

F3 TOPICAL REVISION MATHEMATICS

***A SERIES OF TOPICAL QUESTIONS IN FORM
THREE MATHEMATICS***

***FOR MARKING SCHEMES
CALL/WHATSAPP 0705525657***

MR ISABOKE 0705525657

FORM 3

TOPIC 1

QUADRATIC EXPRESSIONS AND EQUATIONS

1. The table shows the height metres of an object thrown vertically upwards varies with the time t seconds

The relationship between s and t is represented by the equations $s = at^2 + bt + 10$ where b are constants.

t	0	1	2	3	4	5	6	7	8	9	10
s		45.1									

- (a) (i) Using the information in the table, determine the values of a and b
(2 marks)
- (ii) Complete the table
(1 mark)
- (b)(i) Draw a graph to represent the relationship between s and t (3 marks)
- (ii) Using the graph determine the velocity of the object when $t = 5$ seconds
2. (a) Construct a table of value for the function $y = x^2 - x - 6$ for $-3 \leq x \leq 4$
- (b) On the graph paper draw the graph of the function
 $Y = x^2 - x - 6$ for $-3 \leq x \leq 4$
- (c) By drawing a suitable line on the same grid estimate the roots of the equation $x^2 + 2x - 2 = 0$
3. (a) Draw the graph of $y = 6 + x - x^2$, taking integral value of x in $-4 \leq x \leq 5$. (The grid is provided. Using the same axes draw the graph of $y = 2 - 2x$

- (b) From your graphs, find the values of X which satisfy the simultaneous equations $y = 6 + x - x^2$

$$y = 2 - 2x$$

- (c) Write down and simplify a quadratic equation which is satisfied by the values of x where the two graphs intersect.

4. (a) Complete the following table for the equation $y = x^3 - 5x^2 + 2x + 9$

x	-2	-1.5	-1	0	1	2	3	4	5
x^2		-3.4	-1	0	1		27	64	125
$-5x^2$	-20	-11.3	-5	0	-1	-20	-45		
2x	-4	-3		0	2	4	6	8	10
9	9	9	9	9	9	9	9	9	99
		-8.7			9	7		-3	

- (b) On the grid provided draw the graph of $y = x^3 - 5x^2 + 2x + 9$ for $-2 \leq x \leq 5$
- (c) Using the graph estimate the root of the equation $x^3 - 5x^2 + 2x + 9 = 0$ between $x = 2$ and $x = 3$
- (d) Using the same axes draw the graph of $y = 4 - 4x$ and estimate a solution to the equation $x^2 - 5x^2 + 6x + 5 = 0$

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

x	-4	-3	-2	-1	0	1	2
$2x^2$	32		8	2	0	2	

$4x - 3$			-11		-3		5
y			-3			3	13

(b) On the grid provided, draw the graph of the function $y=2x^2 + 4x - 3$ for $-4 \leq x \leq 2$ and use the graph to estimate the roots of the equation $2x^2 + 4x - 3 = 0$ to 1 decimal place. (2mks)

(c) In order to solve graphically the equation $2x^2 + x - 5 = 0$, a straight line must be drawn to intersect the curve $y = 2x^2 + 4x - 3$. Determine the equation of this straight line, draw the straight line hence obtain the roots of $2x^2 + x - 5 = 0$ to 1 decimal place.

6. (a) (i) Complete the table below for the function $y = x^3 + x^2 - 2x$ (2mks)

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	2	2.5
x^3		15.63				-0.13			1		
x^2			4					0.25			6.25
$-2x$						1			-2		
y				1.87				0.63			16.88

(ii) On the grid provided, draw the graph of $y = x^3 + x^2 - 2x$ for the values of x in the interval $-3 \leq x \leq 2.5$

(iii) State the range of negative values of x for which y is also negative

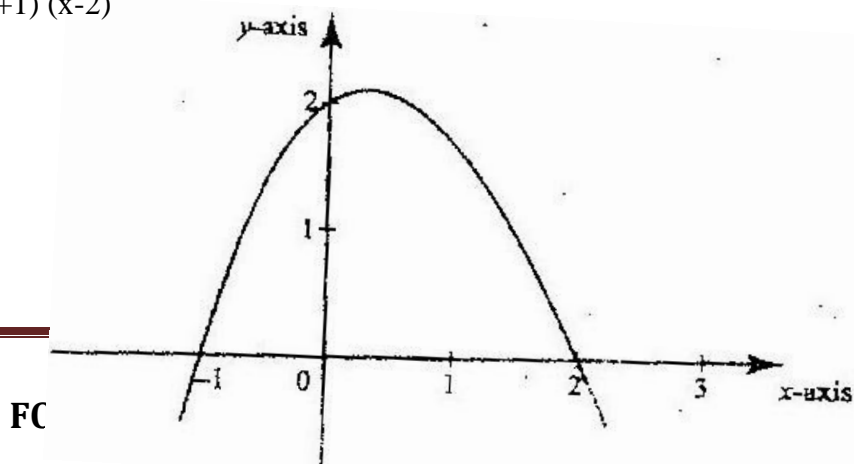
(b) Find the coordinates of two points on the curve other than (0, 0) at which x- coordinate and y- coordinate are equal

7. The table shows some corresponding values of x and y for the curve represented by $Y = \frac{1}{4} x^3 - 2$

X	-3	-2	-1	0	1	2	3
Y	-8.8	-4	-2.3	-2	-1.8	0	4.8

- On the grid provided below, draw the graph of $y = \frac{1}{4} x^2 - 2$ for $-3 \leq x \leq 3$. Use the graph to estimate the value of x when $y = 2$
8. A retailer planned to buy some computers from a wholesaler for a total of Kshs 1,800,000. Before the retailer could buy the computers the price per unit was reduced by Kshs 4,000. This reduction in price enabled the retailer to buy five more computers using the same amount of money as originally planned.
- Determine the number of computers the retailer bought
 - Two of the computers purchased got damaged while in store, the rest were sold and the retailer made a 15% profit. Calculate the profit made by the retailer on each computer sold

9. The figure below is a sketch of the graph of the quadratic function $y = k(x+1)(x-2)$



Find the value of k

10. (a) Draw the graph of $y = x^2 - 2x + 1$ for values $-2 \leq x \leq 4$
(b) Use the graph to solve the equations $x^2 - 4 = 0$ and line $y = 2x + 5$
11. (a) Draw the graph of $y = x^3 + x^2 - 2x$ for $-3 \leq x \leq 3$ take scale of 2cm to represent 5 units as the horizontal axis
(b) Use the graph to solve $x^3 + x^2 - 6 - 4 = 0$ by drawing a suitable linear graph on the same axes.
12. Solve graphically the simultaneous equations $3x - 2y = 5$ and $5x + y = 17$

TOPIC 2

APPROXIMATION AND ERRORS

1. (a) Work out the exact value of $R = \frac{1}{0.003146 - 0.003130}$
 - (b) An approximate value of R may be obtained by first correcting each of the decimal in the denominator to 5 decimal places
 - (i) The approximate value
 - (ii) The error introduced by the approximation
2. The radius of circle is given as 2.8 cm to 2 significant figures
 - (a) If C is the circumference of the circle, determine the limits between which $\frac{C}{\pi}$ lies
 - (b) By taking π to be 3.142, find, to 4 significant figures the line between which the circumference lies.
3. The length and breadth of a rectangular floor were measured and found to be 4.1 m and 2.2 m respectively. If possible error of 0.01 m was made in each of the measurements, find the:
 - (a) Maximum and minimum possible area of the floor
 - (b) Maximum possible wastage in carpet ordered to cover the whole floor
4. In this question Mathematical Tables should not be used
The base and perpendicular height of a triangle measured to the nearest centimeter are 6 cm and 4 cm respectively.

Find

- (a) The absolute error in calculating the area of the triangle
 - (b) The percentage error in the area, giving the answer to 1 decimal place
5. By correcting each number to one significant figure, approximate the value of 788×0.006 . Hence calculate the percentage error arising from this approximation.
6. A rectangular block has a square base whose side is exactly 8 cm. Its height measured to the nearest millimeter is 3.1 cm
- Find in cubic centimeters, the greatest possible error in calculating its volume.
7. Find the limits within the area of a parallelogram whose base is 8cm and height is 5 cm lies. Hence find the relative error in the area
8. Find the minimum possible perimeter of a regular pentagon whose side is 15.0cm.
9. Given the number 0.237
- (i) Round off to two significant figures and find the round off error
 - (ii) Truncate to two significant figures and find the truncation error
10. The measurements $a = 6.3$, $b = 15.8$, $c = 14.2$ and $d = 0.00173$ have maximum possible errors of 1%, 2%, 3% and 4% respectively. Find the maximum possible percentage error in $\frac{ad}{bc}$ correct to 1sf.

TOPIC 3
TRIGONOMETRY 1

1. Solve the equation

$$\sin \frac{5}{2} \theta = -\frac{1}{2} \text{ for } 0^\circ \leq \theta \leq 180^\circ$$

2. Given that $\sin \theta = \frac{2}{3}$ and θ is an acute angle find:

- (a) $\tan \theta$ giving your answer in surd form
(b) $\sec^2 \theta$

3. Solve the equation $2 \sin^2(x-30^\circ) = \cos 60^\circ$ for $-180^\circ \leq x \leq 180^\circ$

4. Given that $\sin(x+30^\circ) = \cos 2x^\circ$ for $0^\circ, 0^\circ \leq x \leq 90^\circ$ find the value of x . Hence find the value of $\cos^2 3x^\circ$.

5. Given that $\sin a = \frac{1}{\sqrt{5}}$ where a is an acute angle find, without using

$$\sqrt{5}$$

Mathematical tables

- (a) $\cos a$ in the form of $a\sqrt{b}$, where a and b are rational numbers
(b) $\tan(90^\circ - a)$.

