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Kenya Certificate of Secondary Education

SMARTFOCUS QUICK REVISION SERIES 2025

MATHEMATICS

34 SERIES EXAMS
PAPER 1 AND 2

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SERIES 1
PAPER 1

SECTION I (50MARKS)

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

1. Evaluate without using tables or calculators (3marks)

$$\frac{{}^{6}/_{7} \text{ of } {}^{14}/_{3} \div 80 \times {}^{-20}/_{3}}{-2 \times 5 \div (14 \div 7) \times 3}$$

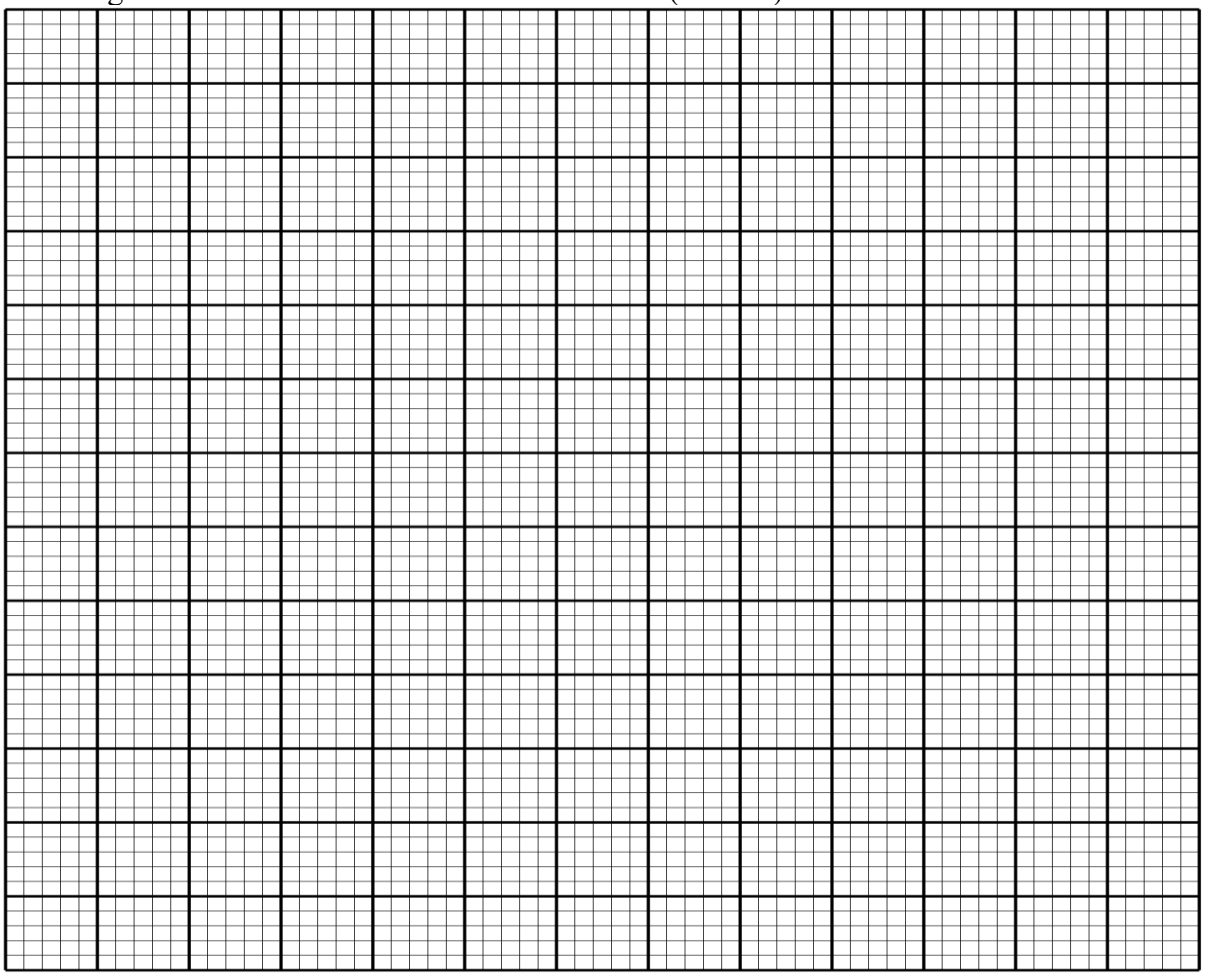
2. Solve the following inequalities and represent the solution on a number line.

$4 - 3 \leq 6x - 1 < 3x + 8$ (3marks)

3. Use tables of squares, cubes roots and reciprocals to evaluate; (4marks)

$$23.5^3 - \sqrt[3]{(4411)} + \frac{1}{0.0071}$$

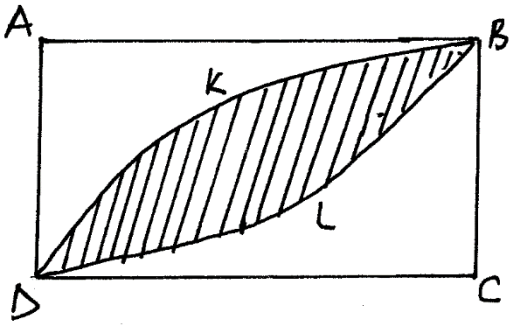
4. Triangle ABC has its vertices at A(3, 0), B(2,3) and C(5,1) if A′(5, 0), B′(3,6) and C′(9,2) is the image of ABC under enlargement. On the same axes and grid provided below, determine the Centre of enlargement and linear scale factor. (3marks)



5. Phenny is a saleslady. She is paid Ksh 15,375 per month. She is also paid a commission of 4 ½ % on the amount of money she makes from her sales. In a certain month, she earned a total of Ksh. 28,875. Calculate the value of her sales that month. (3marks)

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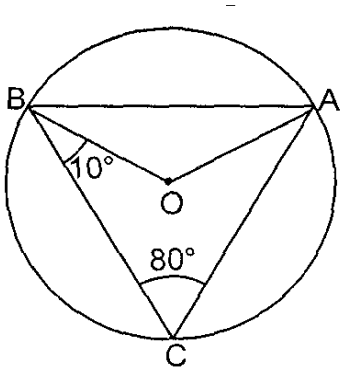
6. The figure drawn below is a square ABCD of sides 36.75cm. The shaded area is formed out of two segments. DCB and DKB. Find the area of the shaded region. (3marks)



7. Solve for x in the equation: $3^{2x+1} + 4 \times 3^{2x+1} - 45 = 0$ (3 marks)

8. Simplify the expression to its simplest form $\frac{24x^2 + 2ax - 12a^2}{18x^2 - 8a^2}$ (3marks)

9. In the figure below, O is the centre of circle. Angle BCA=80 ^{0} and angle CBO = 10 ^{0}. Determine the size of angle CAB. (3marks)



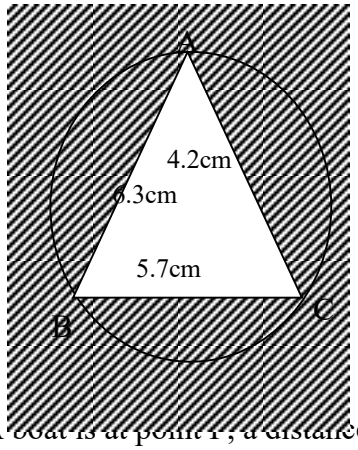
10. A foreign exchange bureau in Mombasa buys and sells selected foreign currencies at the rates shown in the table below.

Currency	**Buying (Ksh)**	**Selling (Ksh)**
1 South African Rand	7.48	7.95
1 Chinese Yuan	20.03	20.20

A tourist arrived in Kenya from South Africa with 7,435,000 South African Rands. She converted the whole amount to Kenya shillings through an agent at a commission of 2%. While in Kenya, she spent 25% of this money and converted the balance to Chinese Yuan. Calculate the amount of Chinese Yuan that she received. (3 marks)

11. Two matrices A and B are such that A=$\begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix}$ and B= $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$,given that the determinant of AB = 4, find the value of K. (3mks)

12. The circle below whose area is 18.05cm ^{2} circumscribes triangle ABC where AB = 6.3cm, BC = 5.7cm and AC = 4.2cm. Find the area of the shaded part. (4Marks)



13. A boat is at point P, a distance of 100km from the bottom of a hill. The angle of elevation of the top of the hill is 30° from P. The boat sails straight towards the hill to a point Q from where the angle of elevation to the top of the hill is now 60°. Calculate the distance PQ (3 marks)

14. The interior angle of a regular polygon is 108 ^{0} larger than the exterior angle. Determine the number of sides of the polygon. (3 Marks)

15. A piece of wire 18 cm long is to be bent to form a rectangle. If its length is x cm, obtain an expression for its area. Hence calculate the dimensions of the rectangle with maximum area from the expression (3marks)

16. A solid comprises of a cube **ABCDEFGH** of each side **2cm** and a square based pyramid **EFGHV**. The slant edges of the pyramid **EV=FV=GV=HV=2cm**. Draw the net of the solid. (3marks)

SECTION II(50 Marks)

*Answer only **five** questions from this section in the spaces provided*

17. A bus left Kisumu at 6.00a.m and travelled towards Usenge Boys at an average speed of 100km/hr. At 6.30 am, a van left Usenge Boys and travelled towards Kisumu to receive the bus with a number of students moving at an average speed of 125km/h.Given that the distance between Kisumu and Usenge Boys is 500km Calculate:

a. The time the two vehicles met. (4marks)

b. On meeting, the bus proceeded with its journey but the van had a break of 30 minutes before proceeding for Usenge Boys. Calculate:

i. The time the bus arrived at Usenge Boys. (3marks)

ii. The time the van arrived at Usenge Boys (3marks)

18. Complete the table below for the function $y= x^2 – 3x + 6$ in the range $-2 \leq x \leq 8$. (2mks)

X	-2	-1	0	1	2	3	4	5	6	7	8
Y											

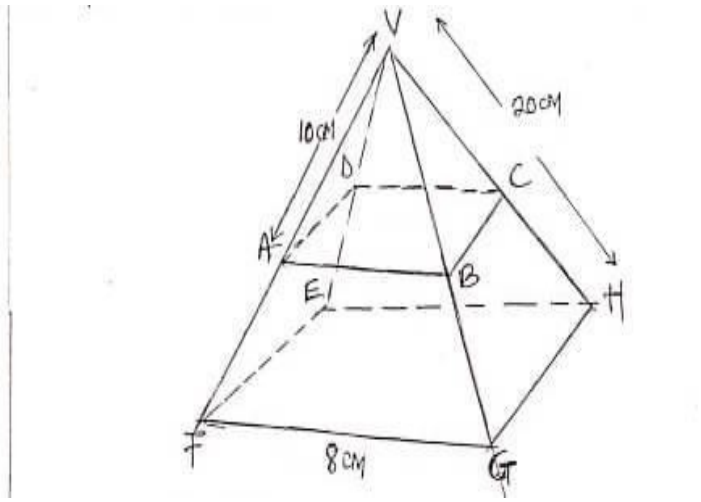
a. Use the trapezium rule with 10 strips to estimate the area bounded by the curve, $y=x^2 - 3x + 6$, the lines x = -2, x =8 and the x – axis. (3mks)

b. Use the mid – ordinate rule with 5 strips to estimate the area bounded by the curve, $y = x^2 – 3x + 6$, the lines x = -2, x = 8 and the x- axis. (3mks)

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c. By integration, determine the actual area bounded by the curve $y = x^2 - 3x + 6$, the lines $x = -2$, $x = 8$, and the x – axis. (2mks)

19. The figure below is a right pyramid VEFGH with a square base of 8cm and a slant edge of 20cm. points A,B,C and D lie and plane ABCD is parallel to the base EFGH.



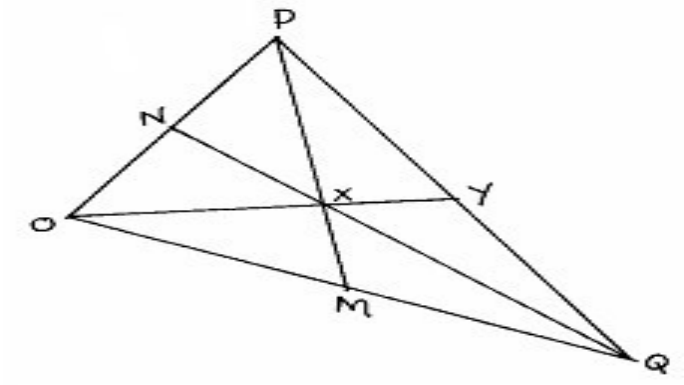
a. Find the length of AB. (2marks)

b. Calculate to 2 decimal places.
i. The length of AC. (2marks)

ii. The perpendicular height of the pyramid VABCD. (2marks)

c. The pyramid VABCD was cut off. Find the volume of the frustrum ABCDEFGH correct to 2 decimal places. (4marks)

20. The figure below is triangle OPQ in which **OP = p** and **OQ = q** . M and N are points on **OQ** and **OP** respectively such that **ON = NP** = 1:2 and **OM: MQ** = 3: 2.



(a) Express the following vectors in terms of p and q.

(i) PM. (2marks)

(ii) QN. (1marks)

(iii) PQ. (1marks)

(b) Lines PN and QN intersect at X such that **PX = rPM** and **QX = tQN**. Express **OX** in two different ways and find the value of **r** and **t.** (4 marks)

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(c) **OX** produced meets **PQ** at **Y** such that **PY: YQ = 5: 3.** Using the ratio theorem or otherwise, find **OY** in terms of **p** and **q**. (2 mark

21. Complete the table below for the equation $y = 2x^2 + 3x - 11$ (2 Marks)

x	-4	-3	-2	-1	0	1	2	3
$2x^2$	32							
$3x$	-12							
-11	-11	-11	-11	-11	-11	-11	-11	-11
y			-9					16

(a) On the grid paper provided draw the graph of $y = 2x^2 + 3x - 11$ (3 Marks)

(b) On the same axes draw the graph of $y = 2x + 1$ (2 Marks)

(c) Use your graph to solve the quadratic

(i) $2x^2 + 3x - 11 = 0$ (1 Mark)

(ii) $2x^2 + x - 12 = 0$ (2 Marks)

22. A straight line**L**1 passes through the points (8, -2) and (4,-4).

(a) Write its equation in the form ax + by +c = 0, where a, b and c are integers. (3Marks)

(b) If the line **L**1 above cuts the x-axis at point P, determine the coordinates of P. (2Marks)

(c) Another line**L2**, which is a perpendicular bisector to the line in (a) above cuts the y axis at the point Q. Determine the coordinates of point Q. (3 Marks)

(d) Find the length of QP (2 Marks)

23. A rectangular field measures 20 metres by 16 metres. A path of uniform width *x* - metres is made all round it. This make the area of the field to reduce in the ratio 7 : 16.

a) Find an expression in *x* for the new length and the width (1mark)

b) Find the expression in *x* for the new area. (1mark)

c) Find the possible value of *x* (4 marks)

d) The remaining area of the field is divided among three siblings Abdi, Bor and Celine such that the ratio of Abdi to Bor's is 3 : 4 while that of Bor's to Celine's is 6 : 5. Find the difference between the area of Celine's share and Abdi's share.

(4marks)

24. Using a pair of compass and ruler only construct.

(a) Triangle PQR in which PQ =5cm∠QPR = 30^0 and ∠PQR=105^0. (3marks)

(b) A circle that passes through the vertices of the triangle PQR. Measure its radius.

(3marks

(c) The height of triangles PQR with PQ as the base. Measure the height. (2marks)

(d) Determine the area of the circle that lies outsides the triangle correct to 2 decimal places (2marks)

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PAPER 2 SECTION I (50 marks)

1. Use logarithms to evaluate (4marks)

$$\sqrt{\left(\frac{\log 9\times 0.954}{0.301\times 4.3}\right)^{-2}}$$

2. AB is the diameter of the circle. Given that A(2, -3) and B(4, -7). Find the equation of the circle in the form $x^2 + y^2 - 2ax + 2by + c = 0$ (3 marks)

3. A quantity P varies partly as the cube of Q and partly varies inversely as the square of Q. When Q = 2, P = 108 and when Q =3, P = 259. find the value of P when Q = 6
(4 rmarks)

4. (a) expand $(a-b)^5$ (2 marks)

(b) Use the first three terms of the expansion in (a) the above to find the value of 1.97^5 to two decimal place (2 marks)

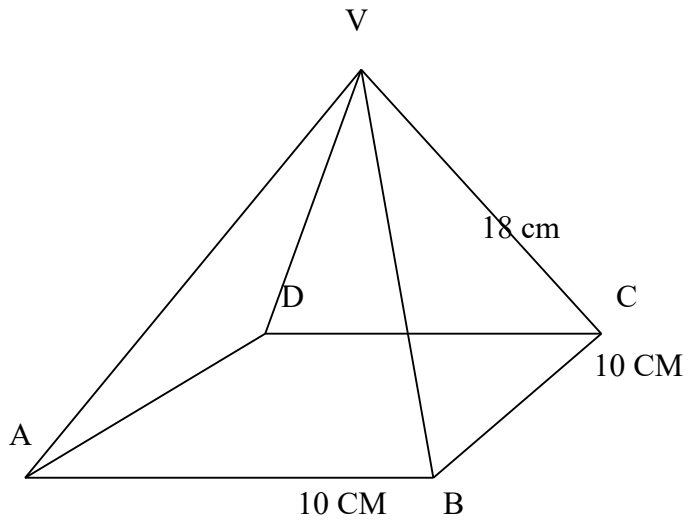
5 . Simplify without using tables or calculator

$\text{Log}_7 49 \times \log_3 27$ (2 marks)

6. Water flows from a tap. At the rate 27cm^3 per second, into a rectangular container of length 60cm, breath 30 cm and height 40 cm. If at 6.00 p.m. the container was half full, what will be the height of water at 6.04 pm? (3 marks)

7.) Figure below shows a square based pyramid ABCD .AV=BV=CV=DV=18 cm.

AB= 10 cm. Calculate the angle between the plane BVC and AVD. (3 marks)



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8.The roots of a quadratic equation are -3 and ½ . Form the quadratic equation in the form

$ax^2 + bx + c = 0$ Where a, b, and c are constants (3 marks)

9.Triangle ABC is mapped onto triangle A˚B˚C˚ by a transformation given by the matrix N= $\begin{pmatrix} 3 & 1 \\ -1 & 1 \end{pmatrix}$. If A˚B˚ = 4 cm , find AB (3 marks)

10. Using log 2 = 0.3010 and log 3 = 0.4771 . Evaluate log 45 (3 marks)

11. The position of two towns A and B on the earth's surface are (36◦N,49◦E) and (36◦N, 131◦W) respectively.

(a) Find the local time at A if the time at B is 12.35pm on Sunday. (1mk)

(b) Using 6370km as the radius of the earth, calculate the shortest distance between town A and B (2mks)

12. 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.(3Mrks)

13. A two digit number is made by combining any of two digits 1,2,3,4, and 5 at random. Find the probability that the number formed is even (2marks)

14. The deviation d from the mean X of the set of data x are given below;

X	15	18	M	23	M+6	28	30
d	-8	-5	Y	0	-y	5	7

a) Find the value of m and y (2 marks)

b) Calculate the mean a bsolute deviation of the data (2 marks)

15. Make y the subject o f the formula (3 marks)

$$q = m\sqrt{\frac{r^2 - y^2}{y^2 - 3}}$$

16. Solve the equation: $3 \cos X = 2 \sin^2 X$ where $0 \leq X \leq 360$ (3marks)

Section II (50 marks) . Answer only five questions in this section in the spaces provided

17.The table below shows the analysis of examination marks scored by 160 candidates

Marks (%)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
No of candidates	2	6	15	22	36	34	20	15	6	4

a)Using an assumed mean of 45.5. calculate

I. The mean (3 marks)

II. The standard deviation (4 marks)

b) Calculate the minimum mark for grade A if 40 student got grade A (3 marks)

18 .A and B are two points on latitude 40^0.The two points lie on the longitude 80^0W and 100^0 E respectively.(taking $\pi = \frac{22}{7}$ and R =6370 KM) .

(a) Calculate;

(i) The distance from A to B along the parallel of latitude (3mks)

(ii)The distance from A to B along the great circle (4mks)

(b) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along the parallel of latitude ,which one arrived earlier and by how much? Give your answer to the nearest minute. (3mks)

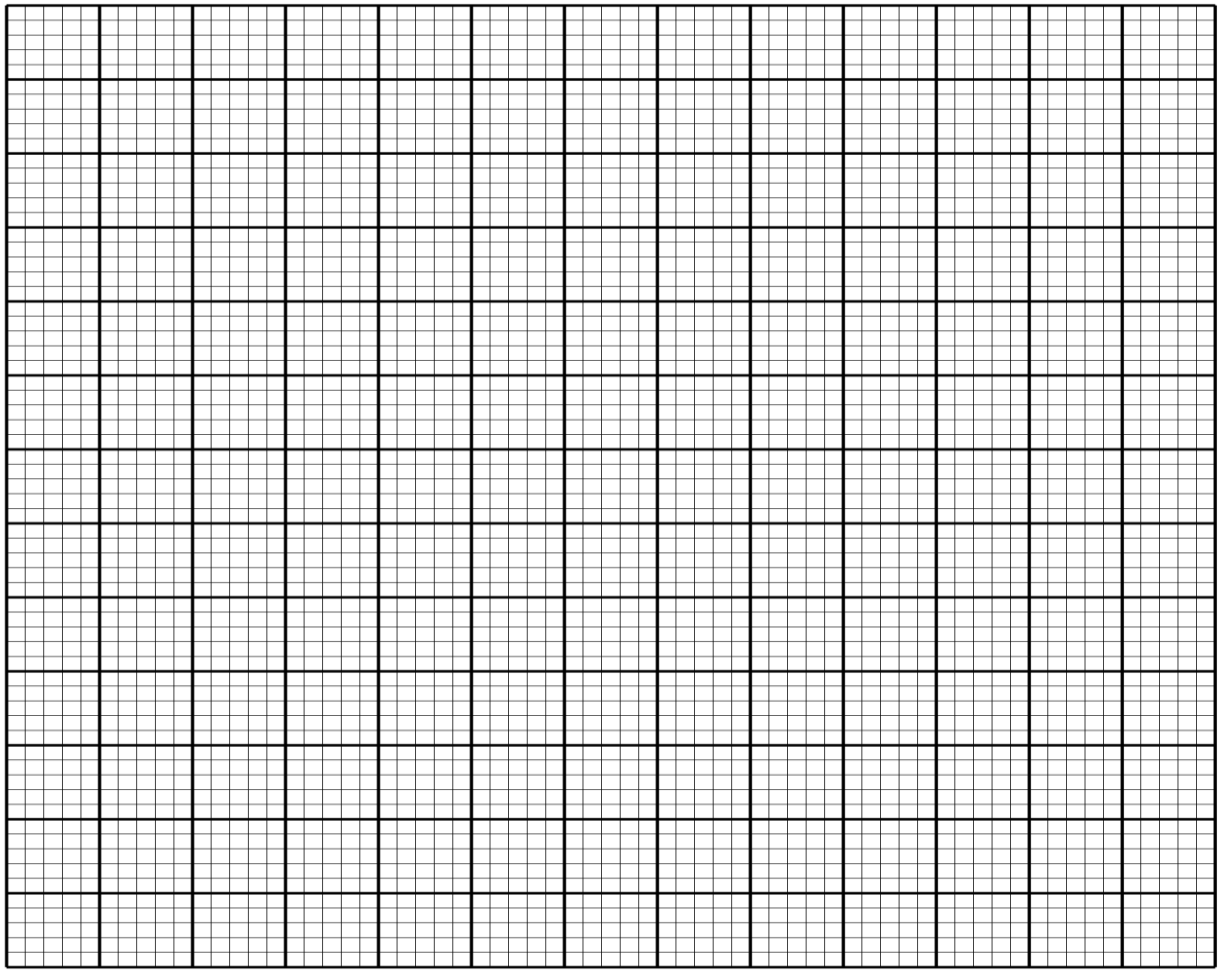
19. a).Complete the table below by filling in the blank spaces for the functions

$y = \sin(x + 30)$ and $y = \cos \frac{1}{2}x$ (2 marks)

X	0	30	60	90	120	150	180	210
$Y=\sin(x+30^0)$	0.5		1		0.5			-0.87
$Y = \cos \frac{1}{2}x$	1.00			0.71			0.00	

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b.) Using the scale,x-axis 1cm =30 ,y-axis 1cm=0.5 units, draw their graphs of the functions on the same axes (5marks)



c)Use your graph to solve

i. $\sin(x + 30) - \cos\frac{1}{2}x = 0$ (1 mark)

ii. $\sin(x + 30) = 0$ (1 mark)

iii) $\cos\frac{1}{2}x = -0.25$ (1mark)

20. The equation of a curve is $y=3x^2-4x+1$

a) Find the gradient function of the curve when x=2 (2 marks)

b) Determine

i) The equation of the tangent of the curve at the point (2, 5) (2marks)

ii) The angle which the tangent to the curves at the point (2,5) makes with the horizontal line (2mks)

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iii) The equation of the line through the point (2, 5) which is perpendicular to the tangent in (b) i above (3marks)

21. The table shows income tax rates for the year 2023

Monthly income in Kenya shillings	Tax Rate in each shilling
0 – 10164	10%
10165 – 19740	15%
19741 – 29316	20%
29317 – 38892	25%
38893 and above	30%

In a certain month of that year an employee's taxable income in the fourth band was K£ 334.2

Tax relief of Ksh 1162 pm. Was allowed.

a)Calculate

i) The employees total taxable income in that month (3 marks)

ii) The P.A.Y.E. in that month (5 marks)

b)The employees income included taxable allowances a mounting to Kshs. 14000. The employees contributed 6% of the basic salary to a co- operative society. Calculate the employee net income for that month .
(3 marks)

22. The probability that Zora goes to school by boda boda is $\frac{2}{5}$ and by a matatu is $\frac{1}{4}$. If she uses a boda boda , the probability that she will be late is $\frac{2}{5}$ and $\frac{3}{10}$ if she uses a matatu . If she uses other means of transport the probability of being late is $\frac{3}{20}$

a) Draw a tree diagram to represent this information (3 marks)

b)F ind the probability that she will be late for school (2 marks)

c)Find the probability that she will be late for school if she does not use a matatu (3 marks)

d)Find the probability that she will be late for school (2 marks)

23. The acceleration of a particle after passing a fixed point P is given by a = 3t-3. Given that the velocity of the particle when t = 2 seconds is 5m/s, find:

a). Its velocity:

i). In terms of t (3 marks)

ii). When t = 4 (2 marks)

b). The maximum velocity attained by the particle. (2 marks)

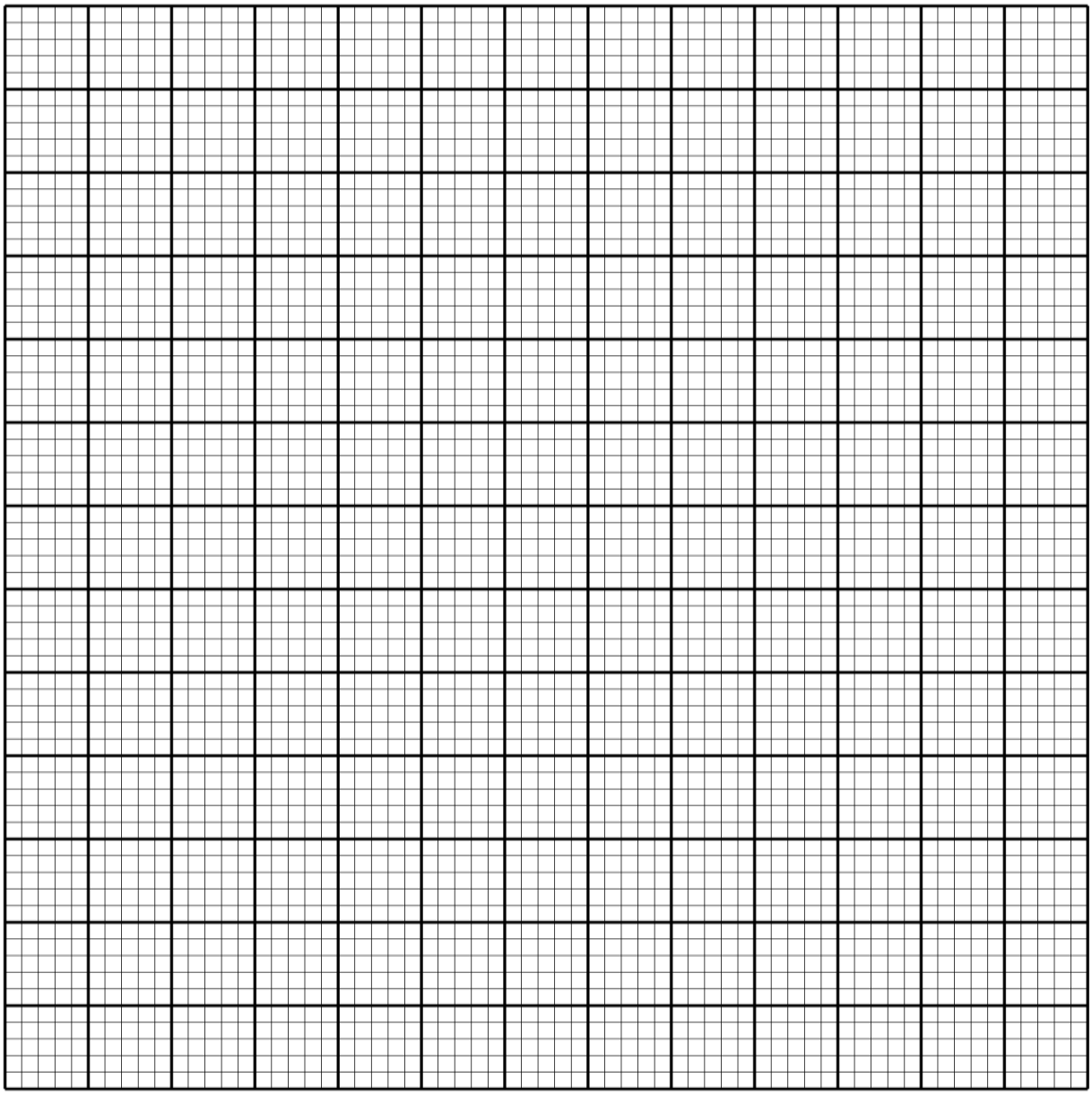
c). Its displacement during the third second. (3 marks)

