MATHEMATICS PP2 2024 KCSE MOCK

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FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

NAME:……………………………………….. INDEX NO…………………

SCHOOL:…………………………..……… STREAM:……… ADM:………….

CANDIDATE'S SIGN ………………..… DATE …………TARGET……………..

121/2
MATHEMATICS Paper 2
FORM 4
Time: 2 ½ Hours

SERIES 1 QUESTION PAPER

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

INSTRUCTIONS TO CANDIDATES

1. Write your name, stream, admission number and index number in the spaces provided above.
2. The paper contains two sections, Section I and II
3. Answer all questions in section I and **ONLY** any **FIVE** questions from section II.
4. All answers and working must be shown on the question paper in the spaces below each question
5. Show all steps in your calculations, giving answers at each stage
6. Marks may be given for each correct working even if the answer is wrong
7. Non-programmable silent electronic calculators and KNEC mathematical tables may be used.

FOR EXAMINERS USE ONLY

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Total**

Section II   **Grand Total**

17	18	19	20	21	22	23	24	**Total**

This paper consists of 18 printed pages. Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing.

SECTION I

Answer all the questions in the spaces provided (50 marks)

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

1. The expression $x^2 + 10x + c + 2 = 0$ is a perfect square. Find the value of c if it is a scalar.   (2mks)

2. Muya was asked to truncate $^7/_9$ to 3 significant figures. He rounded it off instead to 3 decimal places. Calculate the percentage error resulting from his rounding off.   (3mks)

3. The co-ordinates of a point A is (2, 8, 3) and B is (-4, -8, -5). A point P divides $\overrightarrow{AB}$ externally in the ratio 7: -3.
    Find the co-ordinates of P   (3mk

4. In a triangle XYZ, XY = 2cm, YZ $(2\sqrt{3}-1)$ cm, and angle YXZ = 60^0. Determine Sine XZY giving your answer in the form $\dfrac{m + \sqrt{3}}{n}$, where M and N are integers (4mks)

5. Find the independent term of x in the expansion of $(x^3 - {}^2/x^3)^6$ (3mks)

6. Solve for x: $(\log_3 x)^2 - \dfrac{1}{2}\log_3 x = {}^3/_2$ (3mks)

7. The cash price of a T.V set is Ksh.13,800. Walter opts to buy the set on hire purchase terms by paying deposit of Ksh.2,280. If simple interest of 20% p.a is charged on the balance and the customer is required to pay by monthly installments for 2 years, calculate the amount of each installment. (3mks)

8. Make x the subject of the formula $ax = \dfrac{3r}{2} - \dfrac{x^2}{2}$ (3mks)

9. Calculate the area under the curve $y = 3x^2 + 8$ and bounded by lines; $y = 0$, $x = 1$ and $x = 6$, using the mid-ordinate rule with 5 strips. (3mks)

10. A circle is tangent to the y – axis and intersects the x- axis at (2,0) and (8,0). Obtain the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$, where a, b and c are integers (4mks)

11. A variable y varies as the square of x and inversely as the square root of z. Find the percentage change in y when x is changed in the ratio 5:4 and z reduced by 19% (3mks)

12. Solve for X in the equation:
    $2 \sin^2 x - 1 = \cos^2 x + \sin x$, for $0^0 \leq x \leq 360^0$ (3mks)

13. A die is biased so that when tossed, the probability of a narrator of a number n showing up, is given by $p(n) = kn$ where k is a constant and $n = 1, 2, 3, 4, 5, 6$ (the numbers of the faces of the die)
    i)   Find the value of k   (1mk)

    ii)   If the die is tossed twice, calculate the probability that the total score is 11 (2mks)

14. In the figure below, the tangent ST meets chord VU produced at T. Chord SW passes through the Centre, O of the circle and intersects chord VU at X. Line ST = 12cm and UT = 8cm.
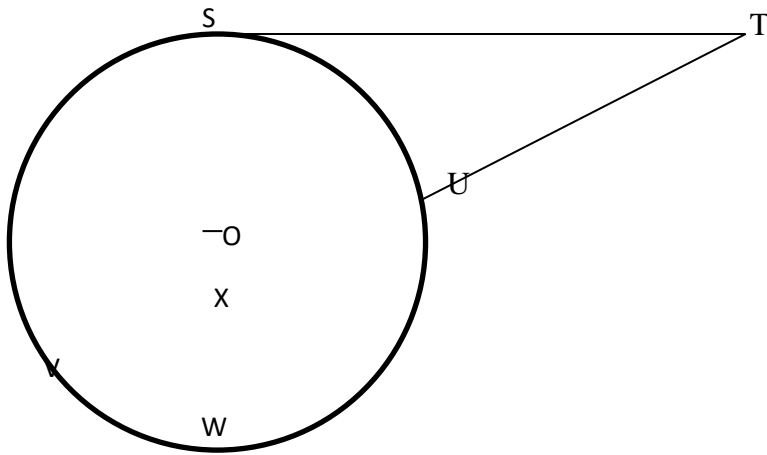
a. Calculate the length of chord VU (1mk)

b. If VX : XU = 2 : 3, Find SX (2mks)

15. Dota measured the heights in centimeters of 104 trees seedlings are shown in the table below

Height	10 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 - 79
No. of Seedlings	9	16	19	26	20	10	4

Calculate the quartile deviation (4mks)

16. Given that the ratio x:y = 2:3, find the ratio (5x – 2y) : (x +y) (2mks)

SECTION II

Answer ONLY five questions in this section (50 marks)

17. A curve is represented by the function, $y = 2x^3 + 3x^2$
    a) Find: (i) the x-intercept of the curve   (2mks)

      (ii) the y-intercept of the curve   (1mk)

    b) (i) Determine the stationary points of the curve of the curve   (3mks)

      (ii) For each point in b(i) above, determine if it is maximum or minimum   (2mks)

    c) Sketch the curve in the space below   (2mks)

18. Use ruler and a pair of compasses only in this question
    a) Construct; (i) triangle ABC in which AB = 8.5cm, BC = 7.5cm and <BAC = 30^0 and <ABC = 105^0 (3mks)

ii) a circle that passes through the vertices of triangle ABC. Measure the radius (3mks)

iii)   the height of triangle ABC with line AB as the base. Measure the height. (2mks)

b) Determine area of the circle that lies outside the triangle   (2mks)

19. a)   Complete the table below, giving your values to 2 decimal places   (2mks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
(2cos x) -1			0		-2		-3		-2	-1	0		1
Sin x	0			1		0.50	0			-1			0

b)   Draw the graph of y= (2 co x) – 1 and y=sin x on the grid provided below. Use the scale 1cm represent 30^0 horizontal 2 cm represent 1 unit vertically and 2cm for 1 unit on the y-axis   (4 mks)
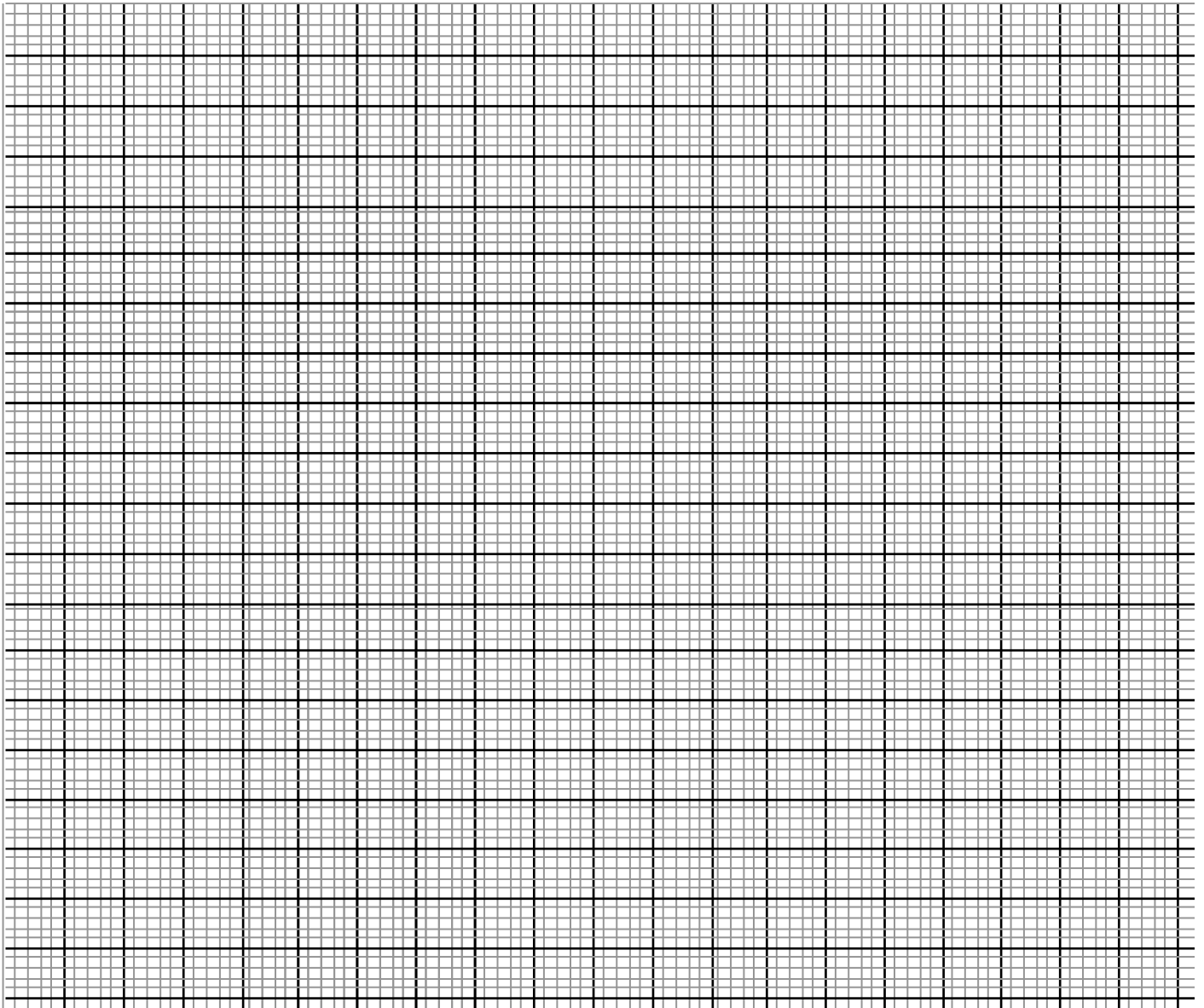
c)   Use the graph to solve:

i) $(2\cos x) - 1 = -1.5$ (1mk)

ii) $2\cos x - \sin x = 1$ (2mks)

d)   State the amplitude of the wave $y = 2\cos x - 1$ (1mk)

20.   A bag contains blue, green and red pens of the same type in the ratio 8:2:5 respectively. A pen is picked at random without replacement and its colour noted.

      a)   Determine the probability that the first pen picked is

          i)   Blue   (1mk)

          ii)   Either green or red.   (2mks)

      b)   Using a tree diagram, determine the probability that

          i)   The first two pens picked are both green   (4mks)

          ii)   Only one of the first two pens picked is red.   (3mks)

21. A and B are two points on the earth's surface and on latitude 30^0N.The two points are on the longitude 40^0W and 104^0E respectively.

Calculate

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

(ii) The shortest distance from A to B along a great circle in kilometre (4mks)

(Take $\pi = \dfrac{22}{7}$ and radius of the earth =6370km)

(b) If the local time at B is 8.00am, calculate the local time at A (3mks)

22. Lengths of 100 mango leaves from a certain mango tree were measured t the nearest centimeter and recorded as per the table below,

Length in cm	9.5-12.5	12.5-15.5	15.5-18.5	18.5-21.5	21.5-24.5
No. of Leaves	3	16	36	31	14
Cumulative frequency					

a) Fill in the table above. (2 mks)
b) Draw a cumulative frequency curve from the above data. (3 mks)
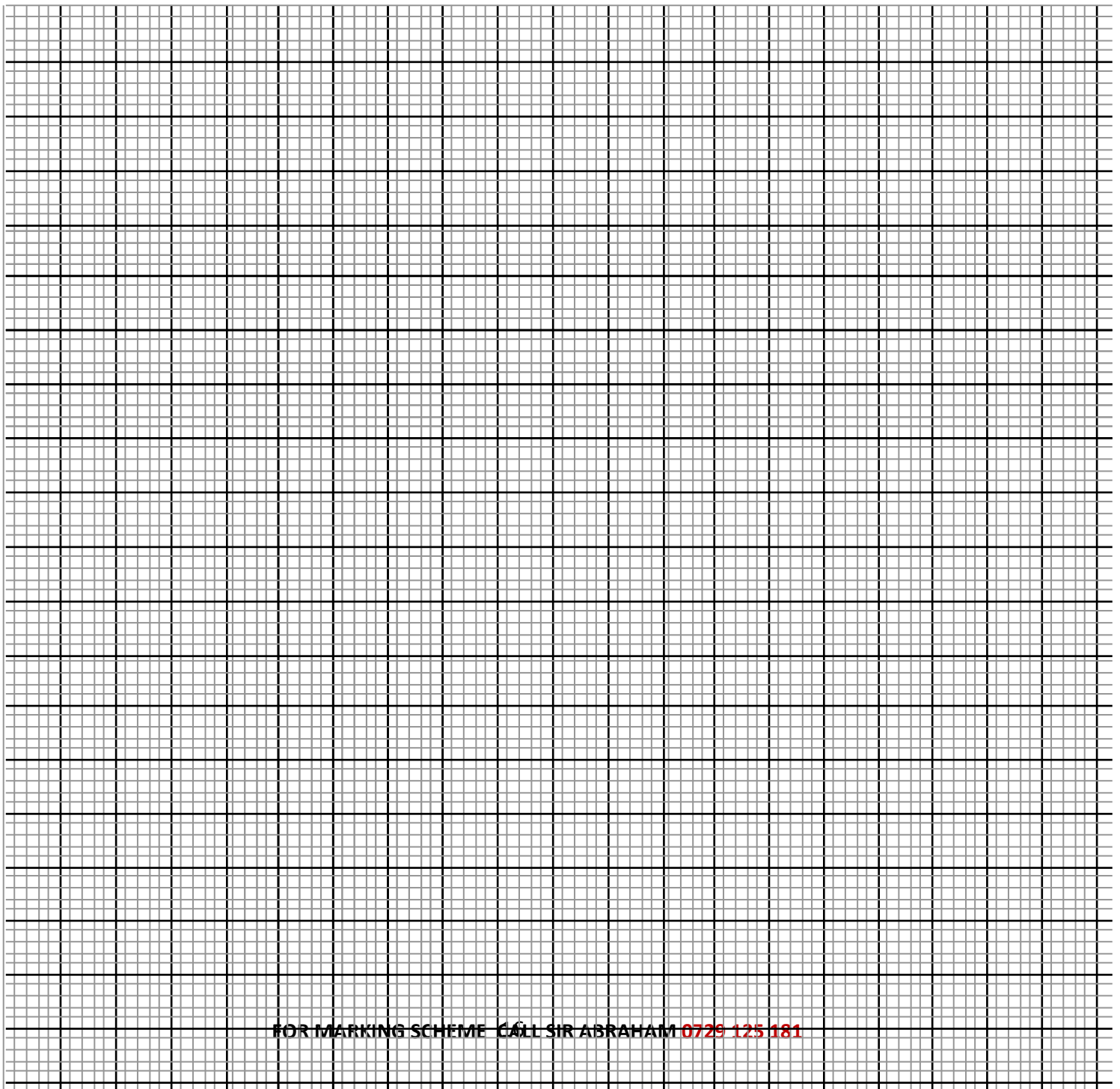
b)   Use your graph to estimate

           i)   The quartile deviation of the leaves   (3mks)

ii)   The number of leaves whose lengths lie between 13cm and 17cm.   (2mks)

23. a) Use the trapezium rule with 7 ordinates to estimate the area enclosed by the curve $y = \frac{1}{2}x^2 + 3$ and the lines x = 0, x = 6 and the x-axis. (4 mks)

b) Determine the exact area bounded the curve and the lines in section a) above (3 mks)

c) Calculate the percentage error from the trapezoidal rule (3 mks)

24. A manufacturer sells two types of books X and Y. Book X requires 3 rolls of paper while Book Y requires $2^1/_2$ rolls of paper. The manufacturer uses not more than 600 rolls of paper daily in making both books. He must make not more than 100 books of type X and not less than 80 of type Y each day

a) Write down four inequalities from this information (4mks)

b) On the grid provided, draw a graph to show inequalities in (a) above (3mks)
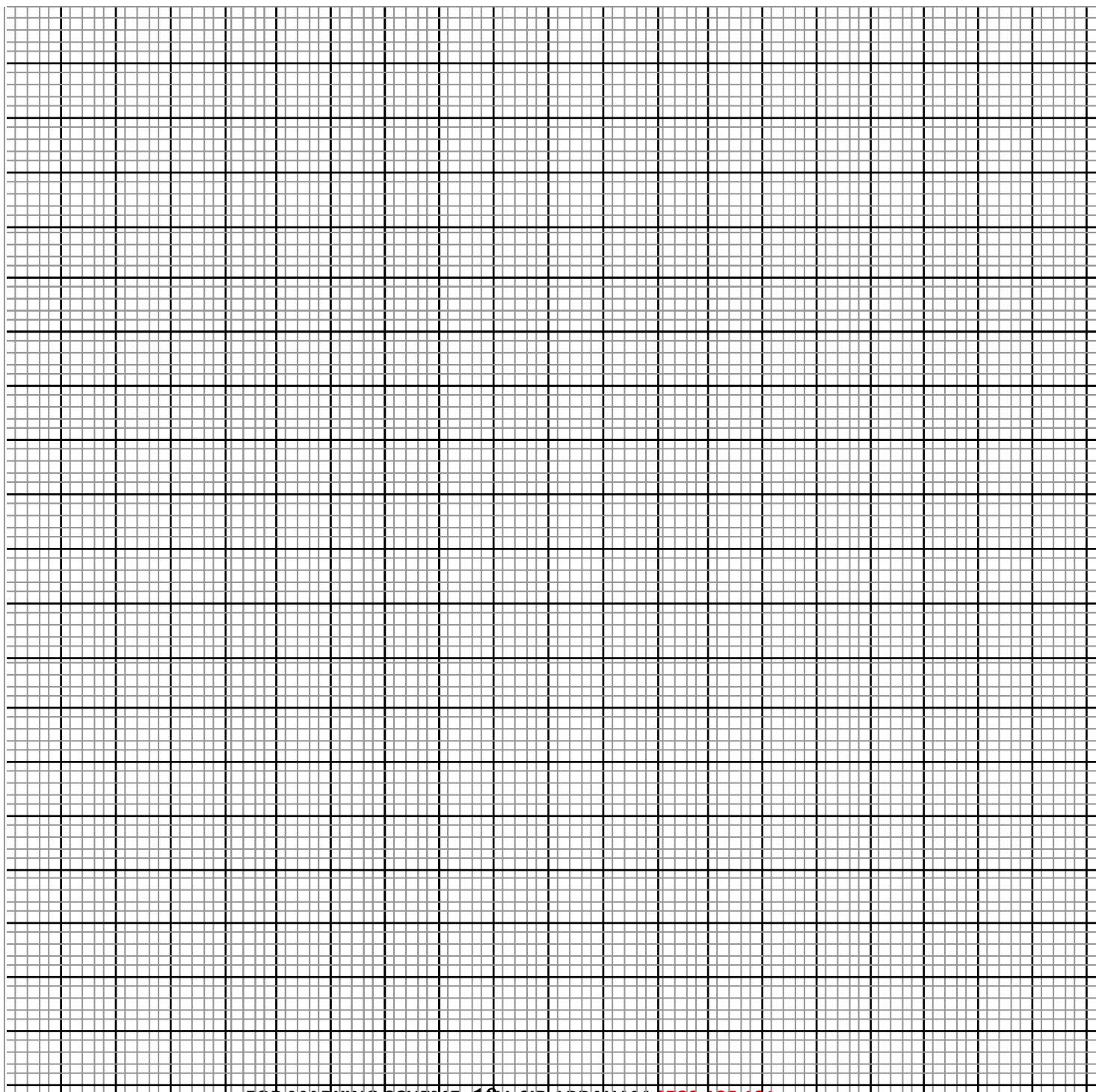
c)   If the manufacturer makes a profit of sh 80 on book X and a profit of sh 60 on book Y, how many books of each type must it make in order to maximize the profit. (3mks)

NAME:……………………………………………..   INDEX NO…………………

SCHOOL:……………………………..………   STREAM:……… ADM:………….

CANDIDATE'S SIGN …………………..… DATE …………TARGET……………..

