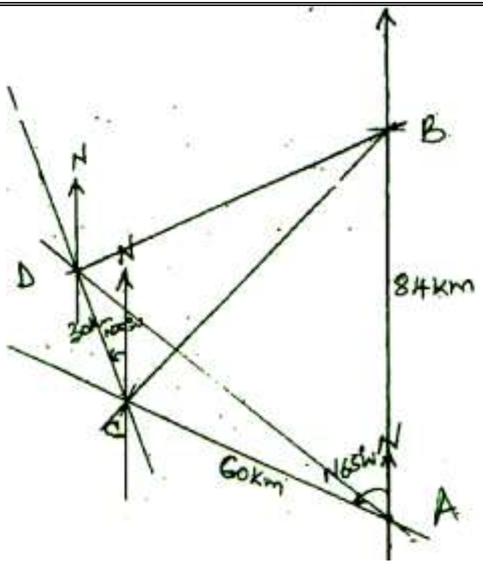
20



(b) SN = 4.8±0.1
Area = $\frac{1}{2}$ x 5 x 4.8Sin 15
= 3.106cm2
Radius 3.5±0.1

21

(a) ∠CDE = $180^0 – 80^0$
(Opposite angles of a cyclic quad)
(b) ∠ABE = 900 – 500 = 400 (BAE is right ∠'d)
∠ ABC = 40 + 80 = 120
∠ CEF = 120^0 (opp ext ∠ of cyclic quad.)
∴ ∠DFE = 180 – (30 + 120) = 30^0
(c) ∠OBC = BCO (base∠s) = 80^0
∠BUC = 180 – (80 + 80) = 20^0
∠CDE = 180 – 20
= 1600 (∠'s in a str. Line)
(c) CDE = 180 – 80 (opp ∠'s in cyclic quad)= 100^0
CED = 180 – (30 + 100)
= 50^0 (∠'S in a Δ)
= ∠AED = 50 + 10 + 50= 110^0
∴∠ADE = 180 – (30 + 110)= 40^0

22	(a) New length = 6x + 3, New width = x + 2 Initial area = (6x – 1) (x-2) = $6x^2 – 13x + 2$ Final area = (6x + 3)(x+2) $6x^2 + 15x + 6$ ∴ $6x^2 + 15x + 6 = 3(6x^2 – 13x + 2)$ $6x^2 + 15x + 6 = 18x^2 – 39x + 6$ $12x^2 – 54x = 0$ 6x(2x – 9) = 0 ∴ 6x = 0 x = 0 OR 2x – 9 = 0 x = 4.5cm ∴ Length = 6 x 4.5 – 1 = 26cm Width = 4.5 – 2 = 2.5cm (b) $\frac{195-65}{65}$ x 100 = 200% (c) (6 x 4.5 – 1) – (4.5 – 2) = 26 – 2.5 = 23.5cm	**24**	(a) V = t2 – 4t + 4 when t = 0 = 0^2 + - 2(0) + 4 = 4m/s (b) v = 0 $t^2 – 4t + 4 = 0$ $t^2 – 2t – 2t + 4 = 0$ (t – 2)(t-2) = 0 t = 2 sec (c) a = $\frac{dv}{dt}$ = 2t – 4 t = 4 2(4) – 4 = 4m/s d) $\int_1^{13}(t^2 - 4t + 4)dt$ $= \int \frac{t^3}{3} - \frac{4}{2}t^2 + 4t \int_1^{13}$ $= \left(\frac{13^3}{3} - 2(13)^2 + 4(13)\right) - \left(\frac{1}{3} - 2 + 4\right)$ $= 446\frac{1}{3} - 2\frac{1}{3}$ = 444m
23	 (a) BC = 8.0±0.1 x 10 = 80±1km Bearing of B from C ≅ N43±10E (b) DB = 7.1±0.1 x 10 = 71±1km Bearing of D from 565^0±W A from D 550±1^0E		

MERU FORM 4 JOINT EVALUATION TEST

121/2
MATHEMATICS
PAPER 2
JULY/AUGUST 2015
TIME: 2 ½ HOURS

1.	$T_2 = a + 2d = 15$ 2T23 = 2(a + 22d) = 94 a + 22d = 47 a + 6d = 15 16d = 32 d = 2; a + 6 x 2 = 15 a = 3
2.	Error±0.05 Perimeter = 6.4 + 7.3 + 8.2 = 21.9 Max peri = 6.45 + 7.35 + 7.25 = 22.05 Min peri = 6.35 + 7.25 + 8.15 = 21.75 Absolute error = $\frac{(22.05-21.75)}{2}$ = 0.15 % error = $\frac{0.15}{21.9}$ x 100% = 0.6849%
3.	∠z = ∠CBE = 20^0 ∠y = 90^0 ∠x = 180 – (90 + 20) = 70^0
4.	$\frac{18-12\sqrt{2}}{3-2\sqrt{2}}$ $= \frac{(18-12\sqrt{2})(3+2\sqrt{2})}{(3-2\sqrt{2}(3+2\sqrt{2})}$ $= \frac{24+36\sqrt{2}-24(2)}{9-4(2)}$
5.	Cf 5,12,28,38,52,65 Median 21.5 – 21-9 Median = 21.45 + $\left(\frac{32.5-28}{10}\right)$ x 0.5 = 21.45 + 0.225 = 21.675
6.	Adj = $\sqrt{13^2 - 5^2}$ = 12 Tan (90 - θ) = $\frac{12}{5}$ = 2.4
7.	$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 2 & 4 \\ 3 & 5 \end{pmatrix} = \begin{pmatrix} 2 & 22 \\ 14 & 24 \end{pmatrix}$ $\begin{pmatrix} 2a+3b & 4a+5b \\ 2c+3d & 4c+5d \end{pmatrix} = \begin{pmatrix} 12 & 22 \\ 14 & 24 \end{pmatrix}$ $\left.\begin{array}{l} 2a + 3b = 12 \\ 4a + 5b = 12 \end{array}\right\} \Rightarrow a = 3, b = 2$ 2c + 3d = 14 4c + 5d = 24 $\therefore T = \begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$
8.	$(2-y)^5 = 25 - 5(2^4)y + 10(2^3)y^2 - 5(2)y^3 + 5(2)y^4 + y^5$ = 32 – 80y + 80y2 – 40y3 + 10y4 – y5 $1.85 = 32 - 80(0.2) + 80(0.2)^2 - 40(0.2)^3$ = 32 - 16 + 3.2 – 0.32
9.	Centre = $\left(\frac{-2\pm2}{2}, \frac{2+6}{2}\right)$ = (-2,4) Radius = $\sqrt{(-2—2)^2 + (6-2)^2}$ = 4 Eqn $(x + 2)^2 + (y-4)^2 = 4^2$ $x^2 + y^2 + 4x - 8y + 4 = 0$
10	$Log_{10}(5x^2) = Log_{10}(10 \times 4^2)$ $5x^2 = 10 \times 16$ $x^2 = 32$ $x = 4\sqrt{2}$
11	2x(x-4) – 2(-7x) = 0 $2x^2 - 8x + 14x = 0$ $2x^2 + 6x = 0$ 2x(x+3) = 0 2x = 0 → 0 x + 3 = 0 → x = -3 ∴ = 0 or -3
12	Dst by fire engine = 64 (11.40 – 9.15) = 64 x 2h 25 min = 64 x $2\frac{22}{60}$ = 154.67 Speed of amb = $\frac{154.67}{11.40-10.10}$ = $\frac{154.67}{1.5}$ = 103km/h
13	Let NX = y 12 x 3 = 15 xy y = $\frac{12 \times 3}{15}$ = 2.4
14	£240 x 112 = KSh 26880 KSh. 26880 – Ksh. 1000 = 25,880 $\frac{1}{2}$ x 25880 = 12,940 $\frac{12940}{113.50}$ = £114.01
15	$\left.\begin{array}{l} 5x + 6y = 2440 \\ 2x + 3y = 1120 \end{array}\right\}$ 10x + 15y = 5600 <u>10x + 12y = 4880</u> 3y = 720 y = 240
16	h $\begin{pmatrix} 6 \\ -5 \end{pmatrix}$ + k $\begin{pmatrix} 5 \\ -3 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ 6h + 5k = 3 -5h – 3k = 1 25h + 15k = -5 18h + 15k = 9 7h = -14 h = -2, k = 3

SECTION II

17. (a) (i) $T_n = 6 - 4n$

2,-2, -10

(ii) $S_{16} = \frac{16}{2}(4 + 15(-4)$

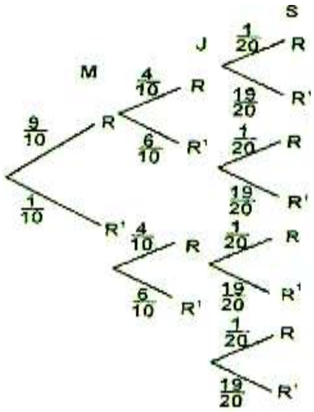
(iii) $T_{25} = 2 + (25 - 1)\ (-4)$

(b) $S_8 = \frac{(2^{8-1})}{2-1}$

$= 100 \times 2^7$

$= 12800$

18.



(i) $\frac{1}{10} \times \frac{6}{10} \times \frac{19}{20} = \frac{114}{2000} = \frac{57}{1000}$

(ii) $\frac{9}{10} \times \frac{4}{10} \times \frac{1}{20} \times \frac{36}{2000} = \frac{9}{1000}$

(iii) $(\frac{9}{10} x \frac{4}{10} x \frac{1}{20}) + (\frac{9}{10} x \frac{4}{10} x \frac{19}{20}) + (\frac{9}{10} x \frac{6}{10} x \frac{1}{20})$

$= \frac{36}{2000} + \frac{684}{200} + \frac{34}{2000} + \frac{4}{2000}$

$= \frac{778}{2000} = \frac{389}{1000}$

(iv) $1 - (\frac{9}{10}\ x\ \frac{4}{10}\ x \frac{1}{20})$

$1 - \frac{36}{2000}$

$= \frac{1964}{2000} = \frac{491}{500}$

19

(a) (i) $(15000 + 8000 + 2000) \times \frac{12}{20}$

= K£15,000

(ii) 5808 x 2 = 11616

5472 x 3 = 16416

3620 x 4 = <u>14560</u>

42592

$\frac{-1156\ x\ 12}{28720}$

(b) $A = 650{,}000\ (1 + \left(1 + \frac{6}{100}\right)^6$

= 922038

I = A – P = 922038 – 650000

20

(a) (i) $\overrightarrow{XY} = \underset{\sim}{y} - \underset{\sim}{x}$

(ii) $\overrightarrow{ON} = x + \frac{2}{5}(y - x)$

$= \frac{3}{5}\underset{\sim}{x} + \frac{2}{5}\underset{\sim}{y}$

(iii) $\overrightarrow{XM} = -x + \frac{1}{3}\underset{\sim}{y}$

(b) $\overrightarrow{XM} = -x + \frac{5}{9}(x + \frac{2}{5}\underset{\sim}{y} - \frac{2}{5}\underset{\sim}{x})$

$= \frac{2}{9}\underset{\sim}{y} - \frac{1}{3}\underset{\sim}{x}$

$\overrightarrow{PM} = -\frac{5}{9}(\frac{3}{5}\underset{\sim}{x} + \frac{2}{5}\underset{\sim}{y}) + \frac{1}{\underset{\sim}{3}}y)$

$= \frac{1}{9}\underset{\sim}{y} - \frac{1}{3}\underset{\sim}{x}$

$\overrightarrow{XP} = \frac{2}{9}(\underset{\sim}{y} - 3\underset{\sim}{x})$

$\overrightarrow{PM} = \frac{1}{9}(\underset{\sim}{y} - 3\underset{\sim}{x})$

Hence XP : PM = 2 : 1

21.

x^0													
3 Cos $2x^0$		2.6	1.5		-1.5	-2.6		-2.6		0	1.5	2.6	
2Sin $(x + 30)^0$	1	1.41		1.93		1.93	1.73	1.41		0.52		-0.52	-1

(c) (i) For Sin $(x + 30)^0$ = 3 Cos 2x

$x = 28.5^0$ and $138^0 \pm 2^0$

(ii) $28.5^0 \leq x \leq 138^0$

23.

x						
x^3	-8			1	8	
$-4x^2$				-4		-36
x	-2					
6						
y	-20			4	0	0

(c) x = - 1 or 3

(d) $(y = x^3 - 4x^2 + x + 6)3$

3y = 18x – 3

y = 6x – 1

x = -1.7 or 0.9

24. (a) x = ky2 ……………….. (i)

$X = k(\frac{125}{100}y)^2$ …………..(ii)

$\therefore X = k(1.25y)^2$ ……………(iii)

$\frac{X}{x} = \frac{k(1.25y)2}{ky^2}$

$\frac{X}{x} = 1.25^2$

$X = 1.5625x = \frac{156.25x}{100}$

Hence % increase = 56.25%

(b) M = KSD3

$850 = k \times 7.5 \times 6^3$

$K = \frac{850}{7.5\,x6^3} = \frac{85}{162}$

$\therefore m = \frac{85}{162}SD^3$

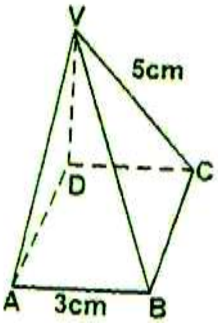
$m = \frac{85}{162} \times 10.5 \times 8^3$

= 2820.74

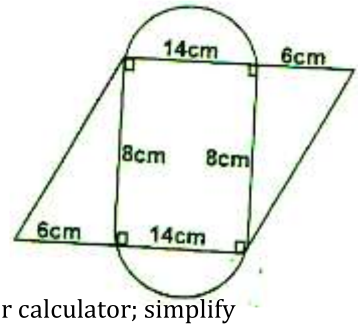
≈ 2821g

GEM SUB-COUNTY JOINT EVALUATION EXAMS 2015
Kenya Certificate of Secondary Education (K.C.S.E)
121/1
MATHEMATICS
Paper 1
2 ½ Hours

1. Without using mathematical table or calculator, evaluate: (3 Marks)
$\sqrt{\frac{0.0032+0.0608}{1.44 \, x \, 0.4}}$
2. The diagonal of a rectangular garden measures $11\frac{1}{4}$ while its width measures $6\frac{3}{4}$. Calculate the perimeter of the garden. (3 Marks)
3. The figure below shows a right pyramid with square base of side 3cm and a slant edge of 5cm. Draw its net. (3 Marks)



4. Simplify the following quadratic expression. (2 Marks)
$\frac{8b^2-50a^2}{(2b+5a)^2}$
5. The sum of interior angles of two regular polygons of sides; n and n + 2 are in the ratio 3:4. Calculate the sum of interior angles of the polygon with n sides. (4 Marks)
6. The figure below represents an opened collar cloth, find the distance round it. (Take $\pi = \frac{22}{7}$) (3 Marks)



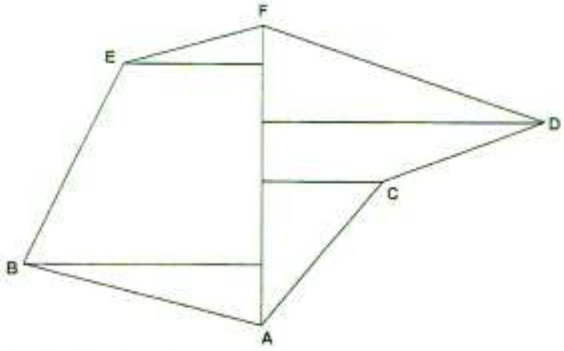
7. Without using log tables or calculator; simplify (3 Marks)
$\frac{Log\,\frac{1}{4}+Log\;64}{Log\;32-Log\,\frac{1}{8}}$
8. Use square roots, reciprocals and square tables to evaluate to 4 significant figures the expressions: (4 Marks)
$(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2$
9. Determine the inverse of the matrix T = $\begin{pmatrix} 1 & 2 \\ 1 & -2 \end{pmatrix}$, hence find the coordinates of the point at which the two lines x + 2y = 7 and x – 2y = -1 intersect. (4 Marks)
10. Find all the integral values of x which satisfy the inequality. (3 Marks)
$3(1 + x) \leq 5x - 11 \leq x+45$
11. Given that θ is an acute angle and Sin θ = $\frac{2\sqrt{3}}{5}$, without using mathematical tables or calculator find tan (90^0 - θ), leave your answer in surd form. (2 Marks)
12. Three quantities A, B and C are such that A varies directly as the square of B and inversely as the cube root of C.
(a) Given that A = 20 when B = 5 and C = 27. Write the equation connecting A, B and C. (3 Marks)
(b) Find the value of A when B = 7 and C = 125. (1 Mark)
13. The curved surface area of a cylindrical container is 1980cm². If the radius of the container is 21cm, calculate to one decimal place the capacity of the container in litres. (Take $\pi = \frac{22}{7}$) (3 Marks)
14. Pipes A and B can fill a tank in 20 minutes and 30 minutes respectively. Pipe C can empty the full tank in 40 minutes. Starting with an empty tank, calculate the length of time it will take to fill the tank when;
(a) All the three pipes are turned on at the same time. (1 Mark)
(b) All the three pipes are turned on at the same time then pipe B is closed after 10 minutes. (3 Marks)

15. Madam Akinyi earns a basic salary of KSh. 24,000 per month. In addition she is paid a commission of 5% for sales above KSh. 30,000. In the month of February she sold goods worth KSh. 300,000 at a discount of 6%. Calculate her total earning that month. (3 Marks)
16. Find the quartile Deviation for the data below. (3 Marks)
    24,32,29,11,21,22,15,18

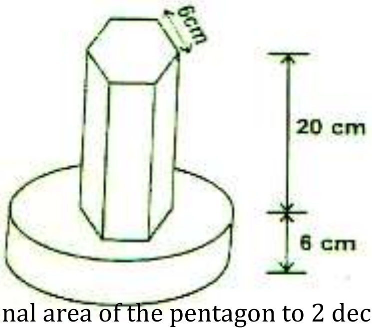
SECTION II – 50 MARKS

Answer only FIVE questions from this section

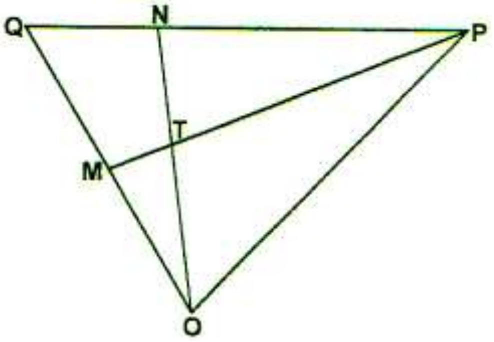
17. Four schools: Lihanda, Kagilo, Bar-Sauri and Ndori are such that Lihanda is 16km from Kagilo on a bearing of 158^0, Bar-Sauri is to the west of Kagilo and 20km away while Ndori is to the South of Bar-Sauri on a bearing of 240^0 from Lihanda.
    (a) Using a scale of 1:400,000 draw a scale diagram showing the relative positions of the four schools. (5 Marks)
    (b) Using your diagram determine the distance and bearing of Ndori from Kagilo. (2 Marks)
    (c) A mast is to be erected so that it is equidistant from Kagilo and Bar-Sauri and 20km from Ndori. On the same diagram show the position of the mast and find its distance from Lihanda. (3 Marks)
18. The figure below shows the outline of the land owned by Rera – Yala community sugarcane Farm drawn to scale.



    (a) Given that AF = 600m, determine the scale used. (1 Mark)
    (b) By showing all your workings enter the details of the farm in a survey field book. (4 Marks)
    (c) Given that this land is currently valued at KSh. 250,000 per hectare, calculate its value. (5 Marks)
19. The figure below shows a model of a pillar to be constructed at the Canterbury. The model consists of a circular base of diameter and a uniform pentagon stand of side 6cm and height 20cm.



    (a) Calculate the cross-sectional area of the pentagon to 2 decimal places. (3 Marks)
    (b) Calculate the total volume of the model to 2 dp. (3 Marks)
    (c) If the height of the real pillar is 52m and the constructor uses two bags of cement for every 500m3 of the construction, calculate the least number of bags of cement required. (4 Marks)
20. The diagram below shows a triangle OPQ in which QN:NP = 1:2, OT:TN = 3:2 and M is the midpoint of OQ.



(a) Given that $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$. Express the following vectors in terms of **p** and **q**.

(i) $\overrightarrow{PQ}$ (1 Mark)

(ii) $\overrightarrow{ON}$ (2 Marks)

(iii) $\overrightarrow{PT}$ (2 Marks)

(iv) $\overrightarrow{PM}$ (1 Mark)

(b) (i) Show that points P, T and M are collinear. (3 Marks)

(ii) Determine the ratio MT:TP (1 Mark)

21. (a) Fill in the table below for the function.

$y = 2x2 + 5x - 12$ for $-8 \leq x \leq 4$

x	-7	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4
$2x^2$	128	98	72		32	18		2	0	2		18	32
5x	-40		-30			-15		-5	0	5			20
-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12
y	76		30			-9		-15		-5			40

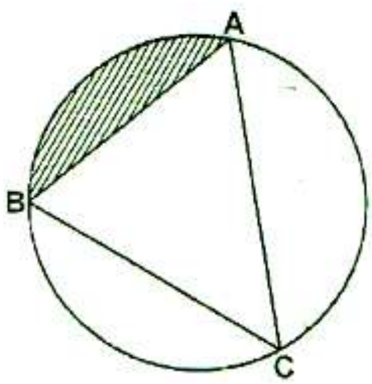
(b) Using the table, draw the graph of the function $y = 2x^2 + 5x - 12$. (4 Marks)

(c) Use the drawn above to solve the following equations.

(i) $2x^2 + 5x - 12 = 0$ (2 Marks)

(ii) $3 - 7x - 2x^2 = 0$ (2 Marks)

22. The diagram below shows a circle ABC with AB = 12cm, BC = 15cm and AC = 14cm.



Calculate to 4 significant figures.

(a) The angle ACB (3 Marks)

(b) The radius of the circle (3 Marks)

(c) The area of the shaded region. (4 Marks)

23. If Nick gives a quarter of the money he owns to Tom, Tom will have twice as much as Nick. If Tom gives q shillings to Nick, then Nick will have thrice as much as Tom. Taking the initial amount owned by Nick and Tom to be x and y respectively;

(a) Express y and q in terms of x. (7 Marks)

(b) Given that Nick's initial amount was KSh. 40,000. Calculate;

(i) the value of q (1 Mark)

(ii) the initial amount by Tom (2Mark)

24. The data below shows the marks scored by students in a Chemistry test.

Marks	Frequency
25-34	3
35-44	6
45-54	16
55-64	12
65-74	8
75-84	4
85-94	1

(a) Calculate the median mark. (4 Marks)

(b) Calculate the standard deviation using an assumed mean of 49.5. (6 Marks)

GEM SUB-COUNTY JOINT EVALUATION EXAMS 2015
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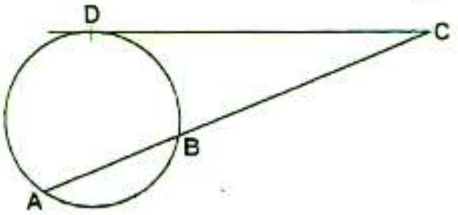
MATHEMATICS
Paper 2
2 ½ Hours

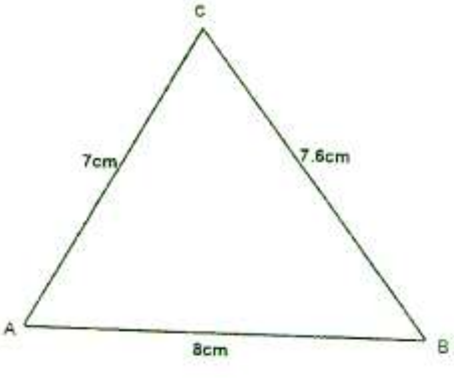
SECTION I (50 MARKS)

Answer ALL questions in this section.

1. A radius of a circle as 2.8cm to 2 significant figures. By taking π to be 3.142, find to 4 significant figures, the limits between the area of the circle lie. (3 Marks)
2. Kamau sells a packet of type A of sugar for KSh. 63 and that of type B of Sugar for KSh. 36. He mixed the two types of sugar in the ratio 3:2. Find the price per packet of the mixture for which he will make the same profit as before (3 Marks)
3. Solve $2S\text{Sin}^2y + 3\text{Cos } y = 3$ for $0^0 \leq 360^0$. (4 Marks)
4. Use logarithm tables to evaluate: (4 Marks)
$$\left(\frac{1.67\ x\ 23.8}{45.9 \div 73.26}\right)^{\frac{2}{3}}$$
5. By expressing tan 30^0 as $\frac{1}{\sqrt{a}}$, simply the expression $\frac{\tan 30}{2-\sqrt{2}}$, leaving your answer with a rationalized denominator.
6. In the figure below DC is a tangent to the circle at point D. Given that ABC is a straight line where AB = 7cm and AC = 16.5cm, find the length of DC. (3 Marks)



7. Make P the subject of the formula in:- (3 Marks)
$$L = \frac{2}{3}\sqrt{\frac{x^2-PT}{y}}$$
8. Given that Log 3 = 1.585 while $\text{Log}_2\,\frac{36\sqrt{5}}{5}$ without using mathematical tables or a calculator. (3 Marks)
9. Write down the equation of a circle (0,2) and radius 3 units, leaving your answer in the form (3 Marks)
$a^2 + by2 + cx + dy + e = 0$
10. A man invests KSh. 10,000 in an account which pays 16% interests p.a compounded quarterly. Fid the amount in the account after 1 ½ years. (3 Marks)
11. (a) Expand and simplify $(1 - 5x)^4$ (1 Mark)
(b) Use the expansion in (a) above to estimate the value of 0.9^4 to 4 significant figures. (2 Marks)
12. On the same side of AB as C, in the triangle below, construct the locus of points P such that triangle ABP has an areas of $24cm^2$. (3 Marks)



13. The position vectors of points P and Q are **p** $=2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and **q** $= 3\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$ respectively. Find the magnitude of PQ correct to 4 significant figures. (3 Marks)
14. A two digit number is such that the sum of the digits is 11. When the digits are interchanged the new number formed is 45 less than the original number. Determine the original number (4 Marks)
15. An unbiased coin with faces, head (H) and tail (T) and a fair die with faces marked 1, 2,3,4,5, 6 are each tossed once.
(a) Show all the possible outcomes. (1 Mark)
(b) Calculate the probability that a 4 of the die and a head (H) of the coin shows up. (1 Mark)
16. Evaluate $\int_{-1}^{3}(-2x+7)\,dx$ (3 Marks)

SECTION II (50 MARKS)

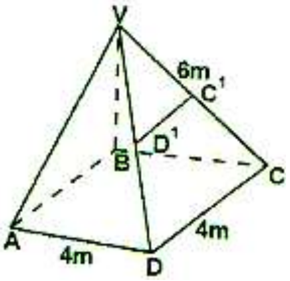
Answer only FIVE questions from this section.

17. A ship sailing at a speed of 200 knots left harbour A (30^0S, 32^0E) and sailed due north to harbour B (30^0N, 32^0E)
(a) Calculate the distance it covered in nautical miles. (2 Marks)
(b) After a 15 minutes stop over at B the ship due west to harbour C (30^0N, 15^0E) at the same speed.
(i) Calculate the total time taken by the ship from A to C through B. (5 Marks)

18. A triangle PQR has co-ordinates P(-6,5), Q(-4,1) and R(3,2) and is mapped onto $P^1Q^1R^1$ by a shear x-axis invariant where P1 is (-6,-4)
(a) On the grid provided draw both PQR and its image $P^1Q^1R^1$ under the shear. (3 Marks)
(b) Determine the matrix representing the shear. (2 Marks)
(c) Triangle $P^1Q^1R^1$ is mapped onto $P^{II}Q^{II}R^{II}$ by the matrix $\begin{pmatrix} -1 & 0 \\ -1.5 & -1 \end{pmatrix}$
(i) Draw $P^{II}Q^{II}R^{II}$ on the same grid above. (3 Marks)
(ii) Describe a single transformation that maps $P^{II}Q^{II}R^{II}$ onto PQR. (1 Mark)
(iii) State the single matrix of transformation that maps PIIQIIRII onto PQR. (1 Mark)

19. The electricity bill E of school is partly fixed and partly varies inversely as the total number of students T.
(a) Write down an expression of E in terms of T. (1 Mark)
(b) When the school had 100 students the bill was KSh. 174 per student while for 35 students the bill was KSh. 200 per student. Calculate the fixed charge. (4 Marks)
(c) Find the appropriate number of students for which the two parts of electricity bill are equal. (3 Marks)
(d) Find the electricity bill E when the students population is 1000. (2 Marks)

20. A right pyramid VABCD below has a square base ABCD of side 4m. The slant edges VA, VB, VC and VD are 6m long.



Calculate
(i) the height of the pyramid. (4 Marks)
(ii) the angle between the plane VAB and the base ABCD. (3 Marks)
(iii) C^1 and D^1 are mid points of VC and VD respectively. Calculate the angle between the planes ABCD and ABC^1D^1. (3 Marks)

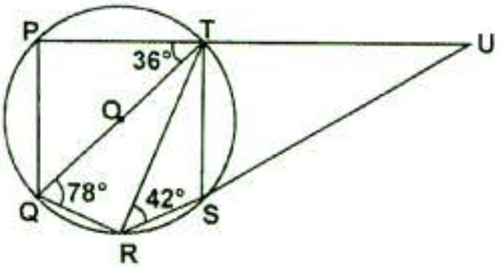
21. (a) The first term of an arithmetic progression is 3 and the sum of its 8 terms is 164.
(i) Find the common difference of the arithmetic progression. (2 Marks)
(ii) Given that the sum of the first terms of AP is 570, find n. (3 Marks)
(c) The first, the fifth and the seventh terms of another Arithmetic sequence forms a decreasing geometric progression. If the first terms of the geometric progression is 64.
(i) find the values of the common differenced of AP. (3 Marks)
(ii) find the first sum of the first ten terms of the G.P. (2 Marks)

22. (a) Complete the table given below by filling in the values correct to 2 decimal place. (2 Marks)

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0
3Sin x^0-1	-1.00	0.50						
Cosx^0	1.00	0.87	0.50	0.00		-0.87	-1.00	

(b) On the same axes draw the graph of y – 3Sinx^0 - 1 and y = Cos x^0 on the grid. (5 Marks)
(c) Use your graph to solve the equation, 3 Sinx^0 – Cosx^0 = 1 (2 Marks)
(d) Find the range of values of x for which 3 Sin x 0 – 1 > Cos x 0 (1 Mark)

23. In the figure below QT is a diameter of a circle centre O. Chord PT produced and RS produced intersect externally at point U. $\angle PTQ = 360^0$, $\angle RQT = 780^0$ and $\angle SRT = 42^0$.



Giving reasons, calculate the size of

(a) $\angle RST$ (2 Marks)
(b) $\angle TUS$ (2 Marks)
(c) $\angle$Reflex $\angle ROT$ (2 Marks)
(d) $\angle PQT$ (2 Marks)

24. An electronics dealer wishes to purchase wishes to purchase radios and TV's sets. He can buy atmost 30 of both items. On average, a radio and a TV set cost KSh. 12,000 respectively and he has KSh. 240,000 to spend. The number of T.V sets should be at most twice the number of radios. He must more than five T.V sets.

(a) Form all the inequalities to represent the above information (Take the number of radios and TV sets to be x and y respectively) (4 Marks)

(b) Graph the inequalities in (a) above on the grid below. (4 Marks)
If the dealer makes a profit of KSh. 600 and KSh. 1000 per radio and T.V sets respectively, find the maximum profit he will make.

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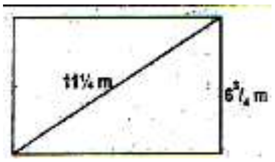
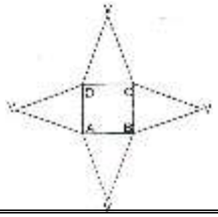
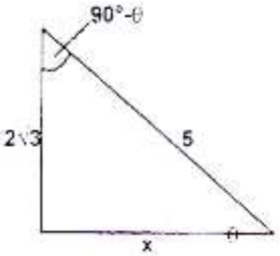
1.	$\sqrt{\left(\frac{0.0032+0.06608}{1.44\ x\ 0.4}\right)} = \sqrt{\left(\frac{0.064\ x\ 1000}{1.44\ x\ 0.4\ x\ 1000}\right)}$ $= \sqrt{\left(\frac{64}{144\ x\ 4}\right)}$ $= \frac{8}{12x2}$ $= \frac{1}{3}$
2.	 $L^2 = \left(11\frac{1}{4}\right)^2 - \left(6\frac{3}{4}\right)^2$ $= \left(\frac{45}{4}\right)^2 - \left(\frac{22}{4}\right)^2$ $= \frac{2025-729}{16}$ $= \frac{1296}{16}$ $L = \frac{36}{4}$ = 9m P = 2(9 + 6.75) = 31.5m
3. 0	
4.	$\frac{8b^2-50a^2}{(2b+5a)^2} = \frac{2\left(4b^2-25a^2\right)}{(2b+5a)^2}$ $= \frac{2(2b+5a)(2b-5a)}{(2b+5a)^2}$ $= \frac{2(2b-5a)}{(2b+5a)}$
5.	$\frac{(2n-4)90^0}{(2(n+2)-4)90^0} = \frac{3}{4}$ $\frac{(2n-4)}{2n} = \frac{3}{4}$ 4(2n – 4) = 3 x 2n 8n – 6n = 16 2n = 16 n = 8 Sn = {(2 x 8) - 4}90^0 =12 x 90^0 = 1080^0
6.	C = $\frac{22}{7}$ x 14 or C = $\frac{1}{2}$ x $\frac{22}{7}$ x 14 x 2 = 44cm $P = 44 + 12 + 2(8^2 + 6^2)^{\frac{1}{2}}$ = 76cm
7.	$\frac{Log\frac{1}{4} + Log\ 64}{Log\ 32 - Log\frac{1}{8}} = \frac{-2Log\ 2+6\ Log\ 2}{5\ Log2+3\ Log\ 2}$ $= \frac{4\ Log\ 2}{8\ Log\ 2} = \frac{1}{2}$
8.	$(0.6458)^{\frac{1}{2}} = (6.458\ x10^{-2})^{\frac{1}{2}}$ $= 2.5413$ x 10^{-1} = 0.25413 $\frac{2}{0.4327} = 2\left(\frac{1}{4.327\ x\ 10-1}\right)$ = 2 x 10 reci 4.327 = 20 x 0.2311 = 4.622 $\left(\frac{2}{0.4327}\right)^2 = (4.622)^2$ = 21.363 Hence $(0.06458)^{\frac{1}{2}} + \left(\frac{2}{0.4327}\right)^2$ = 0.25413 + 21.363 = 21.61713 = 21.62 (4 sf)
9	Det T = -2-2 = -4 $T^{-1} = -\frac{1}{4}\begin{pmatrix}-2 & -2\\ -1 & 1\end{pmatrix}$ Hence $\begin{pmatrix}x\\ y\end{pmatrix} = -\frac{1}{4}\begin{pmatrix}-2 & -2\\ -1 & 1\end{pmatrix}\begin{pmatrix}7\\ -1\end{pmatrix}$ $= -\frac{1}{4}\begin{pmatrix}-16\\ -8\end{pmatrix}$ $= \begin{pmatrix}4\\ 2\end{pmatrix}$ They intersect at Q(4,2)
10	3(1 + x ≤ 5x – 11 ≤ x + 45 3(1 + x) ≤ 5x – 11 3 + 11≤ 5x – 5x 14≤2x 7≤x 5x – 11 ≤ x + 45 4x ≤ 45 + 11 4x ≤ 56 x ≤ 14 7 ≤ x ≤ 14 x = {7,8,9,10,11,12,13,14}
11.	 $x = \sqrt{5^2 - \left(2\sqrt{3}\right)^2}$ $= \sqrt{25}$ – 13 $= \sqrt{13}$ tan (90^0 - θ) = $\frac{\sqrt{13}}{2\sqrt{13}}$ = or tan θ = 2 $\frac{\sqrt{13}}{\sqrt{13}}$ but tan θ = $\frac{1}{\tan(90^0-\theta)}$

8. (a) $A\alpha\frac{B^2}{\sqrt[3]{C}}$

$A = \frac{KB^2}{\sqrt[3]{C}}$

$20 = \frac{25K}{3}$

$K = \frac{12}{5}$

$\therefore A = \frac{12B^2}{5\sqrt[3]{C}}$

(b) $A = \frac{12 x 49}{5 x 5}$

$= 23.52$

9. $2\pi rh = 1980$

$\frac{44}{7}$ x 21 x h = 1980

$h = \frac{1980 x 7}{21 x 44}$

$= 15$

$V = \frac{22}{7} x \frac{21 x 21 x 15}{1000}$

$= \frac{22 x 63 x 15}{1000}$

$= 20.79$

= 20.8 litres (1 dp)

10. (a) Fraction of the tank filled in 1 min when the three are on

$\frac{1}{20} + \frac{1}{30} - \frac{1}{40} = \frac{6+4-3}{120}$

$= \frac{7}{120}$

If $\frac{7}{120}$ of the tank is filled 1 min

$\therefore \frac{120}{120}$ of the tank will be filled in

$= \frac{120}{120} x \frac{120}{7}$

$= 17\frac{1}{7}$ minutes

(b) Fractions of the tank filled after 10 min when A, B and C are on $= \frac{7}{12}$

Remaining fraction filled by A and C $= \frac{5}{12}$

Fraction filled when A and C are on 1 min

$= \frac{1}{20} - \frac{1}{40}$

$= \frac{2-1}{40}$

$= \frac{1}{40}$

If $\frac{1}{40}$ of the tank is filled in 1 min

$\therefore \frac{5}{12}$ of the tank will be filled in $\frac{5}{12} x \frac{40}{1}$

$= 16\frac{2}{3}$ mins

12. Revenue $= \frac{94}{100}$ x 300,000

= 282,000

Commission received $= \frac{5}{100}$ x 282,000

= 14,100/=

Total earning = 24,000 + 14,100

= 38,100/=

13. 11, 15, 18, 21, 22, 24, 29, 32

Upper quartile $= \frac{24+29}{2}$

= 26.5

Lower quartile $= \frac{15+16}{2}$

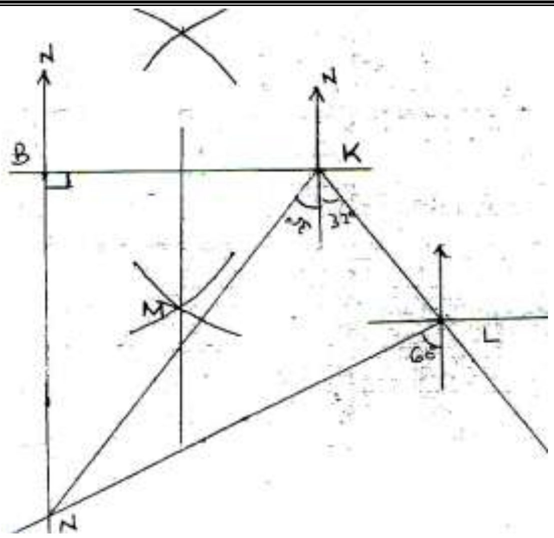
= 15.5

Interquartile Range = 26.5 – 15.5

= 11

Quartile Deviation $= \frac{11}{2} = 5$

17



(b) Distance = 9 x 4

= 36 km

Bearing = 1800 + 350

= $215^0 \pm 1^0$

(c) Drop a perpendicular bisector of line BK

Measure 5cm from N

The distance of the mast from Lihanda is 4.8 x 4

=19.2km

18

11. (a) AF = 7.5cm

The scale 1cm rep 80m

(b) Along the baseline AF

Branch to B = 1.5 x 80 = 120m

Branch to C = 3.5 x 80 = 280m

Branch to D = 5 x 80 = 400m

Branch to E = 6.5 x 80 = 520m

To the offset

B = 6 x 80 = 480m

C = 3.5 x 80 = 280m

D = 7 x 80 = 560m

E = 3 x 80 = 240m

Survey field Book

	F	
240 to E	520	
	400	560 to D
	280	280 to C
480 to B	120	
	A	

(b) Area of the land $= \frac{9}{2} + \frac{3.5 x 3.5}{2} + \frac{5}{2} x 9 + \frac{10.5 x 15.5}{2} + \frac{2.5 x 7}{2} + \frac{3}{2}$

= 4.5 + 6.125 + 22.5 + 7.875 + 8.75 + 1.5 = 51.25

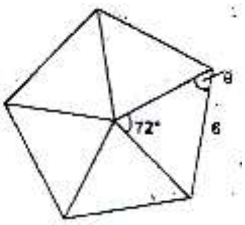
Actual area = 51.25 x 80 x 80

= 3288000m^2

Value of the land = 32.8 x 250,000

= 8,200,000 KShs

19. (a) The angle at the centre $= \frac{360^0}{5} = 72^0$



$= \frac{180^0 - 72^0}{2}$

$= 54^0$

Cross sectional area $= 5 \text{ x } \frac{1}{2} \text{ x } 6 \text{ x } 3 \tan 540$

$= 45 \tan 540$

$= 61.9372\text{cm}^2$

$= 61.94\text{cm}^2$ (2dp)

(b) Volume of the model $= 61.94 \text{ x } 20 + \frac{22}{7} \text{ x } 10.5^2 \text{ x } 6$

$= 1238.8 + 2079$

$= 3317.80\text{cm}^3$ (dp)

(c) L.S.F $= \frac{5200}{26} = 200$

V.S.F = 8,000,000

Volume of the pillar $= \frac{(8{,}000{,}000 \; x \; 3317.8}{1000000}\text{m}^3$

$= 26542.4\text{m}^3$

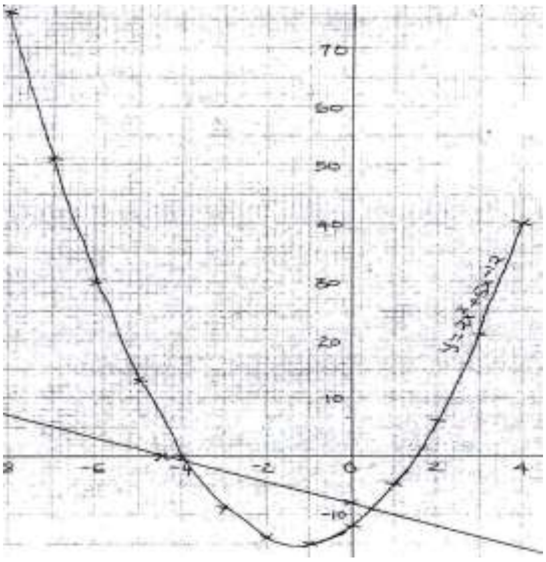
If $500\text{m}^3 = 2$ bags

$\therefore 26542.4 = \frac{26542 \; x \; 2}{500}$

$= 106.1696$

Least No. of bags = 107 bags

b)



c) (i) $2x^2 + 5x - 12 = 0$

$x_1 = -4 \; X_2 = 1.5$

(ii) $y = 2x^2 + 5x - 12$

$0 - 2x^2 - 7x + 13 +$

$y = -2x - 9$

$y = -2x - 9$

x	0	-4.5	-9
y	-9	0	9

Solutions $X_1 = 3.9 \; X_2 = 2.5$

20. (a) (i) $\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$

$= -\mathbf{p} + \mathbf{q}$

(ii) $\overrightarrow{ON} = \overrightarrow{OQ} + \overrightarrow{QN}$

$= \mathbf{q} + \frac{1}{3}\mathbf{p} + \frac{2}{5}(\mathbf{p} - \mathbf{q})$

$= -\frac{4}{5}\mathbf{p} - \frac{2}{5}\mathbf{q}$

(iii) $\overrightarrow{PT} = \overrightarrow{PO} + \overrightarrow{OT}$

$= -\mathbf{p} + \frac{3}{5}(\frac{1}{3}\boldsymbol{p} - \frac{2}{3}\mathbf{q})$

$= -\frac{4}{5}\mathbf{p} - \frac{1}{2}\mathbf{q}$

(b) $\overrightarrow{TM} = \overrightarrow{TO} + \overrightarrow{OM}$

$= \frac{1}{5}\mathbf{p} - \frac{2}{5}\boldsymbol{q} + \frac{1}{2}\mathbf{q}$

$= \frac{1}{5}\mathbf{p} + \frac{1}{10}\mathbf{q}$

$\overrightarrow{PT} = \lambda\overrightarrow{TM}$

$-\frac{4}{5}\mathbf{p} - \frac{2}{5}\mathbf{q} = \lambda(\frac{1}{5}\mathbf{p} + \frac{1}{10}\mathbf{q})$

$-4(\frac{1}{5}\mathbf{p} + \frac{1}{10}\mathbf{q}) = \lambda(\frac{1}{5}\mathbf{p} + \frac{1}{10}\mathbf{q})$

$\lambda = -4$

$\overrightarrow{PT} = -4\overrightarrow{TM}$ hence $\overrightarrow{PT} // \overrightarrow{TM}$

$\overrightarrow{PT}$ and $\overrightarrow{TM}$ have a common T and $\overrightarrow{PT} // \overrightarrow{TM}$ then P. T and M are collinear

22

(a) a2 + b2 – 2ab Cos C = c2

$15^2 + 14^2 - 2 \text{ x } 14 \text{ x } 15 \cos C = 12^2$

$\frac{15^2 + 14^2 - 12^2}{2 \; x \; 14 \; x \; 15} \cos C$

$C = \cos^{-1}(0.659523809)$

$C = 48.7364$

$= 48.74^0$

(b) $\frac{a}{Sin\;A} = \frac{b}{Sin\;B} = \frac{c}{Sin\;C} = 2R$

$2R = \frac{12}{Sin\;48.74^0}$

$= 7.9816$

$= 7.982\text{cm}$

(c) Area of the sector $= \frac{97.48^0 \; x}{360^0} \text{ x } 3.142 \text{ x } 7.982^0$

$= 54.2054$

$= 54.21\text{cm}^2$

Area of Δ ABC $= \frac{1}{2} \text{ x } 7.982^2 \sin 97.48^0$

$= 31.59\text{cm}^2$

Area of the shaded part = (54.21 – 31.59)

$= 22.62\text{cm}^2$

21. (a) $y = 2x^2 + 5x - 12$

x	-8	-7	-6	-5	-4	-3	-2	-1	0	01	2	3	4
2x2	128	98	72	50	32	18	8	2	0	2	8	18	32
5x	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12	-12
y	76	51	30	13	0	-9	-14	-15	-12	-5	6	21	40

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2 ½ Hours

1. 3.142 x 2.75 x 2.75 = 23.76cm^2
3.142 x 2.85 x 2.85 = 25.52cm^2
$23.76 \leq A \leq 25.52$

2. 63 x 3 + 36 x 2
261 ÷ 5 = KSh. 52.20

3. 2(1 – Cos^{2}y) + Cos y = 3
2(Cos^{2}y – 3Cos y + 1 = 0
(2Cos y – 1) (Cos y – 1) = 0
Cos y = ½ Cos y = 1
y = 0^0, 60^0, 300^0, 360^0

4.

No.	S.	Log	
1.67	1.67 x 10^0	0.2227	
23.8	2.38 x 10^1	1.3766	
		1.5993	
45.9	4.59 x 10^1	1.6618	
73.26	7.326 x 10^1	1.8649	
		1.7969	1.8024 x $\frac{2}{3}$
5.91	1.591 x 10^1	1.2016	

6. $\frac{\frac{1}{\sqrt{3}}}{2-\sqrt{2}}$
$\frac{1}{(2\sqrt{3}-\sqrt{6})}$ x $\frac{(2\sqrt{3}+\sqrt{6})}{(2\sqrt{3}+\sqrt{6})}$
$\frac{2\sqrt{3}+\sqrt{6}}{6}$

7. 16.5 x 9.5= DC^2
12.52cm

8. $L^2 = \frac{4}{9}\left(\frac{x^2-PT}{y}\right)$
$PT = x^2 - \frac{9}{4}L^2y$
$P = \frac{x^2-\frac{9}{4}L^2y}{T}$

9. Log (32 x 22 x $\sqrt{5}$)
2(1.585) + 2 + ½ (2.322) – 2.322 = 4.009

10. $(x - 0)^2 + (y - 2) = 3^2$
$x^2 + y^2 - 4y + 4 - 9 = 0$
$x^2 + y^2 - 4y - 5 = 0$

11. $10000(1 + \frac{16}{400})^6$
10,000 x 1.2653 = 12,653.19

12. $1 - 20x + 150x^2 - 500x^3 + 625x^4$
$0.94 = 1 - 20(0.02) + 150(0.02)^2 - 500(0.02)^3 + 625(0.02)^4 = 0.6561$

13. 24 = $\frac{1}{2}$ x h x 10 = 4.8

14. $\begin{pmatrix}3\\-2\\2\end{pmatrix} - \begin{pmatrix}2\\3\\-1\end{pmatrix}\begin{pmatrix}1\\-5\\3\end{pmatrix}$
$\sqrt{1^2 + (-5)^2 + 3^2}$
= 5.916

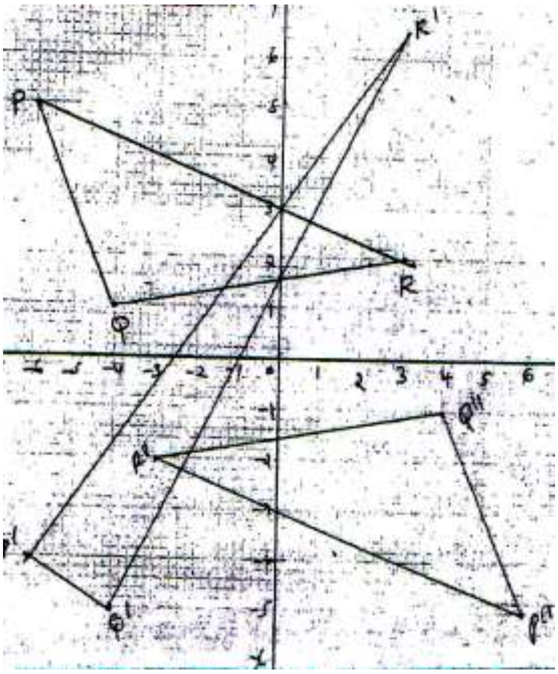
15. x + y = 11
10x + y – (10y + x) = 45
9(11-y) = 45 + 9y
y = 3
x = 8
83

15 (a) Die
1H 2H 3H 4H 5H 6H
1T 2T 3T 4T 5T 6T
$\frac{1}{6}$ x $\frac{1}{2}$ = $\frac{1}{12}$

16 $-x2 + 7x \,\Big|_{-1}^{3}$
$[-(3)^2 + 7x3] - [-(1)^2 + 7x - 1]$
12 - - 2

17 5. (a) 60 x 60 = 360
(b) (i) D = 60 (32 – 15) Cos 30
$t = \frac{888.3+3600}{200}$
22 hrs 22 min
22 hrs 22 min + 15 min
22 hrs 40 min
(ii) 17 x 4 = 68 min
2.00 + 22 hrs 40 min – 68 min
11:32 a.m the next day

18



(b) m $\begin{pmatrix}-6 & -4\\5 & 1\end{pmatrix} = \begin{pmatrix}-6 & -5\\-5 & -5\end{pmatrix}$
m = $\begin{pmatrix}-6 & -4\\-4 & -5\end{pmatrix}\frac{1}{24}\begin{pmatrix}1 & 4\\-5 & -6\end{pmatrix}$
$\begin{pmatrix}1 & 0\\1.5 & 1\end{pmatrix}$

(c) (i) $\begin{pmatrix}-1 & 0\\1.5 & -1\end{pmatrix}\begin{pmatrix}-6 & -4 & 3\\-4 & -5 & 6.5\end{pmatrix} =$
$\begin{pmatrix}6 & 4 & -3\\-5 & -1 & -2\end{pmatrix}$
(ii) Rotation centre (0,0) + 1800
(iii) $\begin{pmatrix}-1 & 0\\0 & -1\end{pmatrix}$

19. (a) $E = F + \frac{K}{T}$

(b) $17400 = F + \frac{K}{100}$

$7000 = F + \frac{K}{35}$

$10400 =- \frac{13K}{700}$

$K = -560,000$

$F = 23,000$

(c) $23000 = \frac{560000}{T}$

$T = 24.34$

$= 25$

(d) $E = 23000 = \frac{560,000}{1000}$

$E = 22,440$

20. (i) $\sqrt{4^2 + 4^2}$

$= 5.657$cm

$\sqrt{16^2 - 2.828^2}$

$= 5.292$cm

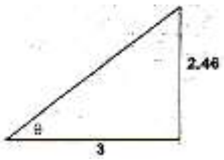
(ii) $\sqrt{6^2 - 2^2}$

$= 5.657$

$\cos\theta = \frac{2}{5.657}$

$\theta = 69.30$

(iii)



$\tan\theta = \frac{2.646}{3}$

$\theta = 41.44^0$

21. (a) (i) $164 = \frac{8}{2}(2 \times 3 + 7\times d)$

$d = 5$

(ii) $570 = \frac{n}{2}[2 \times 3 + (n - 1)5]$

$5n^2 + n - 1140 = 0$

$n = \frac{-1 \pm \sqrt{1 + 4 \times 5 \times 1140}}{2 \times 5}$

$n = 15$

(b) (i) 64, 64+4d, 64 + 6d

$\frac{64+4d}{64} = \frac{64+6d}{64+4d}$

$64^2 + 384d = 64^2 + 512d + 16d^2$

$16d^2 + 128d = 0$

$d(d+8) = 0$

$d = -8$

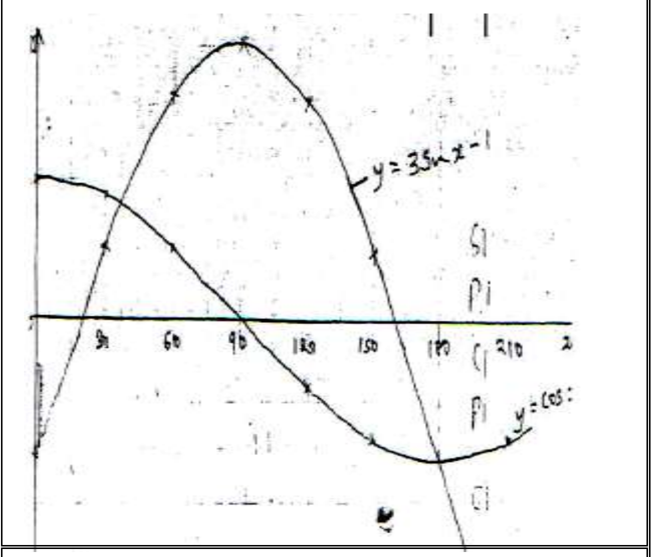
(ii) $S_{10} = \frac{64\left(1-\frac{1}{2}^{10}\right)}{1-\frac{1}{2}}$

127.875

22.

x	0	30	60	90	120	150	180	210
3 Sin x - 1	-1	0.5	1.6	2	1.6	0.5	-1	-2.5
Cos	1	0.87	0.5	0	-0.5	-0.87	-1	-0.87

22.b



(c) x – 37.5

x = 180

(d) 37.5 < x < 180

23

(a) ∠RST = 102^0

Opposite angles of cyclic quadrilateral are supplementary

(b) ∠TUS = 6^0

Angle of a triangle add up to 180^0

(c) Reflex ∠rot = 204^0

Angle at a point sum 360^0

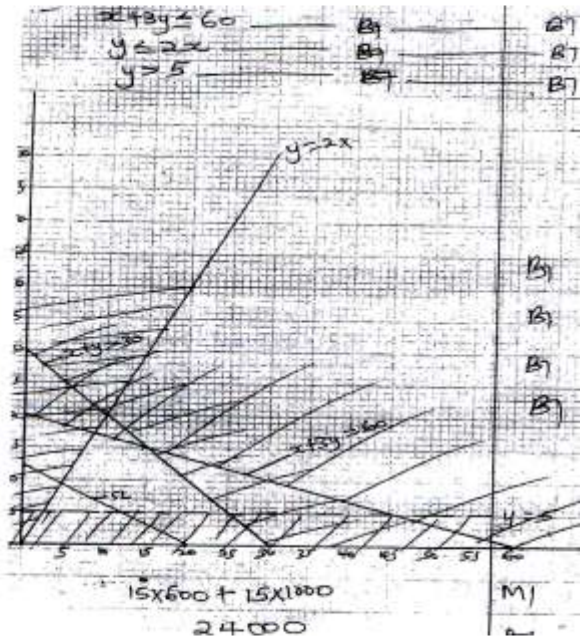
(d) ∠PQT = 54^0

Angle of a triangle sum up to 180^0

(e) ∠QPR = 12^0

Angles subtended by chord at circumference are equal

24



GATUNDU NORTH 2015 MOCK

Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
JULY / AUGUST 2015
2 ½ HOURS

Section 1 (50 mks)

Answer all questions in this section in the spaces provided.

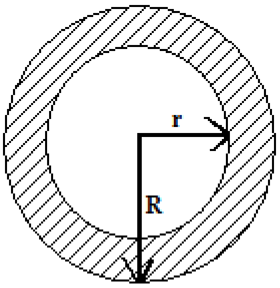
1. Simplify completely (3 mks)

$$\frac{2x^2 + x - 3}{4x^2 - 9}$$

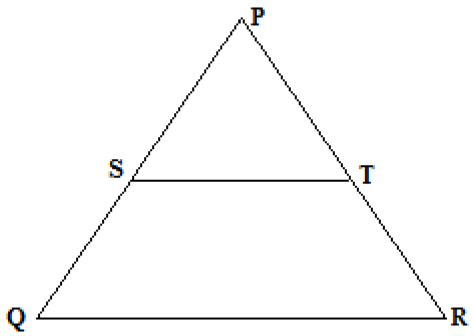
2. Find the area in hectares of a field book measurement recorded in metres as follows. (4 marks)

	D	
	170	
To E 50	140	
	110	60 to C
To F 80	100	
	30	50 to B
	A	

3. The diagram below represents a circular flower bed surrounded by a path of uniform width. Given that R = 14m and r = 12.6m, calculate to the nearest whole number the area of the path. (Take p = $^{22}/_{7}$) (3 mks)



4. The figure below shows triangle PQR in which PR = 12cm. T is a point on PR such that TR = 4cm. Line ST is parallel to OR. If the area of PQR is 336cm^2. Find the area of the quadrilateral QSTR. (4 mks)



5. A number **n** is such that when divided by 3, 7, 11 or 13, the remainder is always one. Find the number **n**. (3 mks)
6. Solve the simultaneous equation. (4 mks)

$$3^x \times 3^y = 1$$
$$2^{(2x - y)} = 64$$

7. Use tables of square, cuberoots and reciprocal to find the value of **x** if (4 mks)

$$x = \sqrt{\frac{1}{0.2365} + \frac{2}{(2.6228)^2}}$$

8. The total age of a group of parents is 342 yrs. A new parent aged 48 yrs joins the group, their average age rises by 1. Find the original number of parents given that they were more than 30. (4 mks)

9. The size of interior angle of a regular polygon is 3x while its exterior angle is (x - 20). Find the number of sides of the polygon. (3 mks)

10. Solve the simultaneous inequality below and list the integral values that satisfy it. (3 mks)
$2x + 21 > 15 - 2x \geq x + 6$

11. The price of an article is marked as 12,000/= Mr. Omanga sold the article at a discount of 10% and still made a profit of 8%. Calculate the cost of the article. (3 mks)

12. A train 20m long is moving at 52km/h. Another train 30m long is moving in the opposite direction at 48km/h. How long do the train take to completely pass each other. Give your answer in seconds. (3 mks)

13. An American tourist arrives in Kenya with 1000 US$ and converted the whole amount into Kenyan shilling. He spend sh. 40000 and changed the balance to Sterling pounds before leaving for United Kingdom. A Kenyan bank buys and sells foreign currencies as shown.

	Buying (in Kshs)	Selling (in ksh)
1 US dollar	84.2083	84.3806
1 Sterling pound	134.7941	135.1294

Calculate the amount he received to the nearest sterling pound. (3 mks)

14. Work out the following.
$^2/_5 \div {}^1/_2$ of $^4/_9 - 1^1/_{10}$ (2 mks)

15. Evaluate the following (2 mks)
$\{-78 \div (-6)\} + \{26x - 2\}$

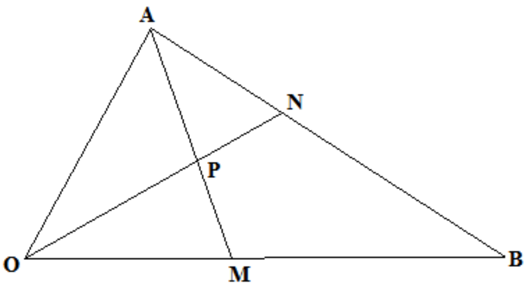
16. Given that $\text{Sin}\theta = {}^2/_3$ and θ is an acute angle, find without tables, $\tan^2\theta + \cos^2\theta$ leaving your answer a a mixed fraction. (2 mks)

Section 2

17. The length and breadth of a rectangle are given as (6x - 1) and (x - 2) metres respectively. If the length and breadth are each increased by 4 metres, the new area is three times that of the original triangle.
a) Form an equation in **x** and solve it. (4 mks)
b) Find the dimension of the original rectangle. (2 mks)
c) Express the increase in area as a percentage of the original area. (4 mks)

18. Three hundred and sixty litres of a homogenous paint is made by mixing three paints A, B and C. The ratio by volume of paints A to paint B is 3 : 2 and paint B to paint C is 1 : 2. Paint A costs sh. 180 per litre, paint B sh. 240 per litre and paint C sh. 127.50 per litre. Determine:
a) The volume of each type of paint in the mixture. (5 mks)
b) The amount of money spent in making one litre of the mixture. (3 mks)
c) The percentage profit made by selling the mixture at sh. 221 per litre. (2 mks)

19. The figure below shows triangle OAB in which $\overrightarrow{OA} = \underset{\sim}{a}$ and $\overrightarrow{OB} = \underset{\sim}{b}$. M and N are points on $\overrightarrow{OB}$ and $\overrightarrow{AB}$ respectively such that $\overrightarrow{OM} = {}^1/_3\overrightarrow{OB}$ and $\text{AN} = {}^2/_5\overrightarrow{AB}$. Line AM and ON meet at P such that $\overrightarrow{OP} = {}^5/_9\ \overrightarrow{ON}$.

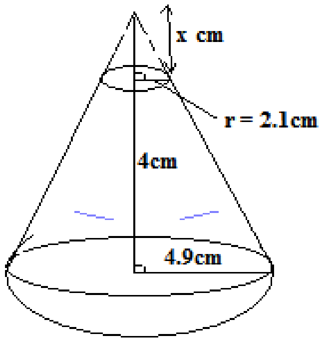


a) Express the following vectors in terms of a and b
i) AB (1 mk)
ii) ON (2 mks)
iii) AM (1 mk)
b) Express AP and PM in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$ and hence show that the points A, P and M are collinear. (6 mks)

20. Four towns P, Q, R and S are such that town Q is 120km due east of town P. Town R is 160km due north of town Q. Town S is on a bearing of 330^0 from P and on a bearing of 300^0 from R.
a) Using a ruler and a compasses only, show the relative positions of towns P, Q, R and S.
Take a scale of 1cm rep 50km. (5 mks)
b) Determine
i) The distance SP in km (2 mks)
ii) The bearing of S from Q. (1 mk)

iii) How far North, s is, from line QP produced. (2 mks)

21. The diagram below represents a solid consisting of a hemispherical bottom and a conical frustrum at the top.



a) Determine the value of **x** hence the height of the cone. (2 mks)

b) Calculate;

i) The surface area of the solid. (4 mks)

ii) The volume of the solid. (4 mks)

22. The table below shows Kenya's tax rates in a certain year.

Income (K**£** p.a)	Tax rates (Ksh per **£**)
1 - 5220	2
5221 - 10440	3
10441 - 15660	4
15661 - 20880	5
20881 and above	6

In that year Mr. Mwangi earned a basic salary of Kshs. 16000 per month. He is entitled to a house allowance of ksh. 12000 per month and a medical allowance of ksh. 2000 per month.

Calculate:

a) i) His taxable income per year in pounds. (2 mks)

ii) His monthly gross tax. (4 mks)

iii) The monthly net tax if he is given a relief of ksh. 1056 per month. (2 mks)

b) Other deductions per month are as follows

N.H.I.F sh. 320, cooperative loan sh. 5600,

WCPS sh 488, coop shares sh 2000

Find his monthly net pay. (2 mks)

23. A bus left town A at 11.45 a.m and travelled towards town B at average speed of 60km/h. A car left town B at 1.15p.m on the same day and travelled towards town A along the same road at an average speed of 90km/h. The distance between the two towns is 540km. Determine

a) The time of day when the two vehicles met. (4 mks)

b) How far from A they met. (2 mks)

c) How far outside town B the bus was when the car reached town A. (4 mks)

24. The distance S metres from a fixed point, covered by a particle t seconds is given by the equation.

$s = t^3 - 6t^2 + 9t + 5$

a) Calculate the gradient of the curve at t = 0.5 seconds. (3 mks)

b) Determine the value of **s** at the maximum turning point of the curve. (4 mks)

c) On the space provided, sketch the curve of $s = t^3 - 6t^2 + 9t + 5$ (3 mks)

GATUNDU NORTH 2015 MOCK
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
JULY / AUGUST 2015
2 ½ HOURS

Section 1 (50 mks)

Answer all questions in this section in the spaces provided.

1. Use logarithms to evaluate. (4 mks)

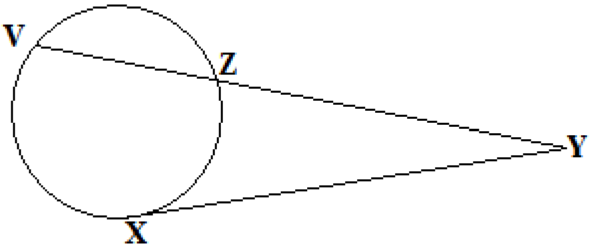
$$\left(\frac{0.9823 \text{ x } (528.4)\ 1/3}{(965.3)}\right)\ \frac{1}{4}$$

2. Make y the subject of the formula. (3 mks)

$$k = \frac{1}{g}\begin{pmatrix} m + y^2 \\ 1 - y^2 \end{pmatrix}$$

3. Without using mathematical tables evaluate,
$6\log_{10}2 - 3\log_{10}2 + 3\log_{10}5$

4. In the figure below XY is a tangent to a circle at YZ.VZ is a chord which produced to meet XY at Y. Given that XY = 9cm and YZ = 6cm. Calculate the length of VZ. (3 mks)



5. The equation of a circle is $x^2 - 8x + y^2 + 12y = 12$. Determine the centre and its radius of the circle. (3 mks)
6. Two values X and Y are such that
$\underline{3.5 < x < 4.9}$
$0.03 \leq x \leq 0.27$
What is the greatest possible value of $\frac{x^2}{y}$ (2 mks)
7. a) Expand and simplified the first four terms of the binomial expression $(2 - 3x)^6$. (1 mk)
b) Use the simplified expression in (a) above to estimate the value of $(1.97)^6$ correct 5 decimal places. (2 mks)
8. Given that (x - 2) is a factor of $3x^2 + kx - 2$ find the value of **k** and hence the other factor. (3 mks)
9. The vectors a = (2x - 4)i + (x - 3)j + (x - 2)k and its length of (a) = 7. Find two possible values of **x**.
10. Simplify the following expression as far as possible. (3 mks)

$$\frac{x}{y - z} - \frac{x}{y + z}$$

Hence or otherwise simplified

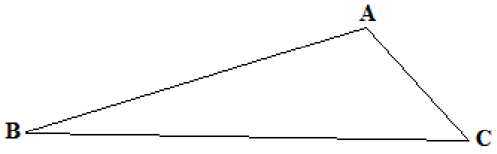
$$\frac{\sqrt{21}}{\sqrt{6} - \sqrt{2}} - \frac{\sqrt{21}}{\sqrt{6} + \sqrt{2}}$$

11. Find the value of **x** in the equation $10\text{Cos}^2x - 7\sin x + 2 = 0$ for domain $0^0 \leq x \leq 360^0$. (3 mks)
12. Given A = $\begin{pmatrix} -3 & 4 \\ 0 & 1 \end{pmatrix}$ and c = $\begin{pmatrix} 9 & 14 \\ 3 & 0 \end{pmatrix}$

Find **a** matrix B so that BA = c (3 mks)

13. Use method of completing of square leaving your answer in a simplified surds $x^2 = 7x - 2$ (3 mks)
14. Two quantities A and B are such that B varies directly as square of A. When A is increased by 20%, what percentage increase in B. (3 mks)

15. Mr. Kamau borrowed some money at 8% simple interest p.a. He borrowed the same amount and again repaid at the end of the year. If Kamau paid interest of Ksh. 2500 and ksh. 4000 respectively for each year, calculate
a) The value of r
b) The amount borrowed per year.
16. The figure below shows triangle ABC. On the given figure, construct the locus of P such that <BPC is always equal to <BAC and that P is always on the same side of B as A.



SECTION B

17. A company is to construct a parking bay whose area is $135m^2$. It is to be covered with a concrete slab of uniform thickness of 150mm. To make the slab, cement, ballast and sand are to be mixed so that their masses are in the ratio 1 : 4 : 4. The mass of $1m^3$ of dry slab is 2500kg. Calculate
a) i) the volume of the slab. (2 mks)
   ii) the mass of the dry slab. (1 mk)
   iii) the mass of cement to be used. (2 mks)
b) If one bag of cement is 50kg, find the number of bags to be purchased. (2 mks)
c) If a lorry carries 7 tonnes of sand, calculate the number of lorries of sand to be purchased. (3 mks)
18. The probability of three dart players Githongo, Mwai and Kanyoro hitting the bulls eye in a competition are 0.4, 0.7 and 0.5 respectively.
a) Draw a probability tree diagrams to show the possible outcomes. (2 mks)
b) Find the probability that
   i) all hit the bulls eye. (2 mks)
   ii) only one of them hit the bulls eye. (3 mks)
   iii) atmost one missed the bulls eye. (3 mks)
19. The first, third and sixth terms of an arithmetic progression (AP) correspond to the first three consecutive terms of a geometric progression (GP). The first term of each progression is 16, common difference of AP and d and common ratio of the GP is r.
a) i) Write two equations involving **d** and **r**. (2 mks)
   ii) Find the values of **d** and **r**. (4 mks)
b) Find the sum of the first 20 terms in the
   i) Arithmetic progression (AP). (2 mks)
   ii) Geometric progression (GP) (2 mks)
20. The diagram below shows a circle centre O. AB is a tangent to the circle at B. BD is a diameter and AEC is a straight line. Angle BDE = 50^0 and DEC = 20^0.
Giving reasons find the size of
   a) angle CBD (2mks)
   b) angle ACD (2 mks)
   c) angle ABC (2 mks)
   d) angle BAC (2 mks)
   e) angle ABE (2 mks)
21. a) Complete the table below for y = 2sin x + 1 and y =3 Cos $(x + 30^0)$ (2 mks)

x	0	30	60	90	120	150	180	210	240
2 sin x + 1	1.0	-	2.7	-	2.7	-	-	0	-0.7
$3Cos(x + 30)^0$	2.6	-	0	-1.5	-	-3	-2.6	-	-

b) On the same axis, draw the graph of y = 2 Sin x + 1 and y = 3 Cos $(x + 30)^0$ for $0^0 \leq x \leq 240^0$. (4 mks)
c) i) Find the values of **x** for which 2 Sin x + 1 = 3 Cos$(x + 30)^0$ (2 mks)
   ii) State the period and the amplitude for y = 3 Cos $(x + 30)^0$ (2 mks)
22. A particle moving along a line passes a point O at a velocity of 15m/s and its acceleration t seconds later is given by a = (2t - 8) m/s^2

a) Find the expression of the velocity after passing the point O. (3 mks)

b) Find the time when the particle is at rest. (3 mks)

c) Find the distance between the points when the particle is at rest. (4 mks)

23. The position of two towns A and B on earth surface are (36^0N, 49^0E) and (36^0N, 131^0W) respectively.
Take R = 6370

a) Find the difference in longitude between the town A and B. (1 mk)

b) Calculate the distance between A and B along the latitude in

i) nautical miles (2 mks)

ii) kilometres (2 mks)

c) i) Another town C is 840km East of town B and on the same latitude as town A and B . Find the position of town C. (3 mks)

ii) If the local time in B is 7.30 a.m, find the local time in C. (2 mks)

24. Triangle PQR has the vertices P(2, 0) Q(2 ,3) and R(5, 2). $P_1Q_1R_1$ is the image of PQR under the translation with the vector $\begin{pmatrix} 0 \\ 4 \end{pmatrix}$ $P_2Q_2R_2$ is the image of $P_1Q_1R_1$ under a transformation given by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

a) On the same axis, plot PQR, $P_1Q_1R_1$ and $P_2Q_2R_2$. (6 mks)

b) Describe the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ (2 mks)

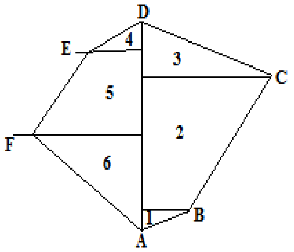
c) Find a single matrix that maps PQR onto $P_2Q_2R_2$.

GATUNDU NORTH 2015 MOCK
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
JULY / AUGUST 2015
2 ½ HOURS

1.
$(2x + 3)x - 2x + 3$
$\underline{(x - 1)(2x - 3)}$
$(2x - 3)(2x + 3)$
$\underline{x - 1}$
$2x - 3$

2



1) $^1/_2 \times 30 \times 50 = 750$
2) $^1/_2 \times 80(50 + 60) = 4400$
3) $^1/_2 \times 60 \times 60 = 1800$
4) $^1/_2 \times 30 \times 50 = 750$
5) $^1/_2 \times 40(80 + 50) = 2600$
6) $^1/_2 \times 100 \times 80 = 400$
$\underline{14{,}300}$ -
$10{,}000 \quad = 1.43$ hec

$A = \pi R^2 - \pi r^2$
$= {^{22}/_7}(14^2 - 12.6^2)$
$= {^{22}/_7}(196 - 158.76)$
$= {^{22}/_7} \times 37.24$
$= 117.04$
$= 117 m^2$

4
L.S.F. $= {^{12}/_8} = {^3/_2}$
A.S.F $= {^9/_4}$
${^{336}/_x} = {^9/_4}$
$x = 149{^1/_3}$
Area of quad $= 336 - 149{^1/_3}$
$= 186{^2/_3}\ cm^2$

5.

3	3	7	11	13
3	1	7	11	13
7	1	1	11	13
11	1	1	1	13
13	1	1	1	1

LCM $= 3 \times 7 \times 11 \times 13$
$= 3003 + 1$
$= 3004$

6
6. $\left.\begin{array}{l} 3^{(x + y)} = 3^0 \\ 2^{2x - y} = 2^6 \end{array}\right\}$

$x + y = 0$
$\underline{2x - y = 6}$
$3x = 6$
$x = 2$
$x + y = 0$
$y = -2$
$x = 2$
$y = -2$

7.
$$\left(\frac{1}{2.365} + 2\left(\frac{1}{2.6228}\right)^2\right)^{\frac{1}{3}}$$
$$\left(0.4228 \times 10^1 + 2(0.1448)\right)^{\frac{1}{3}}$$
$$\left(4.228 + 0.2896\right)^{\frac{1}{3}}$$
$4.5176^{1}/_{3}$
$= 1.65$

8. $\frac{342}{x} + 1 = \frac{342 + 48}{x + 1}$ M1
$\frac{342 + x}{x} = \frac{342 + 48}{x + 1}$

$(342 + x)(x + 1) = x(490)$ M1
$x^2 - 47x + 342 = 0$

$x = \frac{47 \pm \sqrt{841}}{2}$ M1

$x = 38$ or $x = 9$
.: $x = 38$ parents A1

9. $3x^0 + (x - 20)^0 = 180$ M1
$4x = 200^0$
.: $x = 50^0$ M1
Exterior $= 50 - 20 = 30^0$
.: No of sides $= {^{360}/_{30}} = 12$ sides
$= 12$ sides A1

10. $2x + 21 > 15 - 2x$
${^{4x}/_4} > {^{-6}/_4}$
$x > -1.5$ M1
$15 - 2x \geq x + 6$
${^9/_3} \geq 3x$
$3 \geq x$ M1
Integers -1, 0, 1, 2, 3 A1

11

11. ${}^{90}/_{100}$ x 12000 = 10,800/= M1

${}^{108}/_{100}$ x x = 10,800 M1

x = 10,000 A1

12

Dist = 50m (30 + 20)
Relative speed = 100km/h (52 + 48) M1
Time = ${}^{50}/_{100}$ x ${}^{3600}/_{100}$ M1
= 1.8 sec A1

13

1000 x 84.2084 M1
= 84208.3
84208.3 - 40000 M1
= 44208.30
= $\frac{44208}{135.1293}$
= 327 A1

14

${}^{1}/_{2}$ x ${}^{4}/_{9}$ = ${}^{2}/_{9}$

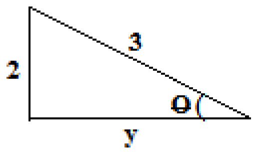
${}^{2}/_{5}$ x ${}^{9}/_{2}$ = ${}^{9}/_{5}$ M1

${}^{9}/_{5}$ - ${}^{11}/_{10}$ = ${}^{7}/_{10}$ A1

15

(52) + (-52) M1
= 0 A1

16



y = $\sqrt{9 - 4}$ = $\sqrt{5}$
$\tan^2\theta + \cos^2\theta$
$\left(\frac{2}{5}\right)^2 + \left(\frac{\sqrt{5}}{3}\right)^2$ M1
= ${}^{4}/_{5}$ + ${}^{5}/_{9}$ = ${}^{61}/_{45}$ = $1^{16}/_{45}$ A1

17

SECTION II

a) Dimension of the new rectangle
$(6x + 3)(x + 2) = 6x^2 + 15x + 6$ M1
$6x^2 + 15x + 6 = 18x^2 - 39x + 6$ M1
$12x^2 - 54x = 0$ M1
$6x(2x - 9) = 0$
x = 4.5 A1

b) Length = 2 6 metres
Breadth = 2.5 metres

c) Original area = (26 x 2.5) = 65m^2 M1
New area = (30 x 6.5) = 195m^2 M1
% increase
= $\frac{195 - 65}{65}$ x 100 M1
= 200%

18.

a) A : B : C = 3 : 2 : 4 M2
A = ${}^{3}/_{9}$ x 360 = 120 litres M1
B = ${}^{2}/_{9}$ x 360 = 80 litres M1
C = ${}^{4}/_{9}$ x 360 = 160 litres M1

b) $\frac{(120 \text{ x } 180) + (240 \text{ x } 80) + (160 \text{ x } 127.5)}{360}$ M2
= sh. 170 A1

c) % profit = $\frac{210 - 170}{170}$ x 100 M1
= 23.53%

19.

a) i) $\overrightarrow{AB} = \underset{\sim}{b} - \underset{\sim}{a}$ M1

ii) $\overrightarrow{ON} = \overrightarrow{OA} + \overrightarrow{AN}$
$= \underset{\sim}{a} + {}^{2}/_{5}(\underset{\sim}{b} - \underset{\sim}{a})$ M1

$= \underset{\sim}{a} + {}^{2}/_{5}\underset{\sim}{b} - {}^{2}/_{5}\underset{\sim}{a}$ A1

$= {}^{3}/_{5}\underset{\sim}{a} + {}^{2}/_{5}\underset{\sim}{b}$

iii) $\overrightarrow{AM} = \overrightarrow{AO} + \overrightarrow{OM}$
$= -\underset{\sim}{a} + {}^{1}/_{3}\underset{\sim}{b}$ A1

b) $\overrightarrow{AP} = \overrightarrow{AO} + \overrightarrow{OP}$
$= -\underset{\sim}{a} + {}^{5}/_{9}({}^{3}/_{5}\underset{\sim}{a} + {}^{2}/_{5}\underset{\sim}{b})$ M1

$= -a + {}^{5}/_{15}\underset{\sim}{a} + {}^{2}/_{9}\underset{\sim}{b}$

$= {}^{2}/_{9}\underset{\sim}{b} - {}^{2}/_{3}\underset{\sim}{a}$

$= {}^{2}/_{3}({}^{1}/_{3}\underset{\sim}{b} - \underset{\sim}{a})$ A1

$\overrightarrow{PM} = \overrightarrow{PO} + \overrightarrow{OM}$
$= -{}^{5}/_{9}({}^{3}/_{5}\underset{\sim}{a} + {}^{2}/_{5}\underset{\sim}{b}) + {}^{1}/_{3}\underset{\sim}{b}$ M1

$= -{}^{1}/_{3}a - {}^{2}/_{9}\underset{\sim}{b} + {}^{1}/_{3}\underset{\sim}{b}$

$= {}^{1}/_{9}\underset{\sim}{b} - {}^{1}/_{3}\underset{\sim}{a}$

$= {}^{1}/_{3}({}^{1}/_{3}\underset{\sim}{b} - \underset{\sim}{a})$ M1

$\overrightarrow{AP} = k\overrightarrow{PM}$
${}^{2}/_{3}({}^{1}/_{3}\underset{\sim}{b} - \underset{\sim}{a}) = k({}^{1}/_{3}({}^{1}/_{3}\underset{\sim}{b} - \underset{\sim}{a})$ M1

${}^{2}/_{3} = {}^{1}/_{3}k$
k = 2

Therefore $\overrightarrow{AP} = 2\overrightarrow{PM}$ and they share a common point P thus they are collinear A1

21

a) $\frac{x}{x + 4} = \frac{2.1}{4.9}$ B1

$4.9x = 2.1x + 8.4$
$2.8x = 8.4$
$x = 3$
Height = 3 + 4 = 7cm A1

b) i) $2\pi r^2$ (Area of hemisphere)
$= 2 \times \frac{22}{7} \times 4.9 \times 4.9$ M1
$= 150.92cm^2$

$\left.\begin{array}{l}\sqrt{7^2 + 4.9^2} = 8.545 \\ \sqrt{3^2 + 2.1^2} = 3.662\end{array}\right\}$

Curved S.A frustrum
$= (\frac{22}{7} \times 4.9 \times 8.545) -$ M1
$(\frac{22}{7} \times 2.1 \times 3.662)$
$= 107.4cm^2$

Area of the top $= \pi r^2$
$= \frac{22}{7} \times 2.1 \times 2.1$
$= 13.86cm^2$ M1
Total surface area
= 150.92 + 107.4 + 13.86
= 272.18cm A1

ii) Volume of the solid
Vol of hemisphere
$= \frac{2}{3} \times \frac{22}{7} \times 4.9^3$
$= 246.5cm^3$ M1
Volume of the frustrum =
$(\frac{1}{3} \times \frac{22}{7} \times 4.9^2 \times 7) - (\frac{1}{3} \times \frac{22}{7} \times 2.1^2 \times 3)$ M1
= 176.07 - 13.86
$= 162.61cm^3$ M1

Total volume of solid =(246.5 + 162.21)
$= 408.71cm^2$ A1

22

a) i) Taxable income
= 16 000 + 12 000 + 2 000 M1
= Sh. 30 000 p.m
$= \frac{30\,000 \times 12}{20}$
= £18 000 p.a A1

ii) 5220 x 2 = sh. 10 440
5220 x 3 = sh. 15 660 M1
5220 x 4 = sh. 20 880 M1
2340 x 5 = <u>sh. 11 700</u>
58 680 p.a
Monthly gross tax = $\frac{58680}{12}$ M1
= 4890 A1

iii) Net tax = 4890 - 1056 M1
= sh. 3834 A1

b) Total deductions
= 3834 + 320 + 5600 + 488 + 2000
= Sh. 12,242
Net pay = 30,000 - 12,242 M1
= Sh. 17 758 A1

23

a) Time before car started = 13.15 - 11.45= $1\frac{1}{2}$h
Distance moved by bus = $\frac{3}{2}$ x 60 = 90km B1
Distance btn two vehicles when car started
= 540 - 90 = 450km
Relative speed = 60 + 90 = 150km M1
Time taken to meet = $\frac{450}{150}$ = 3h M1
Time they met = 1.15 + 3 = 4.15 p.m A1

b) Total time moved by bus when they met
= 16.15 - 11.45 = $4\frac{1}{2}$h
Distance from A = $\frac{9}{2}$ x 60 M1
= 270km A1

c) Time taken by the car to travel from B to A
= $\frac{540}{90}$ = 6h
Tim car reaches A = 13.15 + 6 = 19.15h
Time travelled by bus until car reaches A
= 19.15 - 11.45 = $7\frac{1}{2}$h M1
Distance moved by nus from A
= $\frac{15}{2}$ x 60 = 450km M1
Distance outside town B = 540 - 450 M1
= 90km A1

24

a) $S = t^3 - 6t^2 + 9t + 5$
$\frac{ds}{dt} = 3t^2 - 12t + 9$ M1
At t = 0.5 seconds
Gradient = $3(0.5)^2 - 12(0.5) + 9$ M1
= 3.75m A1

b) When $\frac{ds}{dt} = 0$
$3t^2 - 12t + 9 = 0$
t2 - 4t + 3 = 0
(t - 1) (t - 3) = 0 M1
t = 1 or t = 3 seconds
When t = 1
S = 1 - 6 + 9 + 5 = 9m A1
When t = 3
$S = 3^3 - 6 \times 3^2 + (9 \times 3)$ = 5m = 5m M1A1

c) $\frac{d^2s}{dt^2} = 6t - 12$
At t = 1
$\frac{d^2t}{dt^2} = 6 \times 1 - 12 = 16$ M1
Therefore at (1, 9) max turning point
At t = 3
$\frac{d^2s}{dt^2} = 18 - 12 = 6$
At (3, 5) min turning point M1

GATUNDU NORTH 2015 MOCK
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
JULY / AUGUST 2015
2 ½ HOURS

1	No | Log 0.9823 | 1.992 528.4 | 2.7230 ÷ 3 A1 log 0.9077 M1 0.8999 (a) M1 965.3 | 2.9847÷ 2 1.4924)b) M1 $\frac{\bar{1}.4075}{4}$ (a - b) $7.110 \times 10^{-1} \leftarrow \bar{1}.8519$ $\frac{\bar{4} + 3.4075}{4}$ = 0.7110 A1	**6.**	Maximum value of x = 4.95 Minimum value of x = 3.45 Maximum value of y = 0.275 Minimum value of y = 0.025 greatest possible value M1 $= \frac{(\text{Max value of x})^2}{\text{Min value of y}}$ $= \frac{4.95^2}{0.025}$ = 980.10 A1
2.	$k^3g^3 = \frac{m + y^2}{1 - y^2}$ $k^3g^3 (1 - y^2) = m + y^2$ M1 $k^3g^3 - k^3g^3y^2 = m + y^2$ $k^3g^3 - m = y^2 + k^3g^3y^2$ $k^3g^3 - m = y^2(1 + k^3g^3)$ M1 $y^2 = \frac{k^3g^3 - m}{1 + k^3g^3}$ $y = \pm\sqrt{\frac{k^3g^3 - m}{1 + k^3g^3}}$ A1	**7.**	$1.2^6 . 6.2^5(-3x)\ 15.2^4(-3x)^2\ 20.2^3(-3x)^3$ $64 - 576x + 2160x^2 - 4320x^3$ A1 $(2 - 0.03)^6 = (2 - 3x)^6$ $\frac{-0.03}{-3} = \frac{-3x}{-3}$ x = 0.01 $64 - 576(0.01) + 2160(0.01)^2$ M1 $- (4320)\ (0.01)^3$ = 58.45168 A1
3.	$\log_{10}2^6 - \log_{10}2^3 + \log_3 5$ $\log_{10}(\frac{64 \times 125}{8})$ $\log_{10}{}^{1000} = 3\log_{10}{}^{10} = 3$	**8.**	Let another factor be 3x + a $(x - 2)\ (3x + a) = 3x^2 + kx - 2$ B1 $3x^2 + xa - 6x - 2a = 3x^2 + kx - 2$ x(a - 6) = kx -2a = -2 a = 1 but a = a a - 6 = k M1 1 - 6 = k k = -5 (3x + 1) is another factor A1
4.	Let VƵ = x $(6 + x)6 = 9^2$ M1 36 + 6x = 81 M1 6x = 45 A1 x = 7.5cm	**9.**	Squaring both sides $\sqrt{(2x - 4)^2 + (x - 3)^2 + (x - 2)^2} = 7$ M1 $4x^2 - 16x + 16 + x^2 - 6x + 9 + x^2 - 4x + 4 = 49$ $6x^2 - 26x = 20$ $3x^2 - 13x - 10 = 0$ $3x^2 - 15x + 2x - 10 = 0$ M1 3x(x - 5) + 2(x - 5) = 0 (3x + 2) (x - 5) = 0 $\frac{3x}{3} = \frac{-2}{3}$ or x = 5 A1 for both $x = {}^{-2}/_3$
5.	$x^2 - 8x + (^8/_2)^2 + y + 12y + (^{12}/_2)^2 = 12^2$ $x^2 - 8x + 16 + y^2 + 12y + 36 = 144 + 36 + 16$ M1 $(x - 4)^2 + (y + 6)^2 = 196$ $(x - h)^2 = (x - 4)^2\ (y - k)^2 = (y + 6)^2$ M1 h = 4 k = -6 M1 $R^2 = 14^2$ R = 14 Centre = (4 ; 6) A1 Radius = 14 units		

10

$\frac{x(y + z) - x(y - z)}{y^2 - z^2}$ M1

$\frac{xy + xz - xy + xz}{y^2 - z^2}$

$\frac{2xz}{y^2 - z^2}$ A1

2

.: x = $\sqrt{21}$, y = $\sqrt{6}$ and z = $\sqrt{2}$ M1

$\frac{2\sqrt{21} \times \sqrt{2}}{(16)^2 - (2)^2}$

$= \frac{\sqrt{42}}{2}$ A1

11

NB: $\cos^2 x = (1 - \sin^2 x)$

Let Sinx be t

$10(1 - t^2) - 7t + 2 = 0$ M1

$10 - 10t^2 - 7t + 2 = 0$

$-10x^2 - 7t + 12 = 0$

$10t^2 + 7t - 12 = 0$

$10t + 15t - 8t - 12 = 0$

$5t(2t + 3) - 4(2t - 3) = 0$ B1

$(5t - 4)(2t + 3) = 0$

$t = {}^4/_5$ or $t = {}^{-3}/_2$

but t = Sin x

$\sin x = {}^4/_5$

$X = \sin^{-1} {}^4/_5 = 53.13^0$

$x = 53.13^0$ and 126.87^0 A1

12

Let matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ B

$B = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} -3 & 4 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -9 & 14 \\ 3 & 0 \end{pmatrix}$

$-3a = -9$

$a = 3, \quad c = -1$ M1

$b = 2 \quad d = 4$ B1

$B = \begin{pmatrix} 3 & 2 \\ -1 & 4 \end{pmatrix}$ A1

13

$x^2 - 7x = -2$ B1

$x^2 - 7x + ({}^7/_2)^2 = -2 + ({}^7/_2)^2$

$(x - {}^7/_2)^2 = (-2 + {}^{49}/_4)$ M1

$x = {}^7/_2 \pm {}^{\sqrt{41}}/_2$

$x = \frac{7 + \sqrt{41}}{2}$ A1

3

14

B α A^2

$B = KA^2$

$B^1 = K \times 1.2^2 B^{12}$ M1

$B^1 = 1.44B^{12}$

Change in B = B^1 - B M1

1.44 - 1

= 0.44 x 100 A1

Hence B increase by 44%

15

${}^r/_{100}$ x P x I = 2500

Pr = 250,000

$\frac{(r + 6)}{100}$ x P = 4000

Pr + 6p = 400,000

6P = 400,000 - 250,000 B1

6P = 150,000

P = Ksh. 25,000

P x r = 250,000

r x $\frac{25000}{25000} = \frac{250,000}{25000}$

r = 10% A1

P = Kshs 25,000 per year A1

16

i) Construction of perpendicular of AC and AB B1

Locating point O where perpendiculars meet B1

Constructing arc BAC and labelling it

locus of P A1

17

V = 135 x 0.15 = 20.25m^3

1m^3 = 2500kg

2025m^3 = x

= 20.25 x 2500

= 50625kg

C : B : J

1 : 4 : 4

Cement = ${}^1/_9$ x 50625

= 5625kg

${}^{5625}/_{50}$ = 112.5 bags

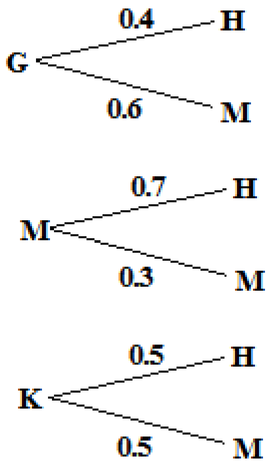
Sand = ${}^4/_9$ x 50625 = 22500

7 tons => 7000kg

= ${}^{22500}/_{7000}$

= 3.2 lorries

18



H-HIT
M-MISS

P(HHH) = 0.4 x 0.7 x 0.5 = 0.14

P(HMM) + P(MHM) + P(MMH)
= (0.4 x 0.3 x 0.5) + (0.6 x 0.7 x 0.5)
+ (0.6 x 0.3 x 0.5)
= 0.06 + 0.21 + 0.09
= 0.36

P(MHH) + P(HMH)+ P(HHM) + P(MMM)
= (0.6 x 0.7 x 0.5) + (0.4 x 0.3 x0.5) + (0.6 x 0.3 x 0.5) + (0.4 x 0.7 x 0.5)
= 0.21 + 0.06 + 0.09 + 0.14= 0.5

19.

Sum (AP
AP = > a, a + 2d, a + 5d $^{20}/_{2}$(2 x 16 + 19 x 4)
GP => a = a = 10(32 + 76)
ar = a + 2d = 10 x 108
ar^2 = a + 5d = 1080

$r = \frac{a + 2d}{a} = \frac{a + 5d}{a + 2d}$

$\frac{a + 2d}{a} = \frac{a + 5d}{a + 2d}$

a(a + 5d) = (a + 2d) (a + 2d)
$a^2 + 5ad = a^2 + 4d + 4d^2$
$4d^2$ - ad = 0
d(4d - a) = 0
d = 0
4d - a = 0
(4 x 16) - n = 0
a = 64
4d - 16 = 0
4d = 16
d = 4

$r = \frac{a + 2d}{a}$ $J = \frac{(r^n - 1)}{r - 1}$

$= \frac{16 + 2 \times 4}{16}$ $= \frac{16(1.5^{20} - 1)}{1.5 - 1}$

$= \frac{16 + 8}{16}$

$= \frac{\cancel{24}\ 3}{\cancel{16}\ 2}$ = 16 x 3324.25673
= 106376.2154

$r = 1^1/_2$

20

<CBD = 20^0 angles supported by the same chord CD

ACD
DBE = ACD = 40^0
Angles supported by the same chord DE

ABE = 50^0 = BDE
Alternate segment angles

BEA = 110^0 angles on straightline
BAC = 20^0
Angles in a triangle
ABE

ABC = 180 - 20 - 50 = 100^0
Angles in a triangle
ABC

21

x	0	30	60	90	120	150	180	210	240
2Cosx + 1	1.0	2.0	2.7	3.0	2.7	2.0	1.0	0	-0.7
3cosx + 30	2.6	1.5	0	-1.5	-2.6	-3	-2.6	-1.5	0

c) x = 22.5^0 and x = 232.5
Amplitude = 3
Period = 360^0

22

a = 2t - 8
$V = \frac{2t^2}{2} - 8t + C$
$V = t^2 - 8t + C$
t = 0, V = 15
15 = 0 - 0 + C
C = 15
$V = t^2 - 8t + 15$

V = 0 at rest
$t^2 - 8t + 15 = 0$
(t - 3) (t - 5) = 0
t = 3 sec
t = 5 sec

22	22. c) $\int_3^5$ $(t^2 - 8t + 15)dt$	
	$\left[\frac{t^3}{3} - 4t2 + 15\right]_3^5$	
	$(^{125}/_{3}$ - 4 x 25 + 15 x 5) -	
	$(^{27}/_{3}$ - 4 x 9 x 15 x 3)	
	(41.67 - 100 + 75) -	
	(9 - 36 + 45)	
	16.67 - 18	
	= 1.33 sq units	
23	a) $(49E^0 + 131^0E)$	
	Long diff = 180^0	A1
	b) i) 180 x 60 x $60Cos36^0$	M1
	= 8737.384nm	A1
	ii) $^{180}/_{360}$ x 2 x p x $6370Cos36^0$	B1
	= 16,190km	A1
	c) i) Longitude diff	
	$(131^0$ - Ɵ) x 2 x p x $6370Cos36^0$ = 9.34 360	M1
	= 840	
	131 - Ɵ = 9.34	M1
	-Ɵ = -121.66	
	Position of C Ɵ = 121.66^0	
	C = $(36^0N$ $121.66^0N)$	A1
	ii) Longitude diff = 9.34^0	M1
	1^0 = 4min	
	9.340 = ?	
	= 37 mins	
	4 x 9.34 = 37 min	
	10.30 + 37 min	
	C = 9.07 a.m	A1
	10	

MURANG'A SOUTH MULTILATERAL EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
JULY / AUGUST 2015
2 ½ HOURS

Section 1 (50 mks)
Answer all questions in this section in the spaces provided.