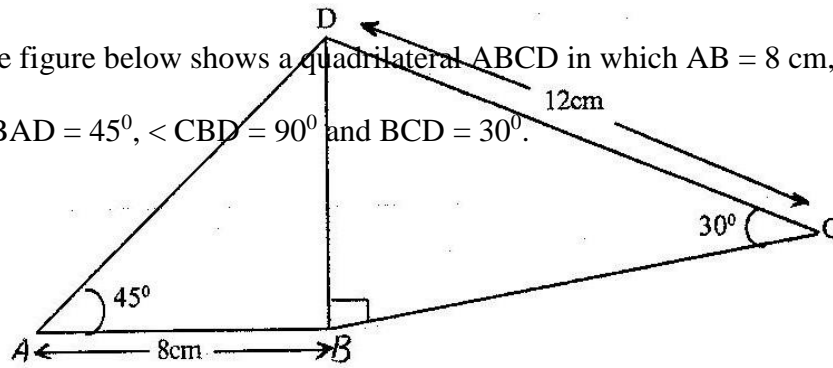
6. Given that x° is an angle in the first quadrant such that $8 \sin^2 x + 2 \cos x - 5 = 0$

Find:

- a) $\cos x$
b) $\tan x$

7. Given that $\cos 2x^\circ = 0.8070$, find x when $0^\circ \leq x \leq 360^\circ$

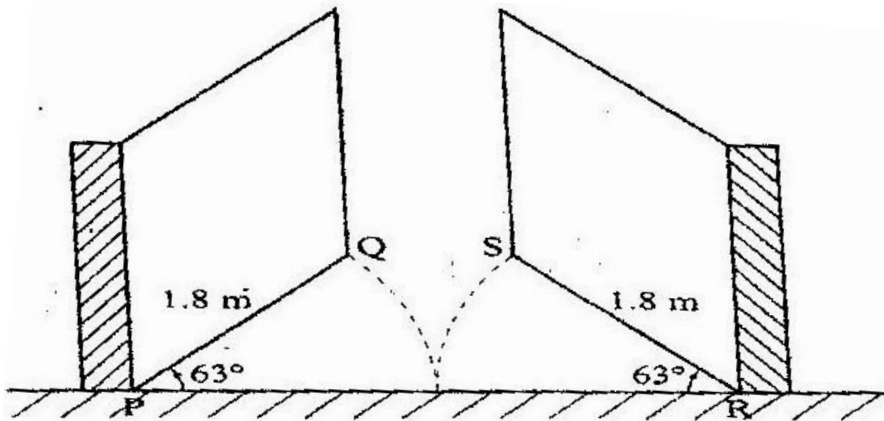
- 8 The figure below shows a quadrilateral ABCD in which $AB = 8 \text{ cm}$, $DC = 12 \text{ cm}$, $\angle BAD = 45^\circ$, $\angle CBD = 90^\circ$ and $\angle BCD = 30^\circ$.



Find:

- The length of BD
 - The size of the angle ADB
9. The diagram below represents a school gate with double shutters. The shutters are such opened through an angle of 63° .

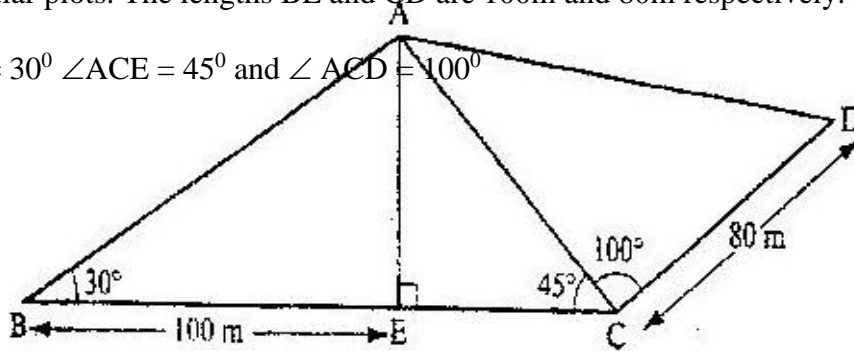
The edges of the gate, PQ and RS are each 1.8 m



Calculate the shortest distance QS, correct to 4 significant figures

10. The figure below represents a quadrilateral piece of land ABCD divided into three triangular plots. The lengths BE and CD are 100m and 80m respectively. Angle

$\angle ABE = 30^\circ$, $\angle ACE = 45^\circ$ and $\angle ACD = 100^\circ$



- (a) Find to four significant figures:

- (i) The length of AE
- (ii) The length of AD
- (iii) The perimeter of the piece of land

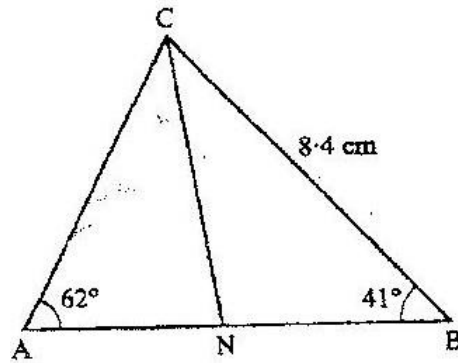
- (b) The plots are to be fenced with five strands of barbed wire leaving an entrance of 2.8 m wide to each plot. The type of barbed wire to be used is sold in rolls of lengths 480m. Calculate the number of rolls of barbed wire that must be bought to complete the fencing of the plots.

11. Given that x is an acute angle and $\cos x = \frac{2\sqrt{5}}{5}$, find without using mathematical

5

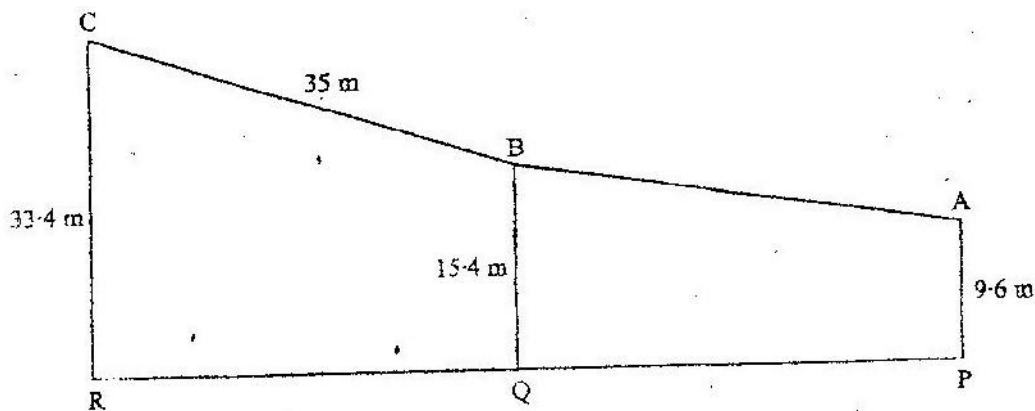
tables or a calculator, $\tan (90 - x)^\circ$.

12. In the figure below $\angle A = 62^\circ$, $\angle B = 41^\circ$, $BC = 8.4$ cm and CN is the bisector of $\angle ACB$.



Calculate the length of CN to 1 decimal place.

13. In the diagram below PA represents an electricity post of height 9.6 m. BB and RC represents two storey buildings of heights 15.4 m and 33.4 m respectively. The angle of depression of A from B is 5.5° While the angle of elevation of C from B is 30.5° and $BC = 35$ m.



- (a) Calculate, to the nearest metre, the distance AB
- (b) By scale drawing find,
 - (i) The distance AC in metres
 - (ii) $\angle BCA$ and hence determine the angle of depression of A from C

TOPIC 4

SURDS AND FURTHER LOGARITHM

1. Without using logarithm tables, find the value of x in the equation

$$\text{Log } x^3 + \log 5x = 5 \log 2 - \log 2$$

5

2. Simplify $(1 + \sqrt{3})(1 - \sqrt{3})$

Hence evaluate $\frac{1}{1 + \sqrt{3}}$ to 3 s.f. given that $\sqrt{3} = 1.7321$

$$1 + \sqrt{3}$$

3. If $\frac{\sqrt{14}}{\sqrt{7}-\sqrt{2}} - \frac{\sqrt{14}}{\sqrt{7}+\sqrt{2}} = a\sqrt{7} + b\sqrt{2}$

Find the values of a and b where a and b are rational numbers.

4. Find the value of x in the following equation $49^{(x+1)} + 7^{(2x)} = 350$

5. Find x if $3 \log 5 + \log x^2 = \log 1/125$

6. Simplify as far as possible leaving your answer in form of a surd

$$\frac{1}{\sqrt{14} - 2\sqrt{3}} - \frac{1}{\sqrt{14} + 2\sqrt{3}}$$

7. Given that $\tan 75^\circ = 2 + \sqrt{3}$, find without using tables $\tan 15^\circ$ in the form $p+q\sqrt{m}$, where p, q and m are integers.