121/2 MATHEMATICS PP2

Time: 2 ½ Hours

Kenya Certificate of Secondary

SERIES 2 QUESTION PAPER

INSTRUCTION TO CANDIDATES

*a)   Write your name and Admission number in the spaces provided above. b)   Sign and write the date of examination in the spaces provided above. c)   The paper consists of **two** sections. **Section I** and **Section II.***

*d)   Answer **ALL** the questions in Section I and any **FIVE** questions in Section II.*

e)   Show all the steps in your calculations, giving your answer at each stage in the spaces provided below each question.

f)   Marks may be given for correct working even if the answer is wrong.

g)   Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.

h)   Candidates should answer the questions in English.

i)   This paper consists of 15 printed pages.

j)   Candidates must check the question paper to ascertain that all pages are printed as indicated and that no question(s) is/are missing

 FOR EXAMINER'S U S E

 SECTION I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Total**

 SECTION

| 17	18	19	20	21	22	23	24	**Total**

Grand Tota

SECTION A (50MARKS)

Answer All Questions in this section

1. The area of a rectangle is 48.4cm^2 and its length is 9.37cm. Calculate the percentage error in width   (3marks)

2. The base of a triangle is $3x$ 2cm. The height of the triangle is 5cm shorter than its base. Given that the area of the triangle is 25cm^2. Find length of the base.   (4marks)

3. Find the area of the triangle shown below   (3marks)
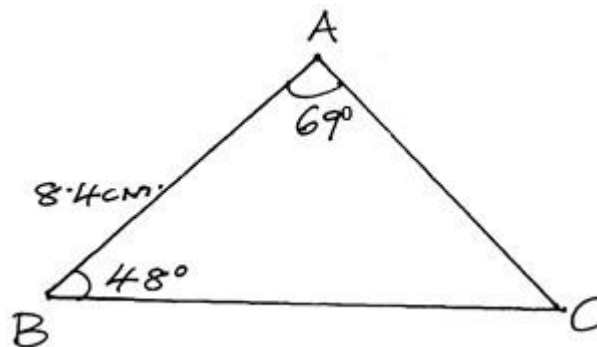
4. Express the following expression in surd form and simplify by rationalising the denominator

$$\frac{2}{1 \tan 30}$$

(3marks)

5. Solve for x in the expression $\log_2 x^2 \log_2 x^3 \ 10$ (3marks)

6. The table below is part of the tax for monthly income for the year 2007

Monthly income (ksh)	Rate %
Under ksh 10165	10
From 10165 but under ksh19741	15

From 19741 but under ksh29317   20

In that year, John's monthly gross tax was Ksh 2885. Calculate his monthly income

(3marks)

7.   A quantity E is partly constant and partly variaes as square root of F.

   i)   Write down an equation connecting E and F where K and C are constants respectively.

   ii) If F=25 where E=22 and F=49 when E=28. Find the value of K and C   (3marks)

8.a)   Expand $\left(1 + \dfrac{1}{2}x\right)^7$

in ascending power of x   (1mark)

b)   Using the first four times of the expansion in (a) above estimate the value $\left(\dfrac{1}{30}\right)^7$

(2marks

9.   Find the number of terms of the series 5+8+11+14+17+……….. that will give a sum of 2183

                                                                                    (3marks)

10.   Find the inverse of the matrix $M \begin{pmatrix} 4 & 3 \\ 2 & 1 \end{pmatrix}$ hence find the co-ordinates of the point at which

   line $4x$ $3y$ 4 and $2x$ y 7 intersect   (3marks)

11.   A trader mixed grade I, II and III of coffee in the ratio 2:3:5 respectively. Grade I cost Sh650 per
        kg, grade II costs sh 500 per kg and grade III costs sh 420 per kg.

a)   Find the cost of one kg of the mixture   (2marks)

b)   If the trader sold the mixture at a profit of 20% calculate the selling price of 3kg of the mixture

(2marks)

12.   Solve for the equation $4\cos^2 x\ 5\ 4\sin x$ for $0^o\ x\ 360$ (3marks)

13.   The figure below has a cross-section of the prism which is an isosceles triangle of side AE= 8cm, DE= 8cm and AD=6cm, where AB=20cm
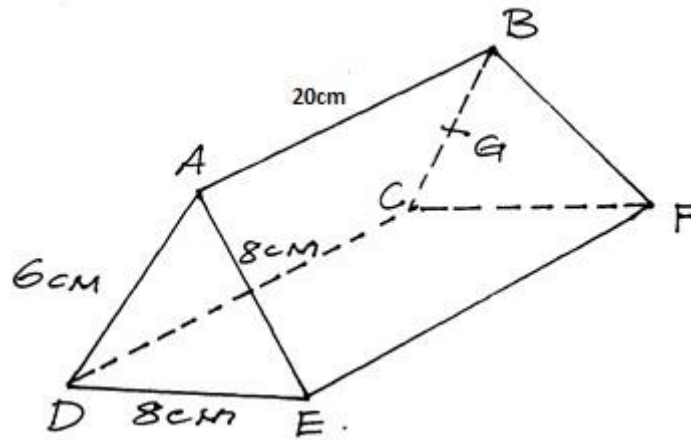
a)   If G is the mid- point of side BC find

   i) GF   (1mark)

ii) AG   (1mark)

b)   The angle between line DF and plane ABCD   (2marks)

14.a)   Construct triangle PQR in which PQ=QR=5cm and angle PQR=90° (2marks)

b)   Draw the locus of S which moves in such a way that it is always on the same side of PR as Q and

        angle $P\hat{S}R$ 45° (1mark)

15.   Determine the amplitude and period in the function $y = \frac{1}{2}\sin 3x \; 60$ (2marks)

16. Two towns P and Q are located on the equator such that P is due east of Q. The distance between the two towns is 1920nm. If the latitude of p is 50°E. Determine the longitude of Q(3marks)

<div align="center">

SECTION B (50 MARKS)

Answer any five questions from this section

</div>

17. The cost of Jane's car at the beginning of year 2000 was sh 750,000. It depreciated in value by 7% per year for the first 3 years, by 8% for the next two years and 11% per year for the subsequent years.

a)   Find the value of the car at

        i) The start of the year 2003   (2marks)

        ii)   The end of year 2007   (3marks)

b)   At the beginning of 2008, Jane sold the car through Mary,s dealers at 22% more than its actual
        depreciated value to Lucy. Taking Mary's sale price as the car's value after depreciation. Find the
        average monthly rate of depreciation for the 8years.   (5marks)

18.   MNP is a triangle with vertices M,(2,2),N(2,-2) and P(-1,-4). Draw the triangle MNP.

(1mark)

a)   If vertex N(2,-2) is mapped to N^1 (5,-2) by a shear with x-axis invariant, draw triangle $M^1N^1P^1$,
       the image of triangle MNP under the shear.   (2marks)
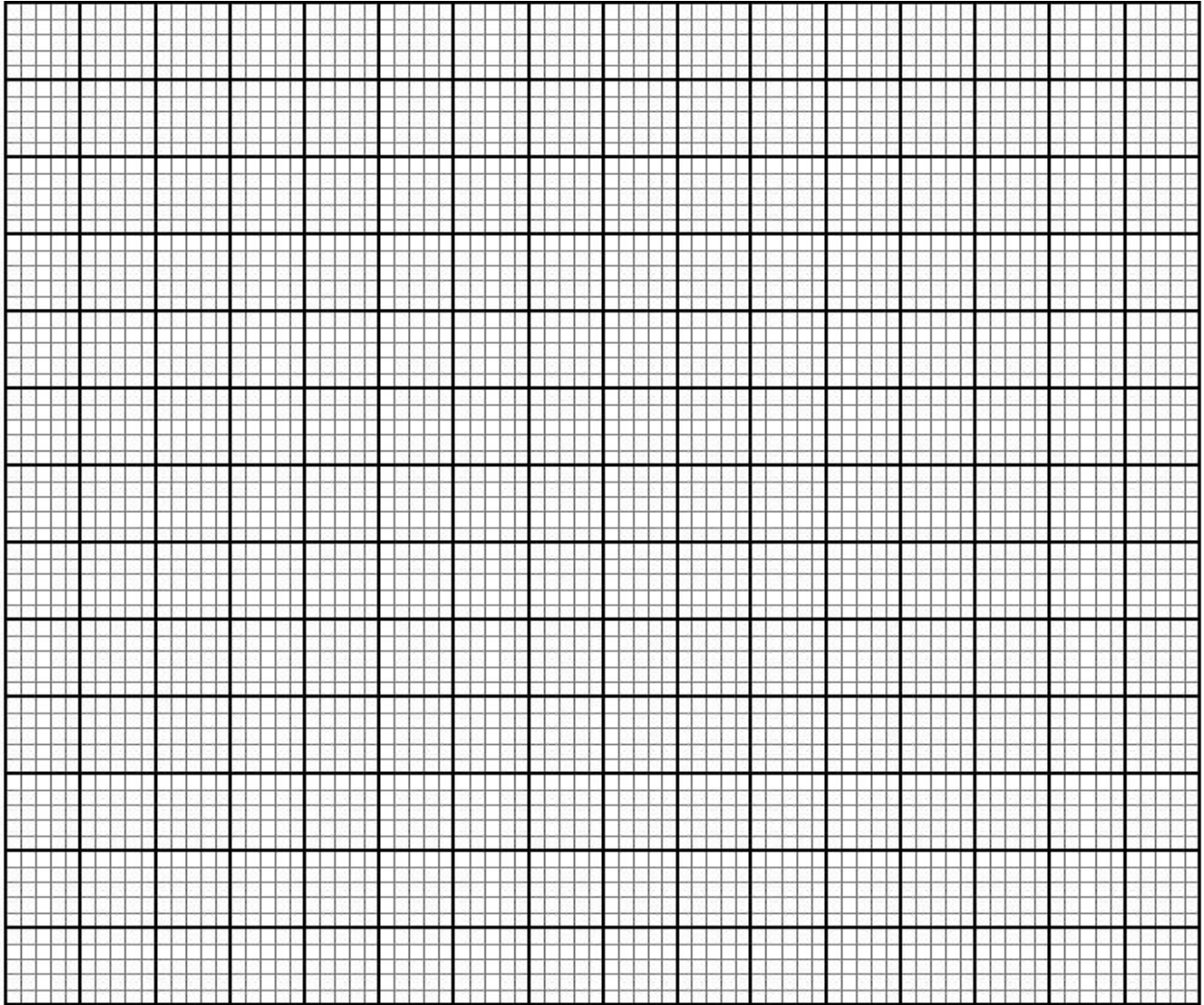
b)   Find the matrix that represent the shear in (a) above   (2marks)

$$\begin{pmatrix} 0 & 1 \\ 1 & 1.5 \end{pmatrix}$$

c)   A transformation where matrix is T $\begin{pmatrix} 0 & 1 \\ 1 & 1.5 \end{pmatrix}$ maps triangle $M^1 N^1 P^1$ onto $M^{11} N^{11} P^{11}$. Draw the

       triangle $M^{11}N^{11}P^{11}$ (3marks)

d)   Describe fully a single transformation that maps triangle $M^{11}N^{11}P^{11}$ back onto triangle MNP and give its transformation matrix.   (2marks)

19.   Complete the table below for the $y \ x^3 \ 3x^2 \ 5x \ 7$ (2marks)
equation

x	-3	-2	-1	0	1	2	3	4	5
y	-32		8	7	0		-8		32

b)   Draw the graph of $y \ x^3 \ 3x^2 \ 5x \ 7$ (3marks)
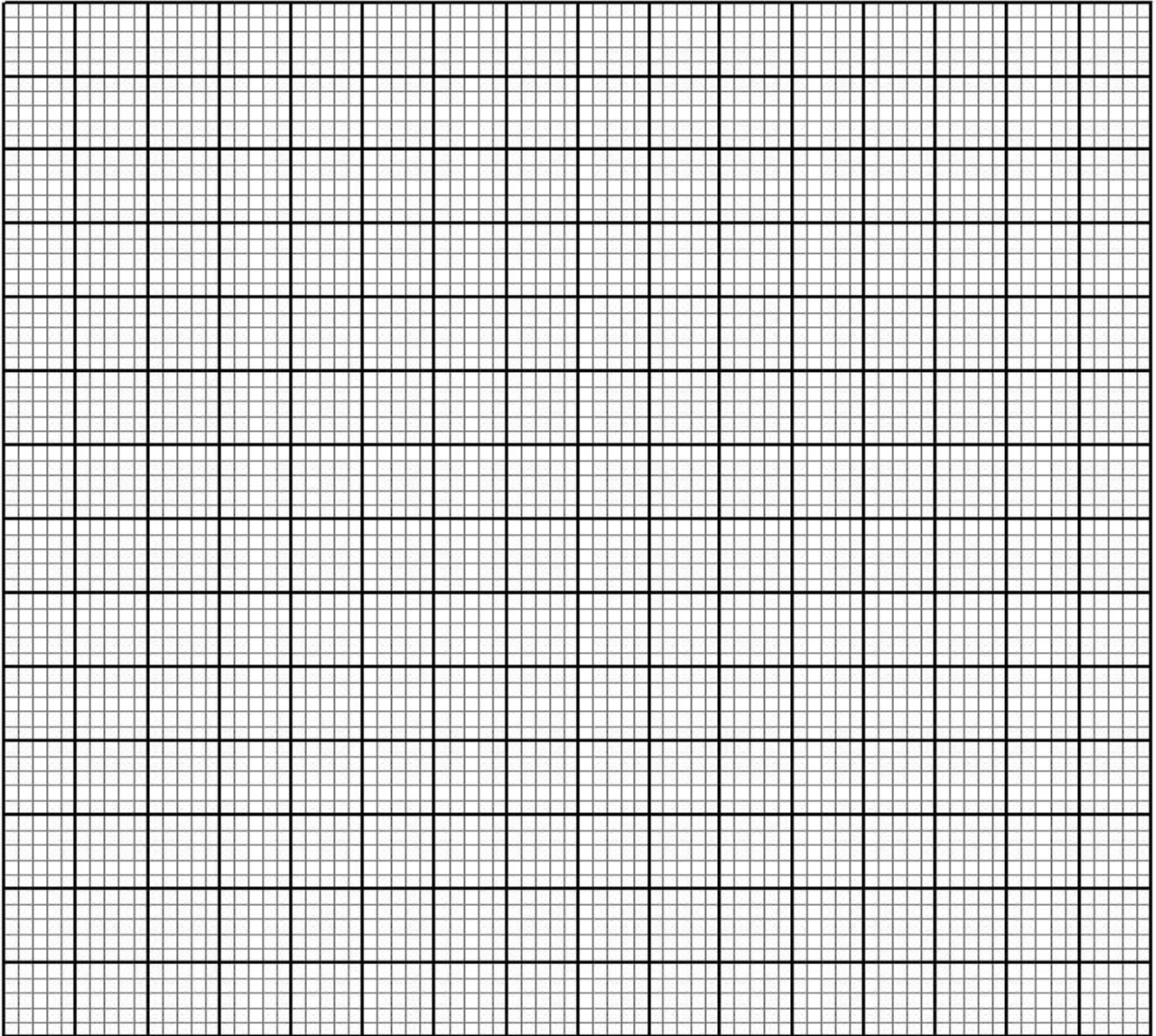
c)   Use your graph to estimate the roots of the
equation $x^3 \; 3x^2 \; 5x \; 7 \; 0$ (2marks)

d)   Use your graph to solve the equation $x^3 \; 3x^2 \; 10x \; 17 \; 0$ (3marks)

20. The table below shows marks scored by 40 students in a test

| Marks	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
frequency	1	5	8	12	7	4	2	1

a) Calculate the upper quartile and lower quartile   (4marks)

b) If 30% of students failed the test, find the pass mark   (3marks)

c) The pass mark was set at 25 marks. How many students passed the test.   (3mark

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

21.) The diagram below shows two intersecting circles with centres X and Y. HG is a tangent to the circle centre X at C. Angle GCE=70° and angle CEF=130°. Given that CB=5cm, BA=4cm, AE=12cm and radius DY=6cm.
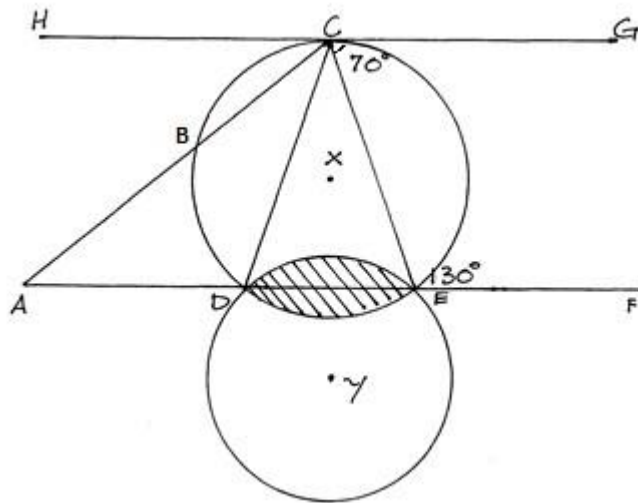
a) Determine

    i)   Angle DXE   (2marks)

    ii)   Length DE   (2marks)

    iii)   Angle DYE   (2marks)

b)   Calculate the area of the shaded region (take $\dfrac{22}{7}$)   (4marks)

22.a)   Wekesa has two fair tetrahedral solids one red and other green. The faces of red solid are numbered 1to 4 while the faces of green solid are numbered 2,3,5 and 6. He tosses the two solids at the same time and recorded the number that is the bottom face of each solid. If **k** is the number that is at the bottom face of red solid while **t** is the number that is at the bottom face of green solid, find the probability that

i)   2k+t=7   (1mark)

ii)   (2k+t) is at most 9   (1mark)

iii) $2k \ t$ (2marks)

b)   In a group of 40 people, 10 are healthy and every person of the remaining 30 has either high
       blood pressure, a high level of cholesterol or both. Given that 15 have high blood pressure, 25
       have

       high level of cholesterol and x have both. If a person is selected at random from this group.
       What is the probability that he/ she

i)   Has high pressure only   (2marks)

ii)   Has high level of cholesterol only   (1mark)

iii)   Hass high blood pressure and high level of cholesterol   (1mark)

iv)   Has either high blood pressure or high level of cholesterol   (2marks)

23.   A company was contracted to transport 1200 tonnes of sand. The company used type A and type B trucks to do the job. Each type A truck carries 10 tonnes of sand per trip while B curries 15 tonnes per trip. The total number of trips must not be less than 70 and type B truck must make at least twice as many trips as type A truck while the later must make not less than 10trips. Taking x to represent the number of trips made by type A trucks and y to represent the number of trips made by type B trucks

a)   Write down all the inequalities representing the above information   (4marks)

b)   Represent the inequality graphically   (4marks)
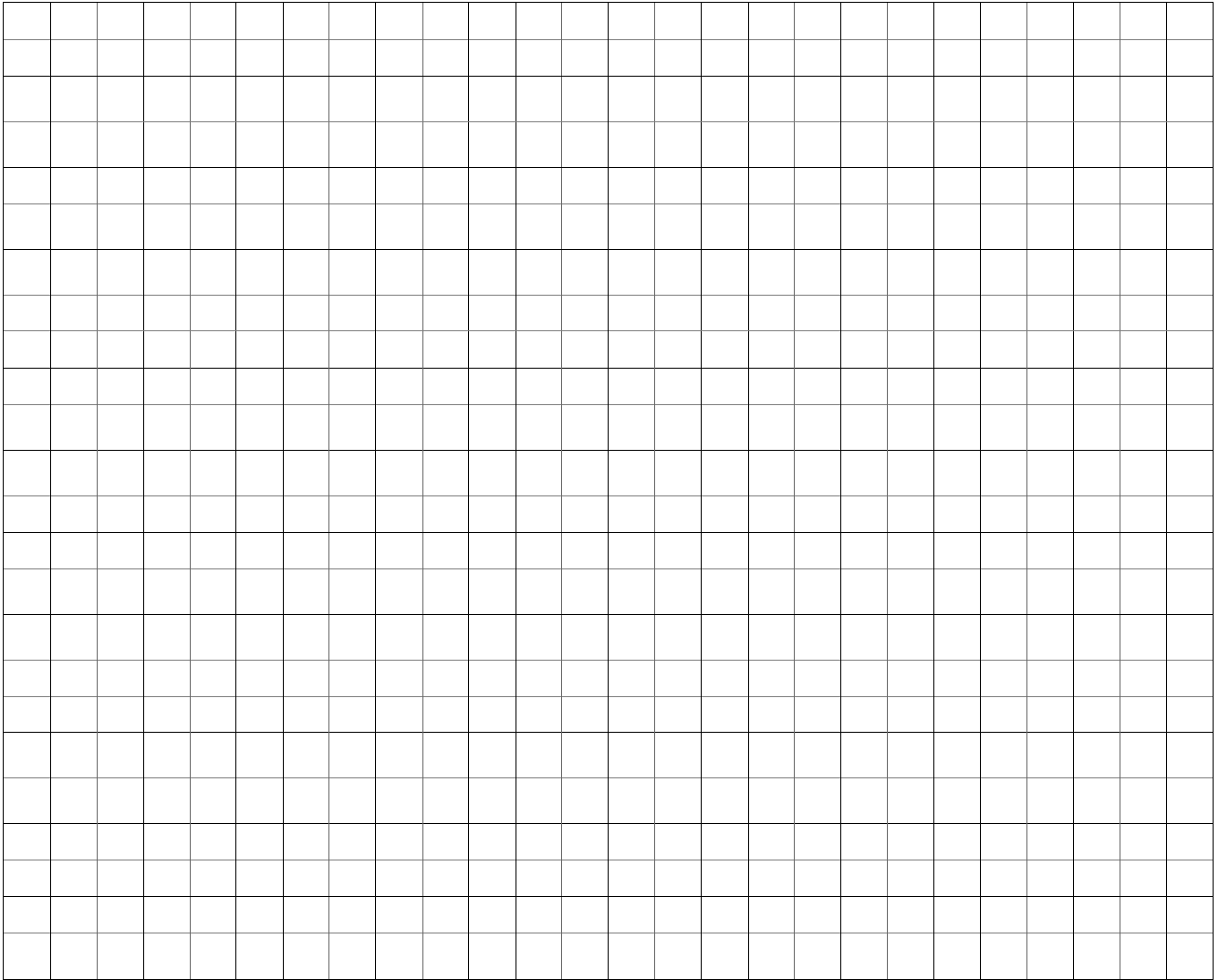
c)   The company makes a profit of sh2000 per trip made by each type A truck and sh 3000 per trip made by each type B truck.

   i) Using a search line, determine the number of trips each type of truck must be made to maximise the profit   (1mark)

   ii) Hence calculate the maximum profit   (1mark)

24.a)   Find the area of the region bounded by the $y = x^3 x$ and the axes between the point x=-1 cuver

and x=1   (4 marks)

b)   At a certain instant a body is moving in a straight line at 20cm/s. Its acceleration during the first

      5seconds of the subsequent motion is (30-6t) cm/s^2 where t is the time in seconds. After 5
      seconds it travels with a constant speed. Find

i)   Its velocity after 2seconds   (2marks)

ii)   The greatest velocity attained   (2marks)

iii) The distance travelled in 10 seconds   (2marks)

THIS IS THE LAST PRINTED PAGE

NAME:………………………………………..   INDEX NO…………………

SCHOOL:…………………………..………   STREAM:……… ADM:………….