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24.A triangle ABC with vertices A(2,0), B(4,-2) and C(4,4) is mapped onto its image $A^1B^1C^1$ under a transformation represented by the matrix $\begin{pmatrix} 1 & 1/2 \\ 0 & 1 \end{pmatrix}$

a)i) State the coordinates of $A^1B^1C^1$ (2 Marks)

ii) On the grid provided plot triangle ABC and triangle $A^1B^1C^1$ (2 marks)



iii)Describe fully the transformation represented by the matrix $\begin{pmatrix} 1 & 1/2 \\ 0 & 1 \end{pmatrix}$ (1 mark)

b)$A^{11}B^{11}C^{11}$ is the image of triangle $A^1B^1C^1$ under reflection on the line X= 0

Plot triangle $A^{11}B^{11}C^{11}$ on the same grid and state the co-ordinates (2marks)

c)Find a single matrix that can map triangle ABC onto triangle $A^{11}B^{11}C^{11}$ (3 mks

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PAPER 2

SECTION I (50 marks)

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

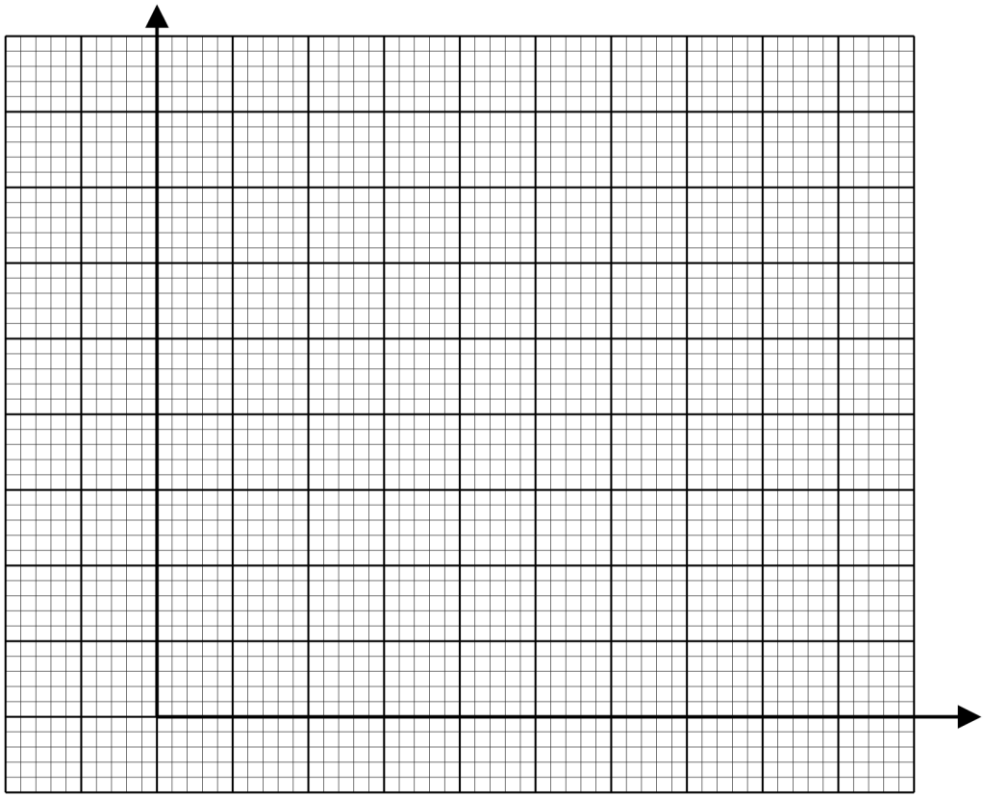
1. Solve for a in the equation $3\frac{a}{5} - 4\frac{a}{20} = 2$. **(3 marks)**

2. At Kona-Samaki Secondary School $\frac{3}{10}$ of the students are boys. On a certain day $\frac{5}{6}$ of the boys were present and $\frac{2}{5}$ of the girls were absent, if the total number of students absent on that day were 99 calculate the population of students in the school. **(3 marks)**

3. Calculate $m = \sqrt[3]{9a}$ without using Calculators or Mathematical Tables given that $\sqrt{a} = 8\sqrt{3}$. **(3 marks)**

4. From a viewing tower, 30 metres above the ground, the angle of depression of an object on the ground is 30° and the angle of elevation of an aircraft vertically above the object is 42°. Calculate the height of the aircraft above the tower to the nearest millimeter. **(3 marks)**

5. On the grid provided draw the region bounded by: $y - 2x \leq 1,\ \ x + y < 7\ and\ y \geq 1$ using a scale of 1cm to represent 1 unit on both axes. **(3 marks)**

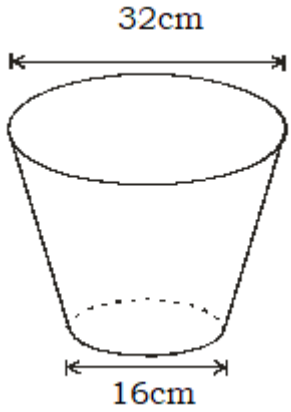


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6. The ratio of the current ages of John and Kelly is 4:5. Five years ago, the ratio of their ages was 7:9. Calculate their current ages in years. **(3 marks)**

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7. The figure below shows a frustum container with base diameter 16cm and top diameter 32cm. The slant height of the frustum is 36cm as shown below. The container 80 percent full of water.



Calculate the volume of the water in the container to the nearest decilitre. **(4 marks)**

8. Solve for k in the equation $(\frac{20}{12})^{(7k-5)} = (\frac{36}{100})^{(k-1)}$. **(3 marks)**

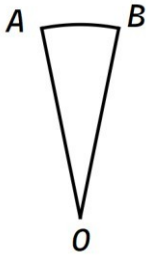
9. Given that x is an acute angle and $\sin(x-20)^\circ = \cos(3x-50)^\circ$ find the value of x in degrees. **(2 marks)**

10. A straight line whose equation is $4y + 3x = 12$ is perpendicular to line QR. Determine the obtuse angle α°, to one decimal place, which line QR makes with x-axis. **(3 marks)**

11. Determine the value of t given that points $P(-6,-3)$, $Q(-2,-1)$ and $R(6,-t)$ are collinear. **(4 marks)**

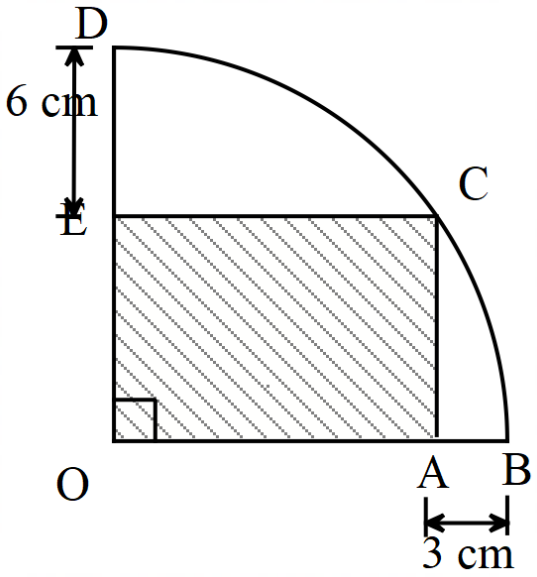
12. Calculate the square of the length of the side of an equilateral triangular card whose area is 81 cm^2 leaving your answer in the form $b\sqrt{c}$. **(3 marks)**

13. In the figure below triangle ABO represents part of a county government badge. The badge has a symmetry of order 3 about O. Complete the figure to show the badge. **(3 marks)**



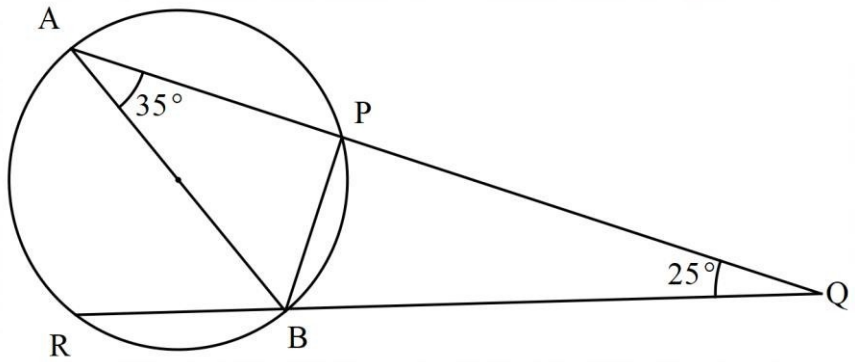
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14. The figure below shows rectangle OACE inscribed in a quarter circle centre O.



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

15. The figure below shows a circle with diameter AB. AP and RB are its chords which intersect externally at point Q.



Calculate the size of angle PBR. **(3 marks)**

16. Use the trapezium rule to estimate the area under the curve $y = x^2 + x - 6$ over the interval $0 \leq x \leq 8$ using 4 trapezia. **(3 marks)**

SECTION II (50 marks)

*Answer any **five** questions from this section in the spaces provided:*

17. The marked price of a piece of metal rod is Kshs. 1250 from Mali-Bora Metal Suppliers Limited. The supplier however have put a condition that discounts can only be allowed to customers who purchase more than 50 pieces of the metal rod. Customers enjoyed a 5% discount on the over purchase of the first 10 rods and thereafter 8%.

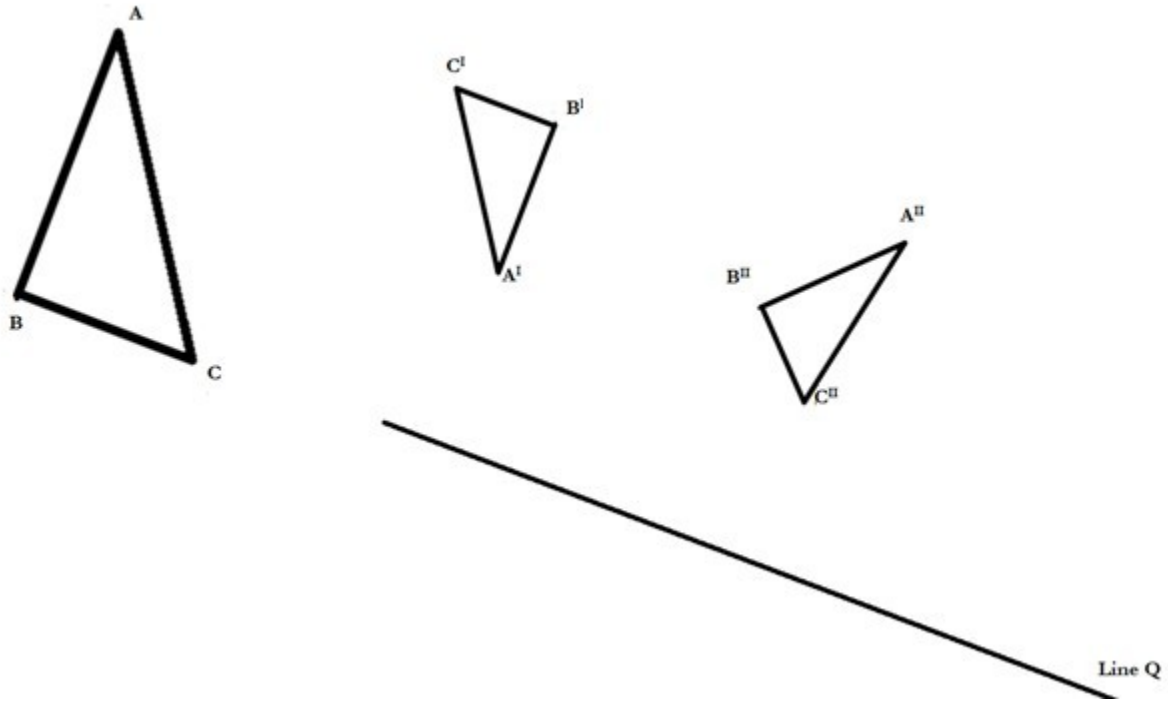
Calculate the:

a) percentage profit the Supplier received from the sale of 62 metal rods given that the Factory supplied them at Kshs. 1078 per rod. **(5 marks)**

b) number of rods received by a customer who paid Kshs.168,675 under the same terms. **(5 marks)**

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18. The triangle $A^IB^IC^I$ is the image of triangle ABC under a transformation enlargement of centre X and scale factor P. On the other hand $A^{II}B^{II}C^{I\,I}$ is the image of $A^IB^IC^I$ under rotation whose centre of rotation is Y and angle of rotation is α°. $A^{II}B^{II}C^{I\,I}$ is further reflected on line Q to give triangle $A^{III}B^{III}C^{III}$.



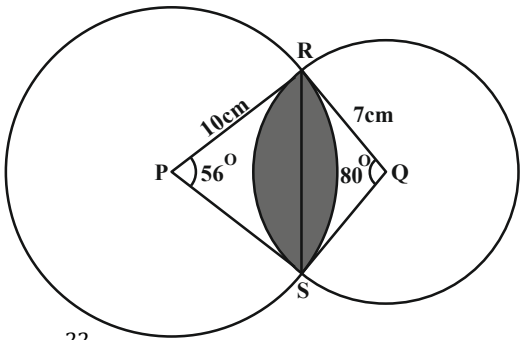
By construction:

a) locate centre X hence calculate, to one decimal place, the scale factor of enlargement P. **(4 marks)**

b) locate centre Y hence measure the angle of rotation α°. **(3 marks)**

c) draw $A^{III}B^{III}C^{III}$ the image of $A^{II}B^{II}C^{II}$ under reflection on line Q. **(3 marks)**

19. The figure below shows two circles centres P and Q of radii 10cm and 7cm respectively. The two circles intersect at R and S so that they have a common chord RS. Given that angle RPS = 56^0 and angle RQS = 80^0.



Taking $\pi = \frac{22}{7}$ calculate to 2 decimal places the area of the:

a) sectors RSP and RSQ **(4 marks)**

b) triangles RPS and RQS **(4 marks)**

c) shaded region. **(2 marks)**

20. Madam Pamela used to buy a certain number of bottles of soda for her class during bashes for Ksh. 3000. However when the prices of each bottle of soda went up by Ksh.10 she had to add money for ten more bottles on top of their usual budget.

a) Taking x as the original number of bottles of soda bought from the original budget, write an expression for the:

i) price of a bottle of soda before the increase in price. **(1 mark**

ii) price of a bottle of soda after the increase in price. **(1 mark)**

b) Calculate:

i) number of bottles of soda purchased by Madam Pamela. **(4 marks)**

ii) the percentage increase in the price of a bottle of soda. **(3 marks)**

iii) the number of learners in the class if each took two bottles of soda. **(1 mark)**

21. The equation of a curve is given by $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 12x + \frac{2}{3}$.

a) Determine the :

i) equation of the normal to the curve $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 12x + \frac{2}{3}$ at $x = -1$. **(3 marks)**

ii) coordinates of the stationary points of the curve $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 12x + \frac{2}{3}$. **(3 marks)**

iii) nature of each stationary point in (ii) above. **(2 marks)**

b) Hence sketch the curve $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - 12x + \frac{2}{3}$ showing clearly the *y*-intercept and the stationary points. **(2 marks)**

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22. Rafiki bus left Nairobi at 8:00am and traveled towards Mombasa at an average speed of 80km/hr. At 8:30am Upendo Bus left Mombasa towards Nairobi at an average speed of 120km/hr. Given that the distance between Nairobi and Mombasa is 400km; determine:

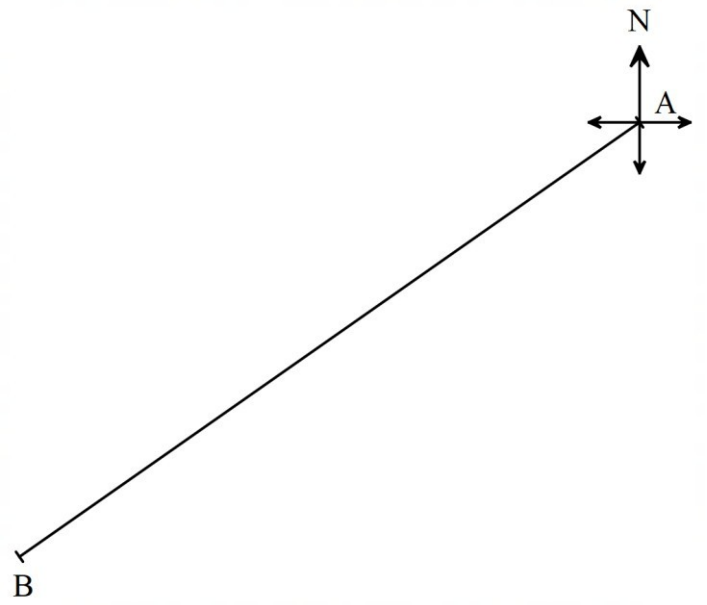
a) time Upendo Bus arrived in Nairobi. **(2 marks)**

b) time the two buses met. **(3 marks)**

c) distance from Nairobi to the point where the two buses met. **(2 marks)**

d) speed in km/hr at which the taxi driver must drive from the airport 10km away ferrying an Investigating Officer who boarded a plane travelling at 300km/hr from Mombasa at 10:10am to intercept a suspect at the terminus of Upendo Bus Service just as the bus arrive given that the taxi driver also require 10 minutes for changeover and braking. **(3 marks)**

23. The scale diagram below shows the relative positions of towns A and B which are 80 kilometres apart.



a) Determine the scale used in drawing the diagram in the form $1: x$ hence state the compass bearing of point A from B. **(2 marks)**

b) Locate another town C on the bearing $150^0$from A and 085^0 from B hence state the distance between town B and C. **(3 marks)**

c) Locate and label a Surveillance Post K which is equidistant from the three towns and hence use it to construct a ring road that passes through the three towns such that the road is always equidistant from the Post K. **(3 marks)**

d) Calculate the length of the ring road. **(2 marks)**

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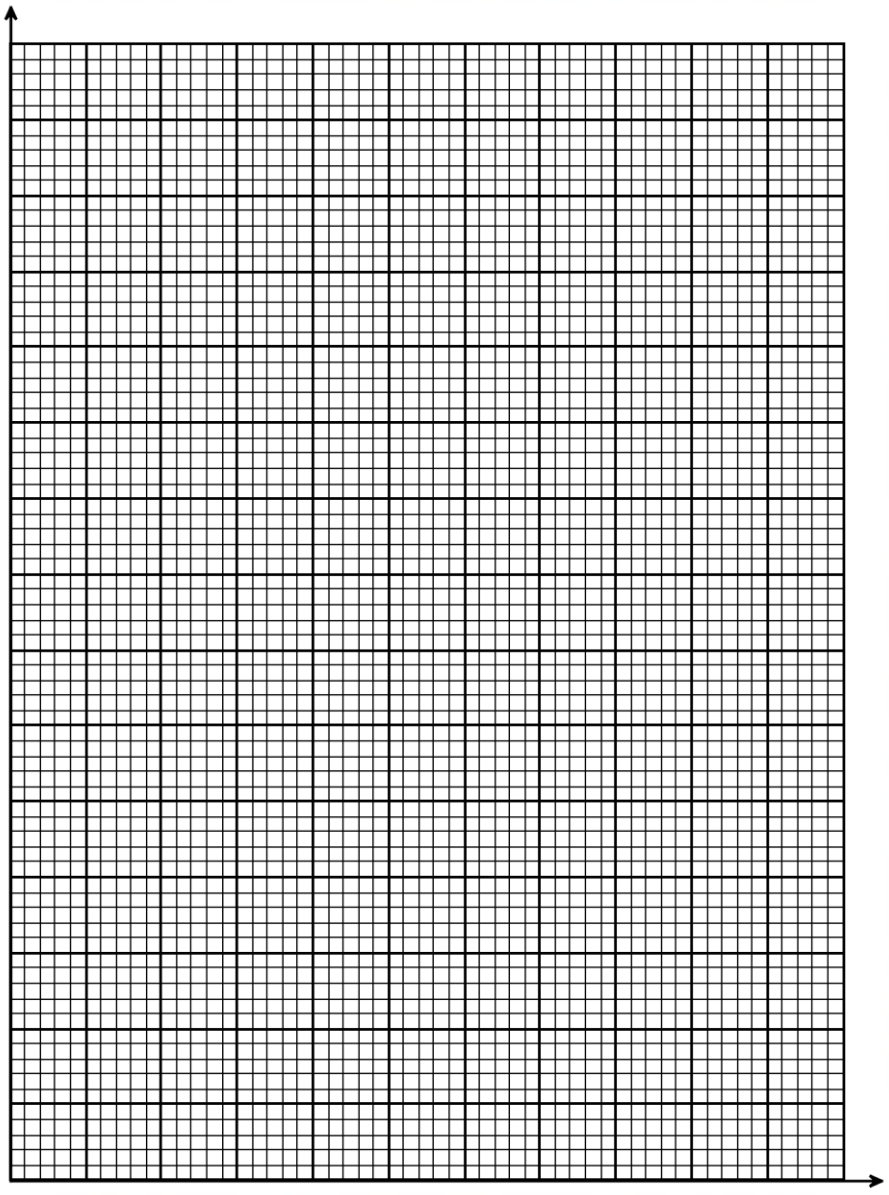
Marks	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Number of learners	3	9	q	14	10	6	r	2

24. The Table below shows marks obtained by 60 students in a Mathematics Exams.

a) Calculate the values of q and r given that the median mark is 45.5. **(4 marks)**

b) Determine the mean mark for the test to two decimal places. **(3 marks)**

c) On the grid provided draw a frequency polygon representing the data using a scale 1cm to represent 10 marks in x-axis and 1cm to represent 1 student in the y-axis. **(3 marks)**



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SECTION 1 (50 marks)

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

1. In what ratio should grade **P** of tea costing sh. 900 per kg be mixed with grade **Q** of tea costing sh. 700 per kg so that a profit of 10% is made by selling the mixture at sh. 902 per kg?

(3 marks)

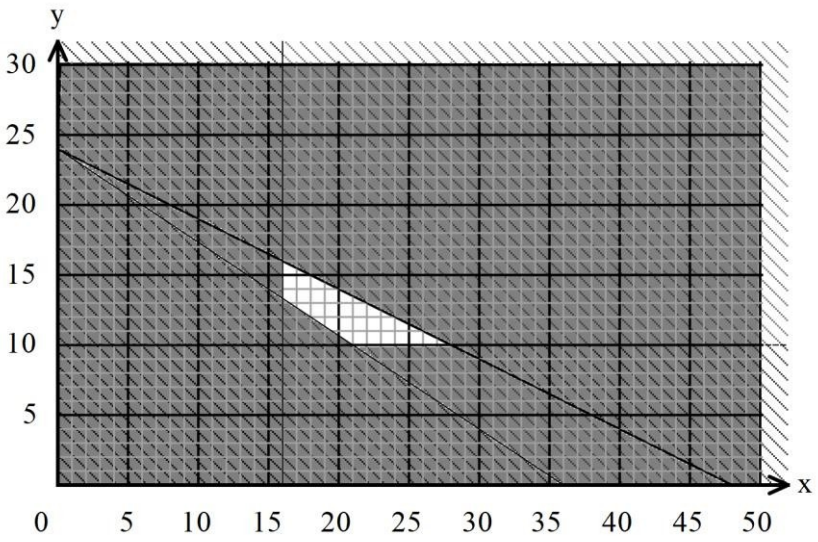
2. Use binomial to expand and simplify the expression (4 marks)

$$\left(2-\frac{1}{\sqrt{7}}\right)^4+\left(2+\frac{1}{\sqrt{7}}\right)^4$$

3. Mrs. Chebukaka bought a television set on hire purchase by paying a down payment of Ksh. 5000 and Monthly installments of Ksh. 1250 for 2 years. If the interest rate charged was 12% p.a compound interest, evaluate the carrying charge to the nearest hundreds. (4 marks)

4. Calculate the mean absolute deviation of 3, 5, 7, 9 and 11 correct to 2 decimal places. (3 marks)

5. Use the graph below to answer the question that follows:



Tarus makes a profit of Ksh. 40 on a ream paper and Ksh. 100 on calculator. Use the graph to determine the maximum profit Tarus can make by using a search line and use number of ream papers be x and calculator be y. (3 marks)

6. Make x the subject of the formula.

$$A-x=\sqrt{Bx+x^2}$$

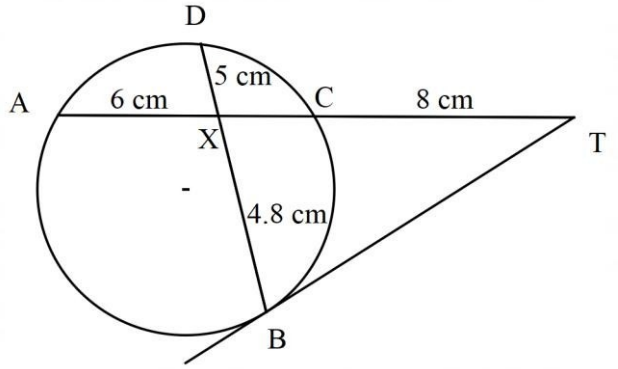
(3 marks)

7. A ball is dropped from the top of a building and its height h, metres above the ground at any time t, seconds is given by $h = 350 + 65t - t^2$.

a) Find the velocity of the ball when t = 2 seconds (2 marks)

b) State the time when the velocity is zero. (1 mark)

8. In the figure 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.

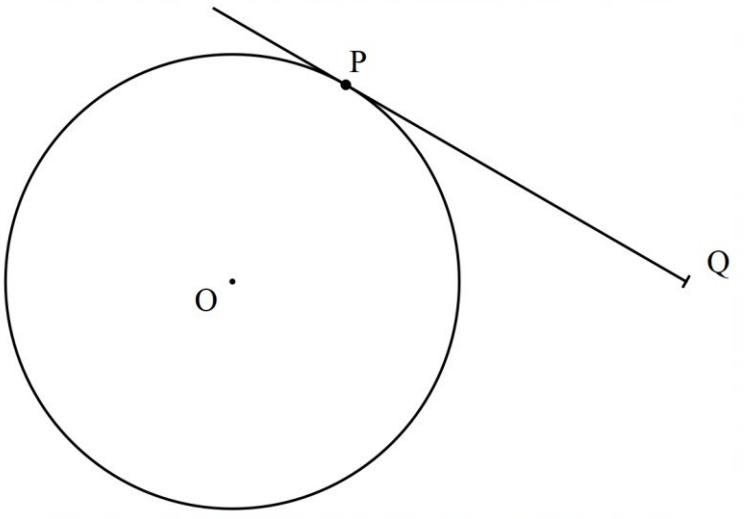


Calculate the length of BT (3 marks)

9. Under a transformation whose matrix is A= $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ a square whose area is 10 cm^2 is mapped onto a square whose area is 110 cm^2. Find the two possible values of x. (3 marks)

10. Solve for y in the equation $\log_2 \sqrt{81} + \log_2 \left(y^2 - 3^{-1} y \right) = 1$ (3 marks)

11. In this question, use a ruler and a pair of compasses. The following figure shows a circle, centre O. A tangent to the circle at P is drawn.