8. Without using mathematical tables, simplify

$$\frac{63}{\sqrt{3}} + \frac{72}{\sqrt{3}}$$

- 32 + 28
9. Simplify $\frac{3}{\sqrt{5}-2} + \frac{1}{\sqrt{5}}$ leaving the answer in the form $a + b\sqrt{c}$, where a, b and c are rational numbers
10. Given that $P = 3^y$ express the questions $3^{2y-1} + 2 \times 3^{(y-1)} = 1$ in terms of P
Hence or otherwise find the value of y in the equation: $3^{(2y-1)} + 2 \times 3^{(y-1)} = 1$
11. Solve for $(\log^3 x)^2 - \frac{1}{2} \log_3 x = \frac{3}{2}$
12. Find the values of x which satisfy the equation $5^{2x} - 6(5^x) + 5 = 0$
13. Solve the equation
 $\text{Log}(x + 24) - 2 \log 3 = \log(9 - 2x)$

TOPIC 5

COMMERCIAL ARITHMETIC

1. A business woman opened an account by depositing Kshs. 12,000 in a bank on 1st July 1995. Each subsequent year, she deposited the same amount on 1st July. The bank offered her 9% per annum compound interest. Calculate the total amount in her account on
 - (a) 30th June 1996
 - (b) 30th June 1997

2. A construction company requires to transport 144 tonnes of stones to sites A and B. The company pays Kshs 24,000 to transport 48 tonnes of stone for every 28 km. Kimani transported 96 tonnes to a site A, 49 km away.
 - (a) Find how much he paid
 - (b) Kimani spends Kshs 3,000 to transport every 8 tonnes of stones to site. Calculate his total profit.
 - (c) Achieng transported the remaining stones to sites B, 84 km away. If she made 44% profit, find her transport cost.

3. The table shows income tax rates

Monthly taxable pay	Rate of tax Kshs in 1 K£
1 – 435	2
436 – 870	3
871-1305	4
1306 – 1740	5
Excess Over 1740	6

A company employee earn a monthly basic salary of Kshs 30,000 and is also given taxable allowances amounting to Kshs 10, 480.

- (a) Calculate the total income tax
- (b) The employee is entitled to a personal tax relief of Kshs 800 per month. Determine the net tax.
- (c) If the employee received a 50% increase in his total income, calculate the corresponding percentage increase on the income tax.
4. A house is to be sold either on cash basis or through a loan. The cash price is Kshs.750, 000. The loan conditions area as follows: there is to be down payment of 10% of the cash price and the rest of the money is to be paid through a loan at 10% per annum compound interest.
- A customer decided to buy the house through a loan.
- a) (i) Calculate the amount of money loaned to the customer.
- (ii) The customer paid the loan in 3 year's. Calculate the total amount

paid for the house.

- b) Find how long the customer would have taken to fully pay for the house if she paid a total of Kshs 891,750.
5. A businessman obtained a loan of Kshs. 450,000 from a bank to buy a matatu valued at the same amount. The bank charges interest at 24% per annum compound quarterly
- a) Calculate the total amount of money the businessman paid to clear the loan in $1\frac{1}{2}$ years.
- b) The average income realized from the matatu per day was Kshs. 1500. The matatu worked for 3 years at an average of 280 days year. Calculate the total income from the matatu.
- c) During the three years, the value of the matatu depreciated at the rate of 16% per annum. If the businessman sold the matatu at its new value, calculate the total profit he realized by the end of three years.
6. A bank either pays simple interest as 5% p.a or compound interest 5% p.a on deposits. Nekesa deposited Kshs P in the bank for two years on simple interest terms. If she had deposited the same amount for two years on compound interest terms, she would have earned Kshs 210 more.
- Calculate without using Mathematics Tables, the values of P
7. (a) A certain sum of money is deposited in a bank that pays simple interest at a certain rate. After 5 years the total amount of money in an account is Kshs 358 400. The interest earned each year is 12 800

Calculate

- (i) The amount of money which was deposited (2mks)
- (ii) The annual rate of interest that the bank paid (2mks)
- (b) A computer whose marked price is Kshs 40,000 is sold at Kshs 56,000 on hire purchase terms.
- (i) Kioko bought the computer on hire purchase term. He paid a deposit of 25% of the hire purchase price and cleared the balance by equal monthly installments of Kshs 2625. Calculate the number of installments (3mks)
- (ii) Had Kioko bought the computer on cash terms he would have been allowed a discount of $12\frac{1}{2}\%$ on marked price. Calculate the difference between the cash price and the hire purchase price and express as a percentage of the cash price
- (iii) Calculate the difference between the cash price and hire purchase price and express it as a percentage of the cash price.

8. The table below is a part of tax table for monthly income for the year 2004

Monthly taxable income In (Kshs)	Tax rate percentage (%) in each shillings
Under Kshs 9681	10%
From Kshs 9681 but under 18801	15%
From Kshs 18801 but 27921	20%

In the tax year 2004, the tax of Kerubo's monthly income was Kshs 1916.

Calculate Kerubo's monthly income

9. The cash price of a T.V set is Kshs 13, 800. A customer opts to buy the set on hire purchase terms by paying a deposit of Kshs 2280.

If simple interest of 20 p. a is charged on the balance and the customer is required to repay by 24 equal monthly installments. Calculate the amount of each installment.

10. A plot of land valued at Kshs. 50,000 at the start of 1994.

Thereafter, every year, it appreciated by 10% of its previous years value find:

- (a) The value of the land at the start of 1995
(b) The value of the land at the end of 1997

11. The table below shows Kenya tax rates in a certain year.

Income K £ per annum	Tax rates Kshs per K £
1- 4512	2
4513 - 9024	3
9025 - 13536	4
13537 - 18048	5
18049 - 22560	6
Over 22560	6.5

In that year Muhando earned a salary of Kshs. 16510 per month. He was entitled to a monthly tax relief of Kshs. 960

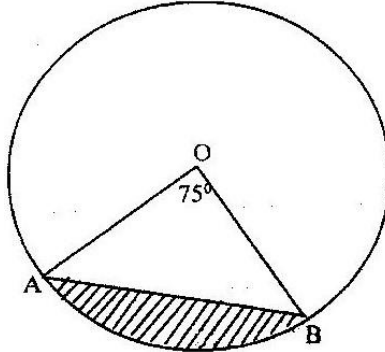
Calculate

- (a) Muhando's annual salary in K £
 - (b) (i) The monthly tax paid by Muhando in Kshs
14. A tailor intends to buy a sewing machine which costs Kshs 48,000. He borrows the money from a bank. The loan has to be repaid at the end of the second year. The bank charges an interest at the rate of 24% per annum compounded half yearly. Calculate the total amount payable to the bank.
15. The average rate of depreciation in value of a water pump is 9% per annum. After three complete years its value was Kshs 150,700. Find its value at the start of the three year period.
16. A water pump costs Kshs 21600 when new, at the end of the first year its value depreciates by 25%. The depreciation at the end of the second year is 20% and thereafter the rate of depreciation is 15% yearly. Calculate the exact value of the water pump at the end of the fourth year.

TOPIC 6

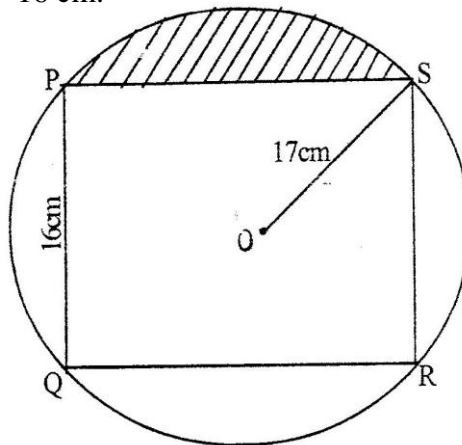
CIRCLES, CHORDS AND TANGENTS

1. The figure below represents a circle a diameter 28 cm with a sector subtending an angle of 75° at the centre.



Find the area of the shaded segment to 4 significant figures

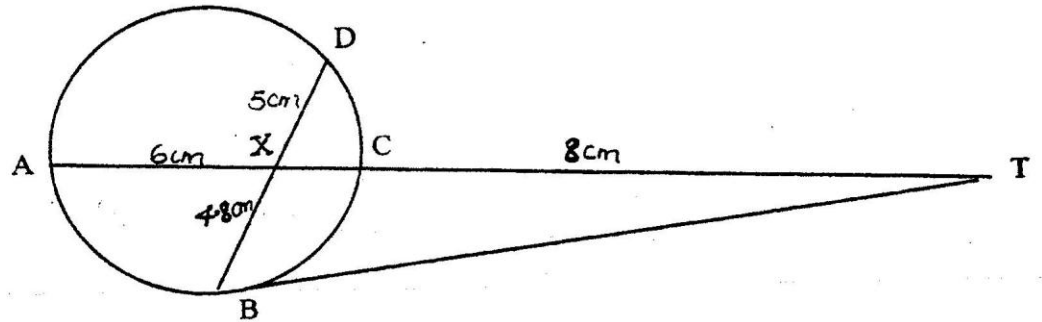
- (a) \angle PST
2. The figure below represents a rectangle PQRS inscribed in a circle centre O and radius 17 cm. PQ = 16 cm.



Calculate

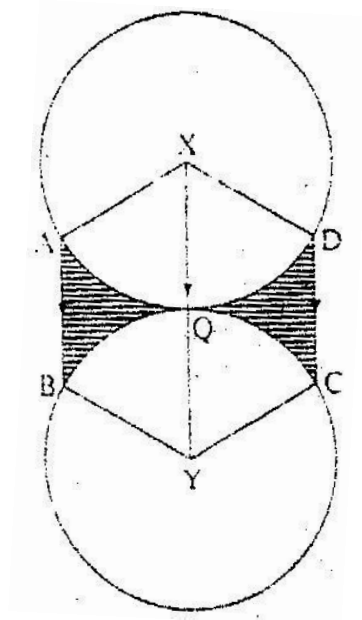
- (a) The length PS of the rectangle
- (b) The angle POS
- (c) The area of the shaded region

3. In the figure below, BT is a tangent to the circle at B . $AXCT$ and BXD are straight lines. $AX = 6$ cm, $CT = 8$ cm, $BX = 4.8$ cm and $XD = 5$ cm.