1. Simplify completely

$$\frac{9a^2y - 16b^2y^3}{4by^2 - 3ay}$$ (4 mks)

2. Simplify the expression. (4 mks)

$\frac{x-1}{x} - \frac{2x+1}{3x}$ Hence solve the equation

$$\frac{x-1}{x} - \frac{2x+1}{3x} = \frac{2}{3}$$

3. If $^2/_3$ is added to the numerator of a certain fraction the fraction will be increased by $^1/_{21}$ and if $^1/_2$ is deducted from its denominator that fraction becomes $^2/_9$. Find the reciprocal of the fraction. (4 mks)

4. Without using a calculator or mathematical tables, evaluate. (3 mks)

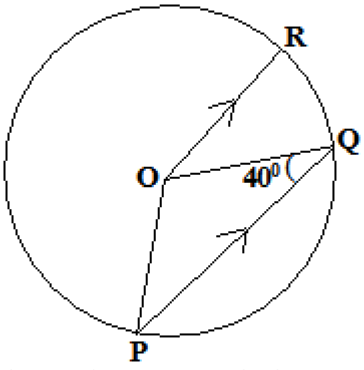
$$\frac{-2(5+3) - 9 \div 3 + 5}{-3(-5) + -2(4)}$$

5. A polygon of **n** sides has half of the interior angles 150^0 each and the rest 170^0 each. Find the value of **n**. (2 mks)

6. Kanyau toured Switzerland from Germany. In Switzerland he bought his wife a present worth 72 Deutsche marks. Find the value of the present in
   a) Swiss Francs
   b) Kenya shillings correct to the nearest sh, if
      1 Swiss Franc = 1.25 Deutsche marks
      1 Swiss Franc = 48.2 Kenya shillings (3 mks)

7. Given that Sin x = $^3/_4$ find without using tables or calculators.
   a) Cos x
   b) Tan (90 - x) (3 mks)

8. In the figure below, O is the centre of the circle. PQ is parallel to OR and PQO = 40^0, find <PRO. (2 mks)



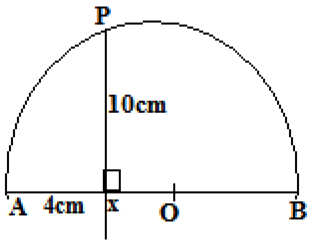
9. A colony of insects was found to have 250 insects at the beginning. Thereafter, the number of insects doubled every two days. Find the number of insects after 16 days. (3 mks)

10. The cash price of a music system is kshs. 30,000. It can be bought under hire purchase terms by paying a deposit of kshs. 10,000 and twelve monthly installments of Kshs. 3,200 per month. Determine the percentage rate of interest per month. (3 mks)

11. A square whose vertices are P(1, 1), Q(2, 1), R(2, 2) and S(1, 2) is given an enlargement with centre at (0, 0). Find the images of the vertices if the scale factor is 3. (3 mks)

12. Kairietu is now four times as old as her daughter and six times as old as her son. Twelve years from now, the sum of the ages of her daughter and son will differ from her age by 9 years. What is Kairietu's present age? (3 mks)

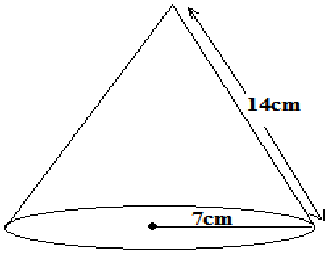
13. In the figure below O is the centre of the circle diameter AB. <AXP = 90^0, AX = 4cm and PX = 10cm. Calculate the radius of the semi-circle. (3 mks)



14. Given that $a = 5i + 4j$, $b = 3i - 2j$ and $c = 7i + 10j$; find the scalars **m** and **n** such that $m\underset{\sim}{a} + n\underset{\sim}{b} = \underset{\sim}{c}$ (4 mks)

15. Solve the simultaneous inequalities and represent the solution on a number line; $4 - 2x < 8$ and $2 - 3x \geq - 7$ (3 mks)

16. The figure below is a cone whose base radius is 7cm and slant height 14cm. The net of the cone is a sector of a circle.



a) Find the angle substended at the centre of the sector. (1 mk)

b) Draw the net of the solid. (2 mks)

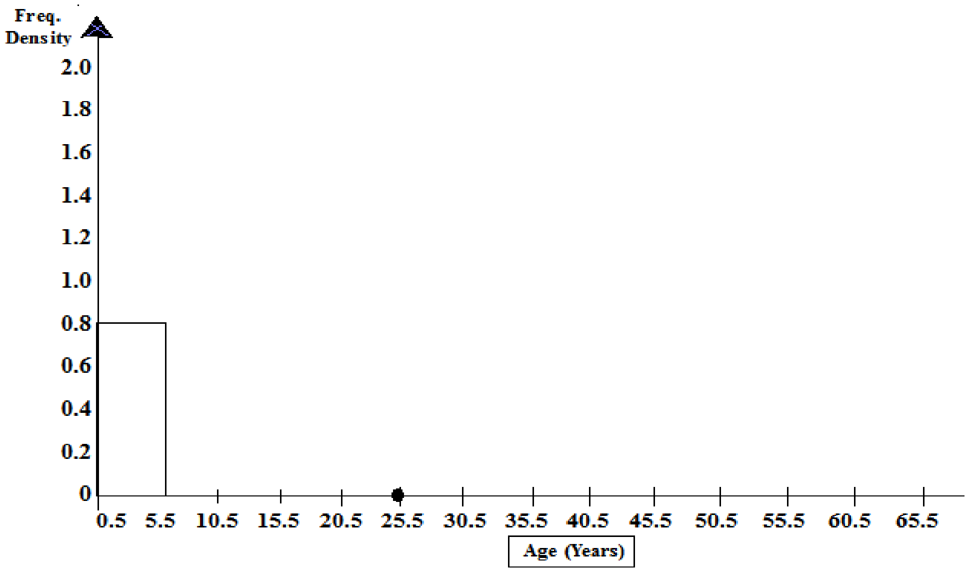
SECTION B (50 MARKS)

Answer any five questions from this section

17. The following data shows the sample of age distribution in years of the people who reside in a certain village in Murang'a.

Age group	Frequency
1 - 5	4
6 - 10	8
11 - 20	8
21 - 30	6
31 - 50	40
51 - 55	3
56 - 65	3

a) Complete the histogram of the given data below. (6 mks)



b) Calculate the mean age of the given sample in the village. (4 mks)

18. a) Copy and complete the following table for $y = 2x^2 + 4x - 5$ (2 mks)

x	-4	-3	-2	-1	0	1	2
$2x^2$	32			2	0		8
4x	-16			-4	0		8
-5	-5	-5	-5	-5	-5	-5	-5
y	11			-7	-5		11

b) i) Draw the graph of $y = 2x^2 + 4x - 5$ (3 mks)

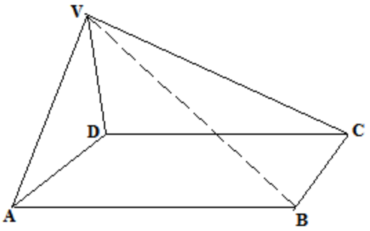
ii) Use the graph of b (i) above to solve the equation $2x^2 + 4x - 5 = 0$ (1 mk)

c) To solve the equation $2x^2 + x - 7 = 0$ a straight line must be drawn to intersect the curve $y = 2x^2 + 4x - 5$.

i) Find the equation of the line. (1 mk)

ii) Draw the line and hence estimate the roots of the equation $2x^2 + x - 7 = 0$. (3 mks)

19. The diagram below is a right pyramid on a rectangular base.



Given that the volume of the solid is $280m^3$ and its base area is $60cm^2$ and that AB : BC = 3 : 5, determine

i) The height of the pyramid. (2 mks)

ii) The length and width of the base. (4 mks)

iii) The slant edge of the pyramid. (4 mks)

20. The table below shows measurements, in metres made by surveyor in his field book.

	F	
	420	
G 100	380	D70
	300	C100
	220	E40
H60	140	
	80	B60
	A	

i) Using an appropriate scale draw the region. (5 marks)

ii) Find the area in hectares of the filed. (5 marks)

21. A cross country route has five sections AB, BC, CD, DE and EA. B is 2km on a bearing of 050^0 from A. C is 5km from B. The bearing of B from C is 300^0. D is 4km on a bearing 230^0 from C. E is 2.5km on a bearing 025^0 from D. Use the scale 1cm for 0.5km to draw the diagram representing the cross country route.

From the diagram determine. (6 mks)

i) The distance in km of A from E. (2 mks)

ii) The bearing of E from A. (2 mks)

22. A bus travels from Murang'a to Meru a distance of 320km at a speed of x km/h. If the speed is reduced by 20km/h the bus would take 48 minutes more.

a) Form an equation to represent the given information and simplify it. (4 mks)

b) Find the speed of the bus. (3 mks)

c) Determine the time taken by the bus for the whole journey. (1 mk)

d) Another car is moving from Meru to Murang'a at a speed of 80km/h. Determine their relative speed. (2 mks)

23. a) Construct a triangle ABC in which AB = 4.3cm, BC = 5.0cm and CA = 6.3cm using a pair of compass and ruler only. (3 mks)

b) Construct an escribed circle centre O opposite angle CAB and measure radius of the circle. (3 mks)

c) Measure the acute angle subtended by BC at the centre of the circle. (2 mks)

d) Determine the area of triangle OBC. (2 mks)

24. A particle starts from rest and moves with an acceleration, a, given by $a = (10 - t)m/s^2$. Given that velocity, Vm/s is 2m/s; when time; t seconds is 1 sec.

a) Express in terms of **t**;

i) Its velocity after **t** seconds. (3 mks)

ii) Its displacement after **t** seconds. (2 mks)

b) Calculate its velocity when **t** = 3 seconds (2 mks)

c) Calculate the maximum velocity attained. (3 mks)

MURANG'A SOUTH MULTILATERAL EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
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2 ½ HOURS

Section 1 (50 mks)

Answer all questions in this section in the spaces provided.

1. Use logarithms correct to 4 significant figures to evaluate. (4 mks)

$$\frac{(93.4)^2 \times \sqrt{0.00435}}{\log 6.56}$$

2. Rono invested a sum of money, sh p at 24% p.a simple interest for 8 years and realised that he got the same amount as Wekesa who invested sh. 2p for 4 years at compound interest. Calculate the rate of interest p.a Wekesa enjoyed. (3 mks)
3. The position vectors of A and B are $\underset{\sim}{a} = 2i - 3j + 4k$ and $\underset{\sim}{b} = -2i - j + 2k$ respectively. Find to 2d.p the length of vector AB. (2 mks)
4. Make **p** the subject of the formula;

$$L = \frac{2}{3}\sqrt{\frac{x^2 - Pt}{y}}$$ (3 mks)

5. Two taps A and B together, can fill water in a tank in 6 minutes. Tap A alone takes 5 minutes longer to fill the tank than the tap B alone. How many minutes does it take tap B alone to fill the tank. (3 mks)
6. Solve for x in the equation. (3 mks)

$$2^{2x-1} + 4^{x+2} = 264$$

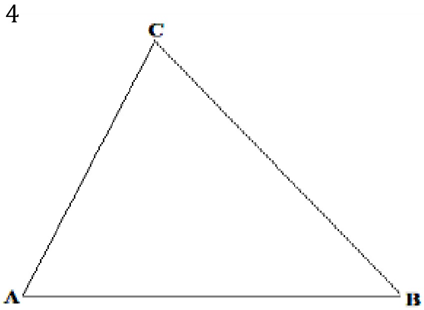
7. Find the radius and co-ordinates of the centre of a circle whose equation is

$$\tfrac{1}{2}x^2 + \tfrac{1}{2}y^2 - 3x + 4y + 6\tfrac{3}{8} = 0$$ (3 mks)

8. Find the equation of the tangent at the point (3, 1) to the curve.

$$y = x^2 - 4x + 4$$ (3 mks)

9.



On the figure, find the locus of point P such that P is

i) nearer to A than B.
ii) Less than 5cm from B.
iii) nearer to AB than to AC. (3 mks)

(Shade the unwanted region.)

10. Ketepa tea worth ksh. 40 per kg is mixed with Sasini tea worth sh. 60 per kg in the ratio 3:1. In what ratio should this mixture be mixed with Kericho tea worth sh. 50 per kg to produce a mixture worth sh. 47 per kg. (3 mks)
11. Solve for x in the equation

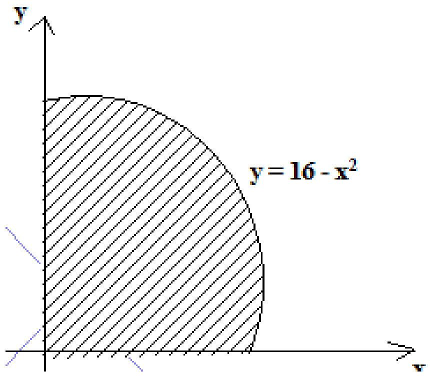
$6\sin^2 x - \cos x - 5 = 0$ for $0 \leq x \leq 360^0$. (4 mks)

12. If $\dfrac{\sqrt{14}}{\sqrt{7} - \sqrt{2}} - \dfrac{\sqrt{14}}{\sqrt{7} + \sqrt{2}} = a\sqrt{7} + b\sqrt{2}$

Find the values of a and b where and b are rational numbers. (3 mks)

13. Expand $(2 + \tfrac{1}{4}x)^6$ up to the term containing x^4. Hence evaluate $(1.975)^6$ to 5 d.p. (4 mks)
14. A quantity **y** varies partly as **x** and partly as the inverse of the square of x. If x = 2 when y = 4 and x = 4 when y = 6.25 find the equation connecting **x** and **y.** (3 mks)
15. The eleventh term of an A.P is four times the second term. If the sum of the first seven terms of the A.P is 175 find the first term and the common difference. (3 mks)

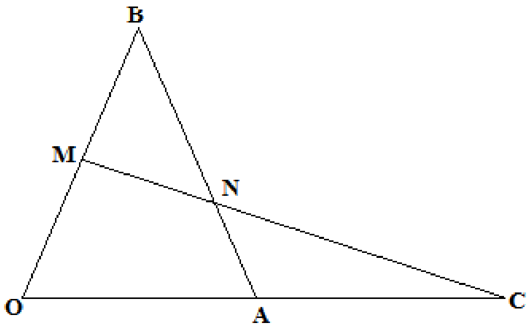
16. Find the exact area of the shaded region. (3 mks)



Section II (50 marks)

Answer any five questions from this section

17. In the triangle OAB below, $\underset{\sim}{OA} = \underset{\sim}{a}$, $\underset{\sim}{OB} = \underset{\sim}{b}$ and OC = $^3/_2$OA. M divided OB in the ratio 3:2.



a) Express in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$ only, the vectors
   i) $\underset{\sim}{BA}$ (1 mk)
   ii) $\underset{\sim}{MC}$ (1 mk)

b) Given further that MN = hMC and BN = kBA, express vector MN in two different ways and hence, find the value of h and k. (6 mks)

c) Show that the points M, N and C are collinear. (2 mks)

18. In a botanical experiment, the length of 60 leaves of a certain type of a tree were measured correct to the nearest 0.1cm.

Length (cm)	3.0 - 3.4	3.5 - 3.9	4.0 - 4.4	4.5 - 4.9	5.0 - 5.4	5.5 - 5.9	6.0 - 6.4	6.5 - 6.9	7.0 - 7.4
No of leaves	1	4	9	14	12	10	6	3	1

a) State the modal class. (1 mk)
b) Calculate the median length. (3 mks)
c) Using a working mean of 5.2, find
i) The mean. (4 mks)
ii) The standard deviation. (2 mks)

19. The table below shows the income tax rates for a certain year.

Taxable pay per month (sh)	**Tax rates (%)**
1 - 9680	10%
9681 - 18800	15%
18801 - 27920	20%
27921 - 27040	25%
Above 37040	30%

In that year Maina paid a net tax of ksh. 5512 per month. His total monthly taxable allowances amounted to ksh. 15,220 and he was entitled to a monthly personal relief of ksh. 1162. Every month the following deductions were made

- NHIF	Ksh. 320
- Union dues	Ksh. 200
- Co-op shares	Ksh. 7500

a) Calculate Maina's monthly basic salary in Ksh. (7 mks)

b) Calculate his monthly net salary. (3 mks)

21. A transformation represented by the matrix $\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$

maps the points A (0, 0), B(2, 0), C(2, 3) and D(0, 3) of the quadrilateral ABCD onto $A^1B^1C^1D^1$ respectively.

a) Draw the quadrilateral ABCD and it's image $A^1B^1C^1D^1$. (2 mks)

b) Hence or otherwise determine the area of $A^1B^1C^1D^1$. (2 mks)

c) A transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$

maps $A^1B^1C^1D^1$ onto $A^{11}B^{11}C^{11}D^{11}$. Draw the image $A^{11}B^{11}C^{11}D^{11}$ (2 mks)

d) Determine the single matrix which maps $A^{11}B^{11}C^{11}D^{11}$ back to ABCD. (4 mks)

21. a) In a F4 class there are 22 girls and 18 boys. The probability that a girl completes the secondary education course is $^3/_5$ whereas that of a boy is $^2/_3$. A student is picked at random from the class. Find the probability that the student picked:

i) Is a boy and will complete the course. (2 mks)

ii) Will complete the course.(2 mks)

iii) Is a girl and will not complete the course. (2 mks)

b) A bag, contains 5 blue balls, 8 red balls and 3 green balls being similar in shape and size. A ball is picked out at random without replacement and it's colour noted. Use a tree diagram to determine the probability that at least one of first two balls picked is green. (4 mks)

22. a) Complete the table below fro the functions y = cos x and y = 2 cos (x + 30) for $0 \leq x \leq 360^0$

x^0	0	30	60	90	120	150	180	210	240	270	300	330	360
Cos x	1	087	0.5		-0.5		-1.0		-0.5		0.5		1.0
2 Cos (x + 30)	1.73			-1.0		-2.0		-1.0		1.0			1.73

(2 mks)

b) On the same axes draw the graphs of y = cos x and y = 2 cos (x + 30) for $0 \leq x \leq 360^0$. (2 mks)

c) State the amplitude of each graph.

y = cos x (1 mk)

y = 2 cos (x + 30) (1 mk)

d) Use your graph to solve

i) Cos x = 2 cos (x + 30) (2 mks)

ii) 2 Cos (x + 30) - $^1/_2$ = 0 (2 mks)

23. A plane S flies from a point P (40^0N, 45^0W) to a point Q(35^0W, 45^0W) and then onto a point T (35^0N, 135^0E).

a) Given that the radius of the earth is 6370km, find the distance P to Q in km. (2 mks)

b) Find in nm;

i) the shortest distance between Q and T. (2 mks)

ii) the longest distance between Q and T (to the nearest tens). (2 mks)

c) Find the difference in time taken when S flies along the shortest and longest routes if its speed is 420 knots.

24. The headteacher of a secondary school placed an order for x - lockers and y - chairs from a metal works with the following conditions:

i) The number of chairs should be more than the number of lockers.

ii) The total number of lockers and chairs must not exceed 100.

iii) There should be at least 20 chairs and not less than 10 lockers.

iv) The cost of a locker is ksh. 2500 and that of a chair is ksh. 1000 and the headteacher has only ksh. 1500 to spend on lockers and chairs during the ter*m.*

a) Write down all the inequalities describing the situation above. (4 mks)

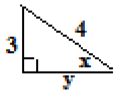
b) On the grid provided, draw a graph representing the inequalities. (4 mks)

c) Determine the maximum number of lockers and chairs that can be bought. (2 mks)

MURANG'A SOUTH MULTILATERAL EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
JULY / AUGUST 2015
2 ½ HOURS

1.	$\frac{y(3^2a^2 - 4^2b^2y^2)}{y(4by - 3a)}$ $\frac{(3a - 4by)(3a + 4by)}{(4by - 3a)}$ $\frac{(3a - 4by)(3a + 4by)}{-(3a - 4by)}$ -3a - 4by	M1 M1 M1 A1
2.	$\frac{x-1}{3} - \frac{2x-1}{3x} = \frac{3x^2 - 3x - 2x^2 - x}{3x^2}$ $= \frac{x^2 - 4x}{3x^2}$ $= \frac{x - 4}{3x}$ $\frac{x-4}{3x} = \frac{2}{3}$ 3(x - 4) = 2(3x) 3x - 12 = 6x -12 = +3x -4 = x	M1 B1 M1 A1
3.	$\frac{x + {}^{+2}/_{3}}{y} = \frac{x}{y} + \frac{1}{21}$ $\frac{x}{y - {}^{1}/_{2}} = \frac{2}{9}$ 9x - 2y = -1 $x + {}^{2}/_{3} = x + {}^{1}/_{21}y$ 21x + 14 = 21x + y y = 14 $x = \frac{2 \times 14 - 1}{9} = 3$ x = 3 $\frac{x}{y} = \frac{3}{14}$ $\frac{y}{x} = \frac{14}{3}$	 M1 M1 B1 A1
4.	$\frac{-2 \times 8 - 9 \div 3 + 5}{15 + -8}$ $\frac{-16 - 3 + 5}{15 - 8}$ -2	M1 M1 A1

5.	$\frac{180^0}{180 - 150} + \frac{180}{180 + 170}$ $\frac{180}{30} + \frac{180}{10}$ 6 + 18 24 sides	M1 M1 A1
6	a) Swiss francs $\frac{72}{1.25} = 57.6$ b) Kshs 57.6 x 48.2 = Sh. 2776	B1 M1 A1
7	Sin x = $^{3}/_{4}$ $y = \sqrt{4^2 - 3^2} = \sqrt{7}$ Cos x = $\sqrt{{}^{7}/_{4}}$  Tan(90-x)=$^{7}/_{3}$	 A1 M1A1
8	<OPQ = 40^0 Base Isosceles <POQ = 180 - (40 + 40) = 100^0 <QOR = 40 alternate <POR = 100 + 40 = 140^0 <PRO = $\frac{180 - 140}{2}$ Base < of Isosceles Δ = 20	 B1 B1
9.	a = 250 r = 2 n = $^{16}/_{2}$ + 1 = 9 Sn = ar^{n-1} $250 \times 2^8 = 6400$	 B1 B1A1
10	3200 x 12 = 38400 30,000 - 10,000 = 20,000 38,400 = 20,000 $(1 + {}^{R}/_{100})^{12}$ 1.92 = $(1 + {}^{R}/_{100})^{12}$ 1.0559 = 1 + $^{R}/_{100}$ 0.0559 = $^{R}/_{100}$ R = 5.59%	 M1 M1 A1

11

P(1, 1) P^1(1 x 3, 1 x 3) P^1 (3,3) B1

Q(2,1) Q^1(2 x 3, 1 x 3) Q^1 (6, 3) B1

R (2, 2) R^1(2 x 3 2 x 3) R^1 (6, 6)

S (1, 2) S^1 (1 x 3 2 x 3) S^1 (3, 6) B1

12

	Now	1n 12yrs
Kairietu	x yrs	x + 12
Son	$^x/_6$yrs	$^x/_6$ + 12
Daughter	$^x/_4$ yrs	$^x/_4$ + 12

$(^x/_6 + 12) + (^x/_4 + 12) = (x + 12) - 9$

$21 = x - {}^x/_6 - {}^x/_4$ M1

$21 = \frac{7x}{12}$

7x = 252

x = 36yrs M1

Kairietu is 36yrs old now A1

13

$10^2 + (r - 4)^2 = r^2$ M1

$100 + r^2 - 8r + 16 = r^2$ M1

116 = 8r

r = 14.5 A1

14

ma + nb = c

$m\begin{pmatrix}5\\4\end{pmatrix} + n\begin{pmatrix}3\\-2\end{pmatrix} = \begin{pmatrix}7\\10\end{pmatrix}$ M1

(5m + 3n = 7) x 4 M1

(4m - 2n = 10) x 5

20m + 12n = 28

<u>20m - 10n = 50</u>

22n = -22 M1

n = -1

5m - 3 = 7

5m = 10

m = 2

n = -1, m = 2 A1

15

4 - 2x < 8

-2x < 4

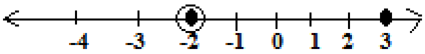
x < -2 B1

$2 - 3x \geq - 7$

$- 3x \geq - 9$

$x \leq 3$

$-2 < x \leq 3$ B1



B1

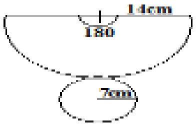
16

2π x 7 = 14π

Arc c, = $^\theta/_{360}$ x 28 x $\pi = 14\pi$

$2\theta = 360^0$

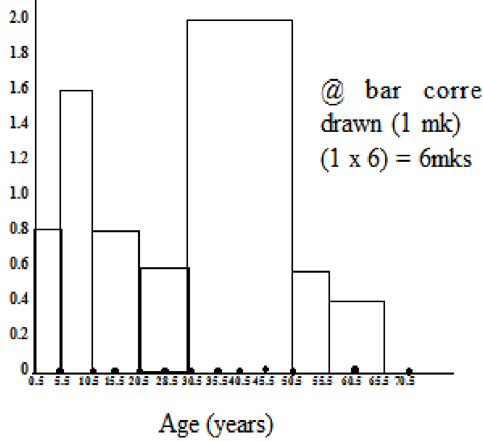
$\theta = 180^0$ B1



B1 Big sector

B1 smaller sector

17.



@ bar correctly drawn (1 mk)
(1 x 6) = 6mks

b)

Class	x	f	fx	
1 - 5 3	4	12		
6 - 10	8	8	64	B1
11 – 20	15.5	8	124	B1
21 – 30	25.5	6	153	
31 – 50	40.5	40	1620	B1
51 - 55	53	3	159	
56 - 65	60.5	<u>3</u>	<u>181.5</u>	

Mean = $\frac{\sum fx}{\sum f}$

$= \frac{2313.5}{72}$

= 32.13

18.

x	-4	-3	-2	-1	0	1	2
$2x^2$	32	18	8	2	0	2	8
4x	-16	-12	-8	-4	0	4	8
-5	-5	-5	-5	-5	-5	-5	-5
y	11	1	-5	-7	-5	1	11

19. i) V = $^1/_3$ x Base area x height

$^1/_3$ x 60 x h = 280 M1

h = 14cm A1

ii) $^x/_y = {}^3/_5$

x = $^3/_5$y ; xxy = 60 M1

$^3/_5\ y^2 = 60$ M1

y = 10cm A1

x = 6cm B1

iii) AC $\sqrt{10^2+6^2}$ = 11.66

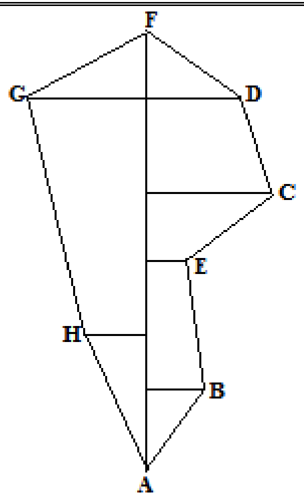
M1A1

VC = $\sqrt{5.83^2 + 14^2}$ M1

= $\sqrt{230}$

= 15.17cm A1

20.



$^1/_2$ x 40 x 70 = 1400

$^1/_2$ x 80 x 170 = 6800

$^1/_2$ x 80 x 140 = 5600

$^1/_2$ x 140 x 100 = 7000

$^1/_2$ x 80 x 60 = 2400 M1

$^1/_2$ x 140 x 60 = 4200

$^1/_2$ x 160 x 240 = 19200

$^1/_2$ x 100 x 40 = 2000 M1

$\frac{48{,}600\text{m}^2}{10{,}000}$ M1

4.86 hectares A1

21

i) Distance AE = 8.5 x 0.5 = 4.25 ± 0.1km

ii) Bearing E from A 112^0 ± 0.1

22

a) $\frac{320}{x} = \frac{320}{x - 20} - \frac{48}{60}$ M1

$\frac{320}{x} = \frac{320}{x - 20} - \frac{4}{5}$

320 (5x - 100) = (320 x (5x) - 4x(x - 25) M1

1600x - 32000 = 1600x - 4x^2 + 80x M1

4x^2 - 80x - 3200 = 0

x^2 - 20x - 8000 = 0 A1

b) x^2 - 20x - 8000 = 0

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{20 \pm \sqrt{400 + 32000}}{2}$ A1

$= \frac{20 \pm \sqrt{400 + 32000}}{2}$

$= \frac{20 \pm \sqrt{32400}}{2}$

$= \frac{20 \pm 180}{2}$ M1

= 100km/h

c) T = $^D/_S$

$^{320}/_{100}$ = 3$^1/_2$hrs B1

d) Relative speed = 100 + 80 M1

= 180km/h A1

23

Radius = 7.3cm B1

OB = 10.8cm B1

<BOC = 25^0 B1

$^1/_2$ Sin 25 x 10.8 x 7.3 M1

= 16.66cm^2 A1

24.

a) (i) $^{dv}/_{dt}$ = 10 - t

v = 10t - $^1/_2$t^2 + C M1

When t = 1, v = 2

Therefore 2 = 10 - $^1/_2$ x 1 + C M1

C = 7$^1/_2$

V = 10t - $^1/_2$t^2 + $^{15}/_2$ A1

ii) S = ∫(10 t - $^1/_2$t^2 - 7$^1/_2$)dt M1

S = 5t^2 - $^1/_6$t^3 - 7$^1/_2$ t + C

When t = 0, S = 0, C = 0

S = 5t^2 - $^1/_6$t^3 - $^{15}/_2$t A1

b) When t = 3

V = 10(3) - $^1/_2$(3)^2 - 7$^1/_2$ M1

= 18m/s A1

c) Maximum velocity

$^{dv}/_{dt}$ = 0

Therefore 10 - t = 0 B1

t = 10 secs

Max v. = 10 (10) - ($^{10}/_2$)^2 - 7$^1/_2$ M1

42.5 m/s A1

MURANG'A SOUTH MULTILATERAL EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
JULY / AUGUST 2015
2 ½ HOURS

1.	**No** **Log** $(93.4)^2$ 1.9703 x 2 3.9406 + M1 all logos 0.00435 $\frac{\bar{3}.6385}{2} = \bar{1}.8193$ M1 sqr & sqrt 2.7599 log 6.56 (0.8169) $\bar{1}.9122$ M1 operation 2.8477 + - ÷ 7.0421 x 10^2 ← = 704.21 A1
2.	Rono : $A = P + P \times {}^{24}/_{100} \times 8$ $= 1.92P + P = 2.92P$ M1 Wekesa $A = 2p\,(1 + {}^{r}/_{100})^4$ $2.92P = 2p(1 + {}^{r}/_{100})^4$ M1 $1.46 = (1 + {}^{r}/_{100})^4$ 4 $1.46 = 1 + {}^{r}/_{100}$ r = 9.923% A1
3.	$AB = \begin{pmatrix} -2 \\ -1 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \\ 4 \end{pmatrix} = \begin{pmatrix} -4 \\ 2 \\ -2 \end{pmatrix}$ $\lvert AB\rvert = \sqrt{(-4)^2 + 2^2 + (-2)^2} = 24$ M1 $\lvert AB\rvert = 4.90$ units A1
4.	$L^2 = \frac{4}{9}\left(\frac{x^2 - PT}{y}\right)$ M1 sqrs $\frac{9L^2y}{4} = x^2 - Pt$ $PT = x^2 - \frac{9L^2y}{4}$ M1 separately $P = x^2 - \frac{\frac{9L^2y}{4}}{T}$ A1
5.	1 min tap (A & B) $= {}^{1}/_{A} + {}^{1}/_{B} = {}^{1}/_{6}$ of work $\frac{1}{B+5} + \frac{1}{B} = \frac{1}{6}$ M1 forming eqn $B^2 - 7B - 30\ 0$ M1 simplified eqn. $(B - 10)(B + 3) = 0$ B = 10 minutes A1
6.	$\frac{2^{2x}}{2} + 2^{2x} \times 16 = 264$ $2^{2x} + 32(2^{2x}) = 528$ M1 $33(2^{2x}) = 528$ $2^{2x} = 16 = 2^4$ M1 $x = 2$ A1
7.	$x^2 - 6x + y^2 + 8y = {}^{-51}/_{4}$ $x^2 - 6x + 9 + y^2 + 8y + 16 = {}^{-51}/_{4} + 25$ M1 completely square $(x - 3)^2 + (y + 4)^2 = {}^{49}/_{4}$ M1 Centre (3, - 4) Radius 3.5 units A1 for both
8	${}^{dy}/_{dx} = 2x - 4$ $x = 3$; ${}^{dy}/_{dx} = 2$ M1 (${}^{dy}/_{dx}$) $y = 2x + C$ $1 = 6 + C$ $C = -5$ M1 $y = 2x - 5$ A1
9	
10	1kg mixture $= \frac{40 \times 3 + 60 \times 1}{4} =$ sh. 45 M1 $\frac{45x + 50y}{x + y} = 47$ M1 $45x + 50y = 47x + 47y$ $3y = 24$ ${}^{x}/_{y} = {}^{3}/_{2}$ x : y = 3 : 2 A1
11	$6(1 - \cos^2x) - \cos x - 5 = 0$ $1 - 6\cos^2x - \cos x = 0$ $6\cos^2x + \cos x - 1 = 0$ M1 Let cosx = y $6y^2 + y - 1 = 0$ $(2y + 1)(3y - 1) = 0$ y = -0.5 or y = 0.3333 M1 Cos x = -0.5 $x = 120^0, 240^0$ Cos x = 0.3333 x = 70.5, 289.5 A1, A1 $x = 70.5^0, 120^0, 240^0, 289.5$
12.	$\frac{\sqrt{14}(\sqrt{7} + \sqrt{2}) - \sqrt{14}(\sqrt{7} - \sqrt{2})}{(\sqrt{7} - \sqrt{2})(\sqrt{7} + \sqrt{2})}$ M1 $\frac{7\sqrt{2} + \sqrt{28} - 7\sqrt{2} + \sqrt{28}}{5}$ M1 $= \frac{2\sqrt{28}}{5} = \frac{4\sqrt{7}}{5} = a\sqrt{7} + b\sqrt{2}$ $a = {}^{4}/_{5}$ $b = 0$ A1 both

13	$(2 + {}^1/_4x)^6$ $= 2^6 + 6 \times 2^5 \times ({}^1/_4x) + 15 \times 2^4 \times ({}^1/_4x)^2$ $+ 20 \times 2^3 \times ({}^1/_4x)^3 + 15 \times 2^2 \times ({}^1/_4x)^4$ M1 $= 64 + 48x + 15x^2 + {}^5/_2x^3 + {}^{15}/_{64}x^4$ M1 $x = -0.1$ $64 + 48(-0.1) + 15(-0.1)^2 + {}^5/_2(-0.1)^3$ $+ 1{}^{15}/_{64}(-0.1)^4$ M1 $= 59.34752$ A1
14	$y = kx + \frac{m}{x^2}$ $4 = 2k + {}^m/_4 \Rightarrow 8k + m = 16$ M1 both eqn $6.25 = 4k + {}^m/_{16}$ $\underline{64k + m = 100}$ $56k = 84$ $k = {}^3/_2$ M1 (both m & k) $m = 4$ eqn $y = \frac{3}{2}x + \frac{4}{x^2}$ A1 (eqn)
15	$(a + 10d) = 4(a + d)$ $a + 10d = 4a + 4d$ $6d = 3a$ $a = 2d$ M1 $175 = {}^7/_2(2a + 6d)$ M1 $50 = 2a + 6d \Rightarrow 50 = 10d$ $d = 5$ A1 (both) $a = 2 \times 5 = 10$
16	$16 - x^2 \Rightarrow x \underline{+} 4$ M1 $\int_0^4 (16 - x^2) = \left[16x - \frac{x^3}{3}\right]_0^4$ M1 integral $64 - {}^{64}/_3 = 42{}^2/_3$ sq units A1
17	a) i) $\underset{\sim}{BA} = \underset{\sim}{a} - \underset{\sim}{b}$ M1 ii) $\underset{\sim}{MC} = {}^3/_2\underset{\sim}{a} - {}^3/_5\underset{\sim}{b}$ M1 b) $\underset{\sim}{MN} = h({}^3/_2\underset{\sim}{a} - {}^3/_5\underset{\sim}{b})$ $= {}^3/_2h\underset{\sim}{a} - {}^3/_5h\underset{\sim}{b}$ M1 $\underset{\sim}{MN} = \underset{\sim}{MB} + \underset{\sim}{BN}$ $= {}^2/_5\underset{\sim}{b} + k(\underset{\sim}{a} - \underset{\sim}{b})$ $= k\underset{\sim}{a} + ({}^2/_5 - k)\underset{\sim}{b}$ M1 ${}^3/_2h\underset{\sim}{a} - {}^3/_5h\underset{\sim}{b} = k\underset{\sim}{a} + ({}^2/_5 - k)\underset{\sim}{b}$ M1 equation equations ${}^3/_2h = k$ $-{}^3/_5h = {}^2/_5 - k$ M1 two equations $-{}^3/_5h = {}^2/_5 - {}^3/_2h$ ${}^3/_2h - {}^3/_5h = {}^2/_5$ M1 attempt to solve ${}^9/_{10}h = {}^2/_5 \Rightarrow h = {}^4/_9$ $k = {}^3/_2 \times {}^4/_9 = {}^2/_3$ A1 both h and k c) $MN = {}^4/_9MC$ M1 MN // MC M common Hence M, N & C are collinear A1
19	Gross tax = (5512 + 1162) = sh. 6674 M1, A1 Rate Total 1st 9680 = 9680 x ${}^{10}/_{100}$ = 968 M1 2nd 9120 = 9120 x ${}^{15}/_{100}$ = 1368 M1 3rd 9120 = 9120 x ${}^{20}/_{100}$ = 1824 4th 9120 = 9120 x ${}^{25}/_{100}$ = 2280 <u>5th x = 780 = x</u> x ${}^{30}/_{100}$ = <u>234</u> B1, B1 Total = 37,820 6674 Basic salary = 37820 - 15220 M1 = Ksh. 22,600 A1 Net pay = 37820 - 13532 M1 = Sh. 24,288 A1
20	**c)** $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{array}{c} A^1B^1C^1D^1 \\ \begin{pmatrix} 0 & 4 & 7 & 3 \\ 0 & 2 & -4 & -6 \end{pmatrix} \end{array} = \begin{array}{c} A^1B^1C^1D^1 \\ \begin{pmatrix} 0 & -2 & 4 & 6 \\ 0 & -4 & -7 & -3 \end{pmatrix} \end{array}$ M1 $A^1 (0,0)$ $B^1(-2, -4)$ $C^1(4, -7)$ $D^1(6, -3)$ d) Single matrix which maps ABCD onto $A^{11}B^{11}C^{11}D^{11}$ is given by $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix} = \begin{pmatrix} -1 & 2 \\ -2 & -1 \end{pmatrix}$ M1 Single matrix which maps $A^{11}B^{11}C^{11}D^{11}$ back to ABCD is Inverse $\begin{pmatrix} -1 & 2 \\ -2 & -1 \end{pmatrix}$ M1 $= \begin{pmatrix} {}^{-1}/_5 & {}^{-2}/_5 \\ {}^2/_5 & {}^{-1}/_5 \end{pmatrix}$ A1

18

Class	x	x - 5.2	f	fd	d^2	fd^2	c.f
3.0 - 3.4	3.2	-2	1	-2	4	4	1
3.5 - 3.9	3.7	-1.5	4	-6	2.25	9	5
4.0 - 4.4	4.2	-1.0	9	-9	1	9	14
4.5 - 4.9	4.7	-0.5	14	-7	0.25	3.5	28
5.0 - 5.4	5.2	0	12	0	0	0	40
5.5 - 5.9	5.7	0.5	10	5	0.25	2.5	50
6.0 - 6.4	6.2	1.0	6	6	1	6	56
6.5 - 6.9	6.7	1.5	3	4.5	2.25	6.75	59
7.0 - 7.4	7.2	2	1	2	4	4	60
				-6.5		44.75	

Modal class : 4.5 - 4.9 A1

Median = $4.95 + \frac{30 - 28}{12} \times 0.5$ M1

$= 4.95 + {}^{2}/_{12} \times 0.5$

$= 4.95 + 0.0833$

$= 5.0333$ A1

Mean = $5.2 + \frac{-6.5}{60}$ M1

$= 5.2 - 0.1083 = 5.0917$ M1A1

s.d = $\sqrt{\frac{44.75}{60} - \left(\frac{-6.5}{60}\right)^2}$ M1

$= 0.7458 - 0.01174 = \sqrt{0.7341}$

$= 0.8568$ A1

21

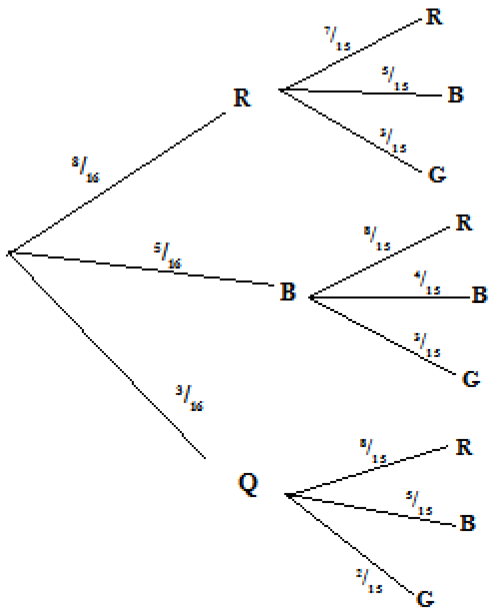
a) i) ${}^{18}/_{40} \times {}^{2}/_{3} = {}^{3}/_{10}$

ii) $({}^{18}/_{40} \times {}^{2}/_{3}) + ({}^{22}/_{40} \times {}^{3}/_{5}) = {}^{3}/_{10} + {}^{33}/_{100}$

$= {}^{63}/_{100}$

iii) ${}^{22}/_{40} \times {}^{2}/_{5} = {}^{11}/_{50}$

b)



$({}^{8}/_{16} \times {}^{3}/_{15}) + ({}^{5}/_{16} \times {}^{3}/_{15}) + ({}^{3}/_{16} \times {}^{8}/_{15}) + ({}^{3}/_{16} \times {}^{5}/_{15}) + ({}^{3}/_{16} \times {}^{2}/_{15})$ M1

$= {}^{24}/_{240} + {}^{15}/_{240} + {}^{24}/_{240} + {}^{15}/_{240} + {}^{6}/_{240} = {}^{84}/_{240}$

$= {}^{7}/_{20}$ A1

23

a) $Q = 5^0$

$PQ = {}^{5}/_{360} \times 2 \times {}^{22}/_{7} \times 6370$ M1

$= 556.11$km A1

b) i) $\theta = 2(90 - 35) = 110^0$ M1

Distance = $60 \times 110^0 = 6600$nm A1

ii) $\theta = 135 + 45 = 180^0$ M1

$180^0 \times 60 \cos 45^0 = 8846.84$

= 8850nm A1

c) S = 5 x 60 + 6600 = 6900

Time = ${}^{6900}/_{420} = 16.429$hrs M1

S = 5 x 60 + 8850 = 9150 M1

Time = ${}^{9150}/_{420} = 21.78$hrs

Time difference = 21.78 - 16.429 M1

= 5.357hrs or

5hrs 21.42min A1

24

$y > x$ B1

$y + x < 100$ B1

$\left.\begin{array}{l} y \geq 20 \\ x \geq 10 \end{array}\right\}$ B1 (both)

$2500x + 100y \leq 150,000$ B1

$5x + 2y \leq 300$

$y > x$ drawn & shaded B1

$y + x \leq 100$ drawn & shaded B1

$\left.\begin{array}{l} y \geq 20 \\ x \geq 10 \end{array}\right\}$ Both drawn & shaded B1 B1

33 lockers B1

67 chairs B1

GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

121/1
MATHEMATICS
PAPER I
JULY/AUGUST 2015
TIME: 2 ½ HOURS

SECTION I

ANSWER ALL QUESTIONS IN THE SPACES PROVIDED BELOW EACH QUESTION

1. Without using Logarithms tables or a calculator evaluate. (3 marks)

$$\sqrt{\frac{384.16 \times 0.0625}{96.04}}$$

2. Simplify completely (4 marks)

$$\frac{2x^2 - 98}{3x^2 - 16x - 35} \div \frac{x + 7}{3x + 4}$$

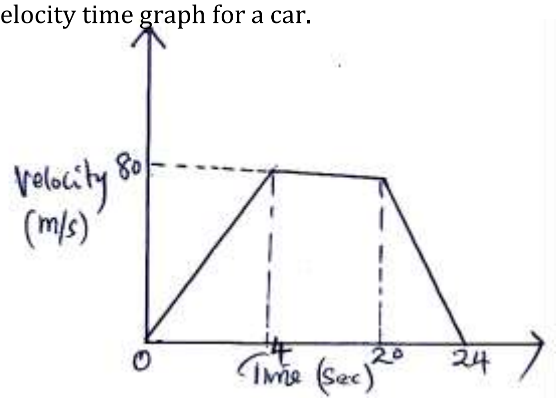
3. Solve the following inequality and show your solution on a number line. (3 marks)

$$4x - 3 \leq ½ (x + 8) < x + 5$$

4. Rose bought a golden necklace for ksh.6000 and sold it to Betty at a loss of 30%. Betty later sold it at a profit of 20%. What was Betty's selling price. (2 marks)
5. If $x = {}^2/_3$ is a root of $6x^2 + kx - 2 = 0$, find the value of k and the other root. (4 marks)
6. Tap A takes 4 minutes to fill a tank and tap B takes 6 minutes to empty the tank. If the tank has a capacity of 3000 litres find the volume of the tank after 2 minutes when both taps are open. (3 marks)
7. From a viewing tower 30 metres above the ground, the angle of depression of an object on the ground is 30^o and the angle of elevation of an aircraft vertically above the object is 42^o. Calculate the height of the aircraft above the ground. (3 marks)
8. Find the equation of the perpendicular bisector of line AB where A is (3, 9) and B(7,5) giving your answer in the form $ax + by + c = 0$ (3 marks)
9. Solve the simultaneous equations. (4 marks)

$$xy = 4$$
$$x + y = 5$$

10. Vectors A and B are $2\mathbf{i} + 5\mathbf{i}$ and $8\mathbf{i} - 7\mathbf{j}$ respectively. Find the coordinates of M which divide AB in the ratio 1:2. (3 marks)
11. Ruto is 12 years old. In three years time he will be 1/3 of his father's present age. How old was his father 12 years ago. (3 marks)
12. Given a:b = 6:7 and b:c = 14.17 find a:b:c. (2 marks)
13. The figure below is a velocity time graph for a car.

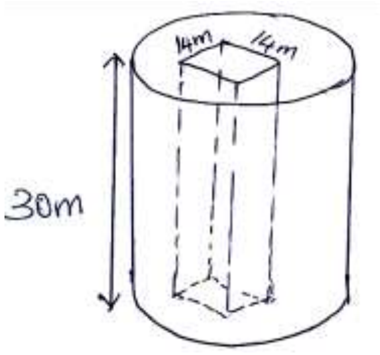


a) Find the total distance traveled by the car. (2 marks)
b) Calculate the deceleration of the car. (2 marks)

14. Two sides of a triangular piece of land are 21km and 32km long. If its area is 240km², find the obtuse angle between the sides. (3 marks)
15. Evaluate using square root, reciprocal and square tables only. (3 marks)

$$\left(\frac{1}{\sqrt{0.7235}}\right)^2 - \frac{1}{10.56}$$

16. A cylinder of diameter 28m was drilled right through it as shown below. Calculate its surface area.



SECTION II

ANSWER ANY 5 QUESTIONS FROM THIS SECTION

17. A bus left Makindu at 11.45 a.m and traveled towards Mombasa at an average speed of 80km/h. A Nissan Matatu left Makindu at 1.15 p.m on the same day and traveled along the same road at an average speed of 120km/hr. The distance between Makindu and Mombasa is 400km.

a) Determine the time of the day the Nissan overtook the bus. (5 marks)

b) Both vehicles continue towards Mombasa at their original speeds. Find how long the Matatu had to wait at Mombasa before the bus arrived. (5 marks)

18. Given that $y = 7 + 3x - x^2$, complete the table below

x	-3	-2	-1	0	1	2	3	4	5	6
y	-11			7						-11

b) On the grid provided and using a suitable scale draw the graph of $y=7 + 3x - x^2$. (3 marks)

c) On the same grid draw a straight line using the graph to solve $x^2 - 4x -3 = 0$ (3 marks)

d) Determine the coordinates of the turning point of the curve. (2 marks)

19. From a reservoir, water flows through a cylindrical pipe of diameter 0.2m at a rate of 0.35m/s.

a) Determine the number of litres of water discharged from the reservoir in one hour. (4 marks)

b) The water flows from the reservoir for 18 hours per day for 25 days per month and serves a population of 2500 families. Determine the average consumption of water per family per month giving your answer to nearest 100 litres. (4 marks)

c) The water is charged at the rate of sh.450 per 100 litres. Calculate the average water bill per family per month. (2 marks)

20. A room is constructed such that its external length and breadth are 7.5m and 5.3m respectively. The thickness of the wall is 15cm and its height is 3.3 metres. A total space of 5m^2 is left for doors and windows on the walls.

a) Calculate the volume of:

(i) the materials needed to construct the walls without the doors and windows. (4 marks)

(ii) the materials needed to construct the walls with doors and windows. (2 marks)

b) The blocks used in constructing the walls are 450mm by 200mm by 150mm. 0.225m^3 of cement is used to join the blocks. Calculate the number of blocks. Calculate the number of blocks needed to construct the room. (4 marks)

21. Every Sunday, Chalo drives a distance of 80km on a bearing of 074° to pick up his brother Ben to go to church. The church is 75km from Ben's house on a bearing of S50°E. After church they drive a distance of 100km on a bearing of 260° to check on their father before Chalo drives to Ben's home to drop him off then proceeds to his house.

a) Using a scale of 1cm represent 10km show the relative positions of these places. (4 marks)

b) Use your diagram to determine

(i) The true bearing of Charo's

(ii) The compass of bearing of the father's home from Ben's home (1 marks)

(iii) The shortest distance between Ben's home and father's home. (2 marks)

(iv) The total distance Charo travels' every Sunday. (2 marks)

22. The following measurement were recorded in a field book using XY as the baseline. XY = 400m.

	Y	
C60	340	
	300	1200
	240	160E
	220	160F
B100	140	
A120	80	
	X	

a) Using a scale of 1:4000 draw an accurate map of the farm. (4 marks)
b) Determine the actual area of the farm in hectares. (4 marks)
c) If the farm is on sale at sh.80,000 per hectare find how much the farm costs. (2 marks)

23. A tailor bought a number of suits at a cost of sh.57,000 from Ken-suit wholesalers. Had he bought the same number of suits from Umoja wholesalers it would have costed him sh.480 less per suit. This would have enabled him to buy 4 extra suits for the same amount of money.

a) Find the number of suits the tailor bought. (6 marks)
b) The tailor later sold each suit for sh.720 more than he had paid for it. Determine the percentage profit he made. (4 marks)

24. A particle P moves in a straight line such that t seconds after passing a fixed point Q. it's velocity is given by the equation $2t^3 - 10t + 12$ find:

a) The values of t when p is instantaneously at rest. (2 marks)
b) An expression for the distance moved by P after t seconds. (2 marks)
c) The total distance traveled by P in the first 3 seconds after passing point O. (3 marks)
d) The distance of P from O when acceleration is zero. (3 marks)

GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

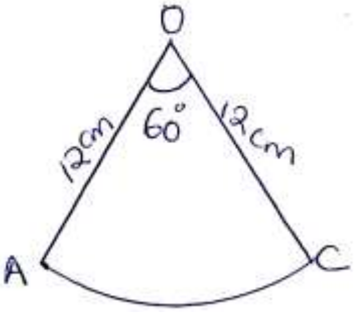
121/2
MATHEMATICS
PAPER II
JULY/AUGUST 2015
TIME: 2 ½ HOURS

SECTION I (50 MARKS) ANSWER ALL QUESTIONS

1. Use mathematical tables to evaluate. (4 marks)

$$\sqrt[3]{\frac{4\cos 60^o \times 0.1324^2}{5\log 7}}$$

2. Solve for x in the equation (3 marks)
 $\sin(4x - 10)^o - \cos(x + 60^o)^o = 0$
3. A radio cassette is offered for sale at shs 8,000 or a deposit of shs. 1,000 and 15 monthly repayments of shs 840. Find the rate of interest compounded monthly that is being charged under hire purchase terms. (4 marks)
4. A colony of insects was found to have 250 insects at the beginning. Thereafter the number of insects doubled every 2 days. Find how many insects there were after 16 days. (3 marks)
5. Under a shear with x-axis invariant a square with vertices A(1,0), B(3,0), C(3,2) and D(1,2) is mapped onto a parallelogram with vertices $A^1(1,0)$ $B^1(3,0)$, $C^1(7,2)$ and $D^1(5,2)$. Find the shear matrix. (3 marks)
6. Using a ruler and a pair of compasses only construct a triangle PQR in which QR is 6.6cm, P=3.8cm and PQ = 5.6cm. Locate point x inside triangle PQR which is equidistant from P and R such that angle PXR = 90°. (3 marks)
7. Find the variance and standard deviation of 3, 5, 7, 9, 11 (3 marks)
8. P and Q are two points such that **OP** = **i** + 2**j** + 3**k** and **OQ** = 4**i** + 5**j** – 3**k**. M is a point that divides PQ externally in the ratio 3:2. Find the co-ordinates of M. (3 marks)
9. The sector below has a radius of 12cm and an angle AOC = 60° is folded to form a cone. Find the volume of the cone formed. (4 marks)



10. Find the equation of the normal to the tangent of the curve $y=x^3 - 3x^2 + 2x + 1$ at the point where x=3. Leave your answer in the form y=mx + c. (3 marks)
11. Without using mathematical tables or calculator; evaluate: (3 marks)

$$\frac{\cos 135^o - \sin 30^o}{\sin 135^o + \sin 30^o}$$

12. Find the midpoint of the straight line joining A (2, 1) and D (6,5). (2 marks)
13. The equation of a circle centre (h, k) is $2x^2 + 2y - 8x + 5y + 10 = 0$. Find the values of h and k. (3 marks)
14. Make y the subject of the formula given

$$H = \sqrt{\frac{t}{q-y^2}}$$

15. If $\frac{1}{a-2} - \frac{1}{a+2} = \frac{c}{a^2-b}$ for all values of a , evaluate c and b. (3 marks)
16. X and Y are two variables such that Y is partly constant and partly varies inversely as the square of X. If Y = 3 when X = 2 and Y = 5 when X = 1, find Y when X = 4. (3 marks)

SECTION II

ANSWER ONLY FIVE QUESTIONS IN THIS SECTION IN THE SPACES PROVIDED.

17. The table below shows the number of students who scored marks in mathematics test.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	3	6	10	10	12	17	15	16	7	4

a) Draw a cumulative frequency graph for the data. (4 marks)

b) Use the graph to estimate the median mark. (2 marks)

c) If students who score over 40 marks pass the tests estimate the percentage of the students

i) who passed (2 marks)

ii) who failed (2 marks)

18. In a geometrical progression, the sum of the second and third terms is 6; and the sum of the third and fourth terms is -12. Find:

a) (i) The first term (3 marks)

(ii) The common ration (3 marks)

b) The sum of number of consecutive terms of an arithmetical progression is -19 ½ ; the first term is 16 ½ ; and the common difference is -3. Find the number of terms. (4 marks)

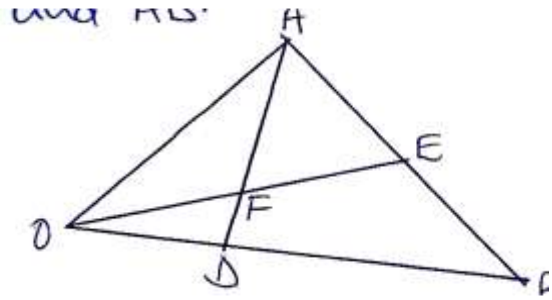
19. a) PQRS is a quadrilateral with vertices p(1, 4) Q(2, 1), R(2, 3) and S(6, 4). On the grid provided plot the quadrilateral (1 mark)

b) Draw $P^1Q^1R^1S^1$ the image of PQRS under a positive quarter turn about the origin and write down its co-ordinates. (3 marks)

c) Draw $P^{11}Q^{11}R^{11}S^{11}$ the image of P1Q1R1S1 under the transformation whose matrix is $\begin{pmatrix}1 & 0\\ -2 & 1\end{pmatrix}$ and write down its co-ordinates. (3 marks)

d) Determine the matrix T of a single transformation that maps PQRS onto $P^{11}Q^{11}R^{11}S^{11}$ (3 marks)

20. In the figure below, E is the midpoint of AB, OD:DB=2:3 and F is the point of intersection of OE and AD.



a) Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$, express in terms of a and b

i) $\overrightarrow{OE}$ (1 mark)

ii) $\overrightarrow{AD}$ (1 mark)

b) Given further that $\overrightarrow{AF} = t\overrightarrow{AD}$ and $\overrightarrow{OF} = s\overrightarrow{OE}$ where s and t are scalars, find the values of s and t. (5 marks)

c) Show that O, F and E are collinear. (3 marks)

21. The position of two towns P and Q are given to the nearest degrees as P(45°N, 110°W) and Q (45°N, 70°E) Take π= 3.142, Radius of the earth R = 6370km. Find

a) The distance between the two towns along the parallel of latitude in km. (3 marks)

b) The distance between the towns along a parallel of latitude in nautical miles. (3 marks)

c) A plane flew from P to Q taking the shortest distance possible. It took the plane 15 hours to move from P and Q. Calculate it's speed in knots (4 marks)

22. Compete the table below (2 marks)

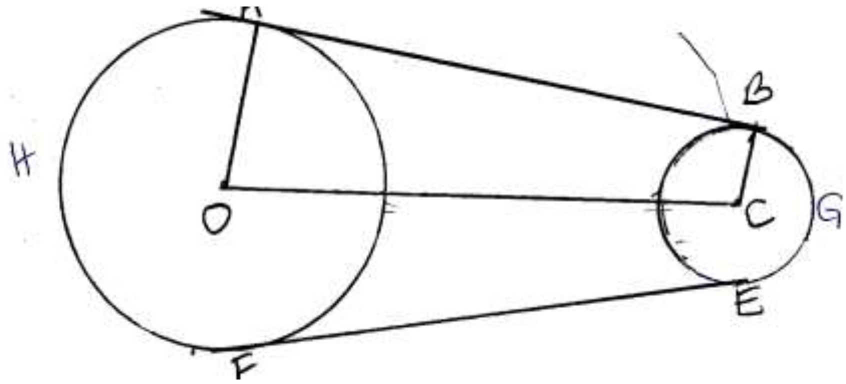
X^o	-180^o	-150^o	-120^o	-90^o	-60^o	-30^o	0^o	30^o	60^o	90^o	120^o	150^o	180^o
$Y=\sin(x+30)^o$			-1				0.50				0.50		
$Y=2\cos(x+30)^o$			0				1.73				-1.73		

b) On the same axes draw the graphs of $y= \sin(x+30)^o$ and $y= 2\cos(x+30)^o$. (5 marks)

c) Use your graphs to solve the equation $2\cos(x+30)^o - \sin(x+30)^o = 0$ (2 marks)

d) State the amplitude of each wave. (1 mark)

23. Two wheels have radii 20cm and 30cm. Their centres are 70cm apart. A belt, passes tightly round the wheels as shown below.

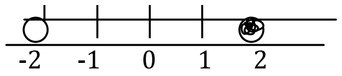


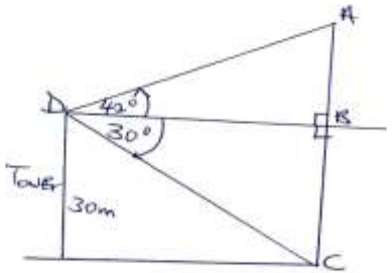
a) Calculate the length of AB and FE . (3 marks)
b) Evaluate the angles AOC and BCO. (3 marks)
c) Calculate the total length of the belt A B G E F H A (4 marks)

24. Given the equations: $y=4 - x^2$ and $y=x^2-2x$;
a) Find the co-ordinates of the points where the two curves meet. (2 marks)
b) Find the co-ordinates of points where $y=4 - x^2$ meet:
(i) The x-axis. (1 mark)
(ii) The y-axis (1 mark)
c) Find the co-ordinates of the points where $y=x^2 - 2x$ meet;
(i) The x-axis (1 mark)
(ii) The y-axis (1 mark)
d) Sketch the two curves above on the same axes (1 mark)
e) Find the area enclosed between the curves $y=4-x^2$ and $y=x^2 - 2x$. (3 marks)

GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

121/1
MATHEMATICS
PAPER 1
JULY/AUGUST 2015
TIME: 2 ½ HOURS

1.	$\sqrt{\frac{384.16 \times 0.0625 \times 10^2}{96.04 \times 10^2}}$ $= \sqrt{\frac{38416 \times 0.0625}{9604}}$ $= \sqrt{4 \times 0.0625}$ 2×0.25 $= 0.5$	M1 M1 A1
2.	$\frac{2(x^2 - 49)}{(3x + 5)(x-7)} \times \frac{3x + 4}{x + 7}$ $\frac{2(x-7)(x+7)}{(3x+5)(x-7)} \times \frac{3x + 4}{x+7}$ $\frac{2(3x+4)}{3x+5}$	M1 M1 M1 A1
3.	$4x - 3 \leq ½ (x + 8)$ $4x - ½ x \leq 4 + 3$ $3 ½ x \leq 7$ $x \leq 2$ $½ x + 4 < x + 5$ $-1 < ½ x$ $-2 < x$ $-2 < x \leq 2$ 	M1 M1 B1
4.	Price at 30% loss $\frac{70}{100} \times 6000$ = sh.4200 Betty price at 20% profit $\frac{120}{100} \times 4200$ = sh.5040	M1 M1
5.	$6x^2 + kx - 2 = 0 \quad x = {}^2/_3$ $6({}^2/_3)^2 + k({}^2/_3) - 2 = 0$ ${}^8/_3 + {}^2/_3 k = 2$ ${}^2/_3 k = -{}^2/_3$ $K = -1$ $6x^2 - x - 2 = 0$ $(2x + 1)(3x - 2) = 0$ $2x + 1 = 0 \quad x = -½$	M1 A1 M1 A1

6.	Tap A in 1 minute ¼ Tap B in 1 minute ${}^1/_6$ Retained $¼ - {}^1/_6 = {}^1/_{12}$ In 2 min ${}^1/_{12} \times 2 = {}^1/_6$ Volume = ${}^1/_6 \times 3000$ = 500 litres	
7.	 Tan 30° = $\frac{\text{opposite}}{\text{Adjacent}} = \frac{BC}{DB}$ Tan 30° = $\frac{30M}{DB}$ DB = $\frac{30m}{\text{Tan } 30^o} = \frac{30m}{51.96}$ AC = 51.96tan42° + 30m = 76.78m	
8.	A(3,9) B(7,5) Mid-point $\left(\frac{3 + 7}{2}, \frac{9 + 5}{2}\right) = (5, 7)$ (5, 7) (x, y) Gradient of AB = $\frac{5 - 9}{7 - 3} = \frac{-4}{4} = -1$ Gradient $M_2 = 1$ $\frac{y - 7}{x - 5} = \frac{1}{1}$ $\quad y - 7 = x - 5$ $y - x - 2 = 0$	
9.	$xy = 4$ - (i) $x + y = 5$ - (ii) $x = 5 - y$ $y(5-y) = 4$ $5y - y^2 - 4 = 0$ $y2 - 5y + 4$ $y2 - y - 4y + 4 = 0$ $y(y - 1) - 4(y - 1) = 0$ $(y - 4)(y - 1) = 0$ $y = 4 \quad y = 1$ $x = 1 \quad x = 4$	
10	${}^1/_3 \binom{8}{-7} + {}^2/_3 \binom{2}{5}$ $\begin{pmatrix} {}^8/_3 \\ {}^{-7}/_3 \end{pmatrix} + \begin{pmatrix} {}^4/_3 \\ {}^{10}/_3 \end{pmatrix} = \begin{pmatrix} {}^{12}/_3 \\ {}^3/_3 \end{pmatrix} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ M(4,1)	

11.

	Present	3 yrs time
Ruto	12	15 years
Father	15 x 3 = 45	

M1
M1

Father 45 – 12 = 33 years A1

12.

a:b = 6:7 b:c = 14:17

a:b 6:7 x 2 M1
14:17 x 1
12:14:17
a:b:c = 12:14:17 A1

13.

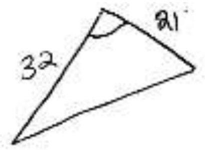
Area under the curve
(a) (½ x 4 x 80) + (16 x 80) + (½ x 4 x 80)

= 160 + 1280 + 160
= 1600m

(b) Deceleration = $\frac{\text{change in speed}}{\text{time taken}}$

= $^{80}/_{4}$ = 20m/s

14.



M1

Area = ½ ab sin ϴ
240 = ½ x 21 x 32 sinϴ
240 = 336sinϴ
Sin ϴ= $\frac{240}{336}$ = 0.7143 M1
ϴ = 45.59
ϴ = 180 – 45.59
= 134.41 A1

15.

$\left(\frac{1}{0.7235}\right)^2 - \frac{1}{10.56}$

Sq. root of 0.7235 M1

= 72.35 x 10^{-2} = 0.8506

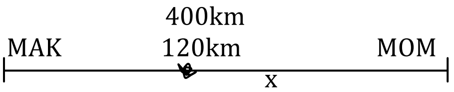
= $\left(\frac{1}{0.8506}\right)^2 - \frac{1}{10.56}$ M1

$(1.1756)^2$ – 0.09470
1.3820 – 0.09470
= 1.2873 A1

16

Surface Area of top and bottom
2 x $^{22}/_{7}$ x 142 – 142 = 840m^2
Curved S.A = $^{22}/_{7}$ x 28 x 30 = 2640m^2
Internal 4(4 x 30) = 480M^2
Total 396m^2

17



a) Bus 11.45a.m
80km/h 1315
CAR 1:15 p.m -1145
120km/h 0130 1hr 30 min

Distance by bus is
1 ½ hrs = 80 x $^{3}/_{2}$ = 120km
Distance to be covered by Bus = x
CAR = 120 + x

Time by Bus = $\frac{x}{80}$

By car = $\frac{120 + x}{120}$

120x = 9600 + 80x 240 + 120
40x = 9600 = 360km

40x = 960
x=240 1:15
+ 3.00

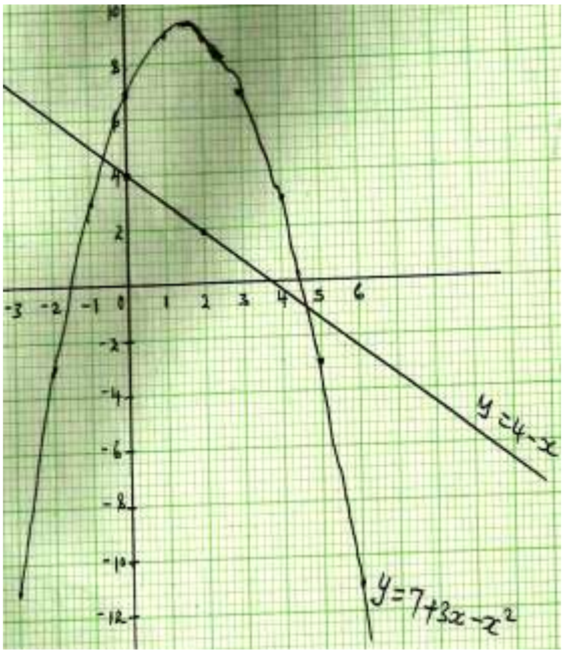
Time = $\frac{360}{120}$ = 3 hrs 4.15 p.m

b) 400 – 360 = 40km
Time taken by car = $\frac{40}{120}$ = 1/3hr = 20min
By bus $\frac{40}{80}$ = ½ hr = 30min
30 min – 20 min = 10 minutes

18

x	-3	-2	-1	0	1	2	3	4	5	6
y	-11	-3	3	7	9	9	7	3	-3	-11

b.



c) $y = 7 + 3x - x^2$

$\underline{0 = -3 - 4x + x^{2+}}$

$y = 4 - x$

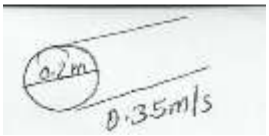
x	0	2
y	4	2

d)

x	1.5
y	9.2

Turning point
(1.5, 9.2)

19 a)



cross- section Area = $3.142 \times 0.1^2 = 0.3142m^2$

in a second volume = 0.03142 x 0.35

= 0.010997

= $0.011m^3$

In 1 hour = 0.0011 x 3600 =

= $39.6m^3$

= 39.6 x 1000

= 39,600 litres

b) 39600 x 18 x 25 = 17,820,000 litres

$\frac{17820,000}{2500}$

= 7128

= 7100 litres

c) $\frac{7100}{100}$ x 4.5 = sh.3195

20 a) 15cm = $\frac{15}{100}$ = 0.15m

(i) 2(5 x 3.3 x 0.15) = $4.95m^3$

2 (7.5 x 3.3 x 0.15) = $\underline{7.425m^3}$ +

$12.375m^3$

(ii) Volume of the door and windows = 5 x 0.15

= $0.750m^3$

Volume will = 12.375 – 0750

= $11.625m^3$

b) 1m = 1000mm

volume of a block = $\frac{450}{1000}$ x $\frac{200}{1000}$ x $\frac{150}{1000}$

= 0.45 x 0.2 x 0.15

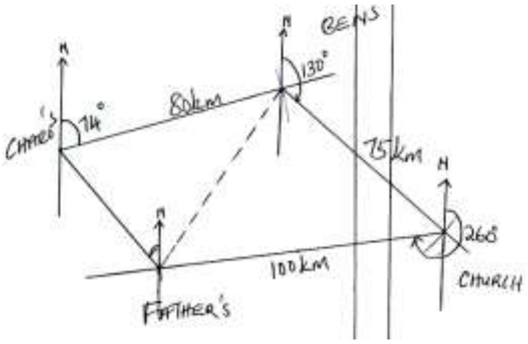
= $0.0135m^3$

Number of block = $\frac{11.625 - 0.225m^3}{0.0135}$

= $\frac{11.4}{0.0135}$ = 844.4

= 845

21



(i) True bearing of charo's from father's

(ii) Compass bearing of fathers from Ben's

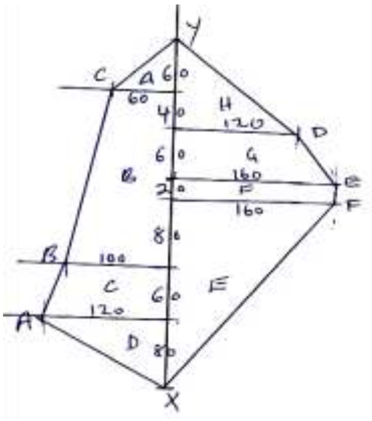
(iii) Distance Ben's and fathers

7.5 x 10 = 75km

(iv) Distance (total) by charo

2(100 + 75 + 80) = 510KM

22



a) Area A = ½ x 60 x 60 = 1800

B = ½ (60 + 100) x 200 = 2600

C = ½ (100 + 120) x 60 = 6600

D = ½ x 80 x 120 = 4800

E = ½ x 160 x 200 = 16000

F = 20 x 160 = 3200

G = ½ (120 + 160x 60 = 8400

H = ½ x 100 x 120 = $\underline{6000}$

72800

= $\frac{72800}{1000}$ = 7.28 ha

c) 7.28 x 80,000 = sh.582400

23 Let the number of suits be x and the cost per suit be y.

xy = 57600

y = $\frac{57600}{x}$

Umoja: No of suits (x + 4)

Cost per suit is (y – 480)

(x + 4) (y – 480) = 57600

(x + 4) ($\frac{57600}{X}$ – 480) = 57600

-480x2 – 1920 + 230400 = 0

X2 + 4x – 480 = 0

(x – 20)(x + 24) =0

X = 20

X = -24

No. of suits = 20

	b) Cost per suit $= \frac{57600}{20}$ $= \text{sh.}2880$ c) Profit per suit = 720 $\frac{720 \text{ x } 100}{2880} = 20\%$
24	a) $V= 2t^2 – 10t + 12$ $\frac{2t^2}{2} – \frac{10t}{2} + \frac{12}{2} = 0$ $t^2 – 5t + 6 = 0$ $t=3$ or $t = 2$ b) $\frac{ds}{dt} = 2t^2 – 10t + 12$ c) $\left(2t^2 + 10t + 12 \ dt \right)$ When $t = 0$ $s = 0$ $c = 0$ $= {}^2/_3t^3 – st2 + 12t$ $= {}^2/3(3)^3 – 5(3)^2 + 12(3)$ $18 – 45 + 36$ $= 9m$

GATUNDU SOUTH FORM FOUR 2015 EVALUATION EXAM

121/2
MATHEMATICS
PAPER II
JULY/AUGUST 2015
TIME: 2 ½ HOURS

1.

No.	Log
2	0.3010 0.3010
0.1324^2	
5	$\bar{1}.1219 \times 2 = \bar{2}.2438$
Log 7	$\underline{2.5448}$
	$\underline{0}.6990$
	$\underline{1.9270}$ +
	$\underline{0.6260}$
	2.5448
	$\underline{0.6260}$ –
2.024×10^{-1}	$\underline{3.9188}$
	3
0.2024	
	← Antilog $\bar{1}.3063$

M1
M1
M1
A1
4

2.

Sin $(4x + 10)^o$ = sin $(90 – (x + 60)^o$ M1

$4 \times 10^o = 90 – x – 60^o$ M1

4x + x = 20 A1

5x = 20

x = 4^o

3

3.

Amount borrowed = 8000 – 1000 = 7000

Installments = 840 x 15 = 12600 M1

If r% is the rate per month

Then 12600 =7000 $(1 + {}^r/_{100})^{15}$ M1

$(1 + {}^r/_{100})^{15} = \frac{12600}{7000}$

= 1.8 M1

$1+ {}^r/_{100}$ = 15 1.8 or $1.8^{1/15}$

= 1.0399 = 1.04

${}^r/_{100}$ = 1.04 – 1

= 0.04 A1

r = 4%

4.

a=250; r = 2, n = ${}^{16}/_2$ + 1 = 9 B1

n^{th} term = 250 x 28 M1

= 64000 A1

Accept use of step by step method.

0	2	4	6	8	10	12
250	500	1000	2000	4000	8000	16000

14	16
32000	64000

5

Let the transformation matrix T = a c
b d

$$\begin{pmatrix} a & c \\ b & d \end{pmatrix} \begin{pmatrix} A & B & C & D \\ 1 & 3 & 3 & 1 \\ 0 & 0 & 2 & 2 \end{pmatrix} \begin{pmatrix} A^1 & B^1 & C^1 & D^1 \\ 1 & 3 & 7 & 5 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

$$\begin{pmatrix} a & 3a \\ c & 3c \end{pmatrix} \begin{pmatrix} 3a + 2b \\ 3c + 2d \end{pmatrix} \begin{pmatrix} a+2b \\ c+2d \end{pmatrix} = \begin{pmatrix} 1 & 3 & 7 & 5 \\ 0 & 0 & 2 & 2 \end{pmatrix}$$

a = 1, c = 0

3(1) + 2b = 7

2b = 4

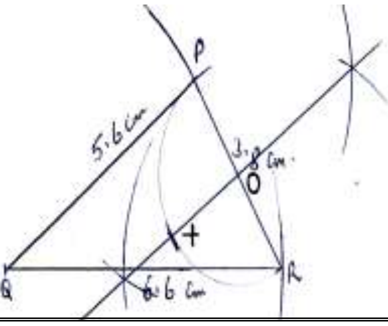
b = 2

2d = 2

d = 1

$$T.M = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$$

6.



B1
B1
B1

7

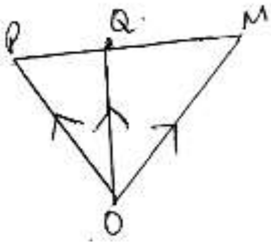
$\frac{3 + 5 + 7 + 9 + 11}{5} = 7$

Deviation (x-x)	-4	-2	0	2	4
$(x\text{-}x)^2$	16	4	0	4	16

Variance = $\frac{\epsilon d^2}{F} = \frac{40}{5} = 8$

s.d $\sqrt{8}$ = 2.8284

8.



Using Ratio theorem

$$OM = \frac{-2}{1}\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} + \frac{3}{1}\begin{pmatrix} 4 \\ 5 \\ -3 \end{pmatrix}$$

$$= \begin{pmatrix} -2 \\ -4 \\ -6 \end{pmatrix} + \begin{pmatrix} 12 \\ 15 \\ -9 \end{pmatrix} = \begin{pmatrix} 10 \\ 11 \\ -15 \end{pmatrix}$$

Coordinates of m (10, 11, -15)

9.

Area of a sector = curve are of a cone.

60x л x 12^2 = лr x 12

$^1/6 \times 12 = r$

Radius = 2cm

$h = \sqrt{12^2 - 2^2}$

$= \sqrt{140}$

= 11.83cm

Volume = $^1/_3 \times {}^{22}/_7 \times 2 \times 2 \times 11.83$

= $49.57cm^3$

10

Gradient $\frac{dy}{dx} = 3x^2 - 6x + 2$

Gradient = $3(3)^2 - 6x\ 3 + 2 = 11$

Gradient of the normal 1 to line

$M_2 = \frac{-1}{11}$

$Y = 33 - 3(3)^2 + 3 \times 2 + 1$

Y = 7; (x, y) is (3, 7)

Since $m_2 = \frac{-1}{11}$

$\frac{-1}{11} = \frac{y-7}{x-3}$

$y = \frac{-x}{11} + \frac{80}{11}$

11

Cos 135° = - cos (180° – 135°)

= - cos45° = - $\frac{\sqrt{2}}{2}$

Sin 30° = ½

Sin 135° = sin (180°- 135°)

= sin 450

=· $\frac{\sqrt{2}}{2}$

$$\frac{\text{Cos } 135^o - \sin 30^o}{\text{Sin } 135^o + \sin 30^o}$$

$$= - \frac{\frac{\sqrt{2}}{2} - \frac{1}{2}}{\frac{\sqrt{2}}{2} + \frac{1}{2}}$$

= -1

12

Mid point of AB =

$$\left(\frac{2+6}{2}, \frac{1+5}{2}\right)$$

$$= \left(^8/_2, ^6/_2\right)$$

= (4, 3)

13

$X^2 + y^2 - 4x + {}^5/2y + 5 = 0$

$X^2 + y^2 - 4x + {}^5/2y = -5$

$X^2 - 4x + 4 + y^2 + {}^5/2y + {}^{25}/_{16} = -5 + 4 + {}^{25}/_{16}$

$(x - 2)^2 + (y + \frac{5}{4})^2 = \frac{9}{16}$

h = 2 ; k = -1.25

14

$H^2 = \frac{t}{q - y^2}$ M1

$t = H^2q - H^2y^2$ M1

$y^2 = \frac{H^2q - t}{H^2}$

$y = \pm \sqrt{\frac{H^2q - t}{H^2}}$ A1

15

$\frac{1}{a-2} - \frac{1}{a+2}$ M1

$= \frac{a+2 - 1(a-2)}{a^2-4}$

$= \frac{4}{a^2 - 4}$ M1

Comparing with $\frac{c}{a^2-4}$ A1

C = 4

b = 4

16

Yk + c where k and c are constants M1

$3 = k + \frac{c}{4}$

5 = k + c

$2 = {}^3/_4c$; $c = {}^8/_3 = 2\,{}^2/_3$

$k = {}^7/_3 = 2\,{}^1/_3$

$k = 2\,{}^1/_3$, $C = 2\,{}^2/_3$

$y = {}^7/_3 + \frac{8}{3x^2}$

When x = 4, $y = {}^7/_3 + \frac{8}{3(4)^2}$ M1

Y = 2 ½ A1

17

a) B1

Class	Frequency	Cumulative Freq. C.F
1 – 10	3	3
11 – 20	6	9
21 – 30	10	19
31 – 40	10	29
41 – 50	12	41
51 – 60	17	58
61 – 70	15	73
71 – 80	16	89
81 – 90	7	96
91 - 100	4	100

B1

B1

b) Median mark the mark scored by the

(½ x 100)th student from the graph 56±2

c) 27 students scored 40 marks and below. B1

(i) Students who scored 41 marks and above B1

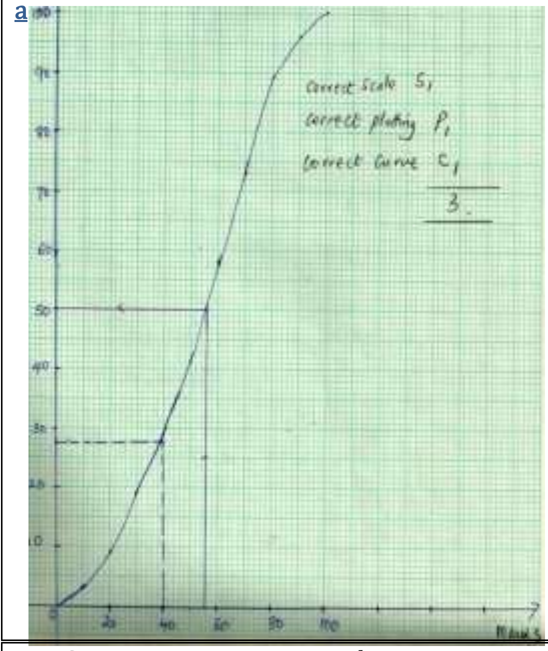
= 100 – 27= 73

Students who passed = $\frac{73}{100} \times 100$

(ii) Students who failed B1

= 100 – 73 = 27% B1

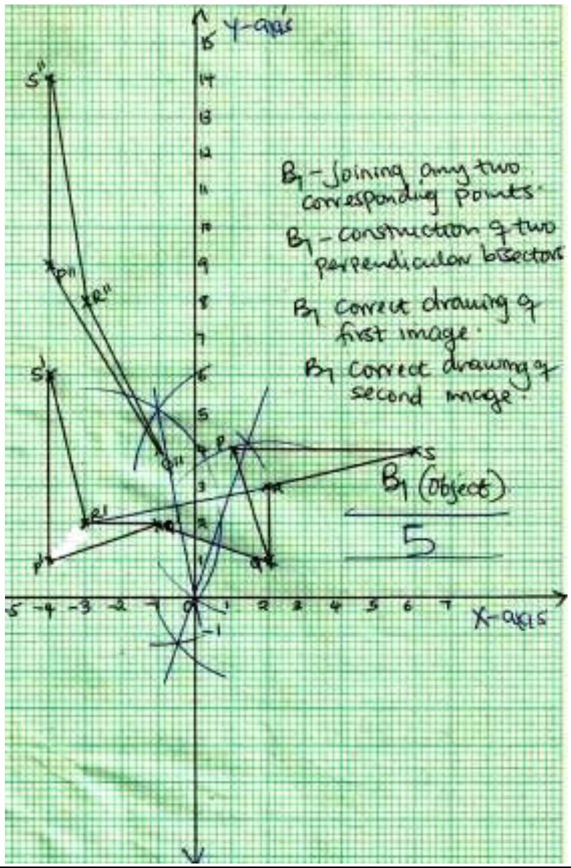
17 a



18

In a G.P series; a term is given by	
ar n-1	
2nd term = ar	
3rd term = ar2	
i) 2nd term + 3rd term = ar + ar2 = 6	M1
ar(a+r) = 6	
$ar^2 + ar^3 = -12$	
ar(1+r) = 6	
$ar^2(1+r)$ -12	M1
$\frac{ar(1+r)}{ar^2(1+r)} = \frac{6}{-12}$	
$\frac{1}{r} = \frac{-1}{2}$	A1
r = -2	
ii) oubsting: r = -2 in ar(1+r) = 6	
-2a(1-2) = 6	M1
2A = 6 = a = 3	
b) bm = n{2a + (n – 1) d}	M1
Given sn = -19 ½ ; a = 16 ½ ; d=-3	A1
$\frac{-39}{2} = \frac{n}{2}\{33 - 3(n-1)\}$	M1
-39 = n(36-3n)	
3n2 – 36n – 39 = 0	M1
N2 – 12n – 13 = 0	
(n-13) (n + 1) = 0	M1
n =13 or n = -1	
Number of term is 13	A1

19



$$\begin{pmatrix}1 & 0\\-2 & 1\end{pmatrix}\begin{array}{c}\begin{array}{cccc}P^1 & Q^1 & R^1 & S^1\end{array}\\\begin{pmatrix}-4 & -1 & -3 & -4\\1 & 2 & 2 & 6\end{pmatrix}\end{array}\begin{array}{c}\begin{array}{cccc}P^{11} & Q^{11} & R^{11} & S^{11}\end{array}\\\begin{pmatrix}-4 & -1 & -3 & -4\\9 & 4 & 8 & 14\end{pmatrix}\end{array}$$

Coordinates P^1 (-4 9): Q^{11}(-1,4)
R^{11}(-3, 8); S^{11}(-4, 14)

d) Let T = $\begin{pmatrix}a & b\\c & d\end{pmatrix}$

$$\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}P & Q & R & S\\1 & 2 & 2 & 6\\4 & 1 & 3 & 4\end{pmatrix} = \begin{pmatrix}P^{11} & Q^{11} & R^{11} & S^{11}\\-4 & -1 & -3 & -4\\9 & 4 & 8 & 14\end{pmatrix}$$

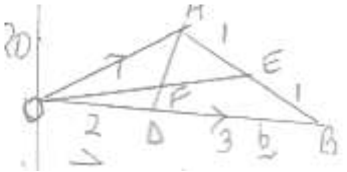
2(a + 4b = -4) = 2a + 8b = -8
2a + b = -1 $\underline{2a + b = -1}$
7b = -7

a = 0

2(c + 4d = 9) = 2c + 8d = 18
2c + d = 4   2c + d = 4
7d = +14
c=1   d=+2

T= $\begin{pmatrix}0 & -1\\1 & 2\end{pmatrix}$

20



a) (i) OE = ½**a** + ½ **b** B1

AD = -**a** + $^2/_5$**b** B1

b) AF = t **AD** B1

AF = t(2/5b – a)

AF = 0**A** + 0**F** B1

= -**a** + s(½ **a** + ½ **b**) B1

= (½ s – 1) **a** + ½ s**b**

Equating

$^2/_5$t**b** = t**a** = (½ s – 1) **a** + ½ s**b**

t = 1 – ½ s B1

$^2/_5$t = ½ s

t = 5s B1

5s = 1 – ½ s

= s = $^2/_{11}$

t = $^{10}/_{11}$

c) OF = KOE B1

OF = S(½ a + ½ b) = 2/11(½ a + ½ b)

OE = ½ a + ½ b

2/11 (½ a + ½ b) = K(½ a + ½ b) B1

K = $^2/_{11}$

O = 2/11 OE

O is common point B1

O, F and E are collinear points.

21

Angle difference = 110° + 70° = 180°

$$\text{Distance} = \frac{\theta}{360^o} \times 2 \times \text{л} \times 6370\cos 45$$

= ½ x 2 x 3.142 x 6370 cos 45

= 3.142 x 6370 x 0.7071

= 14152.28km.

b) Distance in nm = 60α cosΘ

= 60 x 180° x cos 45°

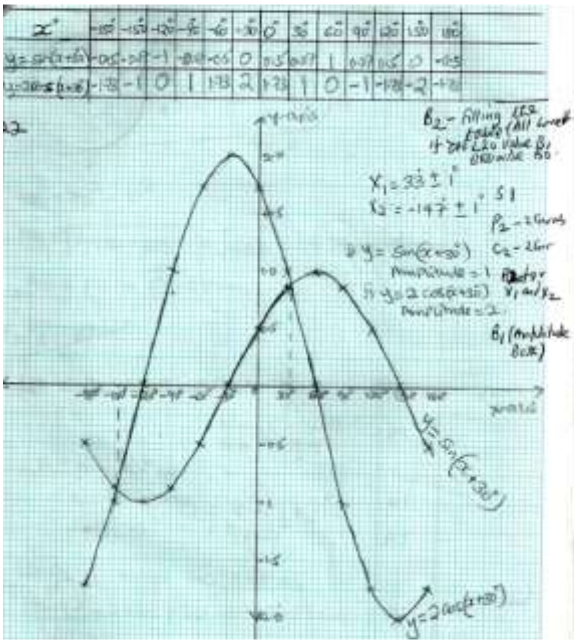
= 7636.68nm.

$$\text{c)Speed} = \frac{\text{Distance in nm}}{\text{time in hours}}$$

$$= \frac{60 \times 90}{15}$$

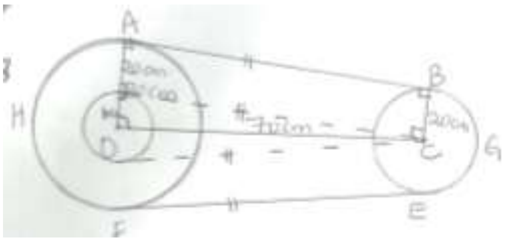
= 360 knots

22



x^o	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
y = sin(x+30)	-0.5	-0.87	-1	-0.87	-0.5	0	0.5	0.87	1	0.87	0.5	0	-0.5
y = 2cos(x+30)	-1.73	-1	0	1	1.73	2	1.73	1	0	-1	-1.73	-2	-1.73

23

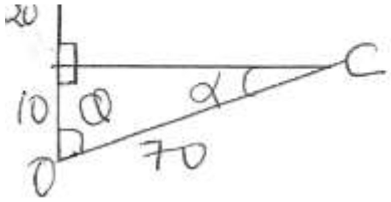


a) AB^2 = 70^2 – 10^2

AB = $\sqrt{4900 - 100}$ = $\sqrt{4800}$ = 69.28cm

AB = FE = 69.28cm.

b)



Let ‹ AOC be Q = Cos Q = $\frac{10}{70}$

Q = Cos^{-1} 0.1429

Q = 81.79°

‹BCD = 90° +α

A = 90° – 8179 = 8.213 + 90°

BCO = 98.21°

b) Length of major arc AHF =

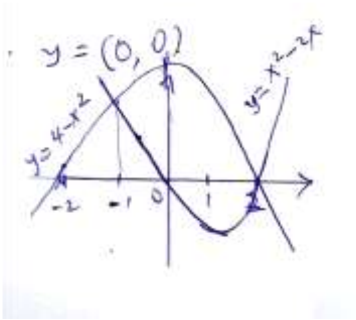
$$\frac{196.42}{360} \times 2 \times \frac{22}{7} \times 30 = 102.89\text{cm}$$

Length of arc BGE

$$\frac{163.58}{360} \times 2 \times \frac{22}{7} \times 20 = 57.12\text{cm}$$

TOTAL LENGTH = (69.28 x 2) + 102.89 + 57.12

= 298.6cm

24	The two curves meet when $4 - x^2 = x^2 - 2x$ $= 4 - x^2 - x^2 + 2x = 0$ $2x^2 - 2x - 4 = 0$ $x^2 - x - 2 = 0$ $(x - 2)(x + 1) = 0$ $x = -1$ or $x = + 2$ (-1, 3) and (2, 0).	B1B1	c)		B1
b)	At the point where $y = 4 - x^2$ meet (i) x-axis, $y = 0$ $0 = 4 - x^2$ $= x = \pm 2$	B1	d)	Area $= \int_{-1}^{+} \left\{ (4 - x^2) - (x^2 - 2x) \right\} dx$	M1
	(ii) At the point where the $y = 4 - x^2$ meets the y-axis $x = 0$. $y = 4 - (0)^2 = 4$ (0, 4)	B1		$= \int^{+2} (4 \text{ x } 2x - 2x^2)\ dx$ $= \left[4x + x^2 - {}^2/_3x^3 \right]_{-1}^{+2}$	M1
	$Y = x^2 - 2x$ x-axis; y-axis; $y = 0$ $0 = x^2 - 2y$ $= x(x-2) = 0$ $x = 0$ or $x = 2$ (0,0) or (2,0) $Y = x^2 - 2x$; y-axis; $x = 0$	B1B1		$(4 \text{ x } 2 + 2^2 - {}^2/_3 \text{ x } 2^3) - (-4 + 1 + {}^2/_3)$ $= 8 + 4 - 5^1/_3 + 4 - 1^2/_3$ $= 9$	

LONDIANI SUB-COUNTY JOINT EXAMINATION 2015
Kenya Certificate of Secondary Education (KCSE)
Paper 1
Mathematics

SECTION I – 50 MARKS

Answer ALL questions in this section.

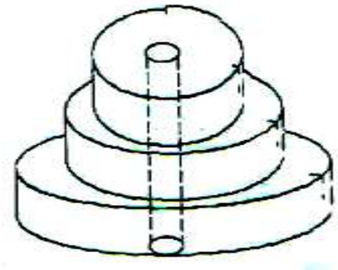
1. Evaluate the following; (3 Marks)

$$\frac{\frac{2}{3}-1\frac{1}{4}\div\frac{5}{6}}{\frac{2}{7}+3\frac{1}{5}\,of\,\frac{7}{8}\div\frac{6}{11}-\left[5\frac{1}{3}+\frac{9}{10}\right]}$$

2. Simplify (3 Marks)

$$\frac{p^2-2pq+q^2}{p^3-pq^2+p^2q-q^2}$$

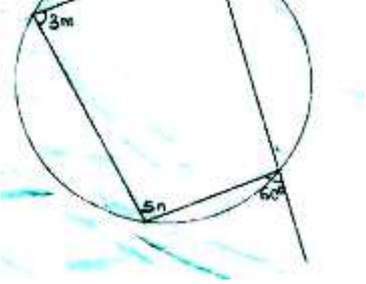
3. A farmer has a piece of land measuring 840m by 396m. He divides it into square plots of equal size. Find the maximum area of one plot. (3 Marks)
4. In a Chemistry experiment, a boy mixed some acid solution of 45% concentration with an acid solution of 25% concentration. In what proportion should the two acids be mixed in order to get 100cm^3 of solution of 30% concentration? (3 Marks)
5. (a) Find the greatest common divisor of the term 9x^{3}y^2 and 4xy^4. (1 Mark)
   (b) Hence factorise completely the expression 9x^{3}y^2 – 4xy^4 (2 Marks)
6. Mr. Wanyama has a plot that is in a triangular form. The plot measures 170m, 190m and 210m, but the altitudes of the plot as well as the angles are not know. Find the area of the plot in hectares. (3 Marks)
7. Given that Log3 = 0.4771 and log 5 = 0.6990, evaluate the following without using logarithm table or calculator.
   (a) Log 135 (2 Marks)
   (b) Log 1125 (2 Marks)
8. Mutai imports rice from the United States at initial cost of 500 US Dollars per tonne. He then pays 20% of this amount as shipping costs and 10% of the same amount as custom duty. When the rice reaches Mombasa he has to pay 5% of the initial cost to transport it to Nairobi. Given that on the day of this transaction the exchange rate was 1US Dollar = KSh. 76.60. Calculate the total cost of importing one tonne of rice up to Nairobi in Kenya Shillings. (3 Marks)
9. Given that tan x = $\frac{5}{13}$, find the value of the following without using mathematics tables of calcular:
   (a) Cost x (2 Marks)
   (b) Sin^2 (90 – x) (2 Marks)
10. A solid consists of three discs each of $1\frac{1}{2}$cm thick with diameter of 4cm, 6cm and 8cm respectively. A central hole 2cm in a diameter is drilled out as shown below. If the density of the material used is 2.8cm3, calculate it mass to 1 decimal place.
    (4 Marks)



11. Sales lady sold goods whose marked price was Sh. 340,000 at a discount of 3%. She was paid Sh. 16,490 as a commission for this sale. Calculate the percentage rate of commission she was paid. (3 Marks)
12. Use reciprocal table to work out the following correct to 4 s.f. (3 Marks)

$$\frac{16}{2.674}+\frac{24}{0.1396}$$

13. Solve the simultaneous inequality below and represent the combined solution of a number line. (4 Marks)
    $2x - 5 \leq 10 - 3x < x + 18$
14. Find the value of m and n in the figure below. (3 Marks)

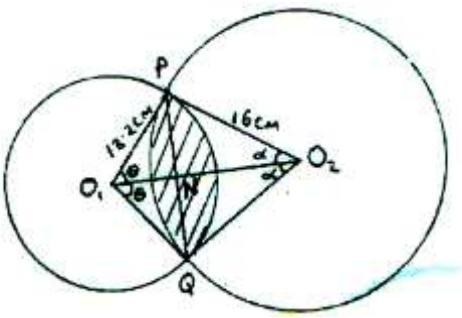


15. The number 5.81 contains an integral part and a recurring decimal. Convert the number into an improper fraction and hence into a mixed number (3 Marks)
16. Sixteen men working 9 hours a day can complete a piece of work in 14 days. How many more men working 7 hours a day would complete the same job in 12 days? (2 Marks)

SECTION II (50 MARKS)

Answer any Five Questions in this section

17. The figure below shows two circles centres O_1 and O_2 of radii 13.2cm respectively. Centre O_1 and O_2 are 20cm apart and $O_1NO:NO_2 = 4:6$.

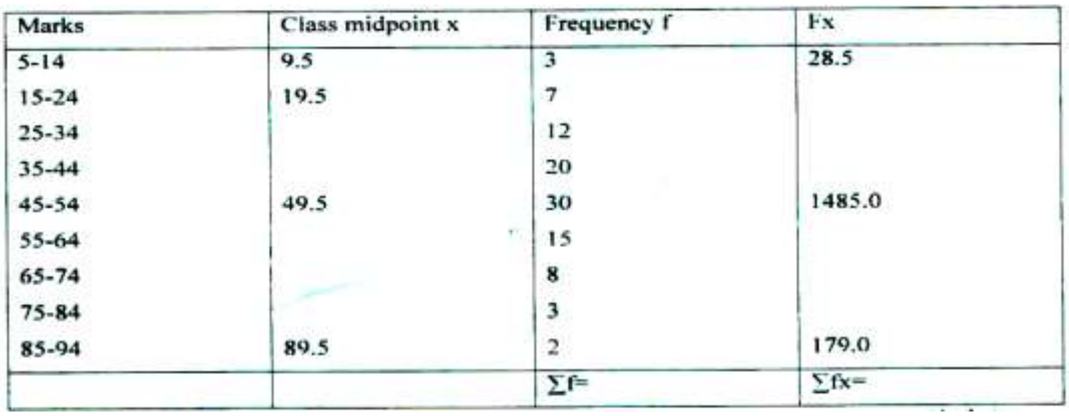


Calculate to 2 decimal places

(a) The size of angle PO_1Q (2 Marks)
(b) The size of angle PO_2Q (2 Marks)
(c) The area of the shaded region (Take $\pi = 3.142$ (6 Marks)

18. Four points P,Q,R and S are situated on a horizontal plane such that Q is 200m on a bearing of 065^0 from P. R is 300m on a bearing of 1200 from Q and S is due west of R.
(a) Draw a rough sketch showing the position of the four points (1 Mark)
(b) Using a suitable scale drawing representing the positions of
(c) By measuring use your scale drawing to find the distance and bearing of
    (i) S from P (2 Marks)
    (ii) Q from S (2 Marks)
(d)

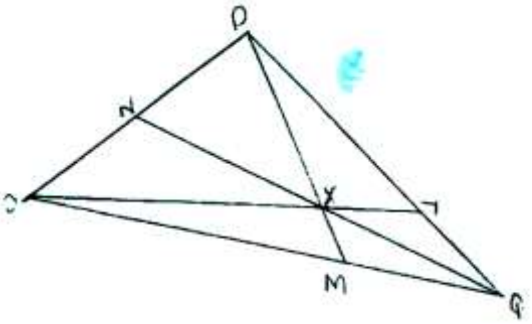
19. The table below shows the marks scored by form one students in a maths test.