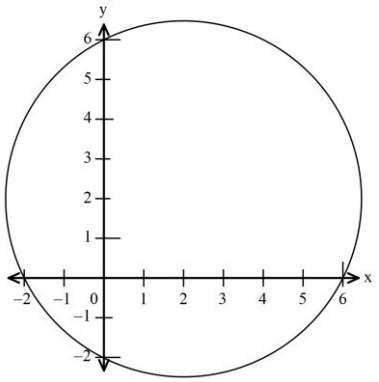
Construct another tangent to the circle to intersect the drawn tangent at an angle of 60 ° .
(2 marks)

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12. A school's environmental club consists of 7 boys and 5 girls. Three members are to be randomly chosen to be officials of the club. Calculate the probability that more boys were chosen to be official. (3 marks)

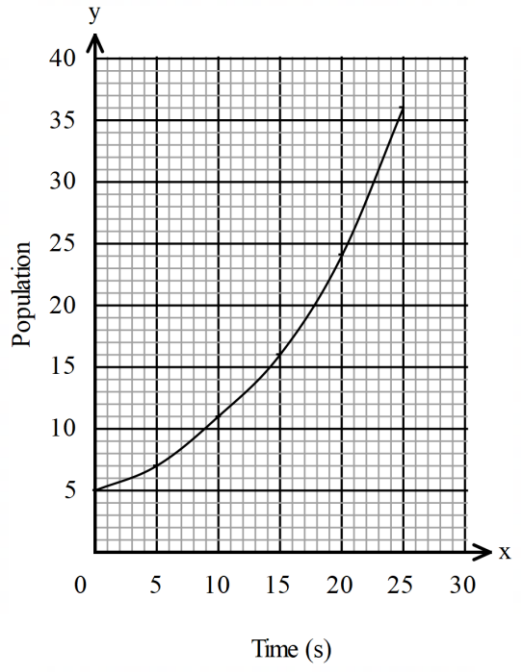
13. Solve the equation $4\sin^2 \alpha = 1\frac{1}{2} - \sin \alpha$ for $0° \leq \alpha \leq 180°$. (4 marks)

14. In the figure below, the circle passes through the points (-2, 0), (6, 0), (0, -2) and (0, 6). Find the centre and radius of the circle and hence the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are integers. (3 marks)



15. The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. (3 marks)

16. The population growth of a colony of insects was recorded at an interval of 5 second(s) as shown in the graph below.

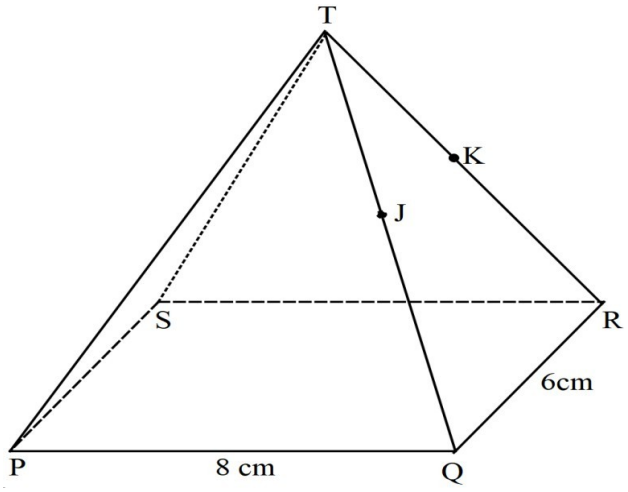


Use the graph to determine, correct to 4 significant figures, the average rate of change of the population of insect at t = 20. (3 marks)

SECTION II (50 marks)

Answer only **five** questions from this section in the spaces provided:

17. The figure below PQRST is a right pyramid with base PQ = 8cm, QR = 6cm and PT = QT = RT = ST = 13cm. J and K are mid points of QT and RT respectively,



Determine;

(a) The height of the pyramid (2 marks)

(b) The angle the length TS makes with SJ (3 marks)

(c) The angle PTS makes with the base PQRS. (2 marks)

(d) The angle between the plane PTS and the plane PJKS. (3 marks)

18. Two variables P and Q are such that P varies partly as the square of Q and partly as the inverse of Q. Given that P=10.5 when Q=2.5 and P=30.75 when Q=4.

a) Find the equation connecting P and Q (4 marks)

b) Find P when Q=1.5 (2 marks)

c) Q is directly proportional to the square root of R, and Q=3.04 when R=3.61 ,find

i) The relationship between Q and R (2 marks)

ii) The relationship between P and R. (2 marks)

19. Using a ruler and a pair of compasses only.

a) Construct triangle ABC such that AB = 9 cm, BC = 10 cm and angle BAC = 75°.

(3 marks)

b) On the same side as C, construct the locus of P such that area of triangle APB =13.5 cm^2

(2 marks)

c) On the same side as C construct the locus of Q such that angle AQB = 60°.
(2 marks)

d) Locate R within the triangle, such that AR < 5cm , ∠ACR ≥ ∠BCR and $AR \leq BR$,by shading the wanted parts. (3 marks)

20. The weight of loads by 100 trucks at the Naivasha weighbridge was as shown in the table below.

Weight (tonnes)	1 – 10	11 - 20	21 - 30	31 - 40	41 - 50	51-60	61-70	71-80	81-90	91-100
No. of Trucks	2	10	13	17	18	14	10	6	6	4

a) Assuming an average load of each truck as 42 tonnes, calculate the actual average load of each truck. (3 marks)

b) Determine the range of weight of the trucks in the 3rd quarter. (5 marks)

c) 20% of the trucks were found to be overload, determine the maximum recommended weight for a truck. (2 marks)

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

Monthly taxable income(Ksh)	Rate of tax (%) in each Ksh
1-10165	10
10166-19740	15
19741-29316	20
29317-38892	25
Over 38892	30

Mr Obambla is an employee who earns a basic salary of Ksh y and he is entitled to a house allowance of Ksh. 5,480 per month. He is also entitled to a monthly personal relief of Ksh. 1162. Given that his employer deducts Ksh. 6075.75 as income tax each month.

a) Calculate;

i) The monthly gross tax (2 marks)

ii) His gross monthly income (6 marks)

b) Calculate Mr. Obambla's basic monthly salary (2 marks)

22. A jet on a mission left town **P (60^0N, 15^0E)** to another town **Q (60^0N, 165^0W)** on the earth surface at a speed of **300 knots** using the shortest route possible. Take $\pi = \frac{22}{7}$ **and R = 6370 km.**

a) Calculate the distance travelled in nautical miles. (2 marks)

b) After some communication, the jet turns round immediately and heads due east of town **Q** with the same speed .However, it runs into a bad weather after covering **2700 nm** and it is forced to land at town **X**. Find the position of town **X .** (3 marks)

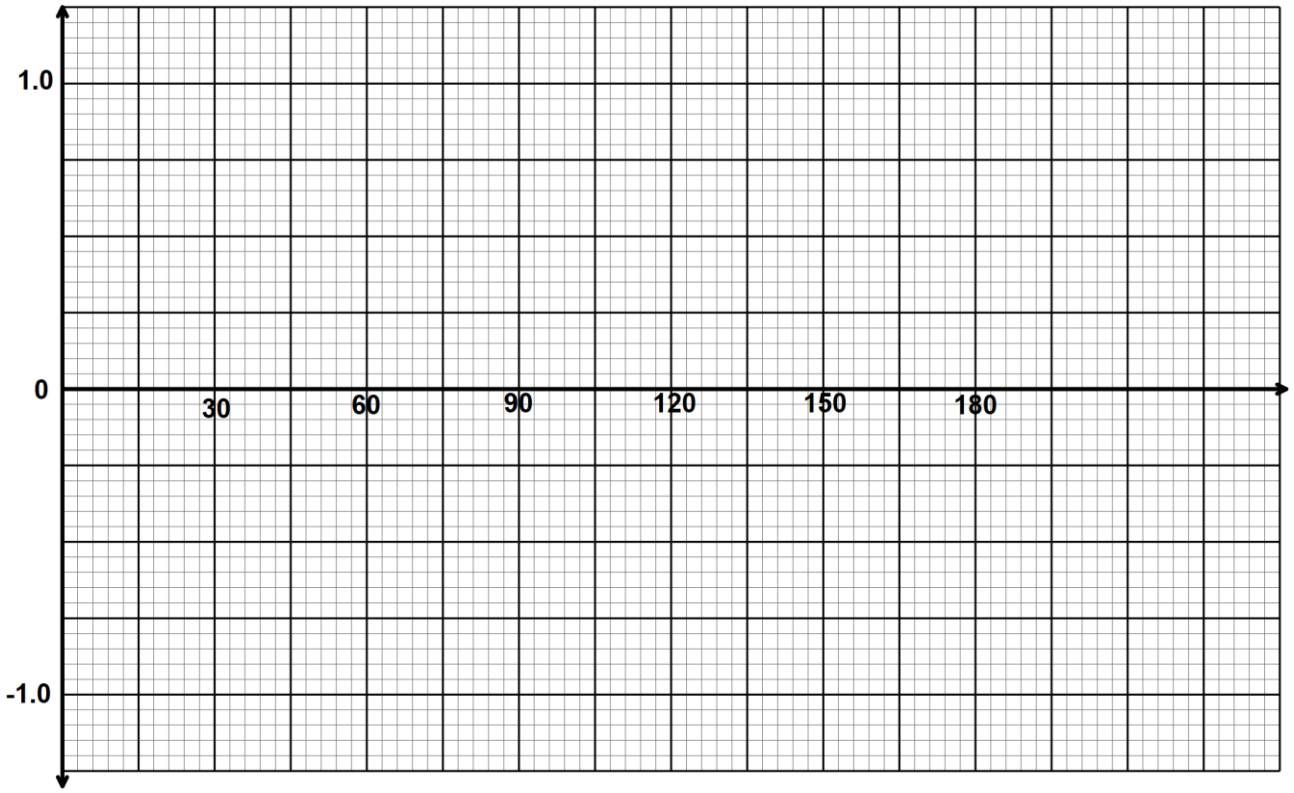
c) If the local time at **P** is **1.30 pm** by the time the jet flew off, what is the local time of its arrival at town **X** (3 marks)

d) Calculate the radius of the latitude in which the jet followed from **Q** to **X** in nm. (2 marks)

23. a) Complete the table below giving your values correct to two decimal places. (2 marks)

x^0	0	15	30	45	60	75	90	105	120	135	150	165	180
$\sin 2x^0$	0.00	0.50		1.00		0.50	0.00		-0.87			-0.50	0.00
$\cos(x-30)^0$	0.87		1.00		0.87			0.26		−0.26	-0.50		

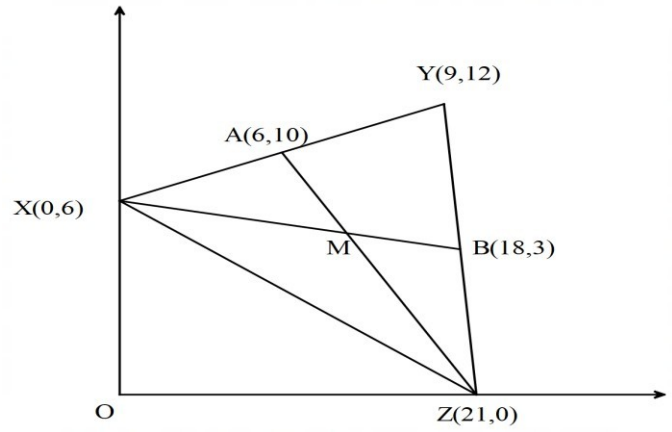
b) Draw on the same axes the graph $y = \sin 2x^0$ and $y = \cos(x-30)^0$ for the range $0^o \le x \le 180^o$ (4 marks)



c) Use the graph to solve the equation $2\sin 2x - 2\cos(x-30)^0 = 0$ (2 marks)

d) Use the graph to find the range of values of x for which $\sin 2x > \cos(x-30)^0$ (2 marks)

24. In the diagram below, the vertices XYZ are X (0, 6), Y (9, 12) and Z (21, 0). Points A (6, 10) and B (18, 3) lie on lines XY and YZ respectively.



a) Find:

i) **XB** (1 mark)

ii) **ZA** (1 mark)

b) Lines XB and ZA intersect at M such that **ZM** = k**ZA** and **XM**=m**XB** where k and m are scalars.

i) By expressing **OM** in two different ways, determine the values of k and m. (5 marks)

ii) Determine the exact coordinates of point M. (2 marks)

iii) Find the ratio in which A divides line ZM. (1 mark)

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PAPER 2

SECTION 1: *ANSWER ALL QUESTIONS IN THIS SECTION*

1. Evaluate $5\frac{1}{2} - 1\frac{1}{7}\left(1\frac{1}{5} + \frac{9}{10}\right) + \frac{1}{3}$ of $\left(\frac{2}{3} \div \frac{5}{6}\right)$ (3mks)

2. Simplify

$$\frac{6a^2 + 7ab + 2b^2}{4a^2 - b^2}$$ (3mks)

3. A positive two digit number is such that the product of the digits is 20.When the digits are reversed , the number so formed is greater than the original number by 9.Find the number.

4. Three years ago,Juma was three times old as Ali.In two years time, the sum of their ages will be 62.Determine their current ages (2 mks)

5. A number n is such that when its divided by 3,7,11 or 13, the remainder is always one . Find the number n. (2mks)

6. The size of each Interior angle of a regular polygon is seven times the size of the exterior angle.

   Find the number of sides of the polygon. (2 mks)

7. Use reciprocal, square and square root tables to evaluate, to 4 significant figures, the expression. (4 marks)

$$\frac{2}{(0.5245)^2} - \frac{5}{\sqrt{363.4}}$$

8. The surface area of two similar bottles are $12cm^2$ and $108cm^2$ respectively. If larger one has a volume of $810cm^3$.Find the volume of the smaller one. (3mks)

9. A solid block in the shape of a cylinder has a height of 14cm and weighs 22kg. If it is made of material of density $5g/cm^3$, find the radius of the cylinder. Take $\pi = \frac{22}{7}$ (3mks)

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10. Find the value of x in the following equations: (3mks)

$(4)^{-2x} = (1/32)^{3x-4}$

11. A line Ax +3y-6=0 is perpendicular to the line 5x+7y-k=0. If 5x+7y-k=0 passes through the point (4,3). Determine the values of A and K (4mks)

12. Agnes paid rent which was 1/10 of her net salary. She used ½ of the remaining amount to make a down payment for a plot. She gave her mother Kshs. 2,500 and did shopping worth Kshs. 7,500 for herself. She saved the remainder which was Ksh. 12,500. How much was the down payment that she made. (4mks)

13. A watch which loses a half-minute every hour was set to read the correct time at 0545h on Monday. Determine the time, in the 12 hour system, the watch will show on the following Friday at 1945h. (3 marks)

14. Use the exchange rates below to answer this question.

	Buying	Selling
1 US dollar	63.00	63.20
1 UK £	125.30	125.95

A tourist arriving in Kenya from Britain had 9600 UK Sterling pounds (£). He converted the pounds to Kenya shillings at a commission of 5%. While in Kenya, he spent ¾ of this money. He changed the balance to US dollars after his stay. If he was not charged any commission for this last transaction, calculate to the nearest US dollars, the amount he received. (3 marks)

15. Solve the following inequality and show your solution on a number line. (3mks)

$4x - 3 \leq \frac{1}{2}(x + 8) < x + 5$

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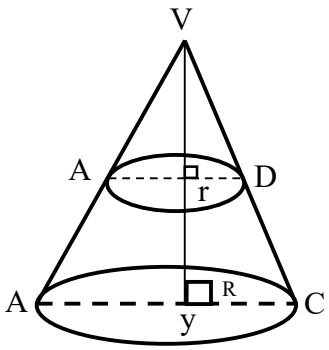
16. The table below shows marks obtained by a form four class in a certain school.

Marks (x)	8≤X<9	9≤X<11	11≤X<13	13≤X<16	16≤X<20	20≤X<21
No. of contents y	2	6	8	3	2	1

Use the table to represent the information on a histogram. (3 Marks)

SECTION B: ATTEMPT ANY FIVE QUESTIONS

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



(a) Find the ratio r:R. (1 Mark)

(b) Given that r = 7cm, find R. (2 Marks)

(c) If the height VY of the original cone is 45cm. Calculate to the nearest whole number the volume of the frustum. (Take $\pi = \frac{22}{7}$) (4 Marks)

(d) The frustum represents a bucket which is used to fill a rectangular tank measuring 1.5m long, 1.2m wide and 80cm high with water. How many full buckets of water are required to fill the tank. (3 Marks)

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18. The displacement h metres of a particle moving along a straight line after t seconds is given by $h = -2t^3 + {}^3/_2\, t^2 + 3t$

(a) Find the initial acceleration. (3 marks)

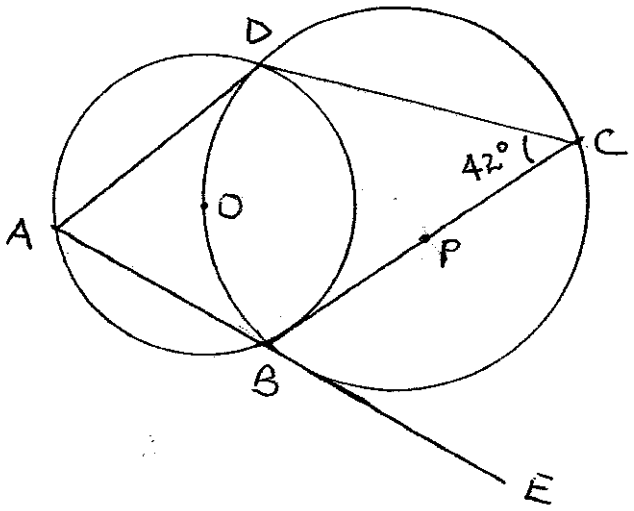
(b) Calculate

(i) The time when the particle was momentarily at rest. (3 marks)

(ii) Its displacement by the time it comes to rest momentarily. (2 marks)

(c) Calculate the maximum speed attained. (2 marks)

19. (a) The figure below shows two intersecting circles. Circle DCB has its centre P while DAB centre O.



Giving reasons, determine the size of:

a) Angle CBD (2 marks)

b) Angle ODB (2 marks)

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c) Angle BAD (2 marks)

d) Angle ABC (2 marks)

e) Angle ODA (2 marks)

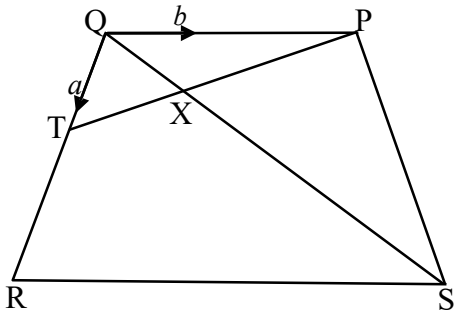
20. A car leaves town X for town Y 120 km away at an average speed of 80 km/hr at 8.30 a.m. At the same time a bus leaves town Y for town X at an average speed of 60 km/hr. At 8.45 a.m., a cyclist leaves town Y for town X at an average speed of 30 km/hr.

    i. Calculate the time when the bus meets the car to the nearest minute. (3 marks)

    ii. Calculate the distance between the car and the bus by the time the cyclist meets the car. (4 marks)

    iii. If the bus upon reaching town X stops for 10 minutes then starts its journey back to Y, Calculate how far from X the bus meets the cyclist. (3 marks)

21. In the figure below, PQRS is a trapezium. Line PT and QS intersect at X and line QP is parallel to RS.$\boldsymbol{QT = a, QP = b}, QR = \boldsymbol{3QT, RS = 2QP, QX = tQS}$, and $\boldsymbol{PX = kPT}$ where k and t are constants.



a) Find in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$:

(i) **PT** (1 mark)

(ii) **PX** (2 marks)

(iii) **QS** (1 mark)

b) Express **QX** in terms of: (2 marks)

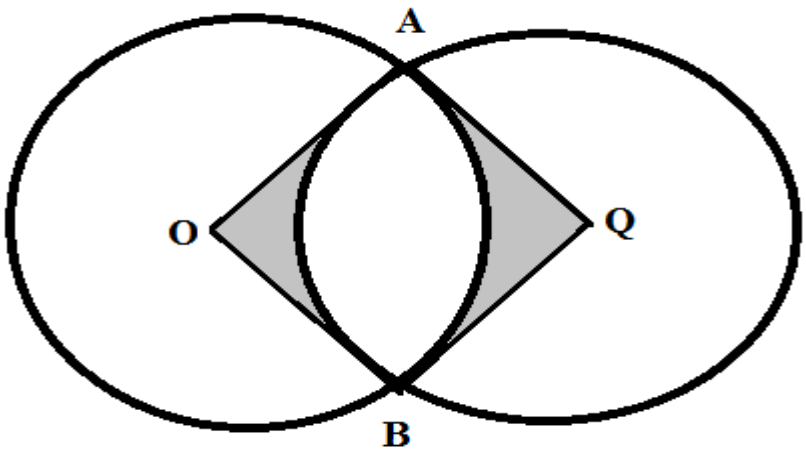
(i)**a, b,** and *t***.**

(ii)**a, b** and*k*

(c) Determine the value of *k* and *t.* (3 marks)

(d) Find the ratio PT:TX (1 mark)

22. Two circles with centres O and Q and radii 8cm intersect at points A and B as shown below.



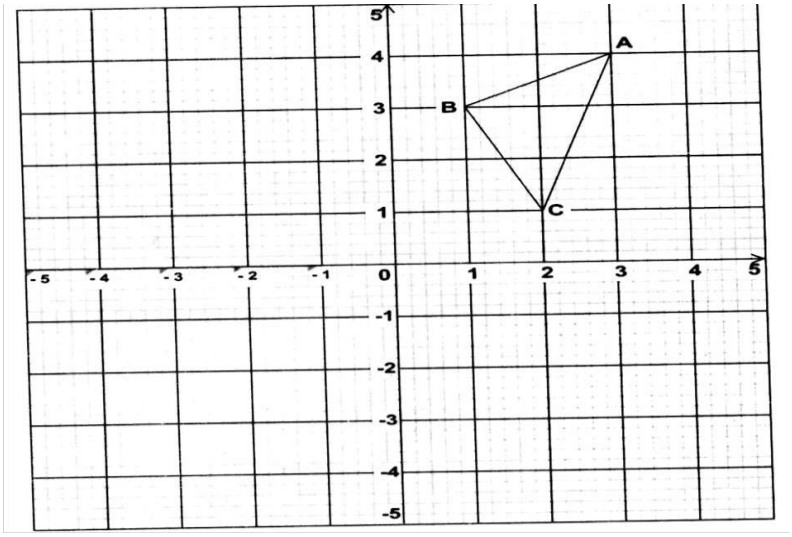
Given that the distance between O and Q is 12cm and that the line AB meets OQ at X, find:

(a) the length of the chord AB. (3marks)

(b) the reflex angle AOB. (3marks)

(c) the area of the shaded region. $\pi = 3.142$ (4marks)

23. The diagram below shows a triangle ABC with A (3, 4), B (1, 3) and C (2, 1).



a) Draw $\triangle A'B'C'$ the image of ABC under a rotation of $+90^0$ about (0, 0). 2mks

b) Draw $\triangle A''B''C''$ the image of $A'B'C'$ under a reflection in the line y=x. 2mks

c) Draw $\triangle A'''B'''C'''$ the image of $\Delta A''B''C''$ under a rotation of -90^0 about (0, 0). 2mks

d) Describe a single transformation that maps $\triangle ABC$ onto $\triangle A'''B'''C'''$. 2mks

e) Write down the equations of the lines of symmetry of the quadrilateral $BB''A'''A'$. 2mks

24. Complete the table below for $y = 14 - 5x - 2x^2$ for the domain $-5 \le x \le 3$ (2 marks)

x	-5	-4	-3	-2	-1	0	1	2	3
14	14	14	14	14	14	14	14	14	14
-5x	25	20			5	0	-5		-15
$-2x^2$	-50		-18		-2	0	-2	-8	
y	-11				17	14	7		

(b) Draw the graph of $y = 14 - 5x - 2x^2$ for the domain $-5 \le x \le 3$ (3marks

(c) Use your graph to solve the equations:

(i) $2x^2 + 5x - 14 = 0$ (2mark)

(ii) $4 - 5x - 2x^2 = 0$ (2marks)

d) Write down and simplify the equation in x which would be solved by drawing the line y=3x+2 on the same axes as (b) above. (1mark)

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SERIES 3
PAPER 1

SECTION I: (50 MARKS)

Answer all the question in this section in the spaces provided:

1. Using logarithm tables only, evaluate

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

(4 marks)

2. The transformation represented by the matrix

$M = \begin{pmatrix} 0 & 1 \\ 3 & 1 \end{pmatrix}$ maps a triangle **ABC** onto another triangle $\mathbf{A^1\ B^1\ C^1}$ of area $36cm^2$.

Find the area of triangle **ABC** (3mks)

3. Simplify $(1+\sqrt{3})(1-\sqrt{3})$ and hence evaluate $\frac{1}{1+\sqrt{3}}$ to 3 significant figures given $\sqrt{3} = 1.7321$. (3 marks)

4. If (M + n) : (M – n) = 8: 3. Find the ratio M: n. (3 marks)

5. Find the values of x if; (3 mks)

$\log_{16}(7x - 14) - \log_{16}(6 - 3x) = \frac{3}{2}$

6. Make q the subject of the formula:

$$P = \sqrt[3]{\frac{nq - m}{q}}$$

(3 marks)

7. The 3 rd term of a geometric sequence is 20 and the 16 th term is -160 Calculate the 8 th term the sequence (3mks)

8. If A = 2.3, B = 8.7 and C = 2.0 find the % error in $\frac{A+B}{C}$. (3 marks)

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9. Simplify:

$$\frac{2\chi^2 + \chi - 6}{\chi^2 - 4} + \frac{1}{\chi - 2}$$ (3 marks)

10. Obtain the binomial expansion of $(1 - 2\chi)^5$ and use your expansion to evaluate $[0.98]^5$ correct to 5d.p. (3 marks)

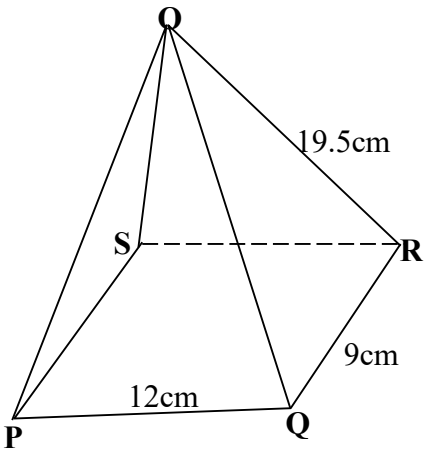
11. After being given a discount of sh.5 on every book James bought, he was able to buy 2 more books than before he was given the discount, with sh.200. What was the price of one book before the discount?

(4 marks)

12. Find the centre and radius of a circle with equation:
$\chi^2 + y^2 - 6\chi + 8y - 11 = 0$ (3 marks)

13. A car was valued at Ksh.3000000 in January 2000. Each year its value decreased by 12% of its
value at the beginning of the year. Find the value of the car in January 2004 giving your answer correct to 4s.f. (3 marks)

14. The figure below is a pyramid of a rectangular base PQRS of length 12cm and width 9cm. The slanting edge has a length of 19.5cm. Determine the angle PO makes with base PQRS



15. A point (-5, 4) is mapped onto (-1, -1) by a translation T. Find the image of (-4, 5) under the same translation. (3 marks)

16. The gradient of the curve $y = a\chi^2 + b\chi$ at the origin is equal to 8. Find the value of a and b if the curve has a maximum turning point at $\chi = 4$. (3 marks)

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SECTION II: (50 MARKS)

*Attempt **ONLY FIVE** questions from this section.*

17. Mr. Karambu is a civil servant in a ministry. He earns a monthly salary of sh.**N** and allowance of sh.1271.all taxable. He is entitled to a monthly relief of sh.1056. The table below shows the rates of taxation.

K£ P.a	Rates %
1 - 5808	10
5.809 – 11280	15
11281 - 16752	20
16753 – 22224	15
22225 and above	30

When his salary was increased by 50% the net tax increased by 66.25 % to sh.9036 per month.

(a) What was his net tax in K£ p.a before the salary increase (2mks)

(b) Calculate his salary before the increase (5mks)

(c) Calculate the percentage increase in his net pay after the salary increase (3mks)

18. A transporter wishes to transfer 1000 bags of sugar to a go down. He has two types of lorries to use. FTR with a capacity of 80 bags and a canter with the capacity of 20 bags. The canter has to make at most twice as many trips as the FTR makes. The total number of trips made by both lorries must be less than 30, and the canter has to make more than 10 trips.