Find the length of

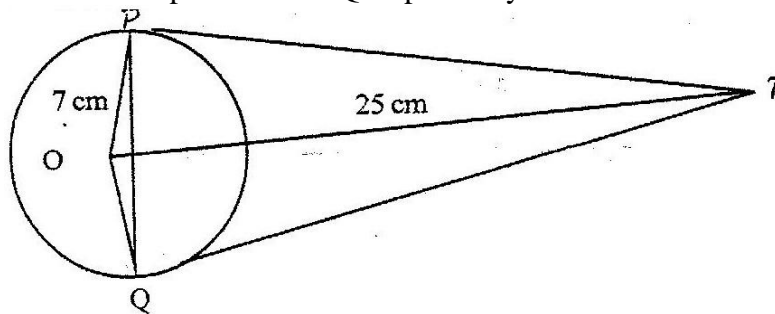
- (a) XC
 (b) BT
4. The figure below shows two circles each of radius 7 cm, with centers at X and Y .
 The circles touch each other at point Q .



Given that $\angle AXD = \angle BYC = 120^\circ$ and lines AB, XQY and DC are parallel,
calculate the area of:

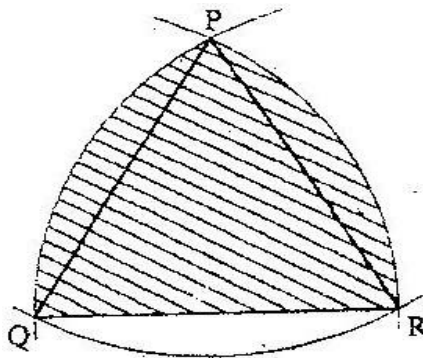
- a) Minor sector XAQD (Take $\pi^{22/7}$)
- b) The trapezium XABY
- c) The shaded regions.

5. The figure below shows a circle, centre, O of radius 7 cm. TP and TQ are tangents to the circle at points P and Q respectively. OT = 25 cm.



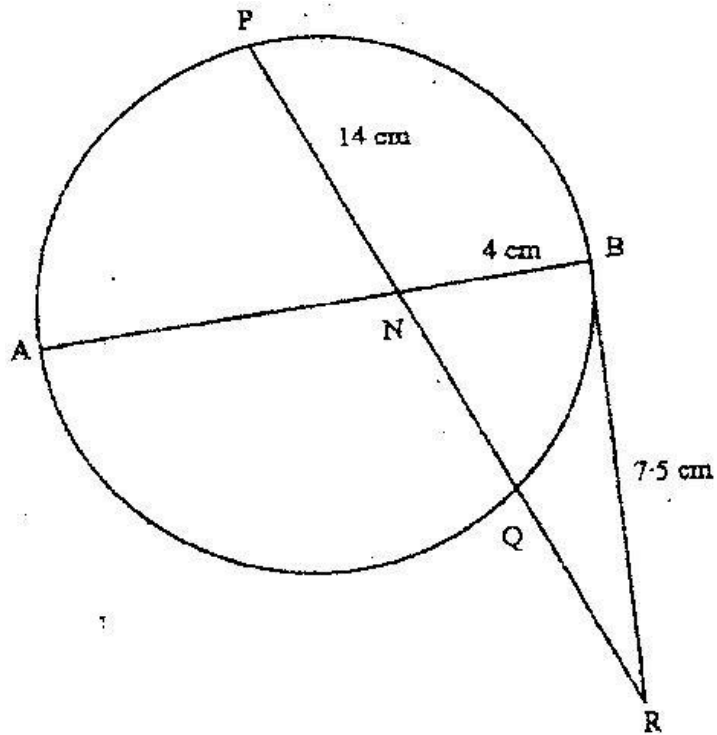
Calculate the length of the chord PQ

6. In the figure below, PQR is an equilateral triangle of side 6 cm. Arcs QR, PR and PQ arcs of circles with centers at P, Q and R respectively.



Calculate the area of the shaded region to 4 significant figures

7. In the figure below AB is a diameter of the circle. Chord PQ intersects AB at N.
A tangent to the circle at B meets PQ produced at R.



Given that $PN = 14$ cm, $NB = 4$ cm and $BR = 7.5$ cm, calculate the length of:

- (a) NR
- (b) AN

TOPIC 7

MATRICES

1. A and B are two matrices. If $A = \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix}$ find B given that $A^2 = A + B$
2. Given that $A = \begin{pmatrix} 1 & 3 \\ 5 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 1 \\ 5 & -1 \end{pmatrix}$, $C = \begin{pmatrix} p & 0 \\ 0 & q \end{pmatrix}$ and $AB = BC$, determine the value of P
3. A matrix A is given by $A = \begin{pmatrix} x & 0 \\ 5 & y \end{pmatrix}$
 - a) Determine A^2
 - b) If $A^2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, determine the possible pairs of values of x and y
4. (a) Find the inverse of the matrix $\begin{pmatrix} 9 & 8 \\ 7 & 6 \end{pmatrix}$
 - (b) In a certain week a businessman bought 36 bicycles and 32 radios for total of Kshs 227 280. In the following week, he bought 28 bicycles and 24 radios for a total of Kshs 174 960. Using matrix method, find the price of each bicycle and each radio that he bought
 - (c) In the third week, the price of each bicycle was reduced by 10% while the price of each radio was raised by 10%. The businessman bought as many bicycles and as many radios as he had bought in the first two weeks.

Find by matrix method, the total cost of the bicycles and radios that the businessman bought in the third week.

5. Determine the inverse T^{-1} of the matrix
- $$\begin{pmatrix} 1 & 2 \\ 1 & -1 \end{pmatrix}$$

Hence find the coordinates to the point at which the two lines $x + 2y=7$ and $x-y=1$

6. Given that $A = \begin{pmatrix} 0 & -1 \\ 3 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 0 \\ 2 & -4 \end{pmatrix}$

Find the value of x if

- (i) $A - 2x = 2B$
 (ii) $3x - 2A = 3B$
 (iii) $2A - 3B = 2x$
7. Find the non- zero value of k for which $\begin{pmatrix} k + 1 & 2 \\ 4k & 2k \end{pmatrix}$ is an inverse.

8. A clothes dealer sold 3 shirts and 2 trousers for Kshs. 840 and 4 shirts and 5 trousers for Kshs 1680. Form a matrix equation to represent the above information. Hence find the cost of 1 shirt and the cost of 1 trouser.

TOPIC 8

FORMULAE AND VARIATIONS

1. The volume $V \text{ cm}^3$ of an object is given by

$$V = \frac{2}{3} \pi r^3 \quad \frac{1}{s^2}$$

Express in term of π , r , s and V

2. Make V the subject of the formula

$$T = \frac{1}{2} m (u^2 - v^2)$$

3. Given that $y = \frac{b - bx^2}{cx^2 - a}$ make x the subject

$$cx^2 - a$$

4. Given that $\log y = \log (10^n)$ make n the subject

5. A quantity T is partly constant and partly varies as the square root of S .

i. Using constants a and b , write down an equation connecting T and S .

ii. If $S = 16$, when $T = 24$ and $S = 36$ when $T = 32$, find the values of the constants a and b ,

6. A quantity P is partly constant and partly varies inversely as a quantity q , given that $p = 10$ when $q = 1.5$ and $p = 20$, when $q = 1.25$, find the value of p when $q = 0.5$

7. Make y the subject of the formula $p = \frac{xy}{x-y}$

$$x-y$$

8. Make P the subject of the formula

$$P^2 = (P - q)(P - r)$$

9. The density of a solid spherical ball varies directly as its mass and inversely as the cube of its radius

When the mass of the ball is 500g and the radius is 5 cm, its density is 2 g per cm^3

Calculate the radius of a solid spherical ball of mass 540 density of 10g per cm^3

10. Make s the subject of the formula

$$\sqrt{P} = r \sqrt{1 - as^2}$$

11. The quantities t , x and y are such that t varies directly as x and inversely as the square root of y . Find the percentage change in t if x decreases by 4% when y increases by 44%

12. Given that y is inversely proportional to x^n and k as the constant of proportionality;

(a) (i) Write down a formula connecting y , x , n and k

(ii) If $x = 2$ when $y = 12$ and $x = 4$ when $y = 3$, write down two expressions for k in terms of n .

Hence, find the value of n and k .

(b) Using the value of n obtained in (a) (ii) above, find y when $x = 5^{1/3}$

13. The electrical resistance, R ohms of a wire of a given length is inversely proportional to the square of the diameter of the wire, d mm. If $R = 2.0$ ohms when $d = 3$ mm. Find the value R when $d = 4$ mm.
14. The volume V cm³ of a solid depends partly on r and partly on r where r cm is one of the dimensions of the solid.
When $r = 1$, the volume is 54.6 cm³ and when $r = 2$, the volume is 226.8 cm³
- Find an expression for V in terms of r
 - Calculate the volume of the solid when $r = 4$
 - Find the value of r for which the two parts of the volume are equal
15. The mass of a certain metal rod varies jointly as its length and the square of its radius. A rod 40 cm long and radius 5 cm has a mass of 6 kg. Find the mass of a similar rod of length 25 cm and radius 8 cm.
16. Make x the subject of the formula
- $$P = \frac{xy}{z + x}$$
17. The charge c shillings per person for a certain service is partly fixed and partly inversely proportional to the total number N of people.
- Write an expression for c in terms on N

- (b) When 100 people attended the charge is Kshs 8700 per person while for 35 people the charge is Kshs 10000 per person.
- (c) If a person had paid the full amount charge is refunded. A group of people paid but ten percent of organizer remained with Kshs 574000.

Find the number of people.

18. Two variables A and B are such that A varies partly as B and partly as the square root of B given that A=30, when B=9 and A=16 when B=14, find A when B=36.