CANDIDATE'S SIGN ……………….…… DATE …………TARGET……………..

121/2 -   MATHEMATICS ALT A   -

FORM FOUR PAPER 2

TIME: 2½ HOURS

SERIES 3 QUESTION PAPER

Kenya Certificate of Secondary Education (KCSE)

INSTRUCTIONS TO CANDIDATES

a) Write your name, index number and date in the spaces provided at the top of this page.
b) Write name, admission number and class in the spaces provided above.
c) This paper contains **TWO** sections: **section I** and **section II**
d) Answer **ALL** the questions in **Section I** and only **five** questions from **section II.**
e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**
f) Marks may be given for correct working even if the answer is wrong.
g) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.
h) **This paper consists of 17 printed pages.**
i) **Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.**

FOR EXAMINER'S USE ONLY:

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**TOTAL**

Section II   **GRAND**
TOTAL

17	18	19	20	21	22	23	24	**TOTAL**

This paper consists of 16 printed pages.
Candidates should check the question paper to ensure that all pages are printed as indicated
and no questions are missing

SECTION I (50 marks)

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

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

1. Use logarithms, correct to **4 decimal places**, to evaluate   (4mks)

$$\sqrt[3]{\frac{83.46x0.0054}{1.52^2}}$$

2. Given that the ratio of x:y = 4:5, find to the **simplest form** the ratio of (7x-2y):(x+2y)

(2 mks)

3. Ruto bought a plot of land for Ksh.280,000. After 4 years, the value of the plot was Ksh.495,000. Determine the rate of appreciation, per annum, **correct to one decimal place**.   (3mks)

4. The height in centimeters, of 100 tree seedlings in a tree nursery are shown in the table below.

Height(cm)	10-19	20-29	30-39	40-49	50-59	60-69
Number of trees	9	16	19	26	20	10

Find the quartile deviations of the heights.   (3mks)

5. The equation of a circle is given by $4x^2 - 12x + 4y^2 - 8y - 3 = 0$. Determine the coordinates of the centre of the circle and the radius of the circle. (4mks)

6. Simplify the expression $\dfrac{\sqrt{48}}{\sqrt{5} + \sqrt{3}}$, leaving the answer in the form $a\sqrt{b} + c$ where a, b and c are integers (3mks)

7. In the figure below R, T and S are points on a circle centre O. PQ is a tangent to the circle at T, POR is a straight line and $<QPR = 20^0$.
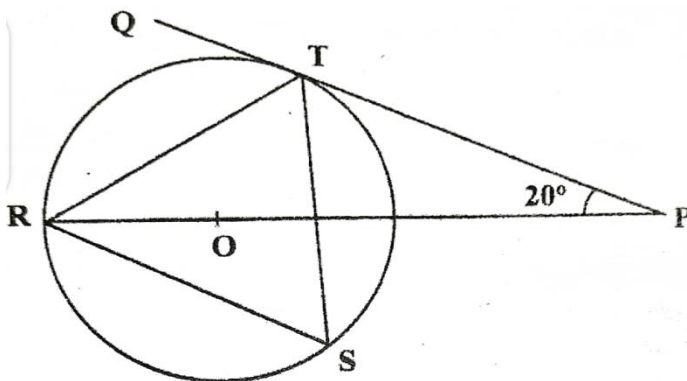
Giving reasons find the size of $< RST$ (2mks)

8. a) Expand the expression $\left(1 + \frac{1}{2}x\right)^5$ in ascending powers of x, leaving the
    coefficients as fraction in their simplest form.   (2mks)

    b) Use the first three terms of the expansion in (a) above to estimate the value of
    $(1.05)^5$
        correct to **4** significant figures   (2mks)

9. Make t the subject of the formula in $s = \sqrt{\frac{3d(t-d)}{8}}$ (3mks)

10. A trader bought maize for Ksh 20 per kilogram and beans for Ksh 60 per kilogram.
    She mixed the maize and beans and sold the mixture at Ksh 48 per kilogram. If she
    made a 60% profit, determine the ratio of maize:beans per kilogram in the mixture.
    (3mks)

11. The cash price of a digital television is Ksh. 27,500. A customer decided to buy it on
    hire purchase terms by paying a deposit of Ksh 17,250. Determine the monthly rate of
    compound interest charged on the balance if the customer is required to repay by six
    equal monthly instalments of Ksh. 2,100 each.   (3mks)

12. The first, the third and the seventh terms 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. (4mks)

13. The lengths of two similar pieces of wood were given as 12.5 m and 9.23 m. Calculate the absolute error in calculating the difference in length between the two bars. (3mks)

14. Solve for x given that $\frac{1}{3}log_2 8 + log_2(2x - 4) = 5$ (3mks)

15. In nomination for a committee, two people were to be selected at random from a group of 3 men and 5 women. Find the probability that a man and a woman were selected. (2mks)

16. 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. Pipe A and B are opened at the same time when the tank is empty. If one hour later, pipe C is opened, find the total time taken to fill the tank. (4mks)

SECTION II (50 marks)
*Answer only **five** questions in this section in spaces provided*

17. The table below shows the income tax rates for a certain year.

Monthly taxable income in Ksh	Tax rate (%) in each shilling
1-11,180	10
11,181-21,714	15
21,715-32,248	20
32,249-42,782	25
Over 42,782	30

   i. During the year, Njuguna's monthly income was as follows: Basic salary Ksh 40,000, House allowance Ksh 11,090 and Commuter allowance Ksh 7,000.

   Calculate a) Njuguna's total monthly taxable income. (1mk)

   b) Total income tax charged on Njuguna's monthly income (4mks)

ii. Njuguna's net monthly tax was Ksh. 10,750.80. Determine the monthly tax relief allowed. (1mk)

iii. A proposal to expand the size of the first income tax band by 50% while retaining the size of the next three bands was made. The tax rates would remain as before in each band. Using the proposal, calculate:
   a) the tax Njuguna would pay in the first band. (2mk)

   b) the tax Njuguna would pay in the last tax band. (2mks)

18. a) Given that $\mathbf{A}=\begin{bmatrix} 3 & x \\ x+1 & 2 \end{bmatrix}$ and $\mathbf{B}=\begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$, find the values of x for which AB is a singular matrix. (3mks)

b) Otieno bought 3 exercise books and 5 pens for a total of Ksh 165. If Otieno had bought 2 exercise books and 4 pens, he would have spent Ksh 45 less. Taking letter **e** to represent the price of an exercise book and letter **p** to represent the price of a pen
   i. Form two equations to represent the above information. (2mks)

   ii. Use matrix method to find the price of an exercise book and that of a pen. (3mks)

iii. The principal of Njabini boys decided to reward 36 students **each** with 2 exercise books and one pen. Calculate the total amount of money he paid. (2mks)

19. Three quantities X, Y and Z are such that X varies directly as the square root of Y and inversely as the fourth root of Z. When X=64, Y=16 and Z= 625.
    i. Determine the equation connecting X, Y and Z. (4mks)

    ii. Find the value of Z when Y=36 and X=160 (2mks)

    iii. Find the percentage change in X when Y is increased by 44% and Z decreased by 19% correct **to one decimal** place. (4mks)

20. The figure below shows a parallelogram OPQR with O as the origin, **OP = p** and **OR= r.** Point T divides RQ in the ratio 1:4. PT meets OQ at S.
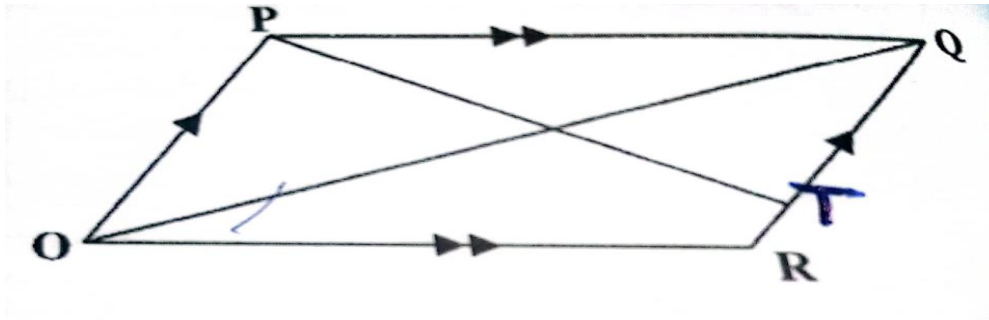
a) Express in terms of **p** and **r** the vectors
     i.   OQ   (1mk)

     ii.   OT   (1mk)

b) Vector OS can be expressed in two ways; i) **OS**= m**OQ** ii) **OS**= **OT** + n**TP**, where m and n are constants. Express **OS** in terms of
     i.   m, **p** and **r**   (1mk)

     ii.   n, **p** and **r**   (1mk)

Hence find the

     iii.   value of n and m   (5mks)

     iv.   ratio **OS:SQ**   (1mk)

21. A quadrilateral ABCD has vertices at A(1,1), B(4,2), C(1,3), D(2,2).
   a) Draw ABCD on the grid provided   (1mk)

b) Give that $X=\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ $Y=\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ $V=\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$. Find the coordinates of $A^1B^1C^1D^1$, $A^{11}B^{11}C^{11}D^{11}$ and $A^{111}B^{111}C^{111}D^{111}$ the images of ABCD under combined transformation **VXY.** Show all your working of coordinates below;

     i.   Coordinates of $A^1B^1C^1D^1$ and draw it on the grid.   (2mks)

     ii.   Coordinates of $A^{11}B^{11}C^{11}D^{11}$ and draw it on the grid.   (2mks)

     iii.   Coordinates of $A^{111}B^{111}C^{111}D^{111}$ and draw it on the grid.   (2mks)

c) Showing your working find a single matrix that will map ABCD onto $A^{111}B^{111}C^{111}D^{111}$.   (3mks)

22. a) Complete the table below for $y = x^3 + 4x^2 - 5x - 5$
    (2mks)

X			-5	-4	-3	-2	-1	0	1	2
$y = x^3+4x^2-5x-5$					19			-5		

b) On the grid provided, draw the graph of $y = x^3+4x^2-5x$ -5 for $-5 \leq x \leq 2$
   (3mks)

c) i) Use the graph to solve the equation $x^3+4x^2-5x-5 = 0$ (2mks)

   ii) By drawing a suitable straight line graph, solve the equation

   $x^3+4x^2-x-4 = 0$ (3mks)
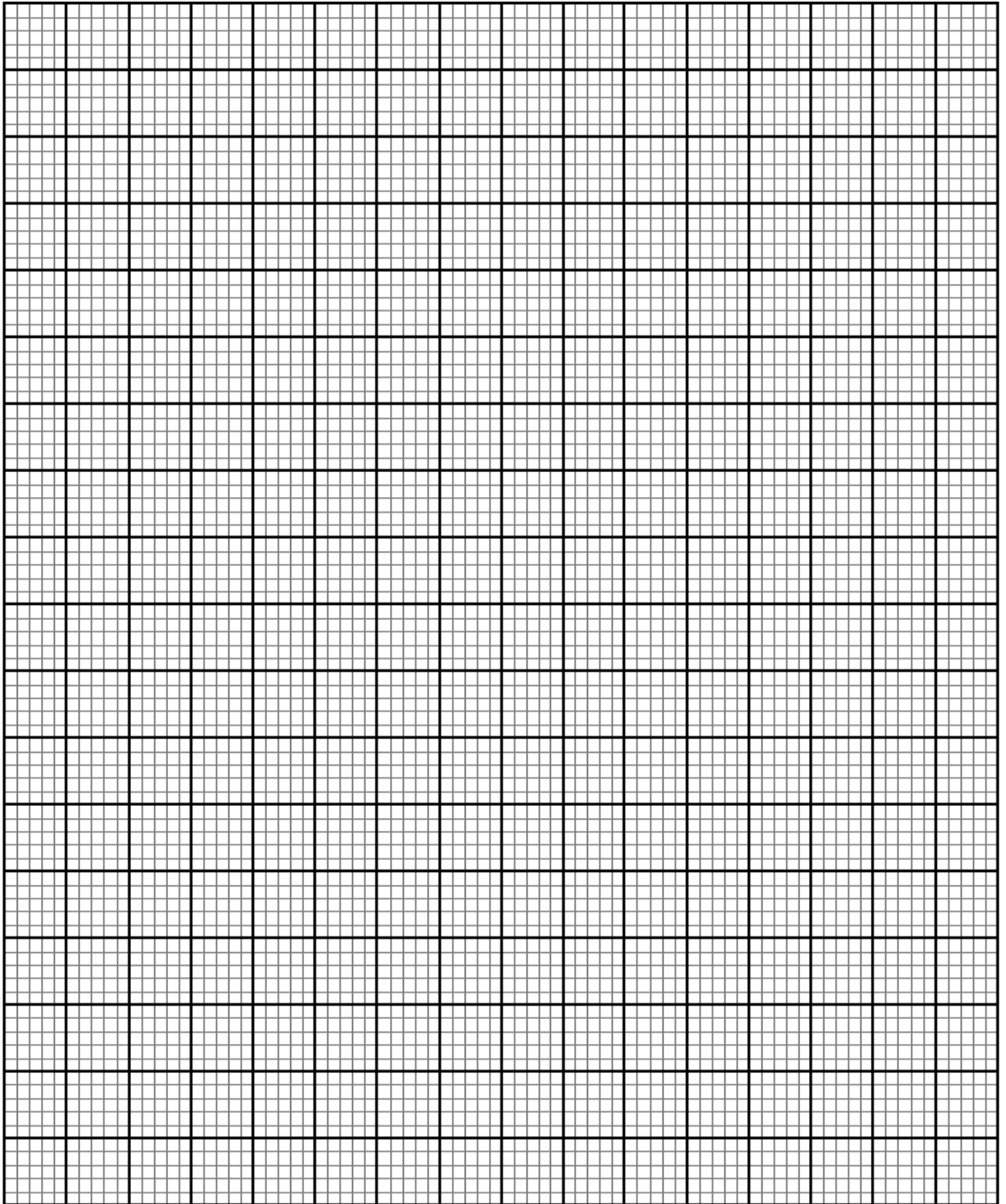
23. A polytechnic planned to buy x lockers for a total cost of Ksh 16,200. The supplier agreed to offer a discount of Ksh 60 per locker. The polytechnic was then able to get three extra lockers for the same amount of money.

a) Write an expression in terms of x, for the:

i)   Original price of each locker;   (1mk)

ii)   Price of each locker after the discount.   (1mk)

b) Form an equation in x and hence determine the number of lockers the polytechnic bought.   (5mks)

c) Calculate the discount offered to the polytechnic as a percentage
(3mks)

24. i) Using ruler and compasses only construct triangle ABC such that AB=4 cm, BC= 5cm and <ABC=120^0.   (3mks)

ii) Measure AC   (1mk)

iii) On the same diagram draw a locus of points equidistant from point A and point C
and label the locus as L_1.   (1mk)

iv) Draw on the same diagram a locus of points L_2 equidistant from point C and point
B and lable the locus as L_2 (1mk)

v) label the point where L_1 and L_2 meet as O. Using O as a centre draw a locus of
points L_3 touching points A, B and C. Measure the length from point O to L_3.
          (2mks)

vi) Draw the locus of points L_4 equidistant from line AC and Line AB. Extend L_4 to
meet line BC and lable where they meet point D. Measure the length AD. (2mks)

NAME:………………………………………..   INDEX NO…………………

SCHOOL:…………………………..………   STREAM:……… ADM:………….

CANDIDATE'S SIGN …………….…. DATE …………TARGET…………….

121/2
MATHEMATICS PAPER 2
TIME: 2 ½ HOURS.

SERIES 4 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES

a) Write your **name** and **index number** in the spaces provided above.
b) Sign and write **date** of examination in the spaces provided above.
c) This paper consists of **two** sections; **Section I** and **Section II.**
d) Answer **All** *questions* in **Section I** and *only* **Five** *questions* from **section II**
e) **All** answers and working **must** be written on the question paper in the spaces provided below each
f) Show all the steps in your calculations giving answers at each stage in the spaces provided below each
g) Marks may be given for correct working even if the answer is wrong.
h) Non-programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.
i) This paper consists of 15 printed pages. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.
m) Candidates should answer questions in **English**.

For examiner's use only.

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**Total**

Section II

17	18	19	20	21	22	23	24	**Total**

GRAND TOTAL

SECTION 1 (50 MARKS)
Attempt all questions.

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

1.   Factorise $x^2 - y^2$, hence evaluate $3282^2 - 3272^2$ (3mks)

2.   Find cos x – Sin x, if tan x= ¾ and $90^\circ \le x \le 360^\circ$ (3mks)

3.   Expand $\left[\dfrac{1}{1-2x} \right]^6$ up to the fourth term. Hence use your expansion to evaluate $(1.02)^6$

       to four decimal places.   (4mks)

4.   The average of the first and fourth terms of a GP is 140. Given that the first term is 64. Find the common ratio.

                                             (3mks)

5. Make b the subject of the formula. (3mks)

$$A = \sqrt{\dfrac{bd}{b^2 - d}}$$

6. Two variables P and Q are such that P varies partly as Q and partly as the square root of Q. Determine the equation connecting P and Q. When Q=16, P=500 and when Q = 25, P = 800 (4mks)

7. **Calculate** the interest on sh 10,000 invested for 1 ½ years at 12 % p.a. Compounded semi-annually. (3 mks)

8.   Given that x=2i+j-2k, y= -3i+4j-k and z =5i + 3j+2k and that P= 3x-y+2z, find the magnitude of vector p to 3 significant figure   (4mks)

9.   Eighteen labourers dig a ditch 80m long in 5 days. How long will it take 24 labourers to dig a
         ditch 64 m long?   (3mks).

10.   The expression 1+ $^x/_2$ is taken as an approximation for $\sqrt{1+x}$

         Find the percentage error in doing so if x = 0.44

                                                                                                      (3mks)

11. The matrices $A = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ o & c \end{bmatrix}$

are such that AB = A + B
Find a, b, and c.

(3mks)

12. Simplify

(3mks)

$$\frac{2x^2 - x-1}{x^2 - 1}$$

13. On map of scale 1:25000 a forest has an area of 20cm². What is the actual area in Km² (3mks)

14. In the figure below, DC = 6cm, AB = 5cm. Determine BC if DC is a tangent. (3mks).
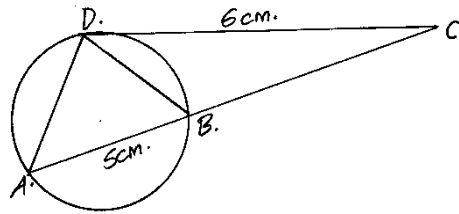
15. Evaluate without using logarithm tables.

$$3 \log_{10} 2 + \log_{10} 750 - \log_{10} 6$$

(3mks)

16. A bag contains 10 balls of which 3 are red, 5 are white and 2 green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and a ball picked at random from the bag. Find the probability that the ball so chosen is red. (4mks).

SECTION II (50 MARKS)
Answer any five questions in this section.

17.   Income tax is charged on annual income at the rates shown below.

Taxable Income K£

Rate (shs per K£)

Taxable Income K£	Rate (shs per K£)
1 – 1500	2
1501 – 3000	3
3001 – 4500	5
4501 – 6000	7
6001 – 7500	9
7501 – 9000	10
9001 – 12000	12
Over 12000	13

A certain headmaster earns a monthly salary of Ksh. 8570.. He is entitled to tax relief of Kshs. 150 per month.

(a) How much tax does he pay in a year.   (6 mks)

(b) From the headmaster's salary the following deductions are also made every month;

W.C.P.S   2% of gross salary

N.H.I.F   Kshs. 1200

House rent, water and furniture charges Kshs. 246 per month.