(a) Write down all the possible inequalities to represent this information (take trips made by FTR be **x** and trips made by canter be **y**) (4mks)

(b) Represent the information above on the grid provided (3mks)

(c) The transporter makes a profit of sh 1800 per trip on FTR and sh 1000 per trip on canter. Determine his maximum profit. (3 mks)

19. A plane S flies from a point P(40°N, 45°W) to a point Q(35°N, 45°W) and then onto a point T((35°N, 135°E).

(a)Given that the radius of the earth is 6370km, find the distance from P to Q in km. (2 marks)

(b) Find in nm;

(i) the shortest distance between Q and T. (2 marks)

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(ii) the longest distance between Q and T (to the nearest tens). (2 marks)

(c) Find the difference in time taken when S flies along the shortest and longest routes if its speed is 420 knots. (4 marks)

20. The data **below** shows the masses in grams of 50 potatoes.

Mass (g)	25 - 34	35 - 44	45 - 54	55 - 64	65 - 74	75 - 84	85 - 94
No. of potatoes	3	6	16	12	8	4	1

(a) On the grid provided draw a cumulative frequency curve for the data.(4 marks)

(b) Use the graph in (a) above to determine:
(i) The 60th percentile mass. (2 marks)

(ii) Percentage of potatoes whose masses lie in the range 53g to 68g. (3 marks)

(iii) Median mass. (1 mark)

21. Matrix P is given by $\begin{pmatrix} 4 & 7 \\ 5 & 8 \end{pmatrix}$

(a) Find the inverse of P. (2 marks)

(b) Two Schools Theri and Kimathi purchased beans at sh.B per bag and maize at sh.M per bag. Theri purchased 8 bags of beans and 14 bags of maize for sh.47,600. Kimathi purchased 10 bags of beans and 16 bags of maize for sh.57,400.
(i) Form a matrix equation to represent the information above. (2 marks)

(ii) Use the inverse matrix of P to find the prices of one bag of each item. (4 marks)

(c) The price of beans later went up by 5% and that of maize remained constant. Theri bought the same quantity of beans but spent the same total amount of money as before on the two items. State the new ratio of beans to maize. (2 marks)

22. Mr. Karanja owns a bicycle which he sometimes rides to go to work. Out of the 21 working days in a month he only rides to work for 18 days. If he rides to work the probability that he is bitten by a rabid dog is $4/15$ otherwise it is only $1/13$. When he is bitten by the dog the probability that he will get treatment is $4/5$ and if he does not get treatment the probability that he will get rabies is $5/7$.

(a) Draw a tree diagram to show the events. (3 marks)

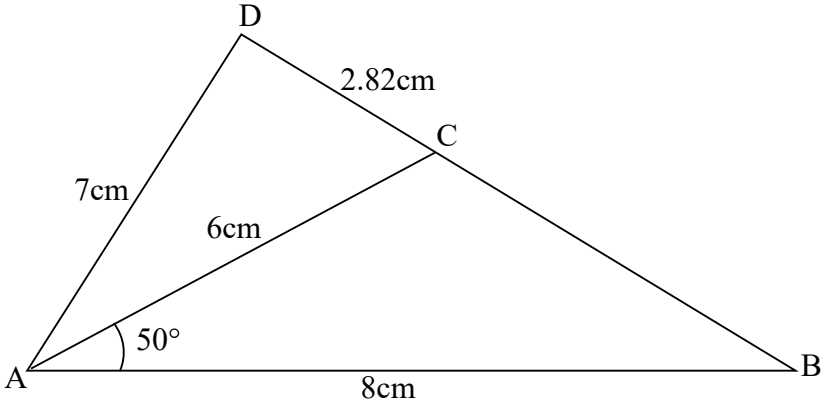
(b) Using the tree diagram in (a) above determine the probability that
(i) Karanja will not be bitten by a rabid dog. (2 marks)

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(ii) He will get rabies. (2 marks)

(iii) He will not get rabies. (3 marks)

23. In the figure **below** (not drawn to scale) AB = 8cm, AC = 6cm, AD = 7cm, CD = 2.82cm and angle CAB = 50°.



Calculate (to 2d.p.)

(a) the length BC. (3 marks)

(b) the size of angle ABC. (2 marks)

(c) size of angle CAD. (3 marks)

(d) Calculate the area of triangle ACD. (2 marks)

24. Complete the table below for the functions $y = \sin 3\theta$ and $y = 2\cos(\theta + 40^0)$ (2 Marks)

θ^0	0^0	10^0	20^0	30^0	40^0	50^0	60^0	70^0	80^0	90^0
3 Sin 3θ	0	1.50		3.00			0.00			-3.0
2 Cos $(\theta + 40^0)$	1.53	1.29			0.35			-0.69		-1.29

(a) On the grid provided, draw the graphs of $Y = 3\sin 3\theta$ and $y = 2\cos(\theta + 40^0)$ on the same axis. Take 1 cm to represent 10^0 on the x-axis and 4 cm to represent 2 unit on the y – axis. (5 marks)

(b) From the graph find the roots of the equation.

(i) $\frac{3}{4}\sin 3\theta = \frac{1}{2}\cos(\theta + 40^0)$ (2 Marks)

(ii) $2\cos(\theta + 40^0) = 0$ in the range $0 \leq \theta \leq 90^0$ (1 Mark)

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PAPER 2

SECTION I (50 MARKS)

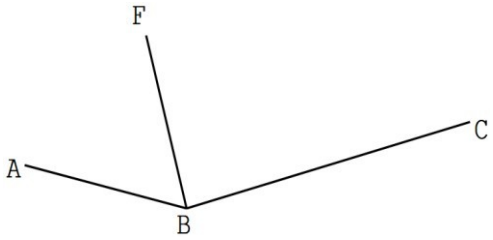
Answer all questions in this section

1. Evaluate without using tables or calculator: $\dfrac{-2\left(3^2 + 5\right) - 12 \div 3 \text{ of } 4 \times (-2)^2}{5^{-1} - 12 \div 10 + 6}$ correct to 3 decimal places (3 marks)

2. Two of the exterior angles of a polygon are each 63°. The remaining exterior angles are each 26^{0}. Determine the number of sides of the polygon and hence the name. (3 marks)

3. Koech and Kigen began a 10000 m race together at the starting line. Koech and Kigen took 36 seconds and 48 seconds respectively to run a 400 m lap. The two athletes were together again at the starting line after some time. Determine the number of laps that Kigen had to run to complete the race after they were together. (3 marks)

4. In the figure below ABF is a uniform cross section of a solid. AB, BC and BF are some of the visible edges of the solid. Complete the sketch showing the hidden edges with broken lines. (3 marks)



5. A Kenyan bank bought and sold Japanese Yen when the rate are as shown below.

	Buying (Ksh)	Selling
(Ksh) 100 Japanese Yen	84.00	85.50

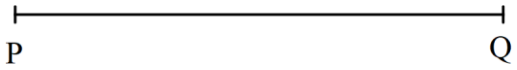
A Kenyan businessman travelled to Japan and converted Ksh. 1 613 760 to Japanese Yen. He spends 75% of the amount and then converted the balance into Kenyan shillings at the bank when buying rate

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increased by 1.4% and selling rate increased by 1.3%. Calculate the amount of money in Kenyan shilling that he received.

(3 marks)

6. (a) Line PQ given below is one of side of a parallelogram PQRS. Using a ruler and a pair of compass only, construct the parallelogram given that ∠SPQ = 75° (2 marks)



(b) Drop a perpendicular from R to PQ produced at T. Measure RT. (2 marks)

7. Six tractors each working 8 hours a day can plough a field in 5 days. Calculate the number of days that four tractors working 10 hours a day would take to plough the field. (3 marks)

8. Rina has several buses, each with a driver and a conductor. All her drivers earn the same wage and all conductors earning are also equal. Any three drivers and four conductors earn a total of Ksh. 7 500 per day and the difference in driver's earning and conductor's earning per day is Kshs. 400. Calculate the daily wage of a driver. (3 marks)

9. From a point Mary notices that the angle of elevation of the top of a tree is 28^0, she then walks 10m towards the tree and finds that the angle of elevation of the top of the tree is now 34^0. Calculate the height of the tree to 1 decimal place given that Mary is 1.5m tall. (3marks)

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10. Under an enlargement with scale factor -1.5, the point R (2, -8) is mapped onto R' (10, 5). By calculation, determine the coordinates of the center of enlargement.

(3marks)

11. Use tables of squares, square roots and reciprocal to find the value of x if its given that

$$x = \frac{2}{\sqrt{0.4278}} + \frac{1}{6.04^2}$$

(4marks)

12. The number line below represents the solution for some given inequalities



Form the two inequalities represented above and write them as a compound statement

(3 marks)

13. The coordinate of A (-2,5) and B(x, 0), calculate the value of x if the magnitude of AB is 13 units

(3 marks)

14. Simplify completely $\left[\frac{(m+5n)^2+(m-5n)^2}{3m^2+75n^2}\right]^{-1}$

(3 marks)

15. Calculate the values of x and a in the equation $\frac{4^{2x}-2^{2x}}{2^{2x}-2^x} = 20$

(3 marks)

16. Find the equation of the normal to the curve $y = x^3 + 2x^2 - 4x$ when x = -1

(3 marks)

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SECTION II (50 MARKS)

*Answer any **FIVE** questions in this section*

17. During a surveying exercise to establish a housing of affordable houses units, a surveyor marked out four points P, Q, R and S to represent an area to be left out for other social amenities. Point Q is 480m on a bearing of N75°E from P. Point R lie on a bearing of 150° at a distance 600m from Q. S is directly south of P a distance of 640m.

a) Draw a scale drawing to represent the relative position of the area under survey (Scale: 1cm represents 80 m).

(4 marks)

b) Using the scale in (a) above, determine

(i) the compass bearing of point R from S

(1 mark)

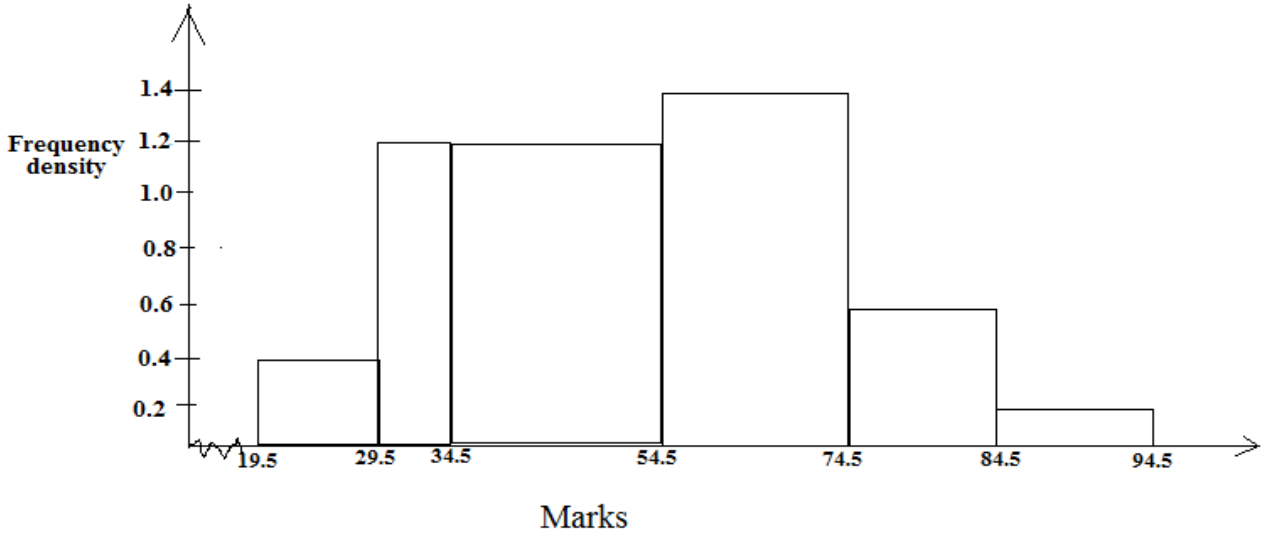
(ii) the distance of point S from point Q

(2 marks)

c) An emergency water point is located within the area marked such that it is equal in distance from line QR and RS. Locate the water point and measure its distance from point P.

(3 marks)

18. The histogram below is drawn from marks obtained by students



(a) Use it to fill the table below

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(4 marks)

Classes	Midpoint	Frequency

(b) Calculate the mean mark.

(3 marks)

(c) Calculate the median mark

(3 marks)

19. (a) A Nissan travelling at a speed of 90 km/h left Nairobi for Nakuru at 9.00 a.m. Half an hour later, a bus left Nakuru for Nairobi at a speed of x km/h. The two vehicles met at a point 180 km from from Nakuru at 11.00 am. Find the value of x

(4 marks)

(b) Given that the bus had a puncture that lasted 20 minutes to repair, determine which vehicle arrived at its destination first and by how long

(4 marks)

(c) Find the distance between town A and B

(2 marks)

.

20. (a) Given that $\mathbf{A^{-1}} = \begin{pmatrix} 2 & \frac{-5}{2} \\ -3 & 4 \end{pmatrix}$, find matrix A

(2 marks)

(b) A student bought 16 exercise books and 10 pens at a total cost of Kshs. 1018. If she had bought 12 exercise books and 8 pens, she would have spent Kshs. 242 less.

(i) Form a matrix equation to represent the information above (2 marks)

(ii) Using the inverse of A in (a) above, determine the price of each item (4 marks)

(c) Find the total cost of 4 books and 5 pens by using matrices of orders 1×2 and 2×1 respectively (2 marks)

21. ABCD is a parallelogram with A(1,1) and C(8,10). The equation of AB is $4x - 5y = -1$ and the equation of BC is $5x - 2y = 20$. Determine

(a) The coordinates of M, where M is the point of intersection of the diagonals

(2 marks)

(b) The coordinates of the vertices of B and D

(6 marks)

(c) The length of AB correct to 3 significant figures

(2 marks)

22. A^1(-1,0) B^1(-1,2) and C^1(-4,0) is the image of A(2,1), B(4,1) and C(2,4) respectively under a rotation

(a) Plot the two triangles on the grid provided (2 marks)

(b) By construction find the center and angle of rotation (3 marks)

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(c) $A''B''C''$ is the image of $A^1B^1C^1$ under enlargement, center (-2,-1) and scale factor -2. Plot $A''B''C''$ and state its coordinates (3 marks)

(d) $A^{111}B^{111}C^{111}$ is the image of $A''B''C''$ under reflection in the line $y + 2 = 0$. Plot $A^{111}B^{111}C^{111}$ on the same grid and state its coordinates (2 marks)

23. A bucket is in the shape of a frustum of a cone. The base radius of the bucket is 30 cm and it is filled with water to a height of 60 cm. The radius of the water level in the bucket is 40 cm. Taking π to be 3.142;

a) Calculate:

(i) The quantity of water in the bucket in litres. (3 marks)

(ii) The surface area of the bucket in contact with water. (4 marks)

b) Find the volume of water that if added into the bucket, would give a 20 cm rise in the water level. (3 marks)

24. The displacement of a particle is given as $S = t^3 - 6t^2 + 9t + 50$ metres. Determine;

a) the displacement of the particle when $t = 2$ seconds. (2 marks)

b) the velocity of the particle when $t = 4$ (2 marks)

c) the acceleration of the particle when $t = 5$. (2 marks)

d) the time when the particle is at rest. (2 marks)

e) the minimum velocity (2 marks)

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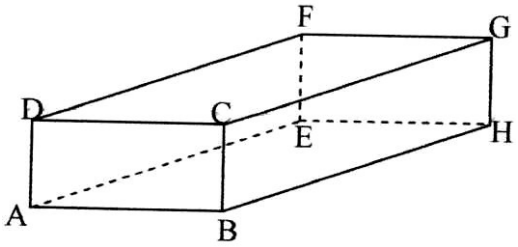
PAPER 2 SECTION I: (50 MARKS)

Answer ALL Questions in this section

1. Use logarithm table to evaluate: (4mks)

$$\sqrt{\left(\frac{0.7493\cos^2 16.335^0}{\text{Log } 559.3 + 10\tan 3^0}\right)}$$

2. What must be added to $\frac{1}{4}x^2 + \frac{1}{9}$ in order to make it a perfect square? (2mks)
3. Expand $(x - \frac{a}{x^2})^6$ in ascending powers of x, up to the term independent of x. If this independent term is 1215, find the value of a. (3mks)
4. An angle of 1.75 radians at the centre of a circle subtends an arc of length 24.8cm. Find the diameter of the circle. (2mks)
5. ABCDEFG is a rectangular box in which AB, AD, AE are 3cm, 4cm and 5cm long respectively. M is the midpoint of FG.



Find the length AM and determine the inclination of AM to EFGH. (3mks)

6. Use square roots, reciprocals and square tables to evaluate the expression: (3mks)

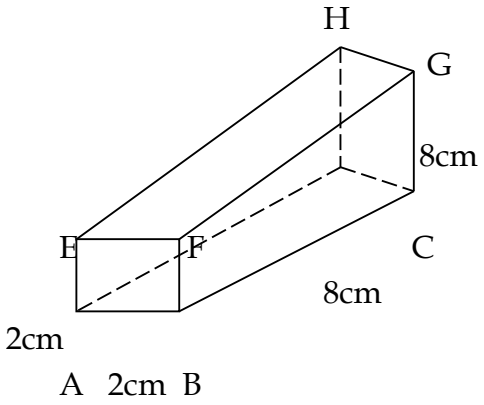
$$(0.00546667)^{\frac{1}{2}} + \left(\frac{3}{0.043279}\right)^2$$

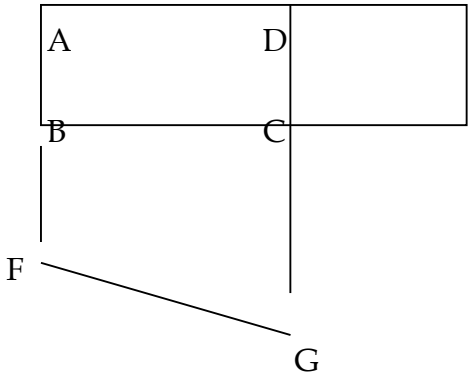
7. A member of a county assembly sold his car for shs. 1,250,000 and deposited this money in a savings account in one of the banks in Kaiboi town. The banks paid 18%p.a compounded quarterly. After two years, the member of the county assembly withdrew a half of the amount from the account. He left the rest for a further two and a half years. Calculate the total interest he earned in the 4½ year period. (4mks)
8. Given that x^0 is an angle in the third quadrant such that $16\sin^2 x^0 + 4\cos x^0 = 10$. Find tan x. (3mks
9. Two variables P and L are such that P varies partly as L and partly varies inversely as the square root of L.
   (a) Determine the relationship between P and L given that L = 16 when P = 500 and L = 25 when P = 800. (3mks)
   (b) Hence find P when L = 81. (1mk)
10. The angle of elevation from the base of a wall to the top of the flag post 70 metres away is 62. The angle of depression from the top of the flag post to the wall is 25^0. Calculate:-
    (a) The height of the flag post. (1mk)
    (b) The height of the wall. (2mks)

11. Given that log 3 = 1.583 and log 5 = 2.322, evaluate without using table or calculator:

Log 135 (2mks)

12. Two values of **a** and **b** are such that 7.1 $\leq$ 7.3 and 12.5 $\leq$ b $\leq$ 12.7. Calculate the percentage error in b, giving your answer correct to 2 decimal places. (3mks)
13. The following figure is a solid and its incomplete net.
    (a) Complete and label the net.





    (b) Hence or otherwise, find the surface area of the solid. (2mks)

14. Solve for x in the equation: (3mks)
    $9^{x+1} - 54 = 3^{2x+1}$
15. The points P (-6, 5) and Q (2, -1) are the ends of a diameter of a circle centre M. Determine:-
    (a) The coordinates of M. (1mk)
    (b) The equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$. (2mks)
16. Solve the simultaneous equations: (3mks)
    $y + 2x + 1 = 0$
    $x^2 + xy = -6$

SECTION II (50 MARKS)

Answer ONLY FIVE questions in this section in the spaces provided

17. Mr. Maiyo, who works in a sugarcane plantation, owns a bicycle which he sometimes rides to work. Out of the 21 working days in a month, he rides to work for 18 days. If he rides to work, the probability that he is bitten by a rabid dog is $^4/_{15}$ otherwise it is only $^1/_{13}$. When he is bitten by the dog, the probability that he will get treated is $^4/_5$ and if he does not get treated, the probability that he will get rabies is $^5/_7$.
    (a) Draw a tree diagram using the given information. (3mks)

    (b) Using the tree diagram in (a) above, determine the probability that;
        (i) Maiyo will not be bitten by a rabid dog. (2mks)

(ii) He will get rabies. (3mks)

(iii) He will not get rabies. (2mks)

18. Tax rates in operation in a certain year in Kenya are as given in the table below.

Income (kf p.a.)	Tax Rates (sh. Per £)
1 – 4,512	2
4,513 – 9,024	3
9,025 – 13,536	4
13,537 – 18,048	5
18,049 – 22,560	6
Over 22,560	6.5

(a) Mr. Koech pays Ksh. 2,172 P.A.Y.E. monthly. He was entitled to a house allowance of Ksh. 5,000 and a medical allowance of Ksh. 2,000 and gets a monthly tax relief of Ksh. 1,093. Calculate his monthly basic salary. (8mks)

(b) Mr. Koech's other deduction per month were as follows:-

NHIF – Kshs. 320

Co-op Loan – Kshs. 4,000

Calculate Koech's net pay per month. (2mks)

19. Using a ruler and a pair of compasses only:

(a) Three points A, B and C are vertices of a triangle ABC such that AB = 8cm, BC = 5cm and AC = 6.4cm. Draw triangle ABC with AB as the base. (2mks)

(b) Construct the locus of P such that it is equidistance from the sides AB, BC and AC. (3mks)

(c) On the opposite side of point C on AB, construct the locus L such $<ALB = 60^0$. (3mks)

(d) Hence determine the area of the major sector bounded by the locus L. (2mks)

20. (a) Complete the table below for the functions $y = 4 \text{ Cos } 2x$ and $y = 3 \text{ Sin } (2x + 30^0)$ giving the values to 1 decimal place. (2mks)

	-30^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0
4 Cos 2x	2.0	4.0	2.0		-4.0	-2.0		4.0	2.0		-4.0
3 Sin $(x+30^0)$	0.0	1.5	2.6	3.6		1.5	0		-2.6		-2.6

(b) Draw the graphs of $y = 4 \text{ Cos } 2x^0$ and $y = 3 \text{ Sin } (x + 30^0)$ for $-30 \leq x \leq 270^0$ on the same axes. Use a scale of 1cm for 30^0 on x-axis and 1cm for 1 unit on the y-axis. (4mk

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

(i) $3 \text{ Sin } (x + 30^0) - 4 \text{ Cos } 2x = 0$. (2mks)

(ii) $3 \text{ Sin } (2x + 30^0) + 1 = 0$ (1mk)

(d) Determine the period of the function $y = 4 \text{ Cos } 2x$. (1mk)

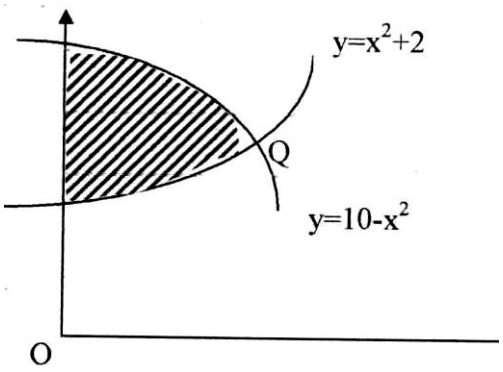
21. An aircraft takes off from the airport X(65^0N, 36^0E) and flies by the most direct route to another airport Y (R^0N, 144^0W) covering a distance of 4800nm.

(a) Find R^0 (1mk)

(b) If instead, the aircraft had flown along the meridian 144^0W to point Y, find how much further it would have flown. (5mks)

(c) Two aircrafts takes off from X to Y at the same time. Given that both fly at the same speed and one flies on the direct route and the other takes the route described in (b) above, state the position of the second aircraft when the first is landing at Y. (2mks)

22. The diagram shown below represents the area between the curves $y = x^2 + 2$ and $y = 10 - x^2$ and y-axis.



Find:-

(a) The coordinates of Q (a point of intersection) (1mk)

(b) The area of the shaded region, by use of mid-ordinate rule with 8 ordinates(6mks

(c) Use integration method to calculate the same area as in (b) above. (3mks)

23. Two quantities of p and r are 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 the linear equation connecting p and r. (1mk)

(b) Using the scale 2cm to represent 0.1 units on both axes, draw a suitable straight line graph on the grid provided;
Hence estimate the value of k and n. (8mks)

(c) Write an equation connecting p and n. (1mk)

24. An aircraft leaves point A and flies on a bearing of 020^0 to a second point B, which is 600km from A. From B, the aircraft then flies on a bearing of 320^0 to a third point C which is 1000km from B. The aircraft then flies directly back to A from C at a speed of 200km/hr. By scale drawing, find:-

(a) Time taken to fly directly from C to A. (6mks)

(b) The bearing in which it would fly from C to A. (1mk)

(c) Locate point D on a bearing 170^0 from C and 280^0 from A. Calculate BD in kilometers. (2mks)

(d) What is the bearing of D from B? (1mk)

KCSE SMARTFOCU HOMESTRECH CLUSTER EXAMS
(POST MOCKS)

Kenya Certificate of Secondary Education

MATHEMATICS ALT. A
PAPER 1
SEPT/OCT. 2024

Name: …….. Index No: ……

School: …….. **Signature**: ……..…..

POST MOCK 5

Featuring Kenya Certificate of Secondary Education, 2024

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number in the spaces provided at the top of this page.
*2. This paper consists of two sections: **Section l and Section II.***
*3. Answer all questions in section **l and five** questions from **Section II.***
4. Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.
5. Marks may be given for correct working even if the answer is wrong.
*6. Non- programmable silent electronic calculators and **KNEC Mathematical** tables may be used.*

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

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SECTION I (50 MARKS)

Answer all the questions in this section.

1. Without using a calculator, evaluate, $\dfrac{2\frac{1}{4}+\frac{3}{5}\div\frac{5}{6}\ of\ 2\frac{2}{5}}{1\frac{7}{10}}$, leaving your answer as a fraction in its simplest form. (3mks)

2. Find the equation of a perpendicular bisector of a line AB if the coordinates of A and B are (-4,-2) and (6,2) respectively. (3mks)

3. Use squares, squares roots and reciprocal tables only to evaluate the following giving your answer correct to 2 decimal places. (4mks)

$$\frac{1}{\sqrt{31.47}}+\frac{3}{8.54^2}$$

4. Find the integral values of x for which: (3mks)

$-6 \leq 3x + 3$

$14 - 3x > 2$

5. Pipe A empties a full tank in 8 hours, pipe B empties in 6 hours and pipe C empties in 3 hours. If all the three pipes are open for 30 minutes and then pipe A closed , How long will it take to empty a full tank. (3mks)

6. Without using a calculator or mathematical table, evaluate. (3mks)

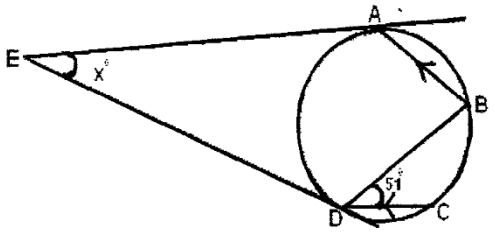
$$\frac{8^{\frac{2}{3}}+4^{\frac{3}{2}}}{16^{-\frac{3}{4}}}$$

7. A man on top of a tower 300m sees two cars P and Q on a straight level road. The angle of depression of P was 48° and that of Q was 28°. Calculate the distance between the two cars. (Give your answer to 2d.p.). (3 marks)

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8. Two trains T_1 and T_2, traveling in opposite directions on parallel tracks are just beginning to pass one another. Train T_1 is 72metres long and is traveling at 108km/hr.T2 is 78 metres Long and traveling at 72km/hr. Find the time in seconds the two take to completely pass one another. (4mks)

9. In the figure bellowed and EA are tangents to the circle at D and A.DC is parallel to AB and <BDC = $51^{0.}$ Calculate the value of x. (3mks)



10. Two similar containers have base areas $25cm^2$ and $324cm^2$ respectively. Calculate the Capacity of the larger container correct to one decimal place if the capacity of the smaller one is $8cm^3$ (3mks)

11. Solve for χ and y in the simultaneous equation. (4 marks)
$3^{2\chi} \times 3^{y} = 27$
$2^{\chi - y} \times 2^{\chi} = 32$

12. Given that $1.\dot{0}\dot{5} = 1\frac{a}{b}$, Find the values of a and b. (3mks)

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

	Buying (Ksh)	Selling (Ksh)
1 Euro	86.25	86.97
100 Japanese Yen	66.51	67.26

A Japanese traveling from France arrives in Kenya with 5000 Euros, which he converts to Kenya shillings at the bank. While in Kenya he spent a total of Ksh.289,850 and then converted the remaining Kenya shillings to Japanese Yen at the bank. Calculate the amount of Japanese Yen that he received. (3 mks)

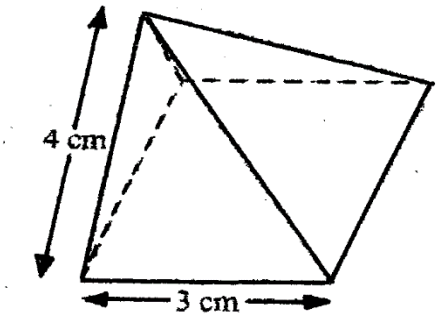
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14. All prime numbers between ten and twenty are arranged in descending order to form a number.
a) Write down the number (1mk)

b) State the total value of the third digit in the number formed in (a) above. (1 mark)

15. If log 2=0.30103 and log 3=0.47712 find the logarithm of 36 without using tables or calculators. (3mks)

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



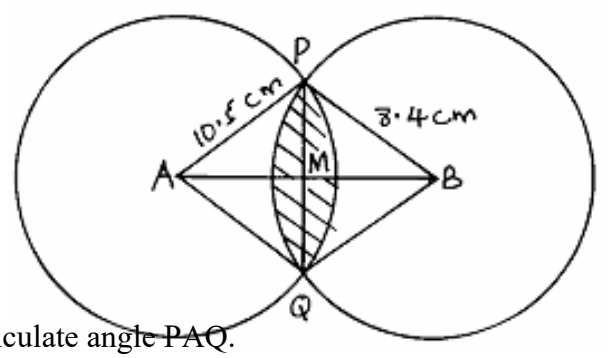
a) Draw a net of the pyramid (2 marks)

b) On the net drawn, measure the height of a triangular face from the top of the Pyramid (1 mark)

SECTION 11(50 MARKS)

Answer only FIVE questions from this section.