19. Make p the subject of the formula

$$A = \frac{-EP}{\sqrt{P^2 + N}}$$

TOPIC 9

SEQUENCE AND SERIES

1. The first, the third and the seventh terms of an increasing arithmetic progression are three consecutive terms of a geometric progression. In the first term of the arithmetic progression is 10 find the common difference of the arithmetic progression.
2. Kubai saved Kshs 2,000 during the first year of employment. In each subsequent year, he saved 15% more than the preceding year until he retired.
 - (a) How much did he save in the second year?
 - (b) How much did he save in the third year?
 - (c) Find the common ratio between the savings in two consecutive years
 - (a) How many years did he take to save the savings a sum of Kshs 58,000?
 - (e) How much had he saved after 20 years of service?
3. In geometric progression, the first is a and the common ratio is r . The sum of the first two terms is 12 and the third term is 16.
 - (a) Determine the ratio $\frac{ar^2}{a + ar}$
 - (b) If the first term is larger than the second term, find the value of r .
4. (a) The first term of an arithmetic progression is 4 and the last term is 20. The sum of the term is 252. Calculate the number of terms and the common differences of the arithmetic progression

- (b) An Experimental culture has an initial population of 50 bacteria. The population increased by 80% every 20 minutes. Determine the time it will take to have a population of 1.2 million bacteria.
5. Each month, for 40 months, Amina deposited some money in a saving scheme. In the first month she deposited Kshs 500. Thereafter she increased her deposits by Kshs. 50 every month.
- Calculate the:
- a) Last amount deposited by Amina
- b) Total amount Amina had saved in the 40 months.
6. A carpenter wishes to make a ladder with 15 cross- pieces. The cross- pieces are to diminish uniformly in length from 67 cm at the bottom to 32 cm at the top. Calculate the length in cm, of the seventh cross- piece from the bottom
7. The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term.
8. The eleventh term of an arithmetic progression is four times its second term. The sum of the first seven terms of the same progression is 175
- (a) Find the first term and common difference of the progression
- (b) Given that p^{th} term of the progression is greater than 124, find the least value of P
9. The n^{th} term of sequence is given by $2n + 3$ of the sequence

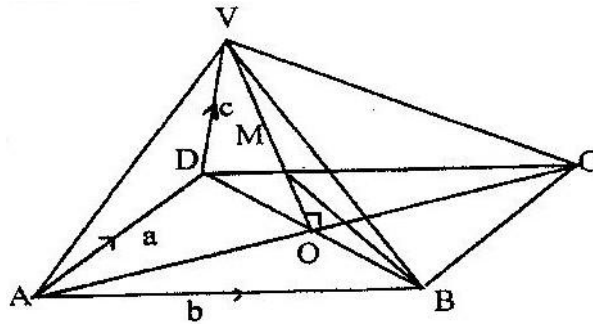
- (a) Write down the first four terms of the sequence
- (b) Find s_n the sum of the fifty term of the sequence
- (c) Show that the sum of the first n terms of the sequence is given by

$$S_n = n^2 + 4n$$

Hence or otherwise find the largest integral value of n such that $S_n < 725$

TOPIC 10
VECTORS

1. The figure below is a right pyramid with a rectangular base ABCD and VO as the height. The vectors $AD = a$, $AB = b$ and $DV = c$

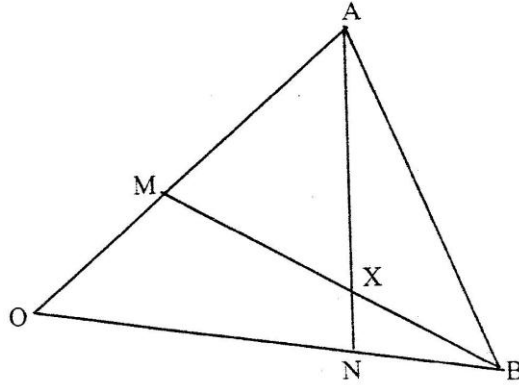


- a) Express
- (i) \vec{AV} in terms of a and c
 - (ii) \vec{BV} in terms of a , b and c
- (b) M is point on OV such that $OM: MV = 3:4$, Express \vec{BM} in terms of a , b and c .
Simplify your answer as far as possible
2. In triangle OAB, $OA = a$ $OB = b$ and P lies on AB such that $AP: BP = 3:5$
- (a) Find the terms of a and b the vectors
- (i) \vec{AB}
 - (ii) \vec{AP}
 - (iii) \vec{BP}
 - (iv) \vec{OP}
- (b) Point Q is on OP such $\vec{AQ} = \frac{5}{8}\vec{a} + \frac{3}{8}\vec{b}$

$8a - 40b$

Find the ratio OQ: QP

3. The figure below shows triangle OAB in which M divides OA in the ratio 2: 3 and N divides OB in the ratio 4:1 AN and BM intersect at X

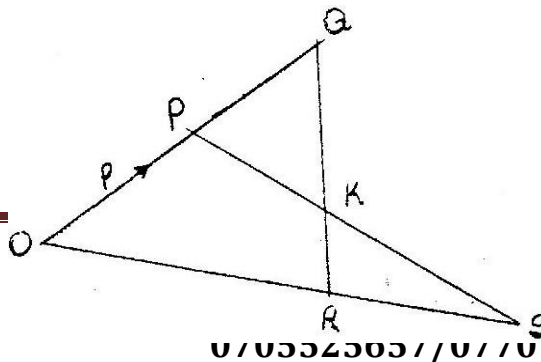


- (a) Given that $OA = a$ and $OB = b$, express in terms of a and b :
- AN
 - BM
- (b) If $AX = s AN$ and $BX = tBM$, where s and t are constants, write two expressions for OX in terms of a, b, s and t

Find the value of s

Hence write OX in terms of a and b

4. The position vectors for points P and Q are $4i + 3j + 6k$ respectively. Express vector PQ in terms of unit vectors i, j and k . Hence find the length of PQ, leaving your answer in simplified surd form.
5. In the figure below, vector $OP = p$ and $OR = r$. Vector $OS = 2r$ and $OQ = \frac{3}{2}p$.



ALL/WHATSAPP

0705525051/0705195807

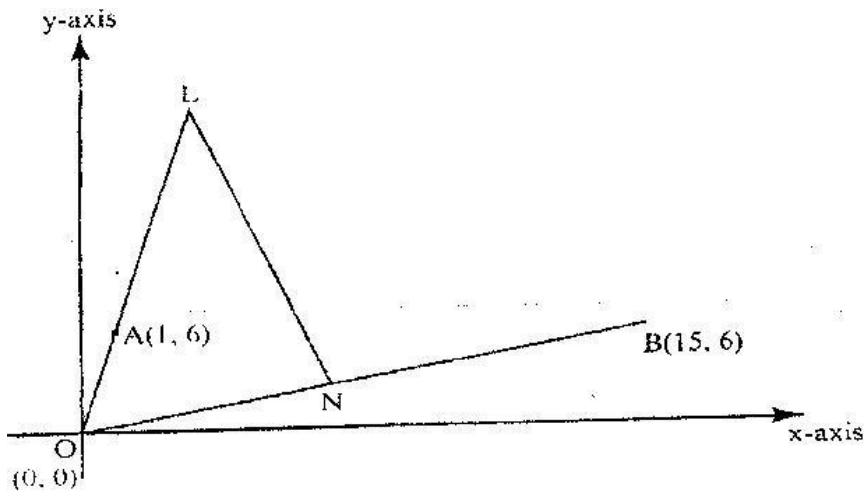
- a) Express in terms of p and r (i) QR and (ii) PS
- b) The lines QR and PS intersect at K such that $QK = m QR$ and $PK = n PS$, where m and n are scalars. Find two distinct expressions for OK in terms of p, r, m and n . Hence find the values of m and n .
- c) State the ratio $PK: KS$
6. Point T is the midpoint of a straight line AB . Given the position vectors of A and T are $i - j + k$ and $2i + 1\frac{1}{2}k$ respectively, find the position vector of B in terms of i, j and k
7. A point R divides a line PQ internally in the ratio $3:4$. Another point S , divides the line PR externally in the ratio $5:2$. Given that $PQ = 8$ cm, calculate the length of RS , correct to 2 decimal places.
8. The points P, Q, R and S have position vectors $2p, 3p, r$ and $3r$ respectively, relative to an origin O . A point T divides PS internally in the ratio $1:6$
- (a) Find, in the simplest form, the vectors OT and QT in terms p and r
- (b) (i) Show that the points Q, T , and R lie on a straight line
- (ii) Determine the ratio in which T divides QR
9. Two points P and Q have coordinates $(-2, 3)$ and $(1, 3)$ respectively. A translation map point P to P' $(10, 10)$
- (a) Find the coordinates of Q' the image of Q under the translation

- (b) The position vector of P and Q in (a) above are p and q respectively given that $mp - nq = -12$

9

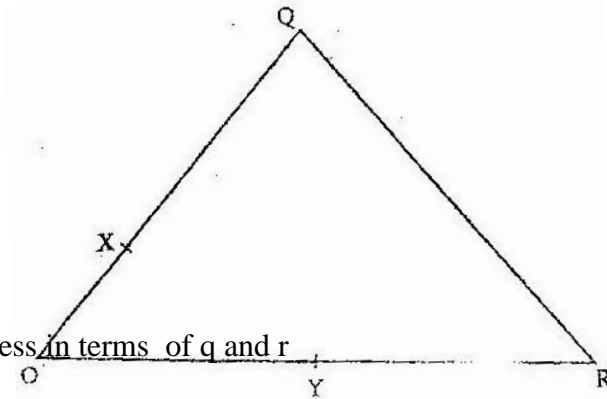
Find the value of m and n

10. Given that $q \mathbf{i} + \frac{1}{3} \mathbf{j} + \frac{2}{3} \mathbf{k}$ is a unit vector, find q
11. In the diagram below, the coordinates of points A and B are (1, 6) and (15, 6) respectively). Point N is on OB such that $3 ON = 2 OB$. Line OA is produced to L such that $OL = 3 OA$



- (a) Find vector LN
- (b) Given that a point M is on LN such that $LM:MN = 3:4$, find the coordinates of M
- (c) If line OM is produced to T such that $OM:MT = 6:1$
- (i) Find the position vector of T
 - (ii) Show that points L, T and B are collinear

12. In the figure below, $OQ = q$ and $OR = r$. Point X divides OQ in the ratio 1: 2 and Y divides OR in the ratio 3: 4 lines XR and YQ intersect at E.