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

Calculate the headmaster's net salary.

(4 mks)

18.   (a) (i) Taking the radius of the earth, R = 6370 km and $\pi = {}^{22}/_7$ calculate the shorter distance between the two cities P (60°N , 29°W) and Q (60°N, 31°E) along the parallel of latitude.

(3mks)

(ii) If it is 1200Hrs at P, what is the local time at Q.   (3mks)

.
(b) An aeroplane flew due South from a point A (60⁰N, 45⁰E) to a point B. The distance covered by the aeroplane was 800km. Determine the position of B.   (4mks).

19.   Triangle PQR whose vertices are p(2,2), Q(5,3) and R(4,1) is mapped onto triangle P'Q'R' by a transformation whose matrix is   1   -1
                                                                                              -2   1

a) On the grid draw PQR and $P^1Q^1R^1$. (4mks)

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) and R^{11} (-4,-1)

   (i) Find the matrix of transformation which maps triangle $P^1Q^1R^1$ onto $P^{11}Q^{11}R^{11}$.

   (2mks)

   (ii) Draw the image $P^{11}Q^{11}R^{11}$ on the same grid and describe the transformation that maps PQR onto $P^{11}Q^{11}R^{11}$. (2mks)

   c) Find a single matrix of transformation which will map PQR on to $P^{11}Q^{11}R^{11}$.(2mks)

20. (a) Complete the table for y = Sin x + 2 Cos x.

(2mks)

X	0	30	60	90	120	150	180	210	240	270	300
Sinx	0			1.0		0.5		-0.5			-0.87
2 cos x	2			0		-1.73		-1.73			1.0
Y	2			1.0		-1.23		-2.23			0.13

   (b) Draw the graph of y = Sin x + 2 cos x. (3mks)

   (c)Solve sinx + 2 cos x = 0 using the graph. (2mks)

   (d) Find the range of values of x for which y ≤ -0.5 (3mks).

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

21. A bag contains 3 red, 5 white and 4 blue balls. Two balls are picked without replacement. Determine the probability of picking.

   (a) 2 red balls   2mks

   (b) Only one red ball   2mks

   (c) At least a white ball   2mks

   (d) Balls of same colour.   2mks

   (e) Two white balls   2mks

22.   (a) Draw the graph of the function

                                                                2mks

   $$y = 10+3x - x^2 \text{ for } -2 \le x \le 5$$

   (b) use of the trapezoidal rule with 5 stripes, find the area under the curve from x = -1 to x = 4.
                                                                4mks

   (c) Find the actual area under the curve from x = -1 to x = 4.   2mks
   (d) Find the percentage error introduced by the approximation.   2mks

23. The figure below is a cuboid ABCDEFGH such that AB = 8cm, BC = 6cm and CF 5cm. Determine (a) the length   (i) AC
                                                                (2mks)

(ii) AF

(2mks)
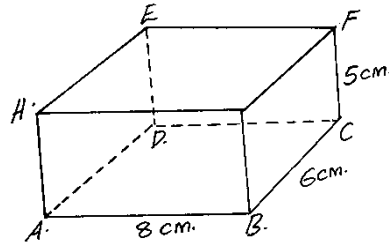
(b) The angle AF makes with the plane ABCD.   (3mks)

(c) The angle AEFB makes with the base ABCD.

(3mks)

24.   A manager wishes to hire two types of machine. He considers the following facts.

Machine A

Machine B

Floor space

2m²

3m²

Number of men required to operate

4

3

He has a maximum of 24m² of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type B than of type A.

(a) If he hires x machines of type A and y machines of type B, write down all the inequalities that satisfy the above conditions.   3mks

(b) Represent the inequalities on the grid and shade the unwanted region.   3mks

(c) If the profit from machine A is sh. 4 per hour and that from using B is kshs8 per hour. What number of machines of each type should the manager choose to give the maximum profit?
                                                                                    (4mks)

NAME:………………………………………..   INDEX NO…………………

SCHOOL:……………………..………   STREAM:……… ADM:………….

CANDIDATE'S SIGN …………….…. DATE …………TARGET……………..

121/2 -   MATHEMATICS ALT A   -   PAPER 2
-TIME: 2½ HOURS

Kenya Certificate of Secondary Education (KCSE)

SERIES 5 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES

j) Write your name, index number and date in the spaces provided at the top of this page.
k) Write name, admission number and class in the spaces provided above.
l) This paper contains **TWO** sections: **section I** and **section II**
m) Answer **ALL** the questions in **Section I** and only **five** questions from **section II.**
n) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**
o) Marks may be given for correct working even if the answer is wrong.
p) **Non-programmable** silent electronic scientific calculators and KNEC mathematical tables may be used except where stated otherwise.
q) **This paper consists of 18 printed pages.**
r) **Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.**

FOR EXAMINER'S USE ONLY:

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**TOTAL**

Section II   **GRAND TOTAL**

17	18	19	20	21	22	23	24	**TOTAL**

SECTION I (50mks)

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

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

1. Simplify without using mathematical tables or calculator. (4mks)

$$\frac{2(\log_{10} 2.5 + \log_{10} 40)}{3 \log_{10} 0.05 + 2\log_{10} 2 - \log_{10} 0.5}$$

2. Simplify $\frac{2}{2+\sqrt{5}} - \frac{2\sqrt{5}}{2-\sqrt{5}}$ and express your answer in the form a+b√c where a, b and c are constants. (3mks)

3. A wedding committee did a budget for a wedding ceremony as follows:
   Food: Ksh.　58,205
   Chairs:Ksh.　11,950
   Entertainment:　8,453

   The sum of the budget was done by first rounding each figure to 3 significant figures.
a) Determine the sum of the budget (2mks)

b) Determine the percentage error in this sum of the budget (2mks)

4. Solve the equation $4\sin^2 x + 4\cos x = 5$ for $0^0 \le x \le 360^0$ (3mks)

5. a) Expand $(1-x)^4$ using the binomial expansion (1mk)

   b). Use the first three terms of the expansion in (a) above to find the value of $(0.998)^4$
   Correct to the nearest hundredth (3mks)

6. Make w the subject of the formula (3mks)

   $$P=\sqrt{\frac{vw^2}{v^2-w^2}}$$

7. Given that $y = 3 \sin (½ x + 60)^0$ find, amplitude, period and the phase angle of the function. (3mks)

8. A ship sails due North from latitude 20^0 S for a distance of 1440nm. Find the latitude of the point it reaches (2mks)

9. The equation of a circle is given by $3x^2+3y^2+3x+42y+30=0$. Determine the radius and the coordinates of the centre circle. (3mks)

10. a) i) Draw a straight line MN such that MN=7cm (1mk)

    ii) Construct the locus P such that < MPN=90^0 (1mk)

    b) On the locus of P in (a) above, mark point T such that T is equidistant from M and N. (2mks)

11. The table below shows tax table for monthly income

Monthly taxable income in Ksh.	Tax rate % in each shilling
0- 9680	10
9681- 18800	15
18801-27920	20

In a certain month, Kamau's tax was sh. 3336. Determine his income during that month.

(3mks)

12. In the figure below OC is the tangent to the circle. If OE=8cm and OC=6cm, find EA. (2mks)
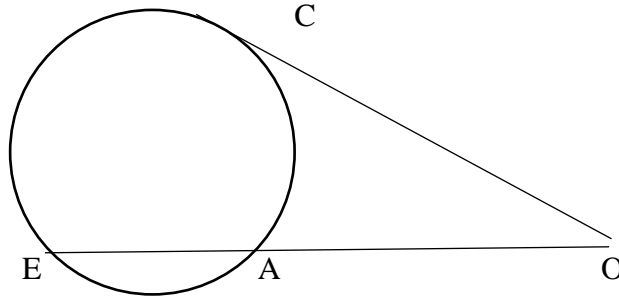
13. Evaluate $\int_1^4 (3x^2 + 1)dx$ (3mks)

14. Liquid P contains 30% of water while liquid Q contains 48% of water. In what ratio should P and Q be mixed so that the mixture contains 42% of water? (3mks)

15. The probability that it is rainy in the morning is 0.6. The probability that John carries an umbrella while going to work is 0.4. Find the probability that
   i)   It is not rainy and John does not carry an umbrella. (2mks)

   ii)   It is rainy and John carries an umbrella (1mk)

16. Solve the simultaneous equations

x-2y=1, x^2+y^2=29   (3mks)

SECTION II (50 MARKS)

(Answer five questions in this section)

17. The first three consecutive terms of a geometric progression are 3^{2x+1}, 9^x and 81 respectively

   a) Calculate the value of x (3mks)

   b) Find the common ratio of the series   (2mks)

   c) Calculate the sum of the first ten terms of this series   (2mks)

   d) Given that the fifth and the seventh terms of this Geometrical Progression form the first two consecutive terms of an arithmetic sequence calculate the sum of the first 20 terms of the arithmetic sequence.   (3mks)

18. In an experiment, the length of 100 rats were measured to the nearest 0.1cm and the
    frequency tabulated as follows:

Length in *(cm)*	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Frequency	1	4	x	20	25	26	7	1	1

a) Find the value of x   (2mks)

b) Calculate the mean length using assumed mean of 42   (4mks)

c) Calculate the standard deviation   (4mks)

19. Complete the table below for the function
    $y=x^3+6x^2+8x$ (2mks)

X	-5	-4	-3	-2	-1	0	1
x^3	-125	-64		-8	-1	0	1
$6x^2$		96	54		6	0	6
$8x$	-40		-24	-16		0	8
Y			3	0	-3	0	15

a) Draw the graph of the function $y=x^3+6x^2+8x$ for $-5\leq x\leq 1$ (3mks)

(Use a scale of 2 big squares to represent 1 unit on the x-axis and 1big square to represent 2 units on the y-axis)
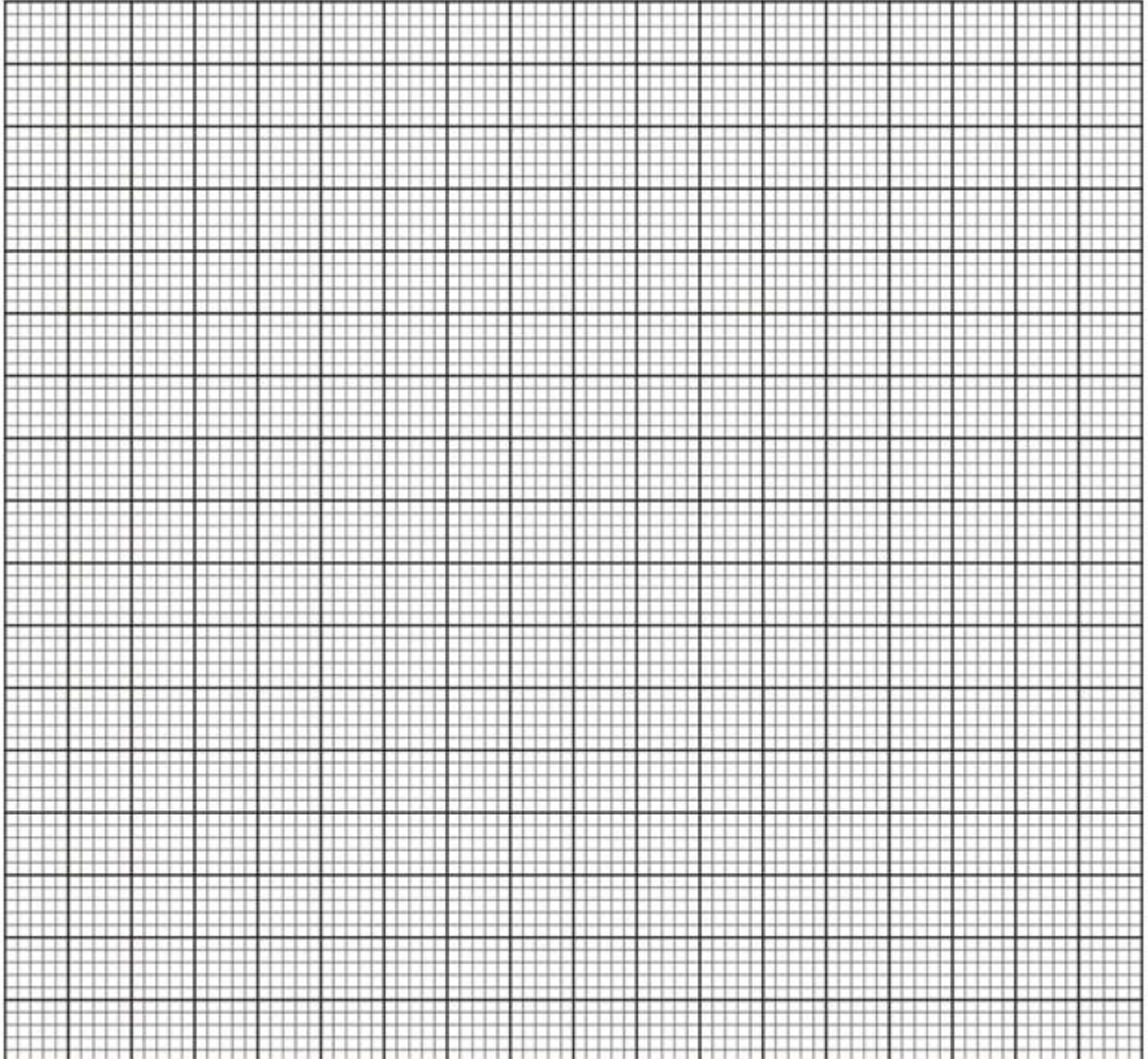
b) Use your graph to estimate the roots of the equations
   i. $x^3+6x^2+8x=0$ (1mk)

   ii. $x^3+5x^2+4x=-x^2-3x-1$ (2mks)

c) Find the values of x which will satisfy the inequality $x^3+6x^2+8x>1$ (2mks)

20. The figure below is a square based pyramid ABCDV with AD=DC=6cm. VO=10cm
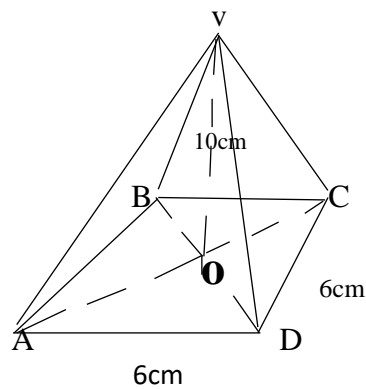
a) State the projection of VA on the base ABCD (1mk)

b) Find:
   i.   The length of VA (3mks)

   ii.   The angle between the planes VA and ABCD (2mks)

iii.   The angle between the planes VDC and ABCD   (2mks)

iv.   The volume of the pyramid   (2mks)

21. The points A (0,0), B (-3,1), C (1,3) and (4,2) are the vertices of a parallelogram ABCD.

a) A$^{/}$B$^{/}$C$^{/}$D$^{/}$ is the image of ABCD under the matrix of transformation $\begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$

Draw ABCD and A$^{/}$B$^{/}$C$^{/}$D$^{/}$ on the grid. Write down the coordinates of A$^{/}$B$^{/}$C$^{/}$D$^{/}$ (3mks)
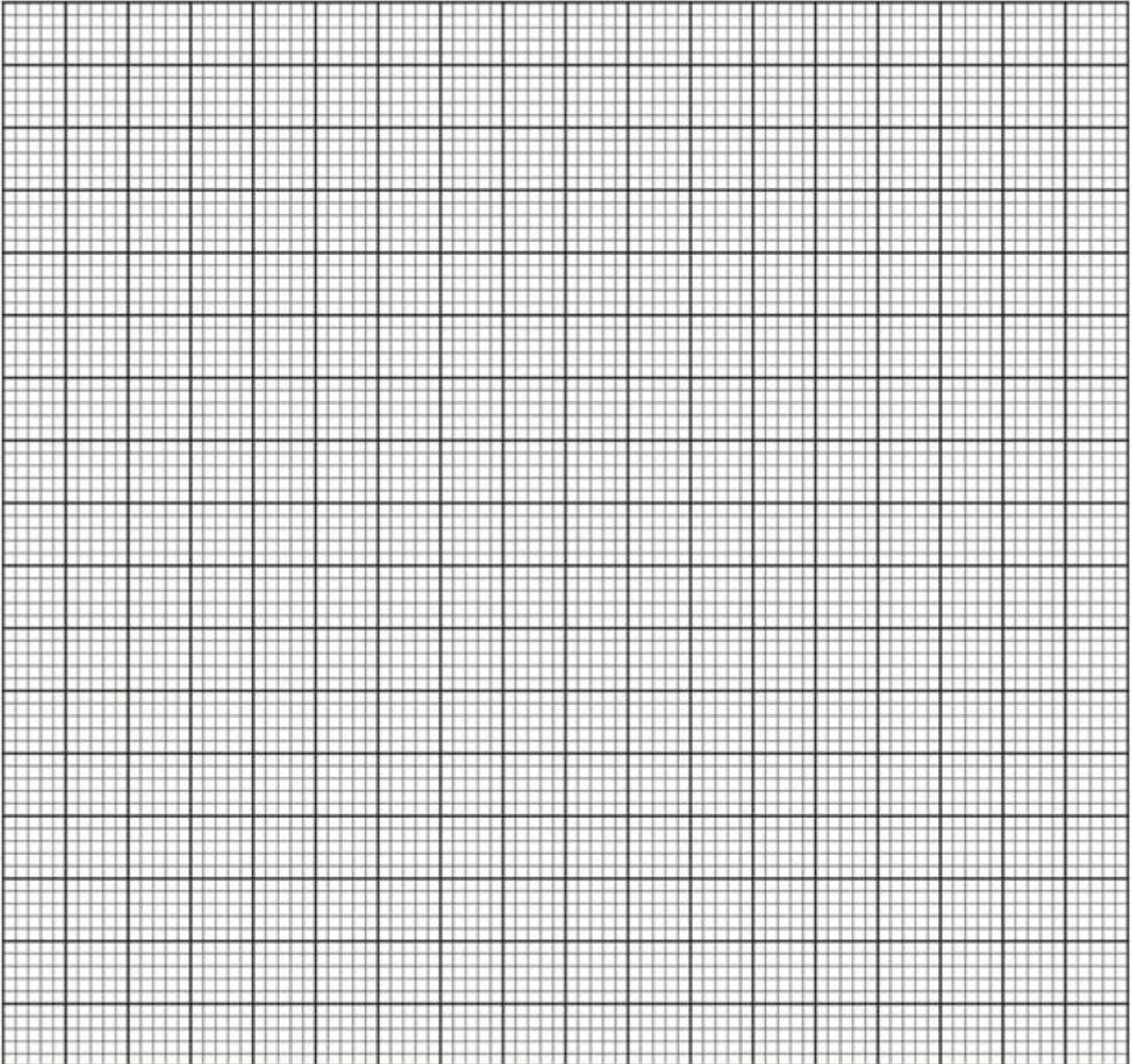
b) The points $A''(0,0)$ $B''(-6,2)$ $C''(2,6)$ and $D''(8,4)$ are the vertices of $A''B''C''D''$ the image of ABCD under a certain transformation. Draw $A''B''C''D''$ on the same grid as ABCD. Describe this transformation fully.   (3mks)

c) A single transformation T maps $A'B'C'D'$ on to $A''B''C''D''$. Determine the matrix of T (4mks)

22. A sum of money is deposited in a bank that pays simple interest at a rate r. After 3 years the total amount of money in the account is Ksh. 358,400. The interest earned each year is Ksh. 12,800.

a) Calculate: i) The amount of money which was deposited.   (2mks)

      ii)   The rate of interest r.   (2mks)

b) A computer whose marked price is Ksh. 40,000 is sold at ksh. 56,000 on hire purchase terms.

i)   James 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 instalments of ksh. 2625. Calculate the number of instalments.   (3mks)

ii)   Had James bought the computer on cash price he would have been allowed a discount of 12.5% on the marked price. Calculate the difference between the cash price and the hire purchase price and express it as a percentage of the cash price.
(3mks)

23. In the figure below OPQ is a triangle in which $OS = \frac{3}{4} \overrightarrow{OP}$ and $\overrightarrow{PR}: \overrightarrow{RQ} = 2:1$. Lines $\overrightarrow{OR}$ and SQ meet at T.
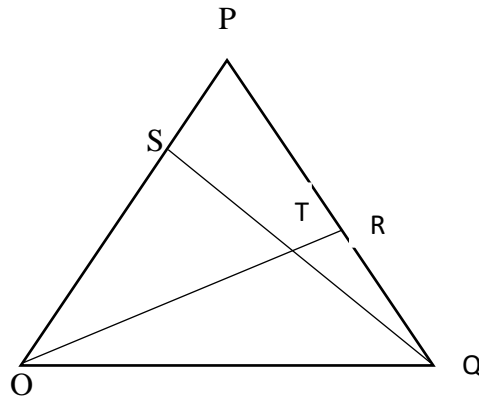
a) Given that $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$. Express the following vectors in terms of p and q:

   i. $\overrightarrow{PQ}$ (1mk)

   ii. $\overrightarrow{OR}$ (2mks)

   iii. $\overrightarrow{SQ}$ (2mks)

b) Given that $\overrightarrow{ST} = m\overrightarrow{SQ}$ and $\overrightarrow{OT} = n\overrightarrow{OR}$ where m and n are consonants, determine the values of m and n   (4mks)

c) Find the ratio of ST:TQ   (1mk)