Marks	Class midpoint x	Frequency f	Fx
5-14	9.5	3	28.5
15-24	19.5	7	
25-34		12	
35-44		20	
45-54	49.5	30	1485.0
55-64		15	
65-74		8	
75-84		3	
85-94	89.5	2	179.0
		∑f=	∑fx=

(a) Complete the table above (4 Marks)
(b) State the modal class (1 Mark)
(c) Use the completed table to calculate the mean mark for the student. (2 Marks)
(d) Draw a histogram and hence a frequency polygon to represent this information. (3 Marks)

20. The figure below shows triangle OPQ in which OP = P and OQ = p. M and N are points on OQ and OP respectively such that ON:NP = 1:3 and OM:MQ = 2:1



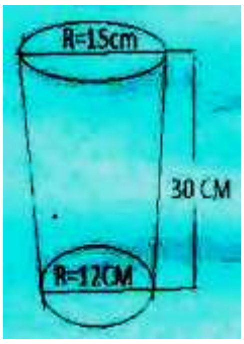
(a) Express the following vectors in terms of p and q (3 Marks)
  (i) PM
  (ii) QN
  (iii) PQ

(b) Lines PM and QN intersect at X such that PX = hPM and QX = kQN. Express OX in two different ways and hence find the value of h and k.

(c) OX produced meets PQ at Y such that PY :YQ = 3:2. Using the ratio theorem or otherwise, find OY in terms of P and q (1Mark)

21. The distance between town A and B is 360km. A minibus left A at 8.15 am and travelled towards B at an average speed of 90km/h. A matatu left B two and a third hours later on the same day and travelled towards A at an average speed of 110km/hr.
(a) (i) At what time did the two vehicles meet? (3 Marks)
  (ii) How far from A did the vehicles meet (3 Marks)
(b) A motorist started from his home at 10.30 am on the same day and travelled at an average speed of 100km/hr. He arrived at B at the same time as the minibus. Calculate the distance from A to his house. (4 Marks)

22. The diagram below shows a frustum which represents a bucket with an open top diameter of 30cm and a bottom diameter of 24cm. The bucket is 30cm deep and it is used to fill an empty cylindrical tank of diameter 1.4m and height of 1.2m.



(a) Leaving your answer in terms of π calculate
  (i) The capacity of the bucket in litres (6 Marks)
  (ii) The capacity of the tank in litres (2 Marks)
(b) Determine the number of bucket that must be drawn in order to fill that tank (2 Marks)

23. A piece of wire can be folded into a rectangle whose dimensions are such that its length is 3cm longer than the width. The area of the rectangle so formed is $28m^2$
(a) Determine
  (i) The dimensions of the rectangle (4 Marks)
  (ii) The perimeter of the rectangle (1 Mark
(b) The wire can also be folded into a circle. Taking $\pi = \frac{22}{7}$ find the radius of the circle and hence calculate its area (5 =Marks)

24. A survey recorded the measurement of a field book using XY = 400m as the base line as shown below.

	y	
To E 200	320	
	210	150 to D
To F 250	170	150 to C
	50	225 to B
	x	100 to A

(a) Use a scale of 1cm 50m to draw the map of the field (5 Marks)
Find the area of the field in hectares.

LONDIANI SUB-COUNTY JOINT EXAMINATION 2015
Kenya Certificate of Secondary Education (KCSE)
Paper 2
Mathematics

SECTION I (50 MARKS)

Answer all the questions from this section

1. Use logarithm tables to evaluate

$$\sqrt[4]{\frac{4.562\,x\,0.38}{0.82}}$$

Correct to 3 significant figures (4 Marks)

2. Simplify the expression: (3x – 2y)(2x + 3y)-5xy (2 Marks)
Hence factorize your answer (1 Mark)

3. Make y the subject of the formula in

$$a = \sqrt{\frac{cy}{b+y}}$$

4. The first three consecutive terms of a geometric progression are:
2, x and 8. Find the value of x (2 Marks)

5. Given that the matrix M = $\begin{bmatrix} a & 0 \\ 5 & b \end{bmatrix}$
(a) Determine M^2 (2 Marks)
(b) If $M^2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ determine the possible pairs of values of a and b (2 Marks)

6. If (x+y) : (x-y) find the ratio x:y (2 Marks)

7. There are two boxes labeled A and B on a table. Box A contains 5 red balls and 3 white balls, while box B contains 2 red balls and 6 white balls. A box is chosen at a random and two balls are drawn from it, one after the other without replacement. Find the probability that the two balls chosen are of different colours (3 Marks)

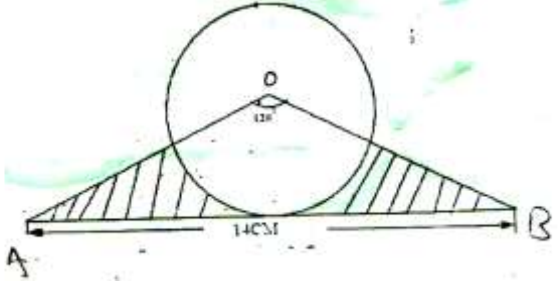
8. A water tank has a capacity of 50 litres. A similar model tank has a capacity of 0.25 litres. If the larger tank has a height of 10cm. Calculate the height of the model tank, to the nearest cm. (3 Marks)

9. Solve for x in (3 Marks)

$$9^x + 3^{2x}\text{-}3 = 51$$

10. Without using a calculator or mathematical tables, express $\frac{\sqrt{3}}{1-Sin60^0}$ in surd form and rationalize the denominator
(3 Marks)

11. The figure shows a circle centre O. The line AB = 14cm is a tangent to the circle such that OA = OB and $\angle$OAB = 120^0.



Calculate to one decimal place
(a) The radius of the circle (2 Marks)
(b) The total of the shaded parts (2 Marks)

12. Calculate the value of (2x + 3)dx (3 Marks)

13. Three quantities; P, Q and R are such that P varies directly as the square of Q and inversely as the square root of R. If P = 6 when Q = R and R = 25. Find the value of P when Q = 15 and R = 81. (3 Marks)

14. A tea blender buys two grades of tea at Sh. 60 and Sh. 80 per packet. Find the ratio in which she should mix them so that by selling the mixture at Sh. 90, a profit of 20% is realized. (3 Marks)

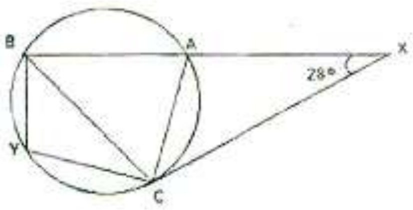
15. (a) Expand:
$(2 + x)^5$ up to the term containing x^3 (2 Marks)
(c) Use the expansion in (a) above to the find the approximate value of (1.99)5 correct to three decimal places.
(2 Marks)

16. Obtain the centre and radius of a circle represented by the equation: (3 Marks)
$x^2 + y^2 + 4x – 10y – 7 = 0$

SECTION II (50 MARKS)

Answer any five questions from this section

17. In the figure below XC is a tangent to the circle ABYC at C and Y is the midpoint of arc BC.



If $\angle BXC = 280$ and $\angle BCA = 2\angle ACX$.

Find, giving reasons for your answer:

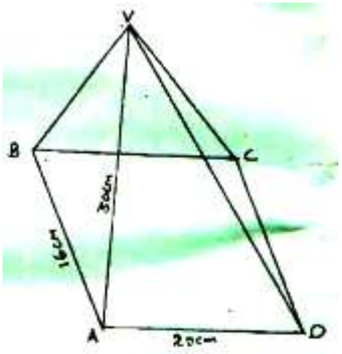
(a) (i) $\angle CBA$ (3 Marks)

(ii) $\angle CBY$ (3 Marks)

(iii) $\angle BYC$ (2 Marks)

(b) Given that AX = 10cm and XC = 12cm, calculate the length of BX (2 Marks)

18. The figure below represents a rectangular based pyramid VABCD. AB = 16cm and AD = 20cm. Point O is vertically below V and VA = 30cm.



Calculate:

(a) The height, VO, of the pyramid (4 Marks)

(b) The angle between the edge VA and the plane ABCD (2 Marks)

(c) The angle between the planes VAB and ABCD. (4 Marks)

19. (a) The eleventh term of an arithmetic progression is four times its second term. The sum of the first seven terms of the same progression is 175.

Find the first term and the common difference of the progression (4 Marks)

(b) Given the series 3 + 9 + 15 + 21 + 27 + ……………………………... find the number of the terms that will given a sum of 432 (2 Marks)

(c) A geometric series is such that its first term is 2. Find the two possible common ratios if the sum of its first three terms is 26

20. (a) Complete the table below:

x	-30	0	30	60	90	120	150
$\sin(x+30)^0$	0		1.7			1.5	
$\sqrt{3}$ Cos x^0		1.7	1.5		0.0		

(b) On the grid provided, using the same scale and axes, draw a graph of:

$y = 2 \sin (x + 30)^0$ and $y = \sqrt{3}$ Cos x for $-30^0 \leq x \leq 1500$ (5 Marks)

(c) Use the graph drawn in (b) above to determine the values of x for which

(i) $2 \text{ Sin } (x + 30)^0 = \sqrt{3}$ Cosx (2 Marks)

(d) Find the difference in amplitudes between $y = 2 \text{ Sin } (x + 300)$ and $y = \sqrt{3}$ Cos x (2 Marks)

21. The points A (1,4), B(-2,0) and C (4,-2) of a triangle are mapped onto $A^1(7,4)$, $B^1(x,y)$ and C^1 (10,16) by a transformation $N = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

(a) (i) Matrix N of the transformation (4 Marks)

(ii) Coordinates of B1 (2 Marks)

(b) $A^{II}B^{II}C^{II}$ are the image of $A^1B^1C^1$ under transformation represented by matrix

$M = \begin{pmatrix} 2 & -1 \\ 0 & 0 \end{pmatrix}$

Write down the co-ordinates of $A^{II}B^{II}C^{II}$ (3 Marks)

(c) A transformation N followed by M can be represented by a single transformation K. Determine K (2 Marks)

22. The table below gives marks scored by candidates in a mathematics test.

Marks	1-10	11-20	21-30	31.40	41-50
No. of candidates	5	13	32	27	3

(a) Using an assumed mean of 25.5, calculate the mean mark (4 Marks)

(b) Estimate the median mark (3 Marks)

(c) Calculate the standard deviation of the marks (3 Marks)

23. The positions of three ports in the Indian Ocean are p (40^0N, 30^0W) Q(400N, 20^0E) and R (36^0S, 30^0W) respectively.

(a) Find the distance in nautical miles to the nearest nm between:

(i) Ports p and Q (3 Marks)

(ii) Ports P and R (2 Marks)

(b) A ship left port P on Tuesday 1430 hours and sailed to port Q at 20 knots.

Calculate:

(i) The local time at port Q when the ship left port P (2 Marks)

(ii) The day and time the ship arrived at port Q (3 Marks)

24. Two quantities Q and R are connected by the equation; $Q = KR^n$

The table of values of Q and R is given below.

Q	1.2	1.5	2.0	2.5	3.5	4.5
R	1.58	2.25	3.39	4.74	7.86	11.6

(a) Complete the table of log Q and log r given below; (2 Marks)

Log Q			0.30	0.40			0.65
Log R		0.35		0.68	0.90		

(b) On a grid, draw a suitable line graph to represent the relation $Q = KR^n$. (3 Marks)

(c) From the graph, determine the values of K and n. (3 Marks)

(d) Hence write down the relationship connecting Q and R. (2 Marks)

LONDIANI SUB-COUNTY JOINT EXAMINATION 2015
Kenya Certificate of Secondary Education (KCSE)
Paper 1
Mathematics

1.

$$Numerator = \frac{2}{3} - \left(\frac{5}{4} + \frac{5}{6} = \frac{15+10}{12} = \frac{25}{12}\right)$$
$$= \frac{2}{3} - \frac{25}{12} = \frac{8-25}{12} = -\frac{17}{12}$$
$$Denominator = \frac{16}{3} + \frac{9}{10} = \frac{160+27}{30} = \frac{187}{30}$$
$$\frac{16}{5} + \frac{7}{8} = \frac{14}{5} x \frac{11}{6} = \frac{77}{15}$$
$$\frac{2}{7} x \frac{77}{15} = \frac{30+539}{105} = \frac{569}{105}$$
$$\frac{569}{105} - \frac{187}{30} = \frac{1138-1309}{210} = -\frac{171}{210}$$
$$-\frac{17}{12} x \frac{-210}{171} = \frac{3570}{2052} = 1\frac{253}{342}$$

2.

$$\frac{p^2 - 2pq + q^2}{p^3 - pq^2 + p^2q - q^3}$$
$$\frac{p^2 - pq - pq + q^2}{p^3 - pq^3 + p^2q - q^3}$$
$$\frac{P(p-q) - q(p-q)}{p(p-q^3) - q(p^2-q^2)}$$
$$= \frac{(p-q)(p-q)}{(p-q)(p-q^3)(p^2-q^2)}$$
$$\frac{(p-q)(p-q)}{(p+q)(p-q^3)(p-q)(p+q)}$$
$$= \frac{(p-q)}{(p+q)^2(p-q^3)}$$

3.

$G.C.D\ for\ 840\ and\ 396$

2	840	396
2	420	148
2	210	74
	105	37

$2x2x2 = 8m^2$

4.

$Let\ volume\ of\ 45\%\ concentration\ be\ x$

$Therefore\ 25\%\ will\ be\ (100-x)$

$$\frac{0.45x + 0.25(100-x)}{100} = 30\%$$
$$0.45x - 0.25x = 30$$
$$0.45x - 0.25x + 25 = 30$$
$$0.20x = 5$$
$$x = \frac{50}{2}, x = 25cm^3, Volume\ of\ 45\% = 25cm^3$$

5.

a) $GCD\ of 9x^3y^2\ and\ 4xy^4$

xy^2	$9x^3y^2$	$4xy^4$
	$9x^2$	$4y^2$

$GCD = xy^2$

b) $9x^3y^2 - 4xy^4 = xy^2(9x^2 - 4y^2)$

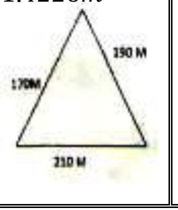
$9x^2 - 4y^2$

$9x^2 - 4y^2 = (3x+2y)(3x-2y)$

$= xy^2(3x+2y)(3x-2y)$

6.

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$
$$S = \sqrt{285(285-170)(285-190)(285-210)}$$
$$A = \sqrt{285x115x95x75} = 15{,}281.4226m^2$$
$$10{,}000m^2 = 1ha$$
$$15{,}281.4226 = ?$$
$$\frac{15{,}281.4226}{10{,}000} x1ha = 1.528ha$$



7.

a) $\log 135$

$135 = 3^3x5$

$\log 135 = \log(3^3x5)$

$= \log 3^3 + \log 5$

$= 3\log 3 + \log 5$

$3(0.477) + 0.6990$

$1.4313 + 0.6990 = 2.1303$

b) $1125 = 3^2x5^3$

$\log 1125 = \log(32x53)$

$= \log 3^2 + log 5^3$

$= 2\log 3 + 3\log 5$

$= 2x0.4771 + 3x0.6990$

$= 0.9542 + 2.0970$

$= 3.0512$

8.

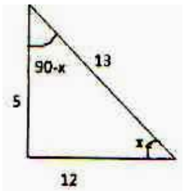
$Shipping\ cost + custom\ duty + transport$

$= 20\% + 10\% + 5\% = 35\%$

$$\frac{135}{100}x500 = 675USD$$
$$1USD = sh.76.60$$
$$\frac{675x76.60}{1} = Ksh.51{,}705$$

9.

a)



$$\cos x = \frac{12}{13}$$

b) $Sin^2(90-x) = \left(\frac{12}{13}\right)^2 = \frac{144}{169}$

10

$Disc\ A\ vol = (3.142x2x2x2x1) = 18.852^3$

$Volume\ of\ the\ hole = 3.142x1x1x1.5$

$= 4.713cm^3$

$Disc\ B = 3.142x3x3x1.5 = 42.417 - 4.713$

$= 37.704cm^3$

$Disc\ C = 3.142x4x4x1.5 = 75.408 - 4.713$

$= 70.695cm^3$

$Total\ volume = 14.139 + 37.704 + 70.695$

$= 122.538cm^3$

$$\int = \frac{m}{v} = m = \int xv = 2.8g/cm^3\ x122.538cm^3$$

11

$Marked\ price\ of\ goods = sh\ 340{,}000$

$$Less\ 3\%\ T.Discount = \frac{97}{100}x3340000$$

$Selling\ price = sh\ 329{,}800$

$Commission\ paid = sh\ 16490$

$$\%\ ratio\ of\ commission = \frac{16490}{329800}x100$$
$$= 5\%$$

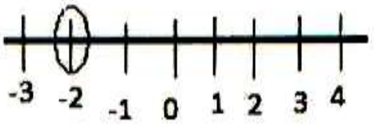
12

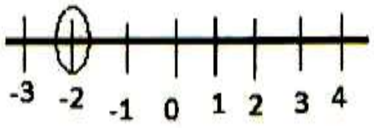
$$\frac{2y^2-2xy-xy-x^2}{2(x^2-y^2)}$$
$=-2y(y-x)-x(y-x)$
$$\frac{(2y-x)(y-x)}{2(x-y)(x+y)}$$
$$\frac{x-2y}{2(x+y)}$$

13

$2x-5\le 10-3x$
$2x+3x-5\le 10-3x+3x$
$5x=5\le 10$
$\frac{5x}{5}\le\frac{15}{5}$
$x\le 310-3x<x+18$
$10-4x<18$
$-4x<8$
$x>-2\ or-2<x$
Combined both

-2<x<3





14

$4n+5n=180^0$
$(opposite\ angle\ \ of\ a\ cyclic\ quadrilateral)$
$qn=180^0$
$n=20^0$
$=3m+120^0$
$=180^0\ (opposite\ angle\ of\ a\ cyclic\ \ quadrilateral)$
$3m=60^0$
$M=20^0$

15

5.81=5.818181
$Let\ r=5.818181$
$Then\ let\ 100r=581.818181\ \dots\dots\dots..$
$Subtract\ equation\ (i)from\ equation\ (ii)$
$99r=576$
$R=\frac{576}{99}$
$R=\frac{64}{11}or\frac{59}{11}$

16

Men	hrs	days
16	9	14
?	7	12

$\frac{9}{7}x\frac{14}{12}x16=24men$
$=24-16=8\ more\ men$

20

a) PM=PO+OM=-p++$\frac{2}{3}q$
ii) QN=QO+ON=-$-p+\frac{1}{4}q$
iii) $PQ=PO+PX=p+hpm$
$(1-h)P+\frac{2}{3}hq\ \dots\dots\dots\dots\dots\dots..(i)$

b) $Using\ \Delta OQX\ we\ have$
$OX=OQ+QX=p+hpm$
$=p+h\left(-p+\frac{2}{3}q\right)$
$Using\ \Delta\ OQX\ we\ have$
$OX=OQ+QX=q+KQN$
$q+k\left(q+\frac{1}{4}p\right)$
$(1-k)r+\frac{k}{4}p$
$\frac{k}{4}p+(1-k)q\ \dots\dots\dots\dots\dots\dots..(ii)$
$From\ equation\ (i)\&(ii)$
$(1-h)p+\frac{2}{3}q=\frac{k}{4}p+(1-k)q$
$Comparing\ coeffient\ of\ p\ we\ have$
$\frac{k}{4}=1-h$
$k=4-4h\ \dots\dots\dots\dots\dots\dots.(iii)$
$comparing\ coefficient\ of\ q\ we\ have.$
$\frac{2}{3}h=1-k$
$2h=3-3k$
$2h+3k$
$=3\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(iv)$
$Substitution\ e.g.\ (iii)$
$K=4-4x\frac{9}{10}$
$=4-\frac{36}{10}=\frac{4}{10}0r\frac{2}{5}$

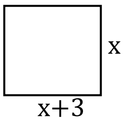
c)Using the ratio theorem,, ΔOPQ
$we\ have\ OY=2p\ 3q$
$3+2p+3+2$
$=\frac{2}{5}p+\frac{3}{5}q$

21

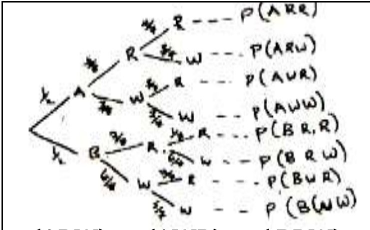
i) $90x\frac{7}{3}=210km$
$360-210=150km\ remaining$
$R.s=110+90=200km/hr$
$\frac{150km}{200km/hr}=45\ mins$
$10:35+45\ mins$
$11.20am$

ii) $8.15am\ to\ 11.20am=3hrs\ 5\ mins=3\frac{1}{12}hrs=\frac{37}{12}hrs$
$=\frac{37}{12}x90=277.5km$

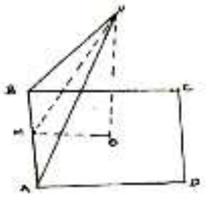
b) $\frac{360km}{90km/hr}=4hrs$
$Minibus\ arrived\ at\ 8.15+4hrs=12.15pm.$
$motorist\ took\ 12.15am-10.30am=1\frac{3}{4}hrs=\frac{7}{4}hrs$
$Distance=100km/hr\text{x}\frac{7}{4}hrs=175km$

22.	From similar triangle $\frac{h+30}{h} = \frac{15}{12} = \frac{5}{4}$ Sh = 4h + 120 H = 120 Small cone height = 120 cm Height of original cone = 150 cm Volume of frustrum = vol. of cone – vol. of cone removed Volume of bucket removed $= \frac{1}{3}\pi$ x 15 x15 x 150 - $\frac{1}{3}\pi$ x 12^2 x 120 =90π(125 -64) =90π x $\frac{61}{1000}$litre =5.49π litres
ii	Vol. of the tank = $\pi r^2 h = \frac{\pi\ x\ 70^2 x\ 120}{1000}$ litres = 588π litres Ns of bucket draw $= \frac{vol.of\ tank}{vol.of\ bucket}$ $= \frac{588\pi}{5.49\pi}$ = 107.1 = 180 buckets
23	 Area of rectangle = x(x + 3) = x2 +3x X2 +3x = 28 X2 +3x – 28 =0 Factorizing = x2 – 4x +7x -28 =0 X(x-4)+7 (x-4)=0 (x-4)(x+7) X=4 or 7 Width of the rectangle = 4 cm Length of the rectangle = 7cm
ii	Perimetre = 2(l+w) = 2(4+7) = 22cm
b	Circumfrence of the circle = perimetre of the rectangle. 2πr = 22 2x$\frac{22}{7}$r = 22 r=$\frac{22x7}{2x22}$ = 3.5 cm area of the circle = πr^2 $\frac{22}{7}$ x 3.5 x 3.5 = 38.5cm^2
24	Area A = $\frac{1}{2}$ x 170 x 250 = 21,250 m^2 Area B =$\frac{1}{2}$ (250 x 200)X100 = 33,750 m^2 Area C =$\frac{1}{2}$ X 80 x 20 = 8000 m^2 Area D =$\frac{1}{2}$ x 150 x 90 = 14250 m^2 Area E = 40 x 150 = 6000m^2 Area F =$\frac{1}{2}$ (225 + 150) X 120 = 22,500 m^2 Area G =$\frac{1}{2}$ X(100 + 225) X 50 = 1825 m^2 Total area = 21250 + 33750+ 8000+14250+6000+22500+8125. =$\frac{113,875}{10000}$ = 11.3875ha.

LONDIANI SUB-COUNTY JOINT EXAMINATION 2015
Kenya Certificate of Secondary Education (KCSE)
Paper 2
Mathematics

1.	NO. LOG 4.562 0.6592 0.38 $\bar{1}$.5798 0.2390 0.82 T. 9138 0.325/ 4 1.2059 X 10^{-2} 0.0813 = 0.012059 ≤ 20.01206	**M1** **M1** **M1** **A1**
2.	(3x -2y)(2x + 3y) – 5xy = $6x^2$ +9xy – 4xy -$6y^2$ - 5xy = $6x^2$ – $6y^2$ = 6(x^2 – y^2) = (6) (x+y)(x-y)	M1 A1 B1
3.	$a^2 = \frac{cy}{b+y}$ $a^2b + a^2y = cy$ $a^2y + cy = a^2b$ $y(a^2 - c) = - a^2b$ $y = \frac{-a^2b}{a^2-c}$	M1 M1 A1
4.	$\frac{X}{2} = \frac{8}{X}$ $x^2 = 16$ X = 14	
5.	$M^{2}= \begin{pmatrix} a & 0 \\ 5 & b \end{pmatrix}\begin{pmatrix} a & 0 \\ 5 & b \end{pmatrix}$ $= \begin{pmatrix} a^2 & 0 \\ 5a+5b & b2 \end{pmatrix}$	M1 B1
b	$\begin{pmatrix} a^2 & 0 \\ 5a+5b & b2 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ $a^2 = 1$ A =+1 And $b^2 = 1$ b = +1	B1 A1
6	(x+ y) : (x-y) = 8 :3 X+y = 8 X= 8-y ……..(i) 8 –y –y = 3 8- 2y = 3 2y = $\frac{5}{2}$ X= 8- $\frac{5}{2}$ = $\frac{11}{2}$: -$\frac{5}{2}$ = 11.5	M1 M1 A1
7	 p(ARW)+p(AWR)+p(BRW)+p(BWR) =(½ x xs/8 x $\frac{3}{7}$) + ($\frac{1}{2}$ x $\frac{3}{8}$ x $\frac{5}{7}$) + ($\frac{1}{2}$ x $\frac{2}{8}$ x $\frac{6}{7}$)+($\frac{1}{2}$x$\frac{6}{8}$x$\frac{2}{7}$)	
	$= \frac{15}{112} + \frac{15}{112} + \frac{12}{112} + \frac{12}{112}$ $= \frac{54}{112}$ or $\frac{27}{56}$	
8.	**v.s.f** $= \frac{vol\ of\ model\ tank}{vol\ of\ w.tank} = \frac{0.25l}{50l} = \frac{1}{200}$ L.s.f = $\sqrt[3]{\frac{1}{200}}$ $= \sqrt[3]{\frac{1}{200}} = \frac{height\ of\ tank}{height\ of\ w.tank} = \frac{x}{100}$ $\left(\frac{x}{100}\right)^3 = \frac{1}{200}$ X3 = $\frac{1}{200}$ x 1000000 = 5000 X = $\sqrt[3]{5000}$ = $10^3 \sqrt{5}$ =10 x 1.7321 =17.321 = 17cm	M1 M1 A1
9.	$\mathbf{(3^2)^x \text{ x } 3^{2x} = 54}$ $\mathbf{3^{2x} + 3^{2x} = 54}$ $\mathbf{2.\,3^{2x} = 54}$ $\mathbf{3^{2x} = 27}$ $\mathbf{3^{2x} = 3^3}$ **2x = 3** **X =** $\mathbf{\frac{3}{2}}$ **=1.5**	**M1** **M1** **A1**
10	$\frac{2\sqrt{3}(2+\sqrt{3})}{(2-\sqrt{3})-(2+\sqrt{3})}$ = $4\sqrt{3}$+6	B1 M1 A1
11	Tan 60 = $\frac{7}{r}$ r = $\frac{7}{\tan 60}$	**M1** **A1**
b	**Area of sector =** $\mathbf{\frac{120}{360}}$ **x** $\mathbf{\frac{22}{7x}}$ **Area of triangle =** $\mathbf{\frac{1}{2}}$ **x 7x X 2** **Shaded area =**	**M1** **A1**
13	$\frac{pxQ^2}{\sqrt{R}}$ P= $\frac{R.Q2}{\sqrt{R}}$ $6 = \frac{12^2R}{\sqrt{25}}$ R = $\frac{6X5}{144} = \frac{5}{24}$ P = $\frac{5\ Q^2}{24\sqrt{R}}$ P = $\frac{5\ (15^{2})}{24\sqrt{81}} = \frac{5}{24}$ X 25 = $\frac{125}{24}$ = 5 $\frac{5}{24}$	

14	Let the grades of tea bought be x and y. for sh. 60 and sh. Respectively $=\frac{60+80y}{x+y}$ cost of the mixture 120% = sh. 90 100% =? 90 X $\frac{100}{120}$ = sh. 75 $\frac{60x+80y}{x+y} = 75$ 60x + 80y = 75x + 75 y -15x = 15y $\frac{x}{y} = \frac{1}{3}$ therefore ratio of x:y = 1:3	A1 M1 A1
15.	a) $(2+x)^5 = 2^5x\,0 + 5.\,2^4x^1 + 10.2^3x^2 + 10.\,2^2x^3$ $= 32 + 80x + 80x^2 + 40x^3$	M1 A1
b	(2+x) = 1.99 X – 0.01 $(1.99)^5 = (2 - 0.01)^5$ 32+ 80 (-0.01)+ 80 (- 0.01)^2 + 40 (- 0.01)^3 32 – 0.8 + 0.008 – 0.00004 = 31.20796 = 31. 208	B1 A1
16	$x^2 + 4x + y^2 - 10y = 7$ $x^2 + 4x + \left(\frac{4}{2}\right)^2 + y^2 - 10y + \left(\frac{-10}{2}\right)^2 = 7 + 2^2 + 5^2$ $(x+2)^2 + (y-5)^2 = 36 = 6^2$ centre is (-2,5) radius is 6 units	M1 A1 A1
17	<Acx = <ABC =< s in alt segments x + x+2x + 28 = 180^0 <s in a triangle 4x = 152 x = 38^0 <CBA = 38^0	B1 B1
ii	<CBA = 180 – [38 + 2(38)] <s in triangle = 180 – 114 =66 <BYC = 180 – 66 = 114 ….opp <s. in cyclic quadrilateral <CBY = $\frac{180}{2}$ - 114. Base angles of isosceles triangle = 33^0	B1 B1
iii	<BYC = 180 – 66 ..op .angles in cyclic quadrilateral. = 114	B1
b.	AX. XB = (cx)^2 10(10 +x) = 12^2 100+10x = 144 10x = 44 X = 4.4 AB = 4.4 + 10 = 14.4cm.	
18.	 Ac $= \sqrt{20^2 + 16^2}$ $= \sqrt{656}$ = 25.61 AO = ½ (25.61) = 12.81 VO = $\sqrt{30^{2-12.81^2}}$ = 27.13cm	

b.	Tan VAC = $\frac{vo}{Ao}$ VAC = tan $^{-1}\frac{27.13}{12.81}$ = 64.72^0	M1 A1
c.	 MV =$\sqrt{900-64}$ = 28.91 M0 = ½ AD = ½ (20) = 10 cm VMO =cos^{-1} $\frac{10}{28.91}$ = 69.77^0	M1 B1
19 a.	T$_{11}$ =a + 10d = T$_2$ = a+d a +10d = 4(a+d) a+10d = 4a +4d -3a =-6d a = 2d ……….(i) s$_7$ =$\frac{7}{2}$[29 +(7-1)d]=175 = $\frac{7}{2}$ (4d + 6d) = 175 $\frac{7}{2}$ x 10d) = 175 70d = 350 d = 5 a = 2(s) a =10 a=10,d =5.	M1 M1 M1 A1
b.	D =9-3=6 Sn =$\frac{n}{2}$[2x3 + (n -1)6] = 432 n(6+6n-6)=864 6n^2 = 144 n=±12 n = 12 terms	
21 a.i	$\begin{pmatrix} a & b \\ c & d \end{pmatrix} + \begin{pmatrix} 1 & 4 \\ 4 & -2 \end{pmatrix} = \begin{pmatrix} 7 & 10 \\ 4 & 16 \end{pmatrix}$ A+4b = 7 ……….(i) x 4 4a + 16b ………..10 (ii) 4a + 16b = 28 $\frac{4a-2b=10}{18b=18}$ b = 1 a = 9-4 = 3 c+4d =4 ………. (iii) x 4 4c – 2d = 16 ………..(iv) 4c + 16d = 16 $\frac{4c-2d=16}{20d=0}$ d =0 c =4 $\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 4 & o \end{pmatrix}$	
ii	$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & 1 \\ 4 & o \end{pmatrix}\begin{pmatrix} -2 \\ 0 \end{pmatrix} = \begin{pmatrix} -6 \\ -8 \end{pmatrix}$ B^1 =(-6 ,-8)	

b.

$$\begin{pmatrix}2 & -1\\ 1 & 0\end{pmatrix}\begin{array}{c}\begin{array}{ccc}A1 & B1 & C1\end{array}\\ \begin{pmatrix}7 & -6 & 10\\ 4 & -8 & 16\end{pmatrix}\end{array}=\begin{array}{c}\begin{array}{ccc}A11 & B11 & C11\end{array}\\ \begin{pmatrix}10 & 4 & 4\\ 7 & -6 & 10\end{pmatrix}\end{array}$$

A1 (10,7) B11(4,-6) C11 (4,10)

C.

$$\begin{pmatrix}2 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}3 & 1\\ 4 & 0\end{pmatrix}=\begin{pmatrix}2 & 2\\ 3 & 1\end{pmatrix}$$

24

Loq q	0.08	0.18	0.30	0.40	0.54	0.65
Log R	0.20	0.35	0.53	0.68	0.90	1.1

22a

marks	m.p	∑	d	∑d	d2	∑d2	cf
1-10	5.5	5	-20	-100	400	2000	5
11-20	15.5	13	-10	-130	100	1300	18
21-30	25.5	32	0	0	0	0	50
31-40	35.5	27	10	270	100	2700	77
41-50	45.5	3	20	60	400	1200	80
		80		100		7200	

Mean (x) $= A + \frac{\sum fd}{\sum f}$

$25.5 + \frac{100}{80} = 26.75$

Median $= 20.5 + \frac{40 – 18 \text{ x } 10}{32} = 27.\,375$

M2 $= 20.5 + \frac{41\text{-}18 \text{ x } 10}{32} = 27.6875$

:. Median $=\frac{(27.375+27.6878}{2} = 27.5312.$

$S=\sqrt{\frac{\sum fd2-}{\sum f}\left(\frac{\sum fd}{\sum f}\right)^2}$

$=\sqrt{\frac{7200}{80}\left(\frac{100}{80}\right)^2}$

$=\sqrt{90 - 1.5625}$

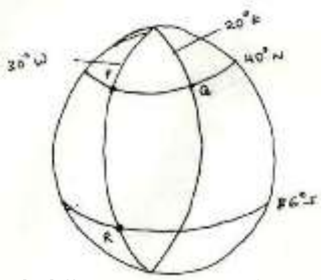
$=\sqrt{88.437s}$

$=9$

20

X	-30	0	30	60	90	120	150
2sin(x-30)	0	1.0	1.73	2.00	1.73	1.0	0
3cos x	1.5	1.73	1.5	0.87	0.0	-0.87	-1.5

23



a) i) longitude difference = 20+30 = 50^0
1^0 = 60 cos 44^0 nm
50^0 =?
= 50 x 60 cos 44^0nm
= 229.81 = 230nm
ii) latitude difference = 40+36= 76
1^0 = 60nm
76^0 = ?
76 X 60 nm
4560nm
b) i) 1 = 5 mins
50^0 =?
= 4x50
= 200mins = 3hrs, 20mins
Time at Q = 1430 + 3 hrs 20 mins = 1750hrs
ii) Time taken $\frac{230nm}{20nm/h}$
$\frac{230}{20}$ = 11 ½ hrs
Time the port arrived at port Q
= 1750hrs + 11hrs 30mins
= 0630hrs
Day is Wednesday.

KIRINYAGA WEST EFFECTIVE "40" EXAM

Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
July /August 2015
2 ½ HOURS

Section 1 (50 mks)

Answer all questions in this section in the spaces provided.

1. A square of side (x + 2) cm has the same area as a rectangle measuring (2x + 4) cm and (x - 2) cm. Calculate the area of the rectangle. (3 marks)
2. Use the prime factors of 1936 and 1728 to evaluate. (3 marks)

$$\frac{\sqrt[3]{1728}}{\sqrt{1936}}$$

3. Simplify the expression. (3 marks)

$$\frac{3x^2 - 27y^2}{2x^2 + 10xy + 12y^2}$$

4. Two boats P and Q are located 45km apart, P being due north of Q. An observer at P spots a ship whose bearing he finds as S56^0. From Q the bearing of the same ship is N38^{0}E. Calculate the distance of the ship from Q to 2 decimal places. (4 marks)
5. The sum of interior angles of a regular polygon is 3240^0. Find the size of each exterior angle. (3 marks)
6. Simplify $\frac{\left(\frac{1}{27}\right)^{-\frac{2}{3}}+\left(\frac{1}{4}\right)^{-\frac{1}{2}}}{8^{\frac{2}{3}}}$ (3 marks)
7. Given that $\underset{\sim}{a} = 5\underset{\sim}{i} + 2\underset{\sim}{j}$ and $\underset{\sim}{h} = 3\underset{\sim}{i} + 4\underset{\sim}{j}$ evaluate $|7\underset{\sim}{a} - 5\underset{\sim}{h}|$ (3 marks)
8. Eight years ago the age of a father was six times the age of his son and after eight years from today the age of the father would be only twice the age of his son. Find their present ages. (3 marks)
9. The mass of a cylindrical metal rod of radius 14cm and height 10cm is 5.47kg. Find it's density in g/cm^3 to 2 decimal places. (3 marks)
10. Construct a DABC in which BC = 5cm, <B = 75^0 and <C = 60^0. From A drop a perpendicular to BC and measure its length to the nearest mm. (4 marks)
11. $\underset{\sim}{A} = \begin{pmatrix} 2 - x & x \\ 3 & 2 + x \end{pmatrix}$

    Find the values of x for which A has no inverse. (3marks)
12. Solve $15 < 5(3 - x) \leq 30$ hence show your solution on a number line. (3 marks)
13. A major arc of a circle substends an angle of 250^0 at the centre of a circle. If the radius of the circle is 9.8cm find the area of the minor sector. (Use $\pi = {}^{22}/_{7}$) (3 marks)
14. A point A (-1, 3) is mapped onto A^1(8, 12). Fidn the centre of enlargement given that the scale factor is 2. (3 marks)
15. A particle moving in a straight line has its displacement x metres from the origin O at time t seconds defined by the equation $x = t^3 - 6t^2 + 7$. Determine the values of t for which the particle is momentarily at rest. (3 marks)
16. Maina can do a piece of work in 12 hours. Muthui can do it in 20 hours. How long would it take Muthui to complete the work if Maina has been working for 7 hours. (3 marks)

SECTION 2 (50 MARKS)

Answer any five questions in this section in the spaces provided

17. A line T passes through points (-3, -5) and (3, -6) and is perpendicular to a line l at (-2, -2).

a) Find the equation of l. (2 marks)
b) Find the equation of T in the form ax + by = c where a, b and c are constants. (2 marks)
c) Given that another line Q is parallel to T and passes through (1, -3) find x and y intercepts of Q. (3 marks)
d) Find the points of intersection of L and Q. (3 marks)

18.

Use this velocity - time graph which represents the motion of a car for 10 seconds, to find:

a) The rate of acceleration. (1 mark)

b) The rate of retardation. (1 mark)

c) The total distance travelled. (2 marks)

d) The total distance travelled during the first 4 seconds. (2 marks)

e) The average speed maintained during this journey. (2 marks)

f) The distance travelled at the constant speed. (2 marks)

19. The percentage marks obtained by 40 students in a test are as under:
85, 30, 49, 62, 17, 84, 24, 15, 82, 61, 74, 38, 27, 13, 44, 72, 61, 49, 38, 23,
90, 32, 67, 18, 45, 58, 22, 46, 37, 39, 43, 55, 62, 30, 46, 59, 41, 26, 34 and 47.

a) Prepare a grouped frequency table from the above data using a class width of 10. (2 marks)

b) Use 49.5 as the working mean and estimate the mean from the grouped frequency table. (3marks)

c) Prepare a cumulative frequency table and draw the cumulative frequency curve on the grid of squares provided. (2 marks)

d) Use the cumulative frequency curve to estimate the median. (3 marks)

20. A calf runs in a straight line towards a cow with a velocity of vm/s after t seconds given by v = t (8 - t).

a) Complete the table below

t	0	1	2	3	4	5	6	7	8
8 - t	8					3	2		
v	0		12					7	

(2 marks)

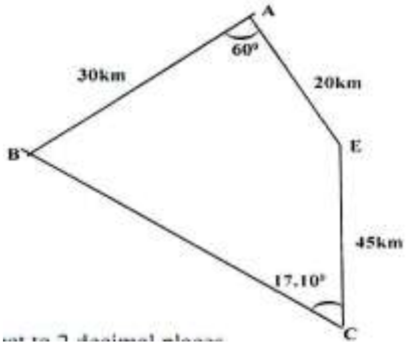
b) Hence draw the graph of v against t for $0 \leq t \leq 8$ on the grid provided. (3 marks)

c) From the graph find the total distance the calf run.

i) Using eight trapezia of equal width. (3 marks)

ii) Using the exact method. (2 marks)

21. The figure below represents a game sanctuary in the shape of a quadrilateral in which AB = 30km, AE = 20km and CE = 45km <BAC = 60^0, <EBC = 30^0 and <ECB = 17.10^0.



Calculate

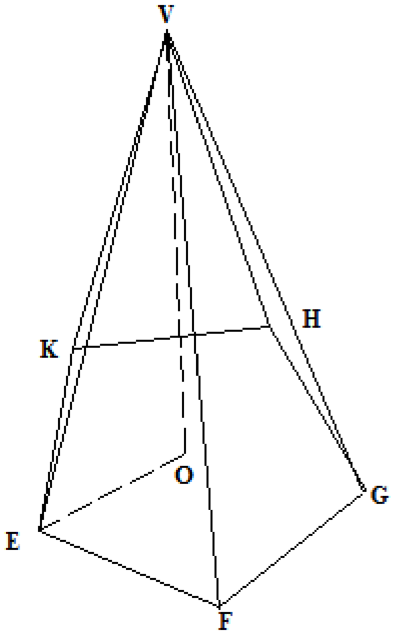
a) The side BC correct to 2 decimal places. (3 marks)

b) The angle ABE to 1 decimal place. (2 marks)

c) The area of the game sanctuary in hectares correct to 2 decimal places. (3 marks)

22. Using a ruler and compasses only, construct a triangle ABC with AB = 4.5cm, <ABC = 75^0 and <BAC = 60^0. Prolong CB and CA hence construct a circle that touches side AB and the prolonged sides. Calculate he area of the circle. Use p = 3.142. (10 marks)

23.



The figure above shows a right pyramid VEFGHK. The base EFGHK is a regular pentagon. EO = 7cm and VE = 12cm. Calculate:

a) The perimeter of the base to 2 decimal places. (3 marks)
b) The length VO to 2 decimal places. (1 mark)
c) The angle which edge VF makes with the edge FE. (3 marks)
d) The volume of the pyramid to 2 decimal places. (3 marks)

24. The equation of a curve is given by $y = 2x^3 + 3x^2 - 12x + 5$.

a) Find the y - intercept of the curve. (1 mark)
b) Determine the stationery points of the curve. (4 marks)
c) Sketch the curve $y = 2x^3 + 3x^2 -12x + 5$ (5 marks)

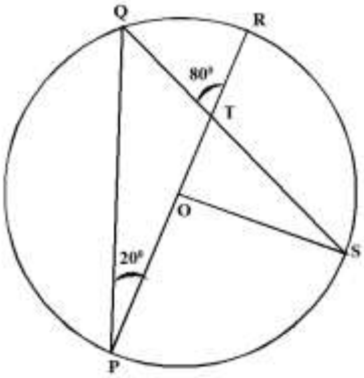
KIRINYAGA WEST EFFECTIVE "40" EXAM
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
MARCH/APRIL 2015
2 ½ HOURS

Section 1 (50 mks)

Answer all questions in this section in the spaces provided.

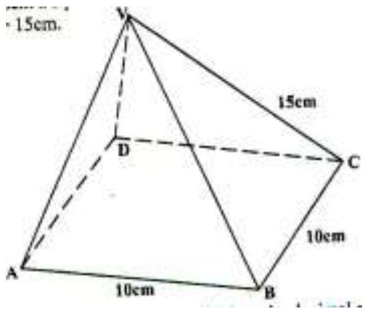
1. The length of two similar iron bars A and B were given as 10.5m and 8.2m. Calculate the maximum possible difference in length between the two bars. (3 marks)
2. The first term of an arithmetic sequence is 5 and the common difference is 2.
   a) List the first six terms of the sequence. (1 mark)
   b) Determine the sum of the first 40 terms of the sequence. (2 marks)
3. In the figure below PQR is the diameter of the circle centre O. Angle QPR = 20^0 and angle QTR = 80^0.



   Determine the size of
   a) Reflex angle POS (2 marks)
   b) Angle OSQ (1 mark)
4. The quantities P, Q and R are such that P varies directly as Q and inversely as the square of R. Given that P = 2 when Q = 12 and R = 6. Determine the equation connecting the three. (3 marks)
5. The table shows the frequency distribution of marks scored by students in a test.

Marks	Frequency
21 - 30	2
31 - 40	4
41 - 50	11
51 - 60	5
61 - 70	3

   Determine the median mark correct to one decimal point. (4 marks)
6. Determine the amplitude and period of the function 3y = 6sin (2x - 30). (2 marks)
7. In a transformation, an object with area $9cm^2$ is mapped onto an image whose area is $54cm^2$. Given that the matrix of transformation is $\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$ find the value of x (3 marks)
8. Expand $(4 - x)^7$ upto to the term in x^4. Hence find the appropriate value of $(3.8)^7$. (3 marks)
9. Solve for x without using mathematical tables or calculators.
   $\text{Log}_2(x^2 - 9) = 3\ \text{Log}_2 2 + 1$ (4 marks)
10. The figure below represent a square based right pyramid ABCDV. AB = 10cm, AV = BV = CV = DV = 15cm.



Calculate the angle between AV and the base ABCD to the decimal place. (3 marks)

11. Solve the simultaneous equations. (4 marks)

$2x - y = 3$

$xy - y^2 = 0$

12. Francis bought a vehicle at ksh. 2 800 000. After three years he sold the vehicle at Kshs. 1,500,000. Determine the average rate of depreciation per annum correct to one decimal place. (3 marks)

13. A plane flies from point P (40^0N, 50^0E) towards West to a point Q. Given that the plane covers a distance of 10,000km what is the position of Q. (3marks)

(Take $\pi = {}^{22}/_{7}$, radius of the earth 6370km)

14. Given $\underset{\sim}{a} = \begin{pmatrix} 2 \\ -3 \\ 5 \end{pmatrix}$ and $\underset{\sim}{b} = \begin{pmatrix} 0 \\ 3 \\ 7 \end{pmatrix}$. Find

$|2\underset{\sim}{a} + \underset{\sim}{b}|$ (3marks)

15. The gradient function of a curve is $x^3 - 4$. If the curve passes through point (2, 3). Find the equation of the curve. (3 marks)

16. A vehicle initially moving at a velocity of 80m/s had breaks applied. The table below shows how velocity changed in the next 14 seconds.

Time (seconds)	0	2	4	6	8	10	12	14
Velocity (m/s)	80	60	46	34	26	20	16	14

Determine the average rate of deceleration between the fourth and the twelfth second. (3 marks)

SECTION II (ATTEMPT ANY FIVE)

17. A businesswoman mixes three types of rice A, B and C in the ratio A : B = 1 : 2 and B : C = 4 : 5. The mixture is to contain 60 bags of type B.

a) Find the ratio A : B : C (2 marks)

b) Find the required number of bags of type C. (2 marks)

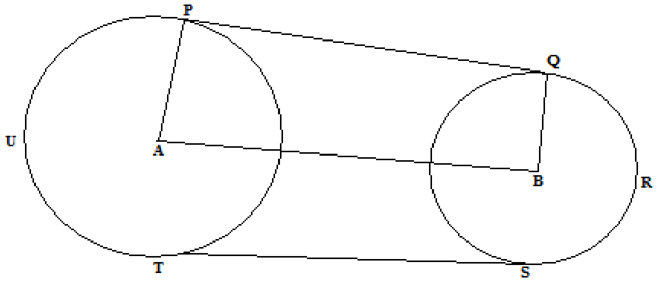
c) The cost per bag of type A is Kshs. 7,500, type B Kshs. 5,000 and type C Kshs. 4,000.

   i) Calculate the cost per bag of the mixture. (2 marks)

   ii) Find the percentage profit if the selling price of the mixture is Ksh. 6,500 per bag. (2 marks)

   iii) Find the selling price of a bag of the mixture if the businesswoman makes a profit of 25%. (2 marks)

18. The figure below shows the pulleys with centres A and B and radii 13cm and 6cm respectively. The distance between the centres is 25cm.



A belt PRSTUP goes round the two pulleys. PQ and TS are also tangents.

a) Calculate

   i) Length PQ (3 marks)

   ii) Angle BAP (3marks)

b) Hence or otherwise calculate the length of the belt. (4 marks)

19. The table below shows income tax rates for a certain year.

Monthly income in Kenya shilling (Ksh)	Tax rate in each shilling
0 - 10164	10%
10165 - 19740	15%
19741 - 29316	20%
29317 - 38892	25%
Over 38892	30%

A secondary school teacher was earning a monthly basic salary of Ksh. 55,480 house allowance of Kshs. 12,000 and a commuter allowance of ksh. 8000. He was entitled to a personal relief of Kshs. 1162 per month.

a) Calculate

   i) The teacher's taxable income. (2 marks)

   ii) The teacher's net monthly tax. (6 marks)

b) In addition to the tax the other deductions were per month as follows:
- Cooperative loan Ksh. 10,000
- Co-operative shares Ksh. 2,000
- Window and children's pensions scheme at 2% of the basic salary.

Calculate the teacher's net monthly pay.

20. A farmer wishes to keep some chicks and ducks. Chicks cost Ksh. 60 each while ducks costs Kshs. 80 each. She finds its uneconomical to keep less than 250 birds. She also wishes to keep more chicks than ducks but the chicks must be less than 200. She cannot afford to spend more than ksh. 24,000.

a) Taking x and y to be the number of chicks and ducks respectively rite down all the inequalities that satisfy the above conditions. (4 marks)

b) Represent the inequalities graphically shading out the unwanted region. (4 marks)

c) If the farmer makes a profit of ksh. 200 per chicks and ksh. 250 per duck, find the number of chicks and ducks she must keep in order to maximize her profit. State the profit. (2 marks)

21. Three pupils Irene, Mary and Atieno applied for a form one vacancy. The probability of Irene, Mary and Margaret getting the chance in the school are 0.5, 0.4 and 0.9 respectively. Determine the probability that

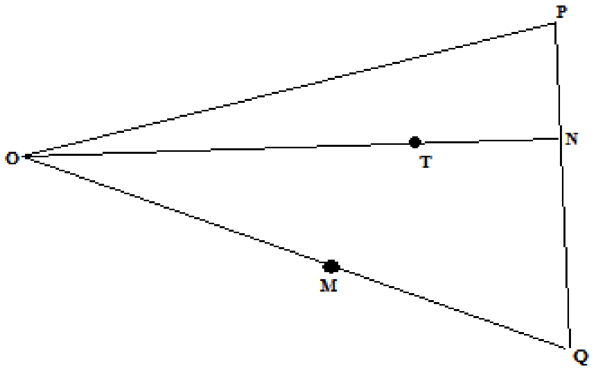
a) None gets the chance (2 marks)

b) Only one gets the chance. (2 marks)

c) At most one of the three gets the chance. (3 marks)

d) At least one of the three gets the chance. (3 marks)

22. The figure shows triangle OPQ in which QN : NP = 1 : 2, OT : TN = 3 : 2 and M is the mid - point of OQ.



$\underset{\sim}{OP} = \underset{\sim}{p}$ and $\underset{\sim}{OQ} = \underset{\sim}{q}$

a) Express the following in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$.

i) $\underset{\sim}{PQ}$ (1 mark)

ii) $\underset{\sim}{ON}$ (2 marks)

iii) $\underset{\sim}{PT}$ (2 marks)

iv) $\underset{\sim}{PM}$ (2 marks)

b) Hence show that P, T and M are collinear. (3 marks)

23. Using a ruler and compasses only, construct triangle ABC such that AB = AC = 3.9cm and angle ABC = 30^0(3marks)

b) Measure BC. (1 mark)

c) A point P is always on the same side of BC as A. Draw the locks of P such that angle BAC is always twice angle BPC. (3 marks)

d) Drop a perpendicular from A to meet BC to D. Measure AD. (3 marks)

24. The relationship between two variables X and Y is known to be of the form $y = ax^2 + b$ where a and b are constants. In an experiment, for some fixed values of x, corresponding values of y were recorded as in the table below.

x	1	2	3	4	5
y	7	13	23	37	55
x^2					

a) Fill the missing values of x^2. (2 marks)

b) Draw the graph of Y against x^2. (3 marks)

c) Using the graph find the value of a and b. (4 marks)

d) State the relationship between y and x. (1 mark)

KIRINYAGA WEST EFFECTIVE “40” EXAM
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
July /August 2015
2 ½ HOURS

1

1. Area of square $(x + 2)^2 = x^2 + 4x + 4$
Area of rectangle (2x + 4) (x – 2) =
$2x^2 – 8$
$2x^2 – 8 = x^2 + 4x + 4$ M1
$x^2 – 4x – 12 = 0$
$x^2 + 2x + 6x + 12 = 0$
x(x – 2) – 6(x + 2) = 0
(x – 6) (x + 2) = 0 M1
Use x = 6
Area of rectangle
= 16 x 4 M1
= $64cm^2$ A1

2

$$\begin{array}{r|l}
2 & 1728 \\
2 & 864 \\
2 & 432 \\
2 & 216 \\
2 & 108 \\
2 & 54 \\
3 & 27 \\
3 & 9 \\
3 & 3 \\
 & 1
\end{array}
\quad \text{M1} \quad
\begin{array}{r|l}
2 & 1936 \\
2 & 968 \\
2 & 484 \\
2 & 242 \\
11 & 121 \\
11 & 11 \\
 & 1
\end{array}$$

$1728 = 2^6 \text{ x } 3^3$ M1 1936 = 24 x 112
3 1728 = 2^2 x 3 $\sqrt{1936} = 22 \text{ x } 11$

$$\frac{\sqrt[3]{1728}}{\sqrt{1936}} = \frac{2^2 \text{ x } 3}{2^2 \text{ x } 11}$$

= $^3/_{11}$ A1

3

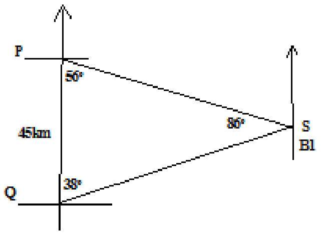
$$\frac{3x^2 – 27y^2}{2x^2 + 10xy + 12y^2}$$

$3(x^2 – 9y^2) = 3(x + 3y) (x – 3y)$ M1
$2x^2 + 6xy + 4xy + 12y^2$
2x(x + 3y) + 4y(x + 3y)
(2x + 4y) (x + 3y) M1

$$\frac{3(x + \cancel{3y}) (x – 3y)}{(2x + 4y) (x + \cancel{3y})}$$

$$\frac{3(x – 3y)}{2x + 4y}$$ A1

4



$$\frac{\text{Sin}86^0}{45} = \frac{\text{Sin}56}{P}$$ M1

$$P = \frac{45\text{Sin}56^0}{\text{Sin}86^0}$$ M1

= 37.40km A1

5

Sum of the interior <s
$(2n – 4)90^0 = 3240^0$ M1
2n – 4 = 36
2n = 40
n = 20
Size of each exterior <

$$= \frac{360^0}{20}$$ M1

= 180 A1

6

$$\frac{\left(\frac{1}{27}\right)^{-\frac{2}{3}}\left(\frac{1}{4}\right)^{-\frac{1}{2}}}{8^{\frac{2}{3}}}$$

$$= \frac{1 + 1}{\frac{^1/_9 + ^1/_2}{4}}$$ M1

$$= \frac{a + 2}{4}$$ M1

= $^{11}/_4$

= $2^3/_4$ A1

7. $\underset{\sim}{a} = 5\underset{\sim}{i} + 2\underset{\sim}{j}$ and $\underset{\sim}{b} = - 3\underset{\sim}{i} + 4\underset{\sim}{j}$

$$= 7 \begin{pmatrix} 5 \\ 2 \end{pmatrix} - 5 \begin{pmatrix} -3 \\ 4 \end{pmatrix}$$ M1

$$= \begin{pmatrix} 35 \\ 14 \end{pmatrix} - \begin{pmatrix} -15 \\ 20 \end{pmatrix}$$

$$= \begin{pmatrix} 50 \\ -6 \end{pmatrix}$$

= $\sqrt{50^2 + 6^2}$
= $\sqrt{2536}$
= 50.3587 M1
= 50.36 Units A1

8.

Let the age of the father be f years and the son s years

f – 8 = 6(s – 8)

f – 6s + - 40 … (i) B1

f + 8 = 2(s + 8)

f – 2s = 8 … (ii)

4s = 48

s = 12 years M1

f – 72 = - 40

f = 32 years

Ages : father 32 years

son 12 years A1

9

Volume of the rod

$^{22}/_{7} \times 14^2 \times 10cm^3 = 6160cm^3$ M1

Density of the rod = $\frac{5470g}{6160cm}$

= 0.888g/cm^3 A1

11

$[(2 - x)(2 + x)] - 3x = 0$ M1

$4 - x^2 - 3x = 0$

$x^2 + 3x - 4 = 0$

$x^2 + 4x - x - 4 = 0$

$x(x + 4) - (x + 4) = 0$

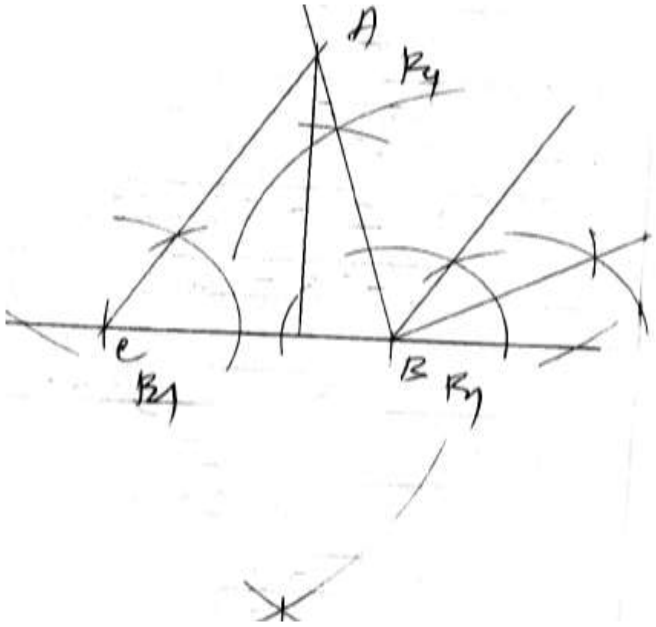
$(x - 1)(x + 4) = 0$ M1

x = 1 A1

x = -4

10

Length of the perpendicular from A 6.0cm B1



12

$15 < 5(3 - x)$

$15 < 15 - 5x$

$0 < -5x$

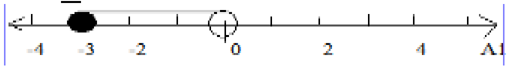
$0 > x$ M1

$5(3 - x) \leq 30$

$15 - 5x \leq 30$

$-5x \leq 15$

$x \geq -3$ M1



Solution

-3, -2, -1

13

13. Area of the minor sector

$\frac{(360 - 250)}{360} \times {}^{22}/_{7} \times 9.8 \times 9.8cm^2$

$= {}^{110}/_{360} \times {}^{22}/_{7} \times 9.82\ cm^2$

$= 92.23\ cm^2$

14

Take O(x, y) : k = 2

$\frac{\frac{x-8}{y-12}}{\frac{x+1}{y-3}} = 2$ M1

$\frac{x-8}{y-12} = 2\frac{(x+1)}{y-3}$ M1

$\frac{x-8}{y-12} = \frac{2x+2}{2y-6}$

x – 8 = 2x + 2

x = -10

y – 12 = 2y – 6

y = -6

0(-10, -6) A1

15

Particle momentarily in rest

$\frac{dx}{dt} = 3t^2 - 12t = 0$ M1

$3t(t - 4) = 0$ M1

Momentarily at rest

When t = 0 and t = 4s A1

16

In 1 hour Maina can do $^{1}/_{12}$

In I hour Muthui can do $^{1}/_{20}$

In 7 hours Maina does $^{7}/_{12}$ of the work

New among work to be done $^{5}/_{12}$

Muthui would take $\frac{\frac{5}{12}}{\frac{1}{20}}$ hours

to complete t : $^{5}/_{12} \times ^{20}/_{1}$

$= 8^{1}/_{3}$ hour

17

SECTION 2 : (50 MARKS)

a) Gradient of line T

$\frac{y+2}{x+2}$

$\frac{-5 - -6}{-3 - 3} = \frac{1}{-6}$ M1

Equation of line L

$\frac{y+2}{x+2} = 6$

$y + 2 = 6(x + 2)$

$y + 2 = 6x + 12$

$y = 6x + 10$ A1

b $\frac{y+5}{x+3} = \frac{-1}{6}$ M1

$6(y + 5) = 1(x + 3)$ M1

$6y + 30 = x - 3$

$x + 6y = -33$ A1A1

c) Equation of Q

q : $\frac{y+3}{x-1} = \frac{-1}{6}$ M1

Line Q :

$6(y + 3) = -1(x - 1)$

$6y + 18 = -x + 1$

$6y = x - 17$

$\frac{6y + x}{-17 - 17} = \frac{-17}{-17}$ M1

$\frac{6y}{-17} - \frac{x}{17} = 1$

x – intercept – 17

y – intercept – $\frac{17}{6}$

$2^{5}/_{6}$

Point (-17, 0) : $(-2^{5}/_{6}, 0)$ A1

c) $x + 6y = -17$

$-6x + y = 10$

$6x + 36y = -102$

$\underline{-6x + y = 10 \ +}$ M1

$37y = -92$

$y = \frac{-92}{37}$

Value of x

$x - ^{552}/_{37} = -17$

$x = -17 + ^{552}/_{37}$ M1

$= ^{-77}/_{37}$

Point of intersection

$(^{-77}/_{37}, ^{-92}/_{37})$ A1

(-2.1, -2.5)

18

a) Rate of acceleration

$= \frac{20 - 0}{3 - 0}$ m/s^2

$= ^{20}/_{3}$ m/s^2 B1

= 6.667m/s^2

b) Rate of retardation

$\frac{0 - 20}{10 - 7}$ m/s

$= ^{20}/_{3}$

= 6.667m/s^2

c) Total distance traveled

= ½ x 20(10 + 4) M1M1

= 10(14) M1

= 140 M1

d) Distance traveled during the first 4 seconds

$= ^{1}/_{2}$ x 20(1 + 4) M1M1

= 50m A1

e) Average speed

$= ^{140}/_{10}$ m/s M1

= 14m/s A1

A = 49.5

f) distance at constant speed

= 20 x 4 M1

= 80m A1

19

a)

Class [a – b]	f	$x = \frac{a+b}{2}$	d = x – A	cf
0 – 19	4	9.5	-40	4
20 – 29	5	29.5	-30	9
30 – 39	8	39.5	-10	17
40 – 49	9	49.5	0	26
50 – 59	4	59.5	10	30
60 – 69	5	69.5	20	35
70 – 79	2	79.5	30	37
80 – 89	3	89.5	40	40
B1	B1	B1		B1

b) $\bar{x} = 49.5 + {}^{20}/_{40}$ M1

$= 49.5 + 0.5$

$= 50$ A1

c) Show the graph

d) Estimate of the median from the cumulative frequency curve

42 B1

20

a)

t	0	1	2	3	4	5	6	7	8
8 – t	8	7	6	5	4	3	2	1	0
v	0	7	12	15	16	15	12	7	0

B1 B1

b) Distance the calf run (show the graph)

c) i) ½ x 1(0 + 8) + ½ (8 +12) + ½ x 1(12 + 15) + ½ x 1 x 1(16 + 15) M1

+ ½ x 1(16 + 15) + ½ x 1(15 + 12) + ½ x 1(12 + 7) + ½ x 1(7 + 0)

= ½(7 + 19 + 27 + 31 + 31 + 27 + 19 + 7) M1

= 1 x 1 (168)

= 84 M1

A1

ii) $\int_0^8 (8t - t^2)dt$

$= [4t^2 - {}^{1}/_{3}t^2]$ M1

$(256 - {}^{512}/_{3})$ M1

$= {}^{256}/_{3}$ A1

= 85.33 M1

21

$BE^2 = 30^2 + 20^2 - 2 \times 30 \times 20\text{Cos}60^0$ M1

$= 1300 - 1200\text{Cos}60^0\text{km}$

BE = 1300 – 600

$\sqrt{700}$

= 26.46km A1

$\frac{\text{Sin}132.9^0}{BC} = \frac{\text{Sin}30^0}{45}$

$BC = \frac{45\text{Sin}132.9\text{km}}{\text{Sin } 30}$

$= \frac{0.5753}{0.5}$

= 1.15

= 1.2km

$\frac{\text{Sin}B}{20} = \frac{\text{Sin}60^0}{26.46}$ M1

$\text{Sin}B = \frac{20\text{Sin}60^0}{26 \times 6}$

$= \frac{17.32}{26.46}$

Sin 0.6546

$<ABE = 40.9^0$ A1

b) Area of the sanctuary M1 M1

$½ \times 30 \times 20 \text{ Sin}60^0 + ½ \times 1.2 \times 45\text{Sin}17.0$

= 259.8076 + 7.9391

$= 267.75\text{km}^2$ A1

10

22

Radius 3.5cm B1

$\text{Area} = \pi r^2 = {}^{22}/_{7} \times 3.5^2$ M1

$= 38.49\text{cm}^2$ A1

23

a) One side of the regular polygon

$(7 \text{ Sin } 36^0) \times 2$ B1M1

= 8.229cm

Perimeter of the base

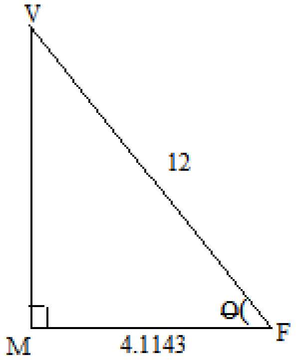
8.229 x 5cn

= 41.14cm A1

b) $VO = \sqrt{12^2 - 7^2}$

= 9.75cm B1

c) <between the edge VF and FE



	$\text{Cos}\Theta = \frac{4.1145}{12}$ M1 Cos^{-1} 0.3429 M1 = 20.05^0 A1 d) Volume of the pyramid $^1/_3$ x Base area x 9.75cm^3 Base area $(^1/_3$ x 7 x 7 x Sin720 x 5$)^6$ M1 Volume = $(^1/_3$ x 49 x Sin720 x 5) x 9.75cm^3 = 757.28cm^3 A1 10	24	24. Y – intercept, mb X = 0 = 5 B1 b) $y = 2x^3 + 3x2 - 12x + 5$ $^{dy}/_{dx} = 6x^2 + 6x - 12$ M1 Put $^{dy}/_{dx} = 0$ for stationary points $6x^2 + 6x - 12 = 0$ M1 $x^2 + 2x - 2 = 0$ $x^2 - 2x - x - 2 = 0$ $x(x + 2) - x(x + 2) =$ $(x - 1)(x + 2) = 0$ M1 x = 1 or -2 x = 1 y = -2 (1, -2) A1 x = -2 y = 25 (-2, 25) $\frac{d^2y}{dx^2} = 12x + 6$ When x = -1 Value = 18 When x = -2 Value = -18 Max m value at (-2, 25) B1 Min m value (1, -2) B1 10

KIRINYAGA WEST EFFECTIVE “40” EXAM
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
July /August 2015
2 ½ HOURS

1
Maximum possible weight of A – 10.55m
Minimum possible length of B – 8.15m B1
For both seen
10.55 – 8.15 M1
= 2.4m A1

2.
a) 5, 6, 9, 11, 13, 15 B1
b) $^{40}/_{2}$ (2 x 5 + (40 – 1)2) M1
= 1760 A1

3
a) Angle PQS = 60^0 B1
Reflex angle POS = 240^0 B1
b) 40^0 B1

4
$P = \frac{KQ}{R^2}$
$2 = \frac{K \times 12}{6^2}$ M1
K = 6
$P = \frac{6Q}{R^2}$ B1

5

Marks	Frequency	Cumulative frequency
21 – 30	2	2
31 – 40	4	6
41 – 50	11	17 – Median Class
51 – 60	5	22
61 – 70	3	25

$^{25}/_{5}$ = 12.5
$40.5 + \frac{12.5 - 6}{11} \times 10$ M1
= 46.4 A1

6
3y = 6Sin(2x – 30)
y = 2Sin (2x – 30) M1
Amplitude = 2 Period = 180^0, or P A1
for both

7.
Area scale factor = 6 B1
4x – 2(x – 1) = 6 M1
x = 2 A1

8.
$16384 - 28672x + 21540x^2 - 8960x^3 + 2240x^4$ B1
$16384 - 28672(0.2) + 21504(0.2)^2 - 8960(0.2)^3$
$+ 2240 (0.2)^4$ M1
= 11441.664 A1
A word for 114411
or 11440
or 11441.7
or 11441.66

9
$\text{Log}_2(2^2 - 9) = 2\log_2 2 + \log_2 2$ M1 for $\log^2 2$
$(x^2 - 9) = 23 \times 2$ M1
$x^2 = 25$ M1
x = +5 A1 for both

10
Length AC = $\sqrt{200} = 10\sqrt{2cm}$
Halt AC = $5\sqrt{2}$ M1
Tan x = $\frac{15}{5\sqrt{2}}$ M1
x = 76.7^0 A1

11
y = 2x – 3
$x(2x - 3) - (2x - 3)^2 = 0$ M1
(3 – x) (2x – 3) = 0 A1
x = 3 or $1^1/_2$ A1
When x = 3 when x = $1^1/_2$ B1 for the two pairs
y = 3 y = 0

12
$2800000(1 - {}^r/_{100})^3 = 1500000$ M1
1 – $^r/_{100}$ = 0.8122 M1
r = 18.8% A1

13
$^{\theta}/_{360} \times 2 \times {}^{22}/_{7} \times 637^0 \times \text{Cos}40$
= 10,000 M1
$O = 117.4^0$ A1
Q(40^0N, 67.4^0W) B1

14
$2\begin{pmatrix}2\\-3\\5\end{pmatrix} + \begin{pmatrix}0\\3\\7\end{pmatrix}$ M1
$\sqrt{4^2 + (-3)^2 + 17^2}$ M1
= 17.72 A1

15

$y = \frac{x^4}{4} - 4x + c$ M1

$3 = \frac{2^4}{4} - 4 \times 2 + c$ M1

$y = {}^1/_4x^4 - 4x + 7$ A1

16

$\frac{16 - 46}{12 - 4}$ M1 – for sub-fraction

M1 for dividing

$7^1/_2$ m/s^2 A1 No minus sign

17

a) A : B : C
1 : 2
4 : 5
A : B : C = 2 : 4 : 5 M1A1

b) 2 : 4 : 5 M1
60 : 75
75 bags of C A1

c) i) $\frac{7500 \times 2 + 5000 \times 4 + 4000 \times 5}{11}$ M1
= Ksh. 5 000 A1

ii) $\frac{6500 - 5000}{5000} \times 100\%$ M1
= 30% A1

18

a) i) 13 – 5 M1
$PQ^2 = \sqrt{25^2 - 7^2}$ M1
= 24cm A1

ii) Cos<BAP = $^7/_{25}$ M1
= 0.28 A1
= 73.74^0 B1

Length PUT = $\frac{212.52}{360} \times 2 \times 3.142 \times 13 = 48.23$ M1
Length SRQ = $\frac{147.48}{360} \times 3 \times 3.142 \times 6 = 23.17$ M1
48.23 + 23.17 + 48 M1
= 119.4cm A1

19

i) 55,480 + 12,000 + 8,000 = 75,480 M1A1

Monthly income in Kenya shillings (Ksh)	Tax rate in each shilling
0 – 10164	1016.40
10165 – 19740	1436.40
19471 – 29316	1915.20
29317 – 38892	2394.40
38893 – 75480	10976.40
	17738.40
	1162.00
	16576.40

b) Total deductions
16576.40 +1109.60 +10,000 + 2,000 M1
= 29686
75480 – 29686
= 45,794 A1

20

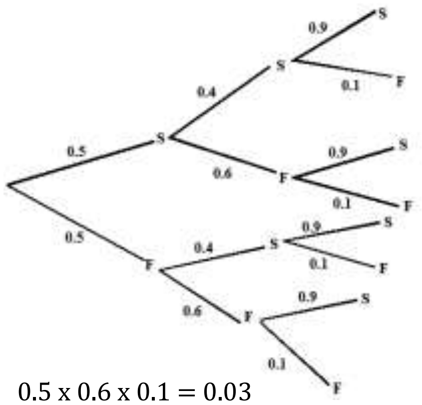
a) $x + y \geq 250$ B1
$60x + 80y \leq 24,000$ B1
$x > y$ B1
$x < 200$ B'1

b)- Linear scale and accommodating all values S1
- 60x + 80y = 24,000 – drawn a correctly shaded B1
x + y = 250 correctly drawn and shaded B1
Both x = y and x = 200 correctly drawn and shaded. B1

c) $200x + 250y = P$
$200x + 250y = 10,000$
198 chicks B1
134 ducks
Kshs. 73,100 B1

21

a)



0.5 x 0.6 x 0.1 = 0.03

b) 0.5 x 0.6 x 0.1 + 0.5 x 0.4 x 0.1 + 0.5 x 0.6 x 0.9 M1
= 0.32 A1

c) 0.03 + 0.32 M1M1
= 0.35 A1

d) 1 – 0.03 M1M1
= 0.97 A1

22

a) i) $\underset{\sim}{PQ} = \underset{\sim}{q} - \underset{\sim}{p}$ B1

ii) $\underset{\sim}{ON} = {}^1/_3\underset{\sim}{p} + {}^2/_3\underset{\sim}{q}$ M1A1

iii) $\underset{\sim}{PT} = -\underset{\sim}{p} + {}^3/_5({}^2/_3\underset{\sim}{q} + {}^1/_3\underset{\sim}{p})$ M1
$= {}^1/_2\underset{\sim}{q} - \underset{\sim}{p}$

$= {}^2/_5\underset{\sim}{q} - {}^4/_5\underset{\sim}{p}$ A1

iv) $\underset{\sim}{PM} = -\underset{\sim}{p} + {}^{1}/_{2}\underset{\sim}{q}$ M1A1

b) $k({}^{2}/_{5}\underset{\sim}{q} - {}^{4}/_{5}\underset{\sim}{p}) = -\underset{\sim}{p} + {}^{1}/_{2}\underset{\sim}{q}$

$k = {}^{5}/_{4}$

$\underset{\sim}{PM} = {}^{5}/_{4}\underset{\sim}{p}$ B1

$\underset{\sim}{PM}$ // $\underset{\sim}{PT}$ B1

P is common B1

hence P, T and M are collinear

23

a) B1 – For 30^0

B1 – For locating C

B1 – Completing ABC

b) 7.0 + 0.1cm B1

c) B1 for 30^0 at B and B1 30^0 for 30^0 at C. B1 – for the locus

d) AD = 2.0 + 0.1cm B1

B1 – For compass marks at BC

B1 – For the perpendicular

24

X	1	2	3	4	5
y	7	13	23	37	55
x^2	1	4	9	16	25

B2 For all values correct

B1 For at least 3 correct

c) b – Y – intercept = 5 B1

(1, 7) , (25, 55) B1

For

identifying any two points

$a = \frac{55 - 7}{25 - 1}$ M1

= 2 A1

d) $Y = 2x^2 + 5$ B1

WESTLANDS DISTRICT JOINT EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
July /August 2015
2 ½ HOURS

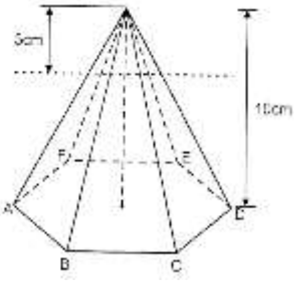
1. Evaluate without using a calculator

$$\frac{\left(-\frac{1}{2}\right)\div\left(-\frac{2}{3}\right) of\ 8-\left(-4\frac{1}{2}\right)}{\frac{3}{4}-\left(2\frac{3}{4}\right)\div\frac{11}{8}}$$ (4 marks)

2. Use tables of squares, square root and reciprocals to evaluate to 3 decimal places the question below.
$\frac{10}{\sqrt{0.625}} + (1.64)^2$ (4 marks)
3. Simplify the expression: (3 marks)
$$\frac{32x^2 - 18y^2}{4x^2 - xy - 3y^2}$$
4. The area of a rhombus is 120 cm^2. Given that one of its diagonals is 24cm, calculate the perimeter of the rhombus. (3 marks)
5. Given that 8^{4y} x 27^x = 36, find the exact values of x and y. (3 marks)
6. Three bells ring at intervals of 18 minutes, 30 minutes and 42 minutes .the bells will next ring together at 10.00am. Find the time the bells last rang together. (3 marks)
7. A truck left Nairobi at 7a.m for Nakuru at an average speed of 60km/hr. At 8 a.m a bus left Nakuru for Nairobi at an average speed of 120km/hr. How far from Nairobi did the vehicles meet if Nairobi is 160 km from Nakuru. (3 marks)
8. Using a ruler and a pair of compasses only, draw a line AB = 7cm long. Construct < BAC = 67.5^0. Use line AC to divide AB into 3 equal parts. (2 marks)
9. Given the vectors $\underset{\sim}{a}\begin{pmatrix}3\\-2\end{pmatrix}$, $\underset{\sim}{b} = \begin{pmatrix}-1\\2\end{pmatrix}$ and $\underset{\sim}{c} = \begin{pmatrix}-4\\2\end{pmatrix}$ find $\left|3\underset{\sim}{a} - 4\underset{\sim}{b} + \frac{1}{2}\underset{\sim}{c}\right|$ giving your answer to 4 significant figures. (3 marks)
10. Given that sin $\Theta = \frac{12}{13}$, find without using mathematical tables or a calculator tan $(90 - \Theta)^0$ (2 marks)
11. Given that p = $\begin{pmatrix}4 & -2\\3 & 0\end{pmatrix}$, Q = $\begin{pmatrix}1 & 5\\-2 & 3\end{pmatrix}$ and R = 2PQ – P^2. Determine matrix R. (3 marks)
12. Without using mathematical tables or a calculator, solve the equation. (3 marks)
$2\log_{10}y - 3\log_{10}2 + \log_{10}32 = \log_2 4$
13. The line 2y – 4x -5 = 0 meets another line L at appoint where y = 4.5. Find the equation of L in the form y = mc+c if the lines are perpendicular to each other. (4 marks)
14. A Kenyan bank buys and sells foreign currencies at the exchange rates shown below.

currency	Buying (ksh)	Selling (ksh)
1 Euro	147.56	148.00
1 US dollar	94.22	94.50

A tourist arrived in Kenya with 11,155 Euros. He converted all the Euros to Kenya shillings at the bank. He spent ksh. 1,130,200.50 while in Kenya and converted the remaining Kenya shillings into US dollars at the bank. Find the amount in dollars that he received correct to 2 decimal places. (4 marks)
15. The figure below represents a solid regular hexagon based pyramid of side 4cm and height 10 cm. It is cut along a plane 3 cm from the vertex. Calculate the volume of the remaining part. (4 marks)

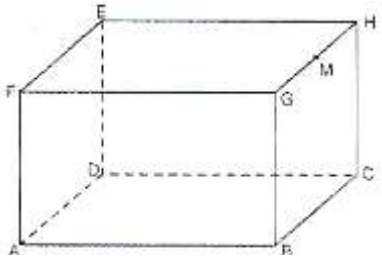


16. A two digit number is such that the sum of the digits is 11. When the digits are reversed, the new number exceeds the original number by 9. Calculate the original number. (3marks)
17. Patients who attended pumwani clinic in one week were grouped by age as shown in the table below.

Age x years	$5\leq x < 10$	$10\leq x < 20$	$20\leq x < 30$	$30\leq x < 50$	$50\leq x < 80$
Number of patients	14	41	59	70	15

a) Estimate the mean age. (3marks)
b) Estimate the median age. (3 marks)
c) On the grid provided, draw a histogram to represent the distribution:
Using the scales: 1 cm to represent 5 units on the horizontal axis
1 cm to represent 1 units on the vertical axis (4marks)

18. The figure below represents a solid cuboid ABCDEFGH with a rectangular base. AC = 13 cm, BC = 5 cm and CH = 15 cm. M is the midpoint of GH.



a) Calculate the surface area of the cuboid (3marks)
b) Calculate the angle between line AH and the base ABCD. (2marks)
c) Calculate the angle between the base ABCD and the plane ADM (2 marks)
d) Calculate the angle between line AC and MF (3 marks)

19. i) It would take Alex working alone 30 days, Bernard 40 days and Charles 60 days to complete a task. All three start working together but after five days, Alex falls sick and cannot continue. Determine how many more days it will take Bernard and Charles to complete the task. (4 marks)
ii) A dealer has three grades of coffee, A, B and C. Grade A costs sh. 140 per kg., grade B costs sh.16 per kg and grade C cost sh. 256 per kg.
a) The dealer mixes grade A and B in the ratio 5:3 to make a brand of coffee which he sells at sh. 180 per kg. Calculate the percentage profit he makes. (3 marks)
b) The dealer maker a new brand by mixing the three grades of coffee in three in the ratio A: B = 5:3 and B: C = 2:5. Determine the selling price of the new brand if he has to make a 30% profit. (3 marks)

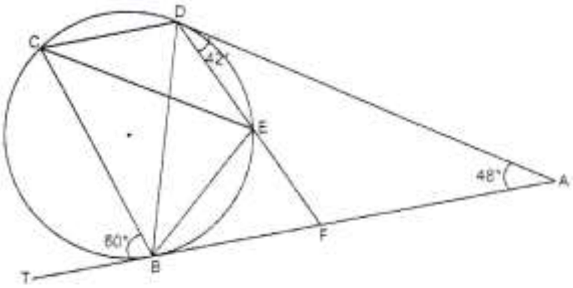
20. A hotel planned to buy sacks of charcoal for a total of sh. 30,000. Before the hotel could buy the charcoal, the price per sack was reduced by sh. 100. This reduction in price enabled the hotel to buy 10 more sacks of charcoal.
a) Determine the number of sacks that the hotel bought. (5 marks)
b) Calculate the percentage change in price (3 marks)
c) If the charcoal dealer makes sh. 50 per bag as commission, calculate the total commission. (2marks)

21. The velocity of a particle moving in a straight line after t seconds is given by $V = 2t^2 - t - 6m/s$. calculate
a) the acceleration of particle after 2 seconds (2marks)
b) the distance covered during the third second. (3marks)
c) the time when the particle will be momentarily at rest. (2marks)
d) the minimum velocity attained. (3 marks)

22. A triangular plot PQR is such that PQ = 72m, QR = 80m and PR = 84m
a) calculate.
i) the area of the plot in square metres (3 marks)
ii) the largest angle in the triangle (2 marks)
iii) The perpendicular height from P to the side QR (3 marks)
b) A water tap is to be installed inside the plot such that the tap is equidistant from each of the vertices P, Q and R. Calculate the distance of the tap from the vertex P (2 marks)

23. A pole stands directly across the street from a building. The angle of depression of the top of the building from the top of the pole is 24.5^0 and the angle of elevation of the top of the pole from the foot of the building is 48.6^0. Given that the distance between the pole and the building is 50 m, calculate to 2 decimal places.
a) the height of the pole (4 marks)
b) the difference in height between the pole and the building. (2 marks)
c) the height of the building. (2 marks)
d) the angle of elevation of the top of the building from the top of the pole. (2 marks)

24. In the figure below, AT and AD are tangents to the circle at B and D respectively. DEF is a straight line, $< CBT = 60^0$, $<$ FAD $= 48^0$ and $<$ ADF $= 42^0$



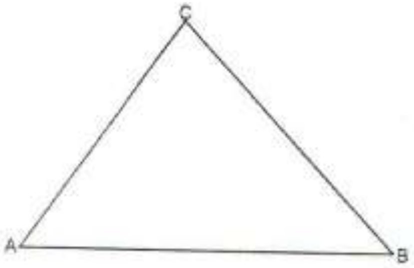
Calculate giving reasons, the value of:

a) < DCE (2 marks)
b) <BCE (2 marks)
c) <DCB (2 marks)
d) <DEC (2 marks)
e) <BEF (2 marks)

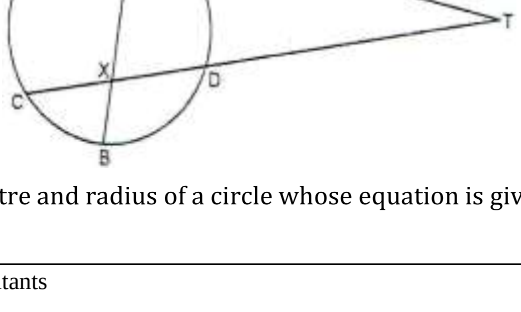
WESTLANDS DISTRICT JOINT EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
July /August 2015
2 ½ HOURS

1. Use logarithm tables to evaluate:
$\sqrt[5]{\frac{(0.6873)^2\ x\ 438.7}{396.8}}$ (4 marks)
2. Make x the subject of the formula (3 marks)
$h = \sqrt{\frac{x^2 - t^2}{4 + t^2x^2}}$
3. A point divides line PQ in the ratio 3: -2. Given that $P = 2\underset{\sim}{i} - 3\underset{\sim}{j} + \underset{\sim}{k}$ and $Q = 3\underset{\sim}{i} - 4\underset{\sim}{j} - 3\underset{\sim}{k}$ find the coordinates of T. (3marks)
4. In the triangle below, a point R moves such that the area of Δ ACB = area of Δ ARB and < ARB = 30^0. Using a ruler and a pair of compasses only, locate the possible position of R on the same side as C and find the distance between them.



5. Solve for x in the equation. Sin $(2x - 10)^0 = -0.5$ for $0^0 \leq x \leq 360^0$ (4 marks)
6. Find the interquartile range of the data below: (3 marks)
2,4,6,8,10,5,6,9,4,6
7. A sum of sh. 50,000 is invested in a financial institution that gives 12% p.a. Find the total investment after 3 years if the interest is compounded quarterly. Give your answer to the nearest 100. (2 marks)
8. Solve for x and y given that.
$\begin{pmatrix} x & y \\ 1 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 26 \\ 4 \end{pmatrix}$ (3marks)
9. Simplify $\frac{7}{3 - \sqrt{11}}$ (2 marks)
10. The base and the height of a right angled triangle were measured as 4.34 cm and 8.25 cm respectively. Calculate the percentage error in the area of the triangle. (3 marks)
11. a) Expand $(1 - 2x)^6$ upto to the fourth term.
b) Use the expansion in (a) above to find the value of $(0.98)^6$ correct to 4 significant figures. (3 marks)
12. In the figure below, AT is a tangent to the circle at A. AB and CD intersect at X. Give that BX = 4 cm, CX = 6cm, CD = 12 cm and AT = 8cm , calculate:
a) the legth of AX
b) the length of secant CT.