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



(a) Calculate angle PAQ. (2 marks)

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(b) Calculate angle PBQ. (2 marks)

(c) Calculate the area of the shaded part. (6 marks)

18. B is 102km on the bearing of 112° from A. C is 94km on the bearing of 062° from B D is 073° from A and 336° from C.

(a) Using a scale of 1cm to represent 20km,draw a diagram to show the positions of A,B,C and D. (6mks)

b) Using your diagram, determine;

i) The bearing of B from D and A from C. (2mks)

ii) The distance AC and BD (2mks)

19. A group of people planned to contribute equally towards a water project which needed kshs. 2,000,000 to complete. However, 40 members of the group withdrew from the project. As a result, each of the remaining members were to contribute ksh 2500 more.

(a) Find the original number of members in the group. (5mks)

(b) Forty five percent of the value of the project was funded by Constituency Development Fund (CDF). Calculate the amount that would be made by each of the remaining members of the group. (3mks)

(c) Members contribution were in terms of labour provided and money contributed. The ratio of the value of labour to the money contributed was 6:19, calculate the total amount of money contributed by the members (2mks)

20. A bus left Kisumu at 9:30 a.m towards Nairobi at an average speed of 81 km/hr. A matatu left Nairobi at 10.10 a.m at an average speed of 72km/hr. The distance between Kisumu and Nairobi is 360km.

(a) Determine

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(i) The time taken before the two vehicles met. (3mks)

(ii) The distance between the two vehicles 40 minutes after meeting. (2mks)

b) A car left Kisumu towards Nairobi at 9.50 a.m at an average speed of 90 km/hr. Determine

i) The time when the car caught up with the bus. (3mks)

ii) The distance of Nairobi from the place where the car caught up with the bus. (2mks)

21. Using a ruler and a pair of compasses only.

(i) Construct line AB = 6cm. (1 mark)

(ii) Construct triangle DAB where angle DAB = 75° and AB = BD. (2 marks)

(iii) Complete the parallelogram ABCD. (1 mark)

(iv) Drop a perpendicular from A to BD and hence find the area of the parallelogram. (3 marks)

(v) Construct a circle to touch line BC, AB produced and DC produced. Measure its radius. (3 marks)

22. A surveyor recorded the measurements of a field in a field book using lines AB 260m as shown below.

	B	
	130	R 40
	70	Q10
	50	P20
S50	10	
	A	

a) Sketch the map of the field. (4mks)

b) Find the area of the field in hectares. (6mks)

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23. A trader sold an article at sh.4800 after allowing his customer a 12% discount on the marked price of the article. In so doing he made a profit of 45%.

a) Calculate

(i) The marked price of the article. (3 marks)

(ii) the price at which the trader had bought the article (2marks)

b) If the trader had sold the same article without giving a discount. Calculate the percentage profit he would have made. (3 marks)

c) To clear his stock, the trader decided to sell the remaining articles at a loss of 12.5% calculate the price at which he sold each article. (2mks)

24. The distances S metres from a fixed point , covered by a particle after t seconds is given by the equation, $S= t^3 – 6t^2 + 9t +5$

a) Calculate the gradient to the curve at t = 0.5 seconds. (3mks)

b) Determine the values of S at the maximum and minimum turning points of the curve. (4mks)

c) On the space provided, Stretch the curves of $S = t^3 – 6t +9t + 5$ (3mks)

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SERIES 5
PAPER 2

SECTION I:5MARKS- ***Answer all questions from this section***

1. Rationalise the denominator and simplify leaving your answer in the form $\sqrt{a} + b$. **(3 marks)**

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

2. a) expand $(1 - \frac{1}{2}x)^5$ **(1 mark)**

b) Use the expansion upto x^3 in (a) above to evaluate $(0.98)^5$ correct to 4 d.p **(2 marks)**

3. Agotho has a rectangular plot that was measured to the nearest meter and found to be 80m in length and 60m in width. Determine the percentage error in its perimeter. (3 marks)

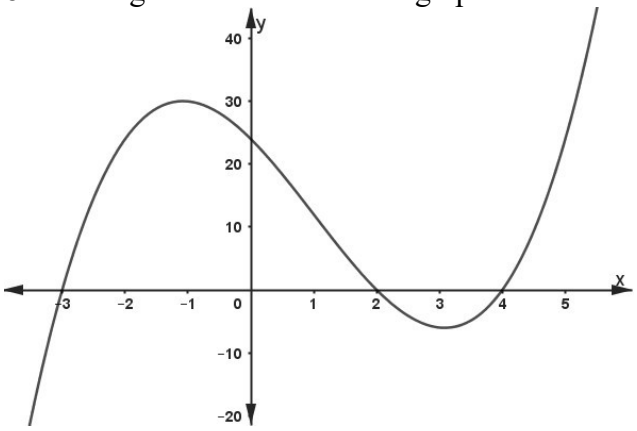
4. Simplify $\frac{9x^2-1}{3x^2+2x-1}$ (3 marks)

5. A circle of radius 3cm has its centre at $(3, -2)$. Express the equation of the circle in the form $x^2 + y^2 + mx + ny + c = 0$. Where m, n and c are constants. (3 marks)

6. Find the value of x that satisfies the equation $\log(2x - 11) - \log 2 = \log 3 - \log x$ (4 marks)

7. Five men working 8 hours a day take 2 days to cultivate an acre of land. How many days would four men working 10 hours a day at double rate take to cultivate 3 acres of land? (3 marks)

8. The figure below shows the graph of a cubic function.

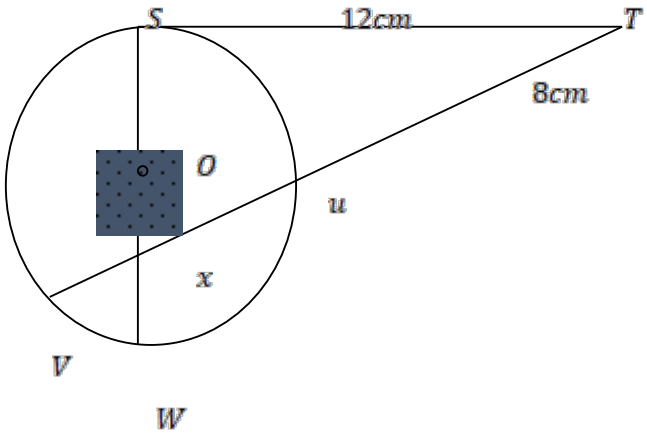


Write the equation of the function in the form $y = x^3 + ax^2 + bx + c$, where a, b and c are constants. (3 marks)

9. Given that $\mathbf{A} = \begin{pmatrix} 1 & k \\ 3 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -3 & 5 \\ 1 & -2 \end{pmatrix}$, find k if the determinant of $\mathbf{AB}$ is 9 (3 marks)

10. A variable P varies directly as t^3 and inversely as the square root of S. When $t = 2$ and $S = 9$ $P = 16$. Determine the equation connecting P, t and S hence find P when $S = 36$ and $t = 3$. (3mks)

11. In the figure below the tangent ST meets chord Vu. Produced at T. chord SW passes through the centre O of the circle and intersect chord Vu at x. Line $ST = 12cm$ and $uT = 8cm$



a) Calculate the length of chord Vu. (1mk)

b) If $wx = 3cm$ and $Vx : xu = 2 : 3$. find Sx (2mks)

12. Make n the subject of the formula.

$$\frac{r}{p} = \frac{M}{\sqrt{n-1}}$$ (2mks)

13. 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 that year Mr. Mogaka gets a total deduction of ksh5,000 he gets a personal tax relief of kshs.1056 and pays kshs.3944 for NHIF, WCPS and sacco loan repayment. Calculate

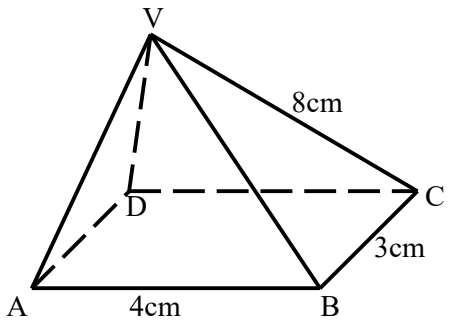
(i) P.A.Y.E. (1 mark)

(ii) Monthly income/salary (3 marks)

14. Use logarithms tables to evaluate. (4mks)

$$\sqrt[3]{\frac{36.72\times(0.46)^2}{185.4}}$$

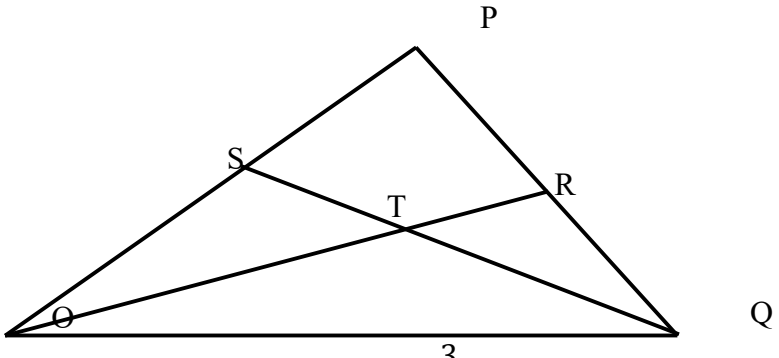
15. The figure below shows a rectangular based right pyramid. Find the angle between the planes ABCD and ABV. (2marks)



16. Find the shortest distance between points A(50°S,25°t) and B(50°S, 140°E in KM (Take R=6370 Km) (3mks)

SECTION II – 50 MARKS;Answer any FIVE questions from this section

17.



In the figure above, OPQ is a triangle in which $OS = \frac{3}{4}OP$ and PR: RQ = 2:1

Line OR and SQ meet at T.

h) Given that OP = p and OQ = q, express the following vectors in terms of p and q.

(i) PQ **(1 Mark)**

(ii) OR **(2 Marks)**

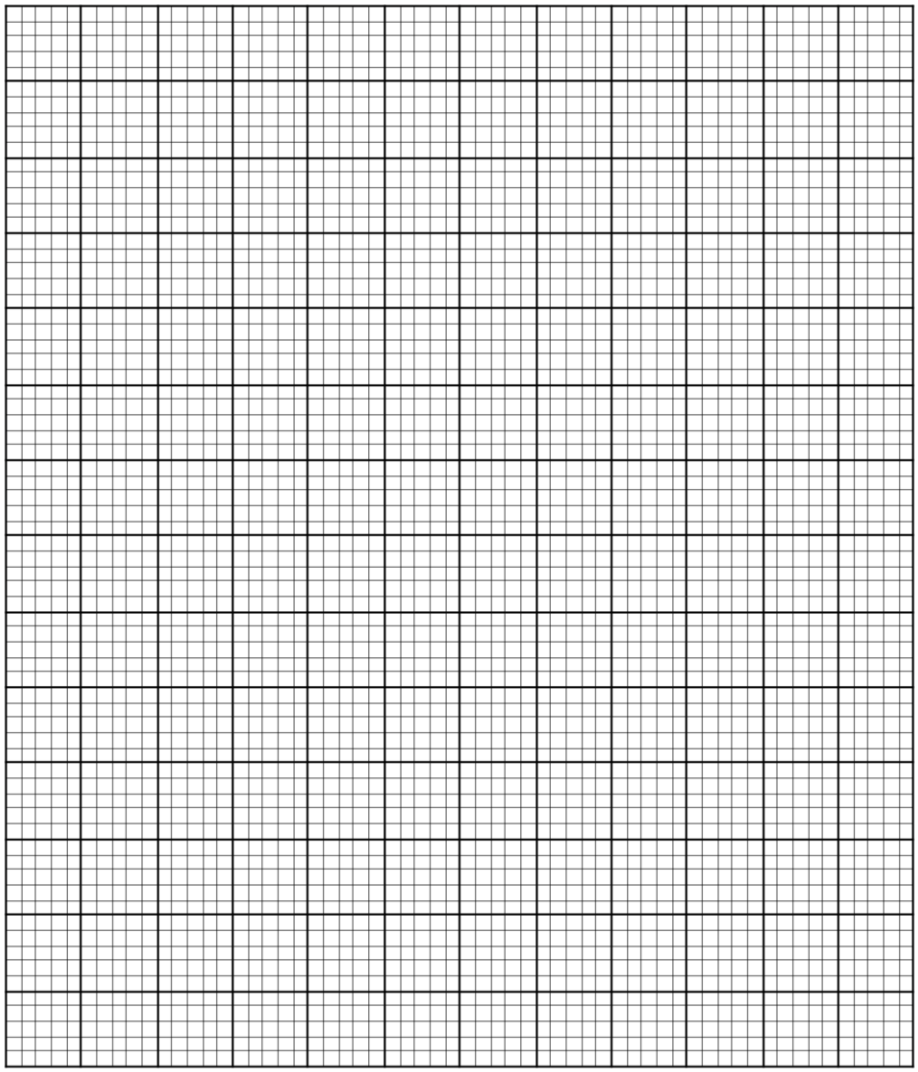
(iii) SQ **(1 Mark)**

i) You are further given that ST = mSQ and OT = nOR. Determine the values of m and n. (6 marks

18. (a) Complete the table given below for the functions $y = -3\cos 2x$ and $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ for $0^0 \leq x \leq 180^0$ (2 marks)

x^0	0	20	40	60	80	100	120	140	160	180
$-3\cos 2x$	−3.00			1.50	2.82	2.82		−0.52	−2.30	
$2\sin\left(\frac{3}{2}x + 30\right)^0$	1.00		2.00	1.73		0.00	−1.00			−1.73

(b) Using the grid provided, draw the graphs of $y = -3\cos 2x$ and $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ for $0^0 \leq x \leq 180^0$ on the same pair of axes. Take 1cm to represent 20^0 on the $x-$axis and 2cm to represent 1 unit on the $y-$axis. (5 marks)



(c) From the graphs in (b) above, find;

(i) the period of $y = 2\sin\left(\frac{3}{2}x + 30\right)^0$ (1 mark)

(ii) the values of x given that $2\sin\left(\frac{3}{2}x + 30\right)^0 + 3\cos 2x = 0$ (2 marks)

19. Awuor was paid an initial salary of Kshs. 180000 per annum with a fixed annual increment. Wasonga was paid and initial salary of Kshs. 150000 per annum with a 10% increment compounded annually.

(a) Given that Awuor's annual salary in the 11th year was Kshs. 288,000, determine:

(i) Her annual increment. (2 marks)

(ii) The total amount of money Awuor earned during the 11 years. (2 marks)

(b) Determine Wasonga's monthly earning, correct to the nearest 10 shillings during the 11th year (3 marks)

(c) Calculate the number of years it will take Awuor's total earnings to be Ksh. 1022400.(3 marks)

20. In a mixed school there are 420 boys and 350 girls. The probability that a girl passes her exams in the school is $\frac{4}{7}$ while that of a boy passing is $\frac{5}{8}$. The probability of a girl being made a prefect is $\frac{2}{11}$ while that of a boy is $\frac{1}{8}$.

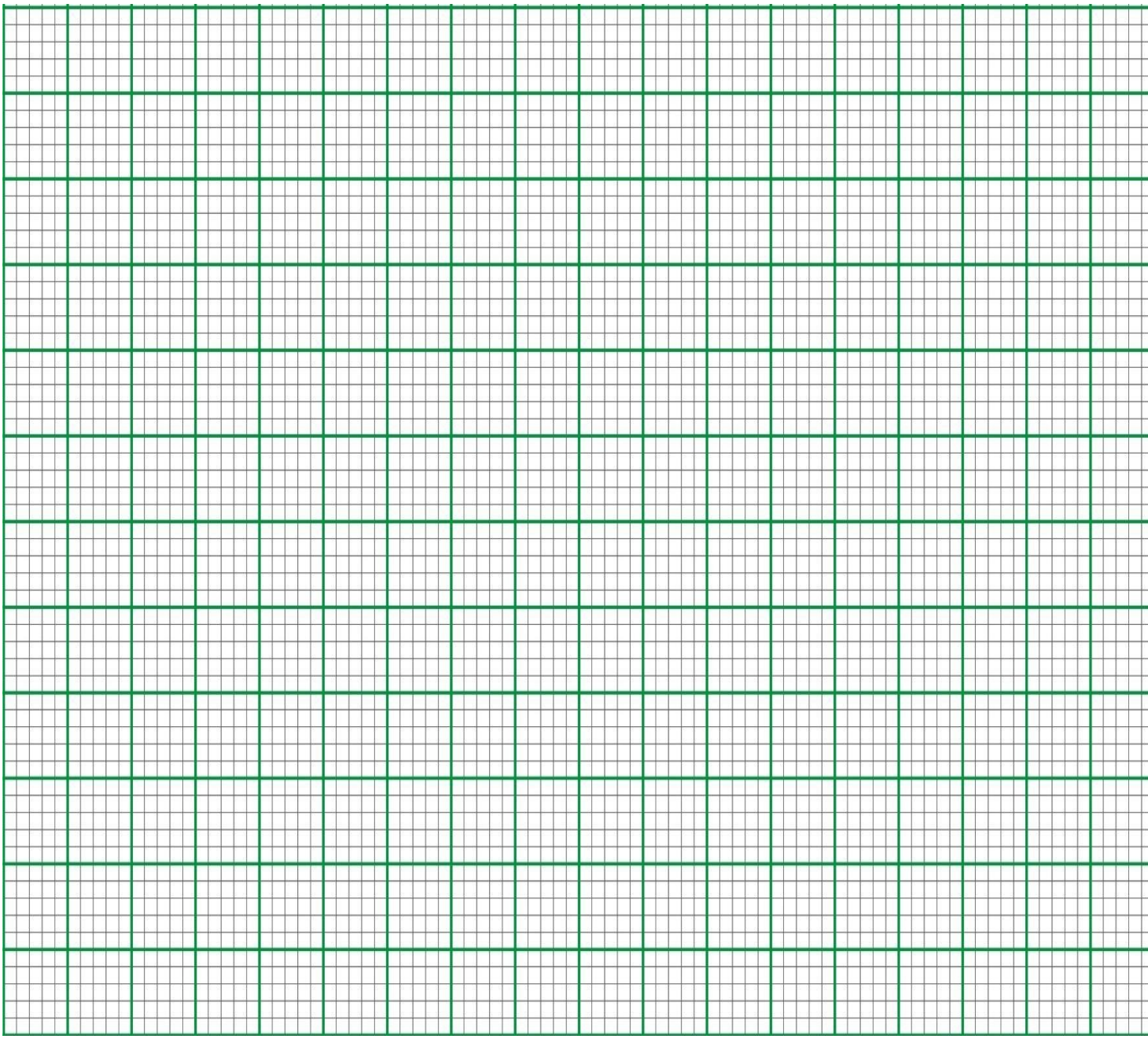
Find the probability that a student picked at random.

a) Is a boy and passes the exam and is not a perfect. (3mks)

b) Is a girl, a prefect and passes the exam. (3mks)

c) Is not as prefect and passes the exam. (4mks)

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



a) Find the co-ordinates of $O^1\ A^1\ B^1\ C^1$. (2mks)
b) On the grid provided draw OABC and $O^1\ A^1\ B^1\ C^1$ (2mks)
c) Find $O^{11}\ A^{11}\ B^{11}\ C^{11}$ the image of $O^1\ A^1\ B^1\ C^1$ under the transformation matrix $\begin{matrix} 1 & 0 \\ 0 & -2 \end{matrix}$ (2mks)
(i) On the same grid draw $O^{11}\ A^{11}\ B^{11}\ C^{11}$. (1mk)
(ii) Find the single matrix that map $O^{11}\ A^{11}\ B^{11}\ C^{11}$ onto OABC. (3mks)

22. A particle moves in such a way that the velocity V at any given time is
$v=10t - \frac{1}{2} t^2 - \frac{15}{2}$ mls.

(a) Calculate the initial velocity (1 mark)

(b) Calculate the velocity when the time t=3 (2 marks)

(c) Find the displacement during the 5th second (4 marks)

(d) Calculate the maximum velocity attained (3 marks)

23. The 2nd and 5th terms of an arithmetic progression are 8 and 17 respectively. The 2nd, 10th and42nd terms of the A.P. form the first three terms of a geometric progression. Find

(a) The 1st term and the common difference. (3mks)

(b) The first three terms of the G.P and the 10th term of the G.P. (4mks)

(c) The sum of the first 10 terms of the G.P. (3mks)

24. Matrix P is given by $\begin{pmatrix} 4 & 7 \\ 5 & 8 \end{pmatrix}$

(a) Find P^{-1} (2 Marks)

(b) Two institutions, Kamunyaka secondary School and Njabini mixed secondary School purchased beans at Sh. b per bag and maize at Sh. m per bag. Kamunyaka secondary purchased 8 bags of beans and 14 bags of maize for KSh. 47,600. Njabini mixed purchased 10 bags of beans and 16 bags of maize for KSh. 57,400.

(i) Form a matrix equation to represent the information above. (2 Marks)

(ii) Use matrix $P^{-1}$to find the prices of one bag of each item. (3 Marks)

(c) The price of beans later went up by 5% and that of maize remained constant. Kamunyaka secondary bought the same quality of beans but spent the same total of money as before on the two items. State the new ratio of beans to maize. (3 Marks)

SECTION I (50 marks)

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

1. Simplify $\frac{b-2}{4}+\frac{b+3}{7}$ (3 marks)

2. Given that the number $987h19564$ is divisible by 11, determine digit h. (2 marks)

3. A tourist changed half of her 24 000 Euros to US dollars in a bank. The currency exchange rates in the bank were:

   1 Euro = Ksh 155.7285

   1 US dollar = Ksh 144.1462

   Calculate, to one decimal place, the amount of money, in dollars, she received. (3 marks)

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4. Evaluate without using calculators or mathematical tables, leaving the answer as a mixed number.

$$\frac{1.23 \times 35 \times 0.0084}{0.056 \times 2.87}$$

(2 marks)

5. Three people X, Y and Z share Ksh 25 300 in such a way that Y gets one and a half times as much as X and Z gets twice as much as Y. Find the amount that Z gets. (3 marks)

6. On his cycling practice, Peter cycled for 6 km on a bearing of 120°. He then cycled for 8 km on a bearing of N80°E. Finally, he turned north and cycled 10 km. Using, scale drawing, find the distance of his final position from the starting point. (4 marks)

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7. Solve the equation; $64^{x} - 121 = 7 - 4^{3x}$ (3 marks)

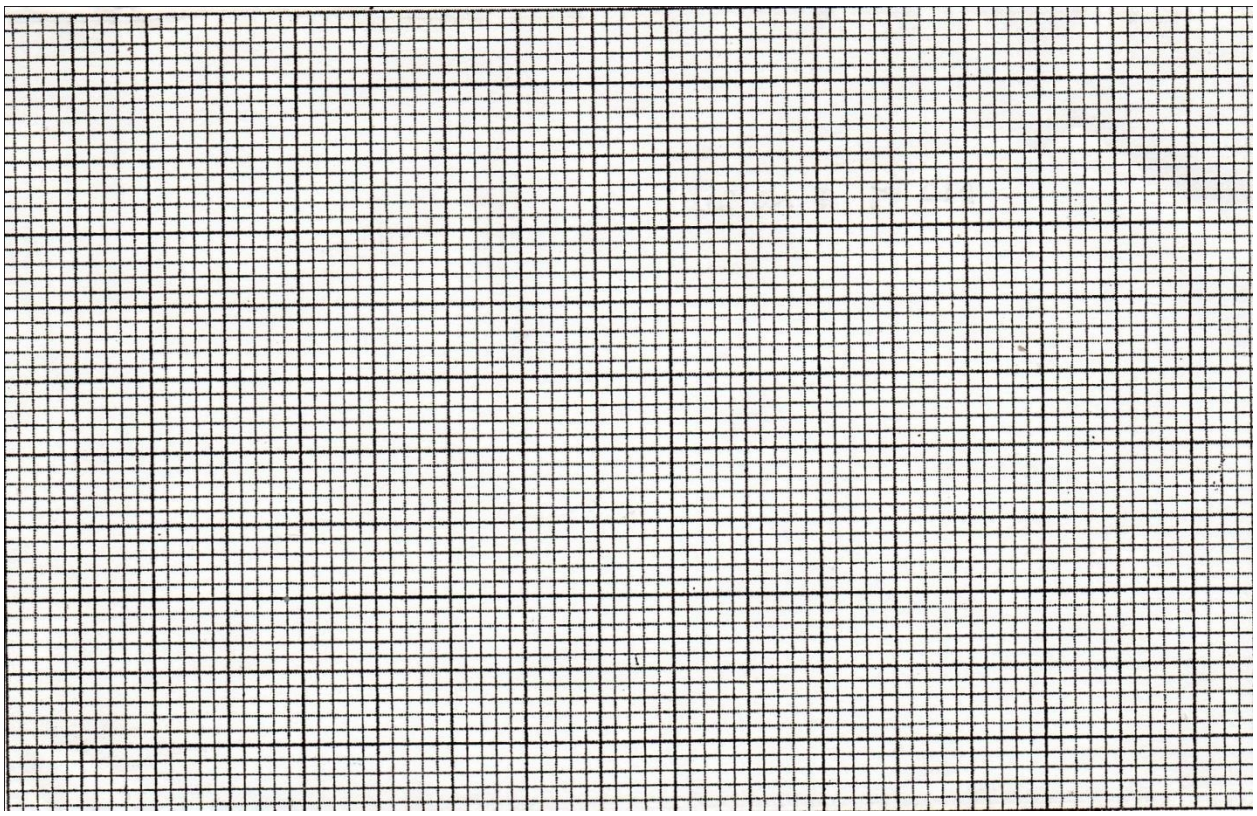
8. Use tables of cubes, squares and reciprocals to evaluate: $12.86^{3} - \frac{10}{(0.17)^{2}}$ (3 marks)

9. A circle whose radius is 15 cm is divided into ten equal sectors. Calculate the total area of the minor segments formed in the sectors. (3 marks)

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10. On the grid provided, solve the simultaneous equations:

$$2y - 6 = 3x \text{ and } 3x + 5y = 15$$ (4 marks)



11. If $\begin{pmatrix} 4 & 1 \\ 1 & 3 \end{pmatrix} \begin{pmatrix} x \\ x^2 \end{pmatrix} = \begin{pmatrix} 5 \\ k \end{pmatrix}$, find the values of k. (4 marks)

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12. A straight line through the points P(2, 1) and Q(4, b) is perpendicular to the line whose equation is $3y + 2x = 5$. Determine the value of b. (3 marks)

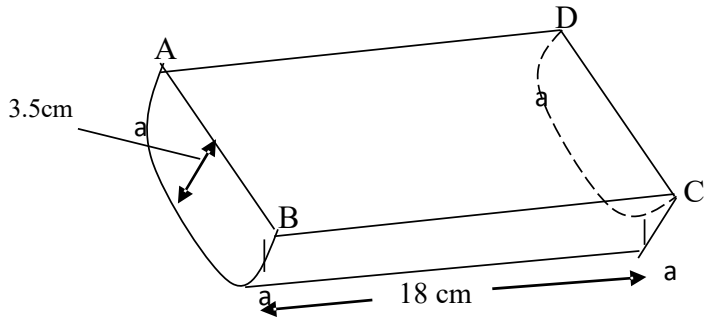
13. Towns P and Q are 360 km apart. A bus leaves town Q for town P at 6.20 a.m. driving at an average speed of 60 km/h. At 7.05 a.m., a van leaves town Q for town P driving at 120 km/h. Determine the distance from town P to the point where the van catches up with the bus. (4 marks)

14. Solve the inequalities and hence represent the solutions on a single number line.

$$4x - 9 \leq 6 + x$$
$$8 - 3x < x + 4$$ (3 marks)

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15. The figure below is a semi-cylindrical solid of length 18 cm and radius 3.5 cm as shown.