24. During installation of electricity bulbs in street lighting a dealer is required to supply
    two types of bulbs A and B. The total number of bulbs should not be more than 400.
    He must supply more of type A than of type B and type A should not be more than
    300 and type B should not be less than 80.

a) By letting the number of type A bulbs to be x and the number of type B bulbs to be y,
   write all the inequalities representing the above information.   (3mks)

b) On the grid provided draw all the inequalities   (4mks)
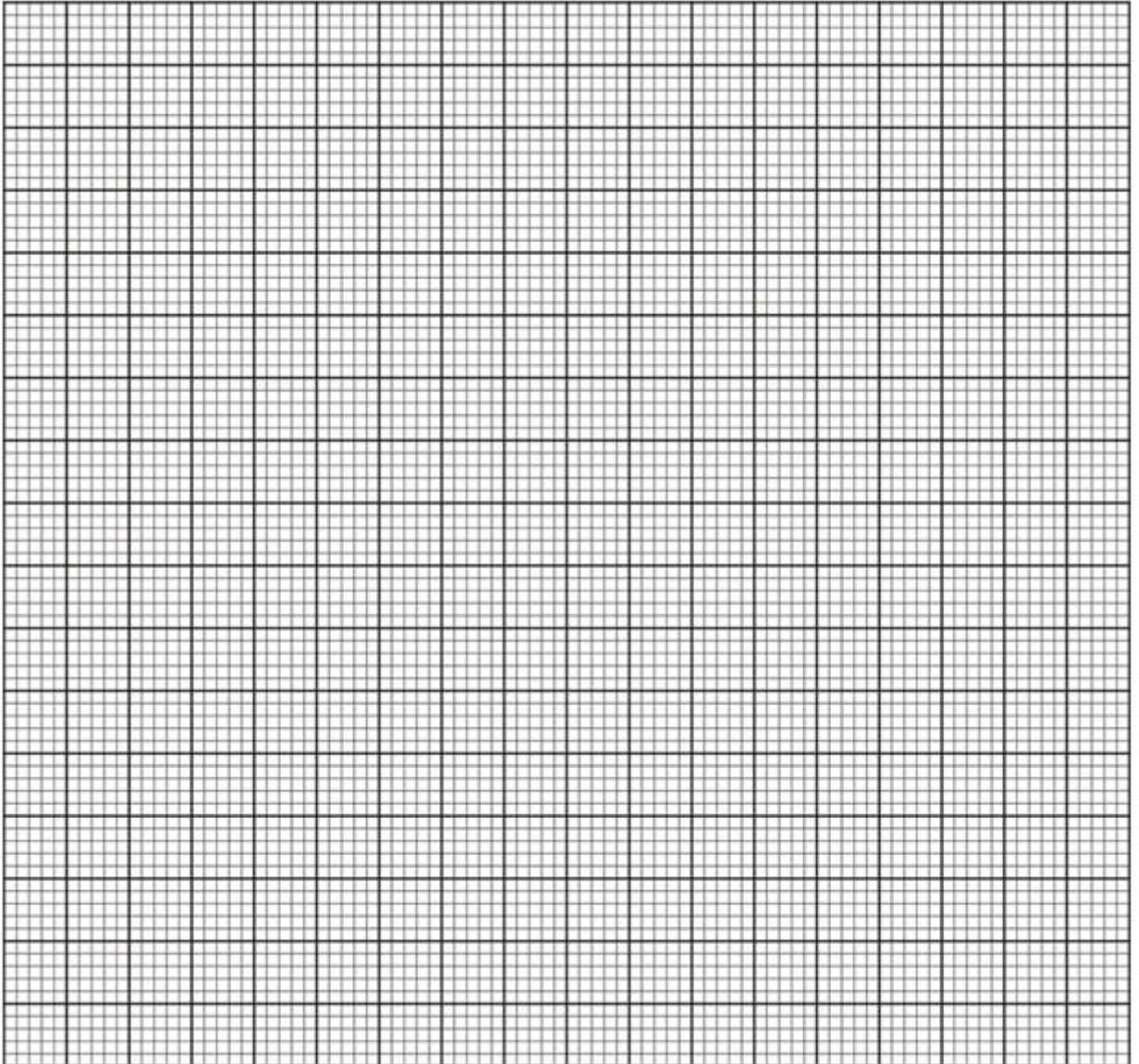
c) If type A bulbs cost sh.450 per piece and type B cost sh.350 per piece and that the higher the cost the higher the profit:

i. Use your graph to determine the number in each type of bulb that he should supply to maximize the profit. (1mk)

ii. Calculate the maximum cost of lighting the street (2mks)

NAME:………………………………………….. INDEX NO…………………

SCHOOL:……………………..……… STREAM:……… ADM:………….

CANDIDATE'S SIGN …………….…. DATE …………TARGET……………..

121/2
MATHEMATICS PAPER 2

TIME: 2 HOURS 30 MINUTES

FORM FOUR
SERIES 6 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES:

- Write your **name**, **admission numbe**r and write **date** of examination in the spaces provided
- The paper contains **two** sections. Section I and Section II.
- Answer **ALL** the questions in section I and any **five** questions in section II.
- Answers and working **must** be written on the question paper in the spaces provided below each question.
- Show all steps in your calculations below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non programmable silent electronic calculators and KNEC mathematical table may be used, except where stated otherwise.

FOR EXAMINERS USE ONLY
SECTION I

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
Marks																	

SECTION II

GRAND TOTAL

Question	17	18	19	20	21	22	23	24	TOTAL
Marks									

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

Section I (50 Marks)
Answer ALL questions in this section in the spaces provided

1. Solve for x

$$(\log_3 x)^2 - \frac{1}{2}\log_3 x = \frac{3}{2}$$

[4marks]

2. In the figure below PT is a tangent to the circle from an external point P. $PT = 24\ cm$ and $OP = 25\ cm$.
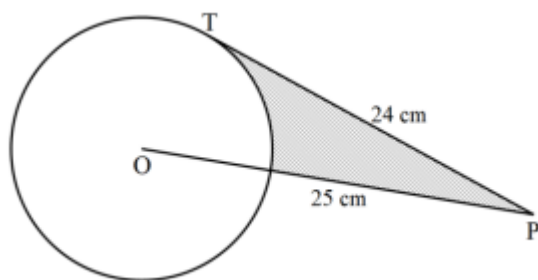
Calculate the area of the shaded region correct to 2 decimal places   [4marks]

3. Find the value of w in the expression $wx^2 - \frac{3}{2}x + \frac{1}{16}$ is a perfect square , given that w is a constant   [2marks]

4. Simplify

$$\frac{4}{\sqrt{5}+\sqrt{2}} - \frac{3}{\sqrt{5}-\sqrt{2}}$$

(3 marks)

5. The cost C of hiring a conference facility for one day consists of two parts, one which is fixed and the other varies as the number of participants n attending the conference. If Kshs 45000 is charged for hiring the facility for 100 participants and Kshs 40000 for 60 participants, Find the number of participants if 63000 is used to hire the facility   [3marks]

6. Juma a form 2 student was told to pick two number x and y from a set of digits 0, 1, 2, 3, 4, 5 and 6. Find the probability that $|x - y|$ is atleast 3.   [3marks]

7. Given that the matrix $\begin{pmatrix} 3x & x \\ x-6 & -3 \end{pmatrix}$ maps a triangle A(0,0), B(2,1) and c(3,5) on to a straight line. Find the possible values of x.   [3marks]

8. The points with co-ordinates A(13,3) and B(-3,-9) are the end of diameter of a circle centre O. Determine ;
   (i)   The coordinates of O   [1mark]

(ii)   The equation of the circle expressing it in the form
$x^2 + y^2 + ax + by + c = 0$ [3 marks]

9. Two containers have base areas of 750cm^2 and 120cm^2 respectively. Calculate the volume of the larger container in litres given that the volume of the smaller container is 400cm^3.   (3 marks)

10. The cash price of a laptop is 4800. Wambui bought it on hire purchase by making a deposit of kshs. 10000 followed by 24 monthly instalments of kshs 2000 each. Calculate the monthly rate at which compund interest was charged   [3 marks]

11. A merchant blends 350kg of KAKUZI tea costing shs. 84 per kg with 140 kg of KETEPA tea costing sh.105 per kg. calculate the price at which he must sell 1kg of the mixture to attain 20 % profit.   [3 marks]

12. The graph below is part of the straight line graph obtained from the initial equation
$V = aP^n$
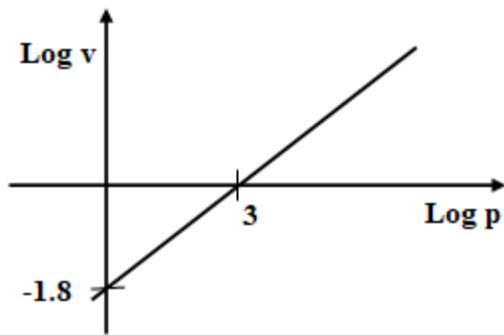
Write down the equation of a straight line in the form of $y = mx + c$ hence use the graph to find the of **a** and **n** [3 *marks*]

13. State the amplitude, period and phase angle of $y = 2\sin\left(\frac{1}{2}x + 30^0\right)$

(i) Amplitude (1 mark)

(ii) Period (1 mark)

(iii) Phase angle (1 mark)

14. Given the position vectors $\overrightarrow{OA} = 4i + 8j - 2k$ and $\overrightarrow{OB} = 3k - i - 2j$. Point C divides vector AB in the ratio of 3:-1. Find the magnitude of $\overrightarrow{OC}$. Give your answer to 2dp

[3 *marks*]

15. The table below shows income tax rates in a certain year

Monthly income in Kshs	Tax rate in each kshs
$1 \leq x < 9681$	10%
$9681 \leq x < 18801$	15%
$18801 \leq x < 27921$	20%
$27921 \leq x < 37040$	25%
Over 37040	30%

In a certain month of the year Mr. Mogaka had a total deduction of ksh5,000, he got a personal tax relief of kshs.1056 and paid kshs.3944 for NHIF, WCPS and sacco loan repayment. Calculate

(i)   P.A.Y.E.   (1 mark)

(ii)   Monthly income/salary   (3 marks)

16. In the figure given below, O is the centre of circle. If $\angle BCA = 80^0$ and $\angle CBO = 10^0$.
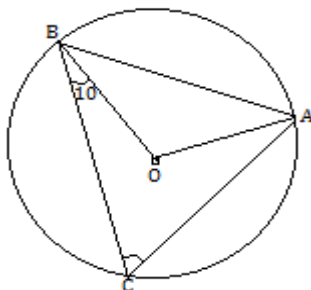
Determine the size of $\angle CAB$.   (3 marks)

Section II (50 Marks)
Answer ONLY FIVE questions in the section in the space provided:

17. In the figure below $\overrightarrow{OB} = \underset{\sim}{b}; OC = 3\overrightarrow{OB}$ and $OA = \underset{\sim}{a}$
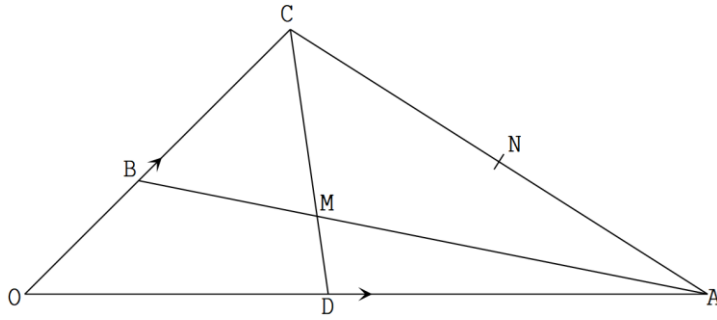
a) Given that $\overrightarrow{OD} = \frac{1}{3}\overrightarrow{OA}$ and $\overrightarrow{AN} = \frac{1}{2}\overrightarrow{AC}$, $\overrightarrow{CD}$ and $\overrightarrow{AB}$ meet at M. Determine in terms

a
~

and b.
~

   i) $\overrightarrow{AB}$ (1 mark)

   ii) $\overrightarrow{CD}$ (1 mark)

b) Given that $\overrightarrow{CM} = k\,\overrightarrow{CD}$ and $\overrightarrow{AM} = h\,\overrightarrow{AB}$. Determine the values of the scalars k and h

   .   (5 marks)

c) Show that O, M and N are collinear.   (3 marks)

18. The table below shows the marks scored by form four students in a mathematics test
    in Amani secondary school.

Marks	Mid-point X	Frequency f	$d = x - A$	fd	d^2	fd^2
40-44		3				
45-49		30				
50-54		29				
55-59		33				
60-64		13				
65-69		1				
70-74		1				

$$\sum f = \qquad\qquad \sum fd = \qquad\qquad \sum fd^2 =$$

Using an assumed mean of 57
   a) Complete the table   (4 marks)
   b) Determine
      i)   the mean mark   (2 marks)

      ii)   The standard deviation   (2 marks)

   c) Find the mark scored by the 50th student.   (3 marks

19. An arithmetic progression AP has the first term a and the common difference d.
(a)   Write down the third, ninth and twenty fifth terms of the AP in terms of a and d.
                                                                                          (2marks)

(b)   The AP above is increasing and the third, ninth and twenty fifth terms form the first three consecutive terms of a geometric progression (G.P). The sum of the seventh and twice the sixth term of AP is 78. Calculate

        (i)   The first term and common difference of the A.P   (5marks)

        (ii)   The sum of the first 5 terms of the G.P   (3marks)

20. (a) (i) Taking the radius of the earth, R=6370km and $\pi = \frac{22}{7}$, calculate the shortest distance between two cities P(60^0N, 29^0W) and Q(60^0N, 31^0E) along the parallel of latitude.   (3marks)

     (ii)   If it is 1200hrs at **P**, what is the local time at **Q**   (3marks)

(b) An aeroplane flew due south from a point A(60^0N, 45^0E) to a point B, the distance covered by the aeroplane was 8000km, determine the position of B. (4marks)

21. (a) Complete the table below to 2 decimal places. (2mks)

X	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
– Cos x	– 1		– 0.5		0.5	0.87		0.87			-0.5	– 0.87	
Sin (x – 30^0)		0.0	0.5			0.87	0.5		– 0.5			– 0.87	– 0.5

(b) Draw the graphs of $y = sin\ (x - 30°)$ and y= – Cos x on the same axes, for $0^0 \le x \le 360^0$. (5mks)
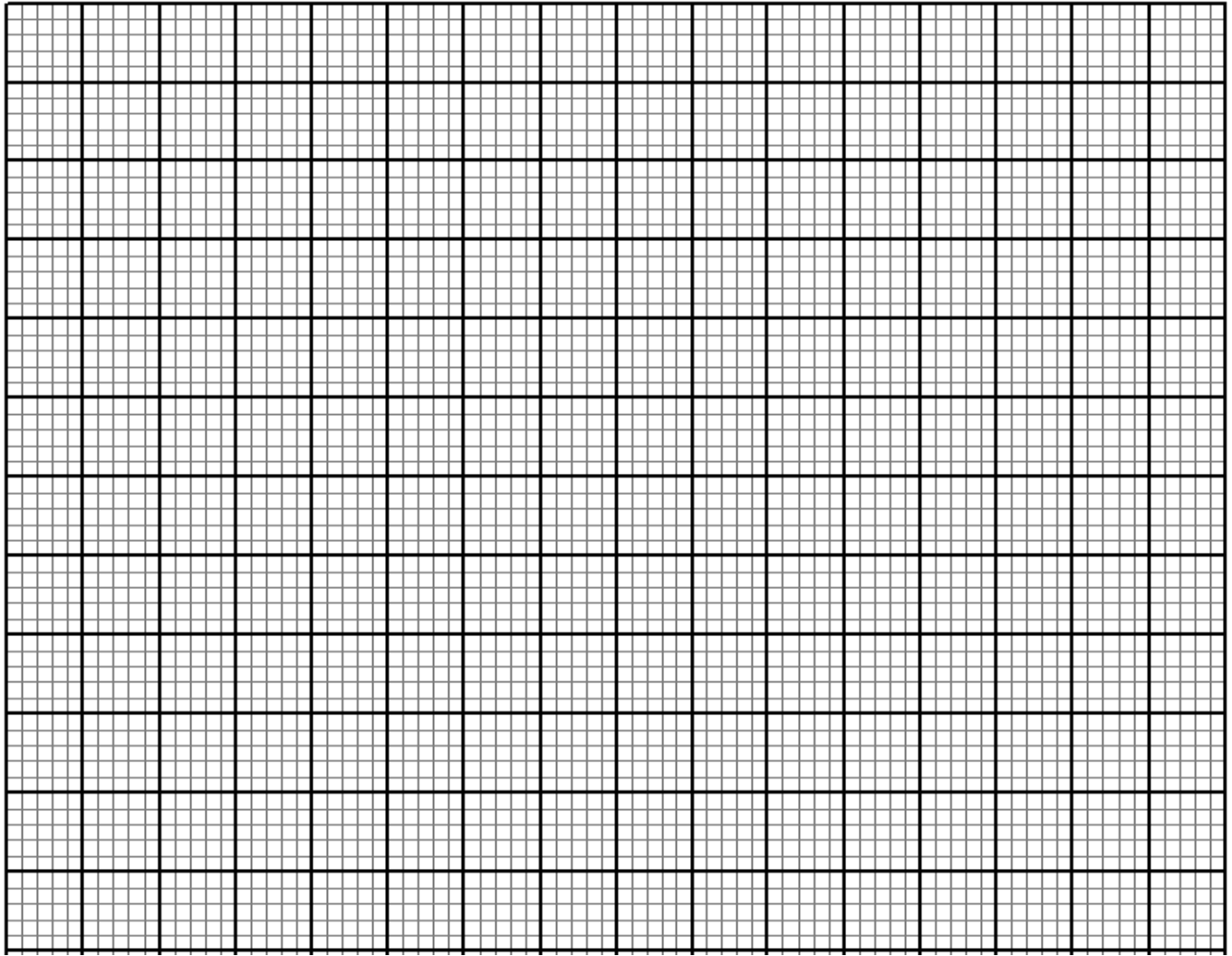
d) Use your graph to solve the equation s

(i) $\sin (x - 30^\circ) + \cos x = 0$. (2marks)

(ii) $-\cos x = 0.5$ (1 marks)

22. Kamau, Njoroge and Kariuki are practicing archery. The probability for Kamau hitting the target is $\frac{2}{5}$, that of Njoroge hitting the target is $\frac{1}{4}$ and that of Kariuki hitting the target is $\frac{3}{7}$.