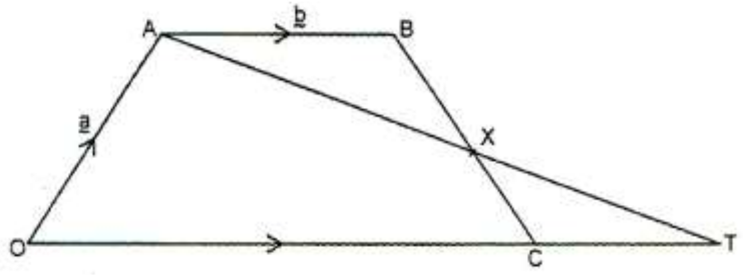


13. Determine the centre and radius of a circle whose equation is given by $2x^2 + 2y^2 - 8x + 4y + 2 = 0$ (3 marks)

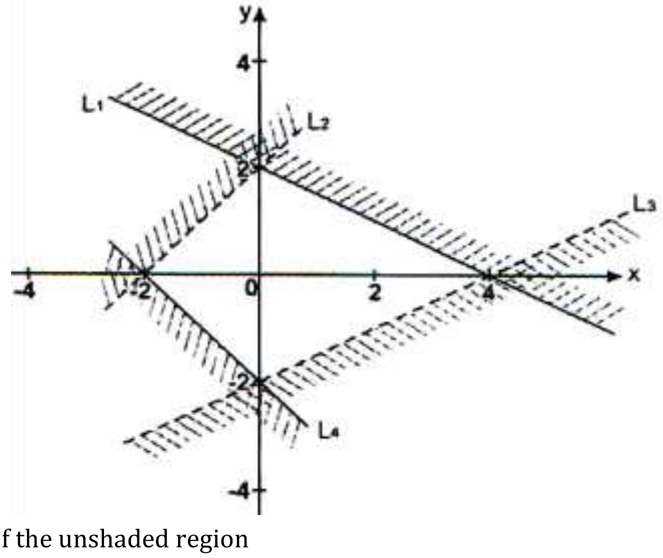
14. The quantities P and Q are such that P varies partly as Q and partly as the square of Q. When q = 60 and when Q = 3, P = 105.
    a) Write the equation connecting P and Q.
    b) Find the value of P when Q = 5 (4 marks)
15. Find the equation of the normal to the curve $y = 3x^2 - 8x+5$ at the point where x = 2 in the form ax + by = c (3 marks)
16. A business woman deposits sh. 4,000 in a bank at the beginning of every year which earns compound interest of 12% p.a. Calculate the total amount that she accumulates at the end of the sixth year to the nearest cent. (2 marks)

SECTION II 50 MARKS

17. The probability of Owino going to school by tuktuk is ¼ while that of going by boda boda is 2/5 .If he travels by tuktuk, the probability of arriving in school late is 1/7 whereas that of the boda boda is 1/3. If he uses other means , the probability of him getting to school late is 1/10
    a) Draw a tree diagram to represent the above information. (2 marks)
    b) Calculate the probability that:
    i) He is late for school. (3mark)
    ii) He is not late for school (2 marks)
    iii) He is late for school if he does not use boda boda. (3 marks)
18. OABC is a trapezium in which OA = a and AB = $\underset{\sim}{b}$. AB is parallel to OC with 2$\underset{\sim}{AB}$ = $\underset{\sim}{OC}$. T is a point on OC produced so that $\underset{\sim}{OC}$: $\underset{\sim}{CT}$ = 2:1. AT and BC intersect at X. So that $\underset{\sim}{BX}$ = h$\underset{\sim}{BC}$ and $\underset{\sim}{AX}$ = k$\underset{\sim}{AT}$



    a) Express the following in terms a and b.
    i) $\underset{\sim}{OB}$
    ii) $\underset{\sim}{BC}$ (2 marks)
    b) Express $\underset{\sim}{CX}$ in terms of a, b, and h. (2 marks)
    c) Express $\underset{\sim}{CX}$ in terms of a, b, and k. (2 marks)
    d) Hence calculate the values of h and k (4 marks)
19. a.) Determine the inequalities that define the unshaded region below (8 marks)



    b) calculate the area of the unshaded region (2marks)

20. a) A triangle ABC has vertices A (1, 4), B (-2, 0), and C (4,-2). On the grid provided, draw ABC. (1 mark)

b) $A^1B^1B^1$ is the image of ABC after transformation N=$\begin{pmatrix}3 & 1\\4 & 0\end{pmatrix}$. Draw $A^1B^1C^1$ on the same grid. (2 marks)

c) $A^{11}B^{11}C^{11}$ is the image of $A^1B^1C^1$ after transformation M =$\begin{pmatrix}2 & -2\\1 & 0\end{pmatrix}$. Draw $A^{11}B^{11}C^{11}$ and find its coordinates

d) N followed by M is represented by matrix K. Determine K. (2 marks)

e) If an object of area 4 cm^2 is transformed using matrix K. find the area of the image. (2 marks)

21. a) Complete the table below giving all values to 2 decimal places for the functions y= cos x^0 and y = 2 cos (x +30)^0

x^0	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0
Cos x^0					-0.50					
2cos (x+30)^0	1.73									

b) For the function y = 2cos(x + 30)^0, state.

i) the period (1 mark)

ii) the phase angle (1 mark)

c) on the same set of axes, draw the waves of the function y = cos x^o and y =2 cos (x+30)^0 for $0^0 \leq x \leq 540^0$. Using the scale 1cm to represent 30^0 horizontally and 2 cm to represent 1 unit vertically. (3 marks)

d) Use your graph in (c) above to solve the inequality 2 cos (x +30)^0 ≤ cos x^o (1mark)

e) Find the transformation that maps y = cos x^0 onto y = 2 cos (x + 30)^0 (2 marks)

22. The frequency distribution of marks 80 students is given in the table below.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Frequency	1	6	10	20	15	5	14	5	3	1

a) Using 45.5 as assumed mean calculate the standard deviation of the data. (5 marks)

b) On the grid provided, represent the data on an ogive and use it to find:

i) The median mark (1 mark)

ii) The pass marks if 60% of the students are to pass. (1 mark)

23. The position of two satellite station A and B on the earth's surface are (36^0N, 50^0E) and (36^0n, 130^0W) respectively . (use π = 3.142 and R = 6400KM)

a) Find the distance along the small circle in km. (2 marks)

b) Find the shortest distance between A and B IN nm (3 marks)

c) If time A is 1700hrs, calculate the time at B in 12 hrs system. (5 marks)

24. Otieno bought a second hand car and later sold it through a sales agent who charges 7 ½ % commissions on the price of the car. He received sh. 222,000 from the agent after the tatter had deducted his commission .Otieno incurred a loss of 25% on the price at which he had bought the car.

a) Calculate the price at which the agent sold the car. (3 marks)

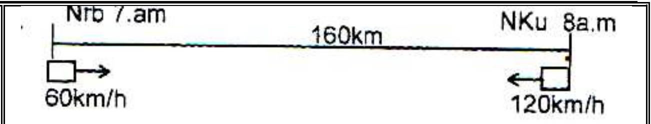
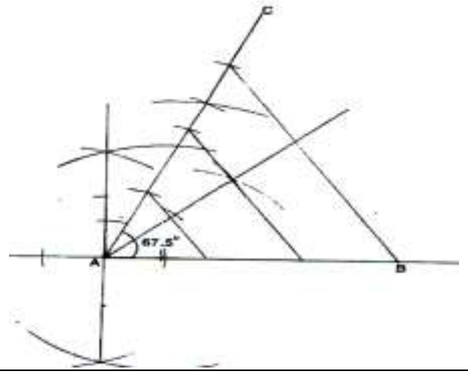
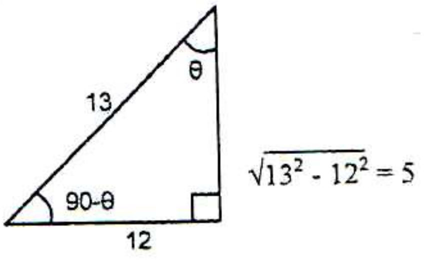
b) Find the price at which Otieno had bought the car (2 marks)

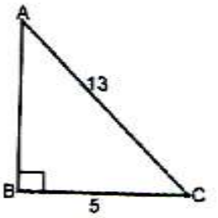
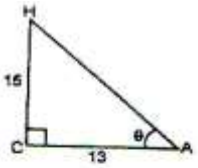
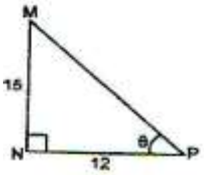
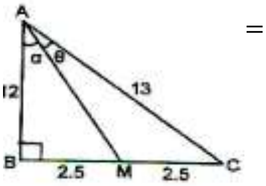
c) If the amount otieno paid for the car was 26% less than the price of the new car, calculate the price of the new car to the nearest cent.

d) Express as a percentage the amount Otieno received for his car to its price when new. (2 marks)

WESTLANDS DISTRICT JOINT EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/1
MATHEMATICS
PAPER 1
July /August 2015
2 ½ HOURS

1	$\frac{-\frac{1}{2}\div\left(-\frac{2}{3}x8\right)+\frac{9}{2}}{\frac{3}{4}-(\frac{11}{4}x\frac{8}{11})}$ $\frac{-\frac{1}{2}x-\frac{3}{6}+\frac{9}{2}}{\frac{3}{4}-\frac{8}{4}}$ $\frac{\frac{3}{32}+\frac{44}{32}}{-\frac{5}{4}}$ $\frac{147}{32}x-\frac{4}{5}$ $-\frac{147}{40}=-3\frac{27}{40}$
2	$\frac{10}{\sqrt{62.5}x10^{-2}}+2.690$ $\frac{10}{7.9057+10^{-1}}+2.690$ $0.1265 \text{ x } 10 \text{ x } 10+2.690$ $12.65+2.690$ 15.34
3	$\frac{2[(4x)^2-(3y)^2p}{4x^2-4xy+3xy-3y^2}$ $\frac{2(4x-3y)(4x+3y)}{4x(x-y)+3y(x-y)}$ $\frac{2(4x-3y)(4x+3y)}{(4x+3y)(x-y)}$ $\frac{2(4x-3y)}{x-y}$
4	Area of rhombus $=\frac{1}{2}$ product of diagonals $\frac{120}{12}=\frac{1}{2}x$ 24 x x 2nd diagonal x $x=10$ y $=\sqrt{5^2+122}=13$cm Perimeter = 13 x 4 = 52cm²
5	$(2^3)^{4y}$ x $(3^3)^x=3^2$ x 2^2 2^{12y} x $3^{3x}=3^2$ x 2^2 $2^{12y}=2^2$ $\frac{3x}{3}=\frac{2}{3}$ $\frac{12y}{12}=\frac{2}{12}$ $y=\frac{1}{6}, x=\frac{2}{3}$
6	$18=2$ x 3^2 $30=2$ x 3 x 5 $42=2$ x 3 x 7 LCM = 2 x 3^2 x 5 x 7 = 630 $\frac{630}{60}=10$ hrs 30 min 10.00 -<u>10.30</u> 23.30 -12.00 11.30 p.m previous day
7	 Truck = 60 x 1 = 60km Resolved distance = 160 – 60 = 100km Relative speed = 120 + 60 = 180km Meeting time takes = $\frac{100}{180}=\frac{5}{9}$ hrs Distance = $11\frac{5}{9}$ x 60 = 93.33 km
8	
9	$3\begin{pmatrix}3\\-2\end{pmatrix}-4\begin{pmatrix}-1\\2\end{pmatrix}+\frac{1}{2}\begin{pmatrix}-4\\2\end{pmatrix}$ $\begin{pmatrix}9 & +4 & -2\\-6 & -8 & +1\end{pmatrix}=\begin{pmatrix}11\\-13\end{pmatrix}$ Magnitude $=\sqrt{11^2+13^2}$ $=\sqrt{121+169}$ $=17.0294$ $=17.03$
10	 $\sqrt{13^2-12^2}=5$ Sin θ $=\frac{12}{13}=\frac{O}{H}$ Tan (90 - θ) $=\frac{O}{A}$ $=\frac{5}{12}$

11	R = $2\begin{pmatrix}4 & -2\\ 3 & 0\end{pmatrix}\begin{pmatrix}1 & 5\\ -2 & 3\end{pmatrix}$-$\begin{pmatrix}4 & -2\\ 3 & 0\end{pmatrix}\begin{pmatrix}4 & -2\\ 3 & 0\end{pmatrix}$ = $2\begin{pmatrix}8 & 14\\ 3 & 15\end{pmatrix}$-$\begin{pmatrix}10 & -8\\ 12 & -6\end{pmatrix}$ = $\begin{pmatrix}16 & 28\\ 6 & 30\end{pmatrix}$- $\begin{pmatrix}10 & -8\\ 12 & -6\end{pmatrix}$ = $\begin{pmatrix}6 & 36\\ -6 & 36\end{pmatrix}$
12	2Log y = 3 Log + Log 23 = $Log_2 2^2$ Log10 $\frac{y^2\ x\ 32}{8} = 0$ $\frac{4y^2}{4} = \frac{10^2}{4}$ $\sqrt{y^2} = \sqrt{25}$ y = ± 5
13	2 (4.5) – 4x – 5 = $\frac{4x}{4} = \frac{9-5}{4}$ x = 1 Point of intersection (1, 4.5) $\frac{2y}{2} = \frac{4x}{2} + \frac{5}{2}$ $M_1 = 2$ $M_2 = -\frac{1}{2}$ (1, 4.5)M = $-\frac{1}{2}(x, y)$ $\frac{y-4.5}{x-1} = -\frac{1}{2}$ 2y – 9 = 1 – x 2y = - x + 10 y = $-\frac{1}{2}x + 5$
14	Convert to KSh. = 11155 x 147.56 = 1,646,031.8 Spent 1,130,200.5 Balance 515,831.30 Convert to dollars $\frac{515{,}831.30}{94.50}$ = 5,458.53
15	Volume of larger pyramid = $\frac{1}{3}$ x $\frac{1}{2}\ x\ 4\ x\ 4\ x \sin 60\ x\ 6\ x\ 10 = 138.564$ Ar x $\frac{x}{4}$ = 3 x 4 x = 1.2 Volume of smaller pyramid = $\frac{1}{3}\ x\ 1.2\ x\ 1.2\ x \sin 60\ x\ 6\ x\ 3$ = 3.7413 Volume of frustum = 138.564 – 3.7413 = 134.8227cm^3
16	Let the number be xy x + y = 11 …………. (i) (10y + x) – (10x + y) = 9 9y – 9x = 9 x + (x + 1) = 11 y = 5 + 1 2x = 10 y = 6 x = 5 The original no. 56
17	
18	(a)  AB = $\sqrt{13^2 - 5^2}$ = 12cm S.A = 2(15 x 5) + 2(12 x 5) + 2(15 x 12) = 2 x 75 + 2 x 60 + 2 x 180 = 630cm  θ = $\tan^{-1}\left(\frac{15}{13}\right)$ = 49.0856  θ = tan-1$\left(\frac{15}{12}\right)$ = 51.3402  (α + θ) = tan-1$\left(\frac{5}{12}\right)$ = 22.6199 α = tan-1$\left(\frac{2.5}{1.2}\right)$ = 11.7683 θ = MAC = 10.8516^0
19	1. 1 day = $\frac{1}{30} + \frac{1}{40} + \frac{1}{60} = \frac{4+3+2}{120} = \frac{9}{120} = \frac{3}{40}$ 5 days = $\frac{3}{40} x\ 5 = \frac{3th}{8}\ done$ Bernard + day = $\frac{1}{40} + \frac{1}{60} = \frac{3+2}{120} = \frac{5}{120} = \frac{1}{24}$ Charles $\frac{1^{th}}{24}$ takes 1 $\frac{5^{th}}{8} = \frac{5}{8}\ x\ 1\ x\ 24$ = 15 days (ii) A B C 140 160 256 x 5 x 3 700 480 (a) 1kg = $\frac{700\ x\ 480}{5+3}$ = 147.5 % profit = $\left(\frac{180-147.5}{147.5}\right)$100% = 22.0339% (b) A : B: C 5 3 5 2 5 10 : 6 : 5 1kg = $\frac{140\ x\ 10+6\ x\ 160+15\ x\ 256}{10+6+5}$ = 200 160% = $\frac{130}{100}$ x 200 = KSh. 260

20

(a) Let the original no. of sacks be x

Original price per sack = $\frac{30000}{x}$

New price = $\frac{3000}{x+10}$

$\frac{30000}{x+10} = \frac{30000}{x} - 100$

$x^2 + x - 3000 = 0$

$(x + 60)(x-50) = 0$

x = -60 x = 50

Bags bought = 50 + 10 = 60

(b) BP = $\frac{30000}{60}$ = 500

% a in price = $\frac{100}{500}\ x\ 100\%$

= 20%

(c) Total commission = 60 x 50

= 3000/=

21

(a) V = 2t2 – t – 6

a = $\frac{dv}{dt} = 4t - 1$

a = 4 x 2 – 1

= $7m/s^2$

(b) S = $\int_2^3 (2t^2 - t - 6)$

$= \left[\frac{2}{3}t^3 - \frac{t^2}{2} - \ 6t + c\right]\begin{matrix}3\\2\end{matrix}$

$\left(\frac{2}{3}x3^3\,\frac{3^2}{2} - \ \ 6\ x\ 3\right) - (\frac{2}{3}x2^3 - \frac{2}{2} - \ 6\ x\ 2)$

$(-4.5)—8\frac{2}{3}\ )$

(c) Particle is momentarily at rest v = 0

$2t^2 - t - 6 = 0$

$2t^2 - 4t + 3t - 6 = 0$

2t(t-2) + 3(t – 2) = 0

(2t + 3)(t – 3) = 0

t = $-\frac{3}{2}$ ignore t = 2 seconds

(d) Minimum velocity attained when a = 0

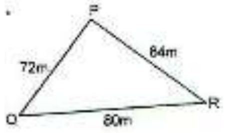
a = $\frac{dv}{dt}$ = 4t – 1 = 0

t = $\frac{1}{4}$

v = $2(\frac{1}{4})^2 - \frac{1}{4} - \ 6$

= $-6\frac{1}{8}m/s$

22



S = $\frac{7+84+80}{2}$

= 118

(e) (i) S = $\sqrt{118(118-72)(118-80)(118-84)}$

= $\sqrt{7012976}$

= $2648.2024cm^2$

(ii) $\frac{1}{2}\ x\ 72\ x\ 80\ Sin\theta\ = 2648.2024$

$\theta = Sin^{-1}\left(\frac{2648.202442}{72\ x\ 80}\right) = 66.8552^0$

(iii) $\frac{1}{2}x\ 80\ x\ h$

40h = 26480.2024

h = $\frac{2648.2024}{40}$

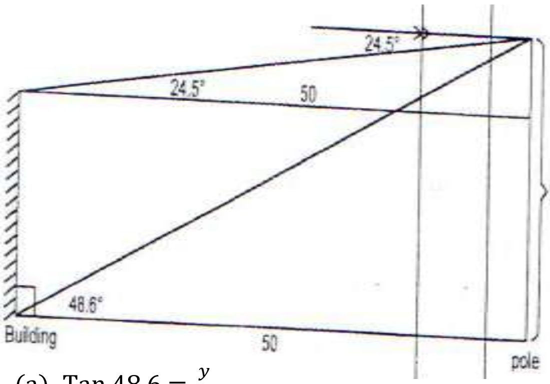
= 66.2051km

$\frac{84}{Sin\ 66.85}$ = 2R

$\frac{84}{0.9195} = 2R$

$R = 45.68m$

23



(a) Tan 48.6 = $\frac{y}{50}$

y = 50 tan 48.6

= 56.7139

≅ 56.71m

(b) x = 50 tan 24.5

= 22.7863

≅ 22.79

(c) Height of building = 56.71 – 22.79

= 33.92

(d) Tan θ = $\frac{33.92}{50}$ = 0.6784

θ = tan-1 0.6784

= 34.15^0

24

(a) DCE = EDF (∠s in alternate segment)

= 42^0

(a) BCE = BDF (∠s in the same segment)

$\frac{180-48}{2} = 42^0$

= 24^0

(b) DCB = DBF (∠s in alternate segment)

DBF = $\frac{180-48}{2}$ (AB =D)

= 66^0

(c) CED = CBD (∠s in the same segment)

CBD = 180 – (60 + 60)(∠s on straight line)

CED = 54^0

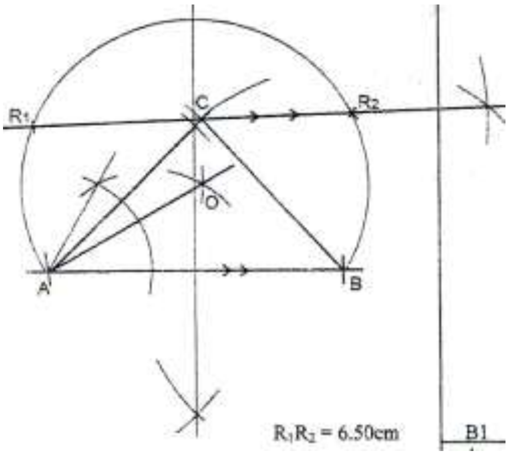
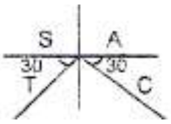
(d) BEF = BCD (ext. angle = opp. interior angle)

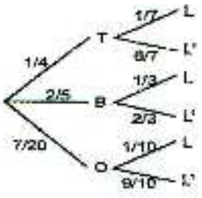
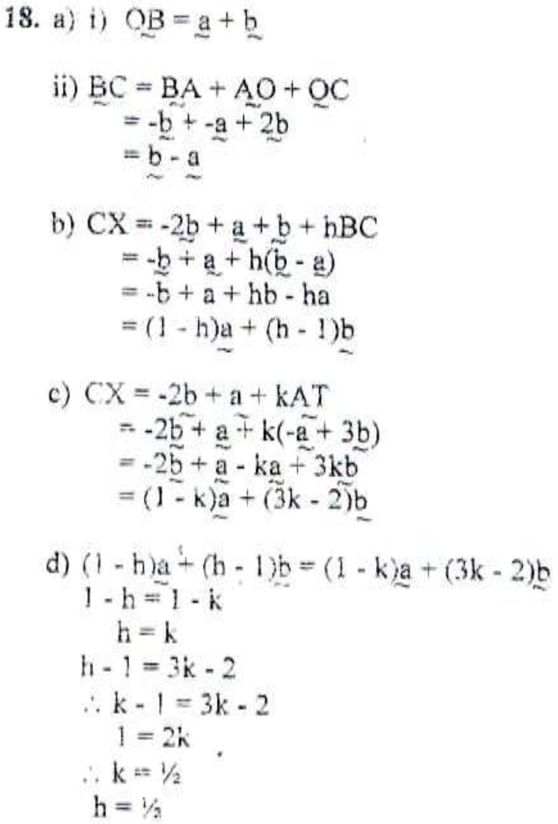
= 24 + 42

= 66^0

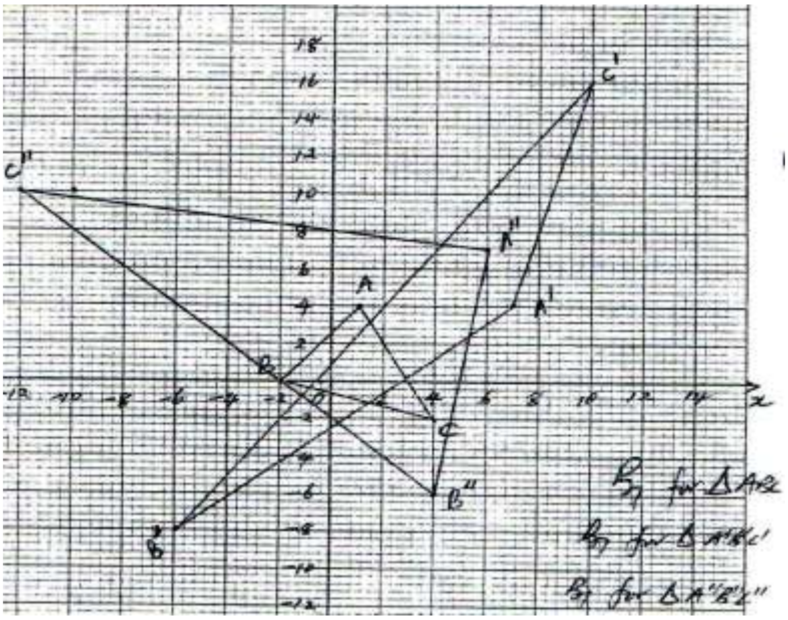
WESTLANDS DISTRICT JOINT EXAMINATION
Kenya Certificate of Secondary Education (K.C.S.E)

121/2
MATHEMATICS
PAPER 2
July /August 2015
2 ½ HOURS

1	No Log 0.6873^2 $\bar{1}.6744$ $\bar{1}.8372$ x 2 438.7 $\underline{2.6422}$ 2.3166 396.8 $\underline{2.5986}$ 1.7180 $\frac{\bar{1}.718}{5}$ 8.782 x 10^{-1} ← $\bar{1}.9436$ $\frac{\bar{5}}{5} + \frac{4.718}{5}$ 0.8782
2	$h^2 = \sqrt{\left(\frac{x^2-t^2}{4+t^2x^2}\right)}^2$ $h^2 = \frac{x^2-t^2}{4+t^2x^2}$ $h^2(4+t^2x^2) = x^2 - t^2$ $4h^2 + h^2t^2x^2 = x^2 - t^2$ $x^2 - h^2t^2x^2 = 4h^2 + t^2$ $\sqrt{x^2}\,\frac{(1-h^2t^2)}{1-h^2t^2} = \sqrt{\left(\frac{4h^2+t^2}{1-h^2t^2}\right)}$ $x = \sqrt{\left(\frac{4h^2+t^2}{1-h^2t^2}\right)}$
3	
4	PT : TQ $\frac{3}{1}$: $-\frac{2}{1}$ OT = 3OQ - 2OP $= 3\begin{pmatrix}3\\-4\\-3\end{pmatrix} - 2\begin{pmatrix}2\\-3\\1\end{pmatrix}$ $= \begin{pmatrix}9 & - & 4\\-12 & + & 6\\-9 & - & 2\end{pmatrix}$ $= \begin{pmatrix}5\\-6\\-11\end{pmatrix}$ T(5,-6,-11)
5	∠acute = $\text{Sin}^{-1}0.5 = 30^0$ 2x – 10 = 210, 330, 570, 690 $\frac{2x}{2} = \underline{220,340,580,700}$ x = $110^0, 170^0, 290^0, 350^0$ 
6	2,4,4,5,6,6,6,8,9,10 1,2,4,5,6,7,8,9,10 $Q_3 = \frac{3}{4}$ X 10 = 7.5th → 8 $Q_1 = \frac{1}{4}$ x 10 = 2.5th → 4 IQR = 8 – 4 = 4
7	$A = 50000\left(1+\frac{12}{100}x\frac{1}{4}\right)^{3x4}$ = 50000 (1.03)12 = 71,288.0443 = 71,300
8.	$\begin{pmatrix}x & y\\1 & -1\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}26\\4\end{pmatrix}$ $x^2 + y^2 = 26$ x –y = 4 ⇒ x = 4 + y $(4+y)^2 + y^2 = 26$ $16 + 8y + 2y^2 = 26$ $\frac{2y2 + 8y - 10}{2} = \frac{0}{2}$ $y^2 + 4y - 5 = 0$ (y + 5) (y – 1) = 0 y = -5 or y = 1 when y = -5 x = 4 + -5 = -1 y = 1 4 + 1 = 5
9	$\frac{7}{(3-\sqrt{11})}$ x $\frac{3+\sqrt{11}}{3+\sqrt{11}}$ $\frac{21+7\sqrt{11}}{9-11}$ $-\frac{21}{2} - \frac{7\sqrt{11}}{2}$ $-10.5 - 3.5\sqrt{11}$
10	Min Actual Max 4.335 4.34 4.345 8.245 8.25 8.255 $\underline{0.5}$ $\underline{0.5}$ $\underline{0.5}$ 17.871 17.9025 17.9340 AE = $\frac{17.934-17.871}{2}$ = 0.0315 % error = $\frac{0.0315}{17.9025}$ x 100% = 0.1759%
11	(a) 1 6 15 20 1 (-2x) $4x^2$ $-8x^3$ = 1- 12x + $60x^3$ – $160x^3$ (b) 1 – 2x = 0.98 2x = 0.02, x = 0.01 = 1 – 12(0.01) + 60(0.01^2) – 160$(0.01)^3$ = 1 – 0.12 + 0.006 – 0.000160 = 0.8858

12	(a) $\frac{4\,x\,AX}{4} = \frac{6(12-6)}{4}$ AX = 9cm (b) (12 + x)x = 64 $x^2 + 12x - 64 = 0$ (x+16) (x-4) = 0 x = 4cm x = -16 ignore DT = 4 + 12 = 16cm
13	$\frac{2x^2 + 2y^2 - 8x + 4y + 2}{2} = \frac{0}{2}$ $(x^2 - 4x + 2^2) + (y^2 + 2y + 1) = -1 + 1 + 4$ $(x-2)^2 + (y+1)^2 = 2^2$ Radius = 2 units Centre (2,-1)
14	$P = aq + bq^2$ (2a + 4b = 60) ÷ 2 (3a + 9b = 105)÷ 3 a + 3b = 35 <u>a + 2b</u> = <u>30</u> b = 5 a = 30 – 2 x 5 = 30 – 10 = 20 (a) P = 20q + 5q2 (b) $P = 20 \times 5 + 5(5^2)$ = 100 + 125= 225
15	$y = 3x^2 - 8x + 5$ $y = 3(2^2) - 8(2) + 5 = 1$, (2,1) $\frac{dy}{dx} = 6x - 8$ $m_1 = 6 \times 2 - 8 = 4$ $\frac{y-1}{x-2} = -\frac{1}{4}$ 4y – 4 = 2 – x $\frac{4y}{4} = -\frac{x}{4} + \frac{6}{4}$ $y = -\frac{1x}{4} + \frac{3}{2} = 4y + x = 6$
16	a = 1.12 x 4000 = 4,480 $r = \left(100 + \frac{12}{100}\right) = 1.12$ $S_6 = \frac{a(r^6-1)}{r-1}$ $= \frac{4480(1.12^6-1)}{1.12-1}$ = 36,356.05
17	 (i) P (late) = $(\frac{1}{4}\ x\,\frac{1}{7}) + (\frac{2}{5}\ x\,\frac{1}{3}) + (\frac{7}{20}\ x\,\frac{1}{10})$ $= \frac{1}{28} + \frac{2}{15} + \frac{7}{200}$ $= \frac{857}{4200}$ or 0.2040 (ii) $P(L^1) = 1 - \frac{857}{4200}$ $= \frac{3343}{4200}$ or 0.7960 (iii) P(TL or OL) = $(\frac{1}{4} x \frac{1}{7}) + (\frac{7}{20} x \frac{1}{10})$ $= \frac{1}{28} + \frac{7}{200} = \frac{99}{1400}$ or 0.07071
18	 18. a) i) $\underset{\sim}{OB} = \underset{\sim}{a} + \underset{\sim}{b}$ ii) $\underset{\sim}{BC} = \underset{\sim}{BA} + \underset{\sim}{AO} + \underset{\sim}{OC}$ $= -\underset{\sim}{b} + -\underset{\sim}{a} + 2\underset{\sim}{b}$ $= \underset{\sim}{b} - \underset{\sim}{a}$ b) $CX = -2\underset{\sim}{b} + \underset{\sim}{a} + \underset{\sim}{b} + hBC$ $= -\underset{\sim}{b} + \underset{\sim}{a} + h(\underset{\sim}{b} - \underset{\sim}{a})$ = -b + a + hb - ha $= (1 - h)\underset{\sim}{a} + (h - 1)\underset{\sim}{b}$ c) CX = -2b + a + kAT $= -2\underset{\sim}{b} + \underset{\sim}{a} + k(-\underset{\sim}{a} + 3\underset{\sim}{b})$ $= -2\underset{\sim}{b} + \underset{\sim}{a} - k\underset{\sim}{a} + 3k\underset{\sim}{b}$ $= (1 - k)\underset{\sim}{a} + (3k - 2)\underset{\sim}{b}$ d) $(1 - h)\underset{\sim}{a} + (h - 1)\underset{\sim}{b} = (1 - k)\underset{\sim}{a} + (3k - 2)\underset{\sim}{b}$ 1 - h = 1 - k h = k h - 1 = 3k - 2 ∴ k - 1 = 3k - 2 1 = 2k ∴ k = ½ h = ⅓
19	(a) L1 (0,2) (4,0) $m = \frac{2-0}{0-4} = -\frac{1}{2}$ ∴ $y = -\frac{1}{2}x + 2$ Hence $y \le -\frac{1}{2}x + 2/2y \le -x + 4$ L2 (0,2) (-2,0) $m = \frac{0- -2}{4-0} = \frac{2}{4} = \frac{1}{2}$ ∴ $y = x + 2$ Hence y < x + 2 L3: (4,0) (0,-2) $m = \frac{0-- 2}{4-0} = \frac{2}{4} = \frac{1}{2}$ ∴ $y = \frac{1}{2}x - \frac{2}{2y} > x - 4$ L4: (-2,0) (0,-2) $m = \frac{0+2}{-2-0} = -1$ ∴ y = -x – 2 Hence y ≥ -2 (c) Area = $(\frac{1}{2} x6\ x\ 2) + (\frac{1}{2} x6\ x\ 2)$

20 **a**



A B C A1 B1 C1

(b) $\begin{pmatrix}3 & 1\\4 & 0\end{pmatrix}\begin{pmatrix}1 & -2 & 4\\4 & 0 & -2\end{pmatrix} = \begin{pmatrix}7 & -6 & 10\\4 & -8 & 16\end{pmatrix}$

A B C A1 B1 C1

(c) $\begin{pmatrix}2 & -2\\1 & 0\end{pmatrix}\begin{pmatrix}1 & -6 & 10\\4 & -8 & 16\end{pmatrix} = \begin{pmatrix}6 & 4 & -12\\4 & -6 & 10\end{pmatrix}$

$\therefore$ $A^{11}(6,7)$ $B^{11}(4,-6)$, $C^{11}(-12,10)$

(d) K = MN

$= \begin{pmatrix}2 & -2\\1 & 0\end{pmatrix}\begin{pmatrix}3 & 1\\4 & 0\end{pmatrix} = \begin{pmatrix}-2 & 2\\3 & 1\end{pmatrix}$

(d) Det k = -2-6=|-8| = 8 = A.s.f

$\frac{area\ of\ triangle}{4}$

.: areas of image = 8 x 4 = 32cm^2

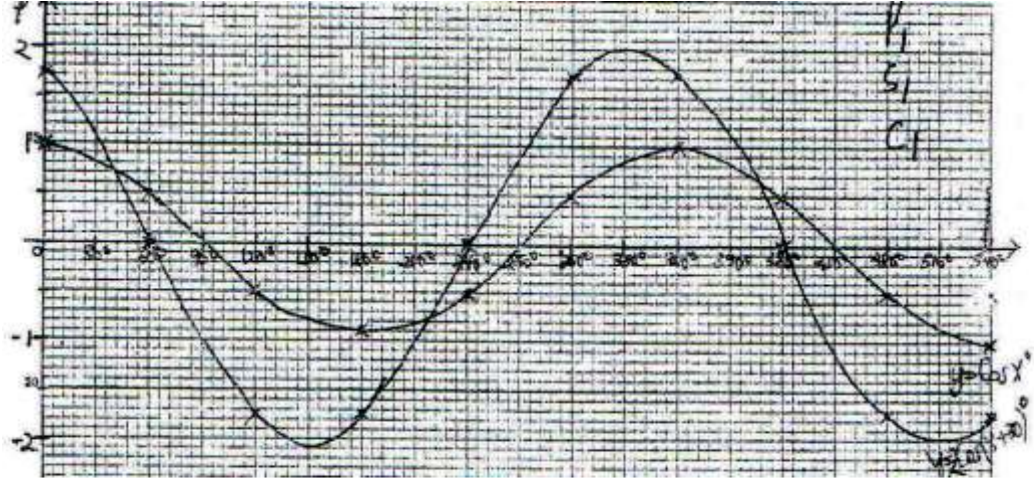
21

x^0	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0
Cos x	1.00	0.50	-0.50	-1.00	-0.50	0.50	1.00	0.50	-0.50	-1.00
2 Cos (x + 30)0	1.73	0	-1.73	-1.73	0	1.73	1.73	0	-1.73	-1.73

(b) (i) Period = 360^0

(ii) Phase angle = 30^0

c)



(d) $39^0 \leq x \leq 219^0$

and $x \geq 406^0$

Stretch parallel to y – axis scale factor 2 followed by a translation vector $\begin{pmatrix}-30^0\\0\end{pmatrix}$

22 **a)**

Marks	Midpoint x	f	d = x – 45.5	fd	fd²
1 – 10	5.5	1	-40	-40	1600
11-20	15.5	6	-30	-180	5400
21-30	25.5	10	-20	-200	4000
31-40	35.5	20	-10	-200	2000
41-50	45.5	15	0	0	0
51-60	55.5	5	10	50	500
61-70	65.5	14	20	280	5600
71-80	75.5	5	30	150	4500
81-90	85.5	3	40	120	4800
91-100	95.5	1	50	50	2500

s.d = $\sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2} = \sqrt{\frac{30900}{80} - \left(\frac{30}{80}\right)^2} = \sqrt{386.1094} = 19.65$

(b)

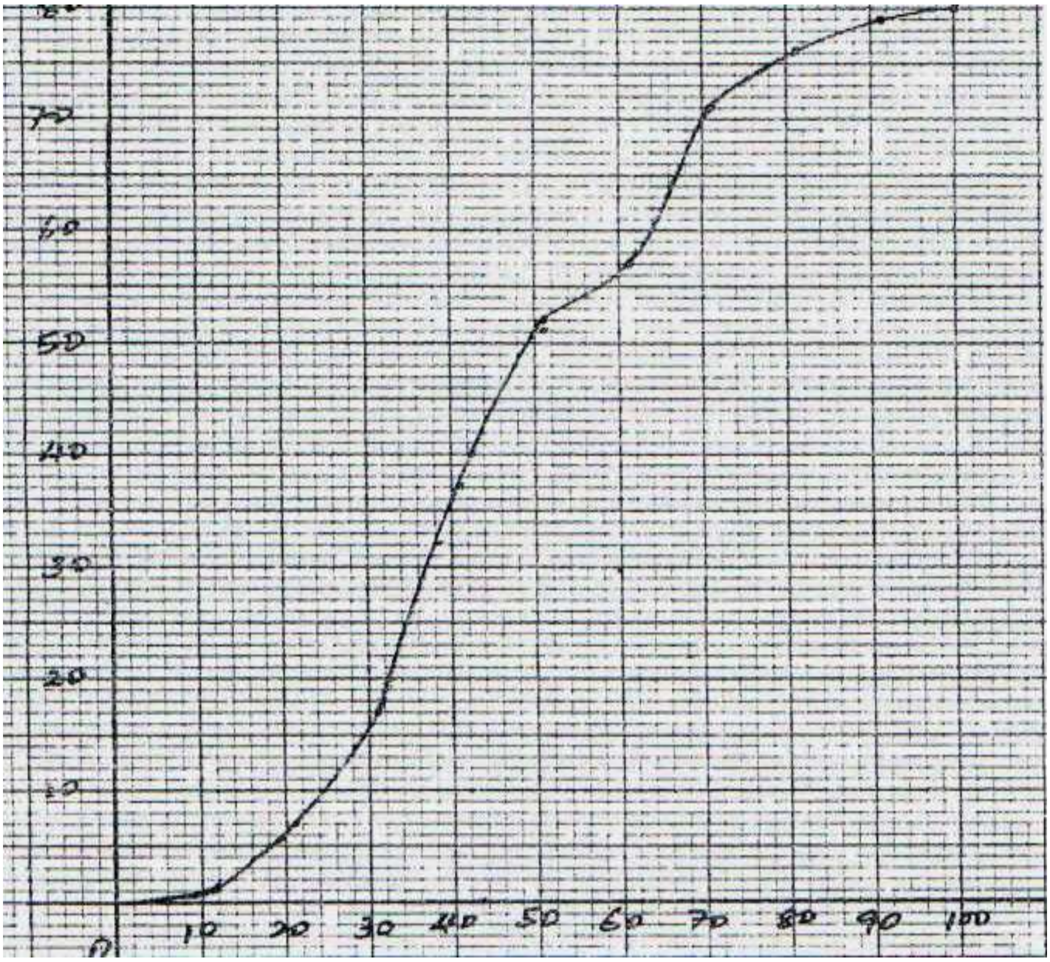
V.C.L	cf
0	0
10.5	1
20.5	7
30.5	17
40.5	37
50.5	52
60.5	57
70.5	71
80.5	76
90.5	79
100	80

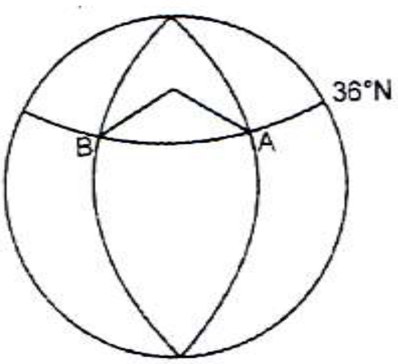
(i) Median = 43± 1

(ii) $\frac{60}{100}$ x 80 = 48 students

80 – 48 = 32 students

∴ Pass mark = 39 marks



23	 (a) $\frac{180}{360}$ x 2 x 3.142 x 6400 sec 36^0 = 16268.3609km (b) 180 – (36 x 2) = 108^0 $\therefore$ distance = 60 x 108 = 6480 nm (c) Time diff. = 4 x 180^0 = 720 minutes $= \frac{720}{60} = 12\ hrs$ $\therefore$ time at = 1700 – 12 hrs = 5.00 a.m previous day	**24**	(a) 92.5% = 222,000 100% = ? $= \frac{100\ x\ 222,000}{92.5}$ = KSh. 240,000 (b) 75% = 240,000 100% = ? $= \frac{100\ x\ 240,000}{75}$ = KSh. 320,000 (c) 74% = 320,000 100% = ? $= \frac{100\ x\ 320,000}{74}$ = KSh. 432,432.432 = KSh. 432,432.40 (d) $\frac{222,000}{432,432.40}$ x 100 = 51.34%

THARAKA SOUTH SUB-COUNTY JOINT EVALUATION
Kenya Certificate of Secondary Education
Mathematics
Paper 1

SECTION I: (50 Marks)

Answer ALL the questions in this section.

1. Evaluate: (3 Marks)

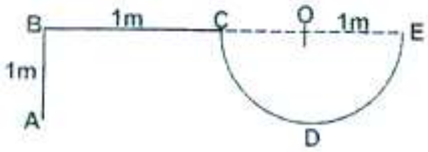
$$\frac{-16 \div 18\, x\, 6 - 3\, x\, 8}{48 \div 6\, x\, 2}$$

2. Given that $1.\ddot{0}5 = 1\frac{a}{b}$, find the values of a and b (3 Marks)

3. Solve for x in the following (4 Marks)

$$3^{(2x+1)} + 3^2 = 3^{(x+3)} + 3^x$$

4. A wire is bent into the shape shown below. BCE is a straight line and CDE is a semicircle radius 1m and centre O. Two ants, starting at the same time moved at equal speeds along the wire from points A and E respectively. How far from C did they meet?



5. 15 men working 4 hours a day can do a job for 20 days. How long does it take 10 men working 5 hours a day to do the same job. (3 Marks)

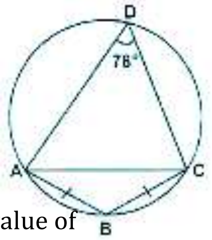
6. All prime numbers between 10 and 20 are arranged in descending order to form a number.
   (a) Write down the number. (1 Mark)
   (b) State the total value of the third digit in the number formed in (a) above. (1Mark)

7. Simplify: (4 Marks)

$$\frac{2y^2 - 3xy - 2x^2}{4y^2 - x^2}$$

8. A Kenyan tourist left America through South Africa. While in South Africa she bought a necklace worth 24 dollars. Given that 1 rand = 0.15 dollars and 1 rand = 11.24 Kenya shillings, find the value of the necklace in
   (a) South Africa rands (1 Mark)
   (b) Kenya shillings (2 Marks)

9. In the figure below, points A, B, C and C lie on the circumference of a circle. ∠ADC = 780 and line AB = line BC. Calculate ∠BAC. (2 Marks)



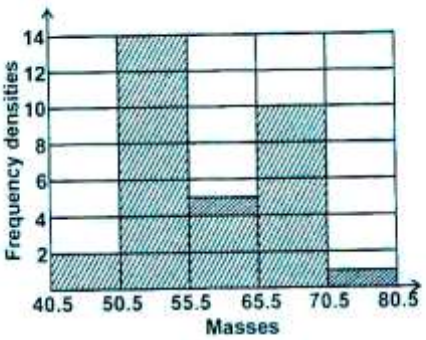
10. Using tables of reciprocals only to find the value of (3 Marks)

$$\frac{5}{0.0829} - \frac{14}{0.581}$$

11. The volumes of two similar cylinders are 4752cm^3 and 1408cm^3. If the area of the curved surface of the smaller cylinder is 352cm^2, find the area of the curved surface of the larger cylinder. (4 Marks)

12. Given that $\overrightarrow{OA} = 2i + 3j$ and $\overrightarrow{OB}$ 3i – 2j. Find the magnitude of AB to one decimal place. (3 Marks)

13. The graph below shows frequency densities for the masses of some 200 students selected from a class. Use it to answer the questions that follow.



(a) Complete the frequency distribution table below. (3 Marks)

Mass in kg					
Frequency					

(b) State the modal frequency. (1 Mark)

14. Given that tan $x^0 = \frac{3}{7}$, find Cos (90 – x) 0 giving your answer to 4 significant figures. (2 Marks)

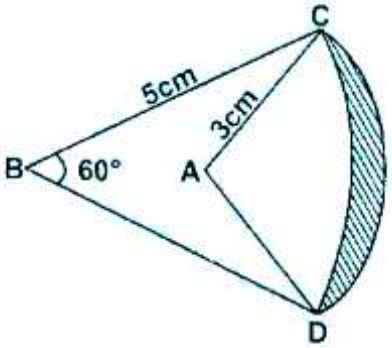
15. An irregular 6 sided polygon has 2 of its interior angles equal to 2x each, 3 angles equal to x each and one side equal to 200. Calculate the value of x. (3 Marks)

16. The diagonals of a parallelogram are 20cm and 28.8cm. The angle between the diagonals is 620. Calculate the area of the parallelogram. (3 Marks)

SECTION II: (50 Marks)

Answer only FIVE questions from this section.

17. The diagram below shows a crescent formed by two circles of radii 3cm and 5cm, centres A and B respectively.



Calculate the area of the shaded region if it subtends and angle of 600 at centre B. (10 Marks)

18. The table below shows the height measured to the nearest cm of 101 pawpaw trees.

Height in cm	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Frequency	2	15	18	25	30	6	3	2

(a) State the modal class. (1 Mark)

(b) Calculate to 2d.p

(i) the mean height (4 Marks)

(ii) the difference between the median height and the mean height. (5 Marks)

19. (a) Using a ruler and a pair of compasses only, construct triangle ABC where line AB = 5.5cm, line BC = 4.8cm and line AC = 6.8cm, construct a circle through vertices A, B and C. (6 Marks)

(b) Measure the radius of the circle. (2 Marks)

(c) Measure the angle subtended at the centre of the circle by a chord AC. (2 Marks)

20. A bus left Kisumu at 9.30 a.m towards Nairobi at an average speed of 81km/h. A matatu left Nairobi at 10.10 a.m at average speed of 72km/hr. The distance between Kisumu and Nairobi is 3600km.

(a) Determine:

(i) the time taken before the two vehicles meet (3 Marks)

(ii) the distance between the two vehicles 40 minutes after meeting (2 Marks)

(b) A car left Kisumu towards Nairobi at 9.50 a.m at an average speed of 90km/h.

Determine

(i) the time when the car caught up with the bus (3 Marks)

(ii) the distance of Nairobi from place where the car caught up with the bus. (2 Marks)

21. Given that $y = -2x^2 - 3x + 11$

(a) Complete the table below. (2 Marks)

x	-4	-3	-2	-1	0	1	2	3
$-2x^2$	-32		-8	-2	0	-2	-8	
-3x	12	9		3	0		-6	-9
11	11	11	11	11	11	11	11	11
y	-9		9	12	11	6	-3	

(b) On the grid provided, draw the graph of $-2x^2 - 3x + 11$ for $-4 \leq 3$ (3 Marks)

(c) Use the graph to solve

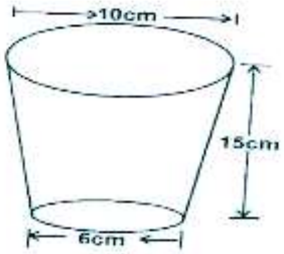
(i) $-2x^2 - 3x + 11 = 0$ (2 Marks)

(ii) $-2x^2 - 5x + 10 = 0$ (3 Marks)

22. The table below shows measurements in metres, made by a surveyor in his field book. Calculate the area of the field in hectares. (10 Marks)

	G	
	280	
F 50	250	
	200	E 40
	150	D 100
C 120	100	
	40	B 50
	A	

23. The figure below shows a tumbler with diameters 6cm and 10cm and height 15cm.



(a) If it is filled with water, what area is in contact with water? (7 Marks)
(b) Find the volume of the tumbler. (3 Marks)

24. A straight line passes through the points (8, -2) and (4, -4)

(a) Write its equation in the form ax + by + c = 0 where a, b and c are integers. (3 Marks)
(b) If the line in (a) above cuts the x-axis at point, determine the coordinates of P. (2 Marks)
(c) Another line which is perpendicular to the line in (a) above passes through point P and cuts the y-axis at the point Q. Determine the coordinates of point Q. (3 Marks)
(d) Find the length of QP (2 Marks)

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MATHEMATICS
PAPER 2

1. a) $T = \frac{1}{0.003146 - 0.003130}$ (1 mark)
   b) An approximate value of T in (a) above may be obtained by first correcting each of the decimal in the denominator to 5 decimal places. Calculate:
   i. The approximate value (1 mark)
   ii. The error introduced by approximation. (1 mark)
2. Find the value of X (3 marks)
   $(5^x)5^{x-1} = 10$
3. Make y the subject of the formula. (3 marks)
   $$T = 2\pi\sqrt{\frac{x^2 + y^2}{gx}}$$
4. Draw the locus of the points that satisfy inequalities $(y-3)^2 + (x-2)^2 \leq 9 \; and \; x + y \geq 6$ (3 marks)
5. Find the binomial expansion of$\left(1 + \frac{1}{2}x\right)^7$ upto the term inx^3. Hence estimate the value of $(1.04)^7$ correct to 4d.p. (4 marks)
6. Object A of area $10cm^3$ is mapped on to its image B of area $60cm^2$ by transformation whose matrix is given by$P = \begin{bmatrix} x & 4 \\ 3 & x+3 \end{bmatrix}$ Find the positive values of x (3 marks)
7. A cold water tap can fill a bath in 10 minutes while a hot water tap can fill it in 8 minutes. The drainage pipe can empty the bath in 5 minutes. The cold water and hot water taps are opened for 4 minutes all the 3 taps are opened. Find how long it will take to fill the bath. (3 marks)
8. Simplify the following (3 marks)
   $\frac{3\sqrt{5}}{\sqrt{7}-2} - \frac{2\sqrt{5}}{\sqrt{7}+2}$
9. Solve$4 - 4cos^2x = 4\sin x - 1 \; for \; 0^0 \leq x \leq 360^0$ (4 marks)
10. The 3rd term of a geometric sequence is 20 and the 6th term is -160. (3 marks)
    Calculate the 8th term.
11. The cost of the 2 brands of coffee A and B per kg are sh. 59.40 and sh. 72 respectively. The two brands are mixed in the ratio x: y and sold at a profit of 20 % above the cost. If the selling price per kg of mixture is sh. 72. Find the value of x and y. (3 marks)
12. Point P$P(40^0S, 45^0S)$ and point Q $(40^0S, 60^0W)$ are on the surface of the earth. Calculate the shortest distance along a circle of latitude between the two points. (3 marks)
13. A quantity y varies partly asx^2 and partly as x. When y=6, x=1 and when y=30, x=3.Find y when x=3. (3 marks)
14. Find the equation of the normal to the curve.
    $y = x^2 + 4x - 3$ at point (1,3) (3 marks)
15. The length and width of a rectangle are 8.3cm and 4.2cm respectively correct to the nearest millimeter. Calculate the percentage error in the area of the rectangle. (3 marks)
16. Obtain the intergral values of x for which $3 < 27^x < 81$ (2 marks)

SECTION B (50 Marks)

Answer only five questions in this section in the space provided.

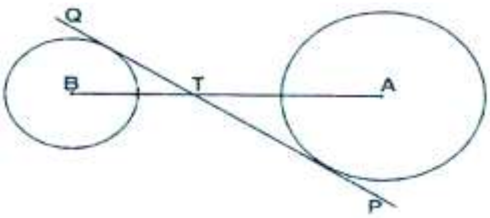
17. The table shows income tax rates.

Monthly taxable pay K£	Rate of tax in Ksh. Per K£
1-435	2
436-870	3
971-1305	4
1306-1740	5
Excess over 1740	6

A company employee earn a monthly basic salary of Ksh. 30,000 and is also given taxable allowances amounting to Ksh. 10480.

a) Calculate the total income tax. (6 marks)
b) The employee is entitled to a personal tax relief of Ksh. 800 per month. Determine the net tax. (1 mark)
c) If the employee received a 50% increase in his total income. Calculate the corresponding percentage increase on the income tax. (3 marks)

18. In the figure below A and B are centres of circles. PQ=12cm is an internal tangent AB=15cm and the ratio of the radii is 2:3



Calculate :

a) The radii of the circles (4 marks)

b) Distance AT and TQ (6 marks)

19. a) Using mid-ordinate rule, estimate the area under the curve $y = \frac{1}{2}x^2 - 2$. Using six strips between x=2 and x=8 and x-axis. (5 marks)

b) Using intergration to determine the exact area under the curve. (3 marks)

c) Find the percentage error in calculating the area using the mid-ordinate rule. (2 marks)

20. The probability that three dart players Akinyi, kamau and Juma hit bull's eye are 0.2, 0.3 and 0.15 respectively.

a) If each plays once show the possible outcomes on a tree diagram. (2 marks)

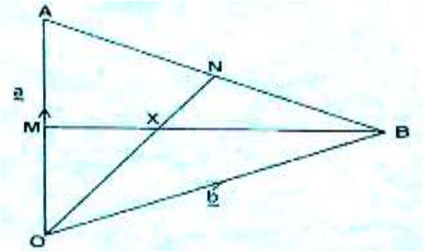
b) Calculate the probability that

i) All hit the bulls eye (2 marks)

ii) Only one hit the bulls eye (2 marks)

iii) Almost one misses the bulls eye. (2 marks)

21. In the figure below $\overrightarrow{OA}$= $\underset{\sim}{a}$ and $\overrightarrow{OB}$=$\underset{\sim}{b}$. M is the midpoint of $\overrightarrow{OA}$ and AN:NB=2:1



a) Express in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$

i) $\overrightarrow{BA}$

ii) $\overrightarrow{BN}$

iii) $\overrightarrow{ON}$

b) Given that $\overrightarrow{BX}$=h$\overrightarrow{BM}$ and $\overrightarrow{OX}$=k$\overrightarrow{ON}$. Determine the values of h and k. (6 marks)

22. A triangle has vertices A (1,2), B (7,2) and C (5,4)

a) Draw ABC on the Cartesian plane. (1 mark)

b) Construct the image triangle $A^1B^1C^1$ of triangle ABC under negative quarter turn about the origin. (2 marks)

c) Draw triangle $A^{11}B^{11}C^{11}$ the image of triangle $A^1B^1C^1$ under reflection in the line y=x. State the coordinates of $A^{11}B^{11}C^{11}$. (2 marks)

d) Find a single matrix of transformation which maps triangle ABC on to triangle$A^{11}B^{11}C^{11}$ (3 marks)

e) Describe a single transformation that maps triangle $A^{11}B^{11}C^{11}$ on triangle ABC. (2 marks)

23. The table below shows heights of student in a certain school.

Height	150-154	155-159	160-164	165-169	170-174	175-179
No. of students	10	26	24	20	14	6

a) Construct cumulative frequency distribution table. (2 marks)

b) Draw cumulative frequency curve (o-give) for the above data. (3 marks)

c) From the o-give curve

i) Find the percentage of students whose height is below 166cm. (2 marks)

ii) Find the quartile deviation. (3 marks)

24. The figure below shows a right pyramid with a square block at its base. The sides of the base are 40cm and height of the base is 30cm. M is the mid-point of QR such that PM=29cm.

Calculate:

a) The vertical height of vertex P from plane ABCD (3 marks)

b) The angle between planes PQR and PST. (3 marks)

c) The projection of the line RP on the plane QRST. (3 marks)

d) The angle between planes QRCD and ABCD. (2 marks)

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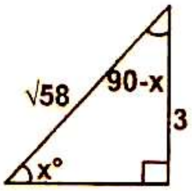
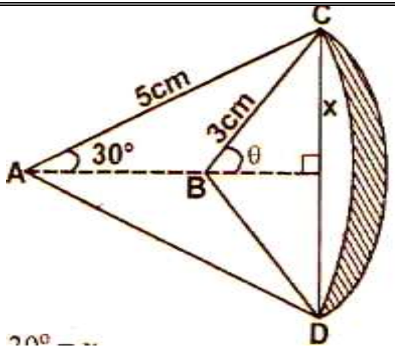
121/1
MATHEMATICS
PAPER 1

<table>
<tr><td>1</td><td>$\frac{-4+108-24}{8x2}$
$=\frac{80}{16}=5$</td></tr>
<tr><td>2</td><td>$Let\ x\ be\ 1.050505$
$100x = 105.50505$
$99x = 104$
$x = \frac{104}{99} = 1\frac{5}{99}$
$a = 5, b = 99$</td></tr>
<tr><td>3</td><td>$3^{2x}.3^1 + 3^2 = 3^x.3^3 + 3^x$
$let\ 3^x = y$
$3y^2 + 9 = 27y + y$
$3y^2 - 28y + 9 = 0$
$(y-9)(3y-1) = 0$
$\Rightarrow y = 9\ or\ \frac{1}{3}$
$But\ 3^x = y$
$\therefore 3^x = 9\ or\ 3^x = 3^{-1}$
$3^x = 3^2\ or\ 3^x = 3^{-1} \therefore x = 2\ or - 1$</td></tr>
<tr><td>4</td><td>$Area\ CDE = \frac{22}{7}x\frac{2}{2} = 3.14m$
$3.14 - 2 = 1.14m$
$\frac{1.14}{2} = 0.57m$
$\therefore they\ meet\ 0.57m\ from\ C$</td></tr>
<tr><td>5</td><td>$\frac{15}{10}x\frac{4}{5}x20 = 24\ days$</td></tr>
<tr><td>6</td><td>a) 19171311
b) $hundreds\ total\ value = 3x100 = 300$</td></tr>
<tr><td>7</td><td>$\frac{2y^2 - 4xy + xy - 2x^2}{(2y-x)(2y+x)}$
$\frac{(2y+x)(y-2x)}{(2y-x)(2y+x)} = \frac{y-2x}{2y-x}$</td></tr>
<tr><td>8</td><td>a) $\frac{24}{0.15} = 160\ rands$
b) $160x11.24 = sh1798.40$</td></tr>
<tr><td>9</td><td>$\angle ABC = 180^0 - 78^0$
$\therefore \angle BAC = \frac{180^0 - 102^0}{2} = 39^0$</td></tr>
<tr><td>10</td><td>$5x\frac{1}{8.29x10^{-2}} = 14x\frac{1}{5.81x10^{-1}}$
$5x0.126x10^2 - 14x0.1721x10$
$60.3 - 24.094 = 36.206$</td></tr>
<tr><td>11</td><td>$LSF = \sqrt[3]{\frac{4752}{1408}} = \frac{16.81}{11.21}$
$ASF = \left(\frac{16.81}{11.21}\right)^2 = \frac{282.6}{125.7}$
$Larger\ area = \frac{282.6}{125.7}x352 = 791.6\ cm^3$</td></tr>
<tr><td>12</td><td>$AB = (3i - 2j) - (2i + 3j) = i - 5j$
$\left|\overrightarrow{AB}\right| = \sqrt{1^2 + (-5)^2} = \sqrt{26} = 5.1\ units$</td></tr>
<tr><td>13</td><td><table>
<tr><td>Mass in kg</td><td>41-50</td><td>51-55</td><td>56-65</td><td>66-70</td><td>71-80</td></tr>
<tr><td>frequency</td><td>20</td><td>70</td><td>50</td><td>50</td><td>10</td></tr>
</table>
b) 70</td></tr>
<tr><td>14</td><td>$h = \sqrt{7^2} + 3^2 = \sqrt{58}$
$\cos(90 - x) = \frac{3}{158}$

 </td></tr>
<tr><td>15</td><td>$Sum\ of\ interior\ angles = (6-2)180 = 720^0$
$2(2x) + 3(x) + 20 = 720$
$4x + 3x + 20 = 720$
$7x = 700$
$x = 100$</td></tr>
<tr><td>16</td><td>$Area = 4x\frac{1}{2}x14.4x10\sin 62^0$
$2x127.14 = 254.28cm^2$</td></tr>
<tr><td>17</td><td>

$\sin 30^0 = \frac{x}{5}$
$x = 5\ \sin 30^0 = 2.5cm$
$\sin\theta = \frac{2.5}{3} = 0.8333$
$\theta = 56.44^0$
$2\theta = 2x56.44 = 112.88$
$Area\ of\ sector - area\ of\ triangle = area\ of\ segment$
$for\ the\ circle\ centre\ A,$
$Area\ of\ segment = \left(\frac{112.88}{360}x\frac{22}{7}x5x5\right)$
$\left(\frac{1}{2}x5x5\sin 60^0\right) = 13.095 - 10.825 = 2.27cm^2$
$For\ the\ circle\ centre\ B,$
$Area\ of\ segment = \left(\frac{112.88}{360}x\frac{22}{7}x3x3\right)$
$\left(\frac{1}{2}x3x3x\sin 112.88\right)$
$= 8.869 - 4.146 = 4.723cm^2$
$\therefore area\ of\ the\ crescent$
$= 4.723 - 2.27 = 2.453cm^2$</td></tr>
</table>

18

a) 40-44

b) i)

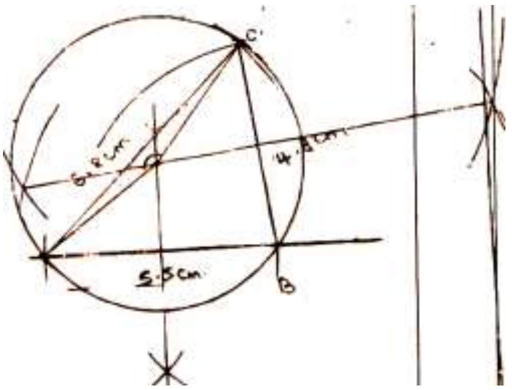
x	f	fx	Sf
22	2	44	2
27	15	405	17
32	18	576	35
37	25	925	60
42	30	1260	90
47	6	282	96
52	3	156	99
57	2	114	101
	101	3762	

$$x = \frac{3762}{101} = 37.25$$

ii) $median = 34.5 + \left(\frac{\frac{101+1}{2}-35}{25}\right)^5 = 37.70cm$

$$Difference = 37.70 - 37.25$$
$$= 0.45cm$$

19



a) 3.9 ± 0.1

$164^0 \pm 1^0$

20

a) $rs = 81 + 72 = 153km/h$

$After\ 40\min distance = 81x\frac{40}{60} = 54km$

$Distance\ left = 360 - 54 = 306km$

$t = \frac{306}{153} = 2hrs$

$\left(\frac{40}{60}x72\right) + \left(\frac{40}{60}x81\right)$

$48 + 54 = 102km$

b) i) $R.s = 90 - 81 = \frac{9km}{h}$

$20min, distance\ covered = \frac{20}{60}x90$

$= \frac{1}{3}hrs$

$3hrs\ 20\ min$

9.50
3.20 or 1.10$p.m$
1310

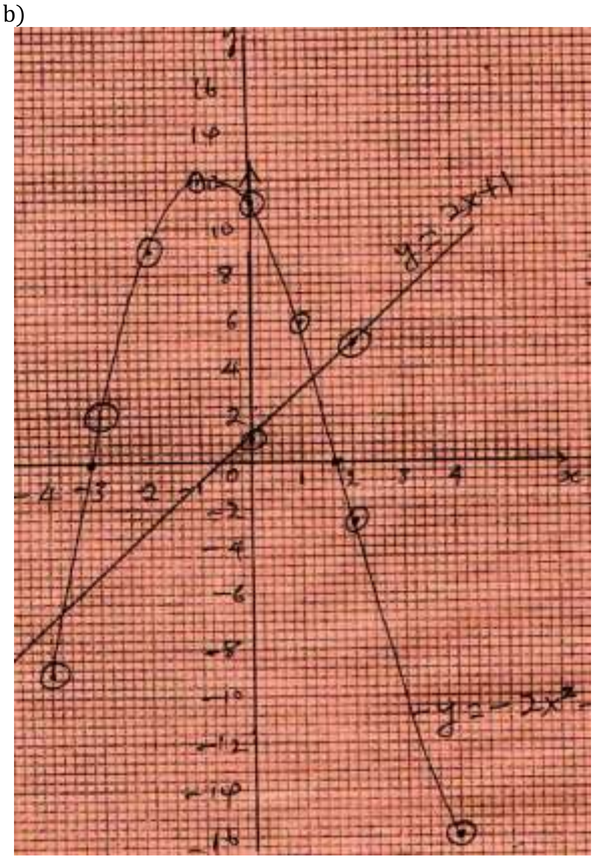
ii)
1310
930 $4\frac{2}{3}hrs$
4.40

$360 - \left(81x\frac{14}{3}\right) = 360 - 108 = 252km$

21

x	-4	-3	-2	-1	0	-1	2	3
-2x	-32	-18	-8	-2	0	-2	-8	-18
-3x	12	9	6	3	0	-3	-6	-9
11	11	11	11	11	11	11	11	11
y	-9	2	9	12	11	6	-3	-16

b)



c) $y = -2x^2 - 3x + 11$

$0 = -2x^2 - 3x + 11$

$y = 0$

$x = -3.2 \pm 0.1\ or\ x = 1.8 \pm 0.1$

ii) $y = -2x^2 - 3x + 11$

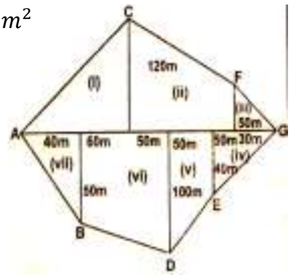
$0 = -2x^2 - 5x + 10$

$y = 2x + 1$

x	0	2
y	1	5

$solutionx = -3.8 + 0.1\ or\ x = 1.2\ \pm 0.1$

22



$Area\ i) = \frac{1}{2}x100x120 = 6000m^2$

$ii) = \frac{1}{2}x150(120 + 50) = 12750m^2$

$iii) = \frac{1}{2}x30x50 = 750m^2$

$iv) = \frac{1}{2}x80x40 = 1600m^2$

$v)\frac{1}{2}x(100 + 40)50 = 3500m^2$

$vi)\frac{1}{2}x(50 + 100)110 = 8250m^2$

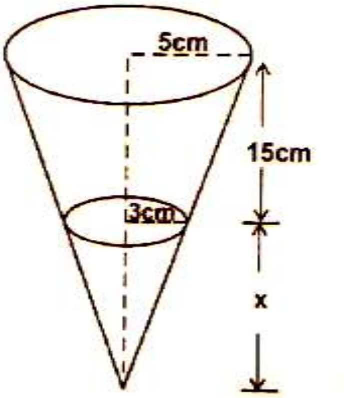
$vii) = \frac{1}{2}x40x50 = 1000m^2$

$33850m^2$

$$Total\ area = \frac{33850}{10{,}000} = 3.385ha$$

23

a)



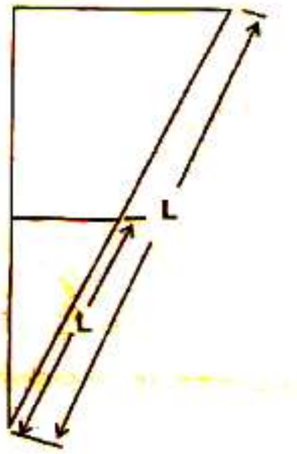
b) $\frac{5cm}{3cm} = \frac{15+x}{x}$

$5x = 3(15 + x)$

$5x = 45 + 3x$

$2x = 45$

$x = 22.5$



$l = \sqrt{37.5^2} - 5^2$

$= 37.83cm$

$l = \sqrt{22.5^2} + 3^2$

$= 22.70cm$

$\therefore area\ of\ the\ curved\ surface$

$= \pi RL - \pi rl$

$= \left(\frac{22}{7}x5x37.83\right) - \left(\frac{22}{7}x3x22.70\right)$

$= 594.47 - 214.03 = 380.44cm^2$

$Area\ of\ the\ bottom = \frac{22}{7}x3x3$

$= 28.29cm^2$

$Total\ area\ in\ contact\ with\ water$

$= 380.44 + 28.29 = 408.73cm^2$

c) $V = \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

$= \left(\frac{1}{3}x\frac{22}{7}x5^2x37.5\right) - \left(\frac{1}{3}x\frac{22}{7}x3^2x22.5\right)$

$= 982.14 - 212.14 = 770cm^3$

24

a) $grad = \frac{-4+2}{4-8} = \frac{-2}{-4} = \frac{1}{2}$

$\frac{y+4}{x-4} = \frac{1}{2}$

$2y + 8 = x - 4 \Rightarrow x - 2y = 0$

$x - 2y - 12 = 0$

b) $x - 2y - 12 = 0$

P(k,0)

$k - 12 = 0$

$x = 12, P(12,0)$

c) $x - 2y - 12$

$grad\ of\ line = -2\ (12,0), (0,-2)$

$\frac{y-0}{x-12} = -2$

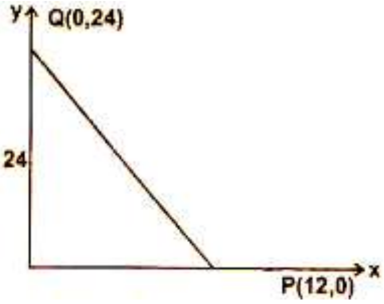
$y = -2x + 24$

$Q = (0,k)$

$k = 24$

$Q(0,24)$

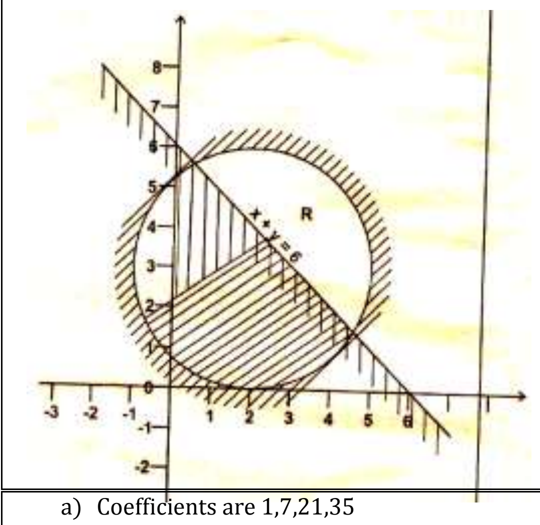
d)



d) $|PQ| = \sqrt{24^2} + 12^2 = \sqrt{720}$

$|PQ| = 26.83units$

THARAKA SOUTH SUB-COUNTY JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/2
MATHEMATICS
PAPER 2

1.	a) $T = \frac{1}{0.000016} = 62.500$ b) $T = \frac{1}{0.0000315 - 00313}$ $i) \frac{1}{0.00003} = 50{,}000$ $ii)\ Error = 625{,}000 - 500{,}000 = 12{,}500$
2	$5^x.5^x.5^{-1} = 10$ $\frac{5^x.5^x}{5} = 10$ $5^{2x} = 50$ $2x\frac{\log 5}{\log 5} = \frac{\log 50}{\log 5}$ $2x = 2.4307$ $x = 1.2153$
3	$T^2 = 4\pi^2\left(\frac{x^2+y^2}{gx}\right)$ $T^2gx = 4\pi^2(x^2+y^2)$ $T^2gx - 4\pi^2x^2 + 4\pi y^2$ $\frac{4\pi^2y^2}{4\pi} = \frac{T^2gx - 4\pi^2x^2}{4\pi^2}$ $y^2 = \frac{T^2gx - x^2}{4\pi^2}$ $\therefore y = \pm\sqrt{\frac{T^2gx}{4\pi^2} - x^2}$
4	
5	a) Coefficients are 1,7,21,35 $\left(1+\frac{1}{2}x\right)^7 = 1 + 7(1)^6\frac{1}{2}x + 21(1)^5\left(\frac{1}{2}x\right)^2 + 35(1)^4\left(\frac{1}{2}x\right)^3$ $= 1 + \frac{7}{4}x + \frac{21}{4}x^2 + \frac{35}{8}x^3$ b) $(1.04)^7 = (1+0.04)^7$ $\frac{1}{2}x = 0.04$ $x = 0.08$ $(1.04)^7 = 1 + \frac{7}{2}(0.08) + \frac{21}{4}(0.08)^2 + \frac{35}{8}(0.08)^2$ $= 1 + 0.28 + 0.0336 + 0.00224 = 1.3158$
6	$det = x(x-3) - 12 = \frac{60}{10} = \frac{6}{1}$ $x^2 - 3x - 18 = 0$ $x^2 - 6x + 3x - 18 = 0$ $x(x-6) + 3(x-6) = 0$ $(x+3)(x-6) = 0$ $x = -3\ or\ 6$ $\therefore x = 6$
7	$\left(\frac{1}{10}+\frac{1}{8}\right)^4 = \frac{90}{40}x40 = \frac{9}{10}$ $\frac{1}{10}+\frac{1}{8}-\frac{1}{3} = \frac{4+5}{40} - 8 = \frac{1}{40}$ $Time\ taken = \frac{1}{10} \div \frac{1}{40} = 40mins$
8	$\frac{3\sqrt{5}(\sqrt{7}+2) - 2\sqrt{5(\sqrt{7}-2)}}{(\sqrt{7}-2)(\sqrt{7}+2)}$ $= \frac{\sqrt[3]{35} + 6\sqrt{5}}{7-4}$
9	$4 - 4(1 - sin^2x) = 4\ \sin x - 1$ $4sin^2x - 4\sin x + 1 = 0$ $(2\sin x - 1)(2\sin x - 1) = 0$ $\sin x = \frac{1}{2}$ $x = 30^0, 150^0$
10	$T_3 = ar^2 = 20 \Rightarrow a\frac{20}{r^5}$ $T_6 = ar^5 = -160 \Rightarrow a = \frac{-160}{r^5}$ $r = -2$ $a = \frac{20}{4} = 5$ $T_8 = 5(-2)^7 = -640$
11	$120 \rightarrow 72$ $100 \rightarrow x$ $x = \frac{7200}{120} = 60$ $\frac{59.40 + 72y}{x+y} = 60$ $59.40x + 72y = 60x + 60y$ $12y = 0.6x$ $120y = 6x$ $\frac{20y}{y} = \frac{x}{y}$ $x{:}y = 20{:}1$ $x = 20, y = 1$

12

$longitude\ difference = 45 + 60 = 105^0$

$Dist\ in\ km = \frac{\theta}{360} x2x3.142x6370\ \ \cos 40^0$

$R\ \ \cos\theta = 6370 \cos 40^0 = 4879.70km$

$Distance = \frac{45+60}{360} x2x3.142x6370 \cos 40^0$

$= 8{,}946.13km$

13

$y = kx^2 + nx$

$6 = k + n$

$30 = 9k + 3n$

$30 = 9k + 3n$

$18 = 3k + 3n$

$12 = 6k$

$k = 2$

$6 = k + n$

$6 = 2 + n$

$n = 4$

$law: y = 2x^2 + 4x$

$when\ x = -3$

$y = 2(-3)^2 + 4(-3)$

$y = 18 - 12 = 6$

14

$\frac{dy}{dx} = 2x + 4$

$m1 = \frac{dy}{dx} = 2(1) + 4 = 6$

$for\ normal\ m_2 = -\frac{1}{6}$

$(1,2), -\frac{1}{6}$

$6y - 12 = -x + 1$

$6y + x = 13$

$x + 6y = 13$

15

$Greatest = 8.35x4.25 = 35.4875cm^2$

$Least = 8.25x4.15 = 34.2375$

$absolute\ error = \frac{35.485 - 34.2375}{2} = 0.625$

$\%\ error = \frac{0.625x100}{8.3x4.2} = 1.79\%$

16

$1 < 3^x < 4$

$\frac{1}{3} < x < \frac{4}{3}$

$integral\ value = 1$

17

a) Taxable income p.m=$\frac{30,000+10480}{20}$

$K£ = 2024$

$1st = 435x2 = 870$

$2nd = 435x3 = 1305$

$3rd = 435x4 = 1740$

$4th = 435x5 = 2175$

$remaining = 284x6 = 1704$

$Income\ tax = 7{,}794$

b) $7794 - 800 = 6994$

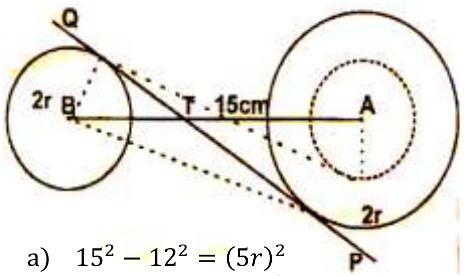
$New\ income = \frac{150}{100}x2024 = K£\ 3036$

$Income\ tax = 870 + 1305 + 1740 + 2175 + 1296x6 = 138666$

$\%\ income = \frac{13866 - 7794}{7794}x100$

$\frac{6072}{7794}x100 = 77.906\%$

18



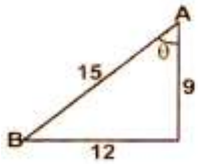
a) $15^2 - 12^2 = (5r)^2$

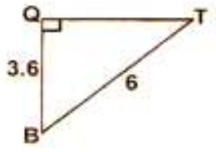
$225 - 144 = 25r^2$

$r = \frac{9}{5} = 1.8$

$2r = 1.8x2 = 3.6cm$

$3r = 1.8x3 = 5.4$



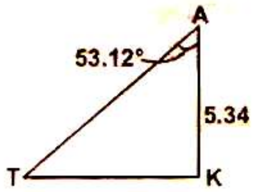


$Tan\ \theta = \frac{12}{9} = 1.333$

$\theta = Tan^{-1}\ (1.333) = 53.12^0$

$QT = \sqrt{6^2 - \sqrt{3.6^2}}$

$QT = \sqrt{23.04} = 48\ cm$



$\cos 53.12 = \frac{5.4}{T.A}$

$TA = \frac{5.4}{\cos 53.12} = 8.998$

$TA = 9cm$

19

X	3.5	4.5	5.5	6.5	7.5
y	4.125	8.125	13.125	19.125	26.125

$A = h(y_1 + y_2 + y_0 + y_4 + y_5)$

$= 1(5.125 + 8.125 + 13.125 + 19.125 + 26.125)$

$= 70.65\ square\ units$

$b)\ i)\ Exact\ area = \int_2^8 \left(\frac{1}{2}x^2 - 2\right)dx$

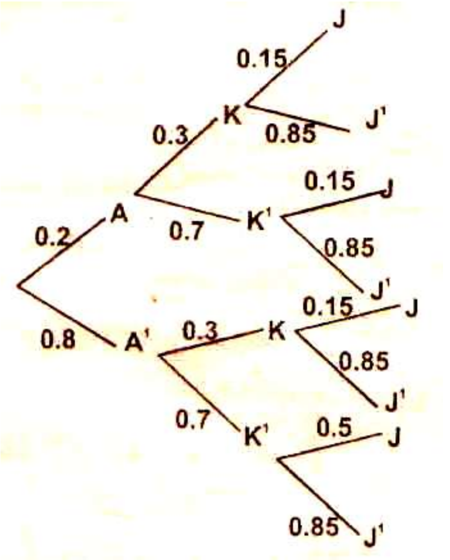
$= \frac{1}{6}x^2 - 2x \int_2^8$

$\left[\frac{1}{6}(8)^3 - 2(8)\right] - \left[\frac{1}{6}(2)^3 - 2(2)\right]$

$= 69.333 - -2.667 = 72\ square\ units$

$\% = \frac{72 - 70.625}{72}x100\% = 1.9077\%$

20



a) $0.2x0.3x0.15 = 0.009\ or\ \frac{9}{1000}$

b) $ii)\ (0.2x0.7x0.85) + (0.8x0.3x0.85) + (0.8x0.7x0.15)$

$$= 0.119 + 0.204 + 0.084 = 0.407\ or\ \frac{407}{1000}$$

$iii)\ (0.2x0.3.0.85) + (0.2x0.7x0.15) + (0.8x0.3x0.15)$

$$= 0.051 + 0.21 + 0.036 = 0.297$$

$iv)\ 0.8x0.3x0.85 = 0.204\ or\ \frac{51}{250}$

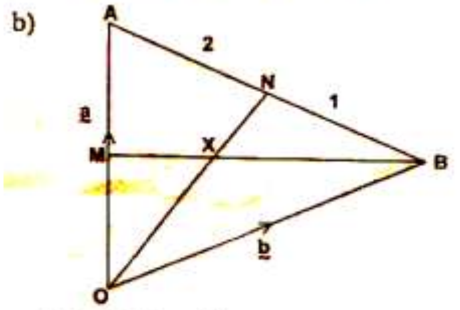
21

a) i) $\underset{\sim}{a} - \underset{\sim}{b}$

ii) $\frac{1}{3}(\underset{\sim}{a} - \underset{\sim}{b})$

iii) $\underset{\sim}{b} + \frac{1}{3}(\underset{\sim}{a} - \underset{\sim}{b}) = \frac{1}{3}\underset{\sim}{a} + \frac{2}{3}\underset{\sim}{b}$

b)



$\underset{\rightarrow}{BX} = h(\frac{1}{2}a - b)$

$\underset{\rightarrow}{OX} = OB + BX = hON$

$\underset{\rightarrow}{OX} = b + h(\frac{1}{2}a - b) = k(\frac{1}{3}a + \frac{2}{3}b)$

$\underset{\rightarrow}{OX} = b + \frac{1}{2}a\,h - bh = \frac{1}{3}a\,k + \frac{2}{3}bk$

$(1 - h)\,b = \frac{2}{3}bk$

$k = \frac{3}{2}(1 - h)$ .... (i)

$\frac{1}{2}ah = \frac{1}{3}ak$

$k = \frac{3}{2}h$ .... (ii)

$\frac{3h}{2} = \frac{3}{2} - \frac{3}{2}h$

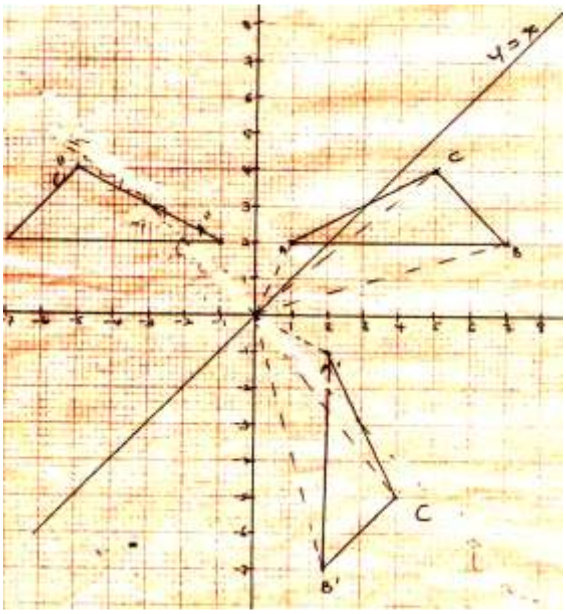
$3h = \frac{3}{2}$

$h = \frac{3}{6} = \frac{1}{2}$

$k = \frac{3}{2}(\frac{1}{2}) = \frac{3}{4}$

$\therefore h = \frac{1}{2}, k = \frac{3}{4}$

22



b) $A^1(2,-1), B^1(2,-7), C^1(4,-5)$

c) $A^{11}(-1,2), B^{11}(-7,2,), C^{11}(-5,4,)$

d) $let\ matrix\ be \begin{pmatrix} a & c \\ b & d \end{pmatrix}$

$$\begin{pmatrix} a & c \\ b & d \end{pmatrix}\begin{pmatrix} 1 & 7 & 5 \\ 2 & 2 & 4 \end{pmatrix} = \begin{pmatrix} -1 & -7 & -5 \\ 2 & 2 & 4 \end{pmatrix}$$

$$a + 2c = -1$$
$$7a + 2c = -7$$
$$\Rightarrow a = -1, c = 0$$

$$b + 2d = 2$$
$$7b + 2d = 2$$
$$\Rightarrow b = 0, d = 1$$

$$\therefore the\ matrix\ is \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

e) Reflection in the y-axis

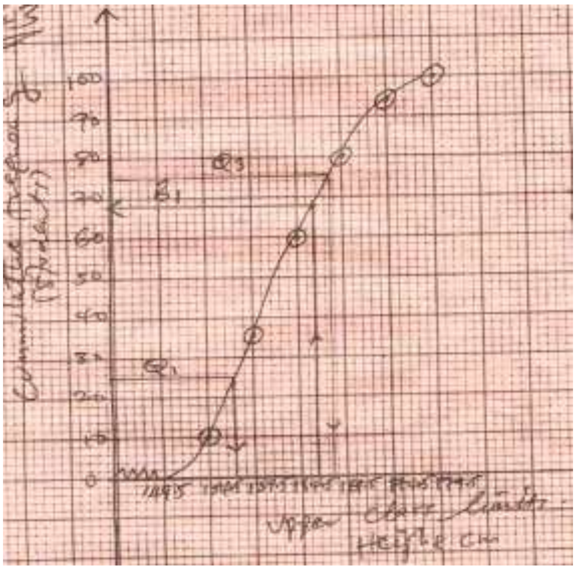
23

Height(cm)	150-154	155-159	160-164	165-169	170-174	175-179
No. of students	10	26	24	20	14	6
c.f	10	36	60	80	94	100

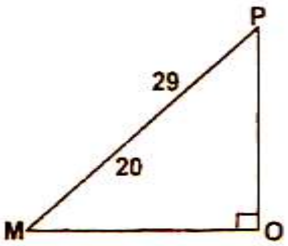
c) i) 68%

ii) $Quartile\ deviation = Q_3 - Q_1$

$= 167.5 - 157 = 10.5$



24



$$OP = \sqrt{\frac{29^2-20^2}{841-400}}$$

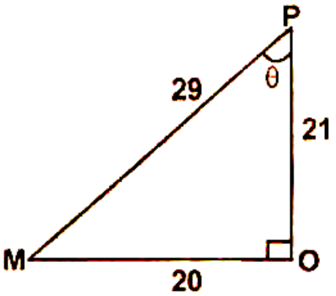
$$OP = \sqrt{441}$$
$$OP = 21$$

b) $Tan\ \theta = \frac{20}{21}$

c)

$\theta = 43.6028$

$43.60x2 = 87.21^0$

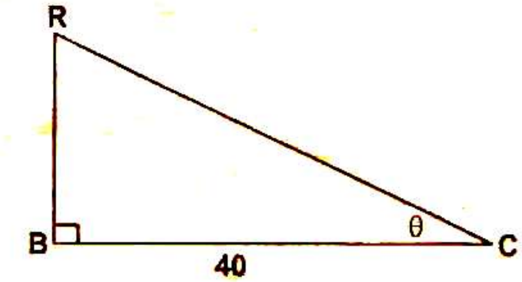


$c)\ RT = \sqrt{40^2 + 40^2}$

$RT = \sqrt{3200}$

$RT = 56.5685$

$Projection\ of\ line\ RP = \frac{1}{2}x56.5685 = 28.28cm$



d) $Tan\theta = \frac{30}{40} = 36.87^0$

KERICHO WEST JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/1
MATHEMATICS
PAPER 1
SECTION 1(50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Without using mathematical tables or calculators, evaluate. (2 marks)

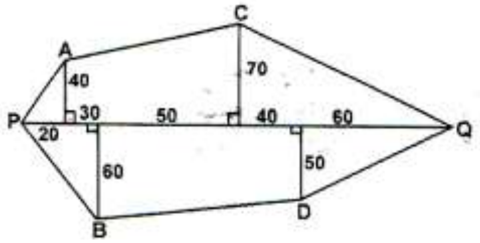
$$\sqrt{\frac{0.0625x2.56x(8)^{\frac{1}{2}}}{0.25x0.16x0.5}}$$

2. The equation of a line is $-\frac{3}{5}x+3y=6$ Find
   a) The gradient of the line (1 mark)
   b) The equation of a line passing through the point (1,2) and is perpendicular to the given line (2 mark)
3. Given that $log_{10}7=0.8451\ and\ log_{10}6=0.7782.find\ log_{10}25.2$ (3 marks)
4. Given that $cos(x-20)^0=Sin(2x+32)^0$ and x is an acute angle. Find tan (x-4) (3 marks)
5. Two similar containers have masses 256kgs and 128kgs respectively. If the surface of the smaller container has an area of $810cm^2$. What is the area of the corresponding surface of the large container. (3 marks)
6. Mashillingi has 21 coins whose total value is Kshs 72. There are twice as many five shillings coins as there are ten shillings coins. The rest are one shilling coins. Find the number of ten shilling coins that mashillingi has. (3 marks)
7. A Kenyan bank buys and sells foreign currencies as shown below.

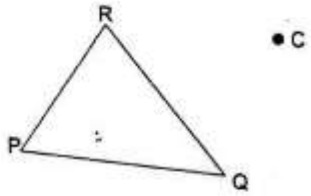
	Buying	Selling
1US Dollar	76.38	75.19
1UK pound	132.92	132.95

A tourist arrived in Kenya from Britain with 126,000 UK sterling pounds. He converted the pounds into Kenyan shillings. While in Kenya he spent $\frac{4}{5}$ of the money. He changed the balance to US dollars. Calculate to the nearest Dollar, the amount he received. (4 marks)

8. The marks scored by 10 students were follows 35, 34,32,33,28, 36,31,32,32 and 37. Calculate the standard deviation of the marks. (3 marks)
9. The figure below shows the sketch of a tea farm. The measurement are in metres. Fill the information given in a field book. Take PQ as the base line, 200m long. (3 marks)



10. Construct the image $P^1Q^1R^1$ of the object PQR below though a rotation of -60 using centre C. (3 marks)



11. Relative to the origin O. $OP=\binom{4}{5}$and $OQ=\binom{9}{3}$ if R is a point on OQ; such that PR:RQ=2:3, Find the co-ordinates of R. (3 marks)
12. Three litres of water (density 1gm/cm^3) is added to twelve litres of methanol. (Density 0.8g/cm^3). What is the density of the mixture? (3 marks)
13. Simplify the following expression completely. $\frac{12a^2-3b^2}{2a^2-ab-b^2}$ (3 marks)
14. Find the exact value of $1.\dot{4}\dot{5}-0.\dot{5}$ in its simplest form. (4 marks)
15. Solve for x; if $9^x x27^{x-1}=1$ (3 marks)
16. Use logarithms tables to evaluate $\sqrt[4]{\frac{849.6x2.41}{394.1}}$ (4 marks)

SECTION 11(50 MARKS)

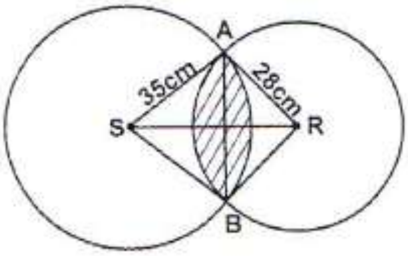
Answer ONLY FIVE questions in this section in the spaces provided.

17. The vertices of a triangle ABC A (2,1) B(5,4) and C (5,1) has been mapped onto $A^1(-2,1)$. $B^1(-5,4)$ and $C^1(-5,1)$ by a transformation matrix T. Triangle $A^1B^1C^1$ is also mapped onto triangle $A^{11}(-2,-1)B^{11}(-5,4)$ and $C^{11}(-5,-1)$ by a transformation matrix S. Find:
    a) The transformation T (4 marks)
    b) The transformation S (4 marks)
    c) The single transformation matrix $\Delta ABC\ onto\ \Delta A^{11}B^{11}C^{11}$ (2 marks)
18. Christians who attended a church service on Sunday were grouped by age as shown in the table below.

Age in(x) years	$0 \leq x < 5$	$5 \leq x < 15$	$15 \leq x < 25$	$25 \leq x < 45$	$45 \leq x < 75$
No.of members	14	41	59	70	15

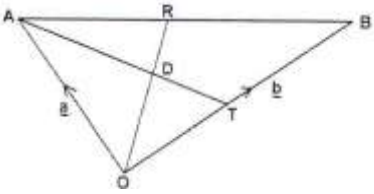
a) Estimate the mean age (4 marks)
b) On the grid provided, draw a histogram to represented the distribution data.
Use the scale 1cm to represent 5 units on the horizontal axis.
2cm to represented 1 units in the vertical axis (4 marks)
c) On the same axis in (b) above, construct a frequency polygon and use it to determine the modal class. (2 marks)

19. The intersecting circles centres S and R have radii 28 and 35 respectively. A common chord AB=38cm.



a) Calculate
i) Angle ASB (2 marks)
ii) Angle ARB (2 marks)
b) Calculate the area of the shaded region. (6 marks)

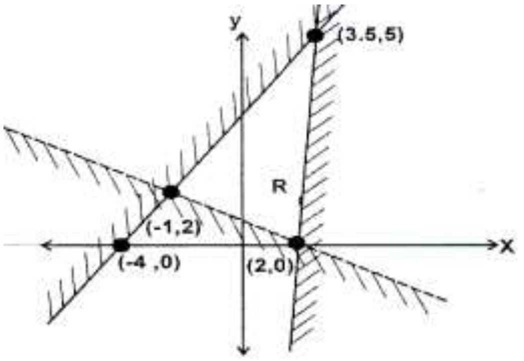
20. The figure below is a triangle OAB, where $\overrightarrow{OA}$=a and $\overrightarrow{OB}$=b. A point R divides AB in the ratio 1:3 $\overrightarrow{OR}$ and $\overrightarrow{AT}$ intersect at D.



a) Find in terms of a and b
i) BT
ii) OR
iii) AT
b) If OD=hOR and AD=kAT, express OD in two ways hence determine the values of h and k. (6 marks)

21. Two countries X and Y are 600km apart. A bus left country Y at 9.00am and an everage speed of 100km/hr. A matatu started from country X at 10.30am for country Y and travelled at an everage speed of 150km/hr. Find
    a) How far country Y the Bus and the matatu met. (4 marks)
    b) The time the bus and the matatu met. (2 marks)
    c) The time at which the matatu arrived at Y (2 marks)
    d) If the matatu started from Y at 10.30am, how far from X would be their overtaking point. (2 marks)

22. a) Give the inequalities that define the unshaded region. (6 mark)



b) Find the extract area of the region. (4 marks)

23. A ship leaves port P and sails to port Q to Ron a bearing of 160^0 and is 150km from Q. From R, the ship returns directly to P at a speed of 25km/hr.

a) Using a suitable scale, show the relative positions of P,Q and R. (3 marks)

b) i) Find the bearing of R from P

ii) Find the distance travelled from R and the time taken to arrive at the destination. (4 marks)

c) As island S is equidistant from P,Q and R. Show its relative position. (2 marks)

24. a) Determine the x-intercept of the curve $y = x^3 - 9x$ (2 marks)

b) Use the trapezium rule with 6 strips to find areas bounded by the curve and the x-axis. (3 marks)

c) By using integration, find the exact area bounded by the curve and the x- axis. (3 mark)

d) Calculate the percentage error in using trapezium rule to obtain the area. (2 marks)

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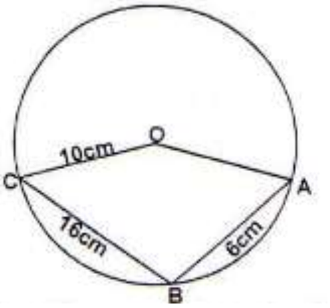
MATHEMATICS
PAPER 2
SECTION 1(50 MARKS)

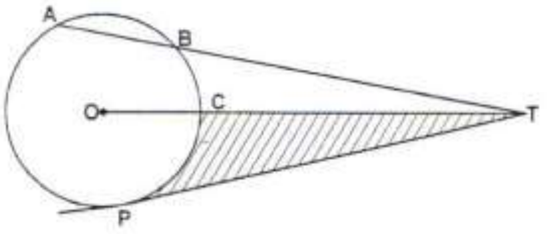
Answer all the questions in this section in the spaces provided.

1. Without using mathematical tables or a calculator, evaluate. (2 marks)
$2log_3 9-\frac{1}{2}log_3 144+log_3 972$
2. Two variable V and R are such that V partly varies as R and partly varies as the square root of R. When R=9, V=144 and when R=16, V=272
   a) Find the law connecting V and R (3 marks)
   b) Hence find the value of V when R=56.25. (1 mark)
3. Make n the subject of the formula given that (3 marks)
$E=\sqrt{\frac{x(n^2-x)}{n^2-1}}$
4. A shopkeeper bought x kg of locally made sugar at Kshs 85 per kilogram and 120kg of imported sugar at ksh 102 per kilogram. He mixed the two types of sugar and sold the mixture at Ksh 119 per kilogram making a profit of 25%. Find the number of kilograms (x) of locally made sugar. (3 marks)
5. In the figure below AB and Bc are chords of a circle centre O. AB=6cm, BC=16cm and OC=10cm



Calculate angle ABC correct to three significant figures. (3 marks)

6. Kamau saved 2000 during the first month of employment. In each subsequent month he saved 15% more than the preceding month. How many years did he take to save a sum of Kshs 2.028,692 (3 marks)
7. Given that $A=2i+j-2k, B=3j+4j-k\ and\ C=-5i+3j+2k\ and\ that\ P=3A-B+2C$, Find the magnitude of the vector P to three significant figures. (3 marks)
8. Solve the equation $2Cos3\theta=\sqrt{3}\ for\ 0^0\leq\theta\leq180^0$ (3 marks)
9. There are two boxes A and B on the floor. Box A contains 3 red marbles and 5 white marbles while Box B contains 6 red marbles and 2 white marbles. A box is chosen at random and two marbles are drawn from it one after the other without replacement. Find the probability that the two marbles are of different colours. (3 marks)
10. Without using mathematical tables or a calculator evaluate. (3 marks)
$\frac{Sin150^0+Cos210^0}{Tan\ 225^0-Tan240^0}$
11. In the figure below ABT is straight line with AB=5cm and BT=4cm. O is the centre of the circle with radius 8 cm and PT is a tangent to the circle at P.



   a) Calculate the length of PT. (1 mark)
   b) Calculate the area of the shaded region correct to two significant figures (Take $\pi=3.142$ (3 marks)
12. a) Expand $(a+b)^5$ (1 mark)
   b) Use the first three terms of the expansion in (a) to find the value of $(1.97)^5$ to two decimal places. (2 marks)

13. Given that $10.5 \leq x \leq 20$ and $1.5 \leq y \leq 3$, find the maximum value and correct to three decimal places of: $\frac{x-y}{y+x}$ (3 marks)

14. Two matrices A and B are A=$\begin{bmatrix} P & 4 \\ 3 & 2 \end{bmatrix}$ and B$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ Given that the product AB is a singular matrix, find the value of P. (3 marks)

15. A (-6,-2) and B (2,-4) are the end point of a diameter of a circle.
    Find the co-ordinates of the centre of the circle (1 mark)
    Find the equation of the circle expressing it in the form $x^2 + y^2 + ax + by + c = 0, where\ a, b\ and\ c\ are$ intergers. (2 marks)

16. A farmer has 200m of fencing with which to form three sides of a rectangular enclosure, the fourth side being existing wall of the yard. Find in metres the dimension of the largest possible area that can be enclosed. (3 marks)

SECTION II (50 MARKS)

Answer only five questions in this section in the spaces provided.

17. Mr. Korir borrowed Kshs 3,600,000 from the bank to buy a residential house. He was required to repay the loan with a simple interest for a period of four years. The repayment amounted to kshs 111 000 per month. Calculate

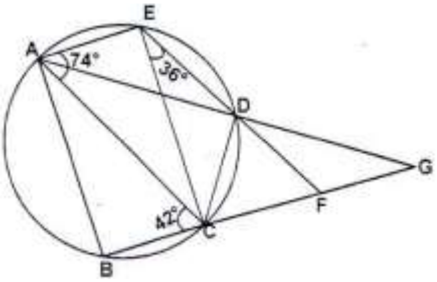
a) i) the interest paid to the bank. (2 marks)
   ii) the rate per annum of the simple interest. (2 marks)

b) The value of the house appreciated at the rate of 15% per annum. Calculate the value of the house after 4 years to the nearest hundreds. (3 marks)

c) After n years, the value of the house was Kshs 8,327,019. Find the value of n. (4 marks)

18. A certain number of Jua kali artisan agreed to contribute equally to buy a welding machine worth Ksh 12,000. Five of the artisan pulled out so the others agreed to contribute an extra Kshs 100 each. Their contribution enabled them to buy a machine worth Ksh 2000 more than the previous machine.
    a) If the original number of artisan was n, write down:
    i) An expression of how much each artisan was to contribute originally. (1 mark)
    ii) An expression of how much each of the remaining artisan contributed. (1 mark)
    b) Calculate how many artisan made the contribution. (6 marks)
    c) Calculate how much each contributed. (2 marks)

19. In the figure below AOC is a diameter, ADG and BCFG are straight lines, angle ACB=42^0, angle CAE=74^0 and angle DEC=36^0



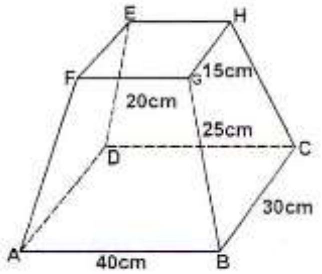
Find the following angles, giving reasons in each case.
    a) Angle CDE (2 marks)
    b) Angle BDC (2 marks)
    c) Angle DCA (2 marks)
    d) Reflex angle COE (2 marks)
    e) Angle DGF (2 marks)

20. a) Copy and complete the given table below to 2 decimal places. (2 marks)

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0
$Sin(x + 30^0)$	0.50	0.87			0.50		-0.50		-1.00	-0.87
$Cos\ (x - 15^0)$	0.97		0.71		-0.26	-0.71		-0.97	-0.71	

b) Using the same axes plot the curves y=Sin(x+30^0) and y=Cos (x-15) (5 marks)
   Taking 1 cm represented 30^0 and x-axis and 1cm represented 0.25cm on the y axis.
c) Using the graph state the amplitude of y=Cos (x-15^0) (1 mark)
d) Using the graph solve the equation: Sin (x+30^0)-Cos (x-15^0)=0 (2 marks)

21. The figure below shows a frustrum ABCDEFGH of a right pyramid where AB=40cm, BC=30cm, FG=20cm, GH=15cm and AF=BG=CH=DE=25cm.



Find the vertical height of the frustrum. (3 marks)

a) Find the angle between line BE and the base ABCD (2 marks)

b) Find the angle between the plane BCHG and the base ABCD. (2 marks)

c) Find the angle between the plane ADEF and the plane AGHD (3 marks)

22. a) Using a ruler and pair of compasses only construct a square ABCD of sides 6cm. (2 marks)

b) A point P moves inside the square such that;

i) $AP \leq PB$

ii) $Angle\ APB \geq 90^0$

iii) P is nearer to AD than AB. construction on the square in (a) show the region that P must lie by shading.

c) Find the area of the region where P must lie. (2 marks)

23. A ship leaves an Island A (600N, 450E) and sails due west for 120hours to another island B.The average speed of the ship is 27 knots.

a) Find the position of the island B (4 marks)

b) Another island C is south of island B and lies on latitude 550N. Find the distance between Islands B and C in nautical miles. (2 marks)

c) The ship leaves island B when the time at Island A is 12.30pm. On Monday and sailed to Island C. If the ship increases its speed by 20% between B and C find out the time of arrival at island C to the nearest minutes and the day. (4 marks)

24. a) Complete the table below for the equation $y = 2x^3 + 5x^2 - x - 6$

x	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
$y = 2x^3 + 5x^2 - x - 6$		-12		0		-2		-6		0		28

b) On the grid provided draw the graph $y = 2x^3 + 5x^2 - x - 6\ for - 3.5 \leq x \leq 2$. Use 2cm to represent 1 unit on the x-axis and 1cm to represent 5 units on the y-axis. (3 marks)

c) By drawing a suitable line use the graph in (b) to solve the equation. (5 marks)

$2x^3 + 5x^2 - 3x - 4 = 0$

KERICHO WEST JOINT EVALUATION
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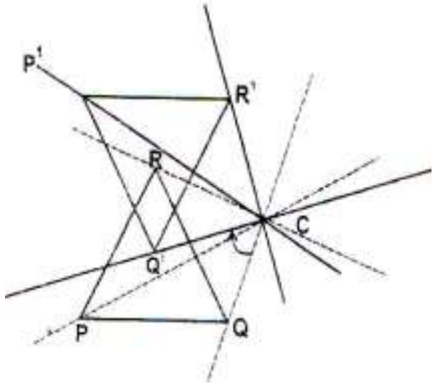
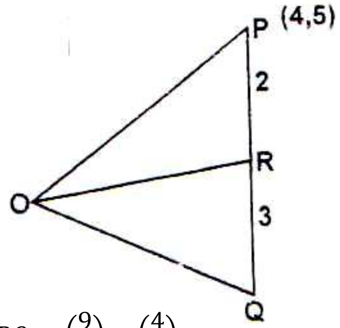
MATHEMATICS
PAPER 1
SECTION 1(50 MARKS)

1.	$\sqrt{\frac{625x256x2}{25x16x10x5}}$ $\sqrt{\frac{256}{16}}$ $\pm\frac{16}{4} = \pm 4$	M1 A1 2	6	Let ten shilling coins be t five shilling coins 2t One shilling coins $(21-3t)$ $(10xt)+(5+2t)+1(21-3t)=72$ $20t+21-3t=72$ $17t=51$ $t=3$	
2.	$\frac{3}{5}x+3y=6$ $3y=\frac{3}{5}x+6$ $y=\frac{1}{5}x+2$ $m=\frac{1}{5}$ Perpendicular line to the given line Gradient$=-5$ $\frac{y-1}{x-1}=-5$ $y-2=-5x+5$ $y=-5x+5+2$ $y=-5x+7$	B1 M1 A1 3	7	1Uk pound=Kshs 132.92 $\therefore 126{,}000 ponds = (126{,}000x132.92)$ $= Kshs\ 16{,}747{,}920$ $Spent = \left(\frac{4}{5} of\ 16{,}747{,}920\right)$ $= 13{,}398{,}336$ Balance Kshs 3,349,584 1 Us dollar =75.19 Ksh 75.19=1Us dollar $\therefore 3{,}349{,}584 = \frac{3{,}349{,}584x1}{75.19}$ =44548.26 =44548. US dollars.	
3.	$log_{10}7 = 0.8451$ $log_{10}6 = 0.7782$ $log_{10}(25.2) = log_{10}\left(\frac{6^2x7}{10}\right)$ $2log_{10}6 + log_{10}7 - log_{10}10$ $2(0.7782)+0.8451-1$ $1.5564+0.8451-1$ 1.4015	M1 M1 A1 3	8	$M=\frac{330}{10}=33$ $D=x-m$ $\frac{D}{D^2}\frac{2}{4}\frac{1}{1}\frac{-1}{1}\frac{0}{0}\frac{-5}{25}\frac{3}{9}\frac{-2}{4}\frac{-1}{1}\frac{-1}{1}\frac{4}{16}$ $\Sigma(x-m)^2=62$ $\therefore variance = Standard\ deviation$ $=\sqrt{6.2}$ =2.45	
4.	$90^0-(x-20)=2x+32$ Or $(x-20)+2x+32=90^0$ $3x-12=90$ $3x=120^0$ $x=34$ $\therefore Tan(x-4)^0$ $Tan(34-4)^0 = Tan\ 30$ =0.57735	M1 A1 B1 3	9	Q 200 140 50 To D To C 70 100 50 60 To B To A 40 20 P	
5.	$M_{large}=256$ $M_{small}=108$ $\frac{M_L}{M_S}=\frac{256}{108}=2$ $\therefore L.s.f = 2$ $(L.s.f)^2$=A.s.f $(2)^2=4$ $A.s.f=\frac{A_L}{A_s}$ $=\frac{A_L}{840}x\frac{4}{1}$ $A_L = Area\ of\ the\ large = 810x4$ $=3240cm^2$		10		

11.	 $PQ = \begin{pmatrix}9\\3\end{pmatrix} - \begin{pmatrix}4\\5\end{pmatrix}$ $= \begin{pmatrix}5\\-2\end{pmatrix}$ $PR = \frac{2}{5}\begin{pmatrix}5\\-2\end{pmatrix}$ $= \begin{pmatrix}2\\0.8\end{pmatrix}$ $\boldsymbol{PR = R - P}$ $\begin{pmatrix}2\\-0.8\end{pmatrix} = \begin{pmatrix}x\\y\end{pmatrix} - \begin{pmatrix}4\\5\end{pmatrix}$ $\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}2\\0.8\end{pmatrix} + \begin{pmatrix}4\\5\end{pmatrix}$ $= \begin{pmatrix}6\\4.2\end{pmatrix}$ $\boldsymbol{R(6, 4.2)}$)	M1 M1 A1 3
12	3 litres of water $=3000cm^3$ 12 litres of Ethanol$=12000cm^3$ $Density\ of\ water = 1g/cm^3$ $Density\ of\ Ethanol = 0.8g/cm^3$ $Density\ of\ mixture = \frac{Total\ mass}{Total\ value}$ $Mass\ of\ water = 3000x1g/cm^3$ $= 3000g$ $mass\ of\ Ethanol = 12{,}000x0.8g/cm$ =9600g $Density\ of\ mixture = \frac{3000 + 9600}{12000 + 3000}$ =0.84g/cm	B1 B1 A1 3
13	$\frac{12a^2 - 3b^2}{2a^2 - ab - b^2}$ Numerator: $3(4a^2 - b^2)$ $3\{(2a + b)(2a - b)\}$ Denominator $(2a + b)(2a - b)$ $\frac{3(2a - b)}{(a - b)}$	M1 M1 A1 3
14	$1.\dot{4}\dot{5} = \frac{48}{33}$ $0.\dot{5} = \frac{5}{9}$ $\frac{48}{33} - \frac{5}{9}$ $\frac{89}{99}$	**B1** **B1** **M1** **A1** **4**

<table>
<tr><td>15</td><td>$9^x x27^{x-1}$
$(3^2)^x x3^{3(x-1)} = 3^0$
$2x + 3x - 3 = 0$
$5x - 3 = 0$
$5x = 3$
$x = \frac{3}{5}$
$x = \frac{3}{5}\ or\ o.6$</td><td></td></tr>
<tr><td>16</td><td>
<table>
<tr><th>No</th><th>Log</th></tr>
<tr><td>849.6
2.41</td><td>2.9292
0.382</td></tr>
<tr><td>394.1</td><td>3.3112
2.5956
$0.7156x^1/_4$</td></tr>
<tr><td>1.51</td><td>0.1789
=1.5097</td></tr>
</table>
</td><td></td></tr>
<tr><td>17</td><td>a) $A\ B\ C\ \ A^1B^1C^1$
$\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}2 & 5 & 5\\1 & 4 & 1\end{pmatrix} = \begin{pmatrix}-2 & -5 & -5\\1 & 4 & 1\end{pmatrix}$
$2a + b = -2 \ldots\ldots..(i)$
$5a + 4b = 4 \ldots\ldots\ldots\ldots(ii)$
a=1
b=0
$2c + d = 1 \ldots\ldots\ldots..(i)$
$5c + 4d = 4 \ldots\ldots\ldots\ldots..(ii)$
c=0
d=1
$Matrix\ T = \begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$

b) $A^1B^1C^1 \qquad A^{11}\ B^{11}\ C^{11}$
$\begin{pmatrix}a & b\\c & d\end{pmatrix}\begin{pmatrix}-2 & -5 & -5\\1 & 4 & 1\end{pmatrix} = \begin{pmatrix}-2 & -5 & -5\\-1 & -4 & +1\end{pmatrix}$
$-2a + b = -2 \ldots\ldots\ldots(i)$
$-5a + 4b = -5 \ldots\ldots\ldots\ldots(ii)$
$-8a + 4b = -8$
$\underline{-5a + 4b = -5}$
$-3a \qquad = -3$
a= 1
b=0
$-2c + d = -1$
$-5c + 4d = -4$
c=0
d=-1

$\begin{pmatrix}a & b\\c & d\end{pmatrix} = \begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}$
$S = \begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}$
c) $TS = \begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}$
$= \begin{pmatrix}-1 & 0\\0 & -1\end{pmatrix}$</td><td></td></tr>
</table>

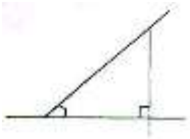
18

	x	f	fx
$5 \leq x < 15$	2.5	14	35
$5 \leq x < 15$	10	41	410
$5 \leq x < 15$			
$25 \leq x < 15$	20	59	1180
$45 \leq x < 60$	35	70	2450
	60	15	900
		f=199	$\Sigma fx = 4975$

$Mean\ \bar{X} = \frac{\Sigma fx}{\Sigma f} = \frac{4975}{199}$

$\frac{4975}{199} = 25$

19 a. i



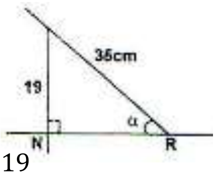
$Sin\theta = \frac{19}{28}$

$\theta = Sin^{-1}\ 0.6786$

$\theta = 42.73^0$

$\angle ASB = 85.46^0$

ii.