Find the surface area of the solid. (3 marks)

16. Under an enlargement, the images of the points $E(1,3)$ and $F(2,-2)$ are $E^{I}(4,5)$ and $F^{I}(6,-5)$. Calculate:

(a) the scale factor of the enlargement; (2 marks)

(b) the centre of the enlargement. (2 marks)

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SECTION II (50 marks)

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

17. The outfitter for the school was asked to stock three different types of school jumpers. He decided to purchase 40 V-neck jumpers, 30 polo-neck jumpers and 30 crew-neck jumpers.

(a) He bought the V-neck jumpers at Ksh 1 200 each and sold them at a profit of 40 % on the cost price. Calculate the selling price of each V-neck jumper. (2 marks)

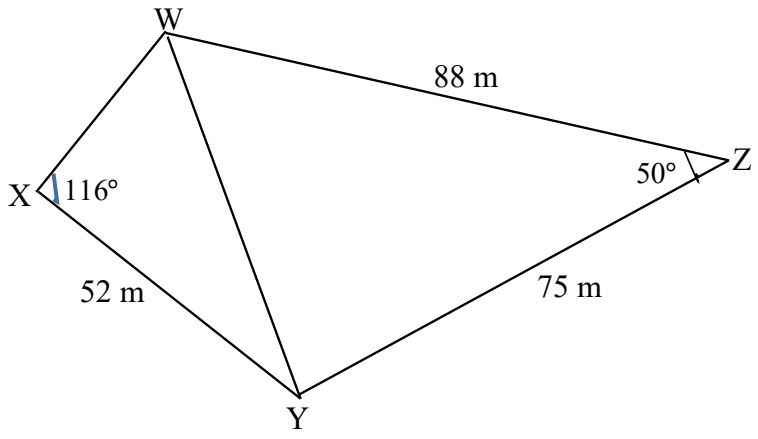
(b) He bought the polo-neck jumpers at Ksh 1 500 each and sold them at a profit of Ksh 800 each. Express the profit as a percentage of the cost price. (2 marks)

(c) He sold each crew-neck jumper at Ksh 1 620, thereby losing 10 % on the cost price. Determine the cost price of each crew-neck jumper. (2 marks)

(d) Calculate the total profit he made on the sale of all the jumpers and express this profit as a percentage of his initial outlay. (4 marks)

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18. The figure below represents a plot of land WXYZ divided into two pieces. Given that XY = 52 m, YZ = 75 m, WZ = 88 m, angle WXY = 116° and angle WZY = 50°.



Calculate to 2 decimal places:

(a) the length of WY; (2 marks)

(b) the size of angle XYW; (3 marks)

(c) the length of WX; (2 marks)

(d) the area of the quadrilateral WXYZ in hectares. (3 marks)

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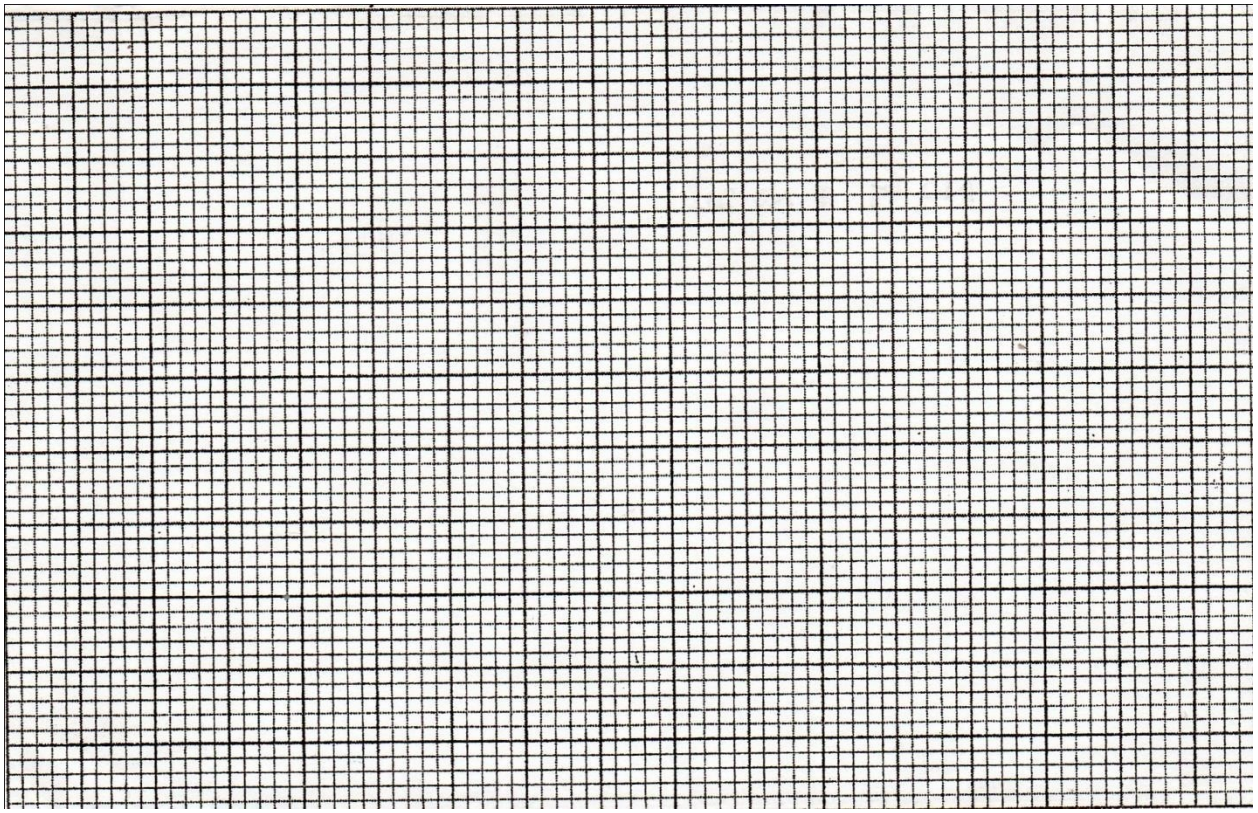
19. The vertices of a triangle T are $A(1, 1)$, $B(3, 0)$ and $C(1, 3)$.

(a) On a grid draw triangle T. (1 mark)

(b) T_1 is the image of T under a reflection in the line $y + x = 0$. Draw T_1. (3 marks)

(c) T_2 is the image of T_1 under a rotation of clockwise quarter turn about the origin. Draw T_2. (2 marks)

(d) T_3 is the image of T_2 under an enlargement scale factor -2 and centre (0, 0). Draw T_3. (2 marks)



(e) Describe a transformation that maps T onto T_2. (2 marks)

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20. The times, in seconds, taken by some athletes who took part in the 400 metres race during an inter-school competition were recorded as below.

64	67	56	60	61	51	52	68	66	59
57	60	46	58	63	52	63	50	64	52
58	53	62	63	47	63	62	68	49	66
55	46	58	45	48	52	55	45	61	65

(a) Using the data provided above, complete the table below. (1 mark)

Time (sec.)	45 – 49	50 – 54	55 – 59	60 – 64	65 – 69
No. of athletes					

(b) State the median class. (1 mark)

(c) Calculate the:

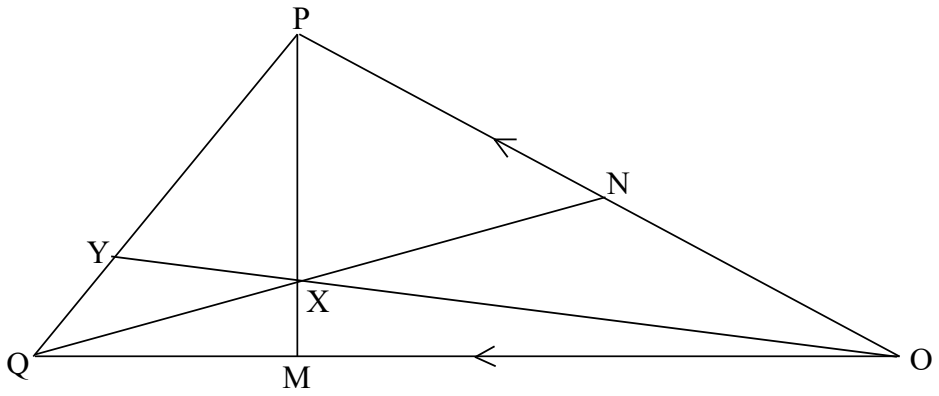
(i) mean time; (3 marks)

(ii) median time. (3 marks)

(d) Determine the percentage of athletes whose time was more than 54 seconds but less than 65 seconds. (2 marks)

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21. The figure below shows a triangle OPQ in which **OP** = **p** and **OQ** = **q.** M and N are points on OQ and OP respectively such that ON : NP = 2 : 3 and OM : MQ = 2 : 1.



(a) Express the following vectors in terms of p and q.

(i) **PM** (1 mark)

(ii) **QN** (1 mark)

(iii) **PQ** (1 mark)

(b) Lines PM and QN intersect at X such that **PX** = h**PM** and **QX** = k**QN**. Express **OX** in two different ways and hence find the values of h and k. (5 marks)

(c) Show that Q, X and N are collinear. (2 marks)

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22. A radio dealer planned to buy some radios from a wholesaler for Ksh 340 000. Before he could buy them the price of each radio was increased by Ksh 300. He then discovers that he can only afford to buy 30 radios less than he had planned to buy with the same amount of money.

(a) If the original price of each radio was Ksh p, write down an expression for:

(i) the original number of radios he could buy; (1 mark)

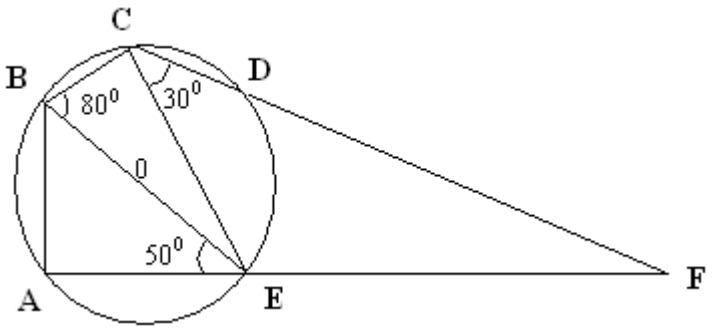
(ii) the new number of radios he could buy after price increase. (1 mark)

(b) Form an equation in P and determine the original price of each radio. (5 marks)

(c) Find the number of radios he finally bought after price increase. (3 marks)

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23. In the figure below, O is the centre of the circle. Angle AEB = 50°, angle EBC = 80° and angle ECD = 30°.



Giving reasons, determine:

(a) angle CDE; (2 marks)

(b) angle DFE; (2 marks)

(c) obtuse angle COE; (2 marks)

(d) angle ADE; (2 marks)

(e) angle FDE; (2 narks)

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24. Three solids, a cylinder, a sphere and a cone, are such that their radii are equal. It is also given that their surface areas are equal. If the volume of the sphere is 904.9 cm^3, calculate, using $\pi = 3.142$ the:

(a) common radius of the solids; (2 marks)

(b) volume of the cylinder; (4 marks)

(c) volume of the cone. (4 marks)

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SERIES 6
PAPER 1

SECTION I (50 Marks)

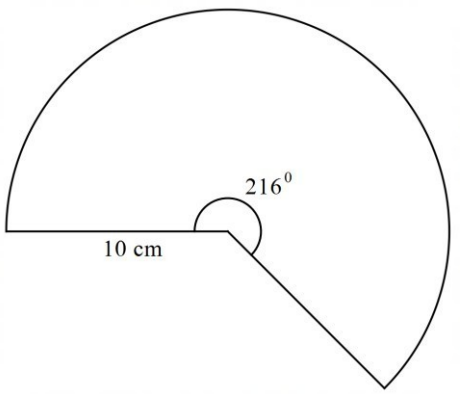
Answer all the questions in this section

1. The radius of sphere is 4.9 cm. Find the maximum percentage error in the volume of the sphere if the error in the radius is 0.5%. Give the answer correct to four significant figures. (3 marks)

2. A school wanted to buy some scientific calculators for members of its Mathematics department with a budget of Ksh. 142200. Before the purchase, the school was given a discount of Ksh. 175 per calculator by the bookshop. As a result, the department was able to buy seven more calculators with the same amount. Calculate the total number of calculators the department was able to buy. (4 marks)

3. Given that $\log 2 = 0.3010$ and $\log 3 = 0.4771$, find $\log 7.2$ (3 marks)

4. The figure below shows a sector of a circle made from a wire model. The sector subtends and angle of 216^0 at the centre of the sector of radius 10 cm.



The model is cut at one point and bent to form a circle. Calculate the radius of the circle formed, correct to one decimal place. Use $\pi = 3.142$ (3 marks)

5. Simplify by rationalizing the denominator (3 marks)

$$\frac{\sin 30^0}{2 - \tan 60^0}$$

6. Two parallel chords of dimensions 15.6 cm and 13 cm are such that they are on either sides of the centre of a circle centre O and radius 12 cm. find the perpendicular distance between the two chords, correct to 2 decimal places. (3 marks)

7. Rose bought a branding machine on hire purchase terms. The cash price of the branding machine was Kshs. 750000. She paid 15 equal monthly installments of Kshs. 62500 each. Calculate the monthly rate at which compound interest was charged. (4 marks)

8. Make m the subject of the formula (3 marks)
$P = \frac{m}{\sqrt[3]{Q^2 - m^3}}$

9. A bag has 3 red balls, 6 blue ball and some green balls of the same shape and size. The probability of picking a green ball is 0.5. Find the probability of picking either a green or a blue ball. (3 marks)

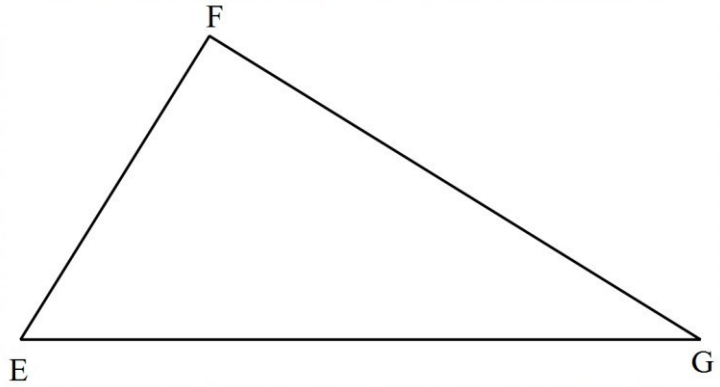
10. The roots to a cubic equation are $x = 2$, $x = 4$ and $x = -3$. Write the equation in the form $x^3 + ax^2 + bx + c = 0$, where a, b and c are constants. (3 marks)

11. (a) Find $\mathbf{A^{-1}}$ given that (1 mark)
$\mathbf{A} = \begin{pmatrix} 3 & 5 \\ 2 & 4 \end{pmatrix}$

(b) Mr. Mutua bought 3 mathematical tables and 5 geometrical sets and paid a total of Ksh. 3050 while Fayo bought 2 mathematical tables and 4 geometrical sets and paid a total of Ksh. 2230. Use $\mathbf{A^{-1}}$ to find the cost of each item. (3 marks)

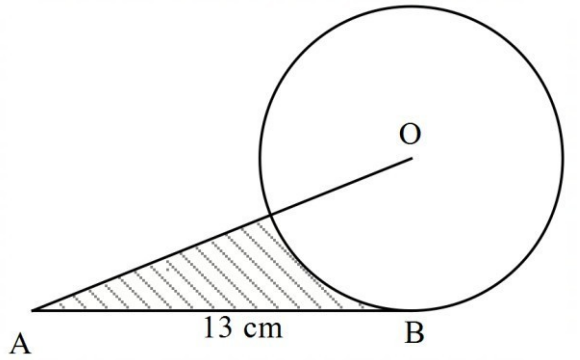
12. Determine the independent term in the expansion of (2 marks)
$\left(2x - \frac{1}{3x^2}\right)^6$

13. The figure below represents a triangular field ABC



(a) Draw the locus of points 2 cm from E
(b) Draw the locus of points equidistant from the sides EF and EG
(c) Draw the locus of all points equidistant from E and G
(d) A coin is lost within a region which is nearer to point E than to the point G and closer to the side EG than to the side EF. Shade the region where the coin can be located. (4 marks)

14. In the figure below, AB is a tangent to the circle centre O at B. The radius of the circle is 5 cm and AB = 13 cm.



Calculate the shaded area. Use $\pi = 3.142$. (3 marks)

15. A coffee trader buys two grades of coffee at Kshs. 80 and Kshs. 100 per packet. The trader blends the two grades in the ratio $1: n$. By selling the blend at Ksh. 120 per packet, a 25% profit realized. Determine the value of n. (3 marks)

16. The area of a triangle PQR is 14 square units. It is transformed using the matrix $\begin{pmatrix} \frac{1}{3}x & 2 \\ 2x & 4 \end{pmatrix}$ and mapped onto triangle $\mathrm{P'Q'R'}$ of area 84 square units. Find the value of x. (2 marks)

SECTION II – 50 Marks
Answer any *five* questions in this section.

17. The table below shows income tax rates for the year 2020

Taxable income (Ksh. per month)	**Tax Rate (% per Ksh)**
1 – 15000	0
15001 – 27000	10
27001 – 37000	15
37001 – 45000	20
45001 – 50000	25
Above 50000	30

In June 2020, Juma earned a basic salary of Ksh. 34320. In addition, he was entitled to a house allowance of Ksh. 12000 per month and medical allowance of Ksh. 6450. He also has a non-taxable risk allowance of Ksh. 6000 per month. He contributes to a provident fund of Ksh. 7500. He also has tax relief of Ksh. 1180 monthly.

(a) Calculate Juma's taxable income in that month. (2 marks)

(b) Calculate Juma's Pay As You Earn for June 2020. (5 marks)

(c) In the month of July 2020, Juma's tax in the last band was Ksh. 2556. Calculate his net salary in July. (3 marks)

18. The table below shows the frequency distribution of the heights of 100 seedlings in a tree nursery.

Height (cm)	Number of seedlings (f)	Midpoint (x)	$d = \frac{x - 55.5}{10}$	fd	fd^2
1 – 10	3				
11 – 20	5				
21 – 30	8				
31 – 40	11				
41 – 50	12				
51 – 60	18				
61 – 70	20				
71 – 80	10				
81 – 90	7				
91 – 100	6				
	$\Sigma f = 100$			$\Sigma fd =$	$\Sigma fd^2 =$

(a) Complete the table (4 marks)

(b) State the modal class (1 mark)

(c) Calculate the mean and standard deviation (5 marks)

19. A farm is quadrilateral in shape with vertices at A, B, C and D such that B is 160 metres from A on a bearing of 090^0. C is 140 metres from A on a bearing of 130^0, and D is 260 metres to the west of C and on a bearing of 240^0 from A

(a) Sketch the relative positions of A, B, C and D. (1 mark)

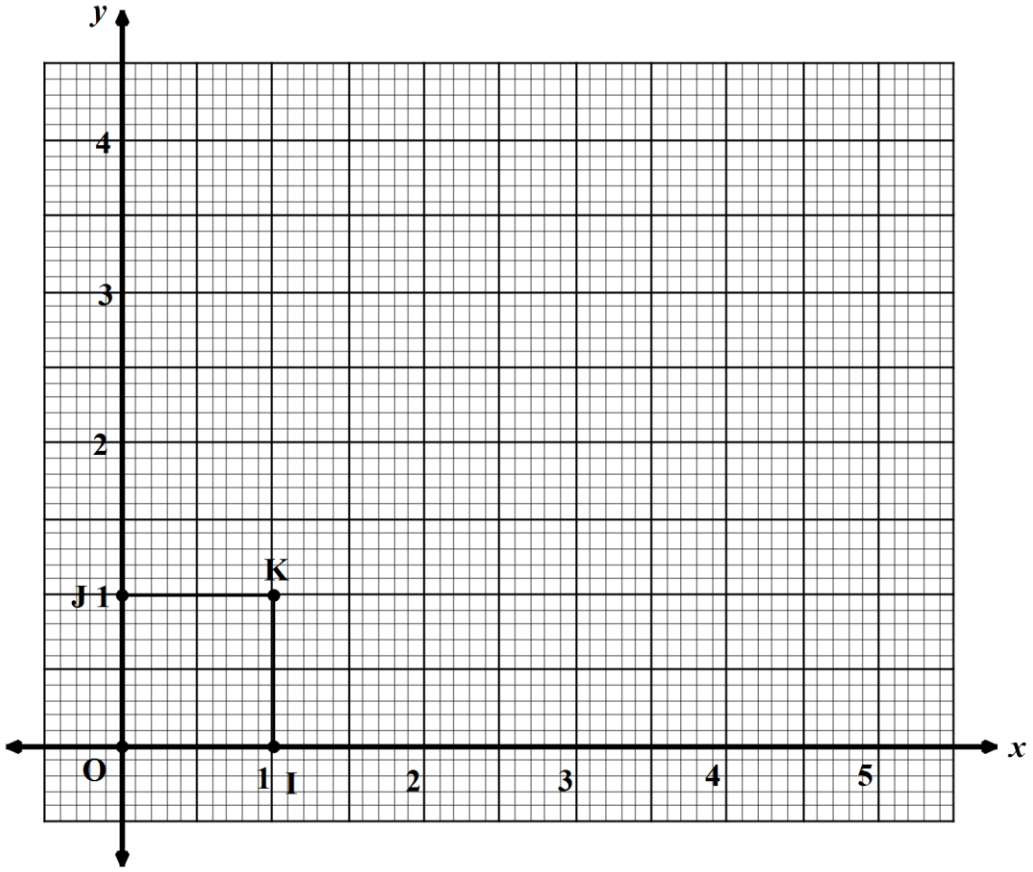
(b) Calculate:

(i) The distance BC, correct to 1 decimal place. (3 marks)

(ii) The bearing of C from D to the nearest degree. (3 marks)

(c) Find the area of the farm in hectares, correct to 3 significant figures. (3 marks)

20. The grid below shows the unit square OIKJ such that O(0, 0), I(1, 0), K(1, 1) and J(0, 1)



(b) $O'I'K'J'$ is the image OIKJ after a transformation M such that $O'(0, 0)$, $I'(4, 0)$, $K'(4, 1)$ and $J'(0, 1)$

(i) On the same grid, draw $O'I'K'J'$ (1 mark)

(ii) Describe fully the transformation M. (3 marks)

(iii) Find the matrix of M. (1 mark)

(c) $O''I''K''J''$ is the image of $O'I'K'J'$ under a transformation described by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$

(i) Find the coordinates of $O''I''K''J''$ (2 marks)

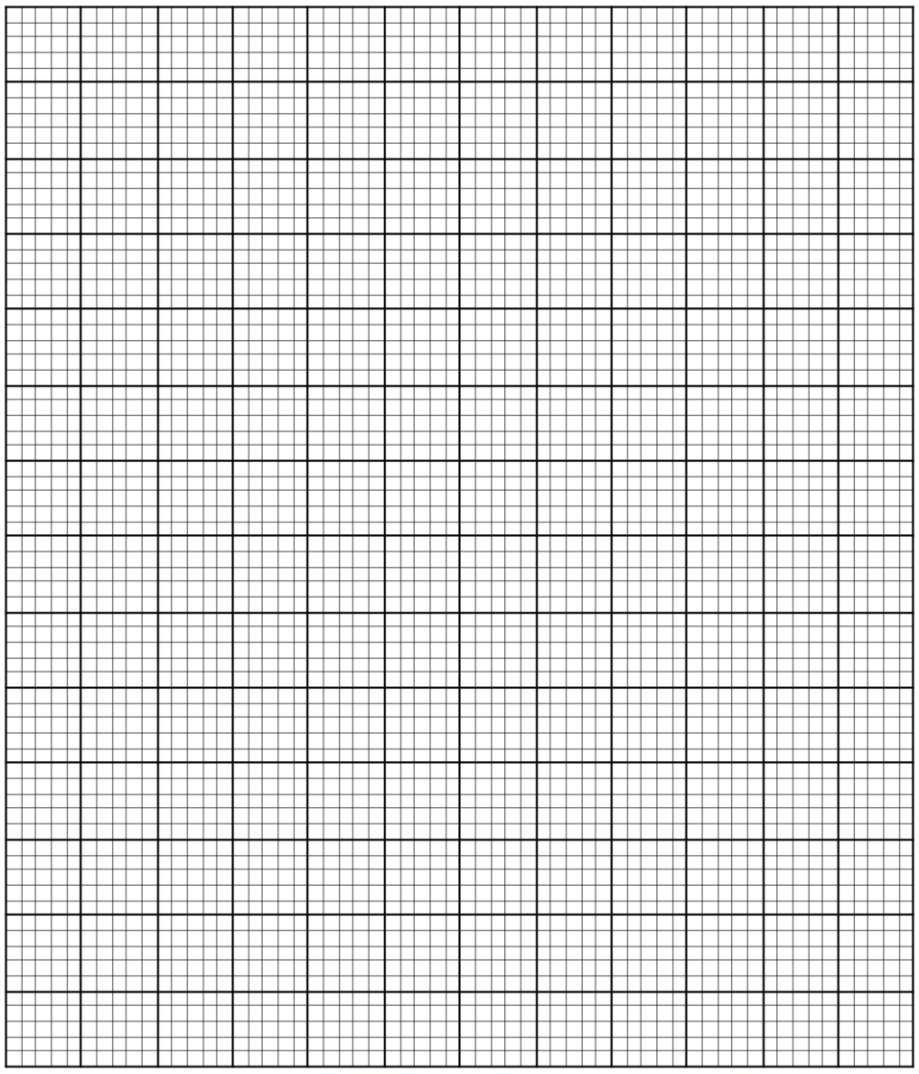
(ii) On the same grid, draw $O''I''K''J''$ (1 mark)

(d) Describe a single transformation that maps $OIKJ$ onto $O''I''K''J''$. (2 marks)

21. (a) Complete the table given below for the functions $y = -3\cos 2x$ and $y = 2\sin(\frac{3}{2}x + 30)^0$ for $0^0 \leq x \leq 180^0$ (2 marks)

x^0	0	20	40	60	80	100	120	140	160	180
$-3\cos 2x$	-3.00			1.50	2.82	2.82		-0.52	-2.30	
$2\sin(\frac{3}{2}x + 30)^0$	1.00		2.00	1.73		0.00	-1.00			-1.73

(b) Using the grid provided, draw the graphs of $y = -3\cos 2x$ and $y = 2\sin(\frac{3}{2}x + 30)^0$ for $0^0 \leq x \leq 180^0$ on the same pair of axes. Take 1cm to represent 20^0 on the $x-$ axis and 2cm to represent 1 unit on the $y-$ axis. (5 marks)



(c) From the graphs in (b) above, find;

(i) the period of $y = 2\sin(\frac{3}{2}x + 30)^0$ (1 mark)

(ii) the values of x given that $2\sin(\frac{3}{2}x + 30)^0 + 3\cos 2x = 0$ (2 marks)

22. Awuor was paid an initial salary of Kshs. 180000 per annum with a fixed annual increment. Wasonga was paid and initial salary of Kshs. 150000 per annum with a 10% increment compounded annually.
(a) Given that Awuor's annual salary in the 11th year was Kshs. 288,000, determine:

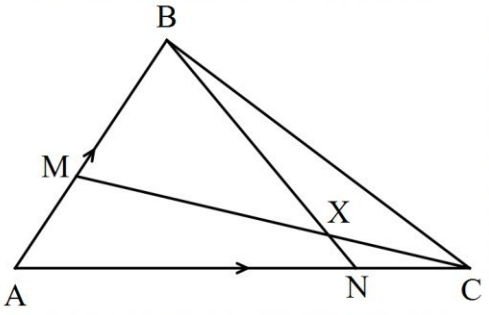
(i) Her annual increment. (2 marks)

(ii) The total amount of money Awuor earned during the 11 years. (2 marks)

(b) Determine Wasonga's monthly earning, correct to the nearest 10 shillings during the 11th year (3 marks)

(c) Calculate the number of years it will take Awuor's total earnings to be Ksh. 1022400. (3 marks)

23. In the triangle ABC shown below, $\mathbf{AB} = \boldsymbol{a}$ and $\mathbf{AC} = \boldsymbol{c}$. Point M lies on AB such that AM: MB=2: 3 and point N lies on AC such that AN: NC = 5: 1. Lines BN and MC at X



(a) Express the following in terms of $\boldsymbol{a}$ and $\boldsymbol{c}$;

(i) **BN**; (1 mark)

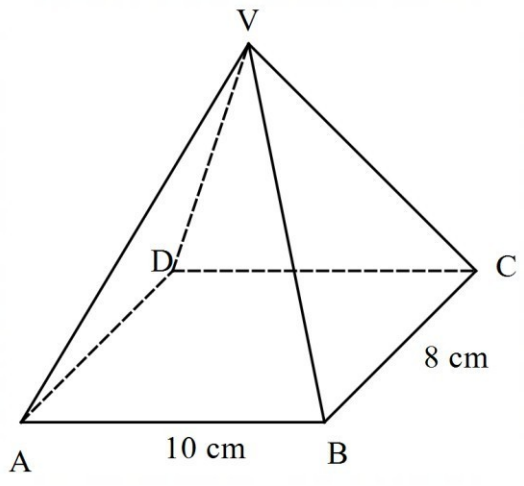
(ii) **CM.** (1 mark)

(b) Given further that $\mathbf{BX} = h\mathbf{BN}$ and $\mathbf{CX} = k\mathbf{CM}$ where h and k are constants

(i) Write two different expressions for **AX** in terms of $\boldsymbol{a}$, $\boldsymbol{c}$, h and k. (4 marks)

(ii) Hence find the values of h and k. (4 marks)

24. The figure below shows a right pyramid VABCD standing on a rectangular base of length 10 cm and width 8 cm. The diagonals of the base intersect at O and M is the midpoint of BC. The vertical height OP of the pyramid is 12 cm and that all the slant edges are equal.