Find the probability that in one attempt;

a) Only one hits the target (2marks)

b) All three hit the target (2marks)

c) None of them hits the target   (2marks)

d) Two hit the target   (2marks)

e) At least one hits the target   (2marks)

23. Figure below is a pyramid on a rectangular base. PQ=16cm, QR = 12cm and VP = 13cm.
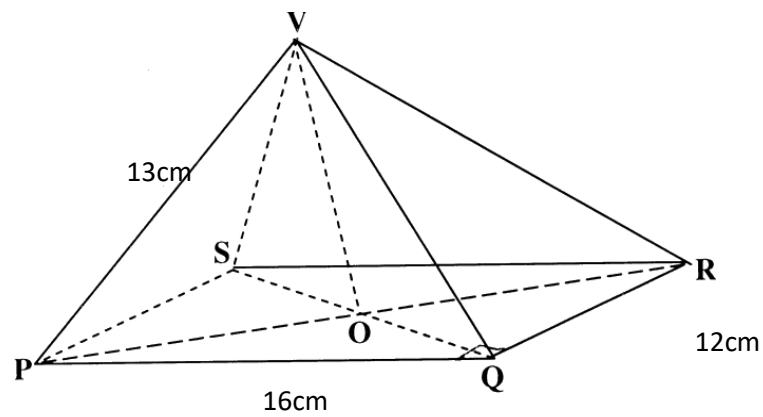
Find

(a) The length of **QS**.   (2marks)

(b) The height of the pyramid to 1 decimal place.   (2marks)

(c) The angle between **VQ** and the base.   (2marks)

(d) The angle between plane **VQR** and the base.   (2marks)

(e) The angle between planes **VQR** and **VPS**   (2marks)

24. **ABCD is** a quadrilateral with vertices as follows: **A** (3, 1), **B** (2, 4) **C** (4, 3) and **D** (5, 1)
(a) (i) On the grid provided draw the quadrilateral **ABCD** and the image **A'B'C'D'** under a transformation With matrix $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$. Find the co-ordinates of **A'B'C'D'** (3marks)
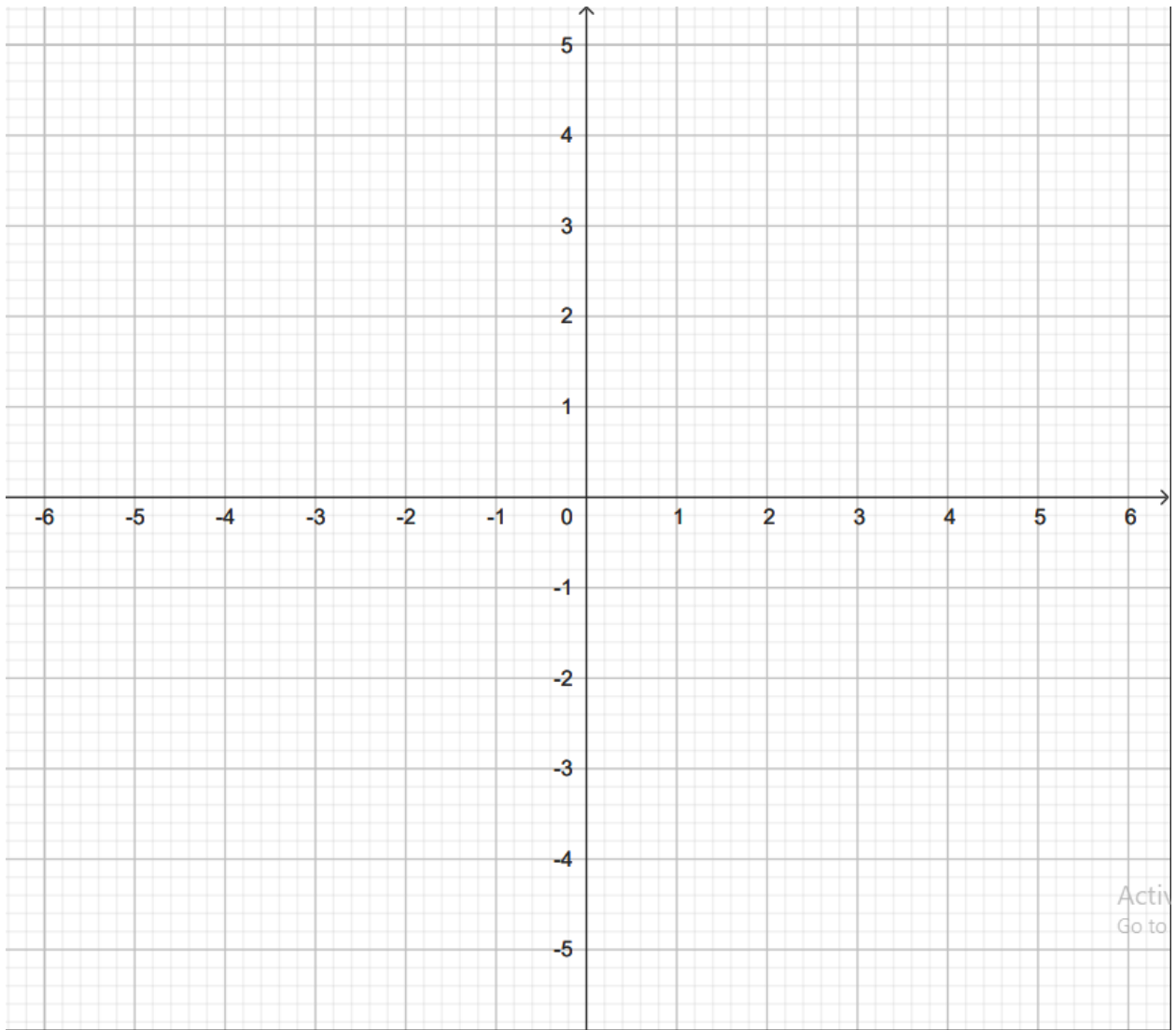
(ii) Describe the transformation that maps **ABCD** onto **A'B'C'D'** fully   (1mark)

(b) A transformation represented by the matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ maps **A'B'C'D'** onto **A''B''C''D''** find the co-ordinates of **A''B''C''D''.** Plot **A''B''C''D''** on the same grid.
(3marks)

(c) Determine a single transformation that maps **A''B''C''D''** onto **ABCD**. Describe this
transformation fully.   (3marks)

NAME:………………………………………..   INDEX NO…………………

SCHOOL:……………………..………   STREAM:……… ADM:………….

CANDIDATE'S SIGN ………………..… DATE …………TARGET……………..

121/2
MATHEMATICS PAPER 2

TIME: 2 HOURS 30 MINUTES

SERIES 7 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES:

- Write your **name**, **admission numbe**r and write **date** of examination in the spaces provided
- The paper contains **two** sections. Section I and Section II.
- Answer **ALL** the questions in section I and any **five** questions in section II.
- Answers and working **must** be written on the question paper in the spaces provided below each question.
- Show all steps in your calculations below each question.
- Marks may be given for correct working even if the answer is wrong.
- Non programmable silent electronic calculators and KNEC mathematical table may be used, except where stated otherwise.

FOR EXAMINERS USE ONLY

SECTION I

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**TOTAL**
Marks																	

SECTION II

Question	17	18	19	20	21	22	23	24	**TOTAL**
Marks									

GRAND TOTAL

SECTION I: 50 MARKS

ANSWER ALL QUESTIONS IN THIS SECTION

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

1. Solve for x in the equation
   $2\sin^2 x - 1 = \cos^2 x + \sin x$ for $0 \leq x \leq 360$ (3 Marks)

2. (a) Expand $\left(1 + \frac{3}{x}\right)^5$ upto the fifth term   (2 Marks)

   (b) Hence use your expansion to evaluate the value of $(2.5)^5$ to 3 d.p.
                                                                              (2 Marks)

3. Make p the subject of the formula   (3 Marks)

   $$E + m = m + \sqrt{\frac{p - 3u}{y - 3mp}}$$

4. A object A of area 10cm^2 is mapped onto its image B of area 60cm^2 by a transformation whose matrix is given by
   P= $\begin{Bmatrix} x & 4 \\ 3 & x + 3 \end{Bmatrix}$. Find the possible value of   (3 Marks)

5. A variable Z varies directly as the square of X and inversely as the square root of Y. Find the percentage change in Z if X increased by 20% and Y decreased by 19% (3 Marks)

6. A circle whose equation is $(x - 1)^2 + (y - k)^2 = 10$ passes through point (2,5). Find the coordinates of the two possible centres of the circle.(3marks)

7. Juma deposited Sh. 45 000 in a bank which paid interest at 12% p.a compounded monthly. Calculate the amount of interest after 3 years

   (3 Marks)

8. (a) Find the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 3 & 5 \end{pmatrix}$ (1 Mark)

   (b) Hence solve the simultaneous equation below using matrix method (3 Marks)

4x + 3y = 6
5y + 3x − 5 = 0

9. Given that P=4+$\sqrt{2}$ and Q=2+$\sqrt{2}$ and that $\frac{P}{Q}$=a+b$\sqrt{c}$, where a, b and c are constants, find the values of a, b and c.   (3 marks)

10.   Find the value of x that satisfies the equation:
     $log_3(x + 24) − 2 = log_3(9 − 2x)$
                                                                      (3 marks)

11.   Under a shear with x-axis invariant the point (3,2) is mapped onto (-2,2). Find the image of point (4,4) under the same transformation.(3marks)

12.   The data below shows the marks obtained by ten students in a test.
      71, 55, 69, 45, 65, 57, 71, 82, 55, 50
      Find the quartile deviations.   (3 marks)

13. A bag contains 4 green, 9 purple and 18 blue balls. The balls are identical except for the colour. Two balls are picked at random, one at a

time without replacement, find the probability that, a blue ball and a green ball are picked. (3 marks)

14. Find the equation of the tangent to the curve $y = x^2 + 2x + 3$ at the point where the gradient is equal to 4. (3 marks)

15. The radius of a spherical ball is 2.5cm correct to one decimal place. Calculate the percentage error in calculating the surface area of the ball (3 marks)

16.
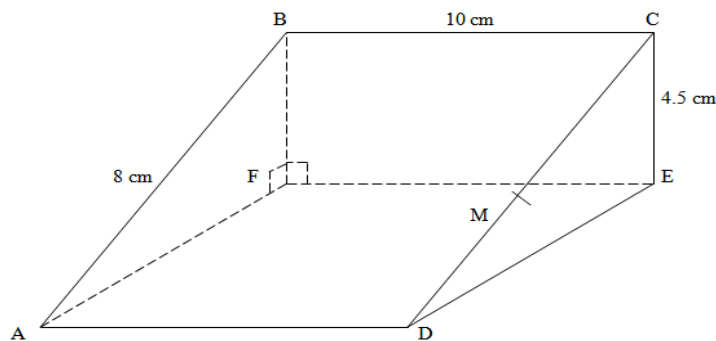
The above diagram represents a wooden prism. ABCD is a rectangle. Points E and F are directly below C and B respectively. M is the mid-point of CD. AB = 8 cm, BC = 10 cm and CE = 4.5 cm. Calculate the Angle CAE makes with the plane ADEF (3marks)

SECTION II: 50 MARKS

ANSWER ANY 5 QUESTIONS IN THIS SECTION

17.   In the figure below, OA = $\tilde{a}$ and OC = $\tilde{c}$. CB = $\frac{2}{3}OA$ and B divides CD in the ratio 3: 1
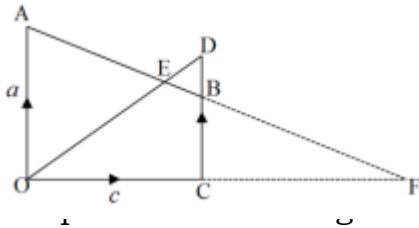
rs in terms of **a** and **c** only:

   (i)   **AB**   (1 mark)

   (ii)   **OD**   (2 marks)

(b)   Given that **OE**=h**OD** and **AE**=k**AB** where h and k are scalars express OE in two different ways hence find the scalars h and k.
                                                                                          (5 marks)

(c)   If OC produced meets AB produced at F, find **OF** . (3 marks)

18.   (a) The 5th term of an AP is 82 and the 12th term is 103. find:
       (i) the first term and common difference.   (3marks)

       (ii) the sum of the 21 terms.   (2 marks)

(b) A stair case was built such that each subsequent stair has a uniform difference in height. The height of the 6th stair from the horizontal floor was 85 cm and the height of the 10th stair was 145. Calculate the height of the 1st stair and the uniform difference in height of the stairs.   (3 marks)

(c)During the construction of the staircase, each step was supported by a vertical piece of timber. If the staircase has 11 stairs, calculate the total length of timber used.   (2 marks)

19.(a) Complete the table below given that $y = -x^2 + x + 12$ for $-4 \leq x \leq 5$ (2 marks)

X	-4	-3	-2	-1	0	1	2	3	4	5
Y	8				12	12				

(b) On the grid provided below, draw the graph of $y = -x^2 + x + 12$ for $-4 \leq x \leq 5$

Scale: 1 cm represents 1 unit on the x – axis and 1 cm represents 2 units on the y – axis.   (4 marks)
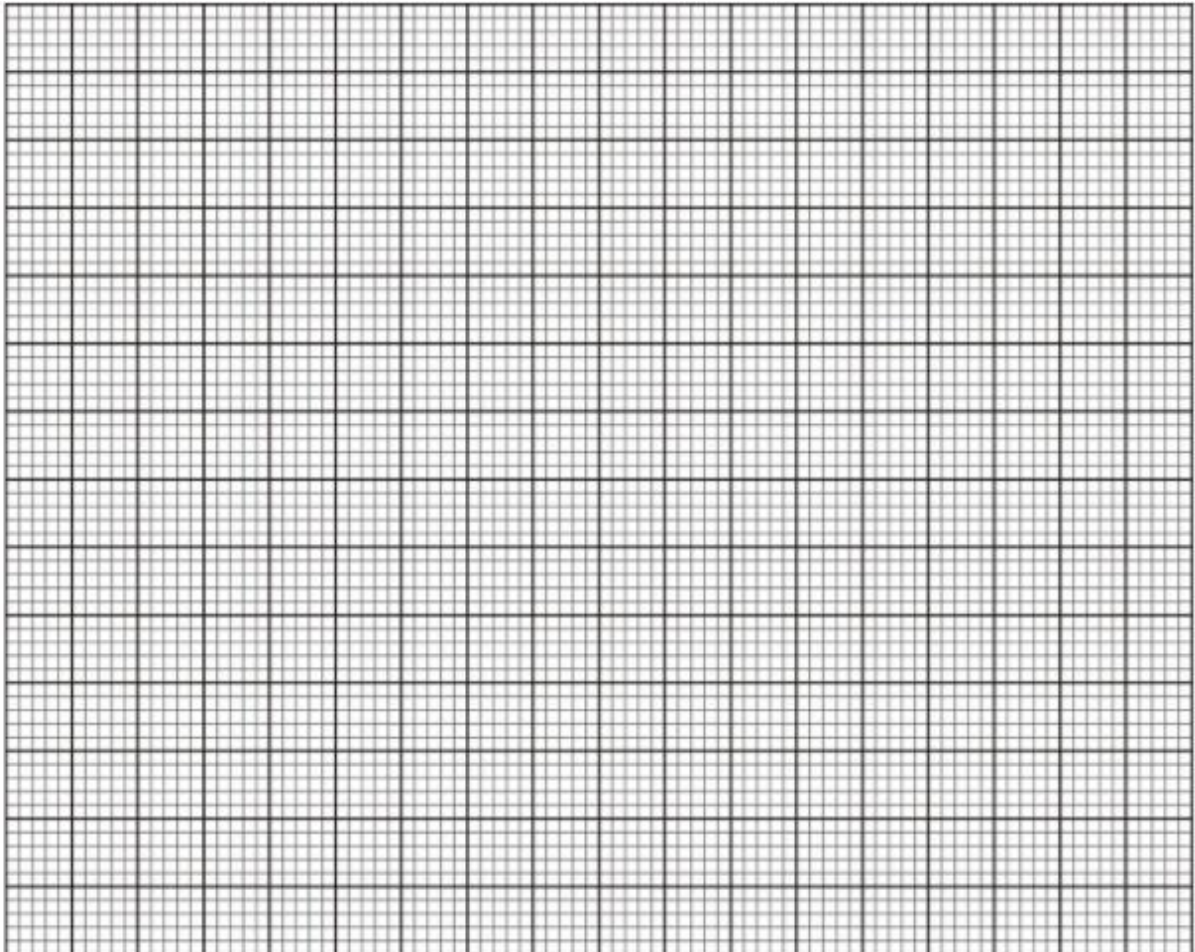
(c)Using your graph, to Solve the equation $x^2 - 3x - 10 = 0$ (2 marks)

ii. State the range of values of x for which $-x^2 + x + 12 \geq 0$ (1 mark)

(d) Estimate the coordinates of the turning point of the curve $y = -x^2 + x + 12$
(1 mark)

20.An aircraft leaves town $P(30°S, 17°E)$ and moves directly to town $Q(60°N, 17°E)$. 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.   (3 marks)

(b) The position of town R.   (3 marks)

(c) The local time at R if the local time at Q is 3:15 p.m   (2 marks)

(d) The total distance moved from P to R in km. Take 1nm=1.853 km
                                                      (2 marks)

21. Using a ruler and compasses only.

    (i) Construct a parallelogram ABCD such that AB = 10cm, BC = 7cm
        and angle ABC = 105°.   (3 marks)

(ii) Construct the loci of P and Q within the parallelogram such that 6cm. $AP \leq 4cm$ and $BQ \leq 6cm$ (3 marks)

(iii)Calculate the area within the parallelogram but outside regions bounded by the loci of P and Q. (4 marks)

22. Below is the histogram representing marks obtained in Mathematics test
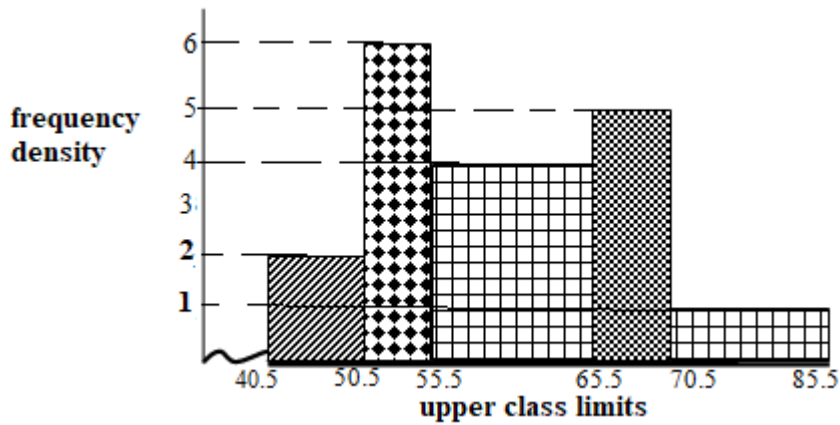
(a) Develop a frequency distribution table for the data (3 Marks)

(b)   Using an assumed mean of 60.5 find the mean. (3 marks)

(c) Calculate Standard deviation.   (4marks)

23.(a) Use the mid ordinate rule with 5 strips to estimate the area bounded
   by the curve $y = x^2 - 3x - 4, x = -2, x = 3$ and $x - axis$ (3 marks)

(b)Calculate the exact area above   (5 marks)

(c) Find the percentage error involve in using the mid-ordinate role.
                                                                      (2 marks)

24. Eldoret Airport is planning to build a fire fighting plant on a space of 250m². Two types of machines are to be installed, machine x which occupies a space of 5m² and machine Y which occupies 10m². The airport can have a maximum of 40 machines at a time. At most 15 machines of type Y are used at any given time.

a) Write down three inequalities other than x>0, and y>0. (3marks)

b) On the grid below, show the region satisfying the given conditions.

(4marks)
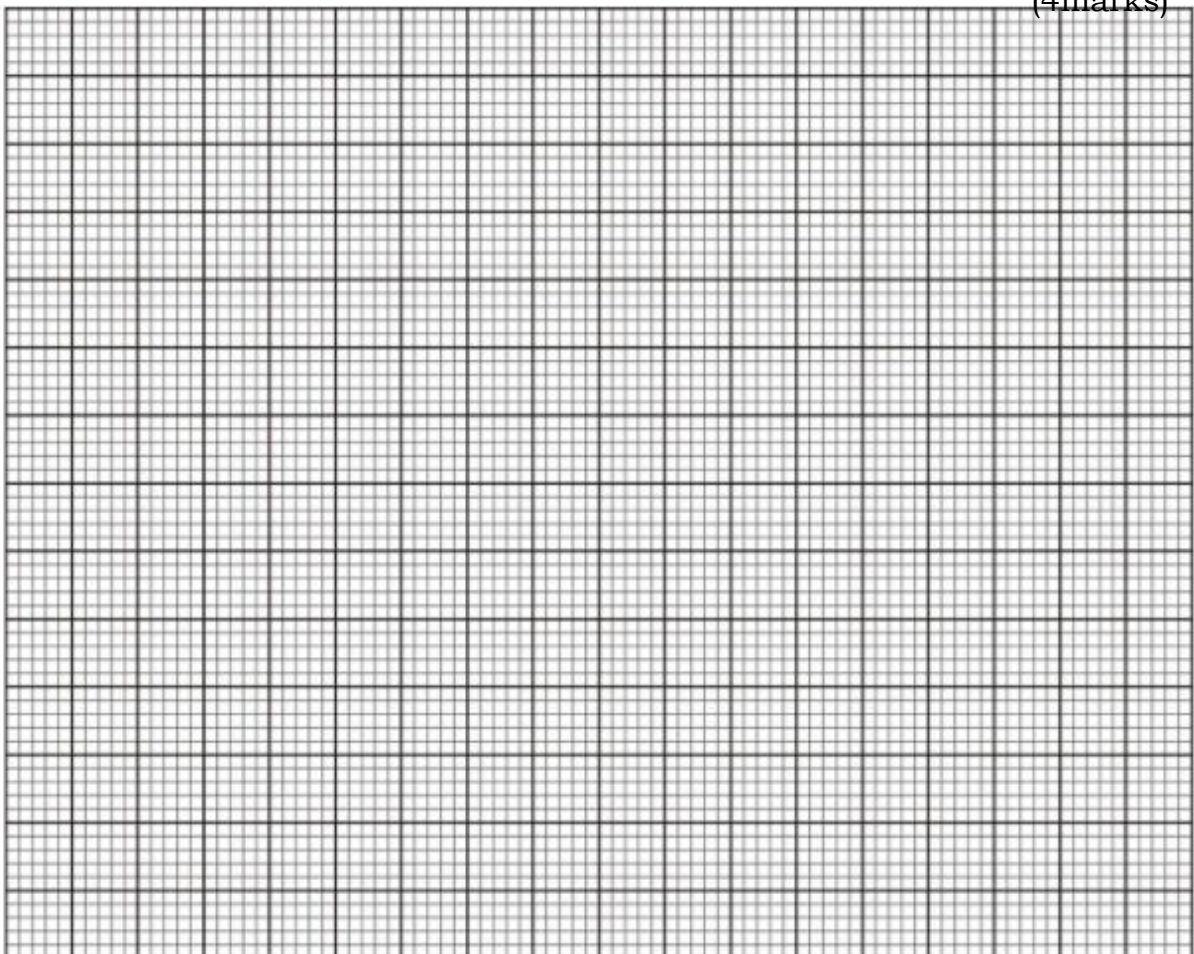
c) The profit from a type x machine is Ksh 1000 and that of type y is Ksh 4000. Use the graph to obtain the number of machines of each type that should be installed to obtain maximum profit. Calculate the maximum profit.
(3marks)

121/2
MATHEMATICS ALT A
TIME: 2½ HOURS

SERIES 8 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES

s) Write your name, index number and date in the spaces provided at the top of this page.

t) Write name, admission number and class in the spaces provided above.

u) This paper contains **TWO** sections: **section I** and **section II**

v) Answer **ALL** the questions in **Section I** and only **five** questions from **section II.**

w) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.**

x) Marks may be given for correct working even if the answer is wrong.

y) **Non-programmable** silent electronic calculators and KNEC mathematical tables may be used except where stated otherwise.

z) **This paper consists of 15 printed pages.**

aa) **Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.**

FOR EXAMINER'S USE ONLY:

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	**TOTAL**

Section II   **GRAND TOTAL**

17	18	19	20	21	22	23	24	**TOTAL**

SECTION 1 (50 MARKS)
Answer all questions in this section in the spaces provided.