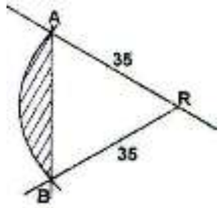
$Sin \propto = \frac{19}{35}$

$\propto = Sin^{-1}\ 0.5429$

$= 32.88^0$

$\angle ARB = 65.76^0$

b)

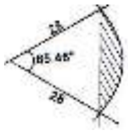


$Area\ shaded = \frac{65.76}{360} x \frac{22}{7} x35x35$

$- \frac{1}{2} x35x35sin65.76$

$= (703.27 - 558.50)cm^2$

$= 144.77cm^2$



$Area = \frac{85.46}{360} x \frac{22}{7} x28x28 - \frac{1}{2} x28x28Sin85.46^0$

$= 584.96 - 390.77$

$= 194.16cm^2$

$Total = 144.77 + 194.16$

$= 338.93cm^2$

20 a) i) **OB=ab**

$TB = {}^3/_4\, b$

$\therefore BT = -{}^3/_4\, b$

ii) $\boldsymbol{OR} = \boldsymbol{OA} + \boldsymbol{OT} = a + {}^2/_5\, AB$

$= a + {}^2/_5\,(b - a)$

$a - {}^2/_5\, a + {}^2/_5\, b$

${}^3/_5\, a + {}^2/_5\, b$

iii) $AT = AO + OT$

$-a + {}^3/_4\, b$

${}^3/_4\, b - a$

b) $OD = h\left\{a + {}^2/_5\,(-a + b)\right\}$

$= h\left(a - {}^2/_5\, a + {}^2/_5\, b\right)$

${}^3/_5\, ha + {}^2/_5\, hb$

$OD = OA + AD$

$a + k\left(\frac{3}{4} b - a\right)$

$a + \frac{3}{4} kb - ka$

$\frac{3}{5} ha = a - ka$

$\frac{3}{5} h = 1 - k \ldots\ldots\ldots\ldots\ldots.(i)$

$\frac{2}{5} hb = \frac{3}{4} kb$

$\frac{2}{5} h = \frac{3}{4} k \ldots\ldots\ldots.(ii)$

From (i) and (ii) $K = 1 - \frac{3}{5} h$

$\frac{2}{5} h = \frac{3}{4}\left(1 - \frac{3}{5} h\right)$

$\frac{2}{5} h = \frac{9}{20} h = \frac{3}{4}$

$\frac{17}{20} h = \frac{3}{4} = h = \frac{15}{17}$

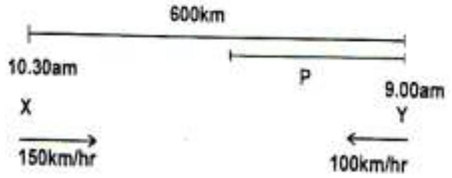
$k = 1 - \frac{3}{5}\left(\frac{15}{17}\right)$

$= 1 - \frac{9}{17}$

$k = \frac{8}{17}$

21

a)



b) Let the two meet at point C P Km from Y.
Time will be the same

$$9.00+\frac{P}{100}=10.30+\frac{600-P}{150}$$

$$\frac{P}{100}-\frac{600-P}{150}=10.30+\frac{600-P}{150}$$

$$\frac{3P-2(600-P)}{300}=\frac{3}{2}$$

P=330km

c) $9.00+\frac{330}{100}$ $\frac{33}{10}=3hrs$ $\frac{3}{10}x60$

9.00
3.18
12.18pm

$$=10.30+\frac{600-330}{150}$$

$$10.30+\frac{270}{150}$$

$$10.30+1.48=12.18\,pm$$

d) $\frac{600}{150}=1430hrs\ 2.30pm$

e) $But\ \frac{3}{2}x100=150$

$$\frac{x-150}{100}=\frac{x}{150}$$

$10x=15(x-150)$
$x=450$
$600-450=150km$

M1
M1
M1

A1

M1

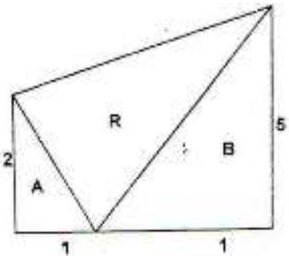
A1

M1

A1
10

22

a) $L1\ \ 4y=3x+11$
Inquality $4y\le 3x+11$
L2 $3y=-2x+4$
Inquality $3y\ge -2x+4$
L3 $y=5x-10$
$y=5x-10$

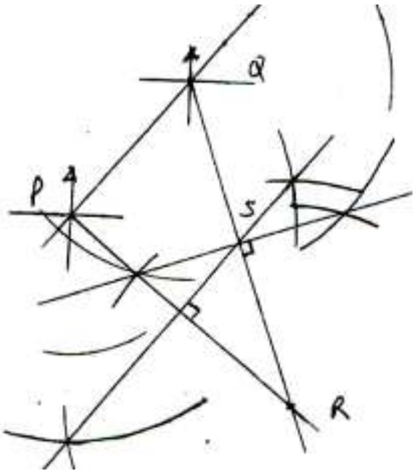


b) Area R= $\left(\frac{1}{2}x7x4\right)-\left\{\left(\frac{1}{2}x2x3\right)+\left(\frac{1}{2}+1x5\right)\right\}$

$=14-(3+2.5)$

$14-5.5=8.5\,units$

23



b)i) $129^0\pm 1^0$
ii) 6.5x20=130km

$$Time=\frac{130}{25}$$

$25.2hrs$

24

a) $x^3-9x=0$
$x(x^2-9)=0$
$x=0\ or\ x=\pm 3$

b)

X	-3	-2	-1	0	1	2	3
y	0	10	8	0	-8	-10	0

$$Area=\frac{1}{2}x1\{0+0+2(10+8+0+8+10)\}$$

$$\frac{1}{2}x2x36=36sq.units$$

c) $Area=\int_{-3}^{0}(x^3-9x)\,dx+\int_{0}^{3}(x^x-9x)\,dx$

$$=\left[\frac{1}{4}x4-\frac{9}{2}x^2+c\right]\begin{matrix}0\\-3\end{matrix}+\left[\frac{1}{4}x^4-\frac{9}{2}x^2+C\right]\begin{matrix}3\\0\end{matrix}$$

$=20.25+-20.25=40.5\ square\ units$

d) Error =40.5-36=45

$$\%Error=\frac{4.5}{40.5}x100$$

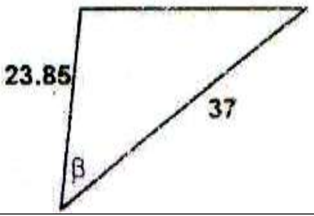
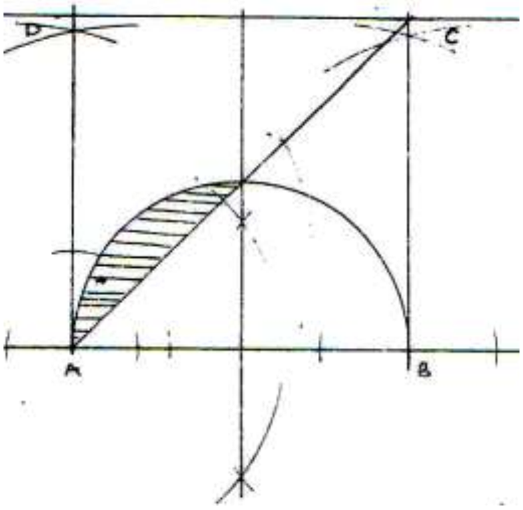
$=11\,{}^{1}/_{9}\,\%$

KERICHO WEST JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/2
MATHEMATICS
PAPER 2
SECTION 1(50 MARKS)

1.	$log\left(\frac{81x972}{11}\right)\ orlog_3\ 6561$ $log_3 3^8 = 8log_3 3 = 8x1$=8	
2	a) $V = aR + b\sqrt{R}$ $144 = 9a + 3b$ $272 = 16a + 4b$ $816 = 48a + 12b$ $576 = 36a + 12b$ $240 = 12a$ a=20 b=-12 $v = 20R = 12\sqrt{r}$ b) $V = 20(56.25) - 12\left(\sqrt{56.25}\right)$ =1035	
3	$E(n^2 - 1) = x(n^2 - x)$ $En^2 - E = xn^2 - x^2$ $En^2 - xn^2 = E - x^2$ $n^2(E - x) = (E - x^2)$ $n = \pm\sqrt{\frac{E - x^2}{E - x}}$	
4	$Cost\ \ price = \frac{100}{125}x119$ =92.50 $\frac{85xx120x102}{x + 120} = 92.50$ $\Rightarrow 85x + 12240 + 11424$ $10.2x = 816$ $x = 80kg$	
5	$10^2 = 10^2 + 16^2 - 2(10x6)Cos\ a$ $q = 36.87^0$ $a = 72.54^0$ $36.87 + 72.54$ =109.41 $= 109^0$	
6	$\frac{2000(1.15^n - 1)}{1.15 - 1} = 2028692$ $1.15^n - 1 = 152.1519$ $\log 1.15^n = \log 153.1519$ $n = \frac{36}{12}\ ,n = 3\ yrs.$	
7	$3(2i + j - 2k) - (-3i + 4j - k) + 2(-5i + 3j + 2k)$ $= -i + 5j - k$ $P = \sqrt{(-1)^2} + (5)^2 + (-1)^2$ $= 5.196152423, 5.20$	
8	$2\cos 3\theta = \sqrt{3} \Rightarrow \cos 3\theta = \frac{\sqrt{3}}{2}$ $3\theta = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$ $3\theta = 30^0, 330, 390$ $\theta = 10^0 110^0 130^0$	

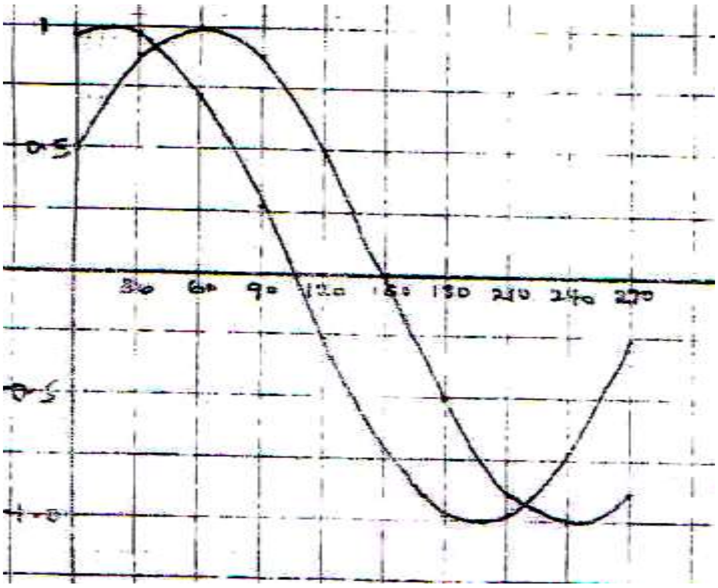
9	$\left(\frac{1}{2}x\frac{3}{8}x\frac{5}{7}\right) + \left(\frac{1}{2}x\frac{5}{8}x\frac{3}{7}\right) + \left(\frac{1}{2}x\frac{6}{8}x\frac{2}{7}\right) + \left(\frac{1}{2}x\frac{2}{8}x\frac{6}{7}\right)$ $\frac{15}{112} + \frac{15}{112} + \frac{12}{112} + \frac{12}{112}$ $= \frac{27}{56}$
10	$\frac{\frac{1}{2} - \frac{\sqrt{3}}{2}}{1 - \sqrt{3}}$ $\frac{\left(\frac{1}{2} - \frac{\sqrt{3}}{2}\right)(1 - \sqrt{3})}{(1 - \sqrt{3})(1 + \sqrt{3})}$ $\frac{\frac{1}{2} + \frac{\sqrt{3}}{2} - \frac{\sqrt{3}}{2} - \frac{3}{2}}{1 - 3}$ $\frac{\frac{1}{2} - \frac{3}{2}}{-2} = \frac{1}{2}$
11	a) $PT^2 = 9x4$ $PT = 6cm$ b) $Area\ of\ triangle = \frac{1}{2}x8x6 = 24cm$ $Area\ of\ the\ section = \frac{36.87}{360}x3.142x8x8$ $= 20.59476267$ $Required\ area = 24 - 20.59 = 3.41cm^2$
12	$a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$ $(2)^5 + 5(2)^4(-0.03) + 10(3)^3(-0.03)^2$ $32 - 2.4 + 0.072 = 29.672$
13	$Maximum\ numerator = 20 - 1.5$ $Minimum\ denominator = 10.5 + 1.5$ $\frac{20-1.5}{10.5+1.5} = 1.5416666667\ \ =1.542$
14	$\begin{pmatrix} P & 4 \\ 3 & 2 \end{pmatrix}\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} P + 12 & 2P + 16 \\ 9 & 14 \end{pmatrix}$ $(P + 12)14 - (2p + 16)9 = 0$ P=6
15	$\left(\frac{-6 + 2}{2}, \frac{-2 - 4}{2}\right) \Rightarrow (-2, -3)$ $Radius = \sqrt{-2 - -2^2 + (-4 - -3)^6 = \sqrt{17}}$ $(x + 2)^2 + (y + 3)^2 = \left(\sqrt{17}\right)^2$ $x^2 + 4x + 4 + y^2 + 6y + 9 - 17 = 0$ $x^2 + y^2 + 4x + 6y - 4 = 0$
16	$A = x(200 - 2x)$ $A = 200x - 2x^2$ $\frac{dA}{dx} = 200 - 4x = 0$ $x = 50, dimension\ is\ length = 100m, width = 50m$

17	i) $111000x48-36000000=Kshs\ 1{,}728{,}000$ ii) $\frac{Rx3,600,000x4}{100}=1{,}728{,}000$ $R=12\%$ b) $3{,}600{,}000\left(1+\frac{15}{100}\right)^4=Ksh\ 6296422.50=Kshs\ 6296400$ c) $3{,}600{,}000\left(1+\frac{15}{100}\right)^n=8327019$ $(1.15)^n=\frac{8327019}{3600000}$ $\log(1.15)^n=log\left(\frac{8327019}{3600000}\right)$ $n=\frac{log\left(\frac{8327019}{3600000}\right)}{\log 1.15}$ $n=6yrs$	
18	a) I) $\frac{12000}{n}\frac{14000}{n-5}$ b) $\frac{14000}{n-5}-\frac{12{,}000}{n}=100$ $14{,}000n-12{,}000n+60{,}000=100n(n-5)$ $2000n+6000=100n\ (n-s)$ $n^2-25n-600=0$ $(n-40)(n+15)=0$ $n=40\ or\ n=-15$ $\therefore n=40$, $No\ of\ artisan\ who\ contributed\ 40-5=35$ c) $\frac{14000}{35}=Shs\ 400$	
19	a) $\angle CDE=180-74=106^0$ *Opposite angles in a cyclic quadrilateral add to* 180^0 b) $\angle BDC=\angle BAC=90-42=48^0$ *Angles subtended by the same chord* (BC) *at the circumference in the same segment* c) $\angle DCA=90-36=54^0$ *They are complimentary angles, I.e complentary angles add to* 54^0 d) $\angle COE=360-2(74)=212^0$ *Angle subtended by a chord at the centre is twice the angle subtended by the same chord at the circumference in the same segments,* e) $\angle DGF=180-(36+138)=6^0$ *Angle of a triangle add to* 180^0	
21	$AC=\sqrt{40^2+30^2}$ $FH=\sqrt{20^{2-}15^2}$ $H=\sqrt{25^2-12.5^2}$ $H=21.65cm$ b) $tan\theta=\frac{21.65}{37.5}$ $\theta=29.83^0$ c) $tan\alpha=\frac{21.65}{10}\ or\ Sin\ \alpha=\frac{21.65}{23.85}$ $\alpha=65.21^0\quad \alpha=65.21^0$ d) $20^2=23.85^2+37^2-2(23.85x37)\cos\theta$ $\theta=29.39^0$	

	
22	 c) $\frac{90}{360}x3x3x\frac{22}{7}-\frac{1}{2}x3x3=2.561428571$
23	a) $Distance\ covered\ 120x27=3240nm$ $\theta x60\cos 60=3240$ $q=108^0$ $x+45=108, x=63^0$ $B(60^0N,63^0W)$ b) $5x60=300nm$ c) $Time\ difference\ between\ A\ and\ B$ $\frac{108x4}{60}=7hr\ 12\ minutes$ $12.30-7hrs\ 12\ minutes=5.18\ am$ $Time\ taken\ from\ B\ to\ C$ $\frac{300}{\frac{120}{100}x27}=9hrs\ 16\ mins$ $5.18+9hrs\ 16\ min=1434hrs\ or\ 2.34pm\ on\ Monday$

20

x^0	30^0	60^0	90^0	150^0	180^0	20	270
$\sin(x+30)^0$		1.00	0.87	0.00		-0.87	
$\cos(x-15)^0$	0.97		0.26		-0.97		0.26



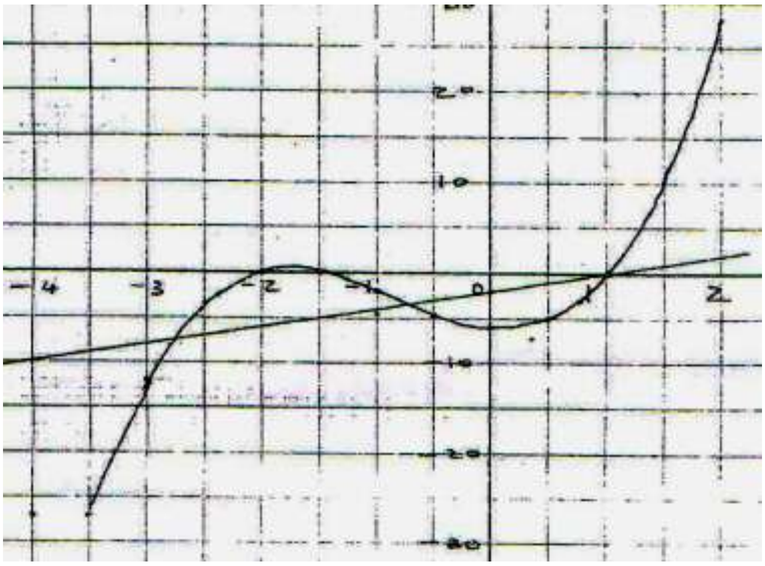
b) Amplitude is 1

c) $\sin(x+30^0)=\cos(x-15)$

$x=39^0\pm 1\ or x=219\pm 1$

24

X	-3.5	-2.5	-1.5	-0.5	0.5	1.5
y	-27	-3.5	0	-4.5	-5	10.5



a) $y=2x^3+5x^2-x-6$

$0=2x^3+5x^2-3x-4$

$y=2x-2$

$x=-2.75\ or-0.75\pm 0.05\ or\ x=1$

KAJIAD0 COUNTY JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/1
MATHEMATICS
PAPER 1
SECTION 1(50 MARKS)

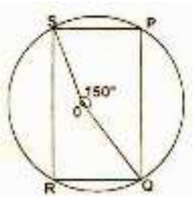
SECTION I: (50 MARKS)
Answer all the questions in this section

1. Without using mathematical tables or calculators evaluate: (3 Marks)
$\frac{\sqrt{1296}}{6+ -18 \div +(5- -3)}$
2. Use reciprocal and square tables to evaluate to 4 significant figures the expression: (3 Marks)
$\frac{1}{24.56} + 4.346^2$
3. Points A(2,7) and B(-4,3) are points on a straight line. Find the equation of the perpendicular bisector of the line AB. (4 Marks)
4. Using a ruler and a pair of compasses only, construct a trapezium ABCD with AB parallel to DC. AB = 10cm, BC = 5cm, CD = 4cm and angle ABC = 45^0. Drop a perpendicular from C to meet AB to O. Measure AD and the altitude of the trapezium. (4 Marks)
5. Simplify completely: (3 Marks)
$\frac{(x-3y)^2-(x+3y)^2}{4xy}$
6. A mobile phone seller gets a commission of Shs. 250 on every mobile phone that he sells. In a given month, he got 33,000 shillings.
(a) How many phones did he sell that month. (1 Mark)
(b) If this commission is 2%. What is the sale price of each mobile phone? (2 Marks)
7. Find the equation of the normal to the curve $y = x^2 + 3x$ at the point P where x = 1. (3 Marks)
8. A test is conducted for the purpose of employing a suitable typist with the following results.

Speed words per minute	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No. of candidates	2	4	8	10	12	3	1

Calculate the mean typing speed. (3 Marks)

9. PQRS is a cyclic quadrilateral and O is the centre of the circle. $\angle QOS = 150^0$



While giving reasons find:
(a) $\angle QPS$ (2 Marks)
(b) $\angle QRS$ (1Mark)

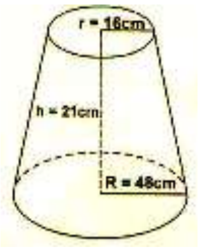
10. The angle subtended by the major arc at the centre of the circle O is twice the angle subtended by the minor arc at the centre. If the radius of the circle is 3.5cm, find the length of the minor arc. (Take $\pi = \frac{22}{7}$) (3 Marks)
11. The image of P(0,2) under an enlargement with the factor 3 is $P^1(4,6)$. Find the centre of enlargement. (3 Marks)
12. Given that x is an acute angle and sin x = $\frac{2\sqrt{5}}{\sqrt{5}}$, find without using tables or calculator tan (90 – x)0 leaving your answer in its simplest form. (3 Marks)
13. A regular polygon with 3x sides has interior angle 40^0 greater than the one with x sides. What is x? (3 Marks)
14. (a) Solve the following inequalities and hence illustrate your solution on a number line. (2 Marks)
$x - 12 \leq 4x - 15 < 13$
(b) List the integral values that satisfy the combined inequality above. (1Mark)

15. Determine the values of m for which the matrix below has no inverse (3 Marks)
$\begin{bmatrix} \frac{1}{3}m & m^2 \\ 3 & 1 \end{bmatrix}$
16. A quantity y is partly constant and partly varies as x^3. If y = 7 when x = 10 and y = $12\frac{3}{80}$ when x = 20, write an equation connecting y and x. (3 Marks)

SECTION II: (50 MARKS)

Answer only five questions in this section.

17. The figure below a frustum of a solid cone of base radius 48cm and top radius 16cm. The height of the frustum is 21cm. (Take $\pi = \frac{22}{7}$) calculate:



(a) The height of the solid cone. (2 Marks)
(b) The volume of the solid frustum. (3 Marks)
(c) The total surface area of the frustum. (5 Marks)

18. The following are masses of 25 people taken in a clinic.

20	35	29	45	60
66	56	29	48	37
59	64	24	28	32
35	45	48	52	55
54	55	36	39	35

(a) Using a class width of 8 and starting with the lowest mass of the people. Make a frequency distribution table for the data. (3 Marks)
(b) Calculate the median mass of the people. (3 Marks)
(c) On the grid provided, draw a histogram to represent the information. (4 Marks)

19. In triangle OAB, $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$ and P lies on AB such that AP:PB = 3 : 5.
(a) In terms of **a** and **b** the vectors.
(i) AB (1Mark)
(ii) AP (2 Marks)
(iii) BP (2 Marks)
(iv) OP (2 Marks)
(b) Point Q is on **OP** such that $\mathbf{AQ} = -\frac{5}{8}\mathbf{a} + \frac{9}{40}\mathbf{b}$ (3 Marks)
Find the ratio OQ:QP

20. (a) Draw the curve $y = x^2$, for $0 < x < 3$.
Take 2cm to represent 1 unit x-axis and 1cm to represent 1 unit on the y-axis. (5 Marks)
(b) Use the graph to estimate the area bounded by the curve $y = x^2$, the x-axis and the lines $x = 0$ and $x = 3$ using trapezia. (correct 3 d.p) (3 Marks)
(c) Given the actual areas as $9cm^2$ calculate the percentage error. (2 Marks)

21. Town A and B are 24km apart. Susan leaves town A at 10.00 a.m and cycles to town B at a steady speed if 12km/h. She rests for exactly one hour and then runs back to town A at 8km/h. Jane leaves town B at 11.45 a.m and rides straight to town A, where reaches 5 minutes after Susan.
(a) At what time did Susan leave town B. (2 Marks)
(b) At what time did Jane reach town A. (3 Marks)
(c) How fast did Jane ride? (2 Marks)
(d) At what time did Susan overtake Jane? (3 Marks)

22. In a bicycle rally, cyclists are to follow routes VWXY. W is 250km from V on a bearing of N75^{0}E from V. X is on a bearing of S70^{0}E from V and 275km from W. Y is 300km on a bearing of N40^{0}E from X. Using a scale of 1cm to represent 50km.
(a) Draw a diagram to show the relative positions of VWXY. (4 Marks)
(b) Determine the distance in km
(i) VX (1 Mark)
(ii) XY (1 Mark)
(iii) WY (1 Mark)
(c) (i) Determine the compass bearing of W from X (1 Mark)
(ii) The compass bearing of Y from W (1 Mark)
(iii) The compass bearing of X from Y (1 Mark)

23. AMREF Kenya decided to buy y bicycles for a total cost of 72,000 shillings. The seller agreed to offer a discount of 200 shillings per bicycle. AMFREF Kenya was able to buy 4 extra bicycles for the same amount of money.
(a) Write an expression in terms of y for the:
(i) original price of each bicycle (1 Mark)
(ii) price of each bicycle after the discount (1 Mark)
(b) Form an equation in y and hence determine the number of bicycles AMREF Kenya bought. (5 Marks)
(c) Calculate the discount offered to AMREF Kenya as percentage. (3 Marks)

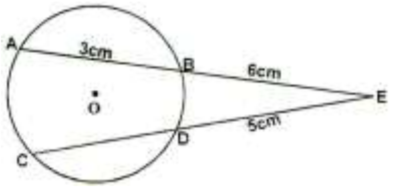
24. Given that the curve $y = x^3 - 3x^2$ find:
(a) The coordinate of the stationary points of the curve. (4 Marks)
(b) Sketch the curve $y = x^3 - 3x^2$ (6 Marks)

KAJIAD0 COUNTY JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/2
MATHEMATICS
PAPER 2
SECTION 1(50 MARKS)

SECTION I: (50 MARKS)

Answer all the questions in this section.

1. $\sqrt[3]{\frac{Log\ 6}{0.988\ x\ 9100}}$ (4 Marks)
2. The volume Vcm^3 of an object is given by V = $\frac{2}{3}\pi^3\left(\frac{1}{sc^2} - 2\right)$
   Express c in terms of π, r,s and v (3 Marks)
3. Simplify the express (3 Marks)
   $\frac{5}{\sqrt{7}-\sqrt{5}}$ - $\frac{7}{\sqrt{5}+\sqrt{7}}$
4. A boy whose eye level when standing is 1.6m stands infront of a storey building 30m tall. He observes the top of the building at an angle of elevation of $42^036'$. Find the distance between the boy and the building leaving your answer correct to 4 s.f. (3 Marks)
5. Solve for θ in the equation
   Sin $(2\theta - 10^0) = -0.5$ for $\theta \leq 0 \leq 360^0$ (2 Marks)
6. Simplify: $\frac{12^{\frac{1}{3}} \div 2^4}{32^{-\frac{1}{5}}}$ (2 Marks)
7. In the figure below, AB = 3cm, BE = 6cm and DE = 5cm. Find CD. (3 Marks)



8. Solve for x in $(Log_2x)^2 + Log_28 = Log_2x4$ (3 Marks)
9. A steel ball has radius of 15.33mm. Calculate the percentage error in its surface area correct to 2 s.f. (3 Marks)
10. Expand $\left(1 + \frac{x}{4}\right)^5$ up to the term x^3. Hence evaluate $(0.95)^5$ giving your answer to 4 significant figures. (4 Marks)
11. Each month for 30 months, Lemit deposited some money in a saving scheme. In the first month he deposited Sh. 500. Thereafter he increased his deposits by Sh. 50 every month. Calculate the:
    (a) last amount deposited by Lemit (2 Marks)
    (b) total amount Lemit had saved in the 30 months (2 Marks)
12. A pond holds 27000 litres of water. How many litres of water would a similar pond hold if its dimensions were double the first one?
13. Position vector of points A and B are a = i + 3j + 5k and b = ui – j + 2k respectively. Find the position vector of point R which divides AB in the ratio 4:-3 (3 Marks)
14. Juma, Peter and Jane shared KSh. 25,000 as follows: Juma and Peter in the ratio 1:2 and that of Peter to Jane in the ratio 4:1. How much did Peter get? (3 Marks)
15. A circle whose centre is (-2,5) has a diameter of 4 units. Find the equation of the circle in its expanded form.(3 Marks)
16. Two points on the surface of the earth are A (40^0N, 30^0W) and B (20^0S, 30^0W). Given that the radius of the earth is 6370km, determination the shortest distance between the two points. (Take $\pi = \frac{22}{7}$) (3 Marks)

SECTION II : (50 MARKS)

Answer only FIVE questions in this section.

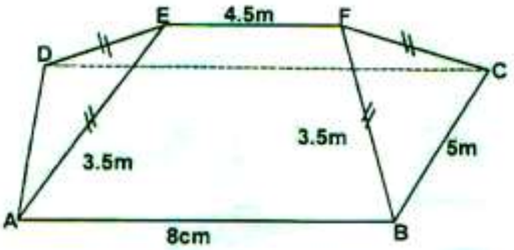
17. (a) Given A = $\begin{pmatrix}5 & 1\\2 & 2\end{pmatrix}$find A^{-1}
    (b) Omolo bought 5 bags of maize and 1 bag of beans for Sh. 14000. If Omolo bought 3 bags of maize less and twice the bags of beans, he would have saved two thousand shillings. If x represents the price of a bag of maize and y represents he price of a bag of beans.
    (i) Form matrix equation to represent the information above. (1 Mark)
    (ii) Find the price of a bag of maize and a bag of beans using equation (i) above. (4 Marks)
    (c) Find the distance of the point of intersection of the lines 5x + y = 14 and 2y + 2x = 12 from the point (11,-2) (3 Marks)
18. (a) Complete the table below giving your values correct to 1 decimal place $-180^0 \leq x360^0$. (2 Marks)

x	-180^0	-150^0	-90^0	-30^0	0^0	30^0	90^0	150^0	180^0	210^0	270^0	330^0	360^0
y = Sin x		-0.5		-0.5		0.5		0.5		-0.5			
y = -Sin x			2				-2				2		0

    (b) Using the grid provided, draw on the same axis the graphs of y = Sin x and y = -2Sin x (4 Marks)

(c) Use your graph in (b) above to solve the equation Sin x + 2 Sin x = 0 (2 Marks)
(d) What transformation maps y = sin x onto y = -2 Sin x in (b) above. (2 Marks)

19. The figure below shows a shape of a roof with horizontal rectangular ABCD. The ridge EF is also horizontal. The measurements of the roof are AB = 8cm, BC = 5cm, EF = 4.5cm and EA = ED = FB = FC = 3.5cm.



Calculate
(i) the length of the ridge EF above the base ABCD (4 Marks)
(ii) the angle between the face AED and the base ABCD (3 Marks)
(iii) the angle between the face ABFE and the base ABCD (3 Marks)

20. For an in-service course in Mathematics, at least four but not more than nine teachers are to be chosen. The ratio of the number of male teachers to the number of female must be less than 2:1 and there must be more males than females.
If x and y represent the number of male teachers and female respectively.
(a) Write down the inequalities which x and y must satisfy. (4 Marks)
(b) Plot the inequalities in (a) above in the grid provided.
(c) Use your graph in (b) above to find composition of the in-service group of:-
(i) the largest size (1 Mark)
(ii) the smallest size (1 Mark)

21. The table below shows month income tax rates for the year 2003

Monthly taxable income in KSh.	Tax rates %
1-9680	10
9681-18800	15
18801-27920	20
27921 – 37040	25
Over 37040	30

The PAYE of Ole Shege in 2003 was Sh. 5079. Ole Shege's earnings include a basic salary, house allowance of KSh. 120,000, a medical allowance of KSh. 2,880 and commuter allowance of KSH. 340. He was entitled to a monthly tax relief of KSh. 1056. Calculate:
(i) Ole Shege's gross tax (1 Mark)
(ii) his basic salary (6 Marks_
(iii) Ole Shege's net salary if he deducted the following amount from his payslip: (3 Marks)
- NHIF KSh. 320
- Cooperative loan KSh. 2050

22. A bag contains 7 red balls and 5 green balls. A ball is drawn at random three times.
(a) Calculate the probability of drawing three red balls if:
(i) the ball is replaced after each draw. (3 Marks)
(ii) the ball is not replaced after each draw (3 Marks)
(b) Calculate the probability of drawing at least two red balls when the ball is not replaced after each draw.
(4 Marks)

23. (a) The gradient function of a curve is given by $\frac{dy}{dx} = 2x^2 - 5$ (5 Marks)
Find the equation of the curve, given that y = 3 and x = 2
(c) The velocity, Vm/s of a moving particle after t seconds is given by $V = 2t^3 + t^2 - 1$. Find the exact distance covered by the particle in the interval $1 \leq t \leq 3$ (5 Marks)

24. Using ruler and a pair of compasses only, construct a triangle ABC such that $\angle ABC = 37\frac{1}{2}^0$, BC = 8cm and AC = 6cm. Locate a point X in the triangle ABC such that X is equidistant from A, B and C. Measure AX, AB and ∠AXC. (10 Marks)

KAJIAD0 COUNTY JOINT EVALUATION
kenya certificate of secondary education
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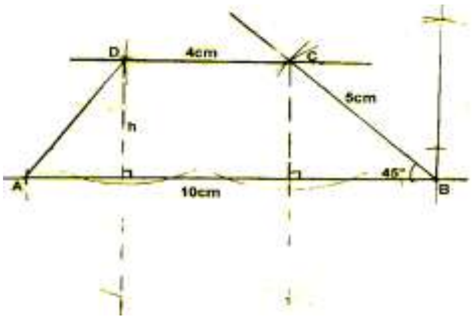
MATHEMATICS
SECTION 1(50 MARKS)

1. $\sqrt{1296} = \sqrt{2^4\ x\ 3^2\ x\ 3^2}$
$= 2^2$ x 3 x 3
$= 36$
$\frac{36}{6-18 \div 9+8} = \frac{36}{6-2+8} = \frac{36}{12} = 3$

2. $\frac{1}{24.56} = 0.04072$
$4.346^2 = 18.888$
$\frac{1}{24.56} = 4.346^2 = 18.93$

3. Midpoint of line AB
$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{2-4}{2}, \frac{7+3}{2}\right)$
(-1,5)
g_1 of AB $= \frac{\Delta y}{\Delta x} = \frac{7-3}{2--4} = \frac{4}{6} = \frac{2}{3}$
$g_2 = -\frac{3}{2}$
$\frac{y-5}{x+1} = \frac{-3}{2} \Rightarrow 2y - 10 = -3x - 3$
$2y = -3x + 7$

4. Length AD = 4.2cm
Altitude (h) = 3.5cm



5. $\frac{(x-3y)^2-(x+3y)^2}{4xy}$
$\frac{[x^2-6xy+9y^2][x^2+6xy+9y^2]}{4xy}$
$\frac{x^2-x^2-6xy-6xy+9y^2-9y^2}{4xy}$
$\frac{-12xy}{4xy} = -3$

6. (a) Let the number of mobile phones be x
250x = 3300 Sh.
$x = \frac{33000}{250} = 132$
x = 132 phones
(b) 2% = 250 sh , 1% $= \frac{250}{2}$
100% $= \frac{250}{2}$ x 100
Price of 1 mobile phone = 12,500 Sh.

7. y = x2 + 3x at x = 1
$y = (1)^2 + 3(1) = 4$
P(1,4)
$g = \frac{dy}{dx} = 2x + 3$
g2 for perpendicular line $= -\frac{1}{5}$
$\frac{y-4}{x-1} = -\frac{1}{5}$
5(y – 4) = -1(x-1)
5y – 20 = -x + 1
5y + x = 20 + 1
5y + x = 21

8.

Class	f	Midpoint x	fx
30-34	2	32	64
35-39	4	37	148
40-44	8	42	336
45-49	10	47	470
50-54	12	52	624
55-59	3	57	171
60-64	1	62	62
	Σf = 40		Σfx = 1875

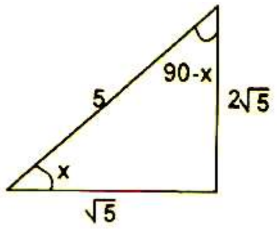
Mean $= \frac{\Sigma Fx}{\Sigma F}$
$= \frac{1875}{40} = 46.875$

9. (a) $\angle QPS = 1050$
Reflex $\angle SOQ = 210^0 \Rightarrow \angle QPS = \frac{1}{2}\angle SOQ$
(b) $\angle QRS = 750$
(Opposite∠s in a cycle quadrilateral are supplementary)

10. 2x + x = 360
$x = 120^0$
$\frac{120}{360}$ x $\frac{22}{7}$ x 2 x 3.5
$\frac{1}{3}$ x 22 x 2 x 0.5= 7.33cm

11. Let C.O.E be (x,y)
$\frac{4-x}{6-y} = 3\left(\frac{0-x}{2-y}\right)$
4 – x = -3x
x = -2
6 – y = 6 – 3y
-2y = 0   y = 0
∴ centre of enlargement = (-2,0)

12.



Adj $= \sqrt{5^2 - \left(2\sqrt{5}\right)^2}$
$= \sqrt{25 - 20}$
$= \sqrt{5}$
$\therefore (90 - x) = \frac{2\sqrt{5}}{\sqrt{5}} = \frac{1}{2}$

13. Sn = (2n – 4)90
$\frac{(2(3x)-4)90}{3x} = \frac{(2(x)-4)90}{x} + 40$
$\frac{(6x-4)90}{3x} = \frac{(2x-4)90}{x} + 40$
$\frac{540x-360}{3x} = \frac{180x-360+40x}{x}$
540x – 360 = 3(220x – 360)
540x – 360 = 660x – 1080
120x = 720
x = 6

14. x - 12≤ 4x – 15 < 13

-12 + 15 ≤ 4x – x   4x - 15< 13

$\frac{3}{3} < \frac{3x}{3}$ 4x<28

Combined inequality ⇒1≤ x < 7

1≤x<7

Integral values (1,2,3,4,5,5,6)

15. $\begin{pmatrix}\frac{1}{3}m & m^2\\ 3 & 1\end{pmatrix}$

$\frac{1}{3}$m – 3m² = 0

m($\frac{1}{3}$ - 3m) = 0

m = 0 $\left(\frac{1}{3} - 3m\right) = 0$

m = 0 $\frac{1}{3}$ = m

m = $\frac{1}{9}$

m = 0 and m = $\frac{1}{9}$

16. y α k + $\frac{1}{x^3}$

7 = k + $\frac{m}{100}$……………..(i)

1000k + m = 7000

$\frac{963}{80} = k + \frac{m}{8000}$

8000 x $\frac{963}{80}$ = 8000k + $\frac{m}{8000}$x 800

96300 = 8000k + m

$\underline{7000 = 1000k + m}$

89300 = 7000k

k = $\frac{893}{70}$ ∴from

m = 7000 – 1000k

= 7000 - 1000$\left(\frac{893}{70}\right)$

= $\frac{49000-89300}{7}$ m = $\frac{-40300}{7}$

∴equation connecting

y = $\frac{893}{70}$ - $\frac{40300}{7x^3}$

17. (a) $\frac{H}{h} = \frac{R}{r} \Rightarrow \frac{48}{16} = \frac{h+21}{h}$

48h = 16h + 336

32h = 336

h = 10.5cm

H = 10.5 + 21 = 31.5cm

(b) Volume of solid frustum

$\frac{1}{3}\pi R^2 H$ - $\frac{1}{3}\pi r^2$h

$\frac{1}{3}$x$\frac{22}{7}$ x 482 x 31.5 - $\frac{22}{7}$ x $\frac{1}{3}$x16² x 10.5

= 76,032 – 2816

(c) L = $\sqrt{48^2 - 31.5^2}$ = 36.22cm

l = $\sqrt{16^2 - 10.5^2}$ = 12.07cm

curved surface area

$\frac{22}{7}$ x 48 x 36.22 - $\frac{22}{7}$ x 16 x 12.07

= 4857.1cm^2

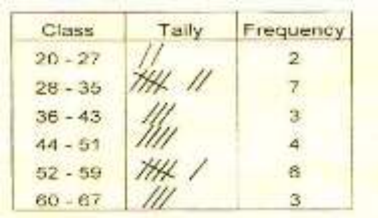
Area of top and bottom

$\frac{22}{7}$ x 48² + $\frac{22}{7}$ x 16² = 8045.71

Total surface area = 4857.1 + 8045.71

= 12902.cm²

18. (a)



Class	Tally	Frequency
20 - 27	//	2
28 - 35	~~////~~ //	7
36 - 43	///	3
44 - 51	////	4
52 - 59	~~////~~ /	8
60 - 67	///	3

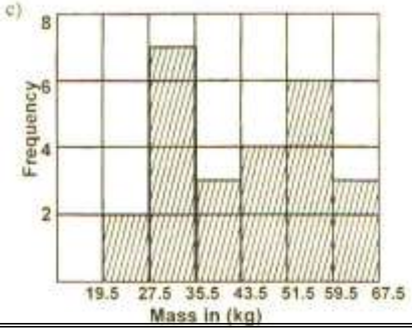
(b) Median = L + $\left(\frac{\frac{N}{2}-C}{f}\right)$i

= 44 + $\left(\frac{13-12}{4}\right)$

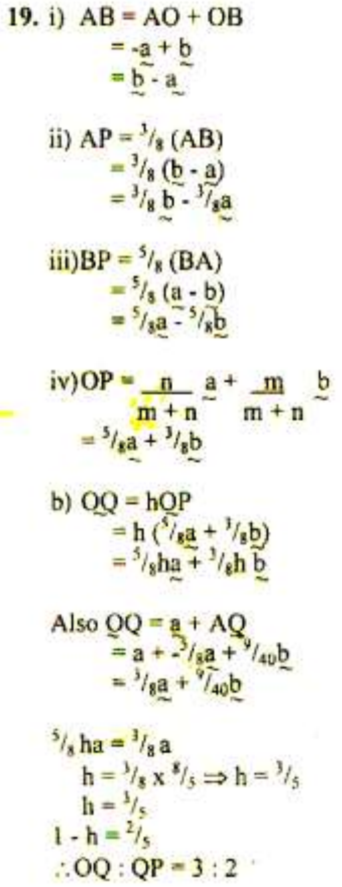
= 44 + $\left(\frac{1}{4} x\ 8\right)$

= 44 + 2

= 46



19



19. i) AB = AO + OB

= -$\underset{\sim}{a}$ + $\underset{\sim}{b}$

= $\underset{\sim}{b}$ - $\underset{\sim}{a}$

ii) AP = $^3/_8$ (AB)

= $^3/_8$ ($\underset{\sim}{b}$ - $\underset{\sim}{a}$)

= $^3/_8$ $\underset{\sim}{b}$ - $^3/_8\underset{\sim}{a}$

iii)BP = $^5/_8$ (BA)

= $^5/_8$ ($\underset{\sim}{a}$ - $\underset{\sim}{b}$)

= $^5/_8\underset{\sim}{a}$ - $^5/_8\underset{\sim}{b}$

iv)OP = $\frac{n}{m+n}\underset{\sim}{a} + \frac{m}{m+n}\underset{\sim}{b}$

= $^5/_8\underset{\sim}{a}$ + $^3/_8\underset{\sim}{b}$

b) $\underset{\sim}{OQ}$ = h$\underset{\sim}{OP}$

= h ($^5/_8\underset{\sim}{a}$ + $^3/_8\underset{\sim}{b}$)

= $^5/_8$h$\underset{\sim}{a}$ + $^3/_8$h $\underset{\sim}{b}$

Also $\underset{\sim}{OQ}$ = $\underset{\sim}{a}$ + $\underset{\sim}{AQ}$

= a + -$^3/_8\underset{\sim}{a}$ + $^9/_{40}\underset{\sim}{b}$

= $^3/_8\underset{\sim}{a}$ + $^9/_{40}\underset{\sim}{b}$

$^5/_8$ ha = $^3/_8$ a

h = $^3/_8$ x $^8/_5$ ⇒ h = $^3/_5$

h = $^3/_5$

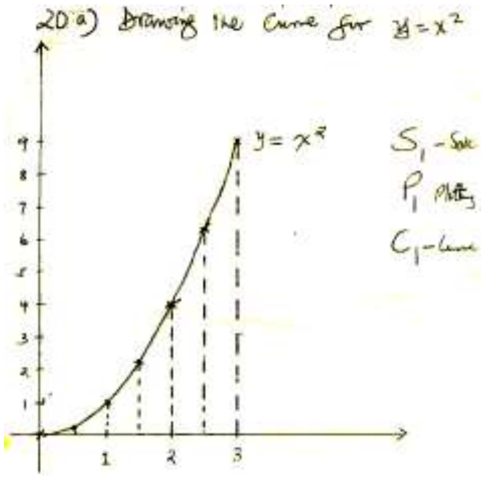
1 - h = $^2/_5$

∴OQ : QP = 3 : 2

20.

(a)

x	0	0.5	1.0	1.5	2.0	2.5	3.0
y	0	0.25	1	2.25	4	6.25	9.0



(b) Area $= 0.5[\frac{1}{2}(0 + 9) + 0.25 + 1 + 2.25 + 4 + 6.25]$

$= 0.5[4.5 + 13.75]$

$= 0.5[18.25]$

$= 9.25cm^2$ (3 d.p)

21

(a) Time taken by Susan from A to B

$\frac{24km}{12km/h} = 2$ hours

Departure time 10.00

3.00

13.00

=1.00 p.m

(b) Time taken by Susan to B

$\frac{24km}{8km/h} = 3$ hours

Arrival time for Susan = 13.00

3.00

1600

= 4.00 p.m

Arrival time for Jane = 16.05

11.45

4.20

Jane's speed $= \frac{24km}{4\frac{1}{3}}$

= 5.54km/h

Let Susan overtake Jane after X hours

$\frac{90}{13} + \frac{72x}{13} = 8x$

$\frac{90}{13} = 8x - \frac{72x}{13}$

$\frac{90}{13} = \frac{32}{13}x$

$x = \frac{90}{13} x \frac{13}{32}$

$= \frac{90}{32} = \frac{45}{16}$ hrs

= 2 hrs 49 min

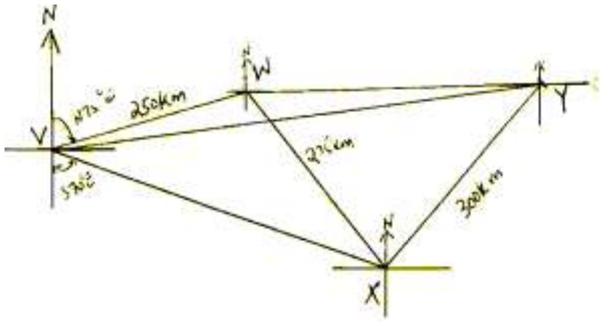
13.00

2.49

15.49

= 3.49 p.m

22



(b) (i) VX = 8.7 + 0.1

8.7 x 50 = 435km either value

8.8 x 50 = 440km

8.9 x 50 = 445km

(ii) VY = 12.2±0.1

12.1 X 50 = 605km

12.2 x 50 = 610km

12.3 x 50 = 615km

(iii) WY = 7.3 ±0.1

7.3 x 50 = 365km

7.4 x 50 = 370km

7.2 x 50 = 360km

(c) (i) Bearing of W from X

N390W±10

(ii) Bearing of Y from W $N88^0E\pm1^0$

(iii) Bearing of X from Y $S40^0W \pm1^0$

23

(a) (i) $\frac{(72000)}{y}$ shillings

$\left\{\left(\frac{72000}{y}\right) - 200\right\}$shillings

(b) $\left(\frac{72000-200}{y}\right)(y + 4) = 72000$

$\frac{72000y+288000-200y^2-800y}{y} = 72000$

72000y + 288000 – 200y2 – 800y = 72000y

$200y^2 + 800y - 288000 = 0$

$y^2 + 4y - 1440 = 0$

y(y – 36) + 40(y – 36) = 0

Either

y + 40 = 0 ⇒ y = - 40 ignore

or y – 36 = 0 ⇒ y = 36

∴ bicycles bought

36 + 4 = 40 bicycles

(c) Price before discount

$\frac{72000}{36} = 2000$

% disc $= \frac{200}{2000}$ x 100

= 10%

24

(a) $y = x^3 - 3x^2$

$\frac{dy}{dx} = 3x^2 - 6x = 0$

$3x^2 - 6x = 0$

$3x(x-2) = 0$

$3x = 0$ and $x - 2 = 0$

$x = 0$ and $x = 2$

Statutory points when $x = 0$

$y = (0)^3 - 3(0)^2 = 0$

(0,0)

Statutory point when $x = 2$

$y = 2^3 - 3(2)^2 = 0$

$= 8 - 12 = -4$

(2,-4)

(b) Sketching the curve $y = x^3 - 3x^2$

Nature of point (0, 0)

x	-1	0	1
$\frac{dy}{dx}$	9	0	-3

Maximum point

+ve/ - \-eve

alternatively by second derivative

$d^2y = 6x - 6$

dx2

so when $x = 0 \Rightarrow 6(0) - 6 = 0 - 6$

$\frac{d^2y}{dx^2} = -6 < 0$

hence it's a maximum point

Nature of point (2, -4)

x	1	2	3
$\frac{dy}{dx}$	-3	0	9

Minimum point

(b) Alternatively when $x = 2$ by second derivative

$\frac{d^2y}{dx^2} = 6x - 6 = 12 - 6 = 6$

$6 > 0$, hence the point is a minimum point

x intercept put $y = 0$

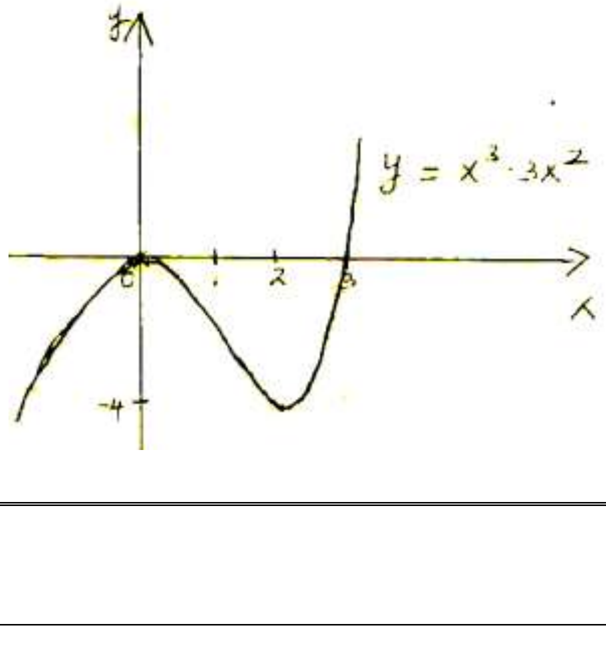
$x^3 - 3x^2 = 0$

$x = 0$ or $x = 3$

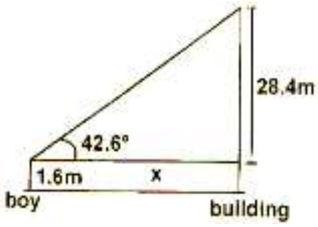
(0,0) and (3,0)

y – intercept $x = 0$

(0, 0)



KAJIAD0 COUNTY JOINT EVALUATION
KENYA CERTIFICATE OF SECONDARY EDUCATION
121/2
MATHEMATICS
PAPER 2
SECTION 1(50 MARKS)

1.	No. Log 0.7782 $\bar{1}.8911$ 0.988 $\underline{1}.9948$ 9100 $\underline{3.9590}$ + $\underline{3.9538}$ $\bar{5}.9373 \text{ x } \frac{1}{3}$ $\underline{6 + 1.9373}$ 3 4.424 x 10-2 $\bar{2}.6458$ = 0.04424
2.	$\frac{3V}{2\pi r^3} = \frac{1}{sc^2} - 2$ $\frac{3v}{2\pi r^3} + 2 = \frac{1}{sc^2}$ $\frac{1}{c^2} = \frac{3vs}{2\pi r^3} + 2s$ $c^2 = \frac{2\pi r^3}{3vs + \pi r^2 s}$ $C = \pm\sqrt{\frac{1}{5}\left(\frac{2\pi r^3}{3v+\pi r^3}\right)}$
3.	$\frac{5(\sqrt{5}+\sqrt{7})-7(\sqrt{7}-\sqrt{5})}{(\sqrt{7})^2-(\sqrt{5})^2}$ $\frac{5\sqrt{5}+5\sqrt{7}-7\sqrt{7}+7\sqrt{5}}{7-5}$ $\frac{5\sqrt{5}+7\sqrt{5}+7\sqrt{5}-7\sqrt{7}}{2}$ $= \frac{12\sqrt{5}-2\sqrt{7}}{2}$ $= 6\sqrt{5}-\sqrt{7}$
4.	$36^1 = 0.6^0$  Tan $42.6^0 = \frac{28.4}{x}$ $x = \frac{28.4}{0.9195}$ x = 30.88m
5.	Sin $(2\theta - 10^0) = -0.5$ Sin-1 (-0.5) = -300 Hence sin-1 (-0.5) = $210^0, 330^0, 570^0, 600^0$ 2θ = 2200, 3400, 5800, 700 $\theta = 110^0, 170^0, 290^0, 350^0$
6.	$\frac{(3^3)^{\frac{1}{3}} \div 2^4}{(2^5)^{-\frac{1}{5}}}$ $= \frac{3 \div 2^4}{2^{-1}}$ $= \frac{3}{16} \text{ x } 2 = \frac{3}{8}$
7.	Let CD = x 9 x 6 = (x + 5)5 i.e. AE. BE = CE. DE 54 = 5x + 25 $x = \frac{54-25}{5}$ x = 5.8
8.	$(\text{Log}_2 x)^2 + \text{Log}_2 8 = \text{Log}_2 x^4$ $(\text{Log}_2 x + \text{Log}_2 2^3 = \text{Log}_2 x^4$ $(\text{Log}_2 x)^2 - 4\text{Log}_2 x + 3\text{Log}_2 2 = 0$ Let $\text{Log}_2 x = y$ $y^2 - 4y + 3 = 0$ $(y - 1)(y - 3) = 0$ either y = 4 or y = 3 $\text{Log}_2 x = 1$ or $\text{Log}_2 x = 3$ x = 2 or x = 8
9	Surface area of sphere = $4pr^2$ Max area = $4 \text{ x } \frac{22}{7} \text{ x } (5.335)^2$ $= 2956.3\text{mm}^2$ Working area = $4 \text{ x } \frac{22}{7}\text{x}(15.33)^2$ $= 2954.4\text{mm}^2$ % error = $\frac{\max area - working\ area}{working\ area}$ x 100 $= \frac{2956.3-2954.4\ x\ 100}{2954.4}$ = 0.064% = 0.064%
10	$1 + \frac{5x}{4} + \ + \frac{10x^2}{16} + \frac{10x^3}{64}$………….. $1 + 1.25 + 0.625x^2 + 0.15625x^3$ $\left(1 + \frac{x}{4}\right)^5 = (1 - 0.05)^5$ $\frac{x}{4} = -0.05$ $x = -0.2$ Substituting $1 + 1.25\ (-0.2) + 0.625\ (-0.2)^2 + 0.15625(0.2)^3$ ….. 1 – 0.25 + 0.025 – 0.00125 …….. = 0.7738 4 s.f
11	(a) $T_{30} = a + (n - 1)d$ = 500 + (30 – 1) 50 = 500 + 29 x 50 = KSh. 1950.00 (b) Sn $= \frac{n}{2}\{2a + (n-1)\}$ $= \frac{30}{2}\{2(300) + (30-1)50\}$ = 15(1000 + 29 x 50) = 15(2450) = KSh. 36,750.00
12	L.S.F = 1:2 V.S.F = 1 : 8 Vol of water held by new tank = 27000 x 8 = 21600 litres
13	Using ratio theorem $-3\begin{pmatrix}1\\3\\5\end{pmatrix} + 4\begin{pmatrix}4\\-1\\2\end{pmatrix}$ $= \begin{pmatrix}-3\\-9\\-15\end{pmatrix} + \begin{pmatrix}16\\-4\\8\end{pmatrix} = \begin{pmatrix}13\\-13\\-7\end{pmatrix}$ $\therefore r = 13\underset{\sim}{i} = 13\underset{\sim}{j} = 7k$

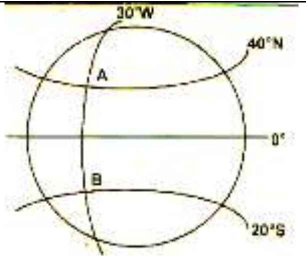
14

1 : 2) 4
4 : 1) 2
New ratio 4: 8 : 2
Juma : Peter : Jane
2 : 4 : 1
Peter's share $= \frac{8}{14}$ or $\frac{4}{7}$
$\frac{4}{7}$ x 25,000 = KSh. 14,285.70

15

$(x - -2)^2 + y - 5)^2 = 2^2$
$(x + 2)^2 + (y - 5)^2 = 2^2$
$x^2 + 4x + 4 + y^2 - 10y + 25 = 4$
$x^2 + y^2 + 4x - 10y + 25 = 0$

16



difference in latitude
$40^0 + 20^0 = 60^0$
distance between the towns are
$= \frac{\theta}{360}$ x $2\pi R$
$= \frac{60}{360}$ x 2 x $\frac{22}{7}$ x 6370 = 6673$\frac{1}{3}$km

17

(a) det = 5 + 2 – 2 x 1
= 10 – 2 = 8
$A^{-1} = \frac{1}{8}\begin{pmatrix} 2 & -1 \\ -2 & 5 \end{pmatrix}$
$= \begin{pmatrix} \frac{1}{4} & -\frac{1}{8} \\ -\frac{1}{4} & \frac{5}{8} \end{pmatrix}$

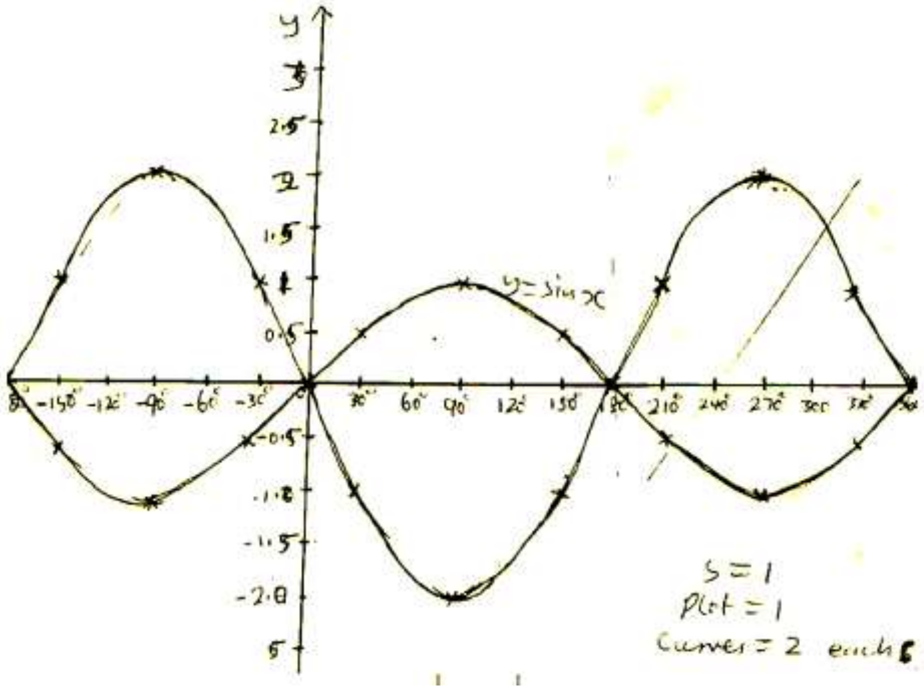
(b) (i) 5x + y = 14000
2x + 2y = 12000
$\begin{pmatrix} 5 & 1 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 14000 \\ 12000 \end{pmatrix}$
(ii) $\begin{pmatrix} \frac{1}{4} & -\frac{1}{8} \\ -\frac{1}{4} & \frac{5}{8} \end{pmatrix}\begin{pmatrix} 5 & 1 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{4} & -\frac{1}{8} \\ -\frac{1}{4} & \frac{5}{5} \end{pmatrix}$
$\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2000 \\ 4000 \end{pmatrix}$
$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2000 \\ 4000 \end{pmatrix}$
x = 2000, y = 4000
A bag of maize cost Sh. 2000
A bag of beans cost Sh. 4000

(c) $\begin{pmatrix} 5 & 1 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 14 \\ 12 \end{pmatrix}$
$\begin{pmatrix} \frac{1}{4} & -\frac{1}{8} \\ -\frac{1}{4} & \frac{5}{8} \end{pmatrix}\begin{pmatrix} 5 & 1 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{4} & -\frac{1}{8} \\ -\frac{1}{4} & \frac{5}{8} \end{pmatrix}\begin{pmatrix} 14 \\ 12 \end{pmatrix}$

(d) $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$
Point of intersection (2,4)
Distance $= \sqrt{(11-2)^2 + (-2-4)^2}$
$= \sqrt{9^2 + (-6)^2}$
$= \sqrt{91 + 36} = \sqrt{117}$
$= 10.81665 \cong 10.82$ mins

18

x	-180^0	-150^0	-90^0	-30^0	0^0	30^0	90^0	150^0	180^0	210^0	270^0	330^0	360^0
y = Sin x	0		-1		0		1		0		-1		0
y = -2Sin x	0	1		1	0	-1		-1	0	1		1	0



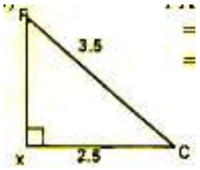
(c) x = 1800, 00, 1800
(d) Reflection on y = 0 followed by a stretch x-axis invariant scale factor 2

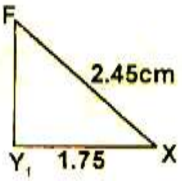
19

(i) $FX = \sqrt{3.5^2 - 2.5^2}$

$= \sqrt{12.5 - 6.25}$

$= 2.45cm$





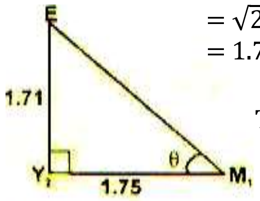
Height of ridge = $FY = \sqrt{2.45^2 - 1.75^2}$

$= \sqrt{6 - 3.06}$

$= \sqrt{2.94}$

$= 1.71cm$

(ii)

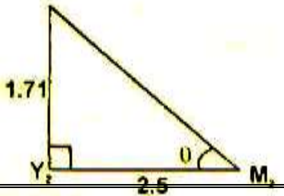


$\text{Tan } \theta = \frac{1.71}{1.75}$

$\text{Tan } \theta = 0.9771$

$\theta \cong 44.3^0$

iii)



$\text{Tan } \theta = \frac{1.71}{2.5}$

$\theta \cong 0.684$

$\theta = 34.37^0$

20.

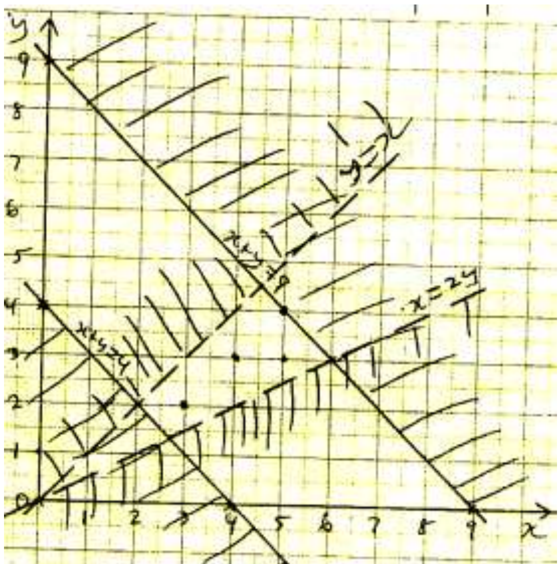
(a) (i) $x + y \geq 4$

(ii) $x + y \leq 9$

(iii) $x : y < 2 :1$

$\frac{x}{y} < \frac{2}{1}$ $x < 2y$

(iv) $x > y$



(c) (i) the largest size of group is (x + y) is 9. 5 males and 4 females

(ii) The smallest size of group (x + y) is 5. 3 males and 2 females

21

(i) Gross tax = Sh. (5079 + 1056)

= Sh. 6135

(ii) Tax in 1st slab = Sh. 9680 x $\frac{10}{100}$ = Sh. 968

Tax in 2nd slab = Sh. 9120 x $\frac{15}{100}$ = Sh. 1368

Tax in 3rd slab = Sh. 9120 x $\frac{20}{100}$ = Sh. $\underline{1824}$

4160

Tax in 4th slab = 6135 – 4160

= Sh. 1975

Let gross salary be x

$\therefore$ (x – 27920) x $\frac{25}{100}$ = 1975

x – 27920 = 1975 x $\frac{100}{25}$

x – 27920 = Sh. 7900

x = 7900 + 27920

= Sh. 35820

Basic salary = Sh. 35820 – 15220

(ii) Total deductions = Sh. 5079

320

$\underline{2050}$

Sh. 7449

Net salary = Sh. 35820

-$\underline{7449}$

Sh. 28371

Net salary = Sh. 35820

- 7449

Sh. 28371

22

(a) (i) P (RRR) = P (R) x P(R) x P(R) P(R) = $\frac{7}{12}$

$= \frac{7}{12} \times \frac{7}{12} \times \frac{7}{12}$

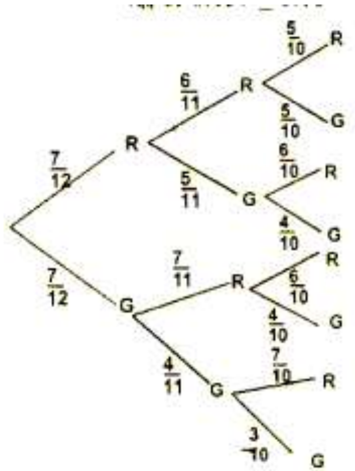
$= \frac{343}{1728}$ or $0.198 \cong 0.2$

(ii) P(RRR) = $\frac{7}{12} \times \frac{6}{11} \times \frac{5}{10}$

$= \frac{7}{2} \times \frac{7}{12} \times \frac{1}{2}$

$= \frac{7}{44}$ or $0.159 \cong 0.16$

(b)



P(2 red) = P(RRR) + P(RRG) + P(RGR) + P(GRR)

$= \frac{7}{12} \times \frac{6}{11} \times \frac{5}{10} + \frac{7}{12} \times \frac{5}{11} \times \frac{6}{10} + \frac{7}{12} \times \frac{6}{11} \times \frac{5}{1210} + \frac{5}{12} \times \frac{7}{11} \times \frac{6}{10}$

23

8. (a) $y = \frac{2x^3}{3} - 5x + c$

$\frac{2 x 2^3}{3} - 5 + 2 + c = 3$

$\frac{16}{3} - 10 + c = 3$

$c = 3 + 10 - \frac{16}{3}$

$c = 13 - 5\frac{1}{3}$

$c = 7\frac{2}{3}$

$c = \frac{23}{7}$

$\therefore y = 2x3 – 5x + \frac{23}{7}$

(b) $\int_1^3 (2t^3) + t^2 – 1)dt$

$\left[\frac{2t^4}{4} + \frac{t^3}{3} - t\right]\begin{matrix}3\\1\end{matrix}$

$\left[\frac{t^4}{2} + \frac{t^3}{3} - t\right]\begin{matrix}3\\1\end{matrix}$

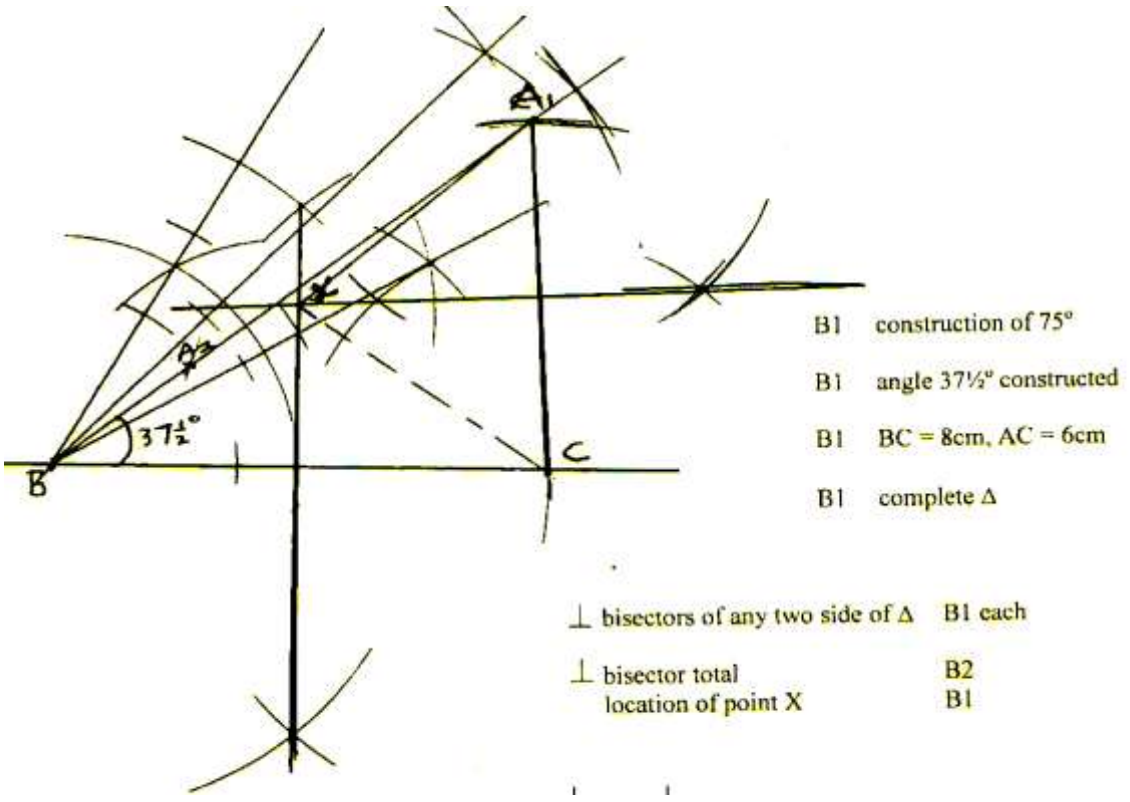
$\left(\frac{3^4}{2} + \frac{3^3}{3} - 3\right) - \left(\frac{1}{2} + \frac{1}{3} - 1\right)$

$(40.5 + 9 – 3) – (-\frac{1}{6})$

$40\frac{1}{2} - - \frac{1}{6}$

$42\frac{1}{2} + \frac{1}{6} = 46\frac{2}{3}$

24



B1 construction of 75°
B1 angle 37½° constructed
B1 BC = 8cm, AC = 6cm
B1 complete Δ

⊥ bisectors of any two side of Δ B1 each
⊥ bisector total B2
location of point X B1

AX = 4.9cm±0.1
AB = 9.7cm + 0.1
∠AXC = $76^0 + 1^0$

Note:

There are two possible points of A hence two possible x where AB = A, B = 9.7cm or AB = A_2B 28cm±0.1
Accept if A2 is hence different values of AX and ∠AXC (follow thro)

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MATHEMATICS
PAPER 1
TIME: 2 ½ HOURS

1. Evaluate: (3 mks)

$$\left(\frac{\left(1\frac{3}{7}-\frac{5}{8}\right)x\frac{2}{3}}{\frac{3}{4}+1\frac{5}{7}\div\frac{4}{7}of\ 2\frac{1}{3}}\right)^{-2}$$

2. Mr. Kamau son and daughter needed clothes. The son clothes were costing Ksh 324 while the daughter clothes were costing Ksh 220. Mr Kamau wanted to give them equal amounts of money. Calculate the least amount of money he would spend on the two and how many clothes each will buy. (3 mks)
3. Use reciprocal tables to find the value of $(0.325)^{-1}$ hence evaluate $\frac{\left(\sqrt[3]{0.000125}\right)}{0.325}$, give your answer to 4 s.f. (3 mks)
4. A type of paper is 40cm long, 32 cm wide and 0.8 mm thick. The paper costs sh 10 per m^2. Find the total cost of a pile of such paper of height 4.8m. (4 mks)
5. A square based brass plate is 2mm high and has a mass of 1.05kg. The density of the brass is 8.4 g/cm^3. Calculate the length of the plate in centimeter. (3 mks)
6. Solve for x in the equation: (3 mks)

$$\frac{x-3}{4}-\frac{x+3}{6}=\frac{x}{3}$$

7. A salesman earns 3% commission for selling a chair and 4% commission for selling a table. A chair fetches K£ 75. One time, he sold ten more chairs than tables and earned seven thousand, two hundred Kenya shillings as commission. Find the number of tables and chairs sold. (4 mks)
8. Using the three quadratic identities only factorise and simplify: (3 mks)

$$\frac{(x-y)^2-(x+y)^2}{(x^2+y^2)^2-(x^2-y^2)^2}$$

9. Two numbers are in the ratio 3: 5. When 4 is added to each the ratio becomes 2: 3. What are the numbers? (3 mks)
10. Given that Sin $(x + 4^0) = \text{Cos } (3x)^0$. Find tan $(x + 40^0)$ to 4 s.f. (3 mks)
11. In a regular polygon, the exterior angle is $^1/_3$ of its supplement. Find the number of sides of this polygon. (3 mks)
12. Find the area of a segment of a circle whose arc subtends an angle of 22 $½^0$ on the circumference of a circle, radius 10cm. (3 mks)
13. An airplane leaves point A (60^0S, 10^0W) and travels due East for a distance of 960 nautical miles to point B. determine the position of B and the time difference between points A and B. (3 mks)
14. Mr. Onyango's piece of land is in a form of triangle whose dimensions are 1200M, 1800M and 1500M respectively. Find the area of this land in ha. (Give your answer to the nearest whole number). (3 mks)
15. Two men each working for 8 hours a day can cultivate an acre of land in 4 days. How long would 6 men, each working 4 hours a day take to cultivate 4 acres? (3 mks)
16. Find the equation of a straight line which is perpendicular to the line 8x + 2y - 3 = 0 given that they intersect at y = 0 leaving your answer in a double intercept form. (3 mks)

SECTION B

17. (a) Use the mid-ordinate rule to estimate the area bounded by the curve $y = x + 3x^{-1}$, the x- axis, lines x = 1 and x = 6. (4 mks)
    (b) Find the exact area of the region in (a) above. (3 mks)
    (c) Calculate the percentage error in area when mid-ordinate rule is used. (3 mks)
18. A car whose initial value is Ksh 600,000 depreciates at a rate of 12% p.a. Determine:
    (a) Its value after 5 years. (4 mks)
    (b) Its value of depreciation after 5 years. (2 mks)
    (c) The number of year it will take for the value of the car to be Ksh 300,000 (3 mks)
19. A square whose vertices are P (1,1) Q (2,1) R(2,2) and S (1,2) is given an enlargement with centre at (0,0). Find the images of the vertices if the scale factors are: (3 mks)
    (i) -1
    (ii) ½
    (iii) 3
    (b) If the image of the vertices of the same square after enlargement are P^1 (1,1), Q^1 (5,1), R^1(5,5) and S^1 (1,5) find:
    (i) the centre of enlargement (2 mks)
    (ii) the scale factor of the enlargement (2 mks)

20. On the graph paper provided plot the point P (2,2) Q (2,5) and R (4,4).

(a) Join them to form a triangle PQR. (1 mark)
(b) Reflect the triangle PQR in the line X = 0 and label the image as $P^1 Q^1 R^1$. (2 marks)
(c) Triangle PQR is given a translation by vector. T $\begin{pmatrix}2\\2\end{pmatrix}$ to $P^{11} Q^{11} R^{11}$. Plot the triangle $P^{11} Q^{11} R^{11}$. (3 marks)
(d) Rotate triangle $P^{11} Q^{11} R^{11}$ about the origin through -90^0. State the coordinates of $P^{111} Q^{111} R^{111}$. (3 marks)
(e) Identify two pair of triangles that are direct congruence. (1 mark)

21. Three warships P, Q and R are at sea such that ship Q is 400 km on a bearing of N30^0 E from ship P. ship R is 750 km from ship Q and on a bearing of S60^0E from ship Q. an enemy warship is sighted 1000 km due south of ship Q.
(a) Use scale drawing to locate the position of ships P, Q, R and S. (4 mks)
(b) Find the compass bearing of: (2 mks)
  (i) Ship P from ship S
  (ii) Ship S from ship R
(c) Use scale drawing to determine: (2 mks)
  (i) The distance of S from P
  (ii) The distance of R from S
(d) Find the bearing of: (2 mks)
  (i) Q from R
  (ii) P from Q

22. The table below shows the amount in shillings of pocket money given to students in a particular school.

Pocket money (Kshs)	201 – 219	220 – 229	230 – 239	240 – 249	250 – 259	260 – 269	270 – 279	280 – 289	290 – 299
No. of students	5	13	23	32	26	20	15	12	4

(a) State the modal class. (1 mk)
(b) Calculate the mean amount of pocket money given to these students to the nearest shilling. (4 mks)
(c) Use the same axes to draw a histogram and a frequency polygon on the grid provided. (5 mks)

23. Given that points X (0,-2), Y (4, 2) and Z (x,6);
(a) Write down the column vector $\overrightarrow{XY}$. (1 mk)
(b) (i) Find $|\overrightarrow{XY}|$ leaving your answer in index form. (3 mks)
  (ii) Given that $|\overrightarrow{XZ}| = 11.3170$, find the coordinates of Z. (3 mks)
(c) Find the mid-point of the line YZ. (3 mks)

24. A bus and a matatu left Voi from Mombasa, 240 km away at 8.00 am. They travelled at 90 km/h and 120 km/h respectively. After 20 minutes the matatu had a puncture which took 30 minutes to mend. It then continued with the journey.
(a) How far from Voi did the catch up with the bus. (6 mks)
(b) At what time did the matatu catch up with the bus? (2 mks)
(c) At what time did the bud reach Mombasa? (2 mks)

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MATHEMATICS
PAPER 2
TIME: 2 ½ HOURS

1. Without using logarithm tables or calculator, solve $3^{2x+3} - 28\,(3^x) + 1 = 0$. (3 mks)
2. Use a mathematical table to evaluate: (3 mks)
$$\left(\frac{4.28\,x\,0.01677}{\tan 20}\right)^{\frac{1}{5}}$$
3. Simply and leave answer in surd form. (3 mks)
$$\frac{-9}{\sqrt{13}+\sqrt{3}} - \frac{5}{\sqrt{3}-\sqrt{13}}$$
4. The sides of triangles were measured and recorded as 8.4 cm, 10.5 cm and 15.3. Calculate the percentage error in perimeter correct to 2 d.p. (3 mks)
5. Simplify: (3 mks)
$$\frac{\log 16 + \log 81}{\log 8 + \log 27}$$
6. Simplify the expression: (4 mks)
$$\frac{(-36+9x^2)+(-6y+3xy)}{3x-6}$$
7. Given that $\frac{x\,(x^2-1)}{x+1}$, find ${}^{dy}/_{dx}$ at the point (2, 4). (3 mks)
8. (a) Expand and simplify the expression $\left(10 + \frac{2}{x}\right)^5$ (2 mks)
   (b) Use the expression in (a) above to find the value of 14^5. (1 mk)
9. John buys and sells rive in packets. He mixes 30 pockets of rive A costing sh 400 per packet with 50 packets of another kind of rive B costing sh 350 per packet. If he sells the mixture at a gain of 20%, at what price does he sell a pocket? (3 mks)
10. A chord of AB of length 13cm subtends an angle of 670 at the circumference of a circle centre O. find the radius of the circle. (3 mks)
11. Find the coordinates of the image of a point (5, -3) when its rotated through 180^0 about (3,1). (3 mks)
12. Two points P (-3,-4) and Q (2,5) are the points on a circle such that PQ is the diameter of the circle. Find the equation of the circle in the form $ax^2 + by^2 + cx + dy + e = 0$ where a, b, c and e are constants. (4 mks)
13. Two metal spheres of radius 2.3 cm and 2.86 cm are melted. The molten material is used to cast equal cylindrical slabs of radius 8 mm and length 70mm. If ${}^1/_{20}$ of the meal is lost during casting. Calculate the number of complete slabs cast. (3 mks)
14. A right pyramid has a rectangular base of 12 cm by 16cm. its slanting lengths are 26 cm. Determine:
   (a) The length of AC (1 mk)
   (b) The angle AV makes with the base ABCD. (2 mks)
15. Determine the inverse, T^{-1} of the matrix T $\begin{pmatrix} 4 & 6 \\ 6 & -2 \end{pmatrix}$ hence solve : (3 mks)
   2x + 3y = 30
   3x – y = 10
16. Use squares, square roots and tables to evaluate: (3 mks)
$$3.045^2 + (49.24)^{-1/2}$$

SECTION B

17. The table below shows the frequency distribution of diameter for 40 tins in millimeters.

Diameter (mm)	130 – 139	140 – 149	150 – 159	160 – 169	170 – 179	180 – 180
No of tins	1	3	7	13	10	6

Using a suitable working mean calculate:
(a) The actual mean for the grouped lengths. (4 mks)
(b) The standard deviation of the distribution. (6 mks)

18. A ${}^3/_2$ Bao yearly plan is a school pocket money (SPM) saving scheme requiring 12 months payments of a fixed amount of money on the same data each month. All savings earn interest at a rate of p% per complete calendar month.

Lewis Kamau decides to invest K£ 30 per month in this scheme as advised by Gumbo and Oteinde 4Q and 4P class governors a.k.a class secretaries and witnesses by very determined mathematics. Martine Mutua Mukumbu (M^3) and makes no withdrawals during the year.

(a) Show that after 12 compelete calendar months, Lewis first payment has increased in value to K£ 30 r^{12}, where $r = 1 + \frac{P}{100}$ (4 mks)

(b) Show that the total value, after 12 complete calendar months, of all 12 payments is K£ 30 $r = \frac{r(r^{12}-1)}{(r-1)}$ (3 mks)

(c) Hence calculate the total interest received during the 12 months when the monthly rate of interest is ½ per cent. (3 mks)

19. A mobile dealer sells phones of two types: Nokia and Motorola. The price of one nokia and one Motorola phone is Ksh 2000 and Ksh 16000 respectively. The dealers wishes to have al least fifty mobile phones. The number of Nokia phones should be at least the same as those of Motorola phones. He has Ksh 120,000 to spend on phones. If he purchases x Nokia phones and y Motorola phones;

(a) Write down all the inequalities to represent the above information. (3 mks)

(b) Represent the inequalities in part (a) above on the grid pro\vided. (4 mks)

(c) The profit on a nokia phone is Ksh 200 and that on a Motorola phone is Ksh 300. Find the number of phones of each type he should stock so as to maximize profit. (3mks)

20. The vertices of parallelogram are O (0,0), A (5,0) B (8,3) and C (3,3). Plot on the same axes:

(i) Parallelogram O'A'B'C', the image of OABC under reflection in the line x = 4 (4 mks)

(ii) Parallelogram O''A''B''C'' the image of O'A'B'C' under a transformation described by the matix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

Describe the transformation. (4 mks)

(iii) Parallelogram O'''A'''B'''C''' under the enlargement, centre (0,0) and scale factor ½ (2 mks)

21. A particle moving with acceleration a = (10 –t) m/s^2. When t = 1 velocity V = 2 m/s and when t = 0 displacement S = OM.

(a) Express displacement and velocity in terms of t.

(b) Calculate the velocity when t = 35

(c) What is the displacement when t = 5

(d) Calculate maximum velocity.

22. (a) Three quantities x, y and t were such that the square root of y varies directly as x and inversely as t. find the percentage change in t if x decreases in ratio 4 : 5 and y increases by 44%. (5 mks)

(b) If y varies as the square root of x and the sum of the vale of y when x = 4 and y = 100 is 2:

(i) Find y in terms of x (3 mks)

(ii) Find x correct to one d.p when y = 14 (2 mks)

23. Use a ruler and pair of compasses only in this question. ABC is a fixed triangle in which AB = AC = 6 cm and angle BAC = 90^0. Show clearly on a two dimensional drawing the locus of Q in each case below.

(b) When Q is equidistant from both lines CA and CB. (5 mks)

(c) When the area of triangle ABC = areas of triangle QBC. (5 mks)

24. Two fair dice are tossed once. The event A and B are defined as follows:

A: the score on the two dices are the same

B: at least one die shows a 4.

(a) Draw a probability space representing the tossing. (2 mks)

(b) Calculate:

(i) The probability of even A (1 mk)

(ii) The probability of even B (2 mks)

(iii) The probability of even A and B (2 mks)

(c) If the two dice are tossed three time

(i) Draw a tree diagram showing the event A happening for the three tosses. (1 mk)

(ii) Calculate the probability that A occurs:

(a) Exactly once (1 mk)

(b) At least once (2 mks)

(c) At most once (2 mks)

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MATHEMATICS
PAPER 1
TIME: 2 ½ HOURS

1.
$$\left(\frac{\frac{3}{4}+\frac{12}{7}\div\frac{4}{7}x\frac{7}{3}}{\left(\frac{10}{7}-\frac{5}{8}\right)x\frac{2}{3}}\right)^2$$
$$\left(\frac{\frac{3}{4}+7}{\frac{45}{56}x\frac{2}{3}}\right)^2=\left(\frac{31}{4}x\frac{28}{15}\right)^2=\left(\frac{217}{15}\right)^2$$
$$=\frac{47089}{225}=209\frac{64}{225}$$

2.

2	324	220
2	162	110
3	81	55
3	27	55
3	9	55
3	3	55
3	1	55
5	1	11
11	1	1

2^2 x 3^4 x 5 x 11
$\frac{17820}{324}$
= 55 clothes
$\frac{17820}{220}$
= 81 clothes

3.
$\frac{1}{3.25\ x\ 10^{-1}}$
= 0.3077 x 10^1
= 3.077 x $\sqrt[3]{125\ x\ 10^{-6}}$
= 3.077 x 5 x 10^{-3}
= $\frac{15.385}{1000}$ = 0.015385

4.
No. of papers in the pile = $\frac{4.8}{0.8\ x\ 10^{-3}}=\frac{4.8\ x\ 1000}{0.8}$
= 6000
Area of one paper = (0.4 x 0.32)m^2
Total area = 0.4 x 032 x 6000
Total cost = 768 x 10 = Sh. 7680

5.
Volume of brass = $\frac{1.05}{8.4\ x\ 1000}$ = 1.25 x 10-4m^3
= 125cm^3
x x x $\frac{2}{10}$ = 125
x^2 = 625
x = 25cm

6.
LCM = 12
3(x – 3) -2(x + 3) = 4x
3x – 9 – 2x – 6 = 4x
x – 15 = 4x
-3x = 15
x = -5

7.
Let the No. of chairs and tables sold be c and t respectively. Commissioned earned.
$\frac{3}{100}$ (600c) + $\frac{4}{100}$ (1500t) = 72000
3c + 10t = 1200
c – t = 10
3c + 10t = 1200
3c – 3t = 30

13t = 1170
t = 90
C = 10 + t
C = 10 + 90
= 100

8.

9.

10.
x + 40 + 3x = 90
4x = 50
x = 12.5
Tan (x + 40) = Tan 52.5
= 1.303225373 = 1.303 (4 s.f)

11.
Interior + exterior = 180
x + $\frac{1}{3}$x = 180
$\frac{4}{3}$x = 180
x = 45 x $\frac{3}{4}$ = 1350
Exterior = 45
No of sides = $\frac{360}{45}$= 8

12.
$\frac{45}{360}$ x πr^2 - $\frac{1}{2}$ x 10 x 10 Sin 45
= $\frac{45}{360}$ x $\frac{22}{7}$ x 100 – 50 sin 45
= 39.26990817 – 35.35533906
= 3.914569111

13.
Distance along a latitude = θ x 60 cos x
960 = θ x 60 cos60^0
θ = $\frac{960}{60\ Cos\ 60}$= 32
Longitude of B = 32 – 10
= 22^0
Position of B
(60^0S, 22^0E)
Time difference
= 32 x 4 = 128 min
= 2 hrs 8 min

14
S = $\frac{1200+1800+1500}{2}$
A=
$\sqrt{2250(2250-1200)(2250-1800)(2250-1500)}$
= $\sqrt{7.9734\ x10^{11}}$
= $\frac{892941.0675m^2}{10000}$
= 89.29410675
≅ 89 ha

15.

Men	hrs	Acres	Days
2	8	1	4
6	4	4	?

$\frac{2}{6}$ x $\frac{8}{4}$ x $\frac{4}{1}$ x 4 = $\frac{32}{3}$ = 10$\frac{2}{3}$ days

16

16.

$2y = -8x + 3$

$y = -4x + \frac{3}{2}$

$m_2 = \frac{1}{4}$

when $y = 0$

$8x = 3$

$x = \frac{3}{8}$

$\frac{y-0}{x-\frac{3}{8}} = \frac{1}{4}$

$y = \frac{1}{4}(x-\frac{3}{8})$

$y = \frac{1}{4}x - \frac{3}{32}$

$\frac{1}{4}x - y = \frac{3}{32}$

$\frac{8}{3}x - \frac{32}{3}y = 1$

$\frac{x}{\frac{3}{8}} + \frac{y}{-\frac{3}{32}} = 1$

17.

(a)

x	1.5	2.5	3.5	4.5	5.5
y	3.5	3.7	4.36	5.167	6.045

A = 1(3.5 + 3.7 + 4.36+5.167+6.045)

= 1(22.772)

=22.772 units

(b) $\int_1^6 (x + 3x^{-1})dx$

$\left[\frac{x^2}{2}\right]_1^6 = \frac{6^2}{2} - \frac{1^2}{2} = 17$ units

(c) % error = $\frac{17.5-22.772}{17.5} \times 100$

= 30.1257%

18.