Calculate correct to 2 decimal places:

(a) The length of VM, (2 marks)

(b) (i) State the projection of VB on the plane ABCD. (1 mark)

(ii) Calculate the angle VB makes with the plane ABCD. (3 marks)

(c) The angle between planes VAD and ABCD. (2 marks)

(d) The volume of the pyramid. (2 marks)

Section 1 (50 marks)

*Answer **all** the questions from this section*

1 Without using mathematical tables or a calculator, evaluate (3marks)

$$\frac{\frac{5}{6} of \left(\frac{1}{3}-\frac{5}{6}\right)}{\frac{7}{12}\times\frac{3}{21}+1\frac{5}{9}\div 2\frac{1}{3}}$$

2. A business woman bought two bags of maize at the same price per bag. She discovered that one bag was of high quality and the other of low quality. On the high quality bag she made a profit by selling at sh. 1040, whereas on the low quality bag, she made a loss by selling at sh. 880. If the profit was three times the loss, calculate the buying price per bag. (3marks)

3 Given that $\mathbf{Q}=\begin{pmatrix}3 & -1\\ 1 & 2\end{pmatrix}$ and $\mathbf{R}=\begin{pmatrix}5 & 3\\ 13 & 5\end{pmatrix}$ and that **PQ = R**, find $\mathbf{P^{-1}}$ (4marks)

4 An artisan has 81kg of a metal of density $9g/cm^3$. She intends to use it to make a cuboid with a square cross section whose side is 10cm. Calculate the length of the cuboid in centimeters. (3 marks)

5 Simplify $\frac{x-4xy+x^2-4y}{4y^2-x^2y-xy-4xy^2}$ (3 marks)

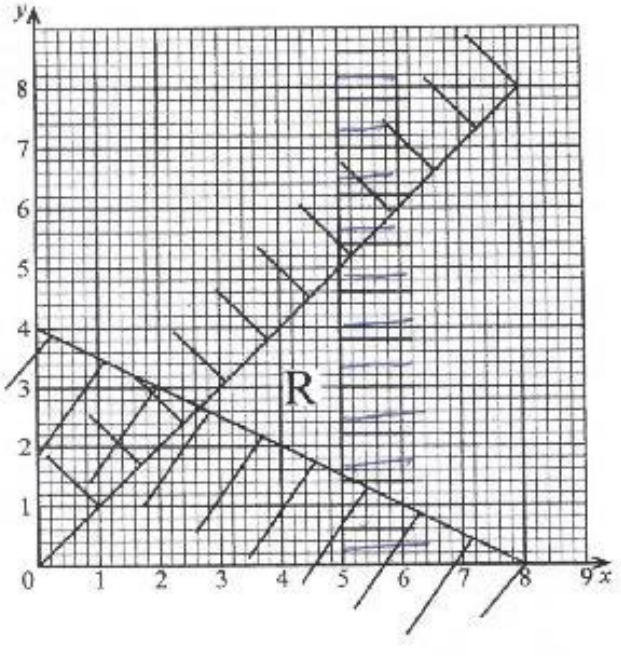
6 The size of an interior angle of a regular polygon is 144 . Find the number of sides of the polygon and hence the sum of its interior angles. (3 marks)

7 The surface areas of two similar solid are $528cm^2$ and $1188cm^2$. If the volume of the larger solid is $1350cm^3$, find the volume of the smaller sphere. (3 marks)

8 The quadratic curve $y = ax^2 + bx - 10$ intersects with the straight line $y = 2x - 5$ at the points $A(-1, -7)$ and $B(2.5, 0)$. Determine the values of *a* and *b*. (3 marks)

9 Evaluate $\dfrac{3^{n+3} - 3 \times 3^{n-1}}{4 \times 3^{n+2}}$ (3 marks)

10 In the diagram below, the region R is defined by three inequalities.



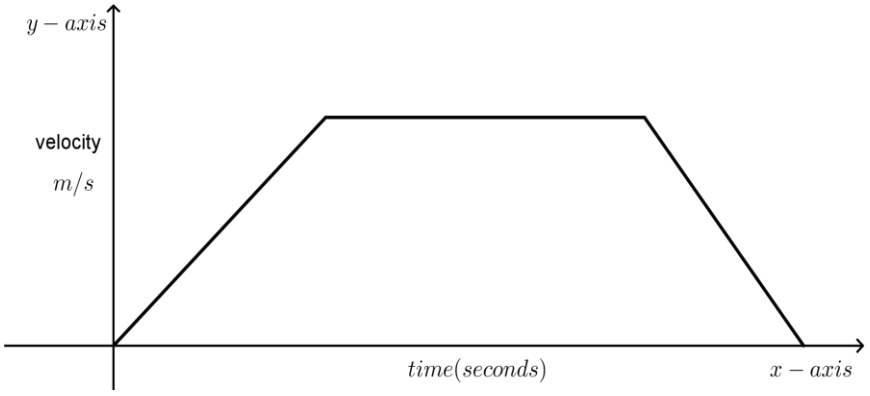
Write down the three inequalities. (3marks)

11 The coordinates of points P and Q are $(2, -1)$ and $(14, 7)$ respectively. Point T is the midpoint of line PQ. Determine the

(a) The coordinates of T. (1 mark)

(b) Equation of the perpendicular bisector of PQ. Leave your answer in the form $y = mx + c$ (3 marks)

12 The diagram below shows the velocity – time graph for a particle moving in a straight line from point P to point Q, a distance of 168 metres. It starts from rest and accelerate uniformly for 5 seconds. It then travels at a constant speed for 10 seconds and finally decelerates uniformly for 3 seconds.

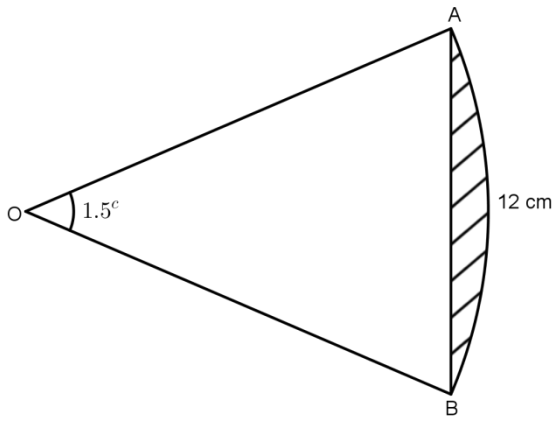


Calculate the maximum speed in km/h attained. *(3 marks)*

13 In a commercial bank, customers may withdraw cash through one of the two tellers at the counter. On average, one teller takes 3 minutes while the other takes 5 minutes to serve a customer. If the two tellers start to serve the customers at the same time, find the shortest time it takes to serve 200 customers. (3 marks)

14 The area of the curved surface of a cone is $308cm^2$. The slant height of the cone is equal to its diameter. Determine the diameter of the cone. (3 marks)

15 The diagram below shows a sector AOB of a circle, centre O. $\angle AOB = 1.5^c$ radians and arc AB is of length 12cm.



(a) Determine the radius OA of the circle. (1 mark)

(b) Calculate the area of the shaded segment. Give your answer to 3 significant figures (2 marks)

16 A ship sails 22km from P on a bearing of 045 to R. From R, it sails a further 30km on a bearing of 095 to arrive at Q. Calculate the area bounded by P, R and Q in km^2.

(3 marks)

SECTION 2 (50 marks)

*Answer **only five** questions from this section*

17 Two friends Jane and Tom live 40km apart. One day Jane left her house at 9.00 a.m. and cycled towards Tom's house at an average speed of 15km/h. Tom left his house at 10.30a.m. on the same day and cycled towards Jane's at an average speed of 25km/h.

a) Determine:

(i) The distance from Jane's house to where the two friends met. (4 marks)

(ii) The time they met (2marks)

(iii) How far Jane was from Tom's house when they met. (2marks)

b) The two friends took 10 minutes at the meeting point and then cycled to Tom's house at an average speed of 12km/h. Find the time they arrived at Tom's house. (2marks)

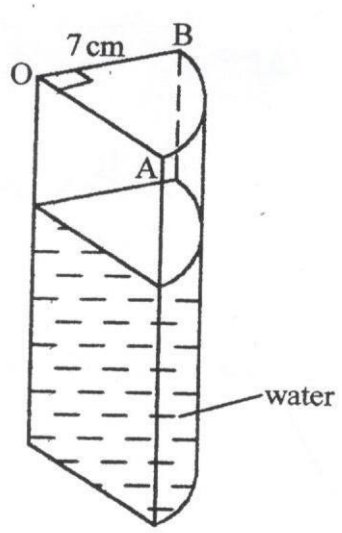
18 Betty and Joan entered into a business partnership in which they contributed sh 320 000 and sh 400 000 every year respectively. After one year, Kevin joined the business and contributed sh 240 000.

(a) Calculate the ratio of their investment after 3 years of business. (3marks)

(b) It was agreed that 30% of the profits after 3 years be used to cater for the costs of running the business, while the remaining would be shared proportionally. Calculate each persons share, if the pro fit made after 3 years was sh 561 000. (4 marks)

(c) If each of them re-invested their shares back in the business, find their new individual investments at the beginning of the fourth year. (3 marks)

19 The figure below shows a vessel in the shape of a prism. The cross section OAB, is a sector of a circle of radius 7cm and angle AOB = 90°. The vessel contains 600cm^3 of water.



(a) Calculate the:

(i) The perimeter of the sector OAB (3 marks)

(ii) The height of the water in the vessel, correct to 1 decimal place. (3 marks)

(b) Given that the vessel is $\frac{4}{5}$ full of water, calculate.

(i) the height of the vessel, correct to one decimal place. (2marks)

(ii) The capacity of the vessel in litres (2marks)

20 A class of 50 pupils sat for a test. The following table shows the distribution of the scores.

Score	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of pupils	6	7	8	10	9	6	3	1

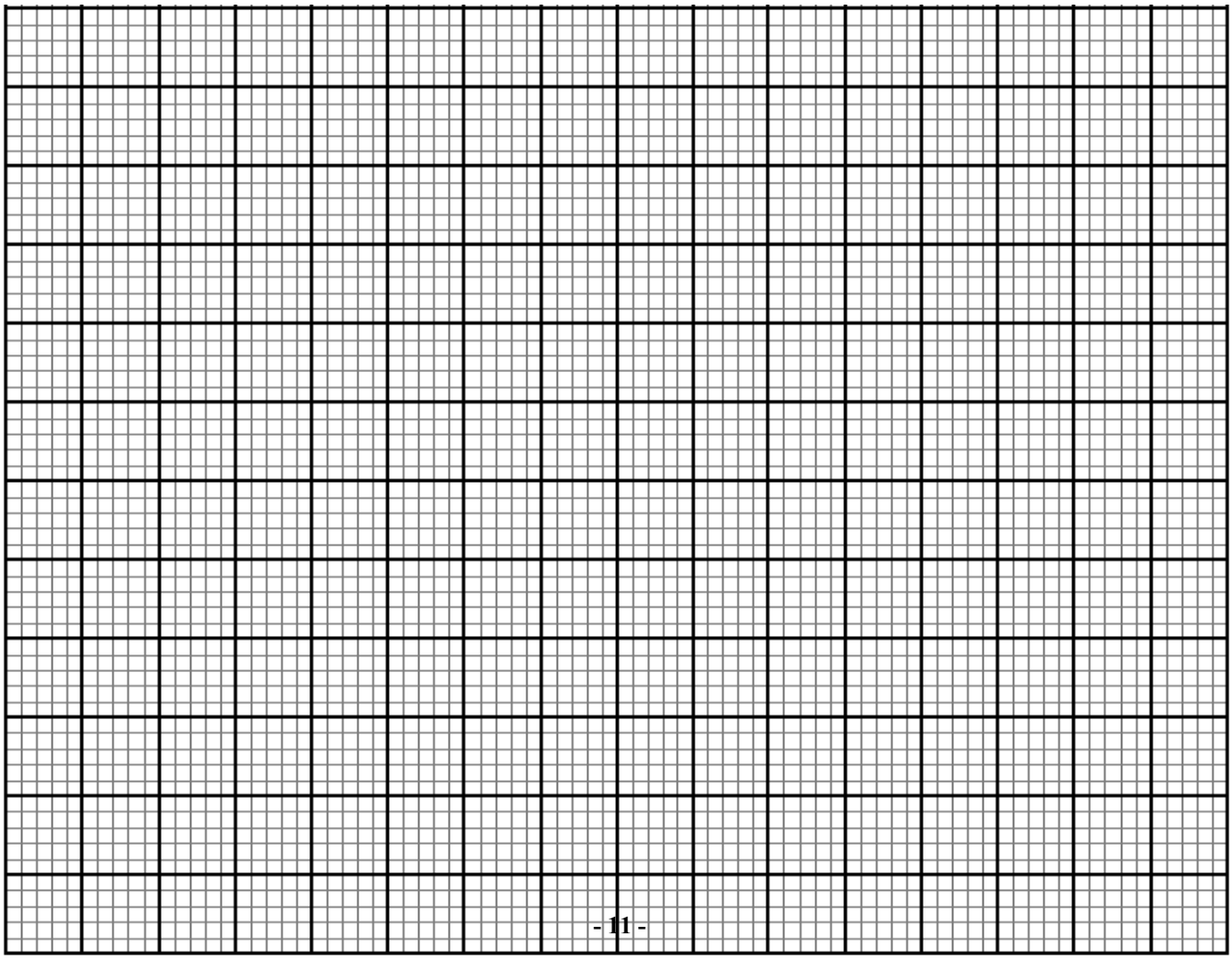
(a) State the modal class. (1mark)

(b) Estimate the

i) Mean score (3marks)

ii) Median score (3marks)

(c) Draw a frequency polygon to represent the information above. (3marks)



21 A square floor is fitted with identical rectangular tiles. The length of the floor is 9.6 m. The perimeter of each of the tiles is 220 cm. Each row (tile lengthwise) carries 20 less tiles than each column (tiles breadthwise). Taking x to represent the width of the tile,

(a) Write the expression in x the number of tiles on both row and column. (2 marks)

(b) Calculate the dimensions of the tiles. (4 marks)

(c) Find the number of tiles needed to cover the whole floor of the room. (1 mark)

(d) Find the cost of fitting, if the tiles are sold in dozen at sh 1500 per dozen and the labour cost is sh 300. (2 marks)

22 Town X is 1620m from a school A on a bearing 056 . Town Y is 1250m from the school A on a bearing of 185^0. Town Z is 1620m from town X on a bearing of 152^0.

(a) Make the drawing of a sketch of the positions of school A and towns X, Y, Z. (2 marks)

(b) Find by calculation the distance of town X from Y to 1 decimal place. (3 marks)

(c) Calculate the bearing of

(i) X from town Y to 1 decimal place. (3 marks)

(ii) Town Z from school A (2 marks)

23 (a) Using a ruler and a pair of compasses only;

(i) Construct triangle ABC in which BC = 7cm, $\angle ABC = 105^{o}$ and $\angle ACB = 30^{o}$. (3marks)

(ii) Drop a perpendicular from A to meet CB produced at T. (1mark)

(iii) Measure angle TAB (1mark)

(iv) Measure TA (1mark)

(b) The triangle ABC represents a farm drawn to scale of 1:500000. Find the area of the farm in ares. (5marks)

24 The velocity Vm/s of a vehicle at any time t seconds is given by the equation $V = t^2 - 4t + 5$.

a) Complete the table below: (2marks)

t	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8
v	2				2	3.25			10			21.25			37

b) Use mid-ordinate rule with seven strips to estimate the area enclosed by the curve $V = t^2 - 4t + 5$, the time – axis and the lines $t = 1$ and $t = 8$. (2marks)

c) Find the exact area of the region in (b) above (3marks)

d) Calculate the percentage error introduced by the use of mid-ordinate rule…in (b) above. (3marks)

SECTION I (50 marks)

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

1. The expression $\mathbf{a}x^2 - 60x + 18$ is a perfect square, where **a** is a constant. Find the value of **a**. (2 marks)

2. A rectangular plot of land has length of 125.8 m and an exact width of 84 m. Find the percentage error in calculating area of the plot *correct to 3 decimal place*. (3 marks)

3. Find the area of a sector of radius 10.5cm subtended by an angle of $\frac{1}{3}\pi^C$ at the center.(3 marks)

4. Without using a calculator or mathematical tables, evaluate; (3 marks)
$$\frac{\sin 45° + \cos 30°}{\tan 30°}$$

5. Simplify the logarithmic expression; $\dfrac{\frac{1}{2}\log 625 + \frac{1}{3}\log 125}{\log 100 - \frac{1}{2}\log 16}$ (3 marks)

6. A man who deposited Sh.50,000 in an investment account compounded semi-annually had at a total amount of Sh.70,925 after three years. Calculate the rate of interest per annum to the nearest whole number. (3 marks)

7. A quantity P is partly constant and partly varies as the square of Q. If $Q = 2$ when $P = 9$ and $Q = 4$ when $P = 33$, find the value of P when $Q = 1.5$. (4 marks)

8. Expand $(3x - y)^4$ and simplify hence evaluate $(1.5 - 0.2)^4$. (4 marks)

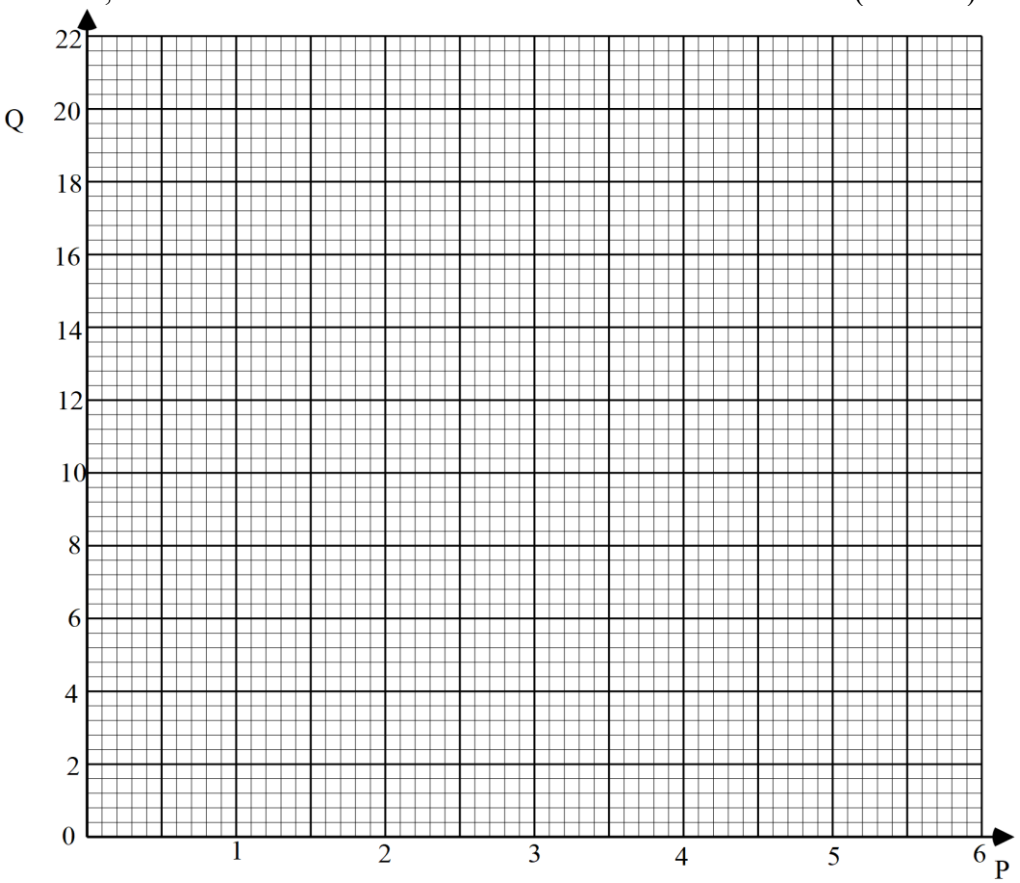
9. A committee of 3 people is to be chosen randomly from 5 men and 3 women. If every gender must be represented in the committee, find the probability of choosing more women than men.
(3 marks

10. An inlet tap can fill an empty tank in 8 hours. It takes 12 hours to fill the tank when the inlet tap and an outlet tap are both opened at the same time. Calculate the time the outlet tap takes to empty the full tank when the inlet tap is closed. (3 marks)

11. The table below shows the relationship between the quantities P and Q.

P	0	1	2	3	4	5	6
Q	2.4	5.2	8.4	11.6	14.0	17.6	20.4

(a) On the grid provided, draw a line of best fit. (2 marks)



(b) Using the graph, find the law connecting P and Q. (1 marks)

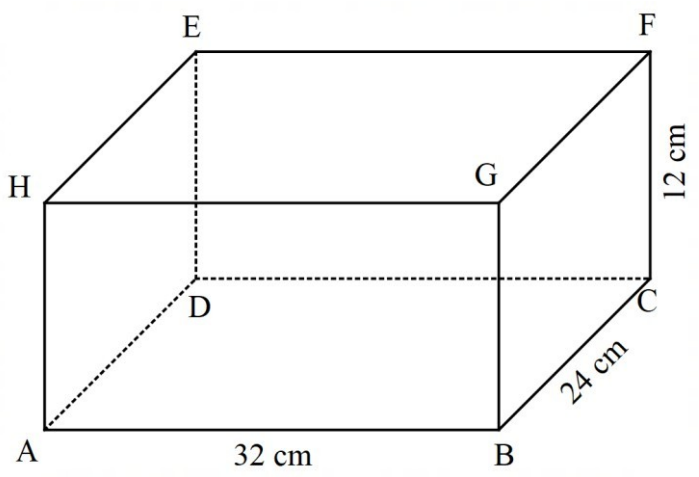
12. Solve the equation $8\text{Sin}^2x = 12\text{Cos}x$ for $O \leq x \leq 360^0$. (4 marks)

13. In a transformation. An object with an area of $6\ \text{cm}^2$ is mapped onto an image whose area is $36\ \text{cm}^2$. Given that the matrix of the transformation is $\begin{pmatrix} 4 & x-1 \\ 2 & x \end{pmatrix}$, find the value of x.
(3 marks)

14. The gradient of curve at any given point is given by $2x^2 - 4$, given that the curve passes through $(1, 2)$, find the equation of the curve. (3 marks)

15. AB is a fixed line segment 6cm long. Point P moves on one side of the plane of AB such that <APB is always 60^0. Construct the locus of P. (3 marks)

16. The figure below represents a cuboid ABCDEFGH. $AB = 32\ cm$, $BC = 24\ \text{cm}$ and $CF = 12\ \text{cm}$.



Given that M is the mid-point of EF, calculate the angle between AM and plane ABCD, correct to 2 decimal places. (3 marks)

SECTION II (50 marks)

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

17. The table below shows income tax rates for the year 2023

Taxable Income in Kshs per month	Tax Rate (%) per month
1 – 15000	0
15001 – 27000	10
27001 – 37000	15
37001 – 45000	20
45001 – 50000	25
Above 50000	30

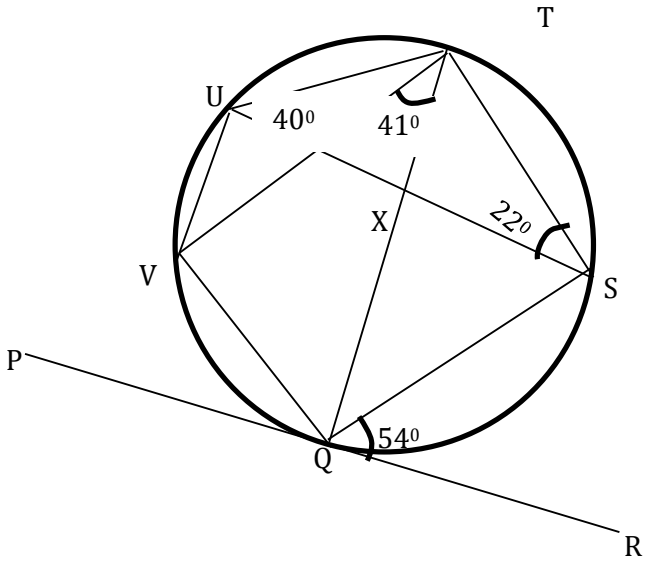
In November 2023, Silas earned a basic salary of Sh. 38 320. In addition, he was entitled to a house allowance of Sh. 12 800 per month and medical allowance of Sh. 6 850. He also has a non – taxable risk allowance of Sh. 5 000 per month. He contributes to a provident fund of Sh. 3 500. He also has tax relief of Sh. 1 480 monthly.

(a) Calculate Silas' taxable income in that month. (2 marks)

(b) Calculate Silas' Pay As You Earn (P.A.Y.E) for November 2023. (5 marks)

(c) In the month of December 2023, Silas' tax in the last band was Sh. 2 556. Calculate his net salary in December. (3 marks)

18. In the figure below PQR is a tangent to the circle at point Q $<SQR = 54^0$, $<VTQ = 41^0$ $<UST = 22^0$ and $<SUT = 40^0$.



Giving reasons, find the value of

(i) <PQV

(ii) <UVT

(iii) <PQT

(iv) <SUV

(v) <QXS

19. (a) The first term of an Arithmetic Progression (AP) is 3. The sum of the first 6 terms of the AP is 78.

(i) Find the common difference of the AP. (2 marks)

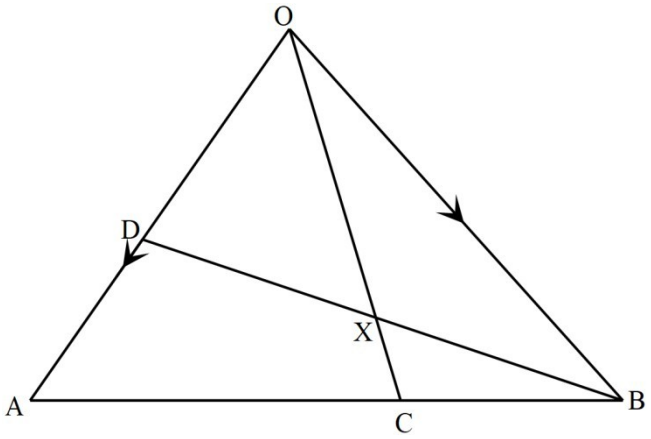
(ii) Given that the sum of the first n terms of the AP is 406, find n. (2 marks)

(b) The 2nd, 4th and 7th terms of another AP form the first three terms of a Geometric Progression (GP). If the common difference of the AP is 2, find;

(i) The first term of the GP; (4 marks)

(ii) The sum of the first 7 terms of the GP, to 4 significant figures. (2marks)

20. In the figure below C is a point on AB such that **BA** = 3**BC** and D is the mid – point of OA. OC and BD intersect at X. Given that **OA** = **a** and **OB** = **b**.