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

1. A positive two digit number is such that the product of the digits is 24. When the digits are reversed, the number formed is **greater** than the original number by 18. Find the number. (3mks)

2. Use tables of squares, square roots and reciprocals to evaluate (4mks)

$$\frac{234}{\sqrt{0.02698}} + \frac{16}{(0.18149)^2}$$

3. The height and radius of a cone are measured as 21 cm and 14.0 cm respectively. Taking $\pi = 3.142$, find the **percentage error** in the volume of the cone. (3mks)

4. Express the following in **surd form** and simplify by rationalizing the denominator without using a calculator and leave your answer in the form $a + b\sqrt{c}$ (3mks)

$$\frac{1 + Cos\ 30^0}{1 - Sin\ 60^0}$$

5. Solve for **x** in: $Log_2(x + 7) - Log_2(x - 7) = 3$ (3mks)

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181

6. A businessman obtained a loan of Ksh 450,000 from a bank to buy a Matatu that was valued at the same amount. The bank charges interest at 24% per annum compounded quarterly per year. Calculate the **total amount** of money the businessman paid to clear the loan in $4\frac{1}{2}$ years to the nearest shilling. (3mks)

7. In the diagram below, BT is a tangent to the circle at B. AXCT and BXD are straight lines. AX = 6cm, CT = 8cm, BX = 4.8cm and XD = 5cm.
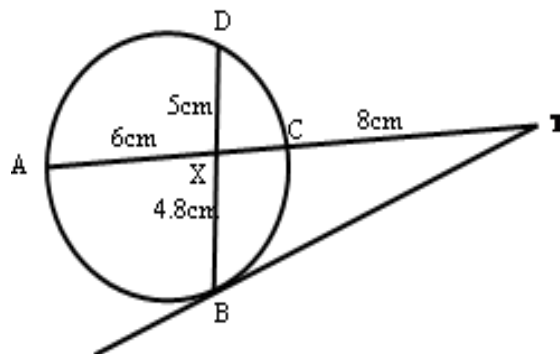
Find the length of **BT**. (3Marks)

8. Find the possible values of x given that $\begin{pmatrix} x+8 & 8 \\ 6 & x \end{pmatrix}$ is a **singular** matrix. (3mks)

9. The cost C of operating an electronic business is partly constant and partly varies as the square of labour input L. If **C=25,000** when **L=20** and **C=45,000** when **L=30**. Find **C** when **L=8.**   (3Mks)

10. The **2nd, 4th** and **7th** terms of an A.P. are the first 3 consecutive terms of a G.P. Find the **common ratio** of the G.P if the common difference of the A.P. is 2.   (3mks)

11. P and Q are two points such that OP=i + 2j + 3k and OQ = 4i + 5j – 3k. M is a point that divides PQ externally in the ratio 3:2. Find the co-ordinates of M, given that O is the origin.   (3mks)

12. A circle Centre C (5, 5) passes through points A (1, 3) and B (a, 9). Find the equation of the circle and hence the possible values of a.   (4mks)

13. Tap A can fill an empty tank in 3 hours, while tap B can fill the same tank in 2 hours. When the tank is full, tap C can empty the tank in 5 hours. Tap A and C are opened for 4 hours and then closed.

   a) Determine the fraction of the tank that is still empty.   (1mks)

   b) Find how long it would take to fill the remaining fraction of the tank if all the three taps are opened.   (2mks)

14. Determine the interquartile range for the following set of numbers.   (2mks)
      4, 9, 5, 4, 7, 6, 2, 1, 6, 7, 8.

15. Solve the equation $\sin(3x - 10)^0 = 0.4337$ for $0^0 \leq \Theta \leq 180^0$ (3mks)

16. (a) Expand and simplify $(3x - y)^4$ (2mks)

(b) Use the first three term of the expansion to approximate the value of $(6 - 0.2)^4$ (2mks)

17. Mrs. Mutua earns a basic salary of K£ 12,000 p.a. and is housed by the employer at a nominal rent of Shs 1,200 per month. She is entitled to a personal relief of K£ 1,320 p.a. and a premium relief of 10% on her insurance premium of K£ 800 p.a. The table of tax rate is as below.

Taxable income (K£ p.a.)	Rate (%)
1 – 2100	10
2101 – 4200	15
4201 – 6300	20
6301 – 8400	25
Over 8400	30

Calculate;
   a) Calculate the net tax per annum.   (7mks)

   b) Other deductions includes W.C.P.S Shs 600 per month, NHIF Shs. 500 per month. Calculate her net pay per month.   (3mks)

18. The Line AB = 5cm is a side of a triangle ABC in which angle ABC = 90º and angle BAC = 60º.

a) Construct triangle ABC (2mks)

b) Construct the Locus P such that angle APB = angle ACB (2mks)

c) Locate by construction points Q1 and Q2 which satisfy the conditions below:

    (i) Q1 and Q2 lie on the same side of line AB and C   (3mks)

    (ii) Area of triangle AQ1B=Area of triangle AQ2B= 3/4 Area of triangle ABC

    (iii)Angle AQ1B=Angle AQ2B =30º

  Measure the length of the line Q1Q2 (3mks)

d) Calculate the area above the line Q1Q2 bounded by the locus of point P   (3mks)

19. The diagram below shows a square based pyramid **V** vertically above the middle of the base. **PQ** = 10cm and **VR** = 13cm. **M** is the midpoint of **VR**.

Find to 2 decimal places
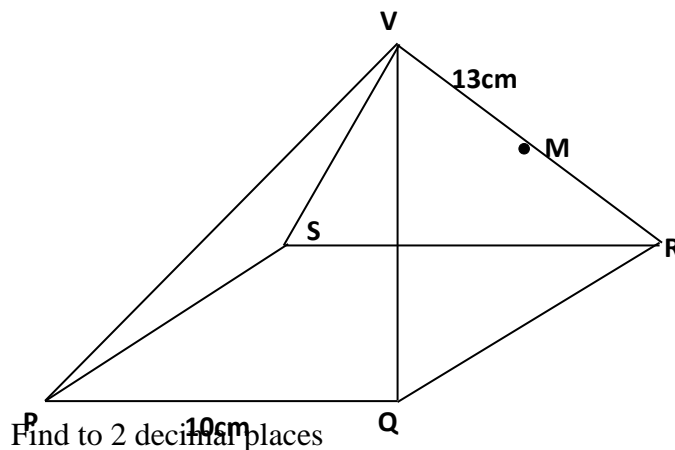
(a)   (i)   the length **PR**.   (2mks)

(ii)   The height of the pyramid.   (2mks)

(b)   (i)   the angle between **VR** and the base **PQRS**.   (2mks)

(ii)   The angle between **MR** and the base **PQRS**.   (2mks)

(iii)   The angle between the planes **QVR** and **PQRS**.   (2mks)

20. a) Complete the table below for y=sin 2x and y=sin (2x + 30) giving values to 2d.p
                                                                      (2mks)

X	0	15	30	45	60	75	90	105	120	135	150	165	180
Sin 2x	0				0.87				-0.87				0
Sin (2x +30)	0.5				0.5				-1				0.5

b) Draw the graphs of y=sin 2x and y = sin (2x + 30) on the axis.

(4mks)
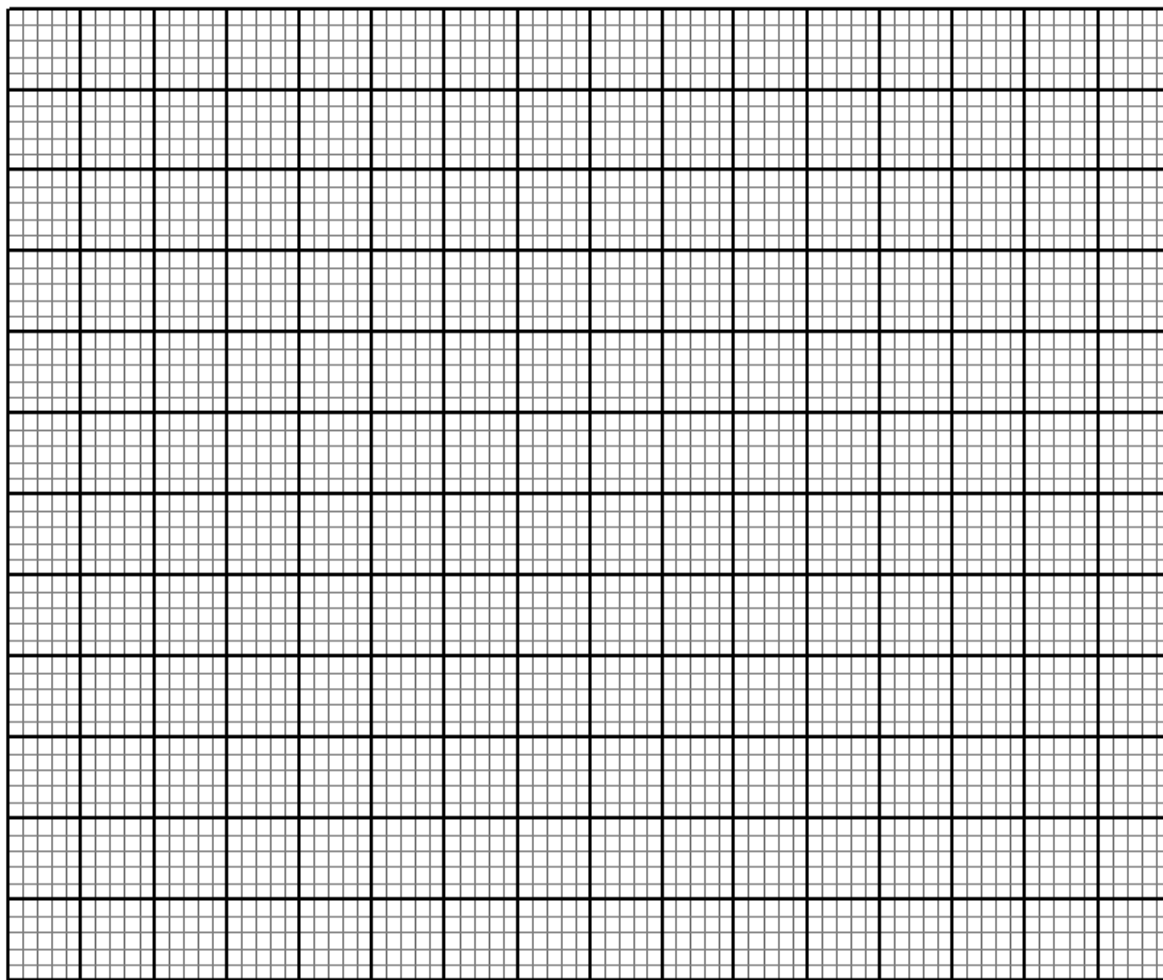
c) Use the graph to solve $sin\ (\ 2x\ +\ 30) - sin\ 2x\ =\ 0$

(1mk)

d) Determine the transformation which maps $sin\ 2x\ onto\ sin\ (2x\ +\ 30)$ (1mk)

e) State the period and amplitude of $y\ =\ sin\ (\ 2x\ +\ 30)$

(2mks)

21. OABC is a parallelogram with verities 0(0,0), A(2,0) B(3,2) and C(1,2). O,A,B,C   is the image of OABC under transformation matrix.$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$
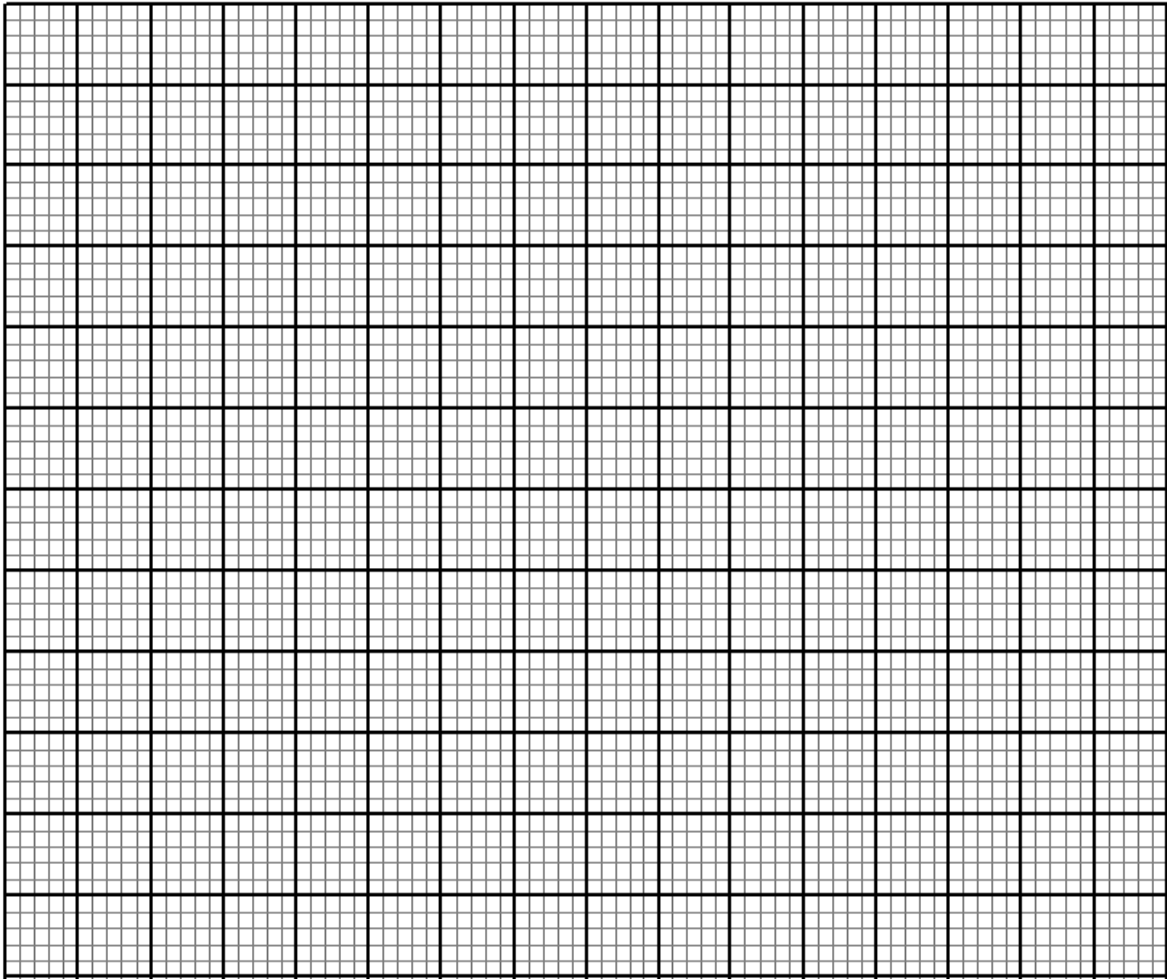
a) Find the coordinates of $O^1A^1B^1C^1$ (2mks)

ii) On the grid provided, draw OABC and $O^1A^1B^1C^1$ (2mks)

b) Find $O^{11}A^{11}B^{11}C^{11}$, the image of $O^1A^1B^1C^1$ under transformation matrix $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$ (2mks)

ii) On the same grid draw $O^{11}A^{11}B^{11}C^{11}$ (1mk)

c) Find a single matrix that maps $O^{11}A^{11}B^{11}C^{11}$ onto OABC (3mks)

22. The following table shows the distribution of marks obtained by 50 students in a test.

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

By using an assumed mean of 62, calculate

a) The mean   (5mks)

b) The variance   (3mks)

c) The standard deviation   (2mks)

23. A box contains 3 brown, 9 pink and 15 white cloth pegs. The pegs are identical except for the colour.
   (a)   Find the probability of picking.
       (i)   A brown peg.   **(1mark)**

       (ii)   A pink or a white peg.   **(2 marks)**

(b)   Two pegs are picked at random, one at a time without replacement.
Find the probability that:

(i)   Atleast one brown peg is picked   **(4marks)**

(ii)   both pegs are of the same colour.   **(3marks)**

24. A wholesaler stocks two types of rice: Refu and Tamu. The wholesale prices of 1 kg of Refu and 1 kg of Tamu are Ksh 80 and Ksh 140 respectively. The wholesaler also stocks blend A rice which is a mixture of Refu and Tamu rice mixed in the ratio 3 : 2.

a.   (i)   A retailer bought 10 kg of blend A rice. To this blend, the retailer added some Tamu rice to prepare a new mixture blend X. The ratio of Refu rice to Tamu rice in blend X was **1:2.**

Determine the amount of Tamu rice that was added   (3marks)

(ii)   The retailer sold blend X rice making a profit of 20%. Determine the selling price of 1 kg of blend X. (3 marks)

b.   The wholesaler prepared another mixture, blend B, by mixing x kg of blend A rice with y kg of Tamu rice. Blend B has a wholesale price of Ksh130 per kg.
Determine the ratio $x : y$.   (4mks)

NAME:……………………………………..   INDEX NO…………………

SCHOOL:……………………..………   STREAM:……… ADM:………….

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Kenya Certificate of Secondary Education

121/2
Paper 2
Mathematics
Time 2 ½ hours
SERIES 9 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES

1. Write your name, index number and class in the spaces provided above.
2. The paper contains two sections: **Section I** and **Section II**.
3. This paper contains **14 PRINTED** pages make sure all **PAGES ARE PRINTED** and **NON IS MISSING**
4. Answer **ALL** the questions in **Section I** and **ANY FIVE** questions from **Section II**.
5. All working and answers must be written on the question paper in the spaces provided below each question.
6. Marks may be awarded for correct working even if the answer is wrong.
7. Negligent and slovenly work will be penalized.
8. Non-programmable silent electronic calculators and mathematical tables are allowed for use.

For examiners use only

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total

TURN OVER

SECTION I   (50 marks)
Answer all the questions

1. Find matrix $\mathbf{X}$ given that $\mathbf{AX} - \mathbf{X} = \begin{pmatrix} -4 \\ -10 \end{pmatrix}$ where $A = \begin{pmatrix} 2 & 3 \\ -2 & 4 \end{pmatrix}$ (3 marks)

2. The cost of providing a commodity consists of transport, labour and raw material in the ratio 8: 4: 12 respectively. If the transport cost increases by 12 % labour cost 18 % and raw materials by 40 %, find the percentage increase of producing the new commodity (3 marks)

3. Find the number of terms in the series $\dfrac{8}{81} - \dfrac{4}{27} + \dfrac{2}{9} - \text{................} -1\dfrac{11}{16}$ (3marks)

4. Using binomial expansion simplify $\dfrac{\left(2+\sqrt{3}\right)^4}{\left(2-\sqrt{3}\right)^4}$ leaving your answer in the form $\mathbf{a+b\sqrt{c}}$

   where a, b and c are rational numbers   (3marks)

5. The figure below shows external intersection of two chords SM and NK which are produced to meet at P. Given that SOK is the diameter of the circle and that SM=15cm, MP=18cm and PK=22cm

FOR MARKING SCHEME CALL SIR ABRAHAM 0729 125 181
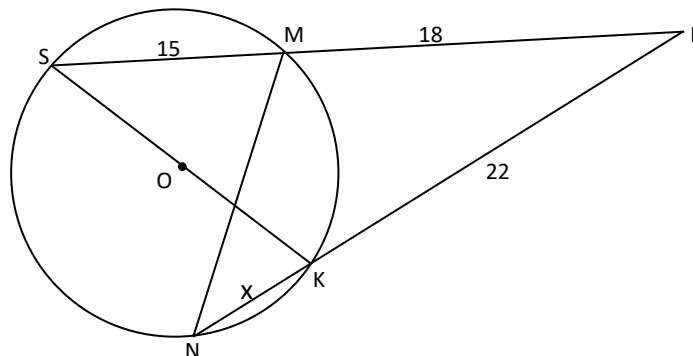
a). Calculate the value of x representing length of chord NK.   (1 marks)

b). Calculate the radius of the circle   (2marks)

6. Determine the equation of a circle if the coordinates of the end points of its diameter are
   A(–4,4) and B(6,–12) leaving your answer in the form of $\mathbf{ax^2 + by^2 + cx + dy + e = 0}$
   where a, b, c, d and e are integers.   (3 marks)

7. Make 'c' the subject of the formula if $v^2 = \frac{r}{3} + \sqrt{\frac{1+c^2}{r^2}}$ (3marks)

8. Find the area enclosed by the curve $y = 81 - x^2$ and the x −axis using mid-ordinate rule
   with 9 strips.   (4marks)

9. Without using a calculator or tables, find the value of x in   (3marks)
   $$\log_{2.5}\left(\frac{1}{x}\right) - 1 - \log_{2.5}(x) = 3\log_{2.5}\left(\frac{1}{x}\right) - \log_{0.5} 2$$

10. Solve for ϑ in the equation $6cos^2\vartheta - sin\vartheta - 4 = 0$ in the range
$-180^0 \leq \vartheta \leq 180^0$ (3 marks).