(a) Express in terms of q and r

(i) XR

(ii) YQ

(b) If $XE = m XR$ and $YE = n YQ$, express OE in terms of:

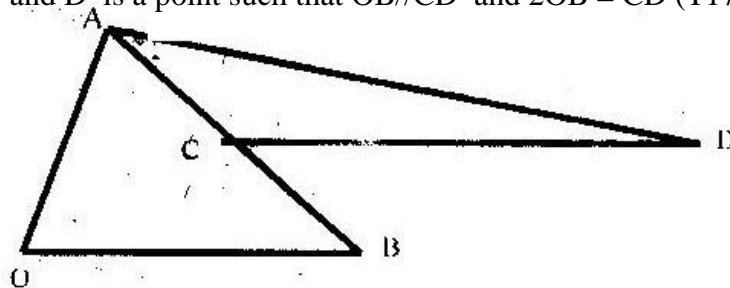
(i) r , q and m

(ii) r , q and n

(c) Using the results in (b) above, find the values of m and n .

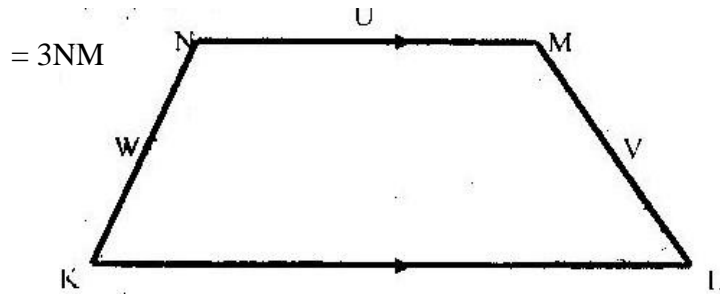
13. Vector q has a magnitude of 7 and is parallel to vector p . Given that $p = 3i - j + 1\frac{1}{2}k$, express vector q in terms of i , j , and k .

14. In the figure below, $OA = 3i + 3j$ ABD $OB = 8i - j$. C is a point on AB such that $AC:CB = 3:2$, and D is a point such that $OB \parallel CD$ and $2OB = CD$ (T17)



Determine the vector DA in terms of i and j

15. In the figure below, $KLMN$ is a trapezium in which KL is parallel to NM and $KL = 3NM$



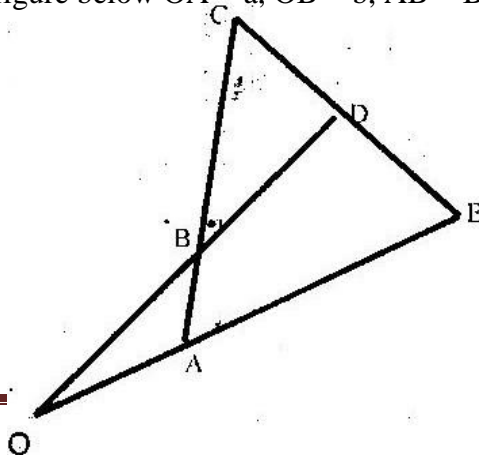
Given that $KN = w$, $NM = u$ and $ML = v$. Show that $2u = v + w$

16. The points P , Q and R lie on a straight line. The position vectors of P and R are $2i + 3j + 13k$ and $5i - 3j + 4k$ respectively; Q divides SR internally in the ratio $2:1$.

Find the

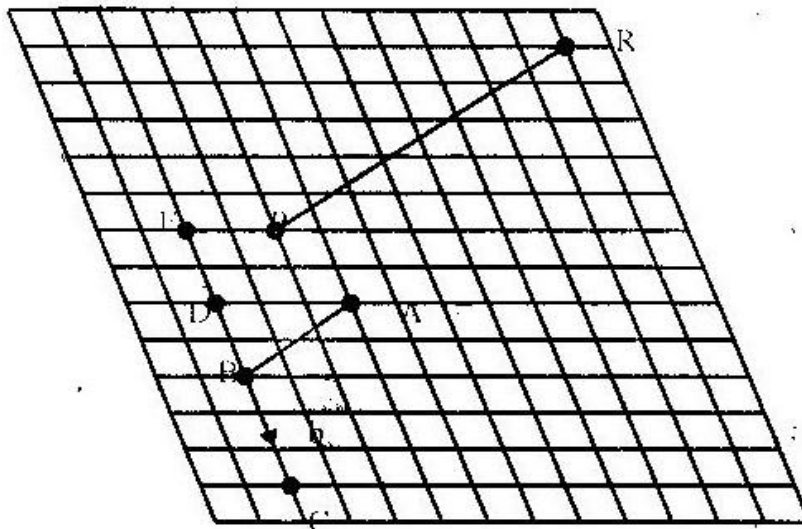
- (a) Position vector of Q
 (b) Distance of Q from the origin
17. Co-ordinates of points O , P , Q and R are $(0, 0)$, $(3, 4)$, $(11, 6)$ and $(8, 2)$ respectively. A point T is such that the vector OT , QP and QR satisfy the vector equation $OT = QP + \frac{1}{2}QT$. Find the coordinates of T .

18. In the figure below $OA = a$, $OB = b$, $AB = BC$ and $OB:BD = 3:1$



- (a) Determine
- (i) AB in terms of a and b
 - (ii) CD , in terms of a and b
- (b) If $CD:DE = 1:k$ and $OA:AE = 1:m$ determine
- (i) DE in terms of a , b and k
 - (ii) The values of k and m

19. The figure below shows a grid of equally spaced parallel lines



$AB = a$ and $BC = b$

- (a) Express
- (i) AC in terms of a and b
 - (ii) AD in terms of a and b
- (b) Using triangle BEP , express BP in terms of a and b

- (c) PR produced meets BA produced at X and $PR = \frac{1}{9}b - \frac{8}{3}a$
- By writing PX as kPR and BX as hBA and using the triangle BPX
determine the ratio PR: RX
20. The position vectors of points x and y are $x = 2i + j - 3k$ and $y = 3i + 2j - 2k$ respectively. Find XY
21. 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 figures.

TOPIC 11

BINOMIAL EXPRESSION

1. (a) Write down the simplest expansion $(1 + x)^6$
- (b) Use the expansion up to the fourth term to find the value of $(1.03)^6$ to the nearest one thousandth.
2. Use binomial expression to evaluate $(0.96)^5$ correct to 4 significant figures.
3. Expand and simplify $(3x - y)^4$ hence use the first three terms of the expansion to approximate the value of $(6 - 0.2)^4$
4. Abdi and Amoit were employed at the beginning of the same year. Their annual salaries in shillings progressed as follows
Abdi: 60000, 64800, 69600
Amoit: 60000, 64800, 69984
- (a) Calculate Abdi's annual salary increment and hence write down an

expression for his annual salary in his n^{th} year of employment?

- (b) Calculate Amoit's annual percentage rate of salary increment and hence write down an expression for her annual salary in her n^{th} year employment?
- (c) Calculate the difference in the annual salary for Abdi and Amoit in their 7th year of employment.

5. Use binomial expression to evaluate

$$2 + \frac{1}{\sqrt{2}}^5 + 2 - \frac{1}{\sqrt{2}}^5$$

6. (a) Expand the expression $1 + \frac{1}{2}x^5$ in ascending powers of x, leaving

the coefficients as fractions in their simplest form.

(b) Use the first three terms of the expression in (a) above to estimate the value of $1 \frac{1}{20}^5$

7. (a) Expand $(a - b)^6$

(b) Use the first three terms of the expansion in (a) above to find the approximate value of $(1.98)^6$

8. Expand $(2 + x)^5$ in ascending powers of x up to the term in x^3 hence approximate the value of $(2.03)^5$ to 4 s.f

9. (a) Expand $(1 + x)^5$
Hence use the expansion to estimate $(1.04)^5$ correct to 4 decimal places
- (b) Use the expansion up to the fourth term to find the value of $(1.03)^6$ to the nearest one thousandth.
10. Expand and Simplify $(1-3x)^5$ up to the term in x^3
Hence use your expansion to estimate $(0.97)^5$ correct to decimal places.
11. Expand $(1 + a)^5$
Use your expansion to evaluate $(0.8)^5$ correct to four places of decimal
12. (a) Expand $(1 + x)^5$
- (b) Use the first three terms of the expansion in (a) above to find the approximate value of $(0.98)^5$

TOPIC 12

PROBABILITY

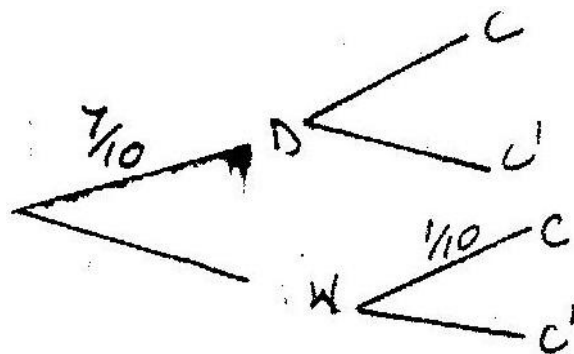
1. The probabilities that a husband and wife will be alive 25 years from now are 0.7 and 0.9 respectively.