(a) $A = P\left(1 - \frac{r}{100}\right)^n$

$= 600{,}000\left(1 - \frac{12}{100}\right)^5$

$= 600{,}000(0.88)^5$

= 600,000(0.5277)

= KSh. 316,620

(b) KSh. (600,000 – 316620)

= KSh. 283380

(c) $300{,}000 = 600{,}000\left(1 - \frac{12}{100}\right)^n$

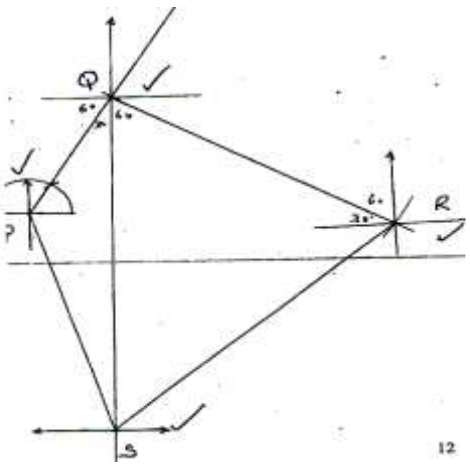
$0.5 = 088^n$

Log0.5 = nlog0.88

$n = \frac{Log\ 0.5}{Log 0.88}$

= 5.422 years

21



(b) (i) N15°W

(ii) S50°W

(c) (i) 6.8cm x 100 = 680km±10km

(ii) 8.8cm x 100 = 880km±10km

(d) (i) 300° or N60°W

(ii) 210° or S30°W 1cm represents 100km

22

(a) 240-249

(b) $\frac{\Sigma fx}{\Sigma f} = \frac{37802.5}{150} = 252.02$

≃ 252

23

(a) $\overrightarrow{XY} = Y - X \begin{pmatrix}4\\2\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}4\\4\end{pmatrix}$

(b) (i) $|\overrightarrow{XY}| = \sqrt{4^2 + 4^2}$

$= \sqrt{32}$

= 5.656854249

(ii) $\overrightarrow{XZ} = Z - X$

$\begin{pmatrix}x\\6\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}x\\8\end{pmatrix}$

$\sqrt{x^2 + 64} = 11.3170$

$x^2 + 64 = (11.3170)^2$

$x^2 = 128.074489 - 64$

$x^2 = 64.074489$

x = 8.0046

z(8,6)

24

(a) Bus travelled a distance of $\frac{20}{60} \times 90 = 30$ km

After 30 min

$\frac{30}{60} x\ 90 = 45$km

Total distance by bus

30 + 45 = 75km

Matatu = 120 x $\frac{20}{60}$ = 40km

Distance between the two

75 – 40 = 35km

Relative speed = 120.90

= 30km/h

Time to catch up

$\Rightarrow \frac{35}{30} = \frac{7}{6}$

Distance from Voi $\Rightarrow 40 + (\frac{7}{6}x120) = 180$km

(b) 20 + 30 + 1 hr 10 min = 2hrs

8.00 + 2hrs = 10.00 a.m

(c) Time taken by bus = $\frac{240}{90}$ = 2 hrs 40 min

Arrival time = 8.00 + 2 hrs 40 min

= 10.40 a.m

SUNSHINE
kenya certificate of secondary education (k.c.s.e.)
MATHEMATICS
PAPER 2
TIME: 2 ½ HOURS

4.
Max perimeter $= 8.45 + 10.55 + 15.35$
$= 34.35$cm
Min perimeter $= 8.35 + 10.45 + 15.25$
Absolute error in perimeter
$= \frac{34.35 - 34.05}{2} = 0.15$
% error $= \frac{0.15}{34.2}$ x 100
$= 0.438596491$
$= 0.44$

5.
$\frac{Log_2{}^4 + Log_3{}^4}{Log_2{}^3 + Log_3{}^3} = \frac{4(Log_2 + Log_3)}{3(Log_2 + Log_3)} = \frac{4}{3}$

6.
$$\frac{(9x^2 - 36)(3xy - 6y)}{3x - 6}$$
$\frac{(3x+6)(3x-6)+y(3x-6)}{3x-6}$
$\frac{(3x\mp 6+y)(3x-6)}{(3x-6)} = 3x + 6 + y$

7.
$y = \frac{x(x-1)(x+1)}{(x+1)}$
$y = x^2 - x$
$\frac{dy}{dx} = 2x - 1$

8.
$10^5, 10^4.\frac{2}{x}, 103.\frac{4}{x^2}, 10^2.\frac{8}{x^3}, 10.\frac{16}{x^4}, \frac{32}{x^5}$
$10000 + \frac{100000}{x} + \frac{40000}{x^2} + \frac{8000}{x^3} + \frac{800}{x^4} + \frac{32}{x^5}$
$\left(10 + \frac{2}{x}\right)^5 = 14^5$
$10 + \frac{2}{x} = 14$
$\frac{2}{x} = 4 \quad x = \frac{1}{2}$

9.
Cost of type A = 30 x 400 = 12000
Cost of type B = 50 x 350 = 17500
Total cost of the packets = 29500
Average cost of one packet $\frac{29500}{80}$
Selling price @ 20% gain
$\frac{120}{100}$ x $\frac{29500}{80}$ = Sh. 44250 per packet

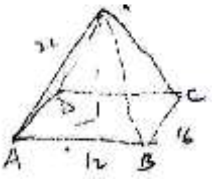
10.
$\frac{13}{Sin\ 67} = 2R$
$\frac{13}{0.9205} = 2R$
R = 7.06135

11.
A rotation of 1800 about (h,k)
maps a point (a,b) on to the point
(2h –a, 2k – h)
Hence (2 x 4 – 5, 2 x 1 – (-3)
1,5)

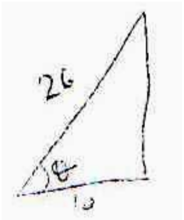
12.
$M(-\frac{3+2}{2}, -\frac{4+5}{2}) = (-\frac{1}{2}, \frac{1}{2})$
PQ = Q – P
$PQ = Q - P = \binom{5}{2} - \binom{-4}{-3} = \binom{9}{5} = \sqrt{9^2 - 5^2} = \sqrt{10}$
$\left(\tilde{x} + \frac{1}{2}\right)^2 + \left(y - \frac{1}{2}\right)^2 = \frac{106}{4}$
$4x^2 + 4y + 4x - 4y + 2 = 106$
$4x^2 + 4y2 + 4x - 4y - 104 = 0$
$2x^2 + 2y^2 + 2x - 2y - 52 = 0$
$x^2 + y^2 + x - y - 26 = 0$
$x^2 + y^2 + x - y - 26$

13
Volume of the two spheres $= \frac{4}{3}$ x $\frac{22}{7}\ x\ (2.3^5 x\ 3.80^3)$
$= 291.99$
Remaining material $= \frac{19}{20}\ x\ 291.99 = 277.297$
No. of slabs $= \frac{277.297}{\frac{22}{7}\ x\ 0.8^2 x\ 7} = 19.6943892$
$= 19$

14
(a) $AC = \sqrt{12^2 + 16^2} = 20$cm



(b) $\text{Cos}\ \theta = \frac{10}{26}$
$\theta = 67.38^0$



15
$T^{-1} = (-8 - 36) = -44$
$-\frac{1}{44}\begin{pmatrix}-2 & -6\\ -6 & 4\end{pmatrix} = \begin{pmatrix}\frac{2}{44} & \frac{6}{44}\\ \frac{6}{44} & -\frac{4}{44}\end{pmatrix} = \begin{pmatrix}\frac{1}{22} & \frac{3}{22}\\ \frac{3}{22} & -\frac{1}{11}\end{pmatrix}$
$4x + 6y = 50$
$6x - 2y = 20$
$\begin{pmatrix}4 & 6\\ 6 & -2\end{pmatrix}\binom{x}{y} = \binom{60}{20}\begin{pmatrix}5\frac{5}{11}\\ 6\frac{4}{11}\end{pmatrix}$
$\binom{x}{y} = \begin{pmatrix}\frac{1}{22} & \frac{3}{22}\\ \frac{3}{22} & -\frac{1}{11}\end{pmatrix}\binom{60}{20}$
$X = 5\frac{5}{11} \quad y = 6\frac{4}{11}$

16
$3.0452 + \frac{1}{\sqrt{49.24}}$
$3.0452 = 9.272$
$\frac{1}{\sqrt{49.24}} = \frac{1}{7.0171}$
$9.272 + \frac{1}{7.0711}$
$9.272 + 0.14225 = 9.3595$

17

x	f	x – A	d^2	fd	fd^2
134.5	1	-20	400	-20	400
144.5	3	-10	100	-30	300
154.5	7	0	0	0	0
164.5	13	10	100	130	1300
174.5	10	20	400	200	4000
184.5	6	30	900	180	5400

$\bar{x} = A + \frac{\Sigma fd}{\Sigma f}$
$= 154.5 + \frac{460}{40} \quad = 166$
(b) $S.D = \sqrt{\frac{\Sigma fd^2}{\Sigma ef}} - \left(\frac{\sum fd}{\Sigma f}\right)^2$
$= \sqrt{\frac{11400}{40} - 132.25}$
$= \sqrt{285 - 132.25}$
$= \sqrt{152.75} = 12.35$

18

(a) After 1month, the initial payment of K£30 has a volume of K£30 + K£30 x $\frac{P}{100}$

= K£30 (1 + $\frac{P}{100}$)

K£30r

After 12 months = K£30r^{12}

(b) Total value of all 12 payments

= K£(20r12 + 30r^{11} + 30r^{10} + ……. + 30r

Hence Sn = $\frac{(r^n - 1)}{r-1}$

$$\frac{30r(r^{12} - r)}{r - 1}$$

(c) r = 1 + $\frac{P}{100}$

P = $\frac{1}{2}$

So r = 1 + $\frac{0.5}{100}$

S$_{12}$ = $\frac{30(1.005)(1.005^{12} - 1)}{1.005-1}$ = K£371.92

19

(a) 2000x + 600y ≤ 120,000

20x + 16y ≤ 1200

5x + 4y ≤ 300 ………… (i)

x – y ≥ 50………………(ii)

x≥y……………………...(iii)

y >0

(b) 5x + 4y ≤ 300

x	0	60
y	75	0

x	0	60
y	75	0

(c) P = 200x + 300y

(20,25)

P = 200(24) + 200(25) = 12300

P = 200x + 300y

(33,34)

P = 200(33) + 300(34) = 16800

Nokia = 33

Motorola = 34

20

(ii)

Rotation → Positive q leaves turn about origin

$$\begin{array}{cc} I & J \\ \end{array} \quad \begin{array}{cc} I^1 & J^1 \\ \end{array}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \rightarrow \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

(iii) O^{III} (0,4)

A^{III}(0,1.5)

B^{III}(-1.5,0)

C^{III}(-1.5,2.5)

21

(e) a = $\frac{dv}{dt}$

$\frac{dv}{dt}$ = 10 – t

v = 10t – $\frac{t^2}{2}$ + c

c = - 7$\frac{1}{2}$

v = 10t – $\frac{t^2}{2}$ – 7$\frac{1}{2}$

v = $\frac{ds}{dt}$ = 10t - $\frac{t^2}{2}$ - 7½

s = 5t2 – $\frac{t^3}{6}$ - 7.5t + c

when t = 0 s = 0 then c = 0

s = 5t2 – $\frac{t^3}{6}$ – 7.5t

(b) v = 10t - $\frac{t^2}{2}$-7.5 t = 35

350 – 612 – 7.5 = -270m/s

(c) s = 5(5) – $\frac{1}{6}x125 - 37.5 = 66\frac{2}{3}$m

(d) Max vel is when $\frac{dv}{dt} = 0$

a = 10 – t

t = 10

V = 10 x 10 – $\frac{100}{2}$ - 7.5 = 42.5m/s

22

(a) $\sqrt{y} = \frac{kx}{t}$

$t = \frac{kx}{\sqrt{y}}$

$$t = \frac{k0.8x}{\sqrt{1.44y}}$$

$$\frac{\frac{0.8kx}{\sqrt{1.44y}} - \frac{kx}{\sqrt{y}}}{\frac{kx}{\sqrt{y}}}$$

$$\frac{\frac{kx}{\sqrt{y}} - \frac{0.8kx}{\sqrt{1.44}} \; x\ 100}{\frac{kx}{\sqrt{y}}}$$

= 33.33%

Increase

(b) (i) y α $\sqrt{x}$

y = kx

100 = 2k

k = 50

(ii) y = 50$\sqrt{x}$

14 = 50$\sqrt{x}$

$\sqrt{x} = \frac{14}{50}$

$\sqrt{x}$ = 0.28

x = (0.28)^2

= 0.0784

= 0.1

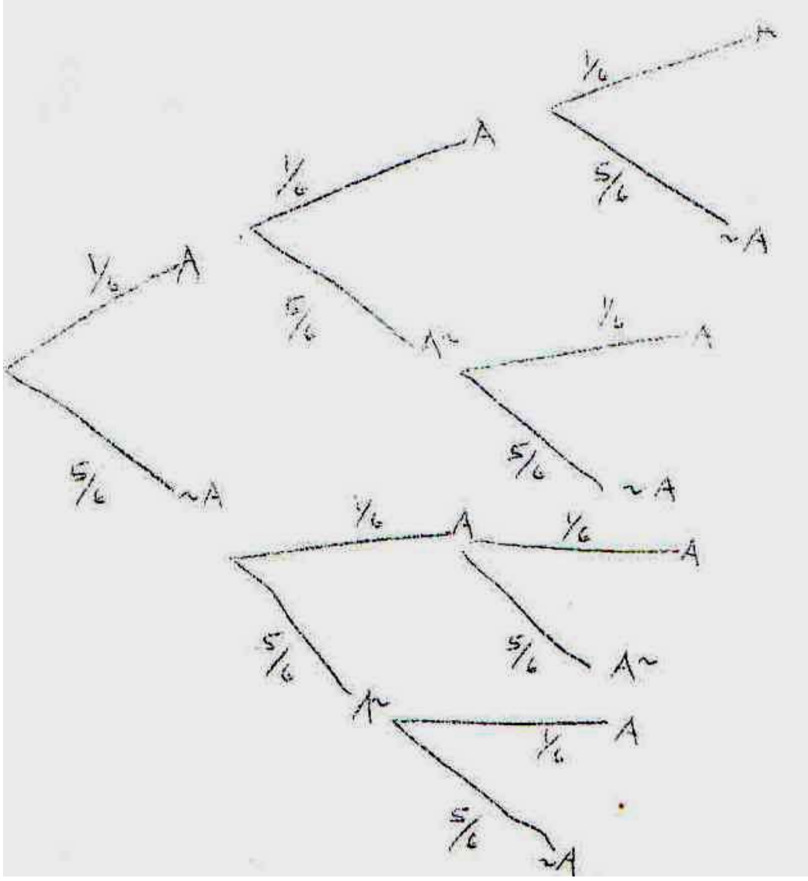
24

Die 2 Die	1	2	3	5	6	
1	(1,1)	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,6	5,7
6	6,1	6,2	6,3	6,4	6,5	6,6

b) (i) P(A) = $\frac{6}{36} = \frac{1}{6}$

(ii) P (B) = $\frac{11}{36}$

(iii) P (A and B) = P(4,4) = $\frac{1}{36}$



(ii) (a) P (A occurs exactly once) 3 $(\frac{1}{6} x \frac{5}{6} x \frac{5}{2}) = \frac{25}{72}$

(b) P (A occurs at most once) PQ 1 – P (A doesn't occur

= 1 – $(\frac{5}{6} x \frac{5}{6} x \frac{5}{6}) - 1 - \frac{125}{216}) = \frac{91}{216}$

(c) P (A occurs at most once = P(A occurs once or zero Times

= $\frac{25}{72} + \frac{125}{216} = \frac{200}{216} = \frac{25}{27}$

KISII CENTRAL FORM FOUR JOINT EVALUATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper 1
July/August 2015
Time 2½ hours

SECTION 1 (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Evaluate (3 marks)

$$\frac{4\times 6+\frac{1}{5}\div 0.05+\frac{1}{5}}{(-3)\div(-6)+(23)-6\ of\ 3}$$

2. When a certain number is divided by 30, 45 or 54, there is always a remainder of 21. Find the least number.(3 marks)
3. Without using calculators of mathematical tables, find the value of (3 marks)

$$\frac{\sqrt{45}\times(2.04)^2}{\sqrt{0.05}\times 2.89}$$

4. Solve for b in the equation (4 marks)

$$5^{2b}-\frac{126}{5}\left(5^{b}\right)=-5$$

5. A trader imported a camera for which she paid import duty at 40% of the purchase price. She later sold it to a customer giving 8% discount. If the customer paid shs 18,032 for the camera, find the purchase price. (3 marks)
6. Solve the simultaneous equations: (4 marks)

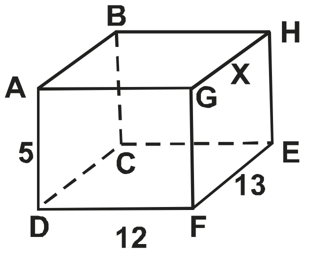
$$\frac{1}{a}+\frac{1}{b}=1$$

$$\frac{2}{a}+\frac{4}{b}=\frac{10}{3}$$

7. Half of the interior angles of an irregular hexagon are in the ratio 2 : 3 : 4, while the other half are in the ratio 4 : 3 : 5 . List the interior angles of the hexagon. (3 marks)
8. A translation T maps P(5, 3) onto P^1 (2, -5). Find the length of P^1R^1 if point R^1 is the image of R(-2, -3) under the same translation T. (3 marks)
9. Use reciprocal and square root tables to evaluate to 4 significant figures, the expression. (3 marks)

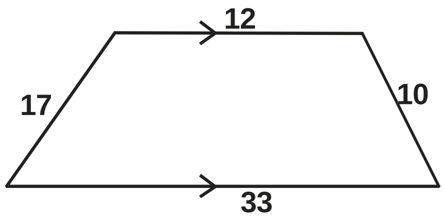
$$\frac{5}{0.04796}\times\sqrt{583.6}$$

10. Working together two taps A and B can fill a tank in 6 hours. By itself tap A can fill the tank in 8 hrs.
    a) How long can tap B take to fill the tank by itself. (1 mark)
    b) Tap A and B are opened at the same time and after running for 2 hours, an outlet tap which can drain the full tank by itself in 12 hours is opened. How much longer will it take the tank to be filled. (3 marks)
11. Find the equation of a line passing through (2, -3) and is perpendicular to the line 4y - 6x + 5 = 0 (3 marks)
12.



The diagram above shows an open cuboid. Find the distance between points C and X on the surface of the net if t he cuboids is opened up into a net by cutting along BC, HF, GE and AD given the GX is 6cm. (3 marks)

13. A flower garden is in the form of the trapezium shown below. Find the area of the garden in m^2 (4 marks)



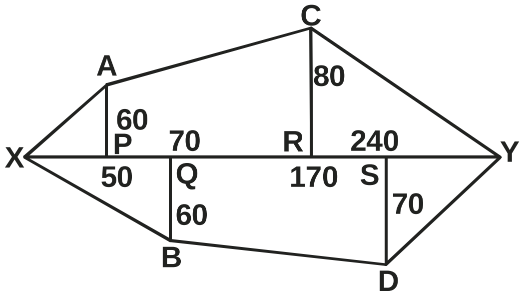
14. Given the vectors a = 6i + 8j

b = 3i - 9j

and c = 4i + j

Find the value of h and k such that ha + kb = c. (3 marks)

15. The figure below shows a sketch of a plot of land showing the baseline XY =300m and offsets drawn against it. If all measurements are in metres. Transfer the information on the sketch to field book (all measurements are in metres.



16. Solve the simultaneous inequalities, $1-2x \leq \frac{2}{3}x-5 < 4-\frac{3}{4}x$, Hence represent your solution on a number line. (3 marks)

SECTION 11 (50 MARKS)

Answer ANY FIVE questions in this section in the spaces provided.

17. The football team in school decided to raise shs 3600 for a party. Each student was to contribute the same amount. However before the contributions were made five members of the football team decided to transfer to other schools. This meant that the remaining contributors had to pay more to meet the same target.

a) If the increase in contribution per student was shs 24. Taking the original number of footballers to be n

   i) Give an expression for the initial amount that each should have contributed. (1 mark)

   ii) Give an expression for the contribution after the transfer. (1 mark)

   iii) Form an equation hence find the number of members in the football team originally (5 marks)

b) Calculate the percentage increase in the contribution per student caused by the transfer. (3 marks)

18. The table below shows the distribution of marks scored by 100 candidates in an examination.

Marks	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79	80 - 89	90 -99
No. of candidates	2	5	k	2k + 3	24	18	10	6	5	3

a) Find k. (1 mark)

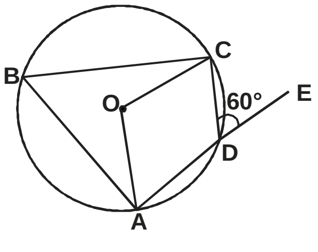
b) Using an assumed mean of 44.5 calculate.

   i) The mean (3 marks)

   ii) The standard deviation. (3 marks)

   c) Calculate the median (3 marks)

19. Below is a quadrilateral inscribed in a circle of centre O and radius 6cm. Angle CDE = 60°



a) Giving reasons find.

   i) Angle ABC (2 marks)

   ii) Angle CAO (2 marks)

   iii) Angle ACD given angle CAD = 20° (2 marks)

b) Find the area of the major segment subtended by the major arc ABC (Use π =3.142) (4 marks)

20. A boat at point X is 200m to the south of point Y. The boat sails from X to another point Z. Point Z is 200m on a bearing of 310° from X. Point X, Y and Z are on the same horizontal plane.

a) Calculate the bearing and distance of Z from Y. (4 marks)

b) W is the point on the path of the boat nearest to point Y. Calculate the distance WY. (3 marks)

c) A vertical tower stands at point Y. The angle of depression of point x from the top of the tower is 6°. Calculate the angle of elevation of the top of the tower from point W. (3 marks)

21. A bus left Nairobi at 7.00 am and travelled towards Eldoret at an average speed of 80km/hr. At 7.45am a car left Eldoret towards Nairobi at an average speed of 120km/hr. The distance between Nairobi and Eldoret is 300km.

Calculate

a) the time the bus arrived at Eldoret. (2 marks)

b) the time of the day the two met (4 marks)

c) the distance from Nairobi where the two met. (2 marks)

d) the distance of the bus from Eldoret when the car arrived at Nairobi. (2 marks)

22. A solid cylinder has a radius of 21cm and a height of 18cm. A conical hole of radius r is drilled in the cylinder on one of the end faces. The conical hole is 12cm deep. If the material removed from the hole is $2^{2}/_{3}$ % of the volume of the cylinder, find : (Use $\pi = {}^{22}/_{7}$)

a) the surface area of the hole. (5 marks)

b) the radius of a spherical balls made out of the material. (3 marks)

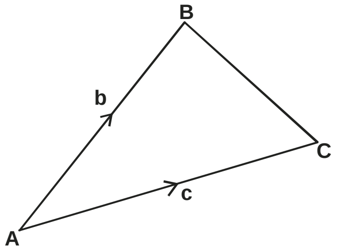
c) the surface area of the spherical ball. (2 marks)

23. a) Sketch the curve $y = -2x^2 - 4x + 6$ (3 marks)

b) Use trapezium rule taking intervals of 0.5 units to find the area under the curve.
$y = -2x^2 - 4x + 6$ within the range $-2 \leq x \leq 4$. (4 marks)

c) Obtain the exact area in (b) above hence calculate the percentage error introduced by using the Trapezium rule. (3 marks)

24. The triangle ABC below is such that AB = b and AC=c. M is on AB such that 3AM = AB and N is on AC such that AC: NC = 4 : 1



a) Write the following in terms of b and c (3 marks)

- i) $\overrightarrow{BC}$
- ii) $\overrightarrow{MN}$
- iii) $\overrightarrow{BN}$

b) Given further that BC produced intersects MN produced at L and ML = hMN while BL = kBC where h and k are constants write ML in two ways hence find the values of h and k. (5 marks)

c) Show the M, N and L are collinear. (2 marks)

KISII CENTRAL FORM FOUR JOINT EVALUATION

Kenya Certificate of Secondary Education

MATHEMATICS

Paper 2

July/August 2015

Time 2½ hours

SECTION 1 (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Using logarithms evaluate $\left(\frac{0.3289\times 5.937}{\log 827.4}\right)^{\frac{1}{3}}$ leaving your answer to 4 significant figures. (4 marks)

2. Simplify $\frac{\sqrt{75}}{\sqrt{5}+\sqrt{3}}$ leaving your answer in the form of $a+b\sqrt{c}$ where a, b and c are integers. (3 marks)

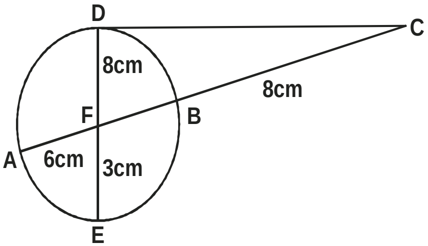
3. Using mid-ordinate rule of 5 strips, determine the area under the curve $y = 3x^2 + 10$, the lines $x = 1$, $x = 6$ and x-axis. (3 marks)

4. Find the value of k if $4x^2 + 25x + 5 + k$ is a perfect square. (2 marks)

5. Make x the subject if $Y=\left(\frac{ax^2+b}{bx^2-x}\right)^{\frac{1}{3}}$ (3 marks)

6. OA = 2i + 3j + 4k while OB = 5i + 9j - 2k. P divides AP externally in the ratio 2 : 1. Find he coordinates of P. (3 marks)

7. In the figure blow, DC is the tangent of the circle at D. BC = 8cm, AF = 6cm, DF=8cm and FE=3cm. Find the length FB and DC. (4 marks)



8. The probability of three students John, Ken and Faith passing exam are 0.8, 0.7 and 0.6 respectively. Find the probability of any two of them passing exam. (3 marks)

9. Expand and simplify $(2 - x)^5$ hence evaluate 1.98^5 using the first 4 terms of the expansion. (4 marks)

10. Solve the equation: $2 \text{ Cos } 2x = \sqrt{3}$ for $0° \leq x \leq 360°$ (3 marks)

11. Find the centre and radius of a circle whose equation is given as :

$2x^2 + 2y^2 + 8x - 20y = 40$ (3 marks)

12. Find the percentage error in calculating the volume of the cuboid whose dimensions are 8.2cm by 6.2cm by 5.7cm (3 marks)

13. P(60°N, 32°E) and Q(60°N, 118°W). Find the shortest distance along parallel latitude PQ. (3 marks)

14. The cost of two brands of coffee A and B are shs 120 and shs 150 per kg respectively. If A and B are mixed in ratio 3 : 7 respectively, and the selling price of the mixture is 30% above the cost, find the selling price per 500g packet of coffee. (3 marks)

15. On the line below, draw the locus of P on the upper side of AB such that angle APB is 65° (2 marks)

16. Income tax on all income earned were taxed as follows.

Income p.m in Kshs	Rate in percentage
1 - 13,500	10
13,501 - 27,000	15
27,001 - 45,000	20
45,001 - 72,000	25
72,001 and above	30

John earns a monthly salary of shs 62,400. He is entitled to a family relief of 1,056 p.m. Find his net tax p.m in kshs.

SECTION 11 (50 MARKS)

Answer ANY FIVE questions in this section in the spaces provided.

17. Two businessmen P and Q invested shs 2,400,000 each in separate banks. P invested in a bank which paid an interest of 12% p.a. compounded semi-annually. While Q invested in a bank which paid simple interest of 20% p.a.

a) Find:

i) the compound interest earned by P after 10 years to the nearest hundreds. (3 marks)

ii) the total interest earned by Q after 10 years to the nearest hundreds. (2 marks)

b) How long will it take P to get an amount equivalent to Kshs 6,000,000. (3 marks)

c) How long does it take Q to reach the amount of Kshs 6,000,000 (2 marks)

18. a) Complete the table below for

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
2 Sin 2x	0		1.73			-1.73	0.00			0.00	-1.73		
3 Cos x	3		1.50			-2.60	-3.00			0.00	1.50		

$y = 2\text{Sin } 2x$ and $y = 3 \text{ Cos } x$. (2 marks)

b) Draw the graph $y = 2\text{Sin } 2x$ and $y = 3\text{Cos } x$ using 1cm to represent 30° horizontal axis and 2cm to represent 1unit on the vertical axis. (5 marks)

c) Use the graph to

i) solve $2 \text{ Sin } x - 3 \text{ Cos } x = 0$ (1 mark)

ii) Find the amplitude and period of the curve $y = 2 \text{ Sin } 2x$. (2 marks)

19. The first, the 7th and the 25th terms of an arithmetic progression are the first three consecutive terms of a geometrical progression. The 20th term of the arithmetic progression is 22. Find:

a) i) The first term and common difference of the arithmetic progression. (4 marks)

ii) The sum of the first 40 terms of the arithmetic progression. (2 marks)

b) i) The 10th term of the geometric progression. (2 marks

ii) The sum of the first 10 terms of the geometric progression. (2 marks)

20. a) The volume of a solid varies partly as a constant and partly as the square of the radius of its base. When volume (v) is 95cm^3, its radius (r) is 5cm. When its volume is 167cm^3, its radius is 7cm. Find the volume when its radius is 10cm. (4 marks)

b) A variable P varies as the square of R and inversely at T.

i) When R is increased by 20%, T is reduced by 10%. Find the percentage change in value of R. (3 marks)

ii) When $P = 12$, $R = 6$, $T=9$. Find the law connecting P, R and T. (3 marks)

21. A triangle AB has vertices A(2, 1), B(5, 1) and C(4, -2). A^1 (4, 1) B^1(10, 1) and C^1(8, -2) is the image of triangle ABC under a given transformation.

a) Draw ABC and triangle $A^1B^1C^1$ on the grid provided. (2 marks)

b) Determine a single matrix of transformation that maps ABC onto $A^1B^1C^1$ hence describe fully the matrix of transformation. (3 marks)

c) $A^2B^2C^2$ is the image of ABC under positive 90° about the origin. Determine the co-ordinates of vertices $A^2B^2C^2$ on the grid provided. (3 marks)

d) $A^3B^3C^3$ is the image of $A^1B^1C^1$ under a transformation given by $M = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ Determine the co-ordinates of the vertices $A^3B^3C^3$. (2 marks)

22. The gradient of a curve is given as $6x^2 + 8x + 5$. If the curve passes through (1, 28), determine the equation of the curve. (3 marks)

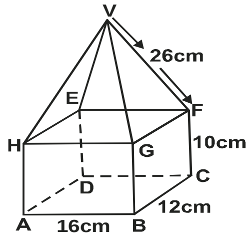
b) The distance (s) moved by a particle after t (seconds) is given as $S=6t^2 - t^3 + 9t$ metres. Determine

i) Displacement after 2 seconds. (1 mark)

ii) The time when the particle is momentarily at rest. (3 marks)

iii) The velocity when $t = 5$ seconds (3 marks)

23. The figure below represents a solid when is partly a cuboid and partly a right pyramid with rectangular base and measurements as shown below.



a) Determine the length AF. (2 marks)

b) Find the vertical height of the pyramid part. (2 marks)

c) Find the angle:

i) HV makes with the base ABCD (2 marks)

ii) HEV makes with the base HGFE. (2 marks)

iii) AF makes with base ABCD (2 marks)

24. The table below shows the marks scored by 50 students in a mathematics test.

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of candidates	3	5	8	12	9	7	4	2

a) On the grid provided below draw an ogive to represent the information above. (5 marks)

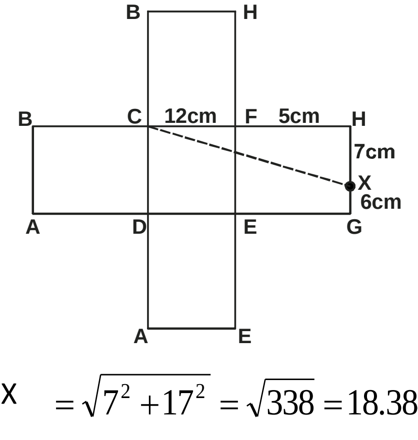
b) Use the graph to determine.

i) The interquartile range. (3 marks)

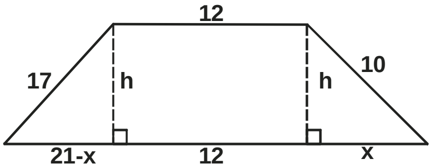
ii) The pass mark if 30% of students passed. (1 mark)

iii) The percentage pass if pass mark is 53 marks. (1 mark)

KISII CENTRAL FORM FOUR JOINT EVALUATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper 1
July/August 2015
Time 2½ hours

1	BODMAS $\frac{4\times6+\frac{4}{5}+\frac{1}{5}}{\frac{1}{2}+5}=\frac{24+1}{\frac{11}{2}}=\frac{25}{11}\times2$ $=\frac{50}{11}=4\frac{6}{11}$
2	$30 = 2 \times 3 \times 5$ $45 = 3^2 \times 5$ $54 = 2 \times 3^3$ $\text{LCM} = 2 \times 3^3 \times 5 = 270$ The number is $270 + 21 = 291$
3.	$\frac{\sqrt{45}}{\sqrt{0.05}}\times\frac{(2.04)\times2.04\times10000}{2.89\times10000}$ $=\frac{\sqrt{900}\times204\times204}{289\times100}$ $=\frac{30\times204\times204}{289\times100}=\frac{3\times12\times12}{10}=\frac{216}{5}$ $=43\frac{1}{5}$
4	$\left(5^b\right)^2+\frac{126}{5}\left(5^b\right)+5=0$ Let $5^b = m$ $m^2 - 126m + 25 = 0$ $m=\frac{126\pm\sqrt{126^2-4(5)(25)}}{2(5)}=\frac{126\pm124}{10}$ $m=25=5^b\Rightarrow b=2$ $m=\frac{1}{5}=5^b\Rightarrow b=-1$
5	Let the purchase price be x $\left(\frac{140}{100}x\right)\times\frac{92}{100}=18032$ $1.288x = 18032$ $x=\frac{18032}{1.288}=14{,}000$
6	let $\frac{1}{a}=x,\frac{1}{b}=y$ $x+y=1.....(i)\times6$ $2x+4y=\frac{10}{3}....(ii)\times3$ $6x+6y=6$ $\underline{6x+12y=10}$ $6y=4$ $y=\frac{2}{3}\Rightarrow\frac{1}{a}=\frac{1}{3}\Rightarrow a=3$ $x=\frac{1}{3}\Rightarrow\frac{1}{a}=\frac{1}{3}\Rightarrow a=3$ $\Rightarrow a=3, b=1.5$
7	Sum = (2n - 40)90° For Hexagon n = 6 Sum = {2(6) - 4} = 720° Half = 360° $2:3:4\Rightarrow\frac{2}{9}\times360=80^\circ,\frac{3}{9}\times360=120^\circ,\frac{4}{9}\times360=160^\circ$ Half = 360 $4:3:5\Rightarrow\frac{4}{12}\times360=120^\circ,\frac{3}{12}\times360=90^\circ,\frac{5}{12}\times360=150^\circ$ The angles are 80°, 120°, 160°, 120°, 90°, 150°
8	Let the translation $T=\begin{pmatrix}x\\y\end{pmatrix}$ $\begin{pmatrix}5\\-3\end{pmatrix}+\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}2\\-5\end{pmatrix}\Rightarrow x=-3,y=-2$ $T=\begin{pmatrix}-3\\-2\end{pmatrix}$ R R^1 $\begin{pmatrix}-2\\-3\end{pmatrix}+\begin{pmatrix}-3\\-2\end{pmatrix}=\begin{pmatrix}-5\\-5\end{pmatrix}\Rightarrow R^1(-5,-5)$ $P^1R^1=\begin{pmatrix}-5\\-5\end{pmatrix}-\begin{pmatrix}2\\-5\end{pmatrix}=\begin{pmatrix}-7\\0\end{pmatrix}$ $Length\ P^1R^1=\sqrt{(-7)^2+(0)^2}=7units$
9	$5(10^2 \times \text{Reciprocal of } 4.796)+\sqrt{100}\times\sqrt{5.836}$ $5(100 \times 0.2085) + 10 \times 2.416$ $5(20.85) + 10 \times 2.416$ $5(20.85) + 24.16 = 128.41$
10	a) Both fill $^1/_6$ per hr A fills $^1/_8$ per hr B fills $\frac{1}{6}-\frac{1}{8}=\frac{1}{24}$ B takes 24 hours to fill the tank b) After 2 hours A and B fill $^1/_3$ of tank $^2/_3$ remaining. Rate of flow $=\frac{1}{6}-\frac{1}{12}=\frac{1}{12}$ ½ fills in ½ $^2/_3$ will fill in $\frac{2}{3}\times\frac{12}{1}=8hrs$ It will take 8 hours more to fill the tank
11	Gradient of $4y - 6x + 5 = 0$ $y=\frac{3}{2}x-5$ $m_1=\frac{3}{2}, m_2\times\frac{3}{2}=-1\Rightarrow M_2=-\frac{2}{3}$ $\frac{y+3}{x-2}=\frac{-2}{3}\Rightarrow3y+9=-2x+4$ $3y + 2x + 5 = 0$
12	 CX $=\sqrt{7^2+17^2}=\sqrt{338}=18.38cm$

13



$h^2 = 17^2 - (21 - x)^2 = 10^2 - x^2$

$=> 289 - (441 - 42x + x^2) = 100 - x^2$
$- 152 + 42x = 100$
$42x = 252$
$x = 6cm$
$h = \sqrt{100 - 36} = 8cm$

Area = ½ (a + b) h
= ½ (12 + 33) × 8 = 180m^2

14

$h (6i + 8j) + k(3i - 9j) = 4i + j$
$6h + 3k = 4$ .....× 3
$8h - 9k = 1$
$\underline{18h + 9h = 12}$
$26h = 13 => h = ½, k = {}^1/_3$

15

	Y	
	300	
	240(S)	70 TO D
TO C 80	170(R)	
	70(Q)	60 TO B
TO A 60	50(P)	
	X	

16

$1 - 2x \leq {}^2/_3 x = 5$
$3 - 6x \leq 2x - 15$
$18 \leq 8x$
$x \geq {}^9/_4$
$x \geq 2.24$
${}^2/_3 x - 5 < 4 - {}^3/_9 x$
$8x - 60 < 48 - 9x$
$17 x < 108$
$x < 6.353$

17

a) i) $\frac{3600}{n}$

ii) $\frac{3600}{n-5}$

iii) $\frac{3600}{n-5} - \frac{3600}{n} = 24$

3600n - 3600 (n - 5) = 24n (n - 5)
$150n - 150n + 750 = n^2 - 5n$
$n^2 - 30n + 25n - 75 = 0$
n(n- 30) + 25(n - 30) = 0
(n + 25) (n - 30) = 0
n = 30, n =-25

The original number was 30 members

b) Original contribution $\frac{3500}{30}$ = 120

$\%Inverse \tfrac{24}{120} \times 100 = 20\%$

19

a) i)∠ABC = 60° (opposite interior angle in a cyclic quadrilatera

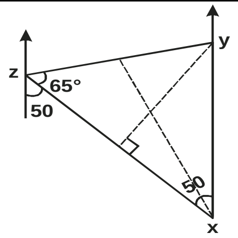
ii) ∠CAO = 60 × 2 = 120° (Angle at the centre is twice that at the circumference)

iii) ∠ACD = 60° - 20° = 40°

b) Area $= \frac{01}{360}\pi^2 + \frac{1}{2}r^2 Sin\theta_2$

$= \frac{240}{360} \times 3.14 \times 6^2 + \frac{1}{2} \times 6^2 Sin120°$
$= 75.408 + 15.59$
$= 90.998 Square\ units$

20



a) XYZ is isosceles

$Sin25° = \frac{x}{200}$

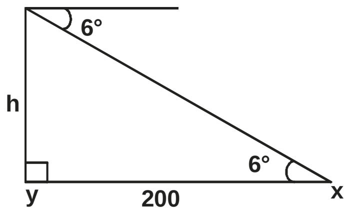
x = 2x = 169.04km
Bearing 360 - 115 = 245°
Z is 169.04km on a bearing of 245°

b) To get YW

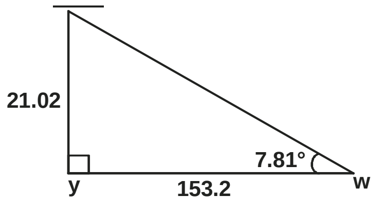
$Sin65° = \frac{h}{169.04}$

h = 169.04 Sin 65°
= 153.2
WY = 153.2km

C)



Tan 6° $= \frac{H}{200} \Rightarrow H = 200\tan 6° = 21.02m$



Tan q = $\frac{21.02}{153.2} = 0.1372$
$= 7.81°$

The angle of elevation of the top of the toners from W is 7.81°

18

a) k + 2k + 3 + 73 = 100 □ 3k = 24 k = 8

Class	x	d=x - 44.5	f	df	d^2	d^2f	cf
0 - 9	4.5	-40	2	-80	1600	3200	2
10 - 19	14.5	-30	5	-150	900	4500	7
20 - 29	24.5	-20	8	-160	400	3200	15
30 - 39	34.5	-10	19	-190	100	1900	34
40 - 49	44.5	0	24	0	0	0	58
50 - 59	54.5	10	18	180	100	1800	76
60 - 69	64.5	20	10	200	400	4000	86
70 - 79	74.5	30	6	180	900	5400	92
80 - 89	84.5	40	5	200	1600	8000	97
90 - 99	94.5	50	3	150	2500	7500	100
			Σf =100	Σdf =330		Σf =39500	

b) i) $$Mean = A + \frac{\Sigma df}{\Sigma f} = 44.5 + \frac{230}{100} = 46.8$$

ii)
$$S_1 d = \sqrt{\frac{\Sigma d^2 y}{\Sigma f} - \left(\frac{\Sigma df}{\Sigma f}\right)^2}$$
$$= \sqrt{\frac{39500}{100} - \left(\frac{330}{100}\right)^2} = \sqrt{395 - 5.29}$$
$$= 19.74$$

b) ii) Median

$$\frac{L + \left(\frac{n}{2} - cf\right)}{f} i$$
$$39.5 + \frac{\left(\frac{10}{2} - 34\right)}{24} 10$$
$$= 39.5 + \tfrac{160}{24} = 39.5 + 6.0167$$
$$= 46.17$$

21

$$T = \tfrac{D}{S} = \tfrac{300}{80} = 3.75 = 3hrs45\text{minutes}$$

b) When the care leaves the bus had covered
80 × 0.75 = 60km. Remainder 240km

$$T = \tfrac{D}{S} = \tfrac{240}{80+120} = 1.2hrs = 1hr\ 12\text{minutes}$$

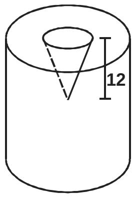
The two meet at 7.45
+ 1.12
8.57 am

c) The two met 60 + (1.25 × 80)km
60 + 96 = 156 km from Nairobi.

d) Time taken by the car $\frac{300}{120}$ = 2.5 hrs

Distance covered by bus = 60 + (80 × 2.5)
= 260km from Eldoret

22.



Volume of the cylinder $\pi r^2 h$
$$\frac{22}{7} \times 21^2 \times 18 = 24948$$

Volume of conical shape

$$2\tfrac{2}{3}\% = \tfrac{8}{300} \times 24,948 = 665.28$$

Volume of small cone $= \tfrac{1}{3}\pi r^2 h = 665.28$

$$\tfrac{1}{3} \times \tfrac{22}{7} \times r^2 \times 12 = 665.28$$

$$r^2 = \frac{665.28 \times 7}{88} = 7.275$$

S.A. of cone = $\pi r^2 + \pi rl$

$$= \tfrac{22}{7} \times 7.275^2 + \tfrac{22}{7} \times 7.275 \times 14.03$$

=166.32 + 320.8
=487.12

b) Volume of cone

$= \frac{4}{3}\pi r^3 = 665.28$

$r^3 = \frac{665.25 \times 7 \times 3}{4 \times 22} = 158.76$

$r = 5.415$

c) S.A. of sphere =4πr²

$= 4 \times \frac{22}{7} \times 5.415^2$

$= 368.6cm^2$

23 To sketch y = -2x² - 4x + 6 x interrupts

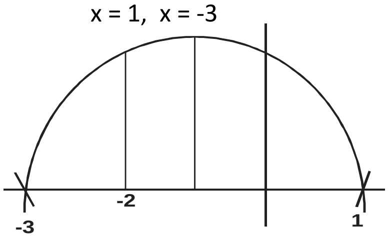
-2x² - 4x + 6 = 0

-2x² - 6x + 2x + 6 = 0

-2x (x + 3) + 2(x + 3) = 0

(-2x + 2)(x + 3) = 0

x = 1, x = -3



x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1
y	0	3.5	6	7.5	10	7.5	6	3.5	0

By trapezium rule $A = \frac{1}{2}h\{ends + 2\ middle\}$

$A = \frac{1}{2} \times 0.5\{(0+0) + 2(3.5+6+7.5+10+7.5+6+3.5)\}$

$= \frac{1}{4} \times 88 = 22sq\ units$

c) Actual Area

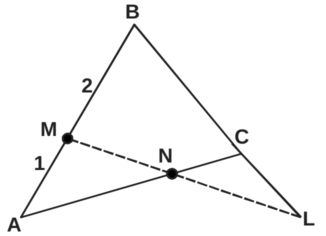
$$\int_{-3}^{1}\left(-2x^2 - 4x + 6\right)dx = \left[\frac{-2x^3}{3} - 2x^2 + 6x\right]_{-3}^{1}$$

$$= \left[\frac{-2}{3} - 2 + 6\right] - \left[\frac{54}{3} \times 8 - 18\right]$$

$$= \frac{10}{3} - (-18) = 21\tfrac{1}{3}$$

$$\%Error = \frac{22 - 21\frac{1}{3}}{21\frac{1}{3}} \times 100 = 3.125\%$$

24



i) BC = **c** - **b**

ii) MN = ¾**c** - ¹/₃**b**

iii) BN = ¾**c** - **b**

b) ML = hMN

= ¾ h**c** - ¹/₃h**b** . . . . .(i)

ML = MB + BL

= ²/₃ **b** + k**c** - k**c**

= (²/₃ - k) **b** + k**c**) . . . .(ii)

¾ h = k 3h

Comparing (i) and (ii)

- 4h = 0

$$\left(\frac{2}{3} - k\right) = \frac{-1}{3}h$$

$$2 - 3k = h \Rightarrow h - 3k = -2 \ldots\ldots \times 3$$

$$3h - 4k = 0$$

$$\underline{3h - 9k = -6}$$

$$5k = 6$$

$$k = \tfrac{6}{5};\ h = \tfrac{8}{5}$$

c) Sum ML = hMN

ML = ⁸/₅ MW

It means that ML is parallel to MN but m is common

therefore M, N and L are collinear

KISII CENTRAL FORM FOUR JOINT EVALUATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper 2
July/August 2015
Time 2½ hours

1

NO	log	Working
0.3289 5.937	1.5171 0.7736	$\frac{\bar{1}.8256}{3}$
Log827.4 2.918	0.2907 0.4651	$\frac{\bar{3}}{3}+\frac{2.8256}{3}$
8.748 ×10-1	$\frac{\bar{1}.8256}{3}$ $\bar{1}.9419$	

$=8.748 \times 10^{-1} = 0.8748$

2.

$$\frac{\sqrt{75}\left(\sqrt{5}-\sqrt{3}\right)}{\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5}-\sqrt{3}\right)}$$

$$=\frac{5\sqrt{15}-15}{5-3}$$

$$=-7.5-2.5\sqrt{15}$$

3

x	1.5	2.5	3.5	4.5	5.5
$3x^2+10$	16.75	28.75	46.75	70.75	100.75

$$Area = 1[16.75+28.75+46.75+70.75+100.75]$$

$$=263$$

4

$b^2 = 4ac$

$25^2 = 4 \times 4\ (5 + k)$ . . . .

a, b and c

$$5+k=\frac{625}{16}$$

$$k=39\tfrac{1}{16}-5$$

$$=34\tfrac{1}{16}$$

5

$$y^3=\frac{ax^2+b}{bx^2-c}$$

$$y^3bx^2-y^3c=ax^2+b$$

$$y^3bx^2-ax^2=b-y^3c$$

$$x^2\left(y^3b-a\right)=b-y^3c$$

$$x^2=\frac{b-y^3c}{y^3b-a}$$

$$x=\pm\sqrt{\frac{b-y^3c}{y^3b-a}}$$

6

$$OP=-1\begin{pmatrix}2\\3\\4\end{pmatrix}+2\begin{pmatrix}5\\9\\-2\end{pmatrix}$$

$$=\begin{pmatrix}-2+10\\-3+18\\-4+-4\end{pmatrix}=\begin{pmatrix}8\\15\\-8\end{pmatrix}$$

$$P(8,15,-8)$$

7.

$$(FB)(6)=8\times3$$

$$FB=4cm$$

$$DC^2=8\times18$$

$$DC=12cm$$

8

JKF^1 or JK^1F or J^1KF

$0.8 \times 0.7 \times 0.4 + 0.8 \times 0.3 \times 0.6 \times 0.2 \times 0.7 \times 0.6$

$0.224 + 0.144 + 0.084 = 0.452$

9

$32 + 5 \times 16\ (-x) + 10\ (8)\ (x^2) + 10 \times 4\ (x^3) + 5 \times 2x^4 - x^5$

$32 - 80x + 80x^2 - 40x^3 + 10x^4 + 10x^4 - x^5$

$32 - 80\ (0.02) + 80(0.02)^2 - 40(0.02)^3 \quad = 30.43168$

10

2x = 30°, 330°, 390°, 690°

x = 15°, 165°, 195° and 345°

11

$x^2 + y^2 + 4x - 10y = 20$

$x^2 + 4x + y^2 - 10y = 20$

$(x + 2)^2 + (y - 5)^2 = 20 + 25 + 4 = 49$

centre (-2, 5)

Radius = 7

12

$$R.E=\frac{0.05}{8.2}+\frac{0.05}{6.2}+\frac{0.05}{5.7}$$

= 0.02293

P.E = 0.02293 × 100

= 2.293

13

Long diff. = 32 + 118 = 150°

Length PQ $=\frac{150}{360}\times2\times\frac{22}{7}\times6370Cos60$

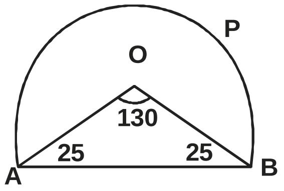
$=30{,}030$

14

Cost of mixture $=\frac{120+3+150\times7}{3+7}=shs141$

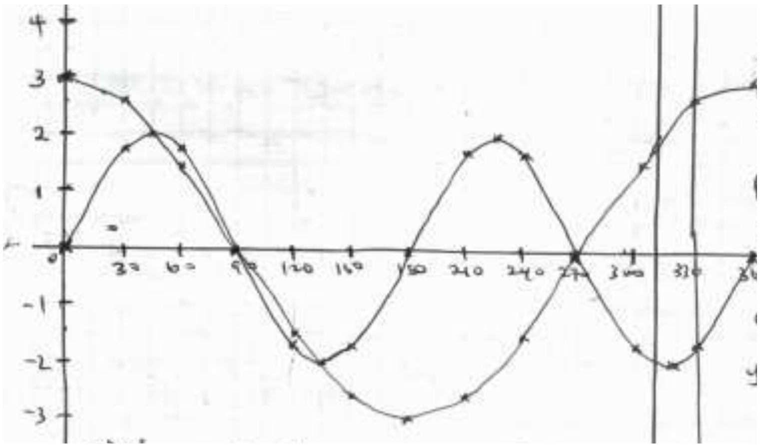
Selling price $=\frac{500}{1000}\times\frac{130}{100}\times shs141$

$=91.65$

15	base angle drawn 25° ± 1° locus P is drawn and correctly locate d.  		b.) $S_{40} = \frac{40}{2}\left[2a + (n-1)d\right]$ $= 20\left[2\times3 + 39\times1\right]$ $= 900$ c) i) $ar^9 = 3(3)^9$ $= 59,049$ ii) $a\left(\frac{r^n - 1}{r-1}\right) = \frac{3(3^{10}-1)}{3-1}$ $= \frac{3}{2}(59048)$ $= 88,572$
16	Kshs 1 - 13500 = 13,500 × $^{10}/_{100}$ = 1350 13501 - 27000 = 13,500 × $^{15}/_{100}$ = 2025 27001 - 45000 = 18000 × $^{20}/_{100}$ = 3600 45001 - 62400 = 17400 × $^{25}/_{100}$ = 4350 11,325 1, 056 10,269		
17	i) Amount = 2,400,000 (1 + $^{6}/_{100}$)$^{2°}$ = 7,697,100 Compound interest = 7,697,000 -2,400,000 = 5,297,100 ii) Interest = PRT = 2,400,000 × $\frac{20}{100}$ × 10 = 4,800,000 b) 6,000,000 = 2,400,00 (1.06)^{2n} 2n = $\frac{\log 2.5}{\log 1.06}$ = 15.73 n = 7.865 years c) Interest = 6,000,000 - 2,400,000 = shs 3,600,000 2,400,000 × $\frac{20}{100}$ T = 3,600,000 T = 7.5 yrs	20	a) V = k + mr² 95 = k + 25m 167 = k + 49m 72 = 24m m = 3 k = 95 - 75 = 20 v = 20 + 3(10)² = 320 b) i $P_1 = \frac{KR^2}{T}$ $P_2 = \frac{1\times1.2^2}{0.9} = 1.6$ $\%age = \left(\frac{1.6-1}{1}\right)\times100$ $= 60\%$ ii) $12 = \frac{36}{9}k,$ $k = 2$ $P = \frac{3R^2}{T}$
19.	a, a + 6d, a + 24d . . . . . . $\frac{a+6d}{a} = \frac{a+24d}{a+6d}$ a² + 12ad + 36d² = a² + 24ad 12ad = 36d² a = 3d . . . . .(i) a + 19d = 22 . . . . . (ii) 3d + 19d = 22 22d = 22 d = 1 a = 3		

18

x	30°	90°	120°	210°	240°	330°	360°
2 sin 2x	1.73	0.00	-1.73	1.73	1.73	-1.73	0.00
3 Cos X	2.60	0.00	-1.50	-2.60	-1.50	2.60	3.00



c) i) 45°, 90°, 135° and 270°

ii) Amplitude = 2 ✓

Period = 180 ° ✓

21

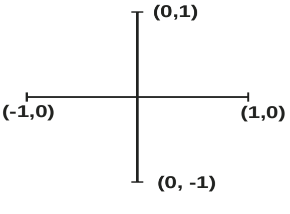
∆ABC ✓ly drawn, $\Delta A^1B^1C^1$ ✓ ly (drawn)

$$\begin{array}{cccc} & \begin{array}{ccc}A & B & C\end{array} & & \begin{array}{ccc}A^1 & B^1 & C^1\end{array}\\ \begin{pmatrix}a & c\\ b & d\end{pmatrix} & \begin{pmatrix}2 & 5 & 4\\ 1 & 1 & -2\end{pmatrix} & = & \begin{pmatrix}4 & 10 & 8\\ 1 & 1 & -2\end{pmatrix}\end{array}$$

$$\begin{array}{ll} 2a + c = 4 & 2b + d = 1\\ \underline{5a + c = 10} & \underline{5b + d = 1}\\ -3a = -6 & 36 = 0\\ a = 2 & b = 0\\ c = 0 & d = 1 \end{array}$$

$$\begin{pmatrix}2 & 0\\ 0 & 1\end{pmatrix}$$

Description: Stretch y-axis
invarrant L.S.F. = 2



$$\begin{array}{cccc} & \begin{array}{ccc}A & B & C\end{array} & & \begin{array}{ccc}A^2 & B^2 & C^2\end{array}\\ \begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix} & \begin{pmatrix}2 & 5 & 4\\ 1 & 1 & -2\end{pmatrix} & = & \begin{pmatrix}-1 & -1 & 2\\ 2 & 5 & 4\end{pmatrix}\end{array}$$

$A^2(-1,2)$ $B^2(-1,5)$ $C^2(2,4)$

$A^2B^2C^2$ vly drawn

d.

$$\begin{array}{cccc} & \begin{array}{ccc}A^2 & B^2 & C^2\end{array} & & \begin{array}{ccc}A^3 & B^3 & C^3\end{array}\\ \begin{pmatrix}1 & 2\\ 0 & 1\end{pmatrix} & \begin{pmatrix}4 & 10 & 8\\ 1 & 1 & -2\end{pmatrix} & = & \begin{pmatrix}6 & 12 & 4\\ 1 & 1 & -2\end{pmatrix}\end{array}$$

$A^3(6,1)$ $B^3(12,1)$ $C^3(4,2)$

22

a)

$$\frac{dy}{dx} = 6x^2 + 8x + 5$$

$$y = \frac{6x^3}{3} + \frac{8x^2}{2} + 5x + c$$

28 = 2 + 4 + 5 + c

c = 17.

$y = 2x^3 + 4x^2 + 5x + 17$

b) i) When t = 2, $s = 6(2)^2 - (2)^3 - 9(2) = 34$

c)

$$v = \frac{ds}{dt} = 12t - 3t^2 - 9 \; and \; \frac{ds}{dt} = 0$$

$t^2 - 4t + 3 = 0$

$(t - 3)(t - 1) = 0$

t = 3 or t = 1

iii)

$$V = \frac{ds}{dt} = 12t - 3t^2 - 9$$

$$= 12(5) - 3(5)^2 - 9$$

$$= -24m / s$$

23

a)

$$AF^2 = \sqrt{16^2 + 12^2 + 10^2}$$

$$= 22..36$$

b)

$$HF = \sqrt{16^2 + 12^2} = 20cm$$

$$AO = 10cm$$

$$h = \sqrt{26^2 - 10^2} = 24cm$$

c) i) Tan $\alpha = \frac{24}{10}$

$\theta = 67.38°$

ii) Tan $\alpha = \frac{24}{6}$

a = 75.96°

iii) Tan P $= \frac{10}{20} = 0.5$

$P = 26.57°$

24

CF	3.0	8.0	16.0	28.0	37.0	44.0	48.0	50.0
VCL	29.5	39.5	49.5	59.5	69.5	79.5	89.5	99.5

b) $Q_3 = 60 \pm 1$

$Q_1 = 45 \pm 1$

i) Interquartile range = 60 - 45

= 15

ii) No. failed = $\frac{70}{100} \times 50 = 35$

Pass mark is at 36th student

= 66

iii)

$$\frac{30}{50} \times 100$$

$$= 60\%$$

NYERI COUNTY FORM 4 JOINT ASSESSMENT
Kenya Certificate of Secondary Education

MATHEMATICS
Paper 1
July/August 2015
Time: 2½ Hours

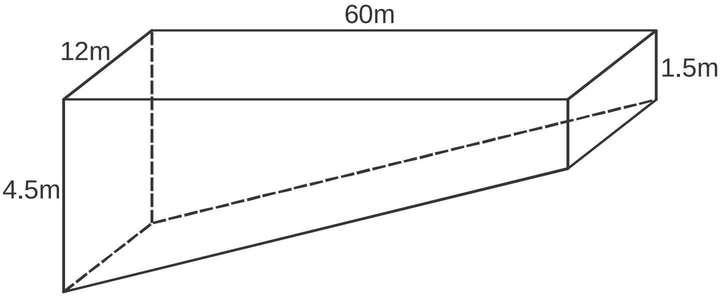
1. Evaluate : $\frac{[32-(-60)\div 4]x18-12}{25\div 5x2+23-6\div 2}$ (3 marks)

2. Simplify : $\frac{18x^2-32y^2}{6x^2-5xy-4y^2}$ (3 marks)

3. Two types of coffee cost sh.250 per kg and sh.200 per kg are mixed so that their masses are in the ratio 3: 5 respectively. Otieno sold the mixture at sh.262.50. Calculate his percentage profit. (3 marks)

4. Two towns A and B are 220km apart. A bus left town A at 11.00a.m and travelled towards town B at 60km/h. At the same time, a matatu left town B for town A and travelled at 80km/h. The matatu stopped for 45 minutes on the way before meeting the bus. Calculate the distance covered by the bus before meeting the matatu. (3 marks)

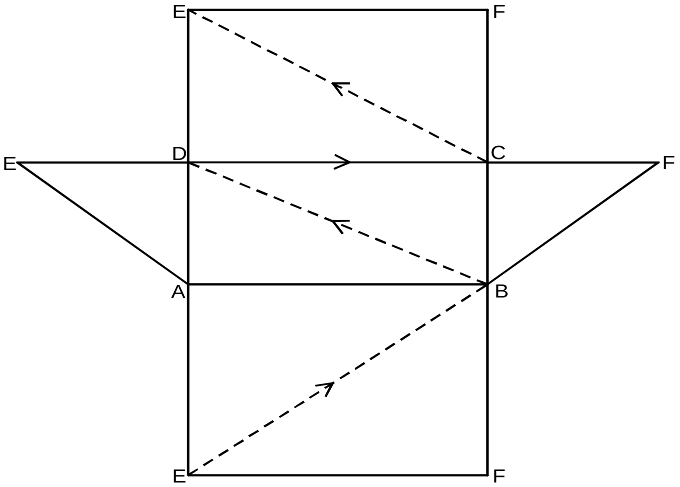
5. The figure below represents a swimming pool. Calculate the volume of the swimming pool in litres. (3 marks)



6. A line P has its x and y intercept as -2 and -3 respectively.
   a) Find the gradient of line P (1 mark)
   b) Line Q passes through (5, -2) and is parallel to line P. Write the equation of line Q in the form y = mx + c (2 marks)

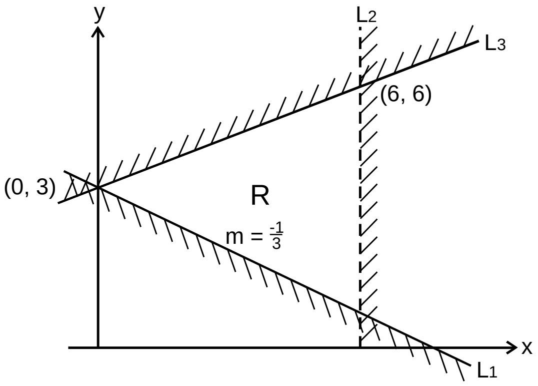
7. Solve for x and y in the equation.
   $(2^{2x})^3 \text{ x } (3^{4y})^{½} = 108$ (3 marks)

8. The figure below represents a net with a path marked on it, drawn accurately.



   a) What solid does the net represent? (1 mark)
   b) Draw the solid and clearly show the path. (3 marks)

9. Write down the three inequalities which define the region R. (3 marks)



10. The angle of elevation of the top of a tree from a boy's eye positioned at point A is 20°. The boy moves 100 metres closer to the tree and the angle of elevation becomes 32°. Find the height of the tree. (Disregard the height of the boy) (4 marks)

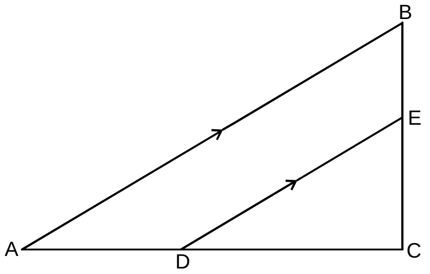
11. Two churches have a total of 500 members, the difference between members of the two churches is 200. How many members are there in each church ? (3 marks)

12. A certain regular polygon has its interior angle 144° greater than its exterior angle. Find the number of sides of the polygon. (3 marks)

13. Use reciprocal tables to find the reciprocals of 0.4346 and 0.9182.

Hence, evaluate $\left(\frac{100}{0.4346} - \frac{50}{0.9182}\right)^2$. Give your answers to 4 significant figures. (3 marks)

14. In the figure below, AB is parallel to DE. AB = 10cm, AD = 2cm, BE = 1cm, DC = 3cm.



a) Calculate the lengths of DE and EC. (2 marks)

b) Hence calculate the ratio of the area of DCE : ADEB (2 marks)

15. A Kenyan bank buys and sells Nigerian neira and Canadian dollar at the following rates.

	Buying (Kshs)	Selling (Kshs)
1 Nigerian neira	32.58	36.42
1 Canadian dollar	91.52	98.99

Mrs. Emenike, a Nigerian arrived in Kenya with 46,000 neira. She exchanged the whole amount to Kenya shillings and spent a total of Kenya shillings 720,000. She later changed the remainder to Canadian dollars on her way to Canada. How much did she receive to 2d.p. (4 marks)

16. Line segment AB is given below: Mark point D on line AB produced, such that AD : DB = 7 : -2 (3 marks)

SECTION II : (50 MARKS)

Answer only five questions from this section.

17. Three worships P, Q and R are at sea such that ship Q is 400km on a bearing of 030° from ship P. Ship R is 750km from ship Q and on a bearing of S60°E from ship Q. Ship Q is 1000km and to the north of an enemy worship S.

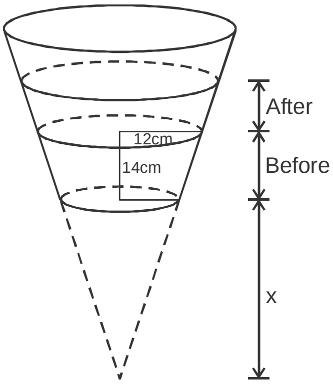
a) Taking a scale of 1cm to represent 100km, locate the position of ships P, Q, R and S. (4 marks)

b) Find the compass bearing of :
- i) ship P from ship S
- ii) ship S from ship R (2 marks)

c) Use the scale drawing to determine
- i) the distance of S from P
- ii) the distance of R from S (2 marks)

d) Find the bearing of :
- i) Q from R
- ii) P from R (2 marks)

18. A conical glass contains water to a height of 14cm and has a water surface of radius 12cm. A student wishes to determine the radius, volume and surface area of a spherical pebble. When he drops the pebble in the water, the water level rises by 8cm and its surface on the glass has a radius of 16cm as shown below.



a) Find x (3 marks)

b) Find the volume of the pebble (3 marks

c) Find the radius of the pebble (2 marks)

d) Find the surface area of the pebble (2 marks)

19. A certain number of people agreed to contribute equally to buy books worth shs.1200 for a school library. Five people pulled out and so that others agreed to contribute an extra sh.40 each. Their contribution enabled them to raise the sh.1200 expected.

a) If the original number of people was x, write an expression of how much each was originally going to contribute. (1 mark)

b) Write down the expression of how much each contributed after the five people pulled out. (1 mark)

c) Calculate how many people made the contribution. (5 marks)

d) If the prices of books before buying went up in the ratio 5 : 4 how much extra did each contributor give.(3 marks)

20. The masses to the nearest kilogram of some students were recorded in the table below.

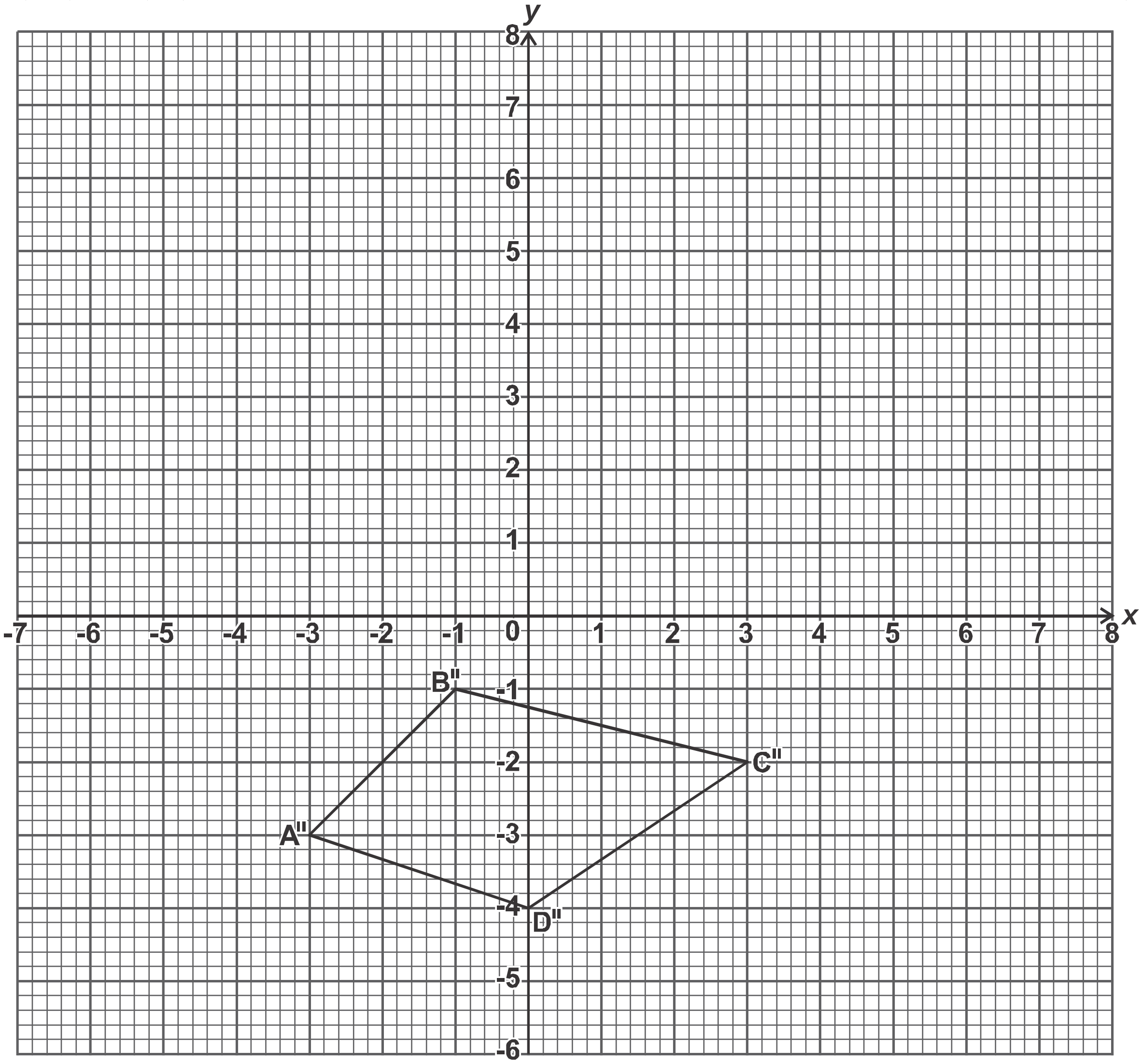
Mass (kg)	41 - 50	51 - 55	56 - 65	66 - 70	71 - 85
Frequency	21	62	55	50	12
fd					

a) Determine the frequency densities to 1 decimal place. (2 marks)

b) On the grid provided, draw a histogram to represent the above information. (4 marks)

c) Use the histogram above to find :
- i) the median (2 marks)
- ii) the mode (2 marks)

21. a) On the cartesian plane given below, draw the quadrilateral ABCD with vertices A(6, 6), B(2, 2), C(4,-6)andD(8,0). (1 mark)



b) Draw the image $A^1B^1C^1D^1$ of ABCD under an enlargement scale factor ½, centre origin.
State the coordinates of $A^1B^1C^1D^1$ (3 marks)

c) Describe the transformation that maps $A^1B^1C^1D^1$ onto the given image $A^{11}B^{11}C^{11}D^{11}$ (2 marks)

d) Rotate $A^{11}B^{11}C^{11}D^{11}$ with centre (-2, -1) through a positive quarter turn to get $A^{111}B^{111}C^{111}D^{111}$.
State the coordinatesof $A^{111}B^{111}C^{111}D^{111}$. (3 marks)

e) State a pair of quadrilaterals that are oppositely congruent. (1 mark)

22. PQRS is a trapezium where PQ is parallel to SR. PR and SQ intersect at X, so that SX = kSQ and PX = hPR where k and h are constants.
Vectors PQ = $3\underset{\sim}{q}$ and PS = $\underset{\sim}{s}$, SR = $\underset{\sim}{q}$

a) Show this information on a diagram. (1 mark)

b) Express vector $\underset{\sim}{SQ}$ in terms of $\underset{\sim}{s}$ and $\underset{\sim}{q}$ (1 mark)

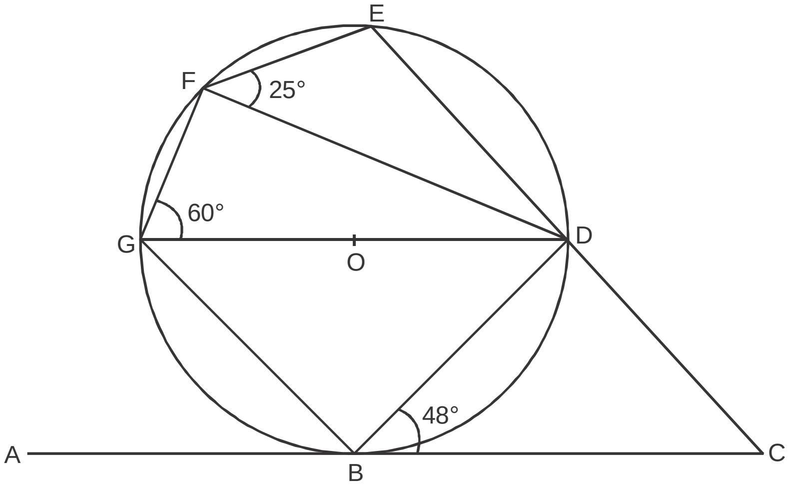
c) Express $\underset{\sim}{SX}$ in terms of k, $\underset{\sim}{q}$ and $\underset{\sim}{s}$ (2 marks)

d) Express $\underset{\sim}{SX}$ in terms of h, $\underset{\sim}{q}$ and $\underset{\sim}{s}$ (2 marks)

e) Obtain h and k (2 marks)

f) In what ratio does X divide SQ ? (2 marks)

23.



In the figure above, ABC is a tangent to the circle, centre O. DOG is a diameter and angle DGF = 60°, angle DBC = 48° and angle DFE = 25°. Giving reasons, find the size of angles :

i)	FED	(2 marks)
ii)	Obtuse FOB	(2 marks)
iii)	EBD	(2 marks)
iv)	BCD	(2 marks)
v)	OBE	(2 marks)

24. A particle starts from rest and moves in a straight line. Its velocity Vms^{-1} is given by $V = t^2 - 3t + 2$, where t is the time in seconds moved from a point O.
Find :

a) i)the velocity when t = 3 (2 marks)
ii) the displacement from O when t = 3 (3 marks)
iii) the acceleration of the particle when t = 3 (2 marks)
b) At what time is the particle momentarily at rest ? (3 marks)

NYERI COUNTY FORM 4 JOINT ASSESSMENT
Kenya Certificate of Secondary Education

MATHEMATICS
Paper 2
July/August 2015
Time: 2½ Hours

1. Use logarithms to evaluate

$$\sqrt{\frac{0.456\tan 81.2}{\log 8293}}$$ correct to 4 significant figures. (4 marks)

2. R is partly constant and partly varies as the square of q. When R = 5, q = 1 and R = 21 when q = 3. Find the value of R when q = 5 (3 marks)

3. **a)** Determine the inverse of the matrix $T = \begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$ (1 marks)

b) Hence find the coordinates of the point of intersection of the lines x + 2y = 7 and -y + x = 1 (2 marks)

4. Grade A tea is mixed with grade B tea. The cost per kg of grade A is Ksh.60 and that of grade B is Ksh.80. Find the ratio in which the two grades should be mixed inorder to make a profit of 20% by selling 1kg of the mixture at Ksh.90. (3 marks)

5. Solve for x. $(\text{Log}_2 x)^2 - \log_2 x^2 = 15$ (4 marks)

6. The length and width of a rectangle measured to the nearest centimetre are 10cm and 6cm respectively. Calculate the percentage error in the area giving your answer to 1 decimal place. (3 marks)

7. Find in terms of π^c the values of x in the interval $0^o \leq x \leq 2\pi^c$ for which $2\sin^2 x - \cos x = 1$.
(Give your answer in radians) (3 marks)

8. Expand $\left(2 - \frac{1}{2}x\right)^5$ (1 mark)

hence use the expansion upto the fourth term to evaluate $(1.98)^5$ (2 marks)

9. The coordinates of the ends of a diameter of a circle are (6, 4) and (-2, 2). If the centre of the circle is Q, determine:

a) the coordinates of centre Q (1 mark)

b) the equation of the circle expressing it in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are constants. (2 marks)

10. **a)** Complete the following table for the function $y = 6 + 3x - 2x^2$ (1 mark)

x	-1.5	-1	0	0.5	1	1.5	2	2.5	3	3.5
y					7				-3	

b) Using the completed table and the trapezoidal rule with 10 strips, estimate the area bounded by the curve and the lines y = -8 and x = -1.5 (3 marks)

11. Simplify leaving your answer in surd form (2 marks)

$$\frac{1}{\sqrt{22} - 2\sqrt{3}} - \frac{1}{\sqrt{22} + 2\sqrt{3}}$$

12. Two students are selected at random from a class of 15 boys and 10 girls. Find the probability that

a) they are both boys (2 marks)

b) one is a boy and the other is a girl (2 marks)

13. An aeroplane took off from an airport at (68°N, 86°E) and flew due West for a distance of 1000 nautical miles before landing. Find to the nearest degree, the coordinates of the place where the plane landed. (3 marks)

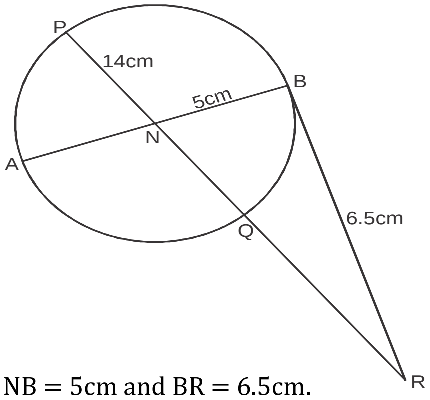
14. The table below is part of the tax table for monthly income for the year 2007.

Monthly income (Ksh)	Rate (%)
Under Ksh.10165	10
From Ksh.10,165 but under 19741	15
From Ksh.19741 but under Ksh.29317	20

In that year, Adan's monthly gross tax was Ksh.2,885. Calculate his monthly income. (4 marks)

16. Given $\underset{\sim}{OX} = 4\underset{\sim}{i} + \underset{\sim}{j} + 3\underset{\sim}{k}$ and $\underset{\sim}{OY} = 7\underset{\sim}{i} - 5\underset{\sim}{j} + \underset{\sim}{k}$. If M is the mid-point of line XY, determine the modulus of XM. (3 marks)

16. In the figure below, AB is a diameter of the circle. Chord PQ intersects AB at N. BR which is a tangent to the circle at B meets PQ produced at R.



Given that PN = 14cm, NB = 5cm and BR = 6.5cm.
Calculate :

a) NR (1 mark)

b) AN (3 marks)

<u>SECTION II : (50 MARKS)</u>

Answer only FIVE questions from this section.

17. In 2001 the salaries of Gitonga and Cherop were sh.252000 per annum and sh.216000 per annum respectively. Their employers decided to increase their salaries as follows.

Gitonga's employer decided to give him fixed annual increments throughout his employment period, with first increment in January 2002.

Cherop's employer decided to give her increments of 8% compounded annually throughout her employment period with the first increment in January 2002.

a) If Gitonga annual salary in 2009 was sh.346080, calculate his annual increment. (2 marks)

b) How much money in total did Gitonga earn from is salaries from 1st January 2001 to 31st December 2009 ? (2 marks)

c) Determine Cherop's monthly salary of August 2009. (2 marks)

d) How much money in total did Cherop earn from her salaries from 1st January 2001 to 31st December 2009. (2 marks)

e) Determine the difference between Gitonga's and Cherop's average yearly earnings from 1st January 2001 to 31st December 2009. (2 marks)

18. A triangle PQR whose vertices are P(2, 2), Q(5, 3) and R(4, 1) is mapped onto triangle $P^1Q^1R^1$ by a transformation whose matrix is $\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}$

a) On the grid provided below, draw triangle PQR and triangle $P^1Q^1R^1$ (4 marks)

b) Triangle $P^1Q^1R^1$ is mapped onto a triangle whose vertices are $P^{11}(-2, -2)$, $Q^{11}(-5, -3)$ and $R^{11}(-4, -1)$

i) Draw triangle $P^{11}Q^{11}R^{11}$ on the same grid. (1 mark)

ii) Find the matrix representing transformation that maps triangle $P^1Q^1R^1$ onto triangle $P^{11}Q^{11}R^{11}$ (2 marks)

c) Describe the transformation that maps PQR onto triangle $P^{11}Q^{11}R^{11}$ (3 marks)

19. **a)** MNQR is a rectangle in which MN = 5cm and NQ = 8cm. Construct the locus of a point P within the rectangle which is such that P is equidistant from sides NM and NQ (2 marks)

c) The locus of P in (a) above cuts MR at T. Draw a circle whose centre O is equidistant from the three sides of triangle MNT and its radius is OM (3 marks)

c) In rectangle MNQR above, construct the locus of a variable point V such that $40^o \leq QVR \leq 90^o$ (5 marks)

20. Mrs Mureithi has 20 acres of land. She intends to grow maize and beans. She requires sh.2000 to plant an acre of maize and sh.4000 for an acre of beans. Twice the area to be planted with maize should not be less than one of beans. The total capital available is sh.60000. The estimated profit is sh.5000 for an acre of maize and sh.7000 for an acre of beans.

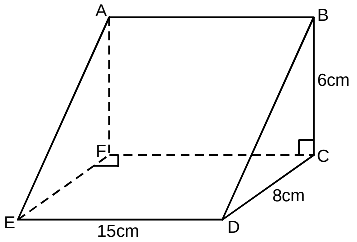
By letting x and y to represent the area to be planted with maize and beans respectively.

a) Find the inequalities to represent the information. (4 marks)

b) On the grid provided, represent the inequalities and show the region which satisfy the condition. (4 marks)

c) Determine the expected maximum profit. (2 marks)

21. In the figure below, ABCDEF is a wedge. BC = 6cm, DC = 8cm and ED = 15cm.



Find the :

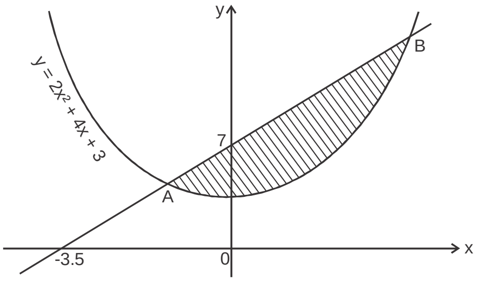
a) length BE (2 marks)

b) angle between BE and the plane EDCF (3 marks)

c) angle between plane ABDE and the plane EDCF (3 marks)

d) volume of the wedge (2 marks)

22. The sketch below shows curve $y = 2x^2 + 4x + 3$ and a straight line intersecting the curve at points A and B.



If the x-intercepts is -3.5 and the y-intercept is 7, find :

a) the equation of the straight line. (2 marks)

b) the coordinates of A and B (4 marks)

c) the area of the shaded region (4 marks)

23. The table shows marks scored by 40 candidates in an examination.

Marks	Frequency
11 - 20	1
21 - 30	5
31 - 40	8
41 - 50	9
51 - 60	8
61 - 70	4
71 - 80	2
81 - 90	3

a) Using an assumed mean of 45.5 estimate :

i) Mean (3 marks)

ii) Standard deviation (3 marks)

b) Calculate the quartile deviation. (4 marks)

24. a) Complete the table below for the values of sin 2x and 2 cos (x - 30^o) (2 marks)

x	0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°
sin 2x			0.87	1		0.5						-0.5	
2 cos (x - 30)°	1.73			1.93				0.52			-1	-1.41	

b) On the grid provided, use a suitable scale to draw the graphs of y = sin 2x and y = 2 cos (x - 30^o) for $0^o \leq x \leq 180^o$ (4 marks)

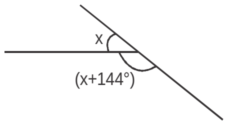
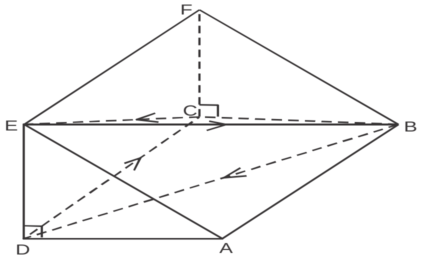
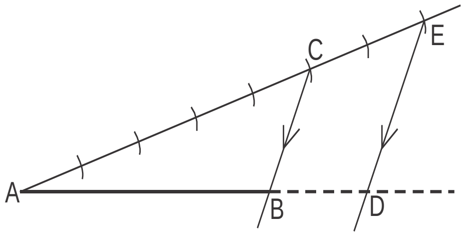
c) Using the graph in part (b) above.

i) Estimate the solution to the equation 2cos (x - 30^o) - sin 2x = 0 for $0^o \leq x \leq 180^o$ (1 mark)

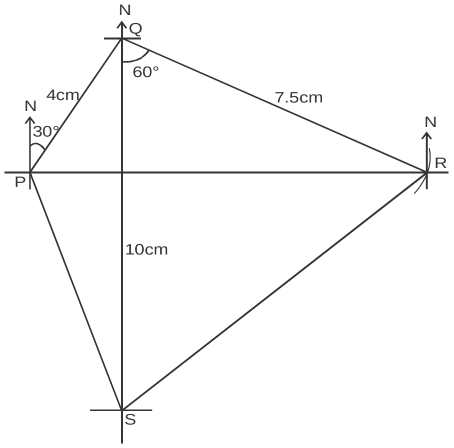
ii) Estimate the value of x for which 4 cos (x - 30^o) + 3 = 0 (3 marks)

NYERI COUNTY FORM 4 JOINT ASSESSMENT
Kenya Certificate of Secondary Education

MATHEMATICS
Paper 1
July/August 2015
Time: 2½ Hours

1.	Num 47 x 18 - 12 = 834 Den 10 + 23 - 3 = 30 $\frac{834}{30} = 27.8$	10	Tan 20° = $\frac{h}{100 + x}$ h = (100 + x) tan 20 Tan 32° = $\frac{h}{x}$ h = x tan 30° 0.2609x = 36.4 x = 139.52 h = 87.18m
2.	$\frac{2(3x + 4y)(3x - 4y)}{(2x + y)(3x - 4y)} = \frac{2(3x + 4y)}{2x + y}$		
3	3 x 250 + 5 x 200 = 1750 262.50 x 8 = 2100 % profit = $\frac{350}{1750}$ x 100 = 20%	11	x + y = 500 x - y = 200 2x = 700 x = 350 y = 150
4	Distance by bus $^3/_4$ x 60 = 45km 220 - 45 = 175km $\frac{175km}{140km/hr} = 1^1/_4$hr $^5/_4$ x 60 = 75km + 45km = 120km	12	 2x + 144° = 180° x = 18° $\frac{360}{18°}$ = 20 sides
5	½ (4.5 + 1.5) x 60 x 12 = 2160m^3 2160 x 10,000m^3 2160000 litres	13	$\frac{1}{0.4346}$ = 2.3010 $\frac{1}{0.9182}$ = 1.0890 230.10 - 54.455 = 175.64 $1.756^2 \times 10^4 = 3.084 \times 10^4$ or 30,840
6.	Gradient = $\frac{-3}{2}$ $\frac{y + 2}{x - 5} = \frac{-3}{2}$ y = $\frac{-3x}{2}$ + 5½		
7.	$(2^{2x})^3 \times 3^{4y})^{½} = 2^2 \times 3^3$ 6x = 2 2y = 3 x = $^1/_3$ y = $1^1/_2$	14	L.S.F = $\frac{5}{3} = \frac{10}{DE}$ DE = 6cm $\frac{5}{3} = \frac{1 + EC}{EC}$ EC = 1.5cm LSF = 3 : 5 ⇒ ASF = 9 : 25 DCE : ADBE 9 : 16
8	a) Triangular prism 	15	46000 x 32.58 1498680 $\frac{1498680 - 720000}{98.99}$ 7866.25
9	L_1 y = $-^1/_3$x + 3 ⇒ y + $^1/_3$ ≥ 3 L_2 x < 6 L_3 gradient = $^1/_2$ y = $^1/_2$x + 3 y - $^1/_2$x ≤ 3	16	

17



b) i) Bearing of P from S = N18°W
ii) Bearing of S from R = S48°W

c) i) Distance of S from P = 6.5cm x 100 = 650km
ii) Distance of R from S = 9.1cm x 100 = 910km

d) i) Bearing of Q from R = N62°W
ii) Bearing of P from R = due West

18

a) 22 + x, 14 + x

$\frac{22 + x}{14 + x} = \frac{16}{12}$

66 + 3x = 56 + x

x = 10

b) volume of pebble

volume of whole cone

$\frac{1}{3} \times \frac{22}{7} \times 16^2 \times 32$

vol of pebble

$\frac{1}{3} \times \frac{22}{7} \times 16^2 \times 32 - \frac{1}{3} \times \frac{22}{7} \times 12^2 \times 24$

8582.10 - 3620.57

4961.53

c) $4961.53 = \frac{4}{3} \times \frac{22}{7} \times r^3$

$r^3 = 4961.53 \times 21$

r = 10.58

d) $4 \times \frac{22}{7} \times 10.58^2$

1407.20cm^2

19

a) $\frac{1200}{x}$

b) $\frac{1200}{x - 5}$

c) $\frac{1200}{x - 5} - \frac{1200}{x} = 40$

$30x - 30x + 150 = x^2 - 5x$

$x^2 - 15x + 10x - 150 = 0$

$(x + 10)(x - 15) = 0$

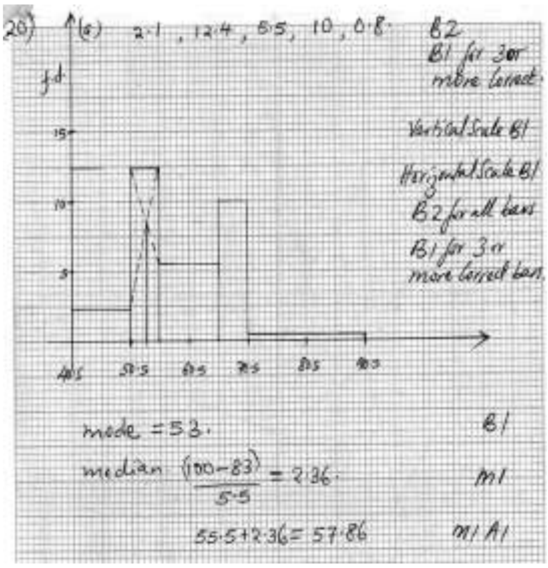
x = -10 or 15

10 pple actually contributed

d) $\frac{1200}{10}$

$\frac{5}{4}$ x 120 - 120 sh.30

20



20) (a) 2.1 , 12.4 , 5.5, 10 , 0.8. B2
B1 for 3 or more correct.

Vertical Scale B1

Horizontal Scale B1

B2 for all bars

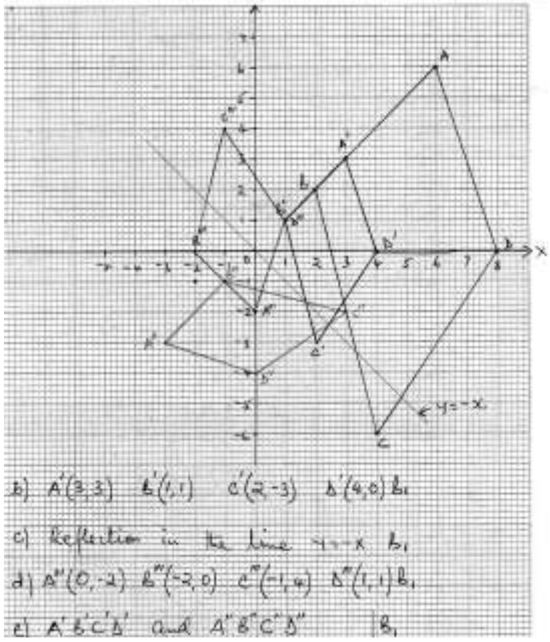
B1 for 3 or more correct bars

mode = 53. B1

median $\frac{(100-83)}{5.5}$ = 2.36. M1

55.5+2.36= 57.86 M1 A1

21



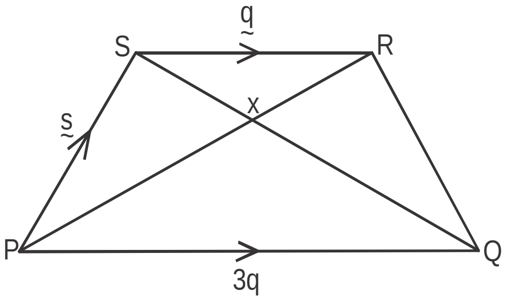
b) A'(3,3) B'(1,1) C'(2,-3) D'(4,0) B1

c) Reflection in the line y = -x B1

d) A''(0,-2) B''(-2,0) C''(-1,4) D''(1,1) B1

e) A'B'C'D' and A''B''C''D'' B1

22



	b) SQ = $-\underset{\sim}{s} + 3\underset{\sim}{q}$ or $3\underset{\sim}{q} - \underset{\sim}{s}$ c) SX = KSQ = K($-\underset{\sim}{s} + 3\underset{\sim}{q}$) = $-k\underset{\sim}{s} + 3k\underset{\sim}{q}$ or $3k\underset{\sim}{q} - k\underset{\sim}{s}$ d) SX = SP + PX = -s + hPR = -s + h(s + q) = $-\underset{\sim}{s} + h\underset{\sim}{s} + h\underset{\sim}{q}$ = $h\underset{\sim}{q} + (h - 1)\underset{\sim}{s}$ e) $3k\underset{\sim}{q} - k\underset{\sim}{s} = h\underset{\sim}{q} + (h - 1)\underset{\sim}{s}$ ⇒3k = h -k = h - 1 -k = 3k - 1 4k = 1 ⇒ k = $^1/_4$ h = 3 x $^1/_4$ = $^3/_4$ h = 3 x $^1/_4$ = $^3/_4$ f) SX = KSQ SX = $^1/_4$SQ ⇒ SX : XQ = 1 : 3	24	a) i) V = 3^2 - 3 x 3 + 2 = $2ms^{-1}$ ii) d = $\frac{t^3}{3} - \frac{3t^2}{2} + 2t + c$ at t = 0, d = 0, c = 0 ∴ d = $\frac{3^3}{3} - \frac{3(3^2)}{2} + 2 \times 3$ = 1.5m iii) a = 2t - 3 = 6 - 3 = $3ms^{-2}$ b) $t^2 - 3t + 2 = 0$ (t - 2) (t - 1) = 0 t = 1 and 2 seconds
23	i ∠FED = 180 - 60 = 120° opposite ∠s of cyclic quadrilateral ii) ∠FDB = 72 ∠FOB = 72 x 2 = 144° ∠ subtended at centre twice ∠ subtended at the circumference iii) ∠EDB = ∠EFG = 25° ∠s subtended by same chord iv) ∠BCD = 180 - (73 + 48) = 180 - 121 = 59° ∠ sum in a triangle equal to 180° v) ∠OBE = 17° difference between ∠OBD and EBD = 25		

NYERI COUNTY FORM 4 JOINT ASSESSMENT
Kenya Certificate of Secondary Education

MATHEMATICS
Paper 2
July/August 2015
Time: 2½ Hours

1.

No	Log
0.456	$\bar{1}.6590$
tan 81.2	0.8102
	0.4692
log 8293	0.5931
	$\underline{\bar{1}.8761}$
	2
8.671×10^{-1} ←	$\bar{1}.9381$
answer	0.8671

2.
$R = a + bq^2$
$a + b = 5$
$\underline{a + 9b = 21}$
$8b = 16$
$b = 2, a = 3$

$R = 3 + 2 \times 5^2$
$= 53$

3
a) $T^{-1} = -\frac{1}{3}\begin{pmatrix}-1 & -2\\ -1 & 1\end{pmatrix}$

b)
$$\begin{pmatrix}x\\ y\end{pmatrix} = -\frac{1}{3}\begin{pmatrix}-1 & -2\\ -1 & 1\end{pmatrix}\begin{pmatrix}7\\ 1\end{pmatrix}$$
$$\begin{pmatrix}x\\ y\end{pmatrix} = -\frac{1}{3}\begin{pmatrix}-9\\ -6\end{pmatrix}$$
$x = 3 \qquad y = 2$

4
$\frac{80}{100} \times 90 = 72$
$A + B = 1$
$60A + 80B = 72$

$B = {}^{12}/_{20} \quad A = {}^{8}/_{20}$

5
let $\log_2 x = y$
$y^2 - 2y - 15 = 0$
$(y - 5)(y + 3) = 0$
$y = 5$ or -3
$x = {}^{1}/_{8}$ or 32

6
max area = 10.5 x 7.5
min area = 9.5 x 6.5
= 61.75
absolute error = $\frac{78.75 - 61.75}{2}$
= 8.5
%age error = $\frac{8.5}{70} \times 100$
= 12.14%

7.
$2(1 - \cos^2 x) - \cos x = 1$
$2\cos^2 x + \cos x - 1 = 0$
let $\cos x = y$
$2y^2 + y - 1 = 0$
$(y + 1)(2y - 1) = 0$

$y = ½$ or -1

$x = {}^{\pi}/_{3}{}^{c}, {}^{5}/_{3}\pi^{c}, \pi^{c}$

8
$32 - 40x + 20x^2 - 5x^3 + {}^{5}/_{8}x^4 + {}^{1}/_{32}x^5$
$= -0.02$
$- ½x = -0.02$
$x = 0.04$
$\therefore 32 - 40(0.04) + 20(0.04)^2 - 5(0.04)^3$
$= 30.4288$

9
a) centre (2, 3)

b) $r = \sqrt{4^2 + 1^2} = \sqrt{17}$
$(x - 2)^2 + (y - 3)^2 = 17$
$x^2 + y^2 - 4x - 6y - 4 = 0$

10

x	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5
	-3	1	4	6	7	7	6	4		-3	-8

The length of the ordinates at various values of x are the values of y + 8
y = 5, 9, 12, 14, 15, 15, 14, 12, 9, 5, 0

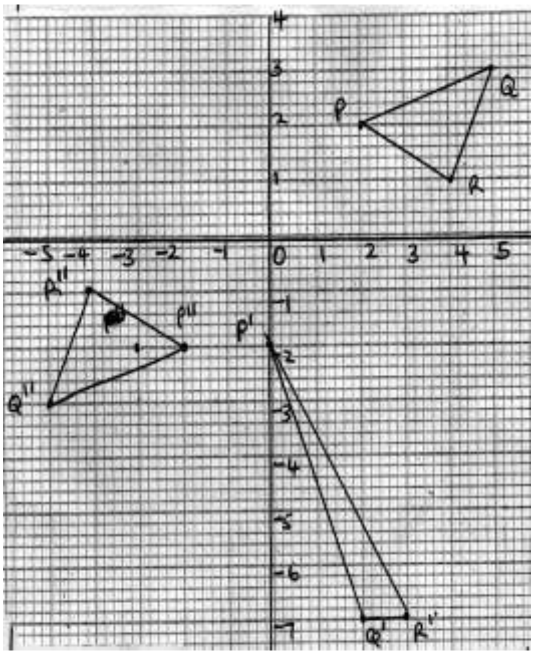
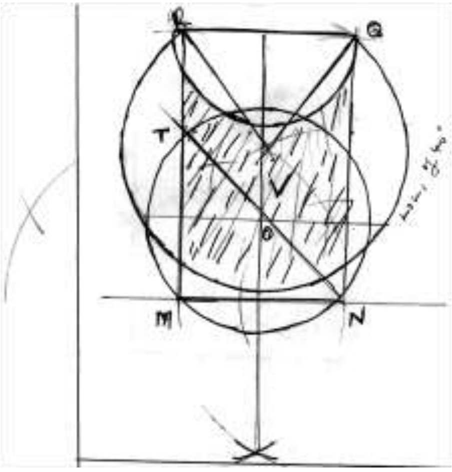
A = ½ x 0.5 [5 + 0 + 2(9 + 12 + 14 + 15 + 15 + 14 + 12 + 9 + 5)]
= 53.75sq. units

11
$\frac{\sqrt{22} + 2\sqrt{3} - (\sqrt{22} - 2\sqrt{3})}{22 - 12}$

$\frac{4\sqrt{3}}{10}$
$= \frac{2\sqrt{3}}{5}$

12
a) $P(BB) = \frac{15}{25} \times \frac{14}{24}$
$= \frac{7}{20}$

b) $P(GB) + P(BG)$
$= \frac{10}{25} \times \frac{15}{24} + \frac{15}{25} \times \frac{10}{24}$
$= \frac{1}{16}$

13	d = 60a cos x $a = \frac{1000}{60 \cos 68}$ = 44.49 ∴ 86 - 44.49 ~ 42^o New position (68^oN 42^oE)
14	$10164 \times {}^{10}/_{100} = 1016.5$ $9576 \times {}^{15}/_{100} = 1436.4$ ∴ 1016.5 + 1436.4 + (x - 19740)0.2 = 2885 x - 19740 = 432.1 x 5 = 2160.5 monthly income = sh.21,900
15	$OM = \begin{pmatrix} 5.5 \\ -2 \\ 2 \end{pmatrix}$ $XM = \begin{pmatrix} 1.5 \\ -3 \\ -1 \end{pmatrix}$ $\lvert XM \rvert = \sqrt{1.5^2 + (-3)^2 + (-1)^2}$ = 3.5 units
16	a) $NR^2 = 5^2 + 6.5$ NR = 8.201 b) QR (14 x 8.2) = 6.5^2 QR = 1.903 5 x AN = 14(8.201 - 1.903) AN = 17.63
17	a) $T_9 = 346080 = 252000 + 8d$ d = sh.11,760 b) Sq = $^9/_2$ [2 x 252000 + 8 x 11,760] = sh.2,691,360 c) $T_n = 216,000 \times 1.08^8$ = sh.399801 monthly earning = $\frac{399,801}{12}$ = sh.33,317 d) $S_9 = \frac{216,000\,(1.08^9 - 1)}{1.08 - 1}$ = sh.2,697,312 e) $\frac{2697312}{9} - \frac{2,691360}{9}$ = sh.661
18	
18	
	a) $P^1Q^1R^1$ $\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}\begin{pmatrix} 2 & 5 & 4 \\ 2 & 3 & 1 \end{pmatrix}$ $P^1(0, -2), Q^1(2, -7)\ R^1(3, -7)$ b) i) $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 0 & 2 & 3 \\ -2 & -7 & -7 \end{pmatrix} = \begin{pmatrix} -2 & -5 & -4 \\ -2 & -3 & -1 \end{pmatrix}$ a = 1 b = 1 c = 2 d = 1 matrix $\begin{pmatrix} 1 & 1 \\ 2 & 1 \end{pmatrix}$ c) Half turn about the origin
	

20

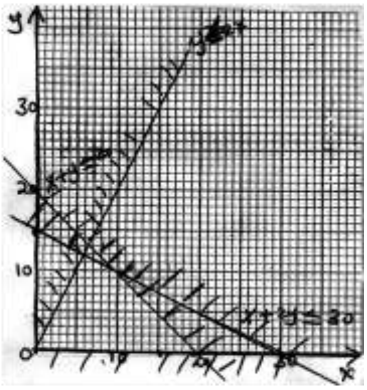
a) $x + y < 20$

$x + 2y \leq 30$

$2x \geq y$

$y \geq 0$

b.



c) p = 5000x + 7000y

max point (10, 10)

maximum profit

5000 x 10 + 7000 x 10

= 120,000

21

a) BE = $\sqrt{15^2 + 8^2 + 6^2}$

= 18.03cm

b) $\sin \theta = \frac{6}{18.03}$

$\theta = 19.44^o$

c) $\tan \beta = {}^6/_8$

$\beta = 36.87^o$

d) volume = ½ x 8 x 6 x 15

= 360cm^3

22

$M = {}^7/_{3.5} = 2$

$\therefore$ y = 2x + 7

b) $2x^2 + 2x - 4 = 0$

x = 1 or 2

coordinates of A(-2, 3)

coordinates of B (1, 9)

d) shaded area

$$\int_{-2}^{1} (2x + 7)dx - \int_{-2}^{1} (2x^2 + 4x + 3)dx$$

$$\left[\frac{2x^2}{2} + 7x\right]_{-2}^{1} - \left[\frac{2}{3}x^3 + 2x^2 + 3x\right]_{-2}^{1}$$

$$\left[(-2^2 + 7(-2)\right] - \left[1 + 7\right] - \left[{}^2\!/_3(-2)^3 + 2(-2)^2 + 3x2\right]$$

$- ({}^2/_3 + 2 + 3)$

= 9 square units

23

x	f	x - 45.5	(x - 45.5)f	$(x - 45.5)^2f$
15.5	1	-30	-30	900
25.5	5	-20	-100	2000
35.5	8	-10	-80	800
45.5	9	0	0	0
55.5	8	10	80	800
65.5	4	20	80	160
75.5	2	30	60	180
85.5	3	40	120	4800
			130	9640

a) i) mean $45.5 + \frac{130}{40} = 48.75$

ii) Std = $\sqrt{\frac{9640}{40} - \left(\frac{130}{40}\right)^2} = 15.18$

b) UQ = $50.5 + \left(\frac{30 - 23}{8}\right)10 = 59.5$

LQ = $30.5 + \left(\frac{10 - 6}{8}\right)10$

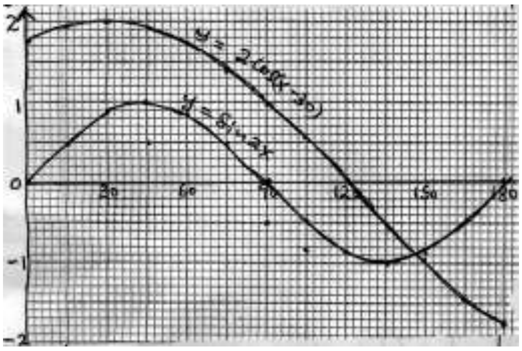
= 35.5

quartile deviation = $\frac{59.5 - 30.5}{2} = 14.5$

24

a) sin 2x, 0, 0.5, 0.87, 0, -0.5, -0.87, -1, -0.87

2 cos(x - 30), 1.93, 2, 1.73, 1.41, 1, 0, -0.52



c) i) x = 147^o

ii) 2 cos (x - 30) = -1.5

$\therefore$ y = -1.5

x = 168^o

BUSIA COUNTY FORM 4 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
PAPER 1

SECTION I (50 MARKS)

Answer ALL the questions in this Section in the spaces provided

Evaluate without using tables or a calculator. (3 marks)

$$100^{-1.5} \times 32^{0.2}$$

1. A line L is perpendicular to 3y - 4x = 7. Determine the acute angle between L and the x-axis. (3 Marks)
3. Two trucks P and Q approach each other at 52km/h and 61km/h respectively. Truck P is 12.5m long and Q is 13m long. If they are 5m apart how many seconds elapses before the two completely pass each other. Give your answer to 2d.p. (4 marks)
4. Find a scalar K such that (2 marks)

$$\begin{pmatrix}4\\3\end{pmatrix} + K\begin{pmatrix}-2\\1\end{pmatrix} = \begin{pmatrix}0\\5\end{pmatrix}$$

5. The ratio of Omondi and Kamau's earning was 4:3. Omondi's earning rose to Sh. 22,800 after an increase of 14%. Calculate the percentage increase in Kamau's earnings given that the sum of their earnings was ksh 39600 of each got an increment. (4 marks)
6. The interior angles of an irregular polygon are 70° and 110° and the rest are each 144°. Determine the number of sides of the polygon. (3 marks)
7. Either by striding 48cm or 54cm, Joan takes an exact number of steps to cross the road. Find the least width of the road in metres. (3 marks)
8. Use logarithms to 4 d.p to evaluate: (4 marks)

$$\sqrt[3]{\frac{36.19 \times (0.58)^2}{273.6}}$$

9. The present ages of two children are 3 years and 5 years respectively. After how long will the sum of the squares of their ages be 130? (3 marks)
10. Pamba bought 4 mobile phones and 2 laptops for ksh, 108,000. Rebecca bought 3 mobile phones and 5 laptops from the same shop for ksh 228,000. How much will Juma pay for one mobile phone and 2 laptops. (3 marks)

= 5cm ⍰BAD = 90° and ⍰BCD = 120°. Measure the shortest

11. Using a pair of compasses construct a trapezium ABCD such that AB is parallel to DC. AB = 8.5cm BC distance from C to line AB. (3 marks)
12. The angle of elevation of the top of a flag post from a point A on the level ground is 12°. The angle of elevation of the top of the flag post from another point B nearer to the flag post and 98m away from A is 34°. B is in between A and the bottom of the flag post and the three points are collinear. Find the height of the flag post to the nearest metre.(3 marks)
13. Find a 2 x matrix m such that; (3 marks)

$$\begin{pmatrix}1 & 3\\2 & -1\end{pmatrix}\underset{\sim}{m} + \begin{pmatrix}4 & -6\\2 & 0\end{pmatrix} = \begin{pmatrix}1 & 7\\3 & -2\end{pmatrix}$$

14. A car dealer buys a car for Ksh 1,500,000 and hires it for 24 weeks at a charge of ksh 3000 per day. Insurance costs Ksh 42,000 during the entire period. He sold the car through a dealer at sh 800,000. If the dealer was paid a commission of 2½% calculate the percentage profit made. (3 marks)
15. Given that 5x = 4y, evaluate (3 marks)

$$\frac{\frac{1}{4}x^2 - 4xy + y^2}{4x^2 + y^2}$$

16. $\int_{-1}^{2} x(x-1)(x+2)\quad dx$ (3 marks)

SECTION II (50 MARKS)

Answer only FIVE questions from this section in the spaces provided

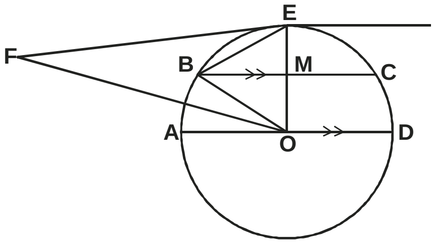
17. A ship sails from A to D through B and C. B is 500km on a bearing of N50°E from A. C is on a bearing of 340° from B and at a distance of 620km. The bearings of D from A and C are N20°W and 560°W respectively.
    (a) Using the scale 1cm to rep 100km, show the relative positions of A, B, C and D. (4 marks)
    (b) Find the distance of D from: (2 marks)
        (i) A
        (ii) C
    (c) Find the bearing of D from B. (1 mark)
    (d) If the ship was sailing at an average of 500km/h. Find how long the journey took. Give the answer to the nearest hour. (3 marks)

18. (a) Complete the table below for $y = 8 - 10x - 3x^2$. (2 marks)

x	-5	-4	-3	-2	-1	0	1	2
y								

(b) On the grid provided, draw the graph of $y = 8 - 10x - 3x^2$ (3 marks)
(c) State the equation of the line of symmetry of $y = 8 - 10x - 3x^2$ (1 mark)
(d) Use your graph to solve:
(i) $3x^2 + 10x - 8 = 0$ (1 mark)
(ii) $3x^2 + 11x + 6 = 0$ (3 marks)

19. In the figure below AOD is a diameter of the circle centre O. BC is a chord parallel to AD and FE is a tangent to the circle at E.