11. Wambua deposited 6,400 in an investment account which pays 30% interest rate per annum compounded semi – annually for 3 years. Muinde invested one and a half times that of Wambua at $12\frac{1}{2}\%$ per annum simple interest for 6 years. Find whose investment earned more interest and by how much give your answer to the nearest shilling. (3marks)

12. (a) Expand and simplify the binomial expression.   (2 Marks)

$$\left(2 - \frac{1}{2}y\right)^5$$

(b) Use the first four terms of the simplified expression in (a) above to evaluate to 5 significant figures. (1.98)5.   (2 Marks)

13. Use logarithms to evaluate $\sqrt[3]{\dfrac{5.27 \times \cos^2 82.48}{\log 6.7}}$ (3marks)

14. Form the quadratic equation whose roots are **x = -⁵/₃** and **x = 1** (2 marks)

15. A biased coin is weighted such that its tail is twice as likely to appear as the head. Find the probability that that a tail and a head appear when the coin is tossed twice. (3marks)

16. Line BC below is a side of a triangle ABC and also side of a parallelogram BCDE.

B _____ C
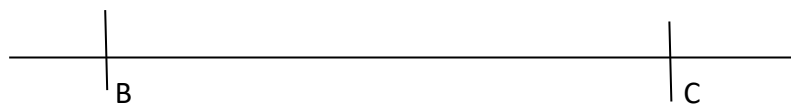
Using a ruler and a pair of compasses only construct:

(i)   The triangle ABC given that $\angle$ABC = 120^0 and AB = 6 cm.   (1 mark)

(ii)   The parallelogram BCDE whose area is equal to that of the triangle ABC and point E is on line AB.   (3 marks)

SECTION II (50 marks)
*Answer **only five** questions from this section*

17. ABCD is a quadrilateral with coordinates A (2, 1), B (3, 2), C (3, 4) and D (0, 3). ABCD is mapped onto A'B'C'D' under transformation **T** given by a shear with x – axis invariant such that A' (4, 1).

   a) Determine the $2 \: x \: 2$ transformation matrix representing **T** and hence determine the coordinates of B', C' and D'.   (2 marks)

b) A'B'C'D' is transformed to A"B"C"D" under a transformation **H** such that A"$(-6,-9)$ and D"$(-12,-15)$ Determine the $2x2$ matrix representing **H** and hence determine the coordinates of B" and C"   (3 marks)

c) A"B"C"D" mapped onto A'''B'''C'''D''' under a transformation **V** representing a reflection in the line **y = −x**. Determine the $2x2$ matrix representing **V** and hence determine the coordinates of A'''B'''C'''D''   (3 marks)

18. The following table shows heights of 200 seedlings of the same species measured to the nearest cm.

Height(cm)	frequency					
70- 79	7					
80-84	30					
85-89	66					
90-94	57					
95-99	27					
100-109	13					

a) Calculate the:-

i) Quartile deviation   3marks

b) Standard deviation using a working mean of 102   3marks

c) Draw an ogive curve representing the above information and use it to determine the percentage number of seedling whose height ranges between 85≤H≤93.   (4marks)
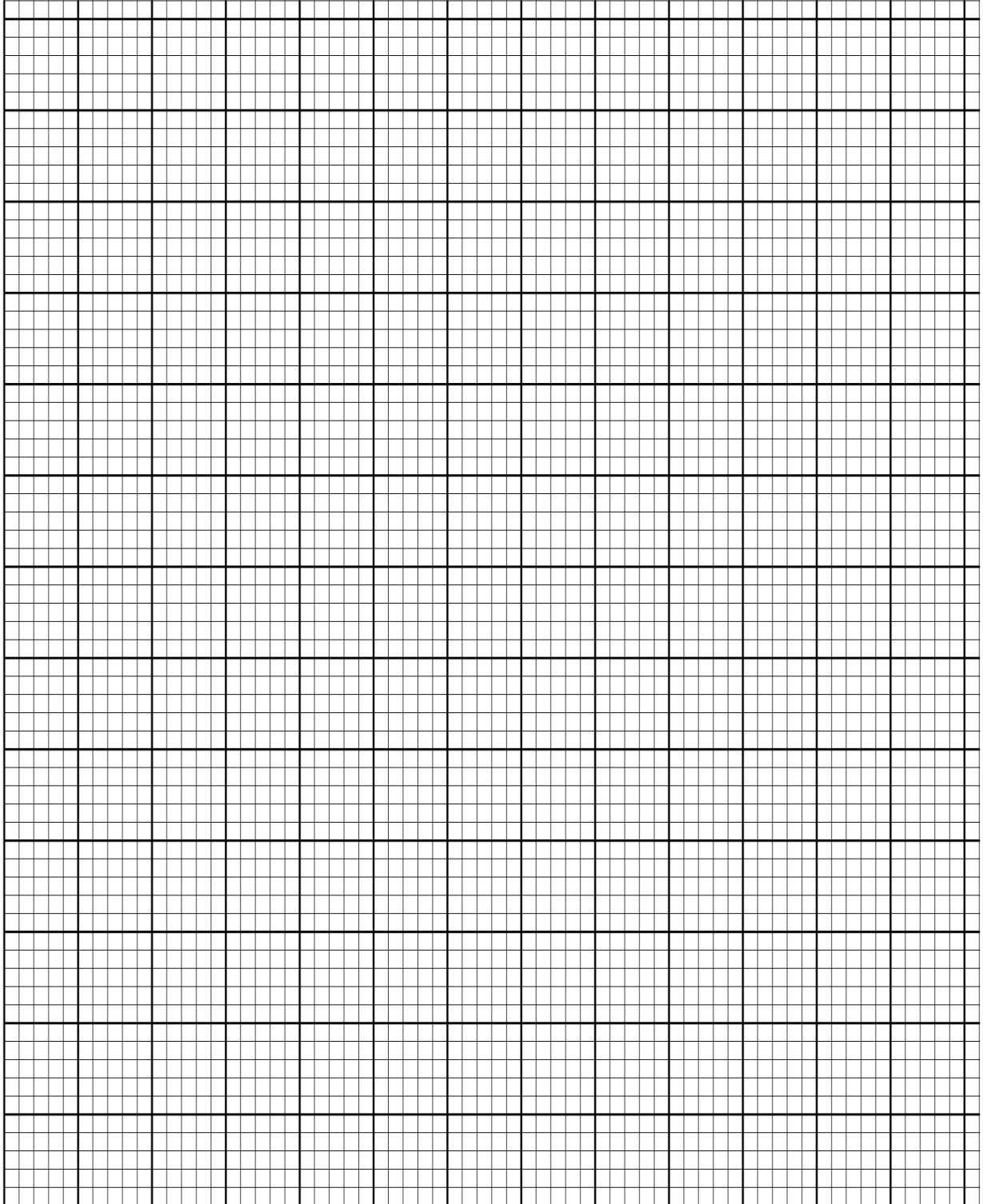
19. In order to ensure optimal health a lab technician needs to feed the rabbits on a daily diet containing a minimum of 24grams of fat, 36grams of carbohydrates and 4grams of

protein. Rather than order rabbit food that is custom blended it is cheaper to order food X and food Y and blend them for an optimal use. One packet of food X contains 6grams of fat ,12 grams of carbohydrates ,2 grams of proteins and costs Sh 50.While one packet of food Y contains 12grams of fat,12 grams of carbohydrates,1 gram of proteins and it costs Sh 60

a). Form all the inequalities to represent the information above.   (4 marks).

b). Graph all the inequalities   (4marks)
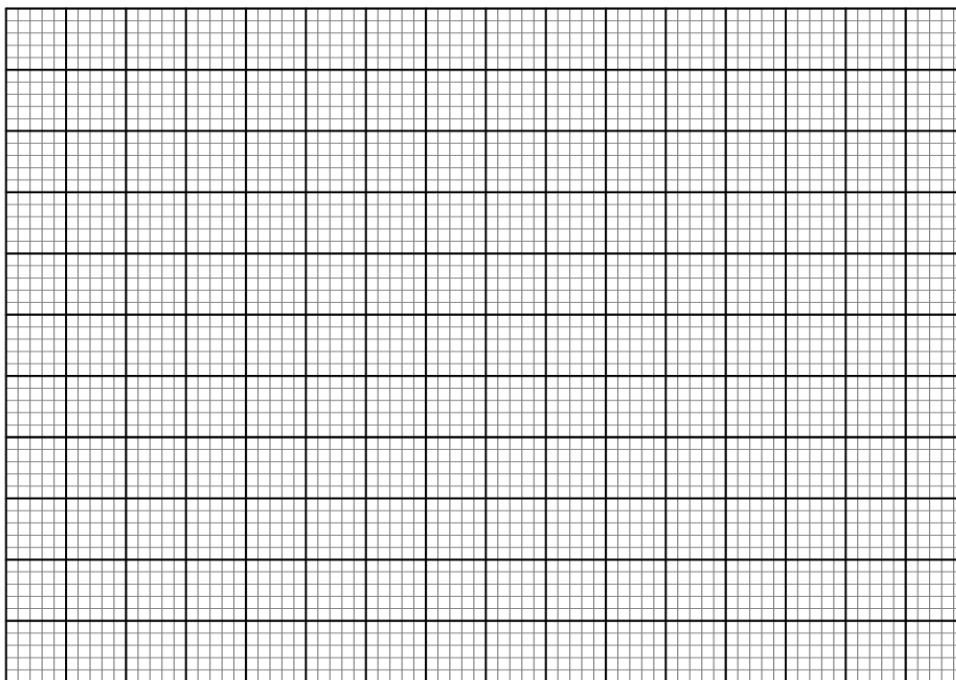
c). Determine the number of packets of type X and Y feed that should be used for optimal health at minimum cost.   (2marks)

20. Mr Kibet's PAYE per month is ksh 29,522. The ratio of his basic salary to taxable allowances is $13:9$. He is housed by his employer and pays a norminal rent of ksh 9000. His taxable pay is his gross pay plus 15% of his gross pay less the norminal rent. He is

entitled to a personal relief of ksh 1056 per month.The following tax rates are used in the tax computation.

Income per annum (k£ per annum)	Rates (Ksh per K£)
1-5808	2
5809-11280	3
11281-16756	4
16753-22224	5
22225 and over	6

Calculate:

a) His basic salary per month   7marks.

b) The percentage change in his PAYE if his taxable pay increases by 10%   3marks

21. A group of students wish to build up a pile of toy bricks so as to have 2 bricks in the top row,4 bricks in the second row, and 6 bricks in the third row and so on. If they have 3000 bricks

a) How many rows can they complete and how many bricks are they left with?   (4marks)

b) Calculate the least number of bricks they should add to have all bricks used with no remainder?   (2marks)

c) Counting from the top, the 3rd row, 9th row, 27th row and so on form a geometric progression. If rows forming this progression are to be summed up, calculate the total number of bricks forming this arrangement after the number of bricks in (b) above have been included.(4marks)

22. P and Q are two pints on latitude $60°S$.Their longitudes are $30°E$ and $150°W$ respectively. Find to one decimal place :(Take the radius of the earth $= 6370km$ and $\pi = \frac{22}{7}$)

a) The distance in km between P and Q along the parallel of latitudes.   (2marks)

b) The shortest distance along the earth's surface between P and Q.   (3marks)

c) A weather forecaster reports that the center of a cyclone at (30°S 120°W) is moving due south at 24 knots. How long will it take to reach a point (45°S, 120°W).   (2marks)

d) A plane leaves P at $1400hrs$ to Q at a speed of $900\ knots$ along the shortest route. Determine the time at Q when the plane arrived.   (3marks)

23. A curve is represented by the following function; $y = x^3 - 4x^2 + 5x - 2$. Use the curve to answer the following questions;

a). Find $\frac{dy}{dx}$ (1 mark)

b). (i). Determine the values of the stationery points of the curve.   (4marks)

(ii). Determine the nature of each stationery point on the curve   (2 marks)

c). In the space provided, sketch the curve of $y = x^3 - 4x^2 + 5x - 2$ (3 marks)

24. Three quantities A,B and C are such that A varies directly as the square root of B and inversely as the square of C.

a). Given that $A = 4$ when $B = 64$ and $c = 5$, find

i). The law connecting A, B and C (4 marks)

ii). A when $B = 16$ and $C = 10$ (2 marks)

b). If B is increased by 44% and C decreased by 20%, find the percentage change in A. (4 marks)

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SCHOOL:……………………..………   STREAM:……… ADM:………….

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Kenya Certificate of Secondary Education

121/2
Paper 2
Mathematics
Time 2 ½ hours
SERIES 10 QUESTION PAPER

INSTRUCTIONS TO CANDIDATES

9. Write your name, index number and class in the spaces provided above.
10. The paper contains two sections: **Section I** and **Section II**.
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16. Non-programmable silent electronic calculators and mathematical tables are allowed for use.

For examiners use only

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total

TURN OVER

Section 1 (50 Marks)

1. Simplify: **(3marks)**

$$\frac{5+3\sqrt{3}}{5-3\sqrt{3}}$$

2. Give that P = $\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ and Q = $\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix}$, Find PQ hence solve the equation **(3 marks)**
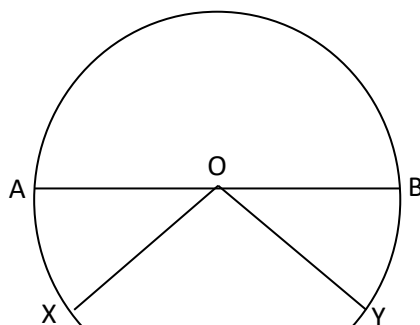
2x – 3y = 5

-x + 2y = -3

3. The gradient function of a curve is given by $\frac{dy}{dx} = x^2 - 8x + 2$

If the curve passes through the point (0, 2) find its equation **(3marks)**

4. Njau borrowed sh 500,000 from a bank which charged interest at 20% p.a compounded quarterly. If he repaid the loan after 2½ years, calculate the total amount paid **(3marks)**

5. 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)**

6. A student at a certain college has 60% chance of passing an examination at the first attempt. Each time a student fails and repeats the examination his chances of passing are increased by 15%. Calculate the probability that a student in the college passes an examination at the third attempt. **(4marks)**

7. The product of three consecutive positive even numbers is 960 more than the product of the largest and square of the smallest. Find the numbers. **(3marks)**

8. Expand and simplify $(1-3x)^5$ up to the term in x^3. Hence use your expansion to estimate $(0.97)^5$ correct to 4 decimal places. **(4marks)**

9. A ship leavers an island (50N, 450E) and sails due west for 120 hours to another island. The average speed of the ship is 27 knots. Find the position of the second island.

(3marks)

10. A variable y varies as the square of x and inversely as the square root of z. Find the percentage change in y when x is increase by 5% and z reduced by 19%. **(3marks)**

11. Solve the equation $2 \sin(4x-30)^0 = -1$ for the range $0^0 \leq x \leq 180^0$ **(3marks)**

12. Find the area bounded by the curve $y = x^2$ and the lines $x = -3$ and $x = 2$ using the mid ordinate rule. (Use five strips). **(3marks)**

13. Under a shear with x-axis invariant, the point A (4, 3) is mapped onto A' (10, 3). Find the coordinates of B' under this shear if point B is (2, 5) **(4marks)**

14. The figure below shows a rectangular sheet of dimensions 20cm by 15cm. equal squares of side x cm are cut from two adjacent corners and the resulting flaps bent to form the tray of a shovel. Find the value of x for which the volume of the tray is maximum.   **(4marks)**

15. If $V^2 = \sqrt{\frac{1+C^2}{R^2}} + \frac{r}{3}$, make C the subject of the formula.   **(3marks)**

16. The coordinates of P and Q are (4, -1,3) respectively. A point T divides PQ externally in the ratio 9.2. Find the coordinates of T.   **(3marks)**

SECTION II (50 MARKS)
Answer any five questions in this section.

17. The table below shows the times in seconds taken by 50 entrants in the hearts of 100 metres free style swimming competition.

Time in seconds	41.0-41.8	41.9-42.7	42.8-43.6	43.7-44.5	44.6-45.4	45.5-46.3	46.4-47.2
Frequency	0 3	5	8	12	13	7	2

    a) Draw accumulative frequency curve   **(4marks)**

   b) Use your graph to estimate
      (i)   The median   **(2marks)**

      (ii)   The second and sixth deciles   **(2marks)**

      (iii)   The number of swimmers who recorded between 42.05s and 46.05 s.
                                                    (2marks)

18. A certain number of people agreed to contribute equally to buy a book worth sh 1200 for a school library. Five people pulled out so the others agreed to contribute an extra sh 10 each. Their contribution enabled them to buy a book worth sh 200 more than they originally expected.
    a) If the original number of people was x write an expression of how much each was to contribute.   **(1mark)**

(b) Write down two expressions of how much each contributed after the five people pulled out. **(2marks)**

(c) Calculate how many people made the contribution. **(5marks)**

(d) State how much each contributed. **(2marks)**

19. Plot the points the triangle ABC whose coordinates are A (-6, 5), B (-4, 1) and C (3, 2).
    b) Given that A (-6, 5) is mapped onto A^1(-6, -4) by a shear with y-axis invariant;
       (i) Draw triangle A^1 B^1 C^1 only one hits the target the image of triangle ABC under this shear. **(3marks)**

       (ii) Determine the matrix representing this shear. **(2marks)**

c) Triangle $A^1B^1C^1$ is mapped onto $A^{11}B^{11}C^{11}$ by a transformation defined by the matrix

(i) Draw triangle $A^{11}B^{11}C^{11}$. **(3marks)**

(ii) Describe fully a single transformation that maps ABC onto $A^{11}B^{11}C^{11}$. **(2marks)**

20. A new tailoring business makes two types of garments A and B. The number of type A garments made are x and that of type B y. Each garment A requires 2½ metres of material while each garment B requires 2 metres of material daily for the production of both garments but produce less than 80 garment s of type A and more than 60 garments of type B. in addition the ratio of production of y to x must be less than 5:3. **(3marks)**

(a) Write down 4 inequalities satisfying the above information **(3 marks)**

(b) Represent the inequalities on the same graph. **(4 marks)**

(c) If the business makes a profit of sh. 7.50 on garment A and a profit of sh 5.00 on garment B. How many garments of each type must the business produce in order to make maximum profit?
State the profit **(2 marks)**
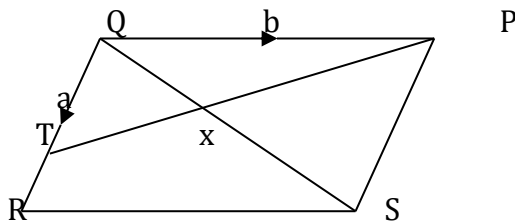
21. Without using a protractor, construct line XY = 8cm

    a) Construct the locus of all points R such that $\angle XRY = 60°$ (4 marks)

b) Construct the locus of all points P such that the area of triangle XPY is $16 \ cm^2$.(3 marks)

c) Mark all the points where the locus of R intersects the locus of P with the letters A,B,C and D   (3 marks)

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

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

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

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

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

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

23. The 2nd, 7th and 27th term of an AP are the first three consecutive terms of a GP. The 13th term of the AP is 38. Determine
(a) The first term and the common difference of the AP.   (**4marks**)

(b) The sum of the first 40 terms of the arithmetic series.   (**3marks**)

c) The sum of the first 6 terms of the geometric series.   (**2marks**)

24. The figure below shows a frustrum ABCDEFGH of a right pyramid AB = 24cm BC = 10cm, FG = 18cm, GH = 7.5cm and AF = BG = CH = DE = 15cm
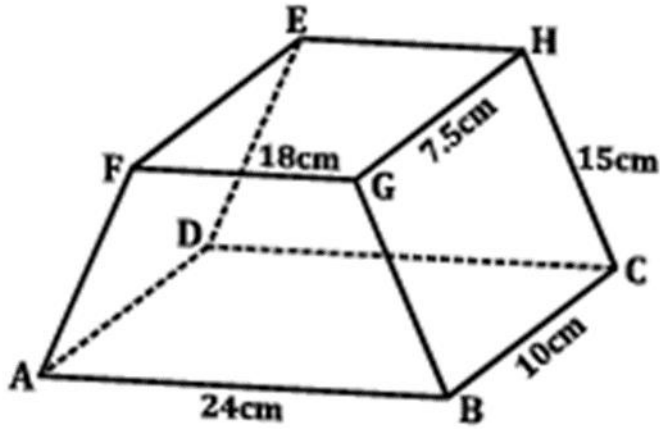
Find
   (a) The height of the pyramid.   (2 marks)

   (b) (i) The triangle between AH and the base ABCD.   (3 marks)

       (ii) The angle between the planes ABGH and ABCD.   (3 marks)

       (i) The angle between the planes ABHE and ABCD.   (2 marks)

THIS IS THE LAST PRINTED PAGE

3. **KISWAHILI**
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   - **FORM 1 – FORM 4 OPENER, MID-TERM AND ENDTERM EXAMS**
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