Find the probability that in 25 years time,

- (a) Both will be alive
 - (b) Neither will be alive
 - (c) One will be alive
 - (d) At least one will be alive
2. 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
 - (ii) Either green or red
 - (b) Using a tree diagram, determine the probability that
 - (i) The first two pens picked are both green
 - (ii) Only one of the first two pens picked is red.
3. A science club is made up of boys and girls. The club has 3 officials. Using a tree diagram or otherwise find the probability that:
- (a) The club officials are all boys
 - (b) Two of the officials are girls

4. Two baskets A and B each contain a mixture of oranges and limes, all of the same size. Basket A contains 26 oranges and 13 limes. Basket B contains 18 oranges and 15 limes. A child selected a basket at random and picked a fruit at a random from it.
- (a) Illustrate this information by a probabilities tree diagram
- (b) Find the probability that the fruit picked was an orange.
5. In form 1 class there are 22 girls and boys. The probability of a girl completing the secondary education course is $\frac{3}{4}$ whereas that of a boy is $\frac{2}{3}$
- (a) A student is picked at random from class. Find the possibility that,
- (i) The student picked is a boy and will complete the course
- (ii) The student picked will complete the course
- (b) Two students are picked at random. Find the possibility that they are a boy and a girl and that both will not complete the course.
6. Three representatives are to be selected randomly from a group of 7 girls and 8 boys. Calculate the probability of selecting two girls and one boy.
7. A poultry farmer vaccinated 540 of his 720 chickens against a disease. Two months later, 5% of the vaccinated and 80% of the unvaccinated chicken, contracted the disease. Calculate the probability that a chicken chosen random contacted the disease.
8. The probability of three darts players Akinyi, Kamau, and Juma hitting the bulls eye are 0.2, 0.3 and 1.5 respectively.
- (a) Draw a probability tree diagram to show the possible outcomes

- (b) Find the probability that:
- All hit the bull's eye
 - Only one of them hit the bull's eye
 - At most one missed the bull's eye
9. (a) An unbiased coin with two faces, head (H) and tail (T), is tossed three times, list all the possible outcomes.
- Hence determine the probability of getting:
- At least two heads
 - Only one tail
- (b) During a certain motor rally it is predicted that the weather will be either dry (D) or wet (W). The probability that the weather will be dry is estimated to be $\frac{7}{10}$. The probability for a driver to complete (C) the rally during the dry weather is estimated to be $\frac{5}{6}$. The probability for a driver to complete the rally during wet weather is estimated to be $\frac{1}{10}$. Complete the probability tree diagram given below.



What is the probability that:

- (i) The driver completes the rally?
 - (ii) The weather was wet and the driver did not complete the rally?
10. There are three cars A, B and C in a race. A is twice as likely to win as B while B is twice as likely to win as c. Find the probability that.
- a) A wins the race
 - b) Either B or C wins the race.
11. In the year 2003, the population of a certain district was 1.8 million. Thirty per cent of the population was in the age group 15 – 40 years. In the same year, 120,000 people in the district visited the Voluntary Counseling and Testing (VCT) centre for an HIV test.
- If a person was selected at random from the district in this year. Find the probability that the person visited a VCT centre and was in the age group 15 – 40 years.
12. (a) Two integers x and y are selected at random from the integers 1 to 8. If the same integer may be selected twice, find the probability that
- (i) $|x - y| = 2$
 - (ii) $|x - y|$ is 5 or more
 - (iii) $x > y$

- (b) A die is biased so that when tossed, the probability of a number r showing up, is given by $p \propto Kr$ where K is a constant and $r = 1, 2, 3, 4, 5$ and 6 (the number on the faces of the die)
- (i) Find the value of K
- (ii) If the die is tossed twice, calculate the probability that the total score is 11
13. Two bags A and B contain identical balls except for the colours. Bag A contains 4 red balls and 2 yellow balls. Bag B contains 2 red balls and 3 yellow balls.
- (a) If a ball is drawn at random from each bag, find the probability that both balls are of the same colour.
- (b) If two balls are drawn at random from each bag, one at a time without replacement, find the probability that:
- (i) The two balls drawn from bag A or bag B are red
- (ii) All the four balls drawn are red
14. During inter – school competitions, football and volleyball teams from Mokagu high school took part. The probability that their football and volleyball teams would win were $\frac{3}{8}$ and $\frac{4}{7}$ respectively.
- Find the probability that
- (a) Both their football and volleyball teams
- (b) At least one of their teams won

15. A science club is made up of 5 boys and 7 girls. The club has 3 officials. Using a tree diagram or otherwise find the probability that:
- (a) The club officials are all boys
 - (b) Two of the officials are girls
16. Chicks on Onyango's farm were noted to have either brown feathers brown or black tail feathers. Of those with black feathers $\frac{2}{3}$ were female while $\frac{2}{5}$ of those with brown feathers were male. Otieno bought two chicks from Onyango. One had black tail feathers while the other had brown find the probability that Otieno's chicks were not of the same gender
17. Three representatives are to be selected randomly from a group of 7 girls and 8 boys. Calculate the probability of selecting two girls and one boy
18. The probability that a man wins a game is $\frac{3}{4}$. He plays the game until he wins. Determine the probability that he wins in the fifth round.
19. The probability that Kamau will be selected for his school's basketball team is $\frac{1}{4}$. If he is selected for the basketball team. Then the probability that he will be selected for football is $\frac{1}{3}$ if he is not selected for basketball then the probability that he is selected for football is $\frac{4}{5}$. What is the probability that Kamau is selected for at least one of the two games?

20. Two baskets A and B each contains a mixture of oranges and lemons. Basket A contains 26 oranges and 13 lemons. Basket B contains 18 oranges and 15 lemons. A child selected a basket at random and picked at random a fruit from it. Determine the probability that the fruit picked was an orange.

TOPIC 13

COMPOUND PROPORTION AND MIXTURES

1. Akinyi bought maize and beans from a wholesaler. She then mixed the maize and beans in the ratio 4:3 she bought the maize at Kshs. 12 per kg and the beans 4 per kg. If she was to make a profit of 30% what should be the selling price of 1 kg of the mixture?
2. A rectangular tank of base 2.4 m by 2.8 m and a height of 3 m contains 3,600 liters of water initially. Water flows into the tank at the rate of 0.5 litres per second
Calculate the time in hours and minutes, required to fill the tank
3. A company is to construct a parking bay whose area is 135m^2 . It is to be covered with concrete slab of uniform thickness of 0.15. To make the slab cement, Ballast and sand are to be mixed so that their masses are in the ratio 1: 4: 4. The mass of m^3 of dry slab is 2, 500kg.
Calculate
 - (a) (i) The volume of the slab
 - (ii) The mass of the dry slab
 - (iii) The mass of cement to be used
 - (b) If one bag of the cement is 50 kg, find the number of bags to be purchased
 - (c) If a lorry carries 7 tonnes of sand, calculate the number of lorries of sand to be purchased.
4. The mass of a mixture A of beans and maize is 72 kg. The ratio of beans to maize

- is 3:5 respectively
- (a) Find the mass of maize in the mixture
- (b) A second mixture of B of beans and maize of mass 98 kg is mixed with A. The final ratio of beans to maize is 8:9 respectively. Find the ratio of beans to maize in B
5. A retailer bought 49 kg of grade 1 rice at Kshs. 65 per kilogram and 60 kg of grade II rice at Kshs 27.50 per kilogram. He mixed the two types of rice.
- (a) Find the buying price of one kilogram of the mixture
- (b) He packed the mixture into 2 kg packets
- (i) If he intends to make a 20% profit find the selling price per packet
- (ii) He sold 8 packets and then reduced the price by 10% in order to attract customers. Find the new selling price per packet.
- (iii) After selling $\frac{1}{3}$ of the remainder at reduced price, he raised the price so as to realize the original goal of 20% profit overall. Find the selling price per packet of the remaining rice.
6. A trader sells a bag of beans for Kshs 1,200. He mixed beans and maize in the ratio 3: 2. Find how much the trader should he sell a bag of the mixture to realize the same profit?
7. Pipe A can fill an empty water tank in 3 hours while, pipe B can fill the same tank in 6 hours, when the tank is full it can be emptied by pipe C in 8 hours. Pipes A and B are opened at the same time when the tank is empty.
- If one hour later, pipe C is also opened, find the total time taken to fill the tank

8. A solution whose volume is 80 litres is made 40% of water and 60% of alcohol. When litres of water are added, the percentage of alcohol drops to 40%
- (a) Find the value of x
 - (b) Thirty litres of water is added to the new solution. Calculate the percentage
 - (c) If 5 litres of the solution in (b) is added to 2 litres of the original solution, calculate in the simplest form, the ratio of water to that of alcohol in the resulting solution
9. A tank has two inlet taps P and Q and an outlet tap R. when empty, the tank can be filled by tap P alone in $4\frac{1}{2}$ hours or by tap Q alone in 3 hours. When full, the tank can be emptied in 2 hours by tap R.
- (a) The tank is initially empty. Find how long it would take to fill up the tank
 - (i) If tap R is closed and taps P and Q are opened at the same time
(2mks)
 - (ii) If all the three taps are opened at the same time
 - (b) The tank is initially empty and the three taps are opened as follows
 - P at 8.00 a.m
 - Q at 8.45 a.m
 - R at 9.00 a.m
 - (i) Find the fraction of the tank that would be filled by 9.00 a.m
 - (ii) Find the time the tank would be fully filled up

10. Kipketer can cultivate a piece of land in 7 hrs while Wanjiru can do the same work in 5 hours. Find the time they would take to cultivate the piece of land when working together.
11. Mogaka and Ondiso working together can do a piece of work in 6 days. Mogaka, working alone, takes 5 days longer than Onduso. How many days does it take Onduso to do the work alone.
12. Wainaina has two dairy farms A and B. Farm A produces milk with $3\frac{1}{4}$ percent fat and farm B produces milk with $4\frac{1}{4}$ percent fat.
- (a) (i) The total mass of milk fat in 50 kg of milk from farm A and 30kg of milk from farm B.
- (ii) The percentage of fat in a mixture of 50 kg of milk A and 30 kg of milk from B
- (c) Determine the range of values of mass of milk from farm B that must be used in a 50 kg mixture so that the mixture may have at least 4 percent fat.
- (d)
13. A construction firm has two tractors T_1 and T_2 . Both tractors working together can complete the work in 6 days while T_1 alone can complete the work in 15 days. After the two tractors had worked together for four days, tractor T_1 broke down. Find the time taken by tractor T_2 complete the remaining work.