Given that OF bisects ∠AOB and M is the intersection of BC and OE and ∠EBC = BOE = 20°. Giving reasons find the following angles.
(i) ∠COE (2 marks)
(ii) ∠BEC (2 marks)
(iii) ∠BEF (2 marks)
(iv) ∠OMB (2 marks)
(v) ∠OFE (2 marks)

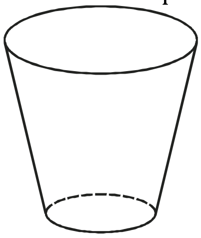
20. The table below gives the marks scored by a group of students in an exam.

Marks	10-19	20- 24	25-29	30 - 34	35-39	40 - 49
No. of students	3	4	x	10	9	7

(a) Given that the mean mark was 32.125, find x. (4 marks)
(b) State the modal class. (1 mark)
(c) Calculate the interquartile range. (5 marks)

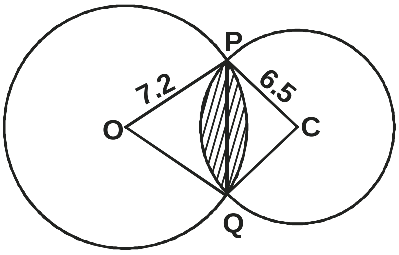
21. The equation of a curve is given by
$y = x^3 - 5x^2 + 2x + 9$
(a) Find the gradient function of the curve and its value when $x = -2$. (3 marks)
(b) Determine
(i) the equation of the tangent to the curve at $x = -2$. (3 marks)
(ii) the equation of the normal to the curve at $x = -2$. (2 marks)
(c) The values of x at the turning points of the curve. (2 marks)

22. A glass is in the shape of a frustum of a cone.



The bottom of the glass is a curve of radius 2cm. A father pours water into the glass to a height of 9cm, while the surface of the water is a circle of radius 6cm.
(a) Calculate the volume of the water in the glass. (4 marks)
(b) The son who is playing with marbles drops two spherical balls into the water. The water level in the glass rises by 1.5cm as a result.
Calculate:
(i) the volume of one marble. (4 marks)
(ii) the radius of a marble. (2 marks)

23. Two circles centres O and C have radii 7.2cm and 6.5cm respectively. The two circles intersect at P and Q and PQ =10cm.



(a) Find (i) ∠POQ (2 marks)

(ii) ∠PCQ (2 marks)

(b) The area of the shaded part. Give answer to 4s.f. (4 marks)

(c) Express ∠POQ in radians. (2 marks)

24. On a certain day Mwema bought plates worth Ksh 120. On another day Mrs Mwema spent the same amount of money but bought the plates at a discount of 20% per plate.

(a) If Mwema bought a plate at sh x write down a simplified expression for the total number of plates bought by the two people. (3 marks)

(b) If Mrs. Mwema bought 6 plates more than her husband find how much each spent on a plate. (5 marks)

(c) Find the total number of plates bought by the family. (2 marks)

BUSIA COUNTY FORM 4 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
PAPER 2

SECTION I (50 MARKS)

Answer ALL the questions in this Section.

1. Evaluate without using tables or calculator. (3 marks)

$$\frac{\left(\frac{4}{11}\right)^2 of \left(\frac{3}{5}-\frac{1}{20}\right)}{\left(1\frac{4}{5}+1\frac{2}{5}\right)\div\left(\frac{1}{5}+\frac{9}{10}\right)}$$

2. Using a calculator, simplify; (2 marks)

$$\frac{1.32 \text{ x } 1.62 + 2.64 \text{ x } 1.19}{0.66 \text{ x } 7.27 - 0.66 \text{ x } 2.27}$$

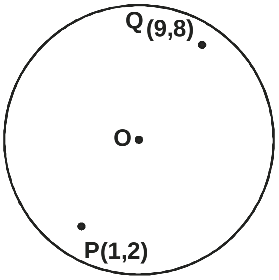
3. (a) Given that $P = \begin{pmatrix} 3 & -1 \\ 2 & 4 \end{pmatrix}$ *and* $Q = \begin{pmatrix} 4 & 1 \\ -2 & 3 \end{pmatrix}$ Find PQ. (1 mark)

(b) Hence, find the point of intersection of the lines 4x + y = 9 and 3y =2x -1 (3 marks)

4. Solve for x, (3 marks)

$$(\log_2 x)^2 + \log_2 8 = \log_2 x^4$$

5. P and Q are the points on the ends of the diameter of the circle below.



(a) Write down in terms of x and y the equation of the circle in the form; (2 marks)
$ax^2 + by^2 + x + y + c = 0$

(b) Find the equation of the tangent at Q in the form ax + by + c = 0. (2 marks)

6. Expand $(1 - {}^{1}/_{2x})^9$ up to the fourth term, hence use your expansion to evaluate 0.995^9, correct to 4 decimal places. (4 marks)

7. Simplify the expression. (4 marks)

$$\frac{2x^2 - 3xy - 2y^2}{4x^2 - y^2} \div \frac{2x + y}{2x - y}$$

8. The cost per kg of two brand of tea x and y are Sh. 60 and Sh. 80. The two brands are mixed and sold at a profit of 20% above the cost. if 1kg mixture was sold at Sh. 78, determine the ratio in which the two brands were mixed.(3 marks)

9. Make P the subject of the formula. (3 marks)

$$YP - X + \frac{Q}{P} = O$$

10. A farmer wishes to enclose a rectangular nursery against a long straight wall. He has 40m of fencing wire. What is the largest area he can fence using the wire. (3 marks)

11. In the figure below, not drawn to scale, AX = 3cm, XB =3cm and ÐCXB =90°. Given that the circle has a radius of 4.5cm. Calculate the length CD. (2 marks)

12. Given that **OA** = 3**i** + 2**j** - 4**k** and **OB** = 4**i** + 5**j** - 2**k.** P divides AB externally in the ratio 3: -2. Determine the position vector of P in terms of **i, j** and **k.** (3 marks)

13. Find the sum of the first six terms of the progression given;
Log 2x + log 4x + log 8x + log 16x + ...
leaving your answer in the form a log bx^2 where a and b are integers. (3 marks)

14. A varies as b and inversely as the square root of C. When B is increased by 26%, C is reduced by 19%. Find the percentage change in the value of A. (4 marks)

15. Solve the equation $4 - 4\text{Cos}^2 x = 4\text{Sin } x - 1$ for the range $0° \leq x \leq 360°$. (3 marks)

16. Find the quartile deviation of the following set of scores. (3 marks)
38, 121, 111, 143, 101, 120, 107, 106, 137, 141, 140.

SECTION II (50 MARKS)

Answer only FIVE questions from this section.

17. The table below shows the rates of taxation in a certain year.

Income in K£ p.a	Rate of taxation in Sh. per K£
1 - 3900	2
3901 - 7800	3
7801 - 11,700	4
11,701 - 15,600	5
15,601- 19,500	7
Above 19,500	9

In that period, Mr. Omoit a teacher at Mundika Boys earning a basic salary of Ksh. 21,000 per month. In addition, he was entitled to a house allowance of Kshs 9,000 p.m and a personal relief of Kshs 1056 /per month.

(a) Calculate how much income tax Mr. Omoit paid per month. (5 marks)

(b) Mr. Omoit's .other deductions per month were co-operative society contributions sh 2,000 loan repayment, sh 2,500/-. Calculate his net salary per month. (2 marks)

(c) Later in the same year, Mr. Omoit was transferred to Katira Secondary School where he earned hardship allowance equivalent to 30% of his basic salary. If on top of deductions in (b) above he also had deduction of sh 2,700 p.m to KCT. Calculate the percentage change in his net salary per month. (3 marks)

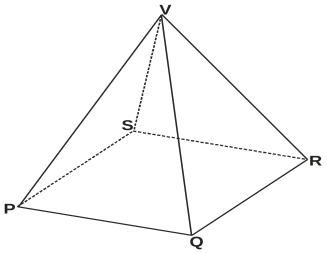
18. A dealer wishes to purchase cookers and refrigerators. he can buy at most 60 of both items. On average, a cooker and a refrigerator costs sh 24,000 respectively. He must spend at least sh 480,000. The number of refrigerators should be at most four times the number of cookers. He must buy more than 10 refrigerators. Taking the number of cookers to be x and the number of refrigerators to be y:

(a) Form all inequalities to represent the above information and graph them. (5 marks)

(b) If the dealer makes a profit of sh 1200 and sh 2000 per cooker and refrigerator respectively, find the maximum profit he will make. (2 marks)

(c) During a sales promotion week, the dealer declared a discount of 10% and 5% on the display prices of each other cooker and refrigerator respectively. Determine his new maximum profit. (3 marks)

19. The diagram below shows a right pyramid with a horizontal rectangular base PQRS and vertex V. The area of the base is 60cm^2 and the volume of the pyramid is 280cm^3.



(a) Calculate the height of the pyramid. (2 marks)

(b) Given the ratio of the sides PQ: QR is 3:5 find the lengths of

(i) PQ (2 marks)

(ii) QR (2 marks)

(c) Find the length of the slanting height. (2 marks)

(d) Calculate the angle between the planes VRQ and PQRS. (2 marks)

20. Use ruler and compasses only for all the constructions in this question.

(a) Construct a triangle ABC in which AB= 6cm, BC = 7cm and angle ABC = 75°. Measure:

(i) the length of AC

(ii) the angle of ACB

(b) Locus of P is such that BP = PC. Construct P. (4 marks)

(c) Construct locus of Q such that Q is on one side of BC opposite A and angle BCQ = 30°. (2 marks)

(d) (i) the locus of P and locus of Q meet at X. Mark X. (1 mark)

(ii) Construct the locus of R in which angle BRC = 120°. (1 mark)

(iii) Show the locus of S inside the triangle ABC such that $XS \geq SR$. (1 mark)

21. I own a motorcycle. Out of the 21 working days in a month, I only ride to work for 18 days. If I ride to work the probability that I am bitten by a rapid dog is $^4/_{15}$, otherwise it is only $^1/_3$ when I am bitten by the dog, the probability that I will get treatment is $^4/_5$ and if I do not get treatment, the probability that I will get rabies is $^5/_7$.

(a) Draw a tree diagram to show the events. (3 marks)

(b) Musing the tree diagram (a) above determine the probability that:

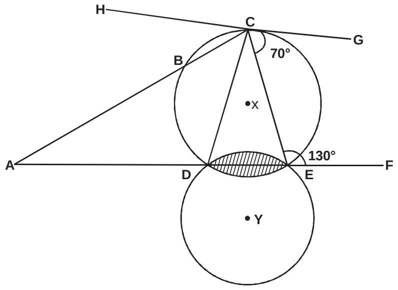
(i) I will not be bitten by a rapid dog. (2 marks)

(ii) I will get rabies (3 marks)

(iii) I will not get rabies

∠GCE = 70° and ∠CEF = 130°. Given that CB = 5cm, BA = 4cm, AE = 12cm and radius DY = 6cm. (2 marks)

22. The diagram below shows two intersecting circles with centres X and Y. HG is a tangent to the circle centre X at C.



(a) Determine:
   (i) Angle DXE (2 marks)
   (ii) Length DE (2 marks)

(b) Hence, calculate the area of the shaded region. (6 marks)

23. Two places P and Q are on the parallel of latitude 26°N. The two points lie on 10°W and 30°E longitudes respectively.

(a) Find the distance between P and Q along their parallel of latitude in
   (i) km (Taking R = 6370km and π = 3.142) (2 marks)
   (ii) nm (2 marks)

(b) Find in km the distance between points P and Q along a great circle. (2 marks)

(c) Two planes X and Y left P for Q at an average speed of 1200 knots and 5000 knots respectively. If X flew along the great circle and Y along the parallel of latitude, which one arrived earlier and by how much time? (4 marks)

24. Triangle PQR is the image of triangle ABC under the transformation where A, B and C maps onto P, Q and R respectively.

(a) Given the points A(5, -1) B(6, -1) and C (4, -0.5). Draw the triangle ABC and its image triangle PQR on the grid provided below. (3 marks)

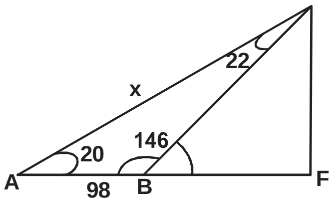
(b) Triangle PQR in part (a) above is to be enlarged by scale factor 2 with centre at (11, -6) to map onto $P^1Q^1R^1$. Construct and label triangle $P^1Q^1R^1$ on the grid above. (2 marks)

(c) By construction, find the co-ordinates of the centre and angle of rotation which can be used to rotate triangle $P^1Q^1R^1$ onto $P^{11}Q^{11}R^{11}$ whose vertices P^{11}(-3, -1) Q^{11} (-7, -1) and R^{11} (-3, -3) (3 marks)

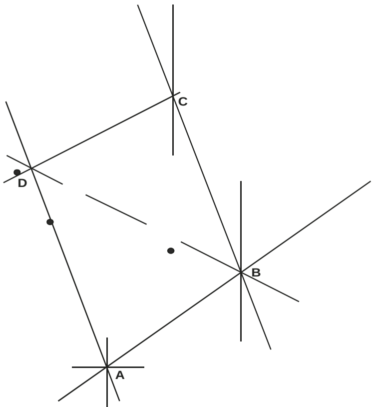
(d) Find the co-ordinates of the vertices of the triangles LMN, the image of triangle $P^1Q^1R^1$ under a stretch scale factor 2, line y = 2, invariant L, M and N to map onto P^1Q^1 and R^1 respectively. (2 marks)

BUSIA COUNTY FORM 4 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
PAPER 1

1.	$100^{-\frac{3}{2}} \times 32^{\frac{1}{5}} = 0.002$
2.	$3y = 7 + 4x$ $y = \frac{7 + 4x}{3}$ $\tan\theta = \frac{4}{3}$ tangent $\theta = 53.13°$
3.	R. Speed = 52 + 61 = 113km/h T. distance = 12.5 + 5 + 13 = 30.5m $t = \frac{30.5}{113 \times 1000}$ h $= \frac{30.5}{113 \times 1000} \times 60 \times 60$ = 0.97s
4.	4 + -2k = 0 or 3 + k = 5 k = 2
5.	114% ____ 22800 100% ____ $\frac{22800 \times 100}{114}$ = ksh 20000 Kamau's original earnings 4 _____ 20,000 3 ____ $\frac{3 \times 20{,}000}{4}$ = sh 15,000 Kamau's new earnings 39600 - 22,800 = sh 16,800 % increase = $\frac{16800 - 15{,}000}{15{,}000} \times 100\%$ = 12%
6.	110 + 70 + 36n = 360° 36n = 180 n = 5 No of sides 5 + 2 = 7 sides
7.	$\begin{array}{c\|cc} 2 & 48 & 54 \\ \hline 2 & 24 & 27 \\ 2 & 12 & 27 \\ 2 & 6 & 27 \\ 2 & 3 & 27 \\ 3 & 1 & 9 \end{array}$ LCM = $2^4 \times 3^3$ = 432 = 4.32m
8.	36.19 → 1.5586 $0.58^2 \to -0.2366 \times 2$ = -0.4732 273.6 2.4371 1.5586 + - 0.4732 - 2.4371 = -1.3517 ÷ 3 = -0.4506 = 0.3543
9.	$(3 + x)^2 + (5 + x)^2 = 130$ $2x^2 + 16x - 96 = 0$ $x^2 + 8x - 48 = 0$ (x + 12) (x -4) = 0 x = 4 years

10.	4m + 2p = 108000 3m + 5p =22800 12m + 6p = 324000 12m + 20p = 912000 -14p = -588000 p = sh 42,000 m = sh 6000 Juma pays: 6000+ 2(42,000) = Ksh 90,000
11.	
12	 $\frac{98}{\sin 22} = \frac{x}{\sin 146}$ = 146.2892 h = 146.2892Sin 12°
13	$\begin{pmatrix} 1 & 3 \\ 2 & -1 \end{pmatrix} \underset{\sim}{m} = \begin{pmatrix} -3 & 13 \\ 1 & -2 \end{pmatrix}$ $m = -\frac{1}{7}\begin{pmatrix} -1 & -3 \\ -2 & 1 \end{pmatrix}\begin{pmatrix} -3 & 13 \\ 1 & -2 \end{pmatrix}$ $m = \begin{pmatrix} 0 & \frac{19}{7} \\ -1 & \frac{24}{7} \end{pmatrix}$
14	Income 3000 x 7 x 24 = 540,000 Sales $\frac{97.5}{100} \times 800{,}000$ = 780,000 (780,000 + 540,000) - (1,500,000 + 42,000) = 258,000
15.	$y = \frac{5}{4}x = 1.25x$ $\frac{\frac{1}{4}x^2 - 4x(1.25x) + (1.25x)^2}{4x^2 + (1.25x)^2}$ $= \frac{-3.1875x^2}{5.5625x^2}$ = -0.573
16.	$\int_{-1}^{2} x^3 + x^2 - 2x \quad dx$ $\left.\frac{x^4}{4} + \frac{x^3}{3} - \frac{2x^2}{2}\right]_{-1}^{2}$ $(4 + 2\frac{2}{3} - 4) - \frac{1}{4} - \frac{1}{3} - 1)$ = 3¾

17. (a)



b) (i) 700km
(ii) 470km
c) 298°
d) Total distance = 500 + 620 + 700 + 470

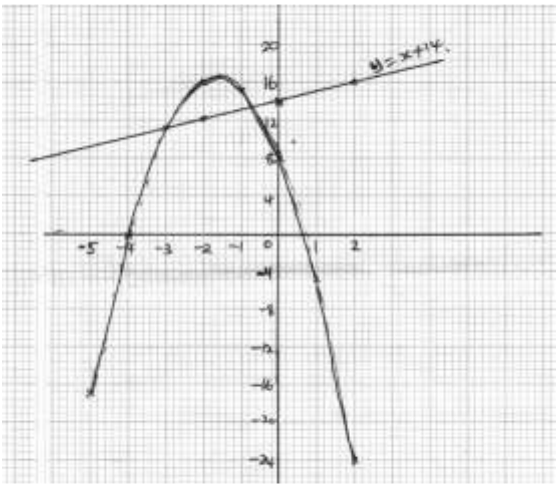
$$\text{Time} = \frac{2290}{500}$$

= 5hrs

18.

x	-5	-4	-3	-2	-1	0	1	2
y	-17	0	11	16	15	8	-5	-24

(b)



c) x = -1.7 $\underline{+}$ 0.1
d) (i) x = -4 or x = 0.6
(ii) y = x + 14
x = -3 or x = 0.8

19. (i) ∠COE = 40°
angle at the centre twice
angle at circumference
(ii) ∠BEC
= ½ (300) = 150°
angle at circumference ½ angle at the centre
(iii) ∠BEF = 10°
Tangent meets radius at 90°
(iv) ∠OMB =100°
An exterior angle of a D equals sum of two
oppositeInterior angles
(v) ∠OFE = 40°
Sum of angles in D

20.

x	14.5	22	27	32	37	44.5	
f	3	4	x	10	9	7	=33 + x
fx	43.5	88	27x	320	333	311.5	=1096 + 27x

$$\frac{1096 + 27x}{33 + x} = 32.125$$

1096 + 27x = 1060.125 + 32.125x
5.125x = 35.875
x = 7
b) 30 - 34
c) Cf 3 7 14 24 33 40

$$34.5+\left(\frac{30-24}{9}x5\right)=37.83$$

$$24.5+\left(\frac{10-7}{7}x5\right)=\frac{26.64}{11.19}$$

21

(a) $^{dy}/_{dx}$ = 3x^2 - 10x + 2
at x = 2
$^{dy}/_{dx}$ = 3(-2)^2 - 10 (-2) + 2
= 34
(b) (i) y = (-2)^3 - 5(-2)^2 + 2(-2) + 9
= -23

$$\frac{y --23}{x --2} = 34$$

y + 23 = 34 (x +2)
y = 34x + 45
(ii) gradient of normal = -$^1/_{34}$

$$\frac{y + 23}{x + 2} = \frac{-1}{34}$$

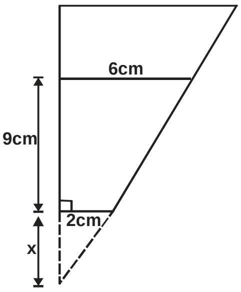
34y = -x - 784

(c) 3x^2 - 10x + 2 = 0

$$x=\frac{10\pm\sqrt{100-4(3)(2)}}{3(2)}$$

$$=\frac{10\pm 8.718}{6}$$ x= 3.1197 or x = 0.2134

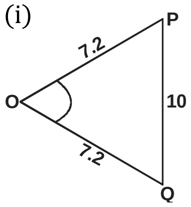
22



$$\frac{x + 9}{x} = \frac{6}{2} \qquad x = 4.5$$

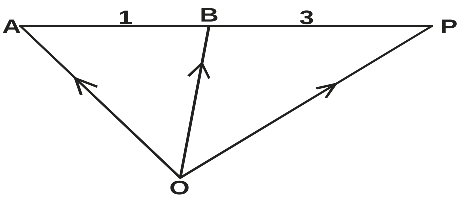
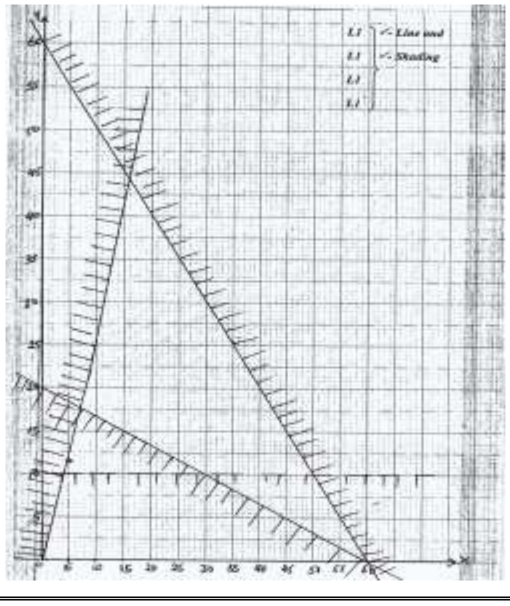
(a) Vol = $^1/_3$p x 6^2 x 13.5 - $^1/_3$p x 2^2 x 4.5
= 490.152cm^3

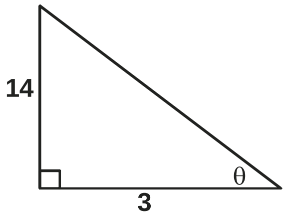
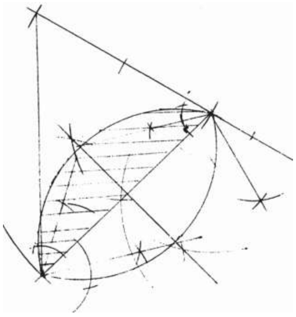
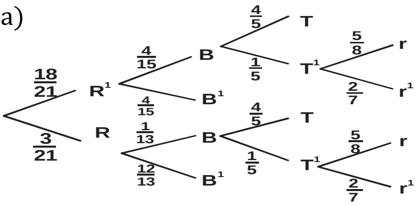
(b) (i) $\frac{r}{2} = \frac{15}{4.5}$ r = 6.667

	$\text{Vol} = \frac{1}{3}p \times 6.667^2 \times 15 - \frac{1}{3}p \times 2^2 \times 4.5$ $= 679.44\text{cm}^3$ Vol of one marble = $\frac{679.44 - 490.152}{2}$ $= 94.644\text{cm}^2$ (ii) $\frac{4}{3}pr^3 = 94.644$ $r^3 = 22.59166$ r = 2.827cm	24.	(a) Plates bought by Mwema = $\frac{1200}{x}$ Plates bought by Mrs. Mwema = $\frac{1200}{0.8x}$ Total $\frac{1200}{x} + \frac{1200}{0.8x}$ (b) $\frac{120}{0.8x} - \frac{1200}{x} = 6$ $1200x - 1200 (0.8x) = 6(0.8x^2)$ $240x = 4.x^2$ $4.8x^2 - 240x = 0$ $x (4.8x - 240) = 0$ x = 50 Mwema: sh 50 per plate Mrs Mwema: sh 40 per plate (c) $\frac{1200}{50} + \frac{1200}{40}$ = 54
23.	(a) (i)  $10^2 = 7.2^2 + 7.2^2 - 2(7.2) (7.2) \text{ Cos } q$ q = 87.97° (ii) $10^2 = 6.5^2 + 6.5^2 - 2(6.5) (6.5) \text{ Cos } q$ q = 100.57° (b) $\frac{87.97}{360} \times p \times 7.2^2 - \frac{1}{2} \times 7.2 \times 7.2 \sin 87.97$ = 13.898 $\frac{100.57}{360} \times p \times 6.5^2 - \frac{1}{2} \times 6.5 \times 6.5 \text{ Sin } 100.57$ = 16.319 Total area = 13.898 + 16.319 = 30.217 = 30.22 (c) $\frac{87.97 \times 2(3.142)}{360}$ = 1.536		

BUSIA COUNTY FORM 4 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
PAPER 2

No	
1.	$\dfrac{\left(\frac{4}{11}\right)^2 of\ \frac{3}{5}-\left(\frac{1}{20}\right)}{\left(1\frac{4}{5}+1\frac{2}{5}\right)\div\left(\frac{1}{5}+\frac{9}{10}\right)}$ $=\dfrac{\left(\frac{4}{11}\right)^2\times\frac{11}{20}}{\frac{16}{5}\div\frac{11}{10}}$ $=\dfrac{\frac{16}{121}\times\frac{11}{20}}{\frac{16}{5}\times\frac{10}{11}}$ $=\dfrac{4}{5}\times\dfrac{11}{32}$ $=\dfrac{1}{40}$
2.	$\dfrac{1.32 \times 1.62 + 2.64 \times 1.19}{0.66 \times 7.27 - 0.66 \times 2.27}$ = 1.6
3.	$PQ=\begin{pmatrix}14 & 0\\ 0 & 14\end{pmatrix}$ $\begin{pmatrix}4 & 1\\ -2 & 3\end{pmatrix}\begin{pmatrix}x\\ y)\end{pmatrix}=\begin{pmatrix}9\\ -1\end{pmatrix}$ $\frac{1}{14}\begin{pmatrix}3 & -1\\ 2 & 4\end{pmatrix}\begin{pmatrix}4 & 1\\ -2 & 3\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix}=\frac{1}{14}\begin{pmatrix}3 & -1\\ 2 & 4\end{pmatrix}\begin{pmatrix}9\\ -1\end{pmatrix}$ $=\begin{pmatrix}x\\ y\end{pmatrix}=\begin{pmatrix}2\\ 1\end{pmatrix}$ Points = (2, 1)
4.	$(\log_2 x)^2 + \log_2 8 = \log_2 x\ 4$ $(\log_2 x^2 + 3 = 4\log_2 x$ Let $\log_2 x = t$ $t^2 - 4t + 3 = 0$ $(t -1)(t -3) = 0$ t = 1 or 3 $\log_2 x = 1, x = 2$ $\log_2 x = 3, x = 8$
5.	(a) Centre $\left(\frac{9+1}{2}, \frac{8+2}{2}\right)$ (5,5) $r=\sqrt{(9.5)^2+(8-5)^2}$ $r=\sqrt{25}$ r = 5 units $(x-5)^2 + (y - 5)^2 = 5^2$ $x^2 - 10x + 25 + y^2 - 10y + 25 = 25$ $x^2+ y^2 \quad 10x - 10y + 25 = 0$ (b) $M_1 = \dfrac{8 - 5}{9 - 5} = \dfrac{3}{4}$ $M_2 = \dfrac{-4}{3}$ $\dfrac{y - 8}{x - 9} = \dfrac{-4}{3}$ 3y - 24 = -4 + 36 4x + 3y - 60 = 0
6	$1 - \dfrac{9}{2x} + \dfrac{9}{x^2} - \dfrac{21}{2x^3}$ x = 100 $0.9959 = 1- {}^{9}/_{200} + {}^{9}/_{(100)^2} - {}^{21}/_{2(100)^3}$ = 1 - 0.045 + 0.0009 - 0.0000105 = 0.95588 = 0.9559 (4d.p)
7.	$\dfrac{2x^2 - 3xy - 2y^2}{4x^2 - y^2} \div \dfrac{2x + y}{2x - y}$ $\dfrac{2x^2 - 4xy + xy - 2y^2}{(2y - y)(2x + y)} \times \dfrac{2x - y}{2x + y}$ $\dfrac{2x(x - 2y) + y(x - 2y)}{(2x - y)(2x + y)} \times \dfrac{2x - y}{2x + y}$ $\dfrac{(x - 2y)(2x - y)(2x -y)}{(2x - y)(2x + y)(2x + y)}$ $= \dfrac{x - 2y}{2x + y}$
8.	Cost per kg of mixture = $\dfrac{100}{120}$ x 78 = sh 65 Ratio of mixture = 15:5 = 3:1
9	$YP - x + \dfrac{Q}{P} = 0$ $YP^2 - XP + Q = 0$ $P^2 - XPQ = 0$ $P^2 - \dfrac{XP}{Y} + \dfrac{Q}{Y} = 0$ $P^2 - \dfrac{X}{Y}P = \dfrac{-Q}{Y}$ $P^2 - \dfrac{XP}{Y} + \left(\dfrac{-x}{2y}\right)^2 = \dfrac{-Q}{Y} + \left(\dfrac{-x}{2Y}\right)^2$ $\sqrt{\dfrac{(P-x)^2}{2Y}} = \pm\sqrt{\dfrac{x^2}{4Y^2}-\dfrac{Q}{Y}}$ $P = \dfrac{x}{2y} \pm \sqrt{\dfrac{x^2}{4Y^2}-\dfrac{Q}{Y}}$ $P = \dfrac{x \pm \sqrt{x^2-4YQ}}{2y}$
10.	Area = X x $\dfrac{(40 -x)}{2}$ X x (20 - ½x) A = 20x - ½x At max. area $\dfrac{dA}{dX} = 20 - x = 0$ ∴ X = 20cm Max. area = 20 x $\dfrac{(40 - 20)}{2}$ = 20 x 10 = 200m²

11.	CD is a bisector of chord AB $\therefore$ CD is diameter CD = 2r = 2 x 4.5 = 9cm
12.	 **OP** = -2**a** + 3**b** = -2(3**i** + 2**j** - 4**k**) + 3(4**i** + 5**j** - 2**j**) = -6**i** - 4**j** + 8**k** + 12**i** + 15**j** -6**k** = 6**i** + 11**j** + 2**k**
13.	Log 2x + log 4x + log 8x d = log 2 a = log 2x Sn= $^n/_2$(2a + (n-1)d) $S_6 = {}^6/_2$(2log 2x + (6 -1) log 2) = 3 (log 4x^2 + 5log 2) = 3(log 4x^2 +log 2^5) = 3 log (4x^2 x 2^5) = 3 log (4x^2 x 32) = 3 log 128x^2
14.	$A\alpha \frac{B}{\sqrt{C}}$ $A = \frac{-B}{\sqrt{C}}$ $A^1 = \frac{\frac{1.26BK - KB}{0.9\sqrt{C} \qquad \sqrt{C}x100}}{\frac{KB}{\sqrt{C}}}$ $= \frac{\frac{KB}{\sqrt{C}}\left(\frac{1.26}{0.9} - 1\right)}{\frac{KB}{\sqrt{C}}} \times 100$
15.	$A\alpha \frac{B}{\sqrt{C}}$ $A = \frac{-B}{\sqrt{C}}$ $A^1 = \frac{\frac{1.26BK - KB}{0.9\sqrt{C} \qquad \sqrt{C}x100}}{\frac{KB}{\sqrt{C}}}$ $= \frac{\frac{KB}{\sqrt{C}}\left(\frac{1.26}{0.9} - 1\right)}{\frac{KB}{\sqrt{C}}} \times 100$ = (1.4 - 1) 100 = 40%
16.	101, 106, 107, 111, 120, 121, 137, 138, 140, 141, 143 Q1 = ¼(11 + 1)th measure = 107 Q3 = ¾(11 + 1)th measure = 140 Quartile deviation = $\frac{140 - 107}{2}$ = 16.5
17.	(a) T.I = $\frac{(30,000 \text{ x } 12)}{20}$ k£ p.a = 18,000 k£ p.a Slab 1: 3900 x 2 = sh 7,800 Slab2: 3900 x 3 = sh 11,700 Slab 3: 3900 x 4 = sh 15,600 Slab 4: 3900 x 5 = sh 19,500 Slab 5: (18,000 - 15,600) 7 = sh 16,800 Gross tax = sh 71,400p.a = sh 5950 p.m Net tax = 5950 - 1056 = sh 4894 p.m (b) Net salary = 30,000 - (4894+ 4500) = sh 20,606 p.m (c) New T.I = $^{130}/_{100}$ x 21,000) + 9000 = sh 36,300 <u>=21,780k£ p.a</u> slab 5: 3900 x 7 = sh 27,300 Slab 6: (21,780 - 19,500)9 = sh 20,520 Gross tax = sh 102,420p.a = sh 8535 p.m Net tax = 8,535 - 1,056 = sh 7,479 p.m Net salary = 36,300 - (14,679) = sh 21,621 p.m % increase = $\frac{21,621 - 20,606}{20,606}$ x 100 = 4.926%
18.	a) $x + y \leq 60$ $x + 3y \geq 60$ $y \leq 4x$ $y > 10$ b) For max P: = 12, y = 48 P = 1200 (12) + 2000(4 = sh 110,400 

	(b) For max P: = 12, y = 48 P = 1200 (12) + 2000(48) = sh 110,400 (c) S.P for Cooker = $\frac{90}{100}$ x 9200✓ = sh 8280 Refrigerator = $\frac{95}{100}$ x 26,000✓ = sh 24,700 Profit = 280 (12) + 700 (48) = sh 36,960
19.	(a) $^1/_3$ x 60h = 280 20h = 280 h =14cm (b) Let PQ = x, QR = $^5/_3$x x . $^5/_3$x = 60 *(follow through any procedure)* $x^2 = 36$ x = 6cm PQ = 6cm QR = 10cm (c) $L^2 = 14^2 + 5^2$ $L^2 = 221$ L = 14.866cm (d) Tan q = $^{14}/_3$ *(accept other trig ratios)* = 4.6° q = 77.91°
20.	 
21.	(a)  (b) i) p(1 will not be bitten) = p(RB^1) + P (R^{1}B^1) = $^{18}/_{21}$ x $^{11}/_{15}$ + $^3/_{21}$ x $^{12}/_{13}$ = $^{198}/_{315}$ + $^{36}/_{273}$ = $^{2422}/_{3185}$ = $^{346}/_{455}$ ii) p(1 will get rabies) = p(RBT^{1}r) + p(R^{1}BT^{1}r) = $^{18}/_{21}$ x $^4/_{15}$ x $^1/_5$ x $^5/_7$ + $^3/_{21}$ + $^1/_5$ x $^5/_7$ = $^8/_{245}$ + $^4/_{375}$ = $^{28}/_{735}$ = $^4/_{105}$ iii) p(1 will not get rabies) = 1 - $^4/_{105}$ = $^{101}/_{10}$
22.	(a) i) ∠CDE = 70° ∠DEC= 50° ∴∠DCE = 180° - (70° + 50°)= 60° hence ∠DXE = 2 x 60° = 120° ii) AC x AB = AE x AD 9 x 4 = 12 x AD ∴AD = $\frac{9 \times 4}{12}$ = 3cm DE = 12 - 3 = 9cm (b) H = 6 - 4.52 H = 3.969cm A = 97.18° x 3.142 x 36 - ¼ x 9 x 3.696 = 360° = 30.53 - 17.86 = 12.67cm^2 Total shaded area = 16.58 + 12.67 = 29.25cm^2
23.	(a)(i) $^{40}/_{360}$ x 2 x 3.142 x 6370 Cos 26° = 3997.5km (ii) 40 x 60 Cos 26° = 2157.11nm (b) $^{128}/_{360}$ x 2 x 3.142 x 6370 = 14,232.56km (c) x: 128 x 60 = 7,680nm t = $\frac{7680}{1200}$ = = 6.4hrs Y : $\frac{2157.11}{500}$ = 4.31 hrs Y arrived earlier by 2h 05 minutes
24	(b) $\begin{pmatrix} 2 & 4 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 5 & 6 & 4 \\ -1 & -1 & -0.5 \end{pmatrix} = \begin{pmatrix} 6 & 8 & 6 \\ -2 & -2 & -1 \end{pmatrix}$ P(6, -2) Q(8, -2) R(6, -1) c) Centre (-1, 0.5) Angle = 180° d) L(1, 2) M(5, 2) N(1, 6)

KIMA JOINT EVALUATION TEST - 2015
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/1
July/August 2015
Time: 2½ hours

SECTION 1 (50 MARKS)

Answer all the questions in this section in the spaces provided.

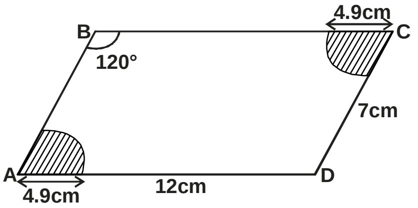
1. Evaluate $$\frac{8\times\frac{1}{3}\,of\,9\div 2}{(12+2\times 3)-\frac{2}{3}\,of\,144\div 12}$$ (3 marks)

2. Find the least number of biscuits that can be packed into carton boxes which contain either 9 or 15 or 20 or 24 with none left over. (3 marks)

3. Find the integral values that satisfy the inequality (3 marks)
$2x + 3 \geq 5x - 3 > -8$

4. Simplify the expression $$\frac{4x^2 - xy - 3y^2}{32x^2 - 18y^2}$$ (3 marks)

5. The diagram below represents a parallelogram. Calculate the area of the shaded region. (3 marks)

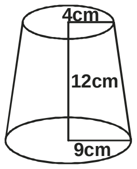


6. A tourist arrived from USA and changed his US $ 1500 to Kshs. He spent Kshs 3,000 per night in a hotel for 20 nights and a further Kshs 5,000 daily for entire period. He left for South Africa having changed the balance to South African Rand. Calculate the amount of South African Rands he was left with, if the bank buys and sells currencies using the table below. (3 marks)

Currency	Buying	Selling
1 Us Dollar ($)	78.4133	78.4744
I sterling pound (£)	114.1616	114.3043
1 South African Rand	7.8842	7.9141

7. x (4, -3) and y(-3, -4) are points on a straight line. Find the equation of a line perpendicular to xy, passing through y. Giving your answer in the form ax + by + c = 0 (3 marks)

8. The figure below shows a frustum. Find its volume.



(4 marks)

9. Each interior angle of a regular polygon is 100 larger than the exterior angle. Determine the number of sides of the polygon. (3 marks)

10. The market price of revision book in a certain bookshop is Kshs 850. Wilson bought two dozens of the revision at a discount of 15%. He sold all of them on the streets making a profit of 25%. Determine the total sales. (3 marks)

11. Solve for x in $125^x + 5^{3x} - 3 = 47$ (3 marks)

12. a) Using the line given below construct the locus of a point P one side such that ∠APB = 60° (2 marks)

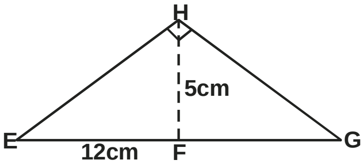
b) On the same diagram locate the position of point C on the Locus of P and is equidistance from A and B. (1 mark)

13. A point P divides AB in the ratio 7 : -5 where A(2, -3, 4) and B(-4, 7, -2). Find the coordinates of P. (3 marks)

14. Use reciprocals, cubes and square root tables to evaluate. (4 marks)

$$\frac{2}{0.9272}+\sqrt[3]{20.7726}-\sqrt{0.2643}$$

15. In the figure below ∠EHF = ∠EFH = 90°. HF = 5cm and EF = 12cm. Calculate the length of FG leaving your answer as a mixed fraction. (3 marks)



16. A bus travelling at a an average speed of 63km/h, left the station at 8 : 15am. A car left the same station at 9:00 am and caught up with the bus at 10:45. Find the average speed of the car. (3 marks)

SECTION II (50 marks)

Answer any five questions

17. The marks obtained by 10 students in a maths test were
25, 24, 22, 23, x, 26, 21, 23, 22, and 27
The sum of the squares of the marks, $\Sigma x^2 = 5154$

a) Calculate the
   i) value of x. (2 marks)
   ii) Standard deviation. (5 marks)

b) If each is increased by 3, write down the
   i) New mean (2 marks)
   ii) New Standard deviation. (1 mark)

18. A bus left Kisumu for Nairobi at an average speed of 60km/hr. After 1½ hours another car left Kisumu for Nairobi along the same route at an average speed of 100km/hr. If the distance between Kisumu and Nairobi is 500km, determine:

a) i) The distance of the bus from Nairobi when the car took off. (2 marks)
   ii) The distance the car travelled to catch up with the bus. (4 marks)

b) Immediately the car caught up with the bus, the car stopped for 25 minutes. Find the new average speed of which the car travelled in order to reach Nairobi at the same time at the bus. (to the nearest whole number). (4 marks)

19. Three towns X, Y and Z are such that X is on a bearing of 120° and 20 km from Y. Town Z is on a bearing of 220^o and 12km from X.

a) Using a scale of 1cm to represent 2km, show the relative position of the places. (3 marks)

b) Find;
   i) The distance between Y and Z (2 marks)
   ii) The bearing of X from Z (1 mark)
   iii) The bearing of Z from Y. (1 mark)
   iv) The area of the figure bounded by XYZ. (3 marks)

20. Triangle PQR whose vertices are P(2, 2), Q(5, 3) and R(4, 1) is mapped onto triangle $P^1Q^1R^1$ by a transformation whose matrix is $\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}$

a) On the grid provided draw triangle PQR and $P^1Q^1R^1$ (4 marks)

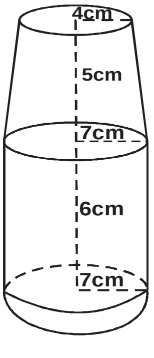
b) The triangle $P^1Q^1R^1$ is mapped onto triangle $P^{11}Q^{11}R^{11}$ whose vertices are P^{11} (-2, -2), Q^{11}(-5, -3), R^{11} (-4, -1)

i) Find the matrix of transformation which maps triangle $P^1Q^1R^1$ onto triangle $P^{11}Q^{11}R^{11}$ (2 marks)

ii) Draw the image $P^{11}Q^{11}R^{11}$ on the same grid and fully described the transformation that maps PQR onto $P^{11}Q^{11}R^{11}$ (2 marks)

c) Find a single matrix of transformation which will map triangle PQR onto triangle $P^{11}Q^{11}R^{11}$ (2 marks)

21. A right conical frustum of base radius 7cm, top radius 4cm and height 5cm is stuck onto a cylinder or base radius 7 cm and height 6 cm and further attached to the hemisphere to form a closed solid as shown below. (Take π = $^{22}/_{7}$)



a) Find the volume of the solid. (8 marks)

b) Given that the mass or the solid is 2430g find its density. (2 marks)

22. a) Complete the table below for the function. (2 marks)

x	2	3	4	5	6	7	8
y							

b) Use the mid-ordinate rule with six ordinates to estimate the area enclosed by the curve of the functions $y = x^2 - 3x + 5$, x - axis and the lines x=2 and x=8. (3 marks)

c) Find the exact area o the region described in (b) above. (3 marks)

d) If the mid-ordinates rule is used to estimate the area under the curve between x = 2 and x=8, what will be the percentage error in the estimation? (2 marks)

23.

a) Fill in the table below to 2 decimal places of the graph y = sin x and y = 2 sin (x - 30) for the range $-180 \leq x \leq 180$(2 marks)

x	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
Sin x	0			-1	-0.87		0		0.87			0.5	
2 sin (x - 30)°	1			-1.73	-2		-1		1			1.73	

b) On the grid provided, using a scale of 1cm to represent 30° on the x-axis and 1cm to represent 0.5 units on the y-axis, draw the graph of y= Sin x° (x - 30)° on the same axes. (4 marks)

c) Using your graph
   i) state the amplitude and the period of the graph y = 2 sin (x - 30)° (1 mark)
   ii) Solve the equation
   Sin x° = 2 Sin (x - 30)° (1 mark)
   iii) Describe fully the transformation that will map y = 2Sin (x - 30)° on y = Sin x (2 marks)

24. Main was paid an initial salary of Kshs 200,000 per annum with a fixed annual increment. John was paid an initial salary of Kshs 250,000 per annum with 50% increment compounded annually.

a) Given that Maina's annual salary is the 8th year was Kshs 298,000 determine
   i) His annual increment. (2 marks)
   ii) The total amount of money Maina earned during the 8 years. (2 marks)

b) Determine John's monthly earning, correct to the nearest shillings during the eight year. (2 marks)

c) Determine, correct to the nearest shilling
   i) The total mount of money John earned during the 8 years. (2 marks)
   ii) The difference between Maina's and John's average monthly earning during the 8 years. (2 marks)

KIMA JOINT EVALUATION TEST - 2015
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/2
July/August 2015
Time: 2½ hours

SECTION 1 (50 MARKS)

Answer all the questions in this section in the spaces provided.

1. Use logarithm table to evaluate to 4 decimal places. (4 marks)

$$\frac{8.23\times\sqrt{0.9982}}{0.7467\div Cos60^\circ}$$

2. Expand the expression (3 √2 + 5)(3 √2 - 5). Hence work out the following. (3 marks)

$$\frac{4}{3\sqrt{2}+5}-\frac{3}{3\sqrt{2}-5}$$

3. Make x the subject of the formula. (3 marks)

$$A=\sqrt{\frac{3+2x}{5-4x}}$$

4. A quantity F varies partly at t and partly as the square root of t. When t = 4, F = 22 and when t = 9, f = 42. Write the equation connecting F and t. (3 marks)

5. The nth term of a sequence in 2n + 1

i) State the first four terms of the sequence (1 mark)

ii) Determine the sum of the first 40 terms of the series. (2 marks)

6. Find the point on the curve $y = x^2 - 3x + 6$ at which the gradient is 3 and find the equation of the tangent to the curve at this point. (3 marks)

7. Solve the trigonometric equation for $0^\circ \le x \le 360^\circ$. (3 marks)

$3Cos^2x + 8\ Sin\ x - 4 = 3$

8. Mr. Partel a civil servant pays PAYE of Kshs 3500 per month. He is entitled to a personal relief of Kshs 1164 per month. Using the tax brackets below. Find Partel's monthly taxable income. (4 marks)

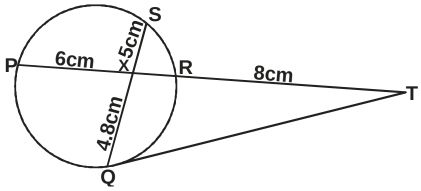
Monthly Earnings in Kshs	Rates in Ksh /pound
1 - 6566	2
6561 - 10,560	3
14561-14560	4
14561 - 18550	6
Over 18,550	8

9. Find the centre of radius of a circle whose equation is $3x^2 + 3y^2 - 18x + 12y + 39 = 12$ (3 marks)

10. Expand $(2 + {}^1/_5\,x)^8$ up to the term in x^3. Use your expansion to evaluate $(2.04)^8$ correct to 4 decimal places. (3 marks)

11. Two types of tea which cost Kshs 200 per kg and Kshs 250 per kg are mixed so that their weights are in the ratio 5 : 3 respectively. Calculate the cost of 20kg of the mixture. (3 marks)

12. In the figure below QT is a tangent to a circle at Q. PXRT and QXS are straight lines. PX =6cm, RT=8cm, QX=4.8cm and XS = 5cm.



Find the length of :

a) XR (2 marks)

b) QT (1 mark)

13. T is a transformation represented by the matrix $\begin{pmatrix}5x & 2\\ -3 & x\end{pmatrix}$ under T, a square of area of 18cm² is mapped into a square of area 110cm². Find the value of x. (3 marks)

14. Given that the dimensions of a rectangle are 12.0cm and 25.0cm. Find the percentage error in calculating the area.(3 marks)

15. After how many years would Kshs 15,000 amount to Kshs 24,015.50 at a rate of 16% p.a. compounded quarterly?(3 marks)

16. a) Find the inverse of the matrix. $\begin{pmatrix} 1 & 1 \\ 3 & 1 \end{pmatrix}$ (1 marks)

b) Hence determine the point of intersection of the lines.

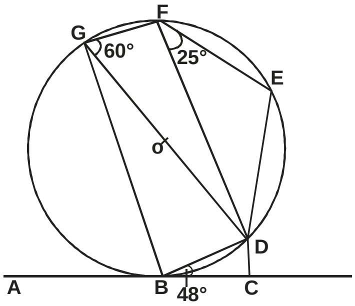
y + x = 7 (2 marks)

3x + y = 15

SECTION II (50 marks)

Answer any FIVE questions from this section.

17. In the figure below ABC is a tangent to the circle centre O. DOG is a diameter, angle DGF = 60°. angle DBC = 48° and angle DFE = 25°. Giving reasons, find the size of angles:



i) $\angle$FEB (2 marks)

ii) Obtuse FOB (2 marks)

iii) $\angle$EBD (2 marks)

iv) $\angle$BCD (2 marks)

v) $\angle$OBE (2 marks)

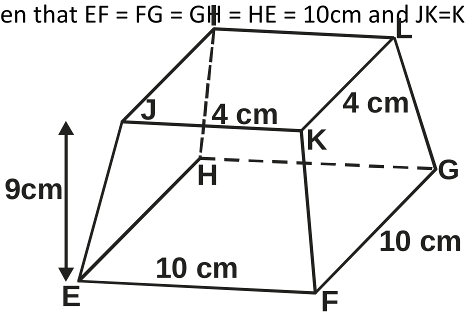
18. Each acre of potatoes required 9 men and each acre of cabbages requires 2 men. The farmer has 240 men available and he must plant at least 10 acres of potatoes. The profit on potatoes is Kshs 1000 per acre and on cabbages is Kshs 1200 per acre. If he plants x acres of potatoes and y acres of cabbages:

a) Write down three inequalities in x and y to describe this information (3 marks)

b) Represent these inequalities graphically. (4 marks)

c) Use your graph to determine the number of acres for each crop which will give maximum profit and hence find the maximum profit. (3 marks)

19. In the figure below EFGHIJKL is a square based frustum whose dimensions are as shown. The perpendicular height of the frustum is 9cm. Given that EF = FG = GH = HE = 10cm and JK=KL=IL=IJ=4cm.



a) Calculate

i) The altitude of the pyramid (2 marks)

ii) The angle between the line FK and the base EFGH (2 marks)

iii) The angle between line LG and EF (3 marks)

b) The volume of the frustum (3 marks)

20. A plane took 2h 10 minutes to fly from town A(6°S, 70°E) to town B (18°N, 70°E) (Take the radius of the earth to be 6370km and $\pi = {}^{22}/_{7}$)

a) Find the average speed of the plane. (3 marks)

b) A traveller in the plane spent 30 minutes in town B conducting some business. He took a second plane to town C (18°N, 10°E). The average speed of the second plane was 70% that o the first plane. Determine the time to the nearest minute the plane took to travel from B to C. (3 marks)

c) When the plane took off at town A the local time was 0400h. Find the local time at C when the traveller arrived . (4 marks)

21. Use a ruler and a pair of compass only in the constructions below:

a) Construct a triangle ABC such that AB = 4cm, BC = 5cm and ∠ABC = 120°, measure AC. (2 marks)

b) On the same diagram

   i) locate P the locus of a point equidistance from the three vertices of the triangle ABC and demonstrate this using a circle. Measure the radius of the circle. (2 marks)

   ii) On the same side of BC as A, construct Q the locus of points such that angle BQC = 120°.(2 marks)

   iii) On the side of AC opposite point B construct R the locus of points 4cm from line AC. (2 marks)

   iv) Within the circle shade the set of points such that ∠BQC ≥ 120° (2 marks)

22. The velocity , Vm/s, of the particles projected into space is given by the formula: $V = 5t^2 - 2t^2 + 9$ where t is time in seconds elapsed since projection,

Determine

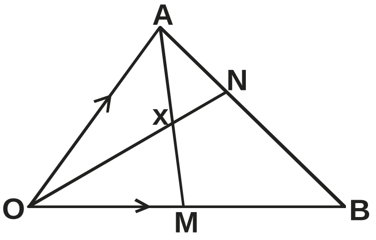
a) The acceleration of the particle when t = 4 (3 marks)

b) The value of t which minimises the acceleration. (2 marks)

c) The velocity of the particle when acceleration is minimum (2 marks)

d) The total distance moved by the particle between t = 1 to t = 4 seconds. (3 marks)

23.



In the figure above, M divides line OB in the ratio 2 : 3 and N divides AB in the ratio 1 : 2. AM and ON intersect at X. Given **OA** = 2**a** and **OM** = **b**

a) Find in terms of **a** and **b**.

   i) **AB** (1 mark)

   ii) **AM** (1 mark)

   iii) **ON** (1 mark)

b) If AX = h **AM** and OX = k**ON** where h and k are scalars.

   i) Express OX in two ways. (2 marks)

   ii) Find the value of h and k (4 marks)

   iii) Find the ratio of AM : MX (1 mark)

24. In chemistry form 4 classes, $^1/_3$ of the class are girls and the rest boys, $^4/_5$ of the boys and $^9/_{10}$ of the girls are right handed while the rest are left handed. The probability that a right-handed student breaks a conical flask in any practical session is $^3/_{10}$ and the corresponding probability of a left-handed student $^4/_{10}$. The probabilities are independent of the students gender.

a) Represent the above information on a tree diagram with independent probabilities. (2 marks)

b) Determine the probability that student chosen at random form the class is left handed and does not break a conical flask in simplest form. (3 marks)

c) Determine the probability that a conical flask is broken in any chemistry practical session in simplest

d) Determine the probability that a conical flask is not broken by a right-handed student in the simplest form.(2 marks)

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1

$$Num: 8\times\tfrac{1}{3}\times 9\times\tfrac{1}{2} = 12$$
$$Den: 18-96\div 12 = 10$$
$$\therefore \tfrac{12}{10} = 1\tfrac{1}{5}$$

2

2	9	15	20	24
2	9	15	10	12
2	9	15	5	6
2	9	15	5	3
3	3	5	5	1
3	1	5	5	1
5	1	1	1	1

LCM = $2^3 \times 3^2 \times 5$
= 8 × 9 × 5
= 72 × 5
= 360 biscuits

3

$2x + 3 \geq 5x - 3 > -8$
$x \leq 2$
$5x - 3 > -8$
$x > -1$
Values 0, 1,

4

$$\frac{4x^2-xy-3y^2}{32x^2-18y^2} = \frac{4x^2-4xy+3xy-3y^2}{2(16x^2-9y^2)}$$
$$= \frac{4x(x-y)+3y(x-y)}{2(4x-3y)(4x+3y)}$$
$$= \frac{(x-y)(4x+3y)}{2(4x-3y)(4x+3y)}$$
$$= \frac{(x-y)}{2(4x-3y)}$$

5

$$A = \frac{60}{360}\times\frac{22}{7}\times 4.9\times 4.9\times 2$$
$$= 25.153cm^2$$

6

5000 × 78.4133 = 392,066.50/=
392,066.50 - (3000 + 5000) × 20
= 232,066.50
$\frac{232,066.50}{7.9141}$ = 29,323.17 South African Rand

7

Grad = $\frac{-4+3}{-3-4} = \frac{1}{7}$

Grad of $\perp$ = -7

Eqn. $\frac{y+4}{x+3} = \frac{-7}{1}$

$\therefore$ eqn 7x + y + 25 = 0

8

L.S.F = $^9/_4$
$\frac{h+12}{h} = {}^9/_4$
= h = 7.2cm
vol = $^1/_3$ x $^{22}/_7$ (81 x 19.2 - 16 x 7.2)
= $1508^4/_7cm^3$
or 1508.5714cm

9

2x + 100 = 180
2x = 80
$\Rightarrow$ x = 40
$\Rightarrow$
= 9

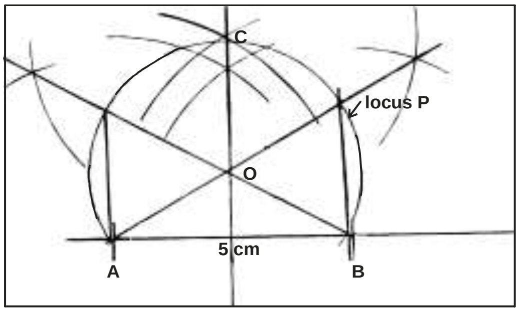
10

$$\frac{85}{100}\times 850\times 24$$
$$\frac{85}{100}\times 850\times 24\times\frac{125}{100}$$
= Kshs 21 675

11

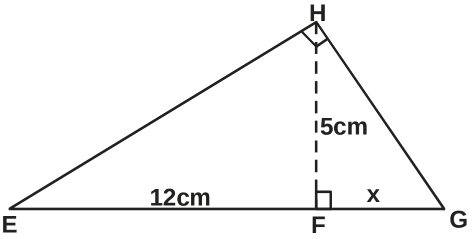
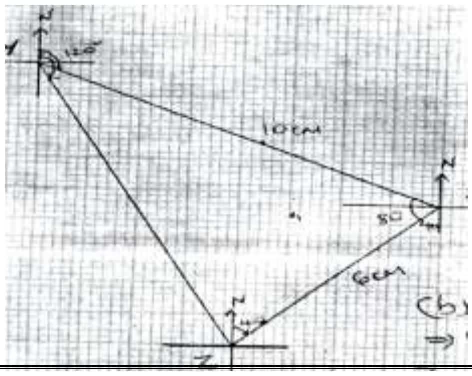
$5^{3x} + 5^{3x} - 3 = 47$
take $5^{3x} = y$
2y - 3 = 47
y = 25
x = $^2/_3$

12



13

$$OP = OA + AP$$
$$= \begin{pmatrix}2\\-3\\4\end{pmatrix} + \frac{7}{2}\begin{pmatrix}-6\\10\\-6\end{pmatrix}$$
$$= \begin{pmatrix}2\\-3\\4\end{pmatrix} + \begin{pmatrix}-21\\35\\-21\end{pmatrix} = \begin{pmatrix}-19\\33\\-17\end{pmatrix}$$
$$P(-19,33,-17)$$

	OR $\frac{-5}{2}\begin{pmatrix}2\\-3\\4\end{pmatrix}+\frac{7}{2}\begin{pmatrix}-4\\7\\-2\end{pmatrix}=\begin{pmatrix}-19\\33\\-17\end{pmatrix}$ $p(-19,33,-17)$		b) i) New mean = $\frac{222+30}{10}=\frac{252}{10}=25.2$ ii) New standard deviation 4.75
14	$2\left(\frac{1}{9.272\times10^{-1}}\right)+\left(20772.6\times10^{-3}\right)^{\frac{1}{3}}-$ $(26.43\times10^{-2})^{\frac{1}{2}}$ $2(0.1079\times10)+(27.489\times10^{-1})-(5.141\times10^{-1})$ $2.158+2.7489-5141$ $=4.3928$	18	a) i) $Kisumu\xrightarrow{500km}Nairobi$ 60km/h 100 km/h $In1\frac{1}{2}\Rightarrow60\times\frac{3}{2}=90km\ from\ Kisumu$ Therefore 500 - 90 = 410 km from Nairobi ii) Approaching speed 100km/h - 60km/h Distance between the two vehicles 90km $Time\ taken=\frac{90km}{40km/h}=2\frac{2}{4}hours$ $\frac{9}{4}\times100=225km$ b) Distance 500 - (90 + 35) = 335km Time taken by bus to cover the distance = $\frac{385}{60}$ Therefore speed = $\frac{410}{\frac{77}{12}}$ $=63.89$ $=64km/h$
15	 EH² = 12² + 5² = 169 = 13cm (x + 12)² - 13² = 5² + x² x² + 24x + 144 - 169 = 25 + x² 24x - 25 = 25 24x = 50		
16	Distance covered by bus 63 × (10.45 - 8.15) 63 × 2.3 157.5 km $Speed=\frac{157.5}{1.75}$ = 90km/h	19	
17	a)i) 25² + 24² + 22² + 23² + x² + 26² +21² +23² + 22² + 27² = 5154 x² + 5073 = 5154 x² = 81 x = 9 ii) $Mean=\frac{\sum x}{\sum f}=\frac{220}{10}=22.2$ $Variance=\frac{\sum x}{\sum f}=\left(\sum x\right)^2$ $=\frac{5154}{10}=492.84$ $=22.56$ $sd_x=\sqrt{\text{var}}\qquad x=\sqrt{22.56}$ $=4.750$		b) i) YZ = 9.9 ± 0.1 ⇒ 9.9 × 2 = 19.8 ± 0.2 ii) 40 ± 1° iii) 158 ± 1° iv) Area = ½ × 10 × 6 × Sin 80° = 29.544cm³ If 1cm² rep 2km × 2km 1 cm² rep 4km² 29.544cm² rep ⇒ (29.544 × 4) = 18.176 km²

20

a) $\begin{pmatrix}1 & -1\\ -2 & 1\end{pmatrix}\left(\begin{array}{ccc}P & Q & R\\ 2 & 5 & 4\\ 2 & 3 & 1\end{array}\right)\left(\begin{array}{ccc}P^1 & Q^1 & R^1\\ 0 & 2 & 3\\ -2 & -7 & -7\end{array}\right)$

$P^1(0,-2), Q^1(2,-7), R^1(3,-7)$

b) i $\begin{pmatrix}a & b\\ c & d\end{pmatrix}\left(\begin{array}{ccc}P^1 & Q^1 & R^1\\ 0 & 2 & 3\\ -2 & -7 & -7\end{array}\right)\left(\begin{array}{ccc}P^{11} & Q^{11} & R^{11}\\ -2 & -5 & -4\\ -2 & -3 & -1\end{array}\right)$

-2b = -2 -2d = -2
b = 1 d = 1
2c - 7d = -3 2a - 7b = -5
2c = 4 2a = 2
c = 2 a = 1

Matrix = $\begin{pmatrix}1 & 1\\ 2 & 1\end{pmatrix}$

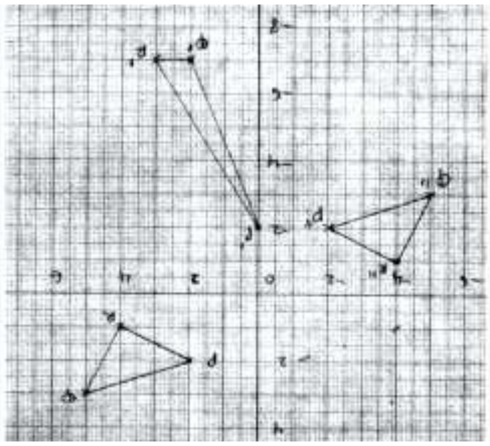
ii) Half turn rotation about the origin

c)

$\begin{pmatrix}a & b\\ c & d\end{pmatrix}\left(\begin{array}{ccc}P^1 & Q^1 & R^1\\ 2 & 5 & 4\\ 2 & 3 & 1\end{array}\right)\left(\begin{array}{ccc}P^{11} & Q^{11} & R^{11}\\ -2 & -5 & -4\\ -2 & -3 & -1\end{array}\right)$

2a + 2b = -2	2c + 2d = -2
5a + 3b = -5	5c + 3d = -3
6a + 6b = -6	6c + 6d = -6
10a + 6b = -10	10c + 6d = -6
-4a = 4	-4c = 0
a = -1	c = 0
b = -2 + 2	d = -1
= 0	

Required matrix = $\begin{pmatrix}-1 & 0\\ 0 & -1\end{pmatrix}$



21

a) Volume of cylindrical part

$$=\pi r^2 h=\tfrac{22}{7}\times 7^2\times 6=924cm^3$$

Volume of hemisphere

$$=\tfrac{1}{2}\times\tfrac{4}{3}\pi^3=\tfrac{1}{2}\times\tfrac{4}{3}\times\tfrac{22}{7}\times 7\times 7\times 7$$

$$=718.7cm^2$$

$$L.s.f=\tfrac{7}{4}=\tfrac{s+h}{n}$$

7h = 20 + 4h
3h = 20

$$h=\tfrac{20}{3}=6.667 or 6\tfrac{2}{3}$$

volume of conical frustum

$$\left(\tfrac{1}{3}\times\tfrac{22}{7}\times 7^2\times 11.67\right)-\left(\tfrac{1}{3}\times\tfrac{22}{7}\times 4^2\times 6.67\right)$$

599.06 - 111.75
= 487.3cm^3

Total volume
(924 +718.7 + 487.2)
= 2129.8cm^3

b)

$$Density=\frac{Mass}{volume}=\frac{2430}{2129.8}$$

$$=1.14095g/cm^3$$

22

a)

x	2	3	4	5	6	7	8
y	2	5	9	15	23	33	45

b)

x	2.5	3.5	4.5	5.5	6.5	7.5
y	3.75	6.75	11.75	18.75	27.75	38.8

Area = 1(3.75 + 6.75 + 11.75 + 18.75 + 27.75 + 38.75)
= 107.5 sq units

$$Exact\,area=\int_2^8 x^2-3x+5dx$$

$$=\left(\frac{x^3}{3}-\frac{3x^2}{2}+5x\right)_2^8$$

$$=\left(\frac{512}{3}-\frac{3}{2}(60)+40\right)-\left(\frac{8}{3}-\frac{12}{2}+10\right)$$

= 168 - 90 + 30
= 108 sq units

d) Percentage error :

$$=\frac{0.5}{1.08}\times 100=0.463\%$$

23

x	-150°	-120°	-30°	30	90	120	180
Sin x	-0.5	-0.87	-0.5	-0.5	1	0.87	0
2 sin (x - 30)	0.0	-1.0	0.0	0.0	1.7	2.0	1.0

c) i) y = 2 Sin (x - 30°)

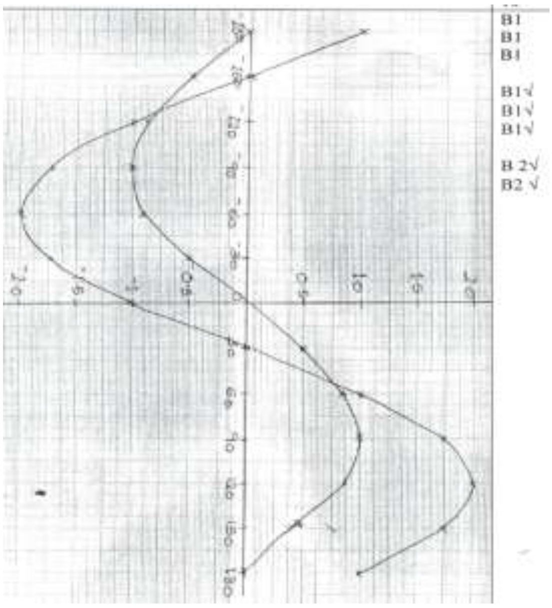
Amplitude = 3 units

Period = 360°

ii) Sin x = 2 sin (x - 30°)

x = -126° cr 51.50 ± 1°

iii) $\begin{pmatrix} +30 \\ 0 \end{pmatrix}$ Translation



24

a) i) 200,000 + (8 - 1) x = 298,000

7x = 98,000

x = 14,000

ii)

$$\tfrac{8}{2}\left(200{,}000 + 298{,}000\right)$$
$$= Kshs1{,}992{,}000$$

b)

$$A = P\left(1 + \tfrac{r}{100}\right)^{\frac{n}{12}}$$
$$= \frac{250{,}000(1.05)^7}{12}$$
$$= shs29{,}315$$

c) i

$$S_8 = \frac{250{,}000(1.05^8 - 1)}{1.05 - 1}$$
$$= Kshs2{,}387{,}277$$

ii)Difference between monthly average for the 8 tears.

$$\frac{2{,}387{,}277 - 1992000}{8 \times 12}$$
$$= Shs4117$$

KIMA JOINT EVALUATION TEST - 2015
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/2
July/August 2015
Time: 2½ hours

1

No	log		
8.256	0.9168	0.9168	
	1.9992÷3	1.9997	+
0.7467	1.8731	0.9165	
Cos 60°	1.6990		-
(0.5)	0.1741	0.1741	
5.526		0.7424	
	←	antilog	

= 5.526

2

$$\left(3\sqrt{2}+5\right)\left(3\sqrt{2}-5\right)=18-25=-7$$

$$\frac{4\left(3\sqrt{2}-5\right)-3\left(3\sqrt{2}+5\right)}{-7}$$

$$\frac{12\sqrt{2}-20-9\sqrt{2}-15}{-7}$$

$$\frac{3\sqrt{2}-35}{-7}=\frac{35-3\sqrt{2}}{7}=5-\frac{3}{7}\sqrt{2}$$

3

$$A=\sqrt{\frac{3+2x}{5-4x}}$$

$$A^2=\frac{3+2x}{5-4x}$$

$A^2(5-4x)=3+2x$
$5A^2-4A^2x=3+2x$
$5A^2-3=2x+4A^2x$
$5A^2-3=x(2+4A^2)$

$$\frac{5A^2-3}{2+4A^2}$$

4

$F = at + b\sqrt{t}$ ✓
$22 = 4a + 2b$ . . . . . . (i)
$42 = 9a + 3b$ . . . . . . (ii)
$a = 3$ and $b = 5$ ✓
$F = 3t + 5\sqrt{t}$ ✓

5

a) nth term = 2n + 1

When n = 1 2 × 1 + 1 = 3
2 × 2 + 1 = 5
2 × 3 + 1 = 7
2 × 4 + 1 = 9
Terms 3, 5, 7, 9 ✓

b)

$$S_n=\tfrac{n}{2}\left(2a+(n-1)d\right)$$
$$=\tfrac{40}{2}\left(2\times3+(40-1)2\right)$$
$$=20(6+78)$$
$$=1680$$

6

$$\frac{dy}{dx}=2x-3=3$$
$$x=3, y=6$$
$$Po\text{int}(3,6)$$
$$Eqn\ of\ \tan gent$$
$$\frac{y-6}{x-3}=3$$
$$y=3x-3$$

7

$3(1 - \sin^2 x) + 8\sin x - 4 = 3$
let sin x = y

$3(1 - y^2) + 8y - 4 = 3$

$3y^2 - 8y + 4 = 0$

$(3y - 2)(y-2) = 0$

$y = 2$ or $y = {}^2/_3$ ✓
$\sin x = 2$ or $\sin x = {}^2/_3$
x = 41.81°, 138.2°

8

Total tax = 3500 + 1164 = Shs 4664

$$\left.\begin{aligned}\frac{6560}{20}\times2&=656\\ \frac{4000}{20}\times3&=800\end{aligned}\right\}$$

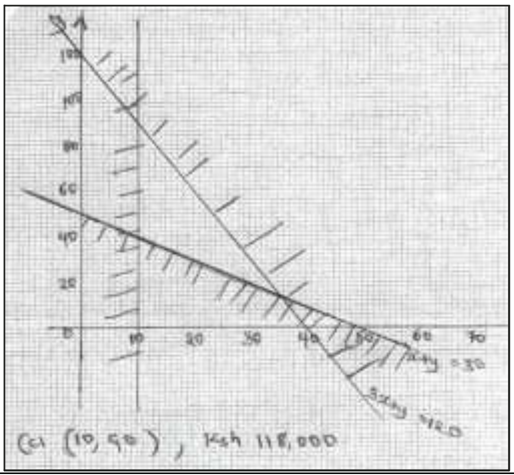
$$\frac{4000}{20}\times6=1200$$

$$\frac{x}{20}\times8\quad=\quad1408$$

$$\overline{\quad\quad\quad\quad4662}$$

x = 3520
Basic salary = 6560 + (4000 × 3) + 3520
= shs 22,080

9.	$3x^2 + 3y^2 - 18x + 12y + 39 - 12 = 0$ $x^2 + y^2 - 6x + 4y + 9 = 0$ ✓ $x^2 + 6x + 9 + y^2 + 4y + 4 = 4$ $(x - 3)^2 + (y + 2) = 2^2$ ✓ Centre (3, -2) radius 2 units ✓
10	$\left(2+\frac{1}{5}x\right)^8 = 1\times 2^8\left(\frac{1}{5}x\right)^0 + 8\times 2^7\left(\frac{1}{5}x\right)^1 + 28\times 2^6\left(\frac{1}{5}x\right)^2 + 56\times 2^5\left(\frac{1}{5}x\right)^3$ $= 256 + \frac{1024x}{5} + \frac{1792x^2}{25} + \frac{1792x^3}{125}$ $\left(2+\frac{1}{5}x\right)^8 \rightarrow (2.04)^8$ $= (2+0.04)^8$ $Hence\ \frac{1}{5}x = 0.04$ $x = 0.04\times 5$ $x = 0.2$ $(2.04)^8 = 256\times\frac{1024}{5}(0.2) + \frac{1792}{25}(0.2)^2 + \frac{1792}{125}(0.2)^3$ $= 256 + 40.96 + 2.8672 + 0.114688$ $= 299.94188$ $= 299.9419$
11	$8kg\ \cos ts(5\times 200)+(3\times 250)$ $20kg\ \cos ts\ \frac{(5+200)+(3\times 250)}{8}\times 20$ $= shs4{,}375$
12	a) $6 \times xR = 4.8 \times 5$ $XR = \frac{4.8\times 5}{6}$ $XR = 4$ b) $QT^2 = 18 \times 8 = 144$ QT = 12cm
13	Det = $5x^2 + 6$ $5x^2 + 6 = \frac{110}{110}$ $5x^2 = 5$ $x^2 = 1$ $x = \pm 1$ $x = 1\ or\ x = -1$
14	Actual area = 120 × 25.0 = 300cm² Max Area = 12.5 × 25.5 ✓ = 318.75 cm² Min area = 11.5 × 24.5 ✓ = 281.75cm² $Error = \frac{318.75 - 281.75}{2} = 18.5$ $\%Error = \frac{18.5}{300}\times 100$ = 6.167%
15	$Rate\ per\ period = \frac{16}{4} = 4\%$ $24015.50 = 15000\left(1+\frac{4}{100}\right)^n$ $24015.50 = 15000(1.04)^n$ $(1.04)^n = 1.610$ $n\log 1.04 = \log 1.6010$ $n = \frac{\log 1.6010}{\log 1.04}$ $n = 12.02 = \simeq 12\ periods$ $After 3 years$
16	$Det \Rightarrow \begin{pmatrix}1 & 1\\ 3 & 1\end{pmatrix}$ $= 1\times 1 - 1\times 3$ $= -2$ $Inverse = -\frac{1}{2}\begin{pmatrix}1 & -1\\ -3 & 1\end{pmatrix}$ $= \begin{pmatrix}-\frac{1}{2} & \frac{1}{2}\\ \frac{3}{2} & -\frac{1}{2}\end{pmatrix}$ $-\frac{1}{2}\begin{pmatrix}1 & -1\\ -3 & 1\end{pmatrix}\begin{pmatrix}1 & 1\\ 3 & 1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = -\frac{1}{2}\begin{pmatrix}1 & -1\\ -3 & 1\end{pmatrix}\begin{pmatrix}7\\ 15\end{pmatrix}$ $\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = -\frac{1}{2}\begin{pmatrix}-8\\ -6\end{pmatrix}$ $\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}4\\ 3\end{pmatrix}$ $x = 4, y = 3$
17	i) 120° opposite <s in a cyclic Quad ii) 144° angle at centre twice of circumf iii) 25° angle subtended by same chord ED iv) 63° angle in alternate segment v) 42° Angle in isosceles Δ
18	a) $x + y \geq 50$ $x \leq 10$ $3\ x + y \geq 120$



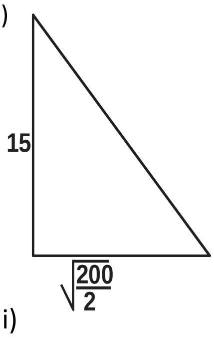
19

$$\frac{9+h}{h}=\frac{5}{2}$$

h = 6

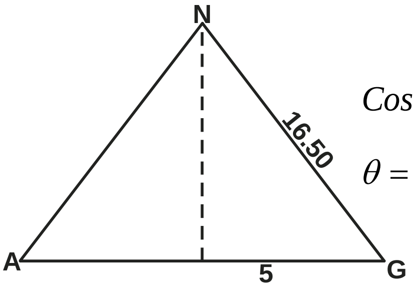
altitude = (6 + 9) = 15

ii)



$$VF=\sqrt{15^2+\left(5\sqrt{2}\right)^2}$$
$$=16.583$$
$$Tan\theta=\frac{15}{5\sqrt{2}}$$
$$\theta=64.76^0$$

iii)



$$Cos\theta=\frac{5}{16.585}$$
$$\theta=72.45$$

b)
$$=\left(\frac{1}{3}\times10\times10\times15\right)-\frac{1}{3}(4\times4\times6)$$
$$=500cm^3$$
$$=468cm^3$$

20

a) Distance from A to B

$$=\quad 2\times6370\times\frac{22}{7}\times\frac{24}{360}=2669.33$$

$$Speed=\frac{2\times6370\times\frac{22}{7}\times\frac{24}{360}}{2\,\frac{1}{3}}$$

= 1144km/h

b)
$$Time=\frac{2\times6370\times\frac{22}{7}\times\frac{60}{360}Cos18}{1114\times\frac{70}{100}}$$

= 7.925470969

= 7 hrs 56 minutes

c) Arrival time at B

0400 + 2 hr 20 min

= 0620 h

Departure time at B

= 0620 + 30

= 0650 h

Time difference between B and C

$$\frac{20-10}{360}\times24$$

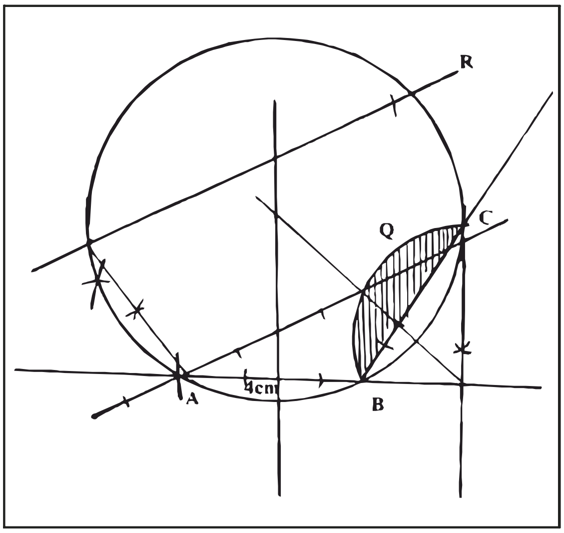
= 4h

Arrival time at C (local time

= 0650 + 7 hr 56 min - 4

= 1046 h

21



22

a) V = 5t² - 2t + 9

$$a=\frac{dv}{dt}=10t-2$$

at t = 4

a = 10 (4) - 2

= 38 m/s ²

b) Min acceleration $\Longrightarrow \frac{dv}{dt}=0$

10t - 2 = 0

c) v = 5(0.2)² - 2(0.2) + 9

= 8.8 m/s

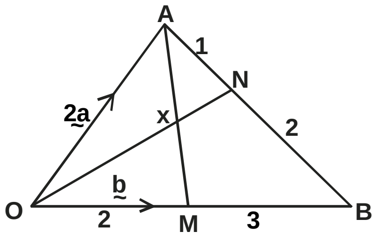
$$s=\int_1^4 \left(5t^2-2t+9\right)dt$$

$$\left[\frac{5t^3}{3}-t^2+9t\right]_1^4$$

$$=\left(\frac{5(4)^3}{3}+(4)^2+9(4)\right)-\left(\frac{5(1)^3}{3}-(1)^2+9(1)\right)$$

$$=117\,m$$

23



a) i) **AB** = - **OA** + **OB**
= -2**a** + $^5/_2$ **b**

ii) **AM** = - **OA** + **OM**
= 2**a** + **b**

iii) **ON** = **OA** + $^1/_3$ **AB**
= 2**a** + $^1/_3$ (-2**a** + $^5/_2$**b**)
= $^4/_3$ **a** + $^5/_6$ **b**

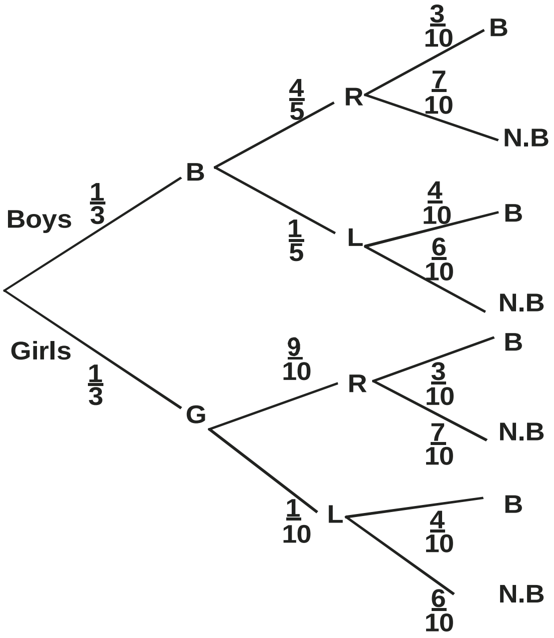
b) i) **OX** = **OA** + **AX**
= 2**a** + h (-2**a** + **b**) or
OX = k($^4/_3$ **a** + $^5/_6$ **b**)

ii) 2**a** + h (-2**a** + **b**) = k($^4/_3$**a** + $^5/_6$ **b**)
2**a** - 2h**a** + **b**h = $^4/_3$ k**a** + $^5/_6$ k**b**
2**a** (1 - h) = $^4/_3$ k**a** . . . . . .(i)
b**h** = $^5/_b$ k**b** . . . . (ii)
h = $^5/_6$ k
2(1 - h) = $^4/_3$ k
but = $^5/_6$ k
2(1 - $^5/_6$ k) = $^4/_3$ k
2 - $^{10}/_6$ k = $^4/_3$ k
2 = $^4/_3$ k + $^{10}/_6$ k
12 = 8k + 10 k
$^{12}/_{18}$ = $^{18}/_{18}$ k $\Rightarrow$ k = $^2/_9$
but h = $^5/_6$ k
b = ($^5/_6$ × $^2/_9$)
h = $^5/_{27}$

iii) AM : MX
AX : h AM
= $^5/_{27}$ AM
$\therefore$ Ratio is 5 : 22

24

B $\rightarrow$ Boys, G $\rightarrow$ Girls, B$\rightarrow$ breaking
R $\rightarrow$ Right, L $\rightarrow$ Left, N.B $\rightarrow$ Not breaking



b) Left handed and does not break the conical flask
P of left not breaking

$$=\left(\tfrac{1}{3}\times\tfrac{1}{10}\times\tfrac{6}{10}\right)+\left(\tfrac{2}{3}\times\tfrac{1}{5}\times\tfrac{6}{10}\right)$$

$$=\tfrac{1}{50}+\tfrac{2}{25}$$

$$=\tfrac{1+4}{50}$$

$$=\tfrac{5}{10}$$

$$=\tfrac{1}{10}$$

c) Probability of a conical flask getting broken

$$P=\left(\tfrac{2}{3}\times\tfrac{4}{5}\times\tfrac{3}{10}\right)+\left(\tfrac{2}{3}\times\tfrac{1}{5}\times\tfrac{4}{10}\right)+\left(\tfrac{1}{3}\times\tfrac{9}{10}\times\tfrac{3}{10}\right)+\left(\tfrac{1}{3}\times\tfrac{1}{10}\times\tfrac{4}{10}\right)$$

$$P=\tfrac{19}{60}$$

d) Probability of Right handed not breaking the flask

$$=\left(\tfrac{2}{3}\times\tfrac{4}{5}\times\tfrac{7}{10}\right)+\left(\tfrac{1}{3}\times\tfrac{9}{10}\times\tfrac{3}{10}\right)$$

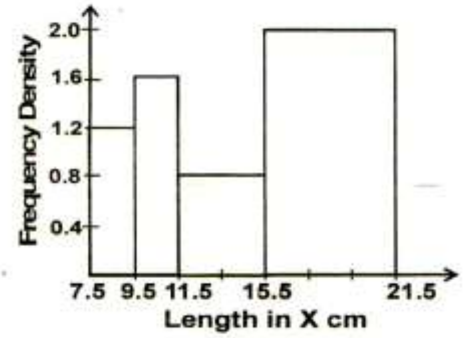
$$=\tfrac{139}{300}$$

GUCHA SOUTH EVALUATION TEST - 2015
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/1
July/August 2015
Time: 2½ hours

SECTION 1 (50 MARKS)

Answer ALL the questions in this section.

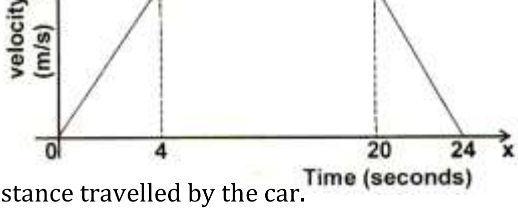
1. Simplify (4 Marks)
$\frac{1\frac{1}{2}+3\frac{1}{6}}{4\frac{1}{3}-3\frac{2}{5}} \div 1\frac{2}{3}$
2. Use tables of squares, square roots and reciprocals to evaluate to 3 decimal places. (3 Marks)
$3.045^2 + \frac{1}{\sqrt{49.24}}$
3. Simplify the expressions; (3 Marks)
$\frac{x^2+3x+2}{x^2-1}$
4. A car dealer charges 5% commission for selling a car. He received a commission of Sh. 17500 for selling a car. How much money did the owner receive from the sale of his car? (3 Marks)
5. A water tank has a capacity of 70 litres. A similar model tank has a capacity of 0.25 litres. If the larger tank has a height of 150cm, calculate the height of the model. (Marks)
6. The figure below shows a histogram.



Fill in the table below the missing frequencies.

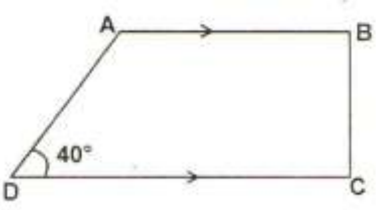
Length in xcm	Frequency
7.5≤x<9.5	12
9.5≤x11.5	
11.5≤x<15.5	
15.5≤21.5	

7. Given that Sin (2x-10) = Cos 600 and x is an acute angle, find x. (3 Marks)
8. The length of a rectangle is (3x+1)cm. Its width is 3cm shorter than the length. Given that area of the rectangle is 28cm^2, find its length. (3 Marks)
9. The sides of a rectangle are given as 4.2cm and 2.8m, each correct to one decimal place. Find the percentage error in its area. (3 Marks)
10. The figure below is a velocity – time graph for a car.

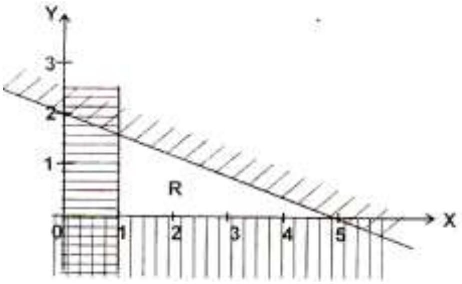


(a) Find the total distance travelled by the car. (2 Marks)
(b) Calculate the deceleration of the car. (2 Marks)

11. Three bells P, Q and R are programmed to ring after intervals of 15 minutes, 25 minutes and 50 minutes respectively. If the ring together at 6.45 am, when did they last ring together? (3 Marks)
12. A straight line 1 passes through the point (3,-2) and is perpendicular to a line whose equation is 2y – 4x = 1. Find the equation of 1 in the form y = mx + c, where m and n are constants. (3 Marks)
13. A man walks directly from point A towards the foot of a tall building 240m away. After covering 180m, he observes that the angle of elevation of the top of a building is 45^0. Determine the angle of elevation of elevation of the top of the building from A. (3 Marks)
14. ABCD is trapezium in which AB is parallel to DC, AB = 6cm, DC = 12cm, $\angle$ADC = 400 and AD = 10cm. Calculate the area of the trapezium. (3 Marks)



15. Three business partners: Kioko, Njau and Osiako are to share Sh. 12,000 in the ratio 5:6:x respectively. If Kioko received Sh. 4000, determine the value of x. (3 Marks)
16. Form three inequalities that satisfy the un-shaded region. (3 Marks)

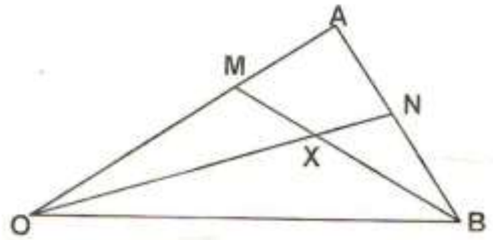


SECTION II (50 MARKS)

Answer only FIVE questions from this section.

17. Three business partners Mogambi, Ouko and Memba contributed Sh. 600,000, Sh. 400,000 and Sh. 800,000 respectively to start a business of matatu plying Kisii – Kisumu route. The matatu carries 14 passengers with each paying Sh. 250. The matatu makes 2 round trips everyday and is ever full. Each day Sh. 6000 is used to cover running costs and wages.
    (a) Calculate their profit per day. (3 Marks)
    (b) The matatu works for 25 days per month and is serviced every month at a cost of Sh. 10,000. Calculate their monthly profit in June. (1 Month)
    (c) The three partners agreed to save 40% of the profit, 24% to be shared in the ratio of their contribution and the remaining to be shared equally. Calculate Ouko's share in the month of July. (4 Marks)
    (d) The matatu developed a mechanical problem and they decided to sell it through an agent who charged a commission of 5% on the selling price. Each partner received Sh. 475,000 from the agent after he had taken his commission. Determine the price at which the agent sold the matatu. (2 Marks)
18. In an n-sided polygon two angles are right angles and each of the remaining angles is 150^0.
    (a) Find the value of n and hence the sum of the interior angles of this polygon. (4 Marks)
    (b) Name the polygon. (1 Mark)
    (c) Find the area of a regular octagon of sides 4cm giving answer correct to 4 significant figures. (5 Mark s)
19. Using a ruler and pair of compasses only,
    (a) Construct triangle ABC such that AB = 6.3cm, BC = 7.2cm and angle ABC = 60^0. (3 Marks)
    (b) Measure the length AC. (1 Mark)
    (c) Draw a circle that touches the vertices A, B and C. (2 Marks)
    (d) Measure the radius of the circle. (1 Mark)
    (e) Hence, calculate of the circle outside the triangle. (3 Marks)

20. The diagram below shows triangle OAB in which N is the midpoint of AB and M is a point on OA such that OM:MA = 2:1. Lines ON and BM meet at x such that OX = hON and MX = kMB.



(a) Given that $\overrightarrow{OA}$ = a and $\overrightarrow{OB}$ = b, express in terms of a and b the following vectors.

(i) $\overrightarrow{AB}$ (1 Mark)

(ii) $\overrightarrow{ON}$ (2 Marks)

(iii) $\overrightarrow{BM}$ (1 Mark)

(b) By expressing OX in two different ways determine the value of h and k. (6 Marks)

21. Milk in a cool factory is stored in a rectangular tank whose internal dimensions are 1.7m by 1.4m by 2.2m. On one day the tank was 75% full of milk.