14. The points P, Q, R and S have position vectors $2p$, $3p$, r and $3r$ respectively, relative to an origin O. A point T divides PS internally in the ratio 1: 6
- (a) Find in the simplest form, the vectors OT and QT in terms of P and r
- (b) (i) Show that the points Q, T and R lie on a straight line.
(ii) Determine the ratio in which T divides QR.

TOPIC 14

GRAPHICAL METHODS

1. The table shows the height metres of an object thrown vertically upwards varies with the time t seconds

The relationship between s and t is represented by the equations $s = at^2 + bt + 10$ where b are constants.

t	0	1	2	3	4	5	6	7	8	9	10
s		45.1						49.9			-80

- (c) (i) Using the information in the table, determine the values of a and b
- (ii) Complete the table
- (b) (i) Draw a graph to represent the relationship between s and t
- (ii) Using the graph determine the velocity of the object when $t = 5$ seconds
2. Data collected from an experiment involving two variables X and Y was recorded as shown in the table below

x	1.1	1.2	1.3	1.4	1.5	1.6
y	-0.3	0.5	1.4	2.5	3.8	5.2

The variables are known to satisfy a relation of the form $y = ax^3 + b$ where a and b are constants

- (a) For each value of x in the table above, write down the value of x^3
- (b) (i) By drawing a suitable straight line graph, estimate the values of a and b
- (ii) Write down the relationship connecting y and x

3. Two quantities P and r are connected by the equation $p = kr^n$. The table of values of P and r is given below.

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

- a) State a linear equation connecting P and r.
- b) Using the scale 2 cm to represent 0.1 units on both axes, draw a suitable line graph on the grid provided. Hence estimate the values of K and n.
4. The points which coordinates (5,5) and (-3,-1) are the ends of a diameter of a circle centre A

Determine:

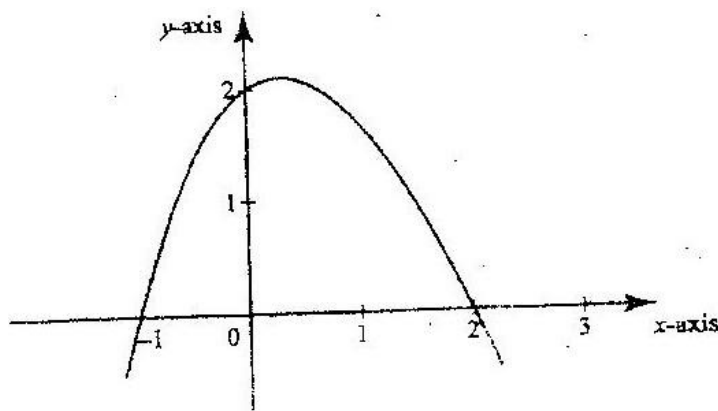
- (a) The coordinates of A

The equation of the circle, expressing it in form $x^2 + y^2 + ax + by + c = 0$

where a, b, and c are constants each computer sold

5. The figure below is a sketch of the graph of the quadratic function $y = k$

$$(x+1)(x-2)$$

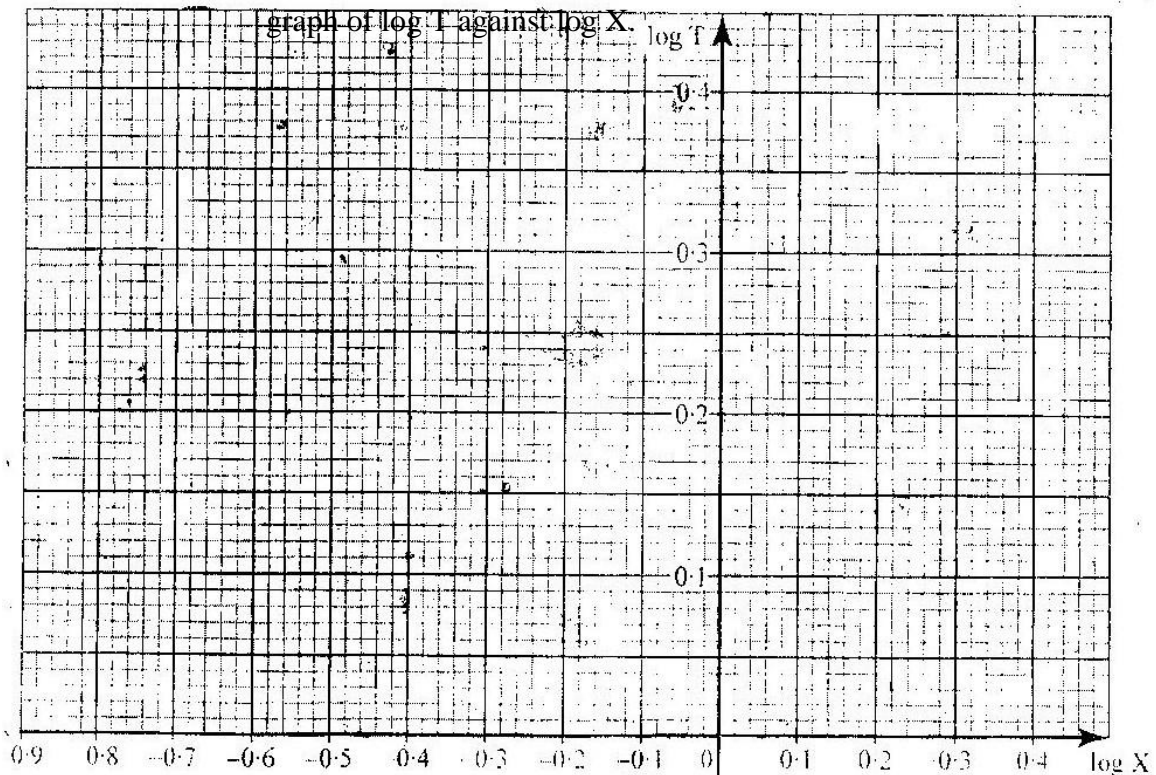


Find the value of k

6. The table below shows the values of the length X (in metres) of a pendulum and the corresponding values of the period T (in seconds) of its oscillations obtained in an experiment.

X (metres)	0.4	1.0	1.2	1.4	1.6
T (seconds)	1.25	2.01	2.19	2.37	2.53

- (a) Construct a table of values of $\log X$ and corresponding values of $\log T$, correcting each value to 2 decimal places
- (b) Given that the relation between the values of $\log X$ and $\log T$ approximate to a linear law of the form $m \log X + \log a$ where a and b are constants
- (i) Use the axes on the grid provided to draw the line of best fit for the



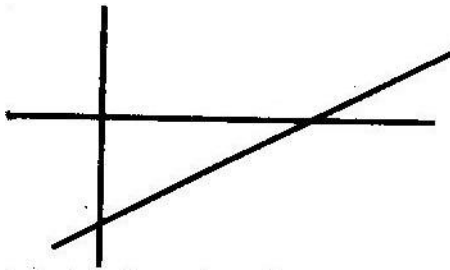
- (ii) Use the graph to estimate the values of a and b
- (iii) Find, to decimal places the length of the pendulum whose period is 1 second.

7. Data collection from an experiment involving two variables x and y was recorded as shown in the table below

X	1.1	1.2	1.3	1.4	1.5	1.6
Y	-0.3	0.5	1.4	2.5	3.8	5.2

The variables are known to satisfy a relation of the form $y = ax^3 + b$ where a and b are constants

- (a) For each value of x in the table above. Write down the value of x^3
 - (b) (i) By drawing a suitable straight line graph, estimate the values of a and b
 - (ii) Write down the relationship connecting y and x
8. Two variables x and y, are linked by the relation $y = ax^n$. The figure below shows part of the straight line graph obtained when log y is plotted against log x.



Calculate the value of a and n

9. The luminous intensity I of a lamp was measured for various values of voltage v across it. The results were as shown below

V(volts)	30	36	40	44	48	50	54
L (Lux)	708	1248	1726	2320	3038	3848	4380

It is believed that V and I are related by an equation of the form $I = aV^n$ where a and n are constant.

- (a) Draw a suitable linear graph and determine the values of a and n
- (b) From the graph find
- (i) The value of I when $V = 52$
- (ii) The value of V when $I = 2800$
10. In a certain relation, the value of A and B observe a relation $B = CA + KA^2$ where C and K are constants. Below is a table of values of A and B

A	1	2	3	4	5	6
B	3.2	6.75	10.8	15.1	20	25.2

- (a) By drawing a suitable straight line graphs, determine the values of C and K.

(b) Hence write down the relationship between A and B

(c) Determine the value of B when $A = 7$

11. The variables P and Q are connected by the equation $P = ab^q$ where a and b are constants. The value of p and q are given below

P	6.56	17.7	47.8	129	349	941	2540	6860
q	0	1	2	3	4	5	6	7

- (a) State the equation in terms of p and q which gives a straight line graph
- (b) By drawing a straight line graph, estimate the value of constants a and b and give your answer correct to 1 decimal place.