(a) Calculate the volume of milk in the tank in litres. (3 Marks)

(b) The milk is packed in small packets which are in the shape of a right pyramid on an equilateral triangle of side 16cm. The height of each packet is 13.6cm. Each packet is sold at Sh. 30. Calculate:-

(i) the volume of milk in milliliters in each packet to 2 significant figures. (4 Marks)

(ii) the exact amount of money that was realized from the sale of all packets of milk. (3 Marks)

22. The marks scored by a group of pupils in a Mathematics test were as recorded in the table below.

Marks	Frequency
0-9	1
10-19	2
20-29	4
30-39	7
40-49	10
50-59	16
60-69	20
70-79	6
80-89	3
90-99	1

(a) State the model class. (1 Marks)

(b) Calculate:

(i) the median (1 Mark)

(ii) the mean (5 Marks)

(c)

23. The points A (1,1) B(2,-3) and C(3,0) are vertices of triangle ABC.

(a) (i) Find the coordinates of the vertices of its image $A^1B^1C^1$ under the transformation defined by the matrix.

$$S = \begin{pmatrix} 3 & 0 \\ 1 & 1 \end{pmatrix}$$

(ii) Draw triangle ABC and its image $\Delta A^1B^1C^1$ on the grid provided. (2 Marks)

(b) The triangle $A^1B^1C^1$ is transformed to triangle A11B11C11 by the transformation R whose matrix is

$$R = \begin{pmatrix} 1 & 0 \\ -1 & 3 \end{pmatrix}$$

(i) Write down the coordinates of $A^{11}B^{11}C^{11}$. (2 Marks)

(ii) Draw the triangle $A^{11}B^{11}C^{11}$ on the grid in (a) (ii) above. (1 Mark)

(iii) Describe fully the transformation which maps triangle ABC onto triangle ABC. (3 Marks)

24. A train is travelling on straight railway. It passes through Kijabe railway station at t = 0 with velocity v = 70km/h. The acceleration after passing through Kijabe is given by 4t – 8.

(a) Find an expression for its velocity. (3 Marks)

(b) Calculate

(i) the average velocity between t = 1 and t = 3. (3 Marks)

(ii) the distance covered by the train in the third hour. (4 Marks)

GUCHA SOUTH EVALUATION TEST
121/2
Mathematics
July/August 2015

SECTION I (50 MARKS)

Answer ALL the questions in this section.

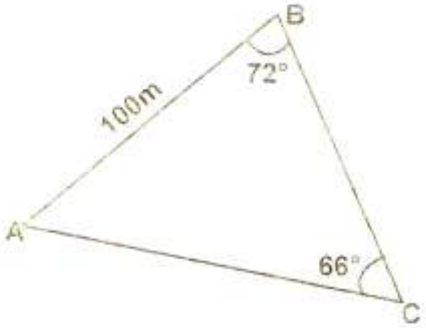
1. In this question, show all steps in your calculations, giving your answers at each stage. Use logarithms correct to 4 decimal places to evaluate;

$$\sqrt[3]{\frac{36.72\ x(0.46)^2}{185.4}}$$

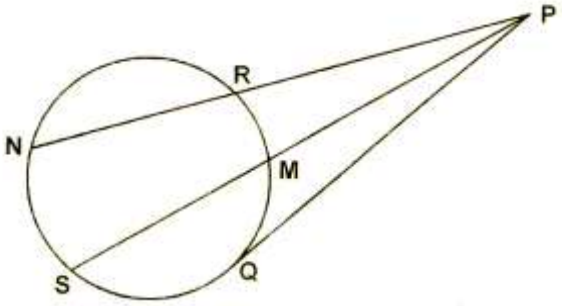
2. Make m the subject of the formula. (3 Marks)

$$x = \sqrt{\frac{am^2}{a^2 - m^2}}$$

3. Write $\frac{10}{\sqrt{7}-\sqrt{2}}$ in the form of a $(\sqrt{b} + \sqrt{c})$ where a, b and c are integers. (2 Marks)
4. If $4x^2 + 8x + (k-3)$ is a perfect square, find the value of k. (2 Marks)
5. A piece of forest is in form of a triangle as shown below. Calculate its perimeter to the nearest metre. (4 Marks)



6. Find the centre and radius of a circle whose equation is $x^2 + y^2 - 4x + 6y - 3 = 0$ (3 Marks)
7. Presently a machine costs KSh. 364,000. What was its cost 5 years ago, if it depreciated at 12% per year (2 Marks)
8. Find the equation of a tangent to the curve $y = x^3 - 2x^2 + 3x - 1$ at $x = 2$ (4 Marks)
9. Transformation M and N are represented by the matrices $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ and $\begin{pmatrix} 3 & 0 \\ 1 & 3 \end{pmatrix}$ respectively. Point R has coordinates (3,-2), find the coordinates of R1 the image of R under a transformation represented by MN (R). (3 Marks)
10. In the figure given below RN and MS are chords of a circle that meet at an external point P. PQ is a tangent to the circle at Q. PR = 2cm, PN = 12cm and PM = 3cm. (3 Marks)



Calculate the length of:

(i) PS (2 Marks)

(ii) PQ (2 Marks)

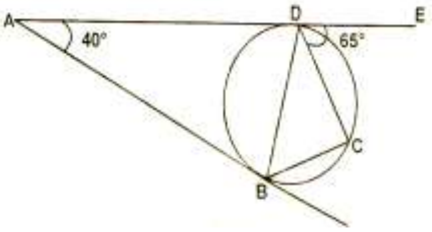
11. Use the first 4 terms of the expansion of $(1 - 2x)^6$ to find the value of $(0.98)^6$ correct to 4 decimal places. (3 Marks)
12. Solve the equation $\text{Log}_{10}(6x - 2) - 1 = \text{Log}_{10}(x-3)$ (3 Marks)
13. The points P, Q and R lie on a straight line. The position vectors of P and R are $2\underset{\sim}{i} + 6\underset{\sim}{j} + 13\underset{\sim}{k}$ and $5\underset{\sim}{i} - 3\underset{\sim}{j} + 4\underset{\sim}{k}$ respectively. Find

    (i) the position vector of Q (2 Marks)

    (ii) the length of PQ (2 Marks)
14. (a) Using a ruler and a pair of compasses only, construct a parallelogram PQRS such that PQ = 8cm, PS = 4.5cm and angle QPS = 60^0. (2 Marks)

    (b) On the diagram in (a) above locate the locus of a point X, such that X is equidistance from P and R (1 Mark)

15. In the figure below ADE and AB are tangents to the circle at D and B respectively. Angle DAB = 40^0 and angle CDE = 65^0.



Calculate
(a) angle ADB (2 Marks)
(b) angle ABC (2 Marks)

16. If $\begin{pmatrix} a-1 & a \\ 3a & a \end{pmatrix}$ is a singular matrix, find the value of a. (2 Marks)

SECTION II (50 MARKS)

Answer only FIVE questions from this section.

17. (a) A certain sum of money is deposited in a bank that pays simple interest at a certain rate. After 3 years the total amount in the account is KSh,. 358,400. The interest earned each year is KShs. 121,800.
Calculate
(i) the amount of money which was deposited (2 Marks)
(ii) the annual rate of interest that the bank paid (2 Marks)
(b) (i) A computer whose marked price is KSh. 40,000 is sold at KShs. 56,000 on hire purchase terms. Kioko bought the computer on hire purchase terms. He paid a deposit of 25% of the hire purchase price and cleared the balance by equal monthly installments of KShs. 2,625.
(ii) Had Kioko bought the computer on cash terms he would have been allowed a discount of $12\frac{1}{2}$% on marked price. Calculate the difference between the cash price and hire purchase price. (3 Marks)

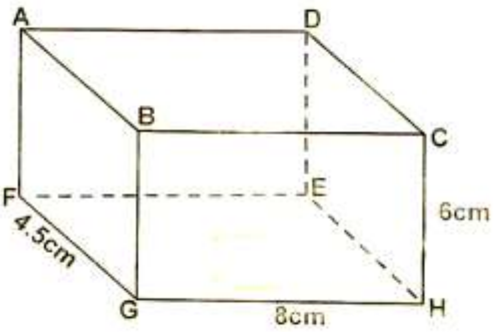
18. The volume of Vcm^3 of a solid depends partly on r^2 and partly on r^3 where r cm is one of the dimensions of the solid. When r = 1 the volume is 54cm^2 and when r = 2cm the volume is 226.8cm^3.
(a) Find the expression of V in terms of r. (6 Marks)
(b) Calculate the volume of the solid when r = 4cm. (2 Marks)
(c) Find the value of r for which, the two parts of the volume are equal. (2 Marks)

19. (a) Complete the table below for the curve y = 2x2 + 3x – 11 (2 Marks)

x	-4	-3	-2	-1	0	1	2	3
2x^2	32		8		0			18
3x	-12		-6		0			9
-11	-11	-11	-11	-11	-11	-11	-11	-11

(b) On the provided grid, draw the graph of y = 2x2 + 3x – 11 (3 Marks)
(c) On the same axes draw the graph of y = 2x + 1. (1 Mark)
(d) Use your graph in (b) above to solve equation 2x^2 + 3x – 11 = 0 (1 Mark)
(e) Use your graphs in (b) and (c) above to solve the quadratic equation 2x^2 + x – 12 = 0 (1 Mark)
(f) Draw a suitable line to the graph in (b) hence solve the equation 2x^2 + 3x – 3 = 0 (2 Marks)

20. The diagram below represents a cuboid ABCDEFGH in which FG = 4.5cm, GH = 8cm and HC = 6cm.



Calculate
(a) the length of FC (4 Marks)
(b) the size of the
(i) angle between the lines FC and FH (2 Marks)
(ii) angle between the lines AB and FH. (2 Marks)
(iii) angle between the planes ABHE and the plane FGJE (2 Marks()

21. From airport A(30^{0}N, 20^{0}W) a plane flies eastwards to airport B(30^{0}N, 80^{0}E) at a speed of 150 knots.
(a) Determine
(i) the distance covered by the plane in nautical miles. (2 Marks)
(ii) time taken by the plane to reach airport B. (2 Marks)

(b) The plane made a stopover at B for 45 minutes before flying southwards to airport C(20^0S, 80^0E) at 600 knots. Calculate the total time taken to complete the journey from A to C. (4 Marks)

(c) If at the time of arrival the local time at C is 5.30 am on Monday. What is the local time A?

22. (a) Estimate the area bounded by the curve y = x2 – x – 6, the axis and the ordinates x = 3 and x = 8, using the trapezoidal rule with 5 trips. (4 Marks)

(b) Find the exact area of the region in (a) above by integration. (3 Marks)

(c) Hence find the percentage error made when the trapezium rule is used to estimate the area. (3 Marks)

23. (a) Complete the table below which shows heights to the nearest centimeters of 40 students in a school.

Height	x	f	d	fd	d^2	fd^2
141-150	145.5	4	-20	-80	400	1600
151-160		3				
161-170		8	0	0	0	0
171-180	175.5	10		100		1000
181-190		7		140		2800
191-200		5				
201-210		3				4800
		40				

where x is the mid-point of a class, f, is the frequency of the class and d is the deviation from the assumed mean.

(b) Hence or otherwise calculate:

(i) the mean height of the 40 students. (2 Marks)

(ii) the standard deviation of the distribution correct to 2 d.p. (3 Marks)

24. (a) Complete the table giving the values correct to 2 decimal places.

x^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
Sin $2x^0$	0		0.87		-0.87		0	0.87	0.87				
Cos x0 - 2	1	0.60			-2	-3.50		-4.60				-0.50	

(b) On the grid provided draw the graphs of y = sin2x and y = $3\cos x^0 - 2$ for $0^0 \leq x \leq 360^0$ on the same axes. Use a scale of 1cm to represent 1 unit on the 30^0 on the x axis and 2cm to represent 1 unit on the y axis.

(c) Use your graphs in (a) above to solve the equation 3Cosx – Sin2x = 2 (2 Marks)

(d) State the amplitude of y = 3Cos x – 2. (1 Mark)

GUCHA SOUTH EVALUATION TEST
121/1
Mathematics
July/August 2015

1. N =1 ½ + $3\frac{1}{6} = \frac{3}{2} + \frac{19}{6}$
$= \frac{9+19}{6}$
$= \frac{28}{6}$
D = $4\frac{1}{3} - 3\frac{2}{5} = \frac{13}{3} - \frac{17}{5}$
$= \frac{65-51}{15}$
$= \frac{14}{15}$
$\frac{N}{D} = \frac{28}{6} \div \frac{14}{15} = \frac{28}{6}\ x\ \frac{15}{14} = 5$
$= 5 \div \frac{5}{3}$
$= 5\ x\ \frac{3}{5}$
= 3

2. $9.272 + \frac{1}{7.0171}$
= 9.272 + 0.1426
= 9.4164

3. $x^2 + 3x + 2 = (x+1)(x+2)$
N = $\frac{(x+1)(x+2)}{(x+1)(x-1)}$
$= \frac{x+2}{x+1}$

4. $\frac{5}{100}$ x $x = 17500$
$x = 350{,}000$
Owner receives = 350000 – 17500
= 332,500

5. V.S.F = $\frac{70}{0.25} = 280$
LSF = $3\sqrt{280}$ = 6.542
Height of smallest tank = $\frac{150}{6.542}$
= 22.93cm

6. Frequency = CI x fd
12 = 2 x 1.2 x k
k = 5
2 x 1.6 x 5 = 16
4 x 0.8 x 5 = 16
6 x 2 x 5 = 60

7. Sin (2x – 10) = 0.5
Acute angle = 30^0
2x – 10 = 30^0, 150^0
2x = 40^0, 160^0
x = 20^0 and 80^0

8. Length = (3x+1), width = 3x + 1 – 3
(3x + 1) (3x-2) = 28
$9x^2 - 6x + 3x - 2 = 28$
$\frac{9x^2}{3} - \frac{3x}{3} - \frac{30}{3} = 0$
$\sqrt{3x^2} - x - 10 = 0$
$3x^2 - 6x + 5x - 10 = 0$
(3x + 5) (x-2) = 0
3x + 5 = 0, x = $-\frac{5}{3}$, x = 2
Length = 3(2) + 1 = 7 cm

9. Max length = 4.25
Max width = 2.85
Max area = 4.25 x 2.85 = 12.11cm^2
Min length = 4.15cm
Min width = 2.75cm
Min area = 4.15 x 2.75 = 11.41cm^2
Error = $\frac{\max area - \min area}{2} = \frac{12.11-11.41}{2}$
$= \frac{0.7}{2}$ = 0.35
Actual area = 4.2 x 2.8 = 11.76
% error in area = $\frac{0.35}{11.76}\ x\ 100 = 2.976\%$

10. (a) D = ½ (24 + 16)80
(b) = $-\frac{80}{4}$
= 20m/s^2 (deceleration)

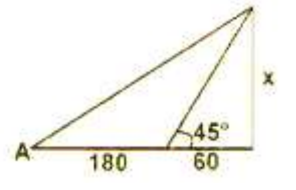
11.

	15	25	50
2	15	25	25
3	5	25	25
5	1	5	5
5	1	1	1

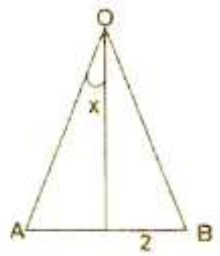
= 2 x 3 x 5^2 = 150min
Time taken = 2hrs 30min
Rang last together = 6.45am
2.30
4.15 am or
0415 hrs

12. 2y = 4x + 1 ⇒ y = 2x + ½
$g_1 = 2$
$g_2 = ½$
$\frac{y+2}{x-2} = -\frac{1}{2}$
2(y + 2) = -1(x-3)
2y = -x – 1
y = $-\frac{x}{2} - \frac{1}{2}$

13.



Tan $45^0 = \frac{x}{60}$
x = 60 tan 45^0
= 60
Tan A = $\frac{60}{240}$
$= \frac{1}{4} = 0.25$
A = 14.04^0

14	h = 10sin 40 Area = ½ x 10 Sin 40(12+6) = 57.85
15	Total ratio = 5 + 6 + x Kioko's share = $\frac{5}{11+x}$ x 12000 = 4000 60000 = 4000(11+x) 60000 = 44000 + 4000x $\frac{16000}{4000} = \frac{4000x}{4000}$ x = 4
16	(i) y ≥ 0 (ii) x > 1 (iii) $\frac{y}{x-5} = -\frac{2}{5}$ 5y + 2x = 10 ∴5y + 2x ≤ 10
17	(a) 250 x 14 x 2 x 2 = 14,000 Net profit = 14000 – 6000 = Shs. 8000 (b) 8000 x 25 = 200000 200000 – 10000 = 190000 (c) Saving $\frac{40}{100}x190{,}000$ = 76,000 Remaining profit = $\frac{36}{100}x190{,}000$ = 68,400 Ouko's share = $\frac{456{,}000}{3} + \frac{2}{9}x68{,}400$ = 30,400 (d) $\frac{475000\ x\ 3\ x\ 100}{95}$ = Sh. 1,500,000
18	10. (a) (2n – 4)90 = 2 x 90 + (n-2)150 180n – 360 = 180 + 150n – 300 180n – 150n = 180 + 60 30n = 240 n – 8 sides Sum = 2 x 90 + 150 x 6 = 1080 (b) Polygon – Octagon (c) Angle at centre = $\frac{360}{8} = 45^0$  Base angles = ½ x 135 = 67.5 x = ½ x 45 = 22.5 tan 67.5 = $\frac{h}{2}$ h = 2 Tan 67.5 = 4.828 Area of ⊿AOB = ½ x 4 x 4.828 = 9.656 Area of octagon = 8 x area of 1∆ = 8 x 9.656 = 77.248
19	Radius 4.0± 0.1cm Area of circle = $\frac{22}{7}\ x\ 4\ x\ 4 = 50.29$ Area of ∆ = ½ x 6.3 x 7.2 x Sin 60 = 19.64 Area of region between = 50.29 – 19.64 = 30.65
20	9. (a) (i) AB = AO = $\underset{\sim}{a}$ + $\underset{\sim}{b}$ = $\underset{\sim}{b}$ – $\underset{\sim}{a}$ (ii) ON = OA + AN = 1 + ½AB = 1 + ½ (b – a) = ½(**a**+**b**) (iii) BM = BO + OM = -$\underset{\sim}{b}$ + $\frac{2}{3}\underset{\sim}{a}$ $= \frac{2}{3}a - b$ (b) OX = hON = h (½a + ½b) = $\frac{h}{2}a + \frac{h}{2}b$ OX = OM + MX = $\frac{2}{3}a + kMB$ $= \frac{2}{3}a + k(-BM)$ $= \frac{2}{3}a - (\frac{2}{3}a - b)$ $= \left(\frac{2}{3} - \frac{2}{3}k\right)\underset{\sim}{a} + k\underset{\sim}{b}$ $\frac{h}{2}a + \frac{h}{2}b = \left(\frac{2}{3} - \frac{2}{3}k\right)$a+kb Comparing coefficients of a and b $\frac{h}{2} = \left(\frac{2}{3} - \frac{2}{3}k\right) \Rightarrow$ h = $\frac{4}{3} - \frac{4}{3}k$ $\frac{4}{3} - \frac{4}{3}k = 2k \Rightarrow \frac{4}{3} = 2k + \frac{4}{3}k$ 4 = 6k + 4k 10k = 4 k = $\frac{2}{5}$ Substitute k in eqn (ii) h = 2 x $\frac{2}{5} = \frac{4}{5}$
21	(a) Volume = 1.7 x 1.4 x 2.2 = 5.23cm^3 Volume of milk $= \frac{75}{100}\ x\ 5.236\ x\ 1000$ = 3927 litres (b) Base are = ½ x 16 x 16 x Sin 60 = 110.85 Volume = 110.85 x 13.6 x $\frac{1}{3}$ = 502.52cm^3 = 500ml 2sf (c) No of packets = $\frac{3927\ x\ 1000}{500}$ = 7854 Amount of money = 7854 x 30 = Sh. 235,620

22

Marks	Midpoint x	f	d = x –a	cf
0-9	4.5	1	-49.9	1
10-19	14.5	2	-39.9	3
20-29	24.5	4	-29.9	7
30-39	34.5	7	-19.9	14
40-49	44.5	10	-9.9	24
50-59	54.5	16	0.1	40
60-69	64.5	20	10.1	60
70-79	74.5	6	10.1	60
80-89	84.5	3	30.1	69
90-99	94.5	1	40.1	70

(a) (i) Modal class = 60 – 69

(ii) Position of median in CF = $\frac{70}{2} = 35th$

Median class = 50 – 59

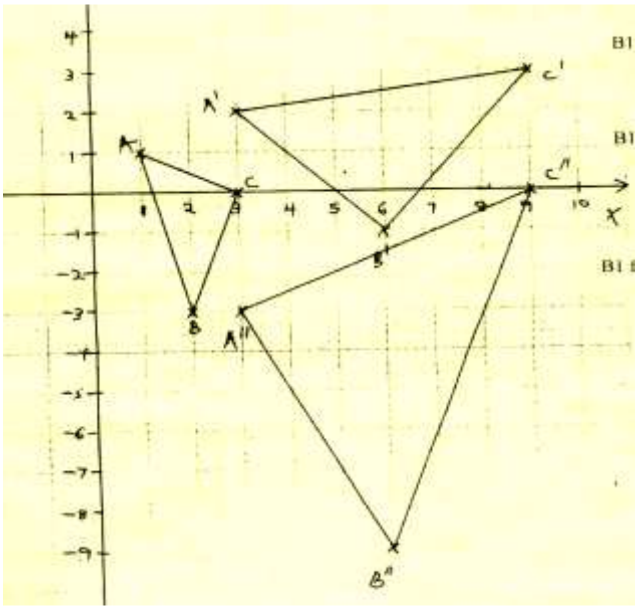
M = L + $\frac{\frac{n}{2}-c}{f}$ x 10

= 49.5 + $\frac{\frac{70}{2}-24}{16}$ x 10

= 49.5 + $\frac{11}{16}$ x 10

(b) Mean = 54.4 + -$\frac{33}{70}$= 53.93

23



(a) $\begin{pmatrix}3&0\\1&1\end{pmatrix}\begin{pmatrix}1&2&3\\1&-3&0\end{pmatrix}=\begin{pmatrix}A^1&B^1&C^1\\3&6&9\\2&-1&3\end{pmatrix}$

A^1 (3,2) B^1(6,-1) C^1(9,3)

(b) $\begin{pmatrix}1&0\\-1&3\end{pmatrix}\begin{pmatrix}A^1&B^1&C^1\\3&6&9\\2&-1&3\end{pmatrix} = \begin{pmatrix}A^{11}&B^{11}&C^{11}\\3&6&9\\3&-9&0\end{pmatrix}$

A^{11}(3,3) B^{11}(6,-9) C^{11}(9,0)

(iii) $\begin{pmatrix}a&b\\c&d\end{pmatrix}\begin{pmatrix}3&-6&9\\3&9&0\end{pmatrix} = \begin{pmatrix}1&2&3\\1&-3&0\end{pmatrix}$

a = 0

b = -$\frac{1}{3}$

c = 0

d = -$\frac{1}{3}$

enlargement

LSF $\frac{1}{3}$

Centre (0,0)

Enlargement centre (0,0) and scale factor $\frac{1}{3}$

24

(a) $V = 2t^2 + 8t + c$

$t = 0, V = 70$

$V = 2t^2 + 8t + 70$

(b) $t = 1, V = 2 + 8 + 70$

$t = 3, V = 6 + 24 + 70$

$\frac{90 + 80}{2}$

$= 85km/h$

(iii) $\left[\frac{2}{3}t^3 + 4t^2 + 70t\right]^3_2$

$(18 + 26 + 210) – (\frac{16}{3} + 16 + 140)$

$264 – \frac{484}{3} = \frac{308}{3}$

$= 102\frac{2}{3}km$

GUCHA SOUTH EVALUATION TEST
121/2
Mathematics
July/August 2015

1	No Log 36.72 1.5649 0.46 $\bar{1}.6628$ x 2 $\bar{1}.3256$ 0.8905 185.4 2.2681 $\bar{2}.6224$ 3 - 0.3474 $\bar{1}.5408$
2	$x^2 = \frac{am^2}{a^2-m^2}$ $a^2x^2 – m^2x = am^2$ $am^2 + m^2x = a^2$ $m^2(a+x) = a^2x^2$ $m^2 = \frac{a^2x^2}{a+x}$ $m = \sqrt{\frac{a^2x^2}{a+x}}$
3	$\frac{10}{\sqrt{7}-\sqrt{2}} x \frac{\sqrt{7}+\sqrt{2}}{\sqrt{7}+\sqrt{2}}$ $= \frac{10(\sqrt{7}+\sqrt{2})}{7-2}$
4	$\frac{(8x)^2}{4x4x^2}$ = K – 3 $\frac{64x^2}{16x^2}$ = K – 3 $4 = K - 3$ K = 7
5	AC = $\frac{100 \, Sin \, 72^0}{Sin66^0}$ = 104.1m BC = $\frac{100Sin42}{Sin66}$ = 73.25m Perimeter = 100 + 104.1 + 73.25 = 277.35 = 277m
6	$x^2 – 4x + y^2 + 6y = 3$ $(x-2)^2 + (y+3)^2 = 3 + (-2)^2 + (3)^2$ $(x-2)^2 + (y + 3)^2 = (4)^2$ Radius = 4 units Centre (2,-3)
7	P $(1-\frac{12}{100})^5$ = 364000 P = $\frac{364000}{(0.88)^5}$ KSh. 689,744
8	At x = 2 y = $(2)^3 – 2(2)^2 + 3(2) – 1 = 5$ (2,5) $\frac{dy}{dx} = 3x^2 - 4x + 3$ at x = 2 gradient of tangent = 7 $\frac{y-5}{x-2} = 7$ Equation of tangent y = 7x – 9
9	MN = $\begin{pmatrix}2&0\\0&2\end{pmatrix}\begin{pmatrix}3&3\\1&3\end{pmatrix}$ = $\begin{pmatrix}6&0\\2&6\end{pmatrix}$ = MN = (R) = $\begin{pmatrix}6&0\\2&6\end{pmatrix}\begin{pmatrix}3\\2\end{pmatrix}$ = $\begin{pmatrix}18\\-6\end{pmatrix}$ Co-ordinates of R^1(19,-6)
10	(a) 12 x 2 = (SM + 3)3 SM = $\frac{24}{3} - 3 = 5$ PS = 5 + 3 = 8cm (b) PQ = $\sqrt{12 \, x \, 2}$ 4.899cm
11	$(1-2x)^6 = 1(1)^6 + 6(1)5 + 15(1)^4 (-2x)^2 + 20(1)^3 (-2x)^3$ $= 1 – 12x + 60x^2 – 160x^3$ (0.98)6 = 1 – 12(0.01) + 60(0.01)2 – 160(0.01)3 = 0.88584 = 0.8858
12	1. Log_{10} (6x-2) Log $_{10}$(x-3) = 1 Log10$\left(\frac{6x-2}{x-3}\right)$ = 1 $\frac{6x-2}{x-3}$ = 10 $6x - 2 = 10x - 30$ -4x = -28 x = 7
13	2. (a) OQ = $\frac{2}{3}\begin{pmatrix}5\\-3\\4\end{pmatrix}+\frac{1}{3}\begin{pmatrix}2\\6\\13\end{pmatrix}$ = $\begin{pmatrix}4\\0\\7\end{pmatrix}$ Position vector of Q 4i + 7k (b) PQ = $\begin{pmatrix}4\\0\\7\end{pmatrix}$-$\begin{pmatrix}2\\6\\13\end{pmatrix}$ Length of PQ = $\sqrt{(2)^2 + 6^2 + -6^2}$ = 8.718 units

KANDARA SUB-COUNTY SECONDARY SCHOOLS
FORM FOUR 2015 JOINT EXAMINATIONS
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/1
July/August 2015

SECTION 1 (50 MARKS)

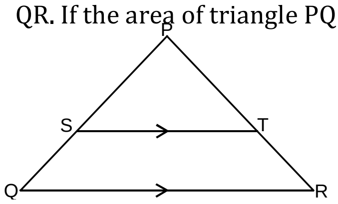
Answer all the questions in this section.

1. Without using mathematical tables or a calculator evaluate. (2 marks)

$$\frac{\sqrt[3]{675\times135}}{\sqrt{2025}}$$

2. Solve the simultaneous equations $\frac{1}{y}=\frac{2}{x}+\frac{1}{10}$ and $\frac{3}{4y}+\frac{5}{2x}=\frac{7}{8}$ (4 marks)

3. The figure below shows triangle PQR in which PR = 12cm. T is a point on PR such that TR =4cm. Line ST is parallel to QR. If the area of triangle PQR is 336cm^2. Find the area of the quadrilateral STQR. (4 marks)



4. Expand the expression. (2 marks)

$$\left(a^2-b^2\right)\left(a^2+b^2\right)\left(a^4-b^4\right)$$

6. Angle of 1.8^0 at the centre of a circle subtends an arc off 46.38cm. Find the area of the arc encloses and the radius. (3 marks)

6. The size of an interior angle of a regular polygon is $3x°$ while its exterior angle is $(x - 20)°$. Find the number of sides of the polygon. (3 marks)

7. Solve the following inequalities and represent the solutions on a single number line. (3 marks)
3x ⍰
3 - 2x < 5
4 -   -8

8. Find the value of x which satisfy the equation. (3 marks)

$5^{2x} - 6 \times 5^{x} + 5 = 0$

9. A rostrum is made by cutting off the upper part of a cone along a plane parallel to the base at $^2/_3$ up the height. What fraction of the volume of the cone does the rostrum represent? (3 marks)

10. A bus takes 195 minutes to travel a distance of $(2x + 30)$ km at an average speed of $(x - 20)$km/h. Calculate the actual distance travelled. Give your answer in kilometres. (3 marks)

11. A fruit seller bought 144 pineapples at Kshs 100 for every six pineapples. He sold some of them at Kshs 72 for every three and the rest at Kshs 60 for every two. If he make a 65% profit, calculate the number of pineapples sold at Kshs 72 for every three. (3 marks)

12. Given that Sin (90 - 0)° = 0.8, where ⍰° is an acute angle, find without using mathematical tables the value of tan ⍰ ° (3 marks)

13. Last year, Nafula was four times as old as her son, Kamau. In four years time, the sum of their ages will be 53. Determine their present ages (3 marks)

14. Solve for x in $Log5-2+\log(2x+10)=\log(x-4)$ (3 marks)

15. Four people working 5 hours per day can clear a piece of land in 4 days. How many days would it take 10 people to clear the same piece of land working 4 hours per day? (4 marks)

16. In this question, mathematical tables should not be used.

A Kenyan bank buys and sells foreign currencies as shown below.

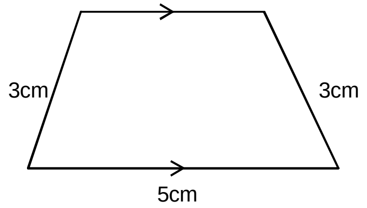
	Buying	Selling
	(in Kenya shillings)	(in Kenya shillings)
1 Hong Kong dollar	9.74	9.77
1 South African rand	12.03	12.11

A tourist arrived in Kenya with 105,000 Hong Kong dollars and change the whole amount to Kenya Shillings. While in Kenya, she spent Kshs 403,879 and changed the balance to South African Rands before leaving for South Africa. Calculate the amount in South African Rand that she received. (4 marks)

SECTION 11 (50 MARKS)

Answer ANY FIVE questions in this section in the spaces provided.

17. The diagram below represents the cross section of a solid prism of length 8cm



(a) Calculate the volume of the prism. (3 marks)

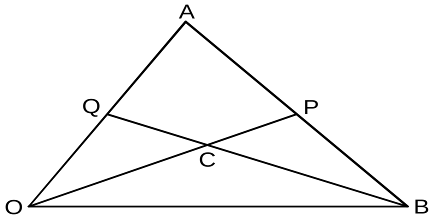
(b) Given that the density of the prism is 5.75gcm^{-3}, calculate its mass in grams. (2 marks)

(c) A second prism is similar to the first one but it made of a different materials. The volume of the second prism is 246.24cm^{3}.

Calculate the area of the cross-section of the second prism. (3 marks)

(d) Given that the ratio of the mass of the first prism to that of the second is 2.5, find the density of the second prism. (2 marks)

18. In the diagram below OA = **a**, OB = **b** the points P and Q are such that **AP** = $^2/_3$ **AB**, **OQ** = $^1/_3$ **OA**



(a) Express **OP** and **BQ** in terms of **a** and **b** (2 marks)

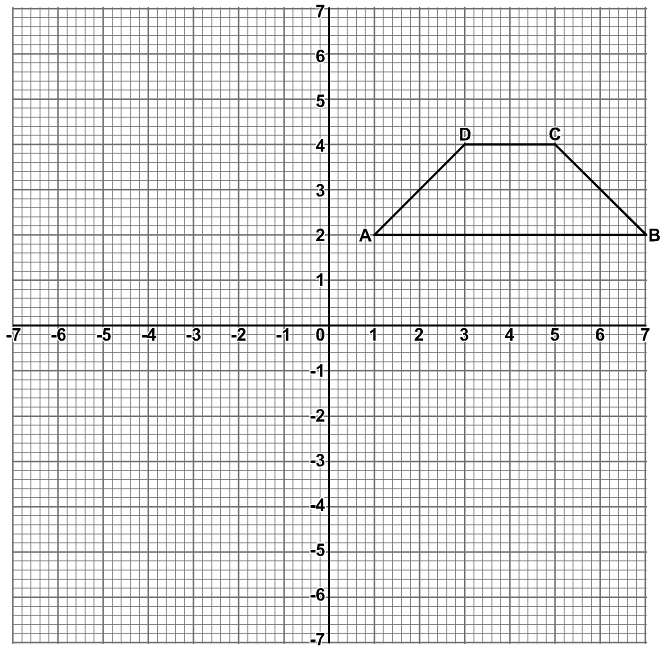
(b) If **OC** = h**OP** and **BC** = k**BQ**, Express OC in two different way and hence

(i) Deduce the value of h and k. (5 marks)

(ii) Express vector OC in terms of **a** and **b** only. (2 marks)

(iii) State the ratio in which C divides BQ (1 mark)

19. The diagram on the grid provided below shows a trapezium ABCD on the same grid.



(a) (i) Draw the image $A^1B^1C^1D^1$ and ABCD under a rotation of 90° clockwise about the origin. (1 mark)

(ii) Draw the image $A^{11}B^{11}C^{11}D^{11}$ of $A^1B^1C^1D^1$ under the reflection in line y = x. State coordinates of $A^{11}B^{11}C^{11}D^{11}$ (3 marks)

(b) $A^{111}B^{111}C^{111}D^{111}$ in the image of $A^{11}B^{11}C^{11}D^{11}$ under the reflection in the line x=0. Draw the image $A^{111}B^{111}C^{111}D^{111}$ of and state its coordinates. (2 marks)

(c) Describe a single transformation that maps $A^{11}B^{11}C^{11}D^{11}$ onto ABCD. (4 marks)

20. A triangular plot ABC is such that AB = 36m, BC = 40m and AC = 42m.

(a) Calculate the :-

(i) Area of the plot in hectares. (3 marks)

(ii) The acute angle between the sides AB and BC. (2 marks)

(b) A water tap is to be installed inside the plot such that the tap is at the centre of the circumcircle passing through the vertices A, B and C. Calculate the distance of the tap from the vertex A. (2 marks)

(c) Find the area outside the plot that would be watered by the sprinkler connected directly to the tap. (3 marks)

21. (a) On the grid provided, draw the graph of the function $y = ½ x^2 - x + 3$ for $0 \leq x \leq 6$ (3 marks)

(b) Calculate the mid-ordinates for 5 strips between $x = 1$ and $x = 6$ and hence use the mid-ordinate rule to approximate the area under the curve between $x = 1$, $x = 6$, and x-axis. (3 marks)

(c) Assuming that the area determined by integration to be the actual area, calculate the percentage error in using the mid-ordinate rule. (4 marks)

22. The boundaries PQ, QR, RS and SP of a ranch are straight lines such that Q is 16km on a bearing of 040° from P. R is directly south of Q and East of P and S is 12km on a bearing of 120° from R.

(a) Using a scale of 1cm to represent 2km, show the above information in a scale drawing. (3 marks)

(b) From the scale drawing determine:

(i) the distance in kilometres between P and S. (2 marks)

(ii) the bearing of P from S. (2 marks)

(c) Calculate the area of the ranch PQRS in square kilometres. (3 marks)

23. A bus left Mombasa and travelled towards Nairobi at an average speed of 60km/h. After 2½hours, a car left Mombasa and travelled along the same road at an average speed of 100km/h. If the distance between Mombasa and Nairobi is 500km, determine:

(a) (i) the distance of the bus from Nairobi when the car took off. (2 marks)

(ii) the distance the car travelled to catch up with the bus. (4 marks)

(b) Immediately the car caught up with the bus, the car stopped for 25 minutes. Find the new average sped at which the car travelled in order to reach Nairobi at the same time as the bus. (4 marks)

24. A sales man is paid a commission of 2% on goods worth over kshs 100,000. He is also paid a monthly salary of Kshs 12000. In certain month, he sold 360 handbags at Kshs 500 each.

(a) Calculate the salesman's earnings that month. (3 marks)

(b) The following month, the salesman's monthly salary was increased by 10%. His total earnings that month was shs 17600 Calculate:

(i) the total amount of money received from the sales of handbags that month. (5 marks)

(ii) the total number of handbags sold that month. (2 marks)

KANDARA SUB-COUNTY SECONDARY SCHOOLS
FORM FOUR 2015 JOINT EXAMINATIONS
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/2
July/August 2015

SECTION 1 (50 MARKS)

Answer all the questions in this section.

1. Use mathematical tables to evaluate. (4 marks)

$$\sqrt[3]{\frac{0.8423\times 72.5}{930.5}}$$

2. The sum of the first three positive numbers of a Geometric progression is 3. If the first term is three times the second term, find the three numbers. (3 marks)

3. A quantity y is partly constant and partly varies as x. If $x = 7, y = 4$ and $x = 16, y = 40$. Find the equation connecting x and y. Find the value of x when $y = 30$. (4 marks)

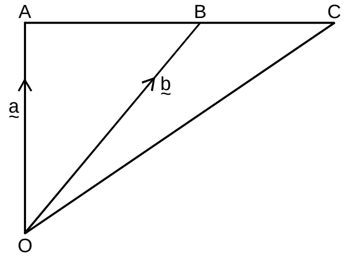
4. Find the radius and centre of a circle whose equation is (3 marks)
$3x^2 + 3y^2 - 12x + 18y = 9$

5. Three oranges and five mangoes cost shs 19 while two oranges and one mango cost shs 8. Form a matrix equation to represent the above information hence find the cost of one orange and one mango. (4 marks)

6. Find $\int_2^4 \left(x^3 - x^2 + 5\right)dx$ (2 marks)

7. Solve the equation (2 marks)
$6t^2 - t - 2 = 0$
Hence solve the equation
$6\text{Cos}^2\theta - \text{Sin}\ \theta + 4 = 0$ in the range $0 \leq \theta \leq 180°$ (2 marks)

8. In the diagram below **OA** = **a** **OB** = **b** and c divides AB in the ratio 3 : -1. Find **OC** (3 marks)



9. Simplify $\left(2+\sqrt{3}\right)^3 - \left(2-\sqrt{3}\right)^3$ (3 marks)

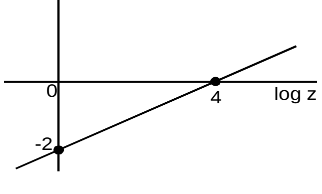
10. Solve for m in the given equation (3 marks)

$$(27)^{-m} \times \frac{1}{81} = 243$$

11. Solve $5 \leq 3x - 1 < 15$ and represent the answer on a number line. (3 marks)

12. Point A(3, 4) is mapped onto A^1 (7, 8) by an enlargement scale factor 3, determine the centre of enlargement. (3 marks)

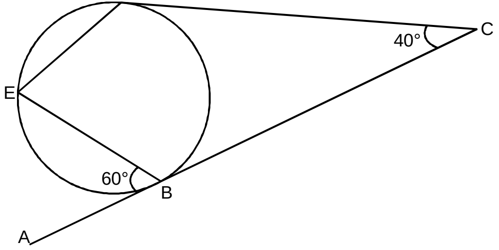
13. The graph below is part of the straight line graph obtained from the initial equation $R = bZ^n$.



(a) Write down the equation of the straight line in the form. (2 marks)
$y = m x + c$
(b) Use the graph to calculate the values of b and n (2 marks)

14. A book and a ruler are sold at a discount of 8% and 3% respectively. Calculate the overall discount offered on the two commodities if the cost of the book is four times that of ruler. (3 marks)

15. On the figure below like ABC and DC are tangents ot the circle at B and D respectively.



(a) ∠CBD (1 mark)

(b) ∠CDE (1 mark)

16. Make P the subject of the formula. (2 marks)

$$2a = \sqrt{\frac{t^2 + q}{p}}$$

SECTION 11 (50 MARKS)

Answer ANY FIVE questions in this section.

17. The table below shows the distribution of marks of 50 students in an opener examination.

Mark	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 - 100
Frequency	4	7	6	6	y	8	4	3	2	1

(a) i) Find the value of y. (1 mark)

(ii) State the modal class. (1 mark)

(b) Using an assumed mean of 45.5 find the mean. (3 marks)

(c) Calculate

(i) Variance. (3 marks)

(ii) Standard deviation. (2 marks)

18. (a) Complete the table for the equation. (3 marks)

$y = 2\text{Sin } (3x + 30°)$

x	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
3x + 30°	30°	60°	90°			180°		240°		300°
y = 2 Sin (3x + 30°)	1	1.73	2			0			-2	-1.73

(b) Using the grid provided draw the graph of y = 2Sin (3x + 30°) for 0 ≤ x ≤ 90°. Take 1cm to represent 10° on the x-axis and 2cm to represent 1 unit on the y-axis. (3 marks)

Use your graph to find

(i) y when x = 45° (1 mark)

(ii) the range of values of x that satisfy the inequality. (3 marks)

$y \geq 1.6$

19. The position of the two towns P and Q on the earths surface are (60°N 139°E) and (60°N, 41°W) respectively.

a) Find the latitude difference between P and Q. (2 marks)

(b) i) Given that the radius of the earth is 6370km, calculate the distance between P and Q (i) via the North pole. (2 marks)

(ii) Along the parallel of latitude. (2 marks)

(c) Another town R is 420km east of town P and on the same latitude as P and Q. Find the longitude of town R. (4 marks)

20. The p^{th} term of a sequence is given by 2p + 3

(a) Write down the first five terms of the sequence. (2 marks)

(b) Find S_{50} , the sum of the first fifty terms of the sequence. (3 marks)

(c) Show that sum of the first P terms of the sequence is given by $S_p = p^2 + 4p$.

Hence or otherwise find the largest integral value of P such that Sp < 725 (5 marks)

21. The table below shows income tax rates.

Taxable pay (K£ per month)	Rate of tax (Kshs/Pound)
1 - 435	2
436 - 870	3
871 - 1305	4
1306 - 1740	5
(Excess over 1740)	6

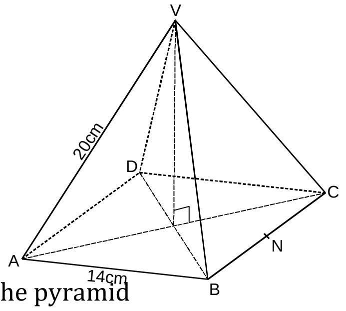
A company employee earns a monthly salary Kshs 32,000 and is also given a taxable house allowance amounting to Kshs 1784 per month.

(a) Calculating his total income tax in K£ per month. (2 marks)
(b) The employee is entitled to a personal relief of Kshs 1700 per month determine his tax. (4 marks)
(c) If the employee is entitled to a personal relief of Kshs 1700 per month determine his tax. (4 marks)

22. A number is selected from 2, 5, 7, 9, 11, 13 and pared with another number selected from 4, 6, 8, 10, 12, 14.

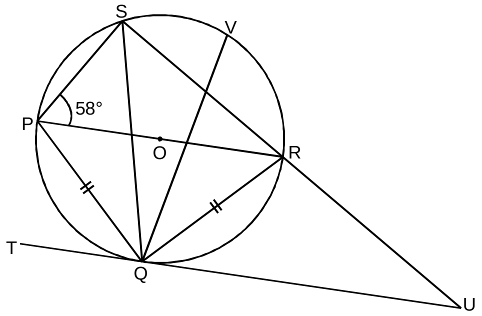
(a) Construct a table sharing how the numbers are paired. (2 marks)
(b) Find the probability that the sum of the selected numbers is even. (2 marks)
(c) Find the probability that the sum is a prime number and also add. (3 marks)
(d) Find the probability that the sum is greater than 15. (3 marks)

23. The diagram below shows a right pyramid on square base ABCD and vertex V. O is the centre of the base AB = 14cm. VA = 20cm and N is the midpoint of BC



Find
(a) the height of the pyramid (2 marks)
(b) the length VN (2 marks)
(c) the angle between
  (i) BV and the plane ABCD (2 marks)
  (ii) VO and the plane BVC (2 marks)
(d) Calculate the volume of the pyramid. (2 marks)

24. In the figure below POR is the diameter of circle centre O, PQ = QR and ∠SPR = 58°. TQU is a tangent to the circle at Q.
V is a point on the minor arc SR.



(a) Calculate the size of the following angles giving reasons for your answer.
  (i) ∠QPS (2 marks)
  (ii) Reflex ∠QOS (2 marks)
  (iii) ∠QVS (2 marks)
  (iv) ∠QVR (2 marks)
(b) Given that SR = 5cm and RV = 4cm find UQ. (2 marks)

KANDARA SUB COUNTY SECONDARY SCHOOLS
FORM FOUR 2015 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - **121 / 1**
July/August 2015
Marking Scheme

1.

$$\frac{\sqrt[3]{675\times135}}{\sqrt{2025}}=\frac{\sqrt[3]{3^3\times5^2\times5\times3^3}}{3^2\times5}=1$$

2

$$\frac{1}{y}=\frac{2}{x}+\frac{1}{10}\ldots\ldots(i)$$
$$\frac{3}{4y}+\frac{5}{2x}=\frac{7}{8}\ldots\ldots(ii)$$
$$\frac{3}{4}\left(\frac{2}{x}+\frac{1}{10}\right)+\frac{5}{2x}=\frac{7}{8}$$
$$\frac{16}{4x}=\frac{32}{40}\Rightarrow x=\frac{40}{32}\times\frac{16}{4}$$
$$=5$$
$$\frac{1}{y}=\frac{2}{5}+\frac{1}{10}$$
$$y=2$$
$$\therefore x=5 \quad y=2$$

3.

$$L.s.f=\frac{12}{8}=\frac{3}{2}$$
$$A.S.f=\left(\frac{3}{2}\right)^2$$
$$\frac{336}{A}=\frac{9}{4}\Rightarrow A=149\tfrac{1}{3}$$
$$Area\ of\ quadrilateral$$
$$=336-149\tfrac{1}{3}$$
$$=186\tfrac{2}{3}\,cm^3$$

4.

$(a^2 - b^2)(a^2 + b^2)(a^4 - b^4)$

$= (a + b)(a - b)(a^2 + b^2)(a^2 + b^2)(a^2 - b^2)$

$= a^8 - a^4b^4 - a^4b^4 + b^8$

$= a^8 - 2a^4b^4 + b^8$

5.

$$\frac{1.8^C}{2\pi^C}\times2\times\pi\times R=46.8$$
$$0.8(2)R=46.8$$
$$R=26$$
$$A=\frac{1.8}{2\pi}\times\pi(2.6)^2=608.4cm^2$$

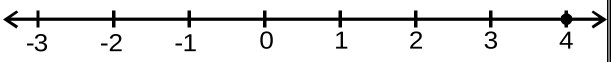
6.

$3x° + (x - 20)° = 180°$

$4x° - 20 = 180°$
$4x° = 160°$
$x = 40°$
Let n = no of sides.
$$\frac{360°}{n}=40°$$
$$40°n=360°$$
$$n=9$$

7.

$3 - 2x < 5$
$-2x < 2$
$x > 1$
$4 - 3x\ ^3 - 8$
$-3x\ ^3 - 12$
x £ 4
-1 < x £ 4



8.

Let $y = 5^x$

$y^2 - 6y + 5 = 0$

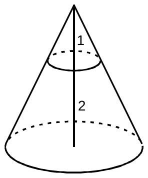
$(y - 5)(y-1) = 0$

$y = 5$ or $y = 1$

$5^{-1} = 5^x$ and $5° = 5^x$

Þ x = 1 or x = 0

9.



$$l.s.f.=\frac{1}{3}$$
$$r.s.f=\left(\frac{1}{3}\right)^3=\frac{1}{27}$$

Fraction of the volume of a cone
$$=1-\frac{1}{27}$$
$$=\frac{26}{27}$$

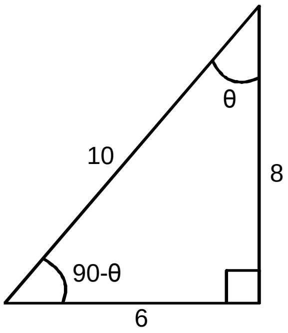
10.

$$\frac{2x+30}{x-20}=\frac{195}{60}=\frac{13}{4}$$
$$4(2x+30)=13(x-20)$$
$$x=76$$
$$d=2(76)+30=182km$$

11

$$\frac{144}{6}\times100=2400$$
$$\frac{x}{3}\times72+\frac{144-x}{2}(60)=\frac{165}{100}(2400)$$
$$24x+80(144-x)=3980$$
$$6x=360$$
$$x=60$$

12.



$$Tan^2(\theta) = \left(\frac{6}{8}\right)^2 = \frac{9}{16}$$

13.

Let Kamau's present age be x

Last year, Kamau's age was x - 1 and Nafula's age was 4(x -1)
⇒ In 4 years time, their respective ages will be (x - 1) + 4 and 4(x - 1) + 4
⇒ (x - 1) + 4 + 4 (x - 1) + 4 = 53
5x = 50
x = 10
Kamau's age = 9 years and Nafula's age 4(10 - 1) = 36 years

14.

Log 5 - log 100 + log (2x + 10) = log (x - 4)

$$Log\left\{\frac{5(2x+10}{100}\right\} = \log(x-4)$$

10x + 50 = 100x - 400

x = 5

15.

People	hours	days
4	5	4
1	1	4 × 5 × 4
10	4	$\frac{4 \times 5 \times 4}{10 \times 4}$ = 2 days

16.

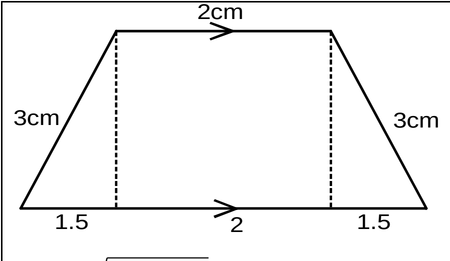
Kshs (105, 000 × 9.74) = 1,022,700

1 0 2 3 7 0 0
\- <u>4 0 3 8 7 9</u>
Kshs 6 1 8, 8 2 1

$\frac{618821}{12.11}$

= 51100 South African Rand

17.
(a)



$h = \sqrt{3^2 - 1.5^2}$
= 2.598
$Volume = \frac{1}{2} \times 2.598(2+5) \times 8$
= 72.75cm^3

(b)

$$= \frac{m}{v} \Rightarrow m = 5.75 \times 72.75$$
$$\varrho \;= 418.31gm$$

L.s.f $= \left(\frac{72.75}{246.24}\right)^{1/3}$

A.s.f $= \left(\frac{72.75}{246.24}\right)^{2/3}$

Cross section area of the second prism

$= \left(\frac{72.75}{246.24}\right)^{2/3} \times 9.093$
= 20.5cm^2

ii) Mass of second prism $= \frac{5}{2} \times 418.31 = 1045.775gm$

$$\rho = \frac{1045.775}{246.24}$$
$$= 4.247gcm^{-3}$$

18.

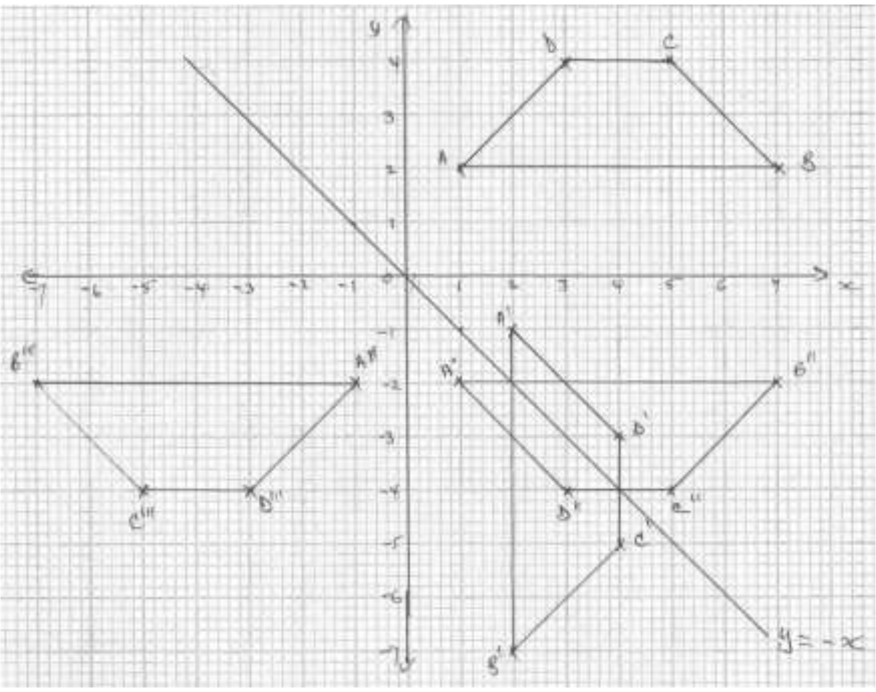
OP = $^2/_3$ **b** + $^1/_3$ **a**
BQ = **-b** + $^1/_3$ **a**

b) i) **OC** = $^2/_3$h **b** + $^h/_3$ **a**
OC = **b - k(-**b + $^1/_3$a)
BC = KBQ
= k(-b + $^1/_3$a)
BC= -K**b** + $^k/_3$a
OC = OB + BC
$^2/_3$ h **b** + $^h/_3$ **a** = **b** + -k**b** + $^k/_3$ **a**
= (1 - k) **b** + $^k/_3$ **a**

$$\frac{h}{3} = \frac{k}{3} \Rightarrow h = k$$
$$\frac{2}{3}h = 1 - k$$

h = $\frac{3}{5}$, $k = \frac{3}{5}$
OC = $^3/_5$ ($^2/_3$ **b** + $^1/_3$**a**)
= $^2/_5$ **b** + $^1/_5$**a**
BC : CQ = 3 : 2

19.



20.

S = ½ (36 + 40 + 42) = 59

A = $\sqrt{59(59-36)(59-40)(59-42)}$

= 662.05m² = 0.0662Ha

ii) 662.05 = ½ × 36 × 40Sin B
B = 66.86°

b)
$$\frac{42}{Sin\,66.86} = 2R \Rightarrow R = 22.84m$$

c)
$$A = \frac{22}{7}\times 22.84^2 = 1639.5m^2$$

$$Area\ of\ \Delta = 662.05$$

$$Area\ outside = 1639.25 - 662.05$$

$$= 977.20m^2$$

(b)

y_1 = 2.625

y_2 = 3.625

y_3 = 5.625

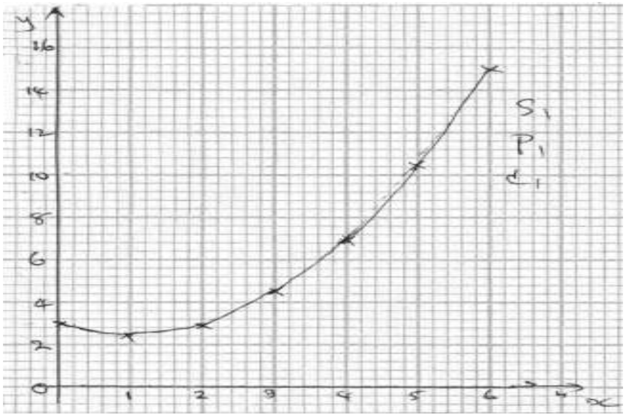
y_4 = 8.625

y_5 = 12.625

(c)
Approximate area
= 1(2.625 + 3.625 + 5.625 + 8.625 + 12.625)
= 33.126 sq units

21.

x	0	1	2	3	4	5	6
y=½ x² - x + 3	3	2½	3	4½	7	10½	15



(c)
$$Area = \int_1^6 \left(\tfrac{1}{2}x^2 - x + 3\right)dx$$

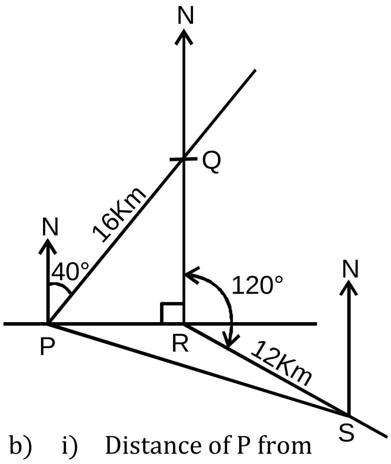
$$= \left[\frac{x^3}{6} - \frac{x^2}{2} + 3x\right]_1^6$$

$$= \left[\frac{6^3}{6} - \frac{6^2}{2} + 3\times 6\right] - \left[\frac{1^3}{6} - \frac{1^2}{2} + 3\right]$$

$$= 33.3$$

$$\%Error = \frac{33.3 - 33.125}{33.3}\times 100$$

$$= 0.625\%$$

22.	Given scale 1cm to 2km  b) i) Distance of P from S = 10.8 ± 0.1cm = 21.6km ii) <PSN = 74 ± 1° Bearing of P from S = 286 ± 1°	24.	Total sales = 360 × 500 = Shs 180,000 a) Commission = (180000 - 100000) = (80000) × $^{2}/_{100}$ = shs 1600 Total earnings 12000 + 1600 = shs 13600 b) i) New salary $12000 + 12000 \times \frac{10}{100}$ = shs 13200 Commission paid = 17600 - 13200 = shs 4400 Commission paid on shs 4400 $4400 \times \frac{100}{2} = 220,000$ Total sales = 220,000 + 100,000 = Shs 320,000 (ii) No. of handbags sold $n = \frac{32000}{500}$ n = 64
23.	(a) (i) Distance covered by bus in 2½hrs = 60 × $^{5}/_{2}$ = 150km 500 - 150 = 350km (ii) Overtaking speed = 100 - 60 = 40km/hr Distance = 150 km Time taken to over = $\frac{150}{40} = 3\frac{3}{4}\, hrs$ Distance travelled by call to catch up = 100 × $^{15}/_{4}$ = 375 km (b) Distance remaining = 500 - 375 = 125km Time taken by bus to cover 125km $\frac{125}{60} = 2\frac{1}{2} = 2hr30\min$ Time left for the car after rest. 2hrs 30 min - 25 min. =$2^{1}/_{12}$ hrs New av. speed $= \frac{125}{\frac{25}{12}}$ $= \frac{125 \times 12}{25}$ $= 5 \times 12$ $= 60 km/hr$		

KANDARA SUB COUNTY SECONDARY SCHOOLS
FORM FOUR 2015 JOINT EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - **121 / 2**
July/August 2015
Marking Scheme

1

No	Log
0.8423	1.9255
72.5	1.8603
	1.7858
930.5	2.9687
	$\frac{2.8171}{3} = 3 + \frac{1.8171}{3}$
0.4033	←1.6057

2.

a + ar + ar² = 3
a = 3ar
r = ¹/₃
a(1 + r + r²) = 3

$$a(1+r+r^2)=3$$
$$a(1+\tfrac{1}{3}+\tfrac{1}{9})=3$$
$$\tfrac{13}{9}a=$$
$$a=\tfrac{27}{13}$$
$$Nos\ are\ \tfrac{27}{13},\tfrac{9}{13},\tfrac{3}{13}$$

3

y = k + mx
4 = k + 7m

$\underline{40 = k + 16m}$
9m = 36
m = 4
k = 4 - 28
= -24
y = -24 + 4x
30 = -24 + 4x
4x = 54
x = 13.5

4

$x^2 + y^2 - 4x + 6y = 3$

$(x - 2)^2 + (y + 3)^2 = 16$

Centre (2, -3)

radius 4 units.

5.

$$3x+5m=19$$
$$2x+m=8$$
$$\begin{pmatrix}3&5\\2&1\end{pmatrix}\begin{pmatrix}x\\m\end{pmatrix}=\begin{pmatrix}19\\8\end{pmatrix}$$
$$\frac{-1}{7}\begin{pmatrix}1&-5\\-2&3\end{pmatrix}\begin{pmatrix}3&5\\2&1\end{pmatrix}\begin{pmatrix}x\\m\end{pmatrix}=\frac{-1}{7}\begin{pmatrix}1&-5\\-2&3\end{pmatrix}\begin{pmatrix}19\\8\end{pmatrix}$$
$$\begin{pmatrix}1&0\\0&1\end{pmatrix}\begin{pmatrix}x\\m\end{pmatrix}=\begin{pmatrix}3\\2\end{pmatrix}$$
$x=3$
$m=2$

6

$$\int_2^4 x^3-x^2+5=\left[\frac{x^4}{4}-\frac{x^3}{3}+5x\right]_2^4$$
$$=\left(\frac{4^4}{4}-\frac{64}{3}+20\right)-\left(\frac{2^4}{4}-\frac{8}{3}+10\right)$$
$$=\left(64-\frac{64}{3}+70\right)-\left(4-\frac{8}{3}+10\right)$$
$$=\frac{154}{3}-\frac{34}{3}=\frac{154}{3}$$
$$=51\tfrac{1}{3}$$

7

6t² - t - 2 = 0

$$t = \frac{1\pm\sqrt{1+4\times6\times2}}{12}$$
$$=\tfrac{2}{3}\,or\,-\tfrac{1}{2}$$

6(Sin²θ - 1) - Sin θ + 4 = 0
6 Sin²θ - Sin θ - 2 = 0
Sin θ = ²/₃ , θ = 41.81°, 138.19°

8

AB = b - d
BC = ³/₂ b - ³/₂ a
OC = ½ a - ³/₂ b

9

$$\left[2^3+3(2)^2\sqrt{3}+3\times2(\sqrt{3})^2+(\sqrt{3})^3\right]$$
$$\left(2^3-3\times2^2\sqrt{3}+3\times2(\sqrt{3})^2-(\sqrt{3})^3\right)$$
$$=12\sqrt{3}+12\sqrt{3}+2\sqrt{3}^3$$
$$=30\sqrt{3}$$

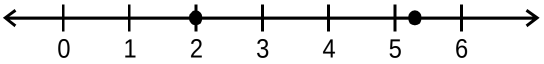
10.

$$3^{-3m} \times 3^{-4} = 3^{5}$$

-3m - 4 = 5
-3 m = 9
m = -3

11

5 ≤ 3x - 1   3x - 1 ≤ 15
6 ≤ 3x   3x ≤ 16
2 ≤ xx ≤ $5^1/_3$



12

$$\frac{2}{3}\begin{pmatrix} x \\ y \end{pmatrix} + \frac{1}{3}\begin{pmatrix} 7 \\ 8 \end{pmatrix} = \frac{3}{4}$$

$$\frac{2}{3}x + \frac{7}{3} = 3$$

$$x = 1$$

$$\tfrac{2}{3}y + \tfrac{8}{3} = 4$$

$$y = 2$$

$$C(1,2)$$

13

Log R = ½ log Z - 2
n = ½
b = $^1/_{100}$

14

$$5x - [(4 \times 0.97x) + 0.92x]$$

$$= 5x - 4.8x = 0.2x$$

$$\frac{0.2x}{5x} \times 100$$

$$= 4\%$$

15

a) ∠CBD = $\frac{180 - 40}{2}$ = 70°

b) 60° + 70° = 130°

16

$$4a^2 = \frac{t^2 + a}{p}$$

$$4a^2P = t^2 + q$$

$$p = \frac{t^2 + q}{4a^2}$$

17

a) i) y = 9
ii) Modal class 41 - 50

Mid pt X	d	f	fd	d²	fd²
5.5	-40	4	-160	1600	6400
15.5	-30	7	-210	900	6300
25.5	-20	6	-120	400	2400
35.5	-10	6	-60	100	600
45.5	0	9	0	0	0
55.5	10	8	80	100	800
65.5	20	4	80	400	1600
75.5	30	3	90	900	2700
85.5	40	2	80	1600	3200
95.5	50	1	50	2500	2500
			Σfd =-170		Σfd²=26500

b) Mean = $45.5 + \frac{-170}{50}$

$$= 42.1$$

i) $$Variance = \frac{26500}{50} - \left(\frac{-170}{50}\right)^2$$

$$= 530 - 11.56$$

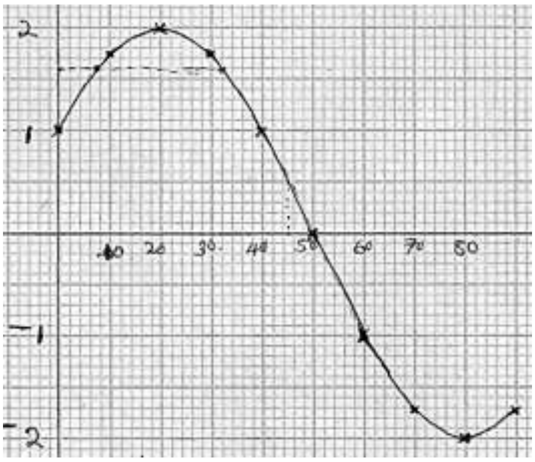
$$= 518.44$$

ii) $$S.d. = \sqrt{518.44}$$

$$= 22.77$$

18

x	0	10	20	30	40	50	60	70	80	90
3x +30	30	60	90	120	150	180	210	240	270	300
y=Sin3x+30	1	1.73	2	1.73	1	0	-1	-1.73	-2	-1.73



i) y = 0.5 ± 0.1

ii) 8° ≤ x ≤ 32°
± 1° ±1°

19

a) (90 - 30)2
= 60°

b) i)
$$\frac{60}{360^\circ}\times 2\times\frac{22}{7}\times 6370$$
$$= 6673.33$$

ii)
$$\frac{180}{360^\circ}\times\frac{22}{7}\times 2\times 6370Cos60^O$$
$$=10{,}010km$$

c)
$$420=\frac{y}{360^\circ}\times 2\times\frac{22}{7}\times 6370Cos60^\circ$$
$$y=7.552^\circ$$

Longitude = 139 + 7.552
= 146.55°E

20

a) 5, 7, 9, 11, 13
a= 5, d =2

b)
$$S_{50}=\frac{50}{2}\left(2\times 5+(50-1)2\right)$$
$$=25\times 108$$
$$=2700$$

$$S_P=\frac{P}{2}\left[2\times 5+(p-1)2\right]$$
$$=\frac{P}{2}\left(2P+8\right)$$
$$=P^2+4P$$

$P^2 + 4P < 725$
$P^2 + 4P - 725 < 0$
$(P + 29)(P - 25)< 0$
$P < 25$
Largest value of P is 24

21

a) 32000 + 1784
$$\frac{33784}{20}=K£1689.2$$

b) 435 × 2 = 870
(870 - 435) × 3 = 1305
(1305 - 870) 4 = 1740
(1689.2 - 1305)5 = 1921
Gross tax = <u>5836</u>
Net tax <u>1700</u>
shs 4136

c) 1689.2 × 1.8 = 3040.56
difference = 1351.36
(1740 - 1689.2)5 = 254
(3040.56 - 1740)6 = <u>7803.36</u>
8057.36
$$\frac{8057.36 - 5836}{5836}\times 100$$
=38.06%

22

	4	6	8	10	12	14
2	2, 4	2, 6	2, 8	2, 10	2, 12	2, 14
5	5, 4	5, 6	5, 8	5, 10	5, 12	5, 14
7	7, 4	7, 6	7, 8	7, 10	7, 12	7, 14
9	9, 4	9, 6	9, 8	9, 10	9, 12	9, 14
11	11, 4	11, 6	11, 8	11, 10	11, 12	11, 14
13	13, 4	13, 6	13, 8	13, 10	13, 12	13, 14

b)
$$\frac{6}{36}OR\frac{1}{6}$$

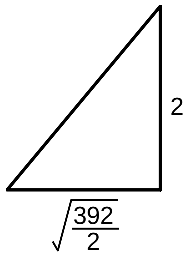
c) $$\text{P(Prime)}=\frac{16}{36}OR\frac{4}{9}$$

P(Prime odd) $$=\frac{4}{9}\times\frac{15}{18}=\frac{10}{27}$$

d)
$$P(Sum\ greater\ 15)=\frac{22}{36}=\frac{11}{18}$$

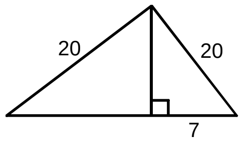
23.

a)



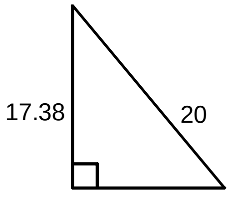
$$\sqrt{20^2-\frac{392}{4}}$$
$$=17.38$$

b)

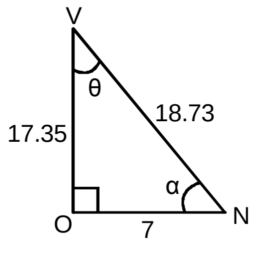


$$\sqrt{20^2-7^2}$$
$$VN=18.37$$

c)i)



$$Sin\theta=\frac{17.38}{70}$$
$$\theta=60.34^\circ$$



$$Cos\theta=\frac{17.38}{18.73}$$
$$\alpha=21.89^\circ$$

d) Volume = $^1/_3$ × 14 × 14 × 17.37
= 1135.49cm^3

24.	a) ∠QRS $= 58 + \frac{90}{2}$ $= 103^{\circ}(angleinsemicircle)$ ii) ∠ QOS =103 × 2 = 206° (angle subtended at centre by an arc is twice angle at the circumference) iii) ∠ QVS =180° - 103° = 77° (angle in cyclic quadrilateral are supplementary) iv) ∠ QVR = 180 - (103° + 45°) = 32° (angle in alternate segment) b) $QU = \sqrt{5 \times 4} = \sqrt{20}$ $= 4.47cm$

MAKUENI COUNTY KCSE 2015 PREPARATORY EXAMINATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/1
July/August 2015

1. Evaluate without using mathematical tables. (3 marks)

$$\sqrt{\frac{-23-(-17)}{-2}-\frac{15-(-2)(-6)}{-3}}$$

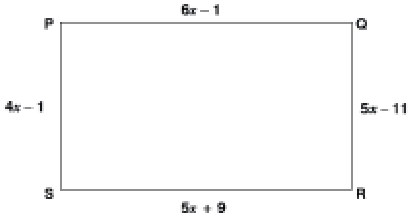
2. Evaluate: (3 marks)

$$\frac{\sqrt{\frac{1}{4}}\text{ of }3\frac{1}{2}+\frac{3}{2}(\frac{5}{2}-\frac{2}{3})}{\frac{3}{4}\text{ of }2\frac{1}{2}\div\frac{1}{4}}$$

3. Use tables of squares, square roots and reciprocals to find the value of x given. (3 marks)

$$\frac{1}{x}=\sqrt{\frac{1}{3.591^2}+\frac{2}{1.526}}$$

4. The figure below shows a rectangle PQRS in which all dimensions are given in centimetres. Find the value of x and hence calculate the area of the rectangle. (3 marks)



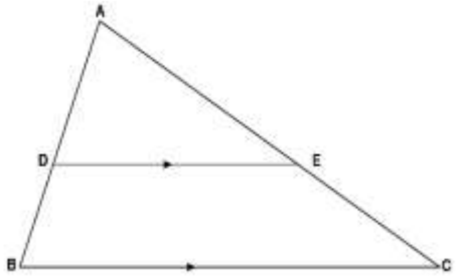
5. Solve for x if: (4 marks)
$93x+1-12\times 33x=-3$.

6. (a) Given that the position vectors of points P, Q and R are p, q and r, respectively, and that R is the mid-point of PQ, state the vector equation that relates **p**, **q** and **r**. (2 marks)

(b) If $\mathbf{p}=\begin{pmatrix}6\\-8\end{pmatrix}$ and $\mathbf{q}=\begin{pmatrix}8\\4\end{pmatrix}$, find **r** and state the coordinates. (2 marks)

7. A straight line passes through points P(4, 9) and Q(4, −3) and has a double intercept of the form
$\frac{x}{a}+\frac{y}{b}=1$
Write the equation in the form $y=\text{M}x+\text{C}$ and determine the values of a and b. (4 marks)

8. In the triangle ABC shown below, DE is parallel to BC. If AE = 3 cm and EC = 2 cm, determine the ratio of the area of the triangle ADE to that of triangle ABC. (2 marks)



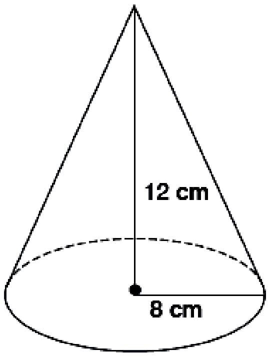
9. A Kenyan bank buys and sells foreign currencies as shown below.

	Buying (Ksh)	**Selling (Ksh)**
1 Hong Kong Dollar	9.74	12.03
1 South African Rand	9.77	12.11

A tourist arrived in Kenya with 105,000 Hong Kong Dollars and changed the whole amount to Kenya Shillings. While in Kenya he spent Ksh 403,879 and changed the balance to South African Rand before leaving for South Africa. Calculate the amount he received. (3 marks)

10. If $\tan x=\frac{12}{5}$, find the value of $\frac{Sinx+2Cosx}{1-Sin\,x}$ (3 marks)

11. The figure below shows a solid cone of base radius 8 cm and height 12 cm.



Calculate to one decimal place:
(a) the slant height of the cone. (1 mark)
(b) the total surface area of the cone. (2 marks)

12. Given the inequalities $3 - 2x < x \leq \frac{2x+5}{3}$
(a) solve the inequalities. (2 marks)
(b) list all the integral values of x that satisfy the combined inequality in (a) above. (1 mark)

13. The sum of the interior angles of an n-sided polygon is 1440°. Find the value of n and deduce the name of the polygon. (3 marks)

14. Solve for x in the equation. (3 marks)

$$2 + \log_7 (3x - 4) = \log_7 98.$$

15. Security light poles have been erected along both sides of a street in Wote town. The poles are 50 m apart along the left-hand side of the road while they are 80 m apart along the right-hand side. At one end of the road the poles are directly opposite each other. How many poles will be erected by the time the poles are directly opposite each other at the end of the road? (3 marks)

16. Find the equation of the normal to the curve $x^2 = 4y$ at (6, 9) leaving your answer in the form $ax + by = c$. (3 marks)

SECTION II (50 marks)

Answer only five questions in this section.

17. Mary bought three brands of tea A, B and C. The prices of the three brands were sh 25, sh 30 and sh 45 per kilogram, respectively. She mixed the three brands in the ratio of 5:2:1, respectively. After selling the mixture, she made a profit of 20%.
(a) How much profit did she make per kilogram of the mixture? (4 marks)
(b) After one year the cost price of each brand increased by 10%.
(i) For how much did she sell one kilogram of the mixture to make a profit of 15%? Give your answer to the nearest 5 cents. (3 marks)
(ii) What would have been her percentage profit if she sold one kilogram of the mixture at sh 45? (3 marks)

18. A rectangle OABC has vertices O(0, 0), A(2, 0), B(2, 3) and C(0, 3). O'A'B'C' is the image of OABC under a translation $T=\begin{pmatrix}0\\4\end{pmatrix}$. O''A''B''C'' is the image of O'A'B'C' under a transformation given by the matrix $M = \begin{pmatrix}0 & -1\\1 & 0\end{pmatrix}$
(a) Draw the rectangles OABC, O'A'B'C' and O''A''B''C'' on the grid provided. (6 marks)
(b) Use your diagram to find the centre of rotation which maps OABC onto O''A''B''C''. (2 marks)
(c) Find the coordinates of O'''A'''B'''C''', the image of O'A'B'C', under a reflection in the line $y=-x$. (2 marks)

19. (a) Complete the table below for the function (2 marks)

x	−6	−5	−4	−3	−2	−1	0	1
y		−3	−7		−9		−3	3

(b) Draw the graph of $y = x^2 + 5x - 3$ for $-6 \leq x \leq 1$.
Use the scale: Vertical axis–1 cm represents 1 unit. (3 marks)
Horizontal axis–1 cm represents 1 unit
(c) (i) State the equation of the line of symmetry for the graph. (1 mark)
(ii) Use your graph to solve the equations:
(a) $x^2 + 5x - 3 = 0$ (1 mark)
(b) $x^2 + 4x - 2 = 0$ (2 marks)
(c) $x^2 + 5x - 3 = -3$ (1 mark)

20. A matatu left Eldoret at 7.45 a.m. and travelled towards Nairobi at an average speed of 60 km/h. A saloon car left Eldoret at 9.15 a.m. on the same day and travelled along the same road at an average speed of 120 km/h. The distance between Eldoret and Nairobi is 360 km.

(a) Determine the time of the day when the saloon car overtook the bus. (6 marks)
(b) Both vehicles continued towards Nairobi at their original speed. How long had the saloon car waited in Nairobi before the matatu arrived? (4 marks)

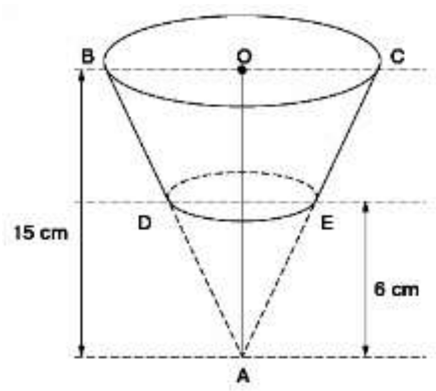
21. The table below shows the distribution of marks scored by 100 candidates in an examination.

Marks	1–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100
No. of Candidates	2	5	8	19	24	18	10	6	5	3

(a) State the modal class. (1 mark)
(b) Calculate the mean. (4 marks)
(c) Calculate the median mark. (4 marks)
d) Find the difference between mean and median. (1 mark)

22. Two planes S and T leave airport A at the same time. S flies on a bearing of 60° at 750 km/h while T flies on a bearing of 210° at 900 km/h. Using a scale of 1 cm to represent 200 km/h, draw a diagram to show the position of the planes after 2 hours. (6 marks)
Use your diagram to determine:
(i) the actual distance between the two planes. (2 marks)
(ii) the bearing of T from S. (1 mark)
(iii) the bearing of S from T. (1 mark)

23. The figure below shows a cone with a vertex at A and diameter 13 cm. The cone is cut off along DE as shown below.



(a) Find the vertical height AO. (2 marks)
(b) Find the volume of the frustrum. (4 marks)
(c) Find the curved surface area of the frustrum. (4 marks)

24. A particle P moves in a straight line such that t seconds after passing a fixed point Q, its velocity is given by the equation $v = 2t^2 - 10t + 12$. Find:
(a) the value of t when P is instantaneously at rest. (3 marks)
(b) an expression for the distance moved by P after t seconds. (2 marks)
(c) the total distance travelled by P in the first 3 seconds after passing point Q. (2 marks)
(d) the distance of P from Q when acceleration is zero. (3 marks)

MAKUENI COUNTY KCSE 2015 PREPARATORY EXAMINATION

Kenya Certificate of Secondary Education

MATHEMATICS

Paper - 121/2

July/August 2015

Section I (50 marks)

*Answer **all** the questions in this section in the space provided.*

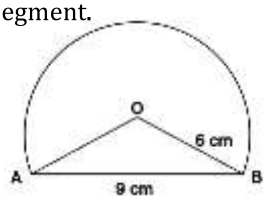
1. Use logarithms to evaluate: (4 marks)

$$\frac{16.49^2 \times \sqrt{0.6318}}{327.5}.$$

2. Simplify the expression (3 marks)

$$\frac{4x^2 - y^2}{3y^2 - 7xy + 2x^2}.$$

3. Wambua saves 1,040 shillings in the first year of his employment and each year afterwards saves 145 more than the preceding year. How much will he have saved by the time he retires in 30 years' time? (3 marks)
4. Given that $y(cx^2 - a) = b - bx^2$, make x the subject. (3 marks)
5. The gradient of a curve at any point is given by $2x - 1$. Given that the curve passes through point (1, 5), find the equation of the curve. (2 marks)
6. In the figure below, O is the centre of a circle whose radius is 6 cm. AB = 9 cm and AOB is obtuse. Calculate the area of the major segment. (4 marks)



7. (a) Expand $(1 - \frac{1}{2}x)^5$ up to the term with x^3. (2 marks)

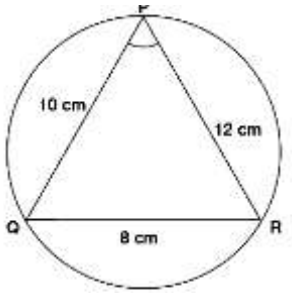
   (b) Use your expansion in (a) above to determine the value of $(0.99)^5$. (2 marks)
8. The length and breadth of a rectangular floor were measured and found to be 5.2 m and 2.4 m respectively. If a possible error of 0.01 m was made in each of the measurements, find the:

   (a) maximum possible area and minimum possible area of the floor. (2 marks)

   (b) maximum possible wastage in a carpet ordered to cover the whole floor. (1 mark)
9. Simplify: (3 marks)

$$\frac{4}{\sqrt{5} + \sqrt{2}} - \frac{3}{\sqrt{5} - \sqrt{2}}.$$

10. In the diagram below, P, Q and R are points on the circumference of a circle. PQ = 10 cm, PR = 12 cm and QR = 8 cm. (3 marks)



Find the radius of the circle to 2 decimal places.

11. Under a transformation given by the matrix $\begin{pmatrix} 2x & x+3 \\ 1 & x+3 \end{pmatrix}$, a rectangle is wrapped onto a straight line.

    Find the value of x. (3 marks)

12. Solve $4 - 4\cos^2\alpha = 4\sin\alpha - 1$ for $0 \leq \alpha \leq 360$. (4 marks)
13. Find the distance between the centre A of a circle whose equation is $2x^2 + 2y^2 + 6x + 10y + 7 = 0$ and the point B (−4, 1). (3 marks)
14. Three grades A, B and C of rice were mixed in the ratio 3:4:5. The cost per kilogram of each of the grades A, B and C was Ksh 120, Ksh 90 and Ksh 60, respectively. Calculate the cost of one kilogram of the mixture. (2 marks)
15. Three quantities p, x and y are such that p varies directly as x and inversely as the square root of y. Find the percentage change in p if x decreases by 7% when y increases by 21%. (3 marks)
16. A black die and a red die are rolled. What is the probability of getting a total score of 5 or 8? (3 marks)

SECTION II (50 marks)

*Answer only **five** questions in this section in the spaces provided.*

17. The table below shows the rate at which tax is charged on annual income.

Annual taxable income (k£)	Rate in Ksh per k£
1 – 1800	2
1801 – 3600	3
3601 – 5400	5
5401-7200	7
7201 – 9000	9
9001 – 10800	10
10801 – 12600	12
Over 12600 - 23579	13

A company employee earns a gross monthly salary of Ksh 12, 600. He is housed by the company and as a result his taxable income is increased by 15%. If he is married and hence claims a relief of Ksh 1,162 per month, find the amount of tax he pays per year and his net salary per month. (7 marks)

If the employee was given a 50% pay rise, calculate the percentage increase on income tax. (3 marks)

18. (a) Complete the table below, giving the values correct to 2 decimal places. (2 marks)

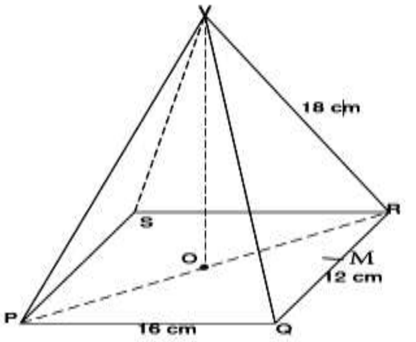
$x°$	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
Sin $2x$	0		0.87		– 0.87		0	0.87	0.87				0
$3\cos x - 2$	1	0.60		– 2	– 3.5			– 4.60			– 0.5		1

a) On the graph paper provided, draw the graphs $y = \sin 2x$ and $y = 3\cos x - 2$ for $0° \leq x \leq 360°$ on the same axes. Use a scale of 1 cm to represent 30° on the x-axis and 2 cm to represent 1 unit on the y-axis. (5 marks)

(c) Use the graph in (b) above to solve the equation $3\cos x - \sin 2x = 2$. (2 marks)

(d) State the amplitude of $y = 3\cos x - 2$. (1 mark)

19. The figure below represents a right pyramid with vertex V and a rectangular base PQRS. VP = VQ =VR = VS = 18 cm. PQ = 16 cm and QR = 12 cm. M and O are the mid-points of QR and PR, respectively.



(a) Calculate the:

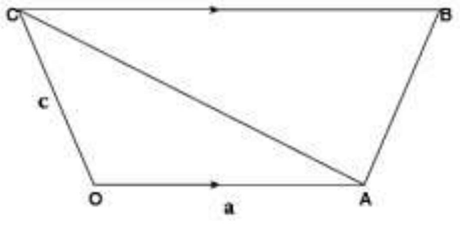
(i) length of the projection of line VP on the plane PQRS. (2 marks)

ii) angle between line VP and the plane PQRS. (2 marks)

(b) Calculate the angle between the face VQR and the base PQRS. (4 marks)

(c) Calculate the volume of the pyramid. (2 marks)

20. The diagram below shows a trapezium OABC. $\overline{OA} = \mathbf{a}$, $\overline{OC} = \mathbf{c}$ and CB = 3**a**. X and Y are points on AC such that AX:XC = 1:2 and AY:YC = 1:3.



(a) Give the following vectors in terms of **a** and **c**.

(i) $\overline{AC}$ (1 mark)

(ii) $\overline{AY}$ (1 mark)

(iii) $\overline{OY}$ (1 mark)

(iv) $\overline{OX}$ (1 mark)

(v) AB (1 mark)

(b) Hence show that the points O, Y and B are collinear. (4 marks)

(c) In what ratio does the diagonal $\overline{OB}$ cut $\overline{AC}$? (1 mark)

21. The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r:

(a) Explain r in terms of a. (3 marks)

(b) Given that the sum of the three terms is 14,

(i) Find the values of a and r and hence write down two possible sequences each up to the 4th term. (5 marks)

(ii) Find the product of the 50th terms of the two sequences. (2 marks)

22. Two points A and B are found on the earth's surface. The position of A is (52°S, 66°W) and B (52°S, 114°E). Use Earth's radius as 6 370 km.

(a) Find the longitude difference between A and B. (1 mark)

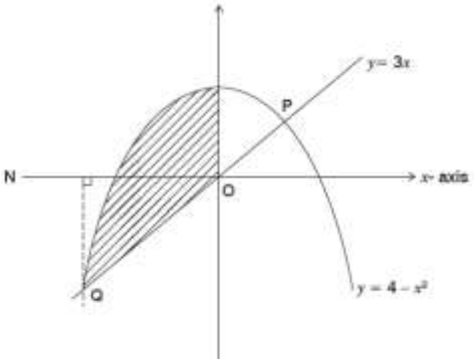
(b) Calculate the shortest distance between A and B along:

(i) the latitude in kilometres to the nearest whole number. (2 marks)

(ii) the longitude in kilometres to the nearest whole number. (3 marks)

(c) A plane travelling at 800 km/h leaves point A at 10.00 a.m. and flies through South Pole to point B. Find the local time the plane arrives at point B to the nearest minutes. (4 marks)

23. The diagram below shows a sketch of the line $y = 3x$ and the curve $y = 4 - x^2$ intersecting at points P and Q.



(a) Find the coordinates of P and Q. (3 marks)

(b) Given that QN is perpendicular to the x-axis at N, calculate:

(i) the area bound by the curve $y = 4 - x^2$ and the x-axis. (2 marks)

(ii) the area of the shaded region that lies below the x-axis. (2 marks)

(iii) the area of the shaded region enclosed by the curve $y = 4 - x^2$, the line $y = 3x$ and the y-axis. (3 marks)

24. A factory manufactures two types of tables; A and B. Type A table requires 2 hours for painting and 4 hours for assembling. Type B table requires 2 hours for assembling and 5 hours for painting. There are 48 hours for assembling and 60 hours for painting. The number of type B tables must be at least 3 and less than twice the number of type A tables. Profit on type A table is sh 180 and profit on type B table is sh 120. If x represents the number of type A tables and y represents the number of type B tables:

(a) Form all inequalities representing the information above. (3 marks)

(b) Illustrate the inequalities on the grid provided by shading the unwanted region. (4 marks)

(c) Determine the number of tables of each type which can be manufactured to make maximum profit and determine the maximum profit. (3 marks)

THE ABOVE (MAKUENI COUNTY) IS A REVISION EXERCISE

KANGEMA MATHIOYA FORM FOUR JOINT EVALUATION
Kenya Certificate of Secondary Education
MATHEMATICS
Paper - 121/1
July/August 2015
Time: 2½ hours

INSTRUCTIONS TO CANDIDATES

SECTION 1 (50 MARKS)

Answer all the questions in this section in the spaces provided.

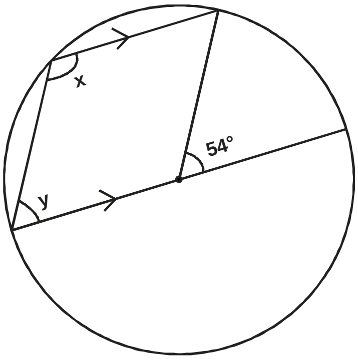
1. Evaluate without using tables or a calculator. (3 marks)

$$\frac{\frac{2}{3} of \left(1\frac{1}{2}+\frac{3}{4}\right)-\frac{1}{4}\times\frac{1}{8}\div\frac{1}{16}}{\frac{4}{5}\left(3\frac{1}{4}-1\frac{3}{8}\right)\div\left(2\frac{1}{2}\div5\frac{1}{3}\right)}$$

2. Find the value of y in the following equation. (3 marks)

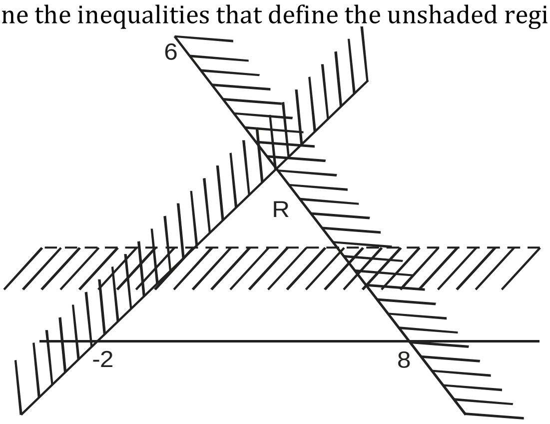
$$3^{-1}\left(\frac{1}{27}\right)\times\left(\frac{1}{27}\right)y = 243$$

3. In the figure below O is the centre of the circle and AOB is a straight line. Find the value of x and y. (3 marks)



4. Simplify $\frac{9x^2 - y^2}{2y^2 - 7xy + 3x^2}$ (3 marks)

5. Determine the inequalities that define the unshaded region marked R in the diagram below.



6. The straight line L₁ with equation $\frac{x}{a}+\frac{y}{b}=1$ passes through (4, 0) and (0, -15)

i) Formulate the equation of the line in the form y=mx + c (2 marks)
ii) Another line parallel to line L₁ passes through (4, 5) what is its equation in the form ax + by = c (2 marks)

7. The size of an interior angle of a regular polygon is 156°. Find the number of sides of the polygon. (2 marks)

8. Musyoka mixes Basmati rice costing shs 150 per kg with pishori rice costing shs 170 per kg in the ratio of 3 : 2 respectively. At what price must he sell the mixture per kg inorder to make a 40% profit. (3 marks)

9. Given that $Sin\theta = \frac{\sqrt{3}}{\sqrt{7}}$ and that Θ is obtuse, determined Cos Θ without using tables or a calculator. (3 marks)

10. Six men working 3 hours a day can lay 300 bricks. How many more bricks can 12 men lay, working 2 hours a day at double the rate of the first group? (3 marks)

11. The position vectors of A, B and C are $OA = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$, $OB = \begin{pmatrix} 5 \\ 12 \end{pmatrix}$ and $OC = \begin{pmatrix} 8 \\ 19 \end{pmatrix}$ show that A, B and C are collinear. (3 marks)

12. Solve the equation for the value of x. (3 marks)

$$8^{x+1} + 2^{3x+1} = 160$$

13. Use logarithms to evaluate (4 marks)

$$\frac{0.367^{\frac{1}{2}} \times 7324}{\sqrt[3]{2.365 - 3.3489}}$$

14. 3g of metal A of density 2.7g/cm^3 is mixed with 1.6cm^3 of metal B of 3.2g/cm^3. Determine the density of the mixture. (3 marks)

15. Use reciprocal tables to evaluate and solve for x in the equation (4 marks)

$$\frac{1}{x} = \frac{2}{0.125} + \frac{3}{0.008}$$

16. Kamau is paid on commission by his employer. He gets a commission of 10% for selling goods worth shs 10,000. For any sale beyond shs 10,000 he gets a commission of 7.5%. In the month of September he was paid shs 7750. Calculate the total value of goods sold by Kamau in that month. (3 marks)

SECTION II (50 marks)

17. Three business partners Amina, Mutheu and Wamae contributed shs 200,000, shs 300,000 and Shs 500,000 respectively and bought a matatu. the three decided that a quarter of the profit from the matatu at the end of the month would be saved for emergencies. A fifth of the remainder would be shared among the three partners in the ratio of their contributions. During the month of September the profit made was shs 184,800. Determine how much each received at the end of that month. (10 marks)

18. A cylindrical tank is to be constructed. A model of the tank is made such that it is similar to the actual tank. The curved surface area of the model is 2160cm^2 and that of the proposed tank is 135m^2

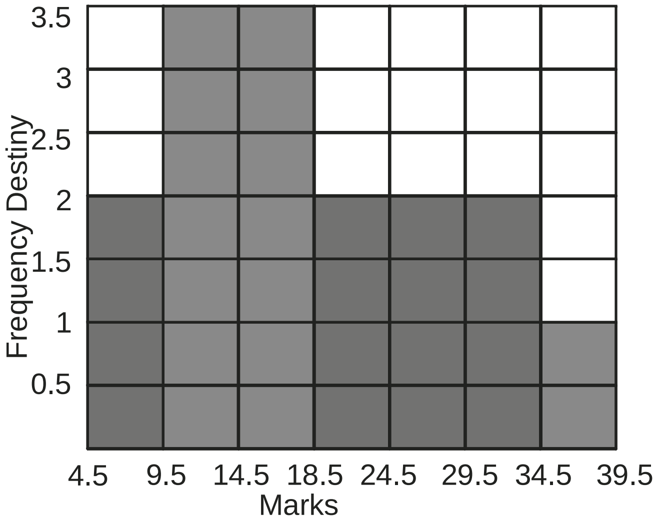
a) Given that the height of the model is 6cm, calculate the height of the actual tank in metres. (3 marks)

b) Calculate the volume of the model given that the diameter of the actual tank in 14m. (3 marks)

c) Determine the volume of actual tank in m^3 (2 marks)

d) The actual tank is to be used to store some liquid whose density is 0.82g/cm^3. If the tank is half full determine the mass of the liquid in kg. (2 marks)

19. The figure below shows a histogram representing marks obtained by 80 students in a test



a) Construct a frequency distribution table for the data shown on the histogram. (4 marks)

b) State the modal class. (1 mark)

c) Calculate the mean mark. (3 marks)

d) Find the median (2 marks)

20. A strip leaves port P and sails to port Q which is 80km away on a bearing of 040°. The ship then sails from Q to R on a bearing of 160° where R is 150km from Q. From R the ship returns directly to P at a speed at 25km/h.

a) Using a suitable scale, show the relative positions of P, Q and R. (3 marks)

b) i) Find the bearing of R from P. (1 mark)

ii) Find the distance travelled from R and the time taken to arrive at the destination. (4 marks)

c) An island S is equidistance from P, Q and R. Show its relative position. (2 marks)

21. A vehicle starting from rest attains a velocity of 15mls after it has been travelling for *6* seconds with a constant acceleration. It continues at this speed for 15 seconds. Then it slows down with constant retardation until it comes to rest in a further 9 seconds.

i) From this information draw a velocity time graph. (2 marks)

ii) What is the acceleration of the vehicle. (2 marks)

iii) What is the retardation. (2 marks)

iv) Find the distance travelled in the total time 30 seconds. (2 marks)

v) Find the average speed for the whole journey. (2 marks)

22. a) In triangle PQR, q = 3cm, r=5cm and P=120°, Find P and the area of the triangle. (2 marks)

b) A room measuring 5.8m long, 4.2m wide and 2.5m high is to be painted on all walls the floor and the ceiling. The room has one door measuring 1.8m by 80cm and three widows measuring 1.2m by 75cm each. Calculate

i) The area of the floor and ceiling. (2 marks)

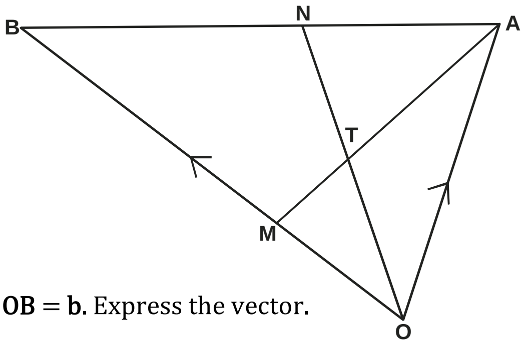
ii) The area of all the walls except the door and windows. (2 marks)

iii) The area to be painted (including floor and ceiling) (2 marks)

iv) If painting costs shs 100 per m^2 find the cost of painting two similar rooms. (2 marks)

23. a) Given that **OA** = **i** + 2**j** - 3**k** and **OB** = 2**i** - **j** - 2**k** find |**AB**| (2 marks)

b) The diagram shows triangle OAB in which **BN** : **NA** = 1 : 2, **OT** : TN = 3 : 2 and M is the midpoint of **OB**.



Give that **OA** = **a** and **OB** = **b**. Express the vector.

AB

ON

AT in terms of **a** and **b**. (3 marks)

Show that the point A, T and M are collinear and hence determine the ratio MT : TA. (5 marks)

24. The displacement S metres of a particle from a fixed point in motion at any given time (t) seconds is given by $s = 3t + {}^3/_2\, t^2 - 2t^3$

a) Find the initial acceleration. (3 marks)

b) Calculate

i) the time when the particle was momentarily at rest. (2 marks)

ii) its displacement by the time it comes to rest momentarily. (2 marks)

c) Calculate the maximum speed attained. (3 marks)

THE ABOVE (**KANGEMA MATHIOYA**) IS A REVISION EXERCISE