(a) Write down in terms of **a** and **b** the vectors;

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

(ii) **OC** (2 marks)

(iii) **BD** (1 mark)

(b) If $\mathbf{BX} = h\mathbf{BD}$, express OX in terms of **a**, **b** and h . (1 mark)

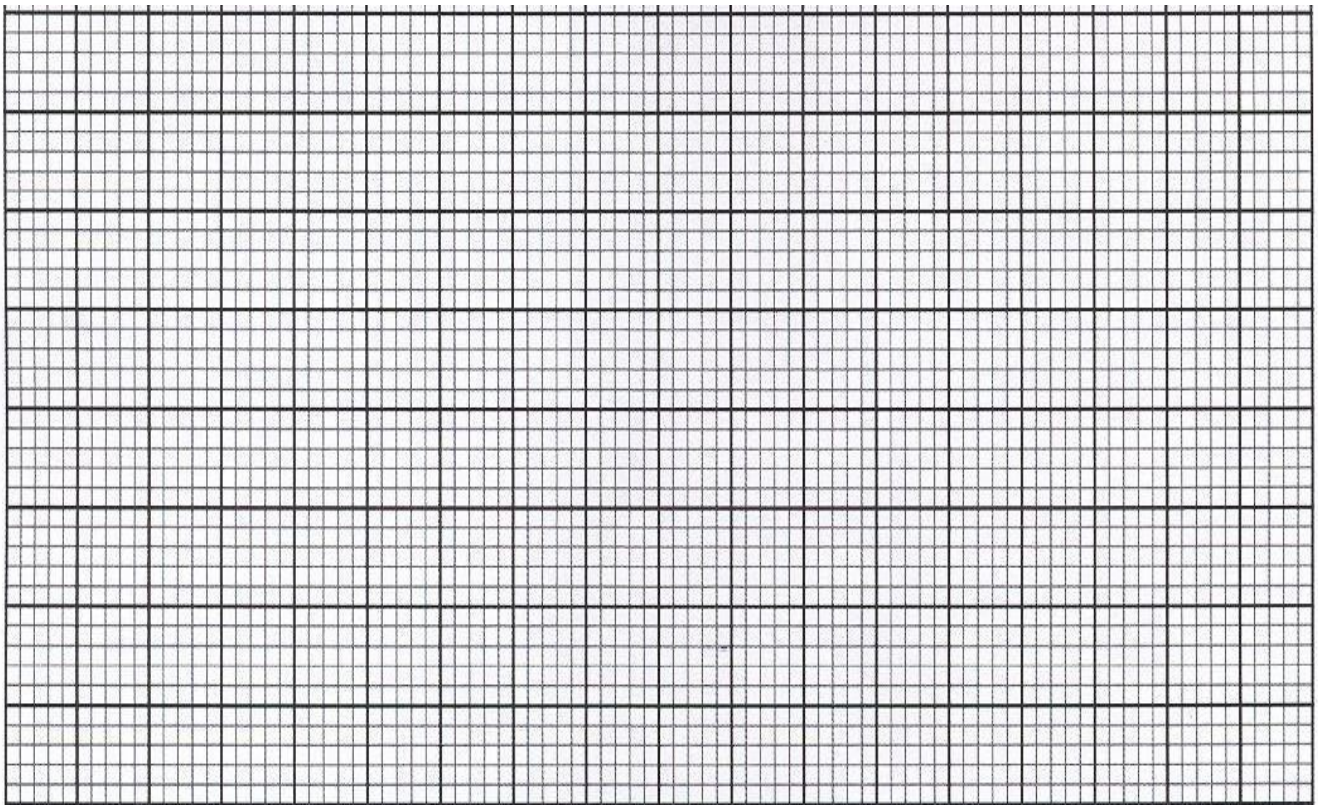
(c) If $\mathbf{OX} = k\mathbf{OC}$, find h and k. (3 marks)

(d) Show that B, X and D are collinear. (2 mark)

21.Triangle A'B'C' is the image of triangle ABC with vertices A(3,-1), B(1,3) and C(4,2) transformation represented by matrix M = $\begin{pmatrix} -0.6 & -0.8 \\ -0.8 & 0.6 \end{pmatrix}$

(a) Find the coordinates of triangle A'B'C'. (2 marks)

(b) (i) on the grid below draw Triangles ABC and A'B'C'. (2 marks)



(ii) describe fully the transformation M. (2 Marks)

(c) Triangle A"B"C" is the image of triangle A'B'C' and a transformation represented by the matrix N = $\begin{pmatrix} 2 & -1 \\ -4 & 3 \end{pmatrix}$

(i) Find the coordinates of Triangle A"B"C" and draw on the same axis.
(2 marks)

(ii) Determine a single matrix that maps triangle ABC onto triangle A"B"C".
(2 marks)

22. The position of two towns P and Q are given as $P(40°N, 10°W)$ and $Q(40°N, 170°E)$. (use $\pi = \frac{22}{7}, Radius\ of\ the\ Earth = 6371km$) .

(a) Find the difference in longitude between the two towns. (1 mark)

(b) Find the shortest distance from P to Q in Kilometres correct to two decimal places.
(2 marks)

(c) (i) A ship sailed from town P towards town R which is directly east of P covering a distance of 2000km. Determine the position of R. (3 marks)

(ii) If the ship departed P at 2.00pm, sailing at an average speed of 150 knots, find the local time at R when the ship arrived. (4 marks)

23. The masses of 64 hybrid goats in a ranch in Laikipia were recorded as follows:

Mass in kg	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44
No.of goats	9	12	21	15	5	2

(a) On the grid provided, draw a cumulative frequency curve to represent the above information. (4 marks)

(b) Use your graph to estimate:

i) The median (1 mark)

ii) The number of goats that were overweight if 36 kg is the recommended healthy weight. (2 marks)

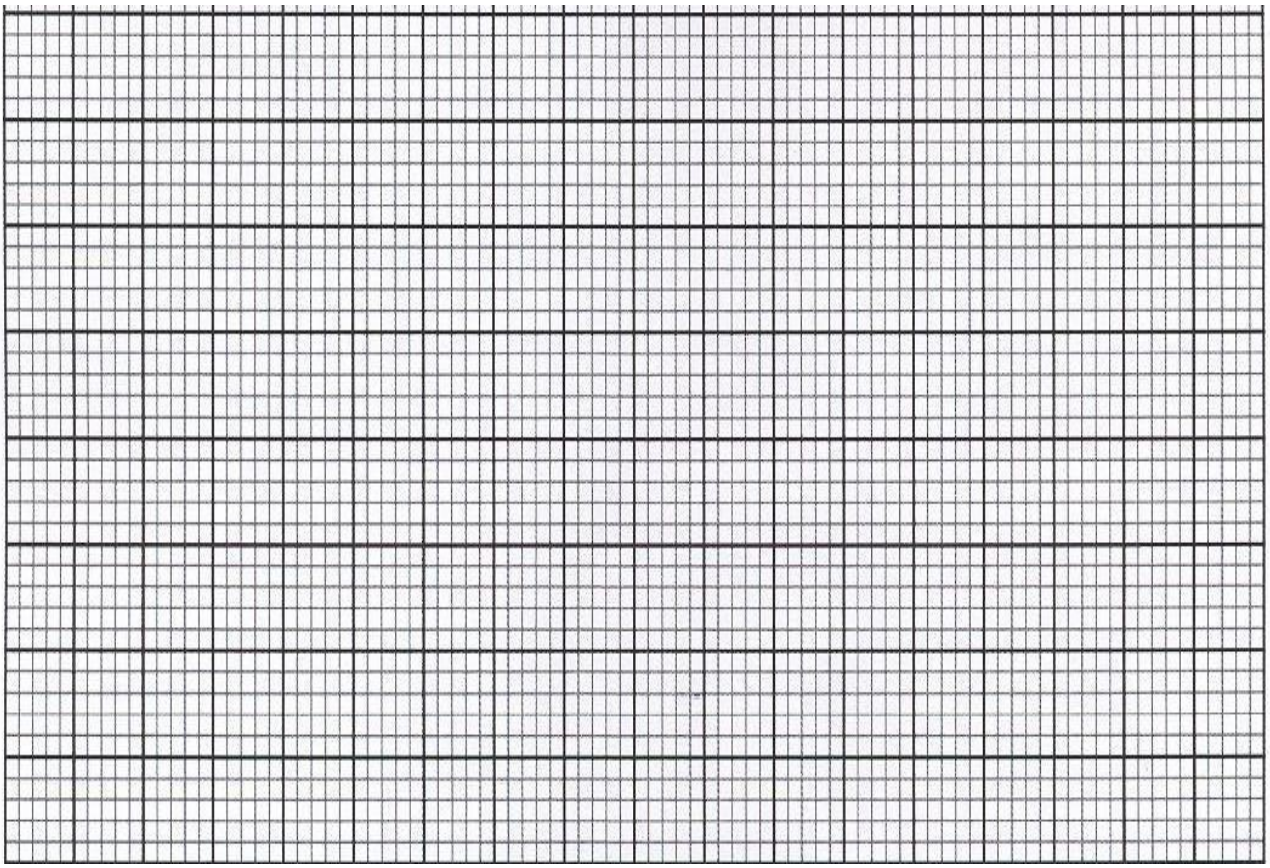
iii) The range of weight of the middle 40% of the goats. (3 marks)

24. The dimensions of a rectangular flow of a proposed room are such that
- The length is greater than the width but at most twice the width
- The sum of the width and length is more than 4 meters but less than 10 meters

If x represents the width and y the length.

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

(b)Represent the inequalities in (a) above on a linear programming diagram.(4 marks)



(c) Using the integral values of x and y, list all the possible dimensions of the floor hence find the maximum possible area of the floor. (2 marks)

SECTION I (50 marks)

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

1 Given that $x = 403217 + 321860 \div 11$, find the total value of the second digit of x. (2 marks)

2 Mary sells goods worth Ksh 950 000. Her total commission was Ksh 45 000. If the commission on the first Ksh 50 000 was half that earned on the rest, find the two rates of commission. (3 marks)

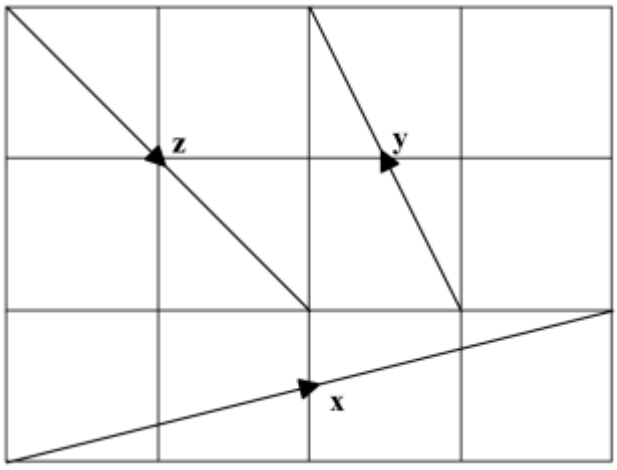
3 A restaurant serves tea from an urn that can fill cups of capacities 300 ml, 360 ml or 450 ml exact number of times. Each cup of tea is sold at Ksh 100 for the 300 ml, Ksh 120 for the 360 ml and Ksh 150 for the 450 ml. Calculate the maximum revenue that can be collected if the urn is to have the least capacity. (3 marks)

4 An alloy of density 7 g/cm^3 is made from two metals A and B by mixing them in the ratio 3:2 by volume. Another alloy of density 5.5 g/cm^3 is formed by mixing the same metals in the ratio 3:7 by volume. Find the densities of A and B. (3 marks)

5 Solve the equation $\sin(5x-15) - \cos(3x+33) = 0$ hence find the exact value of $\tan(7x-3)$.

(3 marks)

6 The vectors **x**, **y** and **z** are represented on the grid below.



On the same grid, draw the vectors:

(a) $\mathbf{x}+\mathbf{y}$ (2 marks)

(b) $\mathbf{x}-\mathbf{z}$ (2 marks)

7 The interior angles of a hexagon are $4x$, $(5x-10)$, $6x$, $(7x-40)$, $8x$ and $(9x-10)$. Find the value of x hence determine the size of the largest interior angle. (3 marks)

8 Ali's rectangular plot is represented by an area of 252 cm^2 on map A and 700 cm^2 on map B. If the scale of map B is 1:30 000, find the scale of map A. (3 marks)

9 Solve the equation $3^{2x-1}+9^x=36$. (3 marks)

10 Kamau spends $\frac{1}{4}$ of his salary on school fees, $\frac{2}{3}$ of the remainder on food and $\frac{1}{5}$ of what is left on transport. He saves the balance. In a certain month, he saved Ksh 8 500. Calculate his salary. (3 marks)

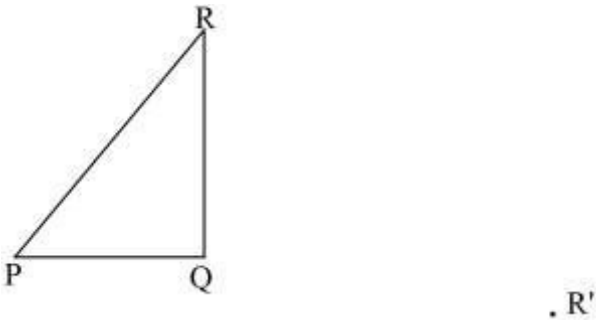
11 A translation **T** maps a point $A(-2,1)$ onto $A'(\ , -3)$. Given that a point $B'(-4, 9)$ is the image of B under the translation **T**, find:

(a) The coordinates of B. (2 marks)

(b) The distance between A and B. (2 marks)

12 Solve the inequality $x-3 \leq 3x+k\ x+13$ giving your answer as a combined inequality hence list all the integral values of x. (3 marks)

13 The figure below shows triangle PQR and a point R', the image of R, under reflection in the line MM.



(a) Draw the line of reflection MM. (1 mark)

(b) Construct triangle $P'Q'R'$, the image of triangle PQR under reflection in the line MM. (2 marks)

14 A right – angled triangle has sides of lengths x cm, $(x-2)$cm and $(x+2)$cm . Calculate the value of x hence determine the perimeter of the triangle. (4 marks)

15 A solid comprises a cube ABCDEFGH of each side 2 cm and a square based pyramid EFGHV. The slant edges of the pyramid EV = FV = GV = HV = 2 cm. Draw the net of the solid. (3 marks)

16 The length of a minor arc of a circle of radius 7 cm is 8.8 cm. Calculate the area of the minor sector.

Take π to be $\frac{22}{7}$. (3 marks)

SECTION II (50 marks)

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

17 ABC is an isosceles triangle in which AB = BC. The coordinates of A and B are $(-2,1)$ and $(6,-3)$ respectively and M is the mid-point of AB.

Given that the equation of AC is $x-3y+5=0$, find:

(a) The equation of CM in the form $y=mx+c$ where m and c are constants. (4 marks)

(b) The coordinates of C. (3 marks)

(c) The x and y intercepts of BC. (3 marks)

18 A conical flask comprises of a bottom in the shape of a frustum of a cone and a top in the shape of a cylinder. The base and top diameters of the frustum are 8.4 cm and 3.5 cm and the height of the frustum is 8.4 cm. The height of the cylindrical part is 5 cm.

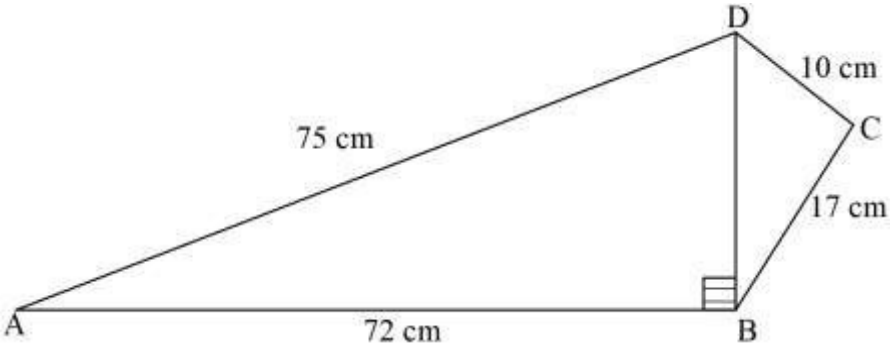
Taking π to be $\frac{22}{7}$,

(a) Calculate volume of water in the flask when filled to a height of 12.4 cm. (5 marks)

(b) Calculate surface of the flask in contact with water when the flask is filled to a height of 7.2 cm. (5 marks)

19 In the figure below ABCD is a quadrilateral. AB = 72 cm, BC = 17 cm, CD = 10 cm and AD = 75 cm.

The size of angle ABD = 90 .



(a) Calculate correct to 1 decimal place:

(i) The size of angle BCD. (4 marks)

(ii) The size of angle ABC. (3 marks)

(b) Calculate the area of the quadrilateral ABCD. (3 marks)

20 ABCD is a trapezium in which AB = 10 cm, AD = 5 cm, $\angle DAB = 60^\circ$, $\angle ABC = 75^\circ$ and AB is parallel to DC.

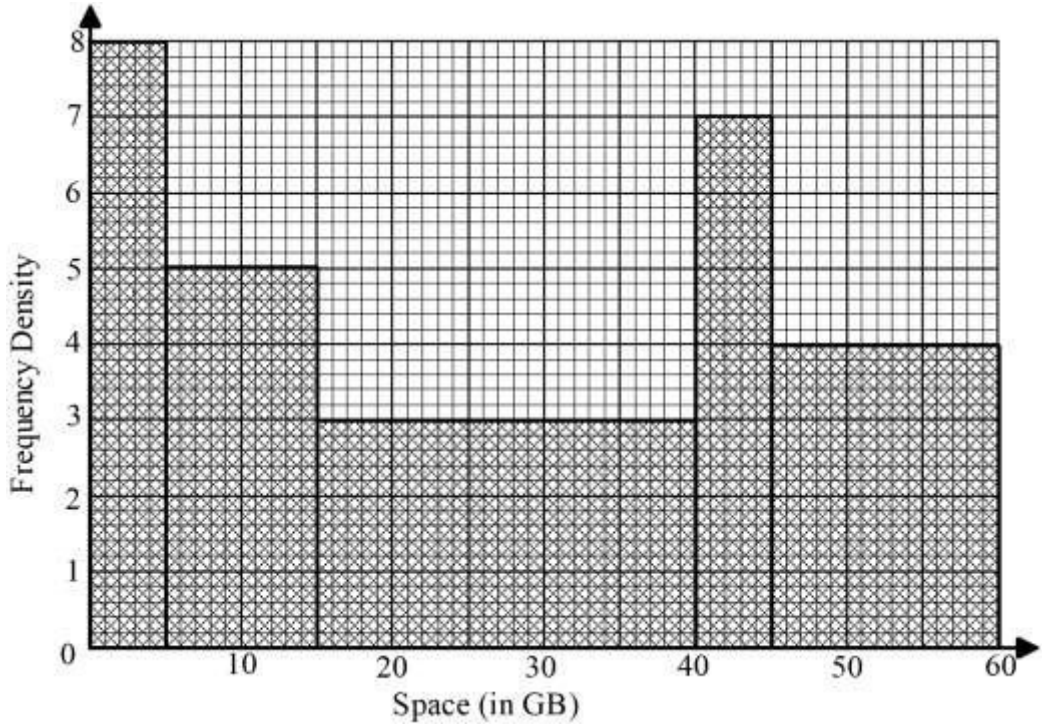
(a) Using a ruler and a pair of compasses only;

(i) Construct the trapezium. (4 marks)

(ii) Construct a circle centre O such that AB, AD and DC are its tangents. Measure the radius of the circle. (3 marks)

(b) Calculate to 1 decimal place, the area of the trapezium that lies outside the circle. Take π to be 3.142. (3 marks)

21 A school investigated how much space on its computers' hard drives is used for data storage. The results are shown below. It is given that 16 hard drives use less than 5GB for data storage.



(a) Find the total number of hard drives represented. (3 marks)

(b) Calculate the average space on its computers' hard drives. (4 marks)

(c) Use the histogram above to estimate the median. (3 marks)

22 The distance between Nairobi and Mombasa is 500 km. A bus left Nairobi at 10.45 a.m. and travelled towards Mombasa at an average speed of 60 km/h. A matatu left Nairobi for Mombasa at 1.15 p.m. using the same route and on the same day at an average speed of 100 km/h.

(a) Calculate:

(i) The time of the day when the matatu overtook the bus. (3 marks)

(ii) The distance of the matatu from Mombasa when it overtook the bus. (2 marks)

(b) Both vehicles continue towards Mombasa at their original speeds.

(i) How far was the bus from Mombasa when the matatu arrived? (2 marks)

(ii) For how long did the matatu wait in Mombasa before the bus arrived? (3 marks)

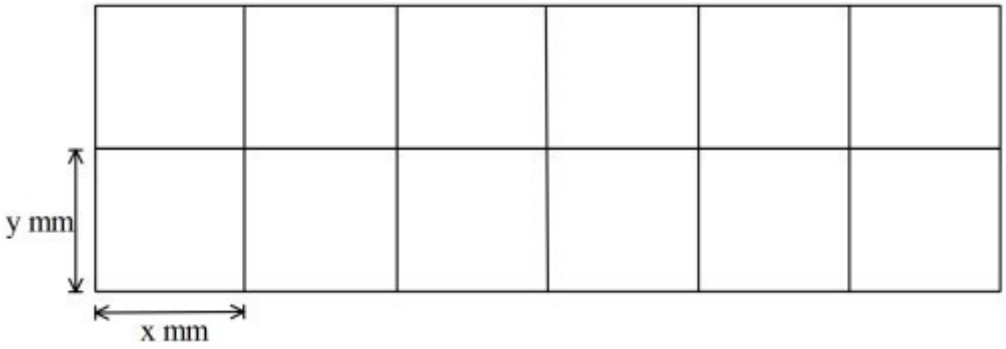
23 (a) Given that $\mathbf{A} = \begin{pmatrix} 2 & -5 \\ -1 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 4 & 6 \\ 1 & -1 \end{pmatrix}$, find the determinant of $\mathbf{AB}^{-1}$. (4 marks)

(b) The cost of a Mathematics book in shop A is Ksh *x* and that of a Chemistry book is Ksh *y*. In shop B, the cost of a Mathematics book is 6% less of that in shop A while the cost of a Chemistry book is 5% more than that in shop A. Jane bought 5 Mathematics books and 4 Chemistry books from shop A and paid a total of Ksh 6 630. Dan bought 5 Mathematics books and 4 Chemistry books from shop B and paid a total of Ksh 6 549.

(i) Form a matrix equation to represent the above information. (2 marks)

(ii) Use matrix method to find the cost of a Mathematics book and that of a Chemistry book in shop A. (4 marks)

24 The shape shown below is a wire frame in the form of a large rectangle split by parallel lengths of wire into 12 smaller equal – sized rectangles.



(a) Given that the total length of wire used to complete the whole frame is 1512 mm, find an expression in x for the area of the whole shape, A mm^2. (4 marks)

(b) Hence find:

(i) The values of x and y for which the area of the whole shape is a maximum. (4 marks)

(ii) The maximum area of the whole shape. (2 marks)

SECTION I (50 marks)

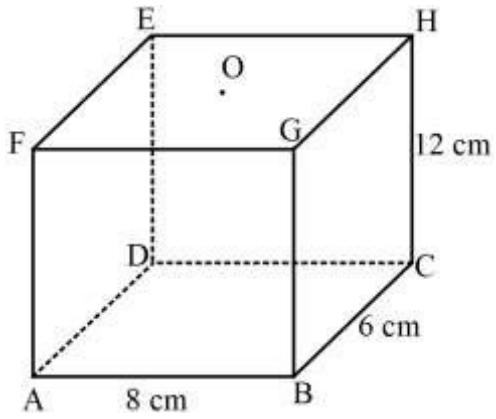
*Answer **all** the questions in this section in the spaces provided.*

1 Nandi obtains an approximate value of 3.80×7.4 by rounding off the given values to the nearest whole numbers. Determine the percentage error in the calculation arising from the approximation. (3 marks)

2 Without using tables or calculators, express $\frac{\sqrt{3} + 4 \sin 30}{2 - \tan 60}$ in the form $a + b\sqrt{c}$. (3 marks)

3 Ayub bought Ugandan tea at Ksh 160 per kilogram, Kenyan tea at Ksh 200 per kilogram and Tanzanian tea at Ksh 140 per kilogram. He then mixed them in the ratio $2 : 5 : a$ respectively by mass. Find the value of a if the mixture was sold at a profit of 20% for Ksh 208.80. (3 marks)

4 ABCDEFGH is a cuboid in which AB = 8 cm, BC = 6cm and CH = 12 cm. O is the centre of the plane FGHE.



Calculate:

(a) The length of AO. (2 marks)

(b) The size of angle AOC correct to 1 decimal place. (2 marks)

5 A circle centre O and diameter 16 cm has two parallel chords of length 11 cm and 12.6 cm such that the two chords are on opposite sides of the centre. Calculate the perpendicular distance between the two chords correct to 2 decimal places. (3 marks)

6 Solve for x in the equation $\left(\log_2 x\right)^2 + \log_2 4 = \log_2 x^3$. (3 marks)

7 The x – intercepts of a cubic function are -2, 1 and 2. Given that the y – intercept of the function is -4, find the equation of the function in the form $y = x^3 + ax^2 + bx + c$ where a, b and c are integers.

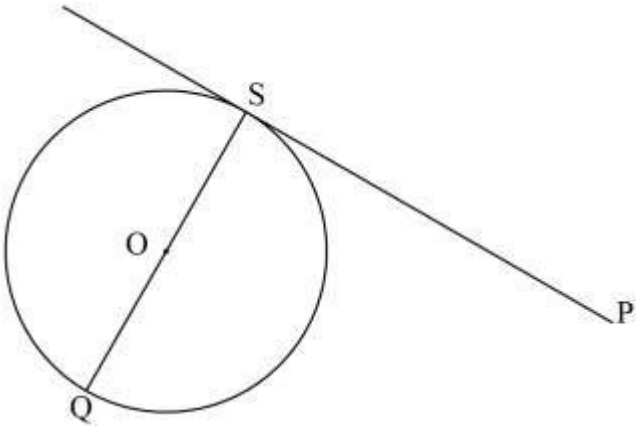
(3 marks)

8 Make q the subject of the formula $c = \frac{a}{p} - \frac{b}{q}$. (3 marks)

9 An aircraft flew due north from Nairobi $(4\text{ S},37\text{ E})$ at an average speed of 440 km/h for 4 hours 33 minutes to point Q. Find the location of Q. Take $\pi = \frac{22}{7}$ and the radius of the earth as 6 370 km.

(3 marks)

10 In the figure below, PS is a tangent to the circle at S. O is the centre of the circle and QS is its diameter. Given that the equation of the circle is $x^2 + y^2 + 6x - 6y - 16 = 0$, and the gradient of PS is $-\frac{3}{5}$, find the equation of the diameter of the circle. (4 marks)



11 Find the independent term in the binomial expansion $\left(2x - \frac{1}{x}\right)^6$. (2 marks)

12 A farmer borrowed Ksh 180 000 from a bank which charged interest at a rate of 16% per annum compounded half yearly for 30 months. How much interest did he pay at the end of the period? (3 marks)

13 A line segment AB is 6 cm long. Using a ruler and a pair of compasses only, shade a region Q on the upper side of AB that is bounded by the following loci: (3 marks)

(a) The locus of R such that $AR > 4$ cm.

(b) The locus of P such that $\angle APB = 120^\circ$.

14 Given that $\mathbf{Q} = \begin{pmatrix} 3 & 5 \\ 3 & 1 \end{pmatrix}$ and $\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, find two possible values of k for which the determinant of $\mathbf{Q} - k\mathbf{I}$ is zero. (3 marks)

15 A hot water tap can fill a bath in 4 minutes while a cold water tap can fill it in 5 minutes. A drainage pipe can empty the full bath in 3 minutes. Find how long it would take to fill the bath if all three are left open. (3 marks)

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

SECTION II (50 marks)

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

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

Taxable income (Ksh per month)	Percentage tax rate per Ksh
1 – 15 000	0
15 001 – 27 000	10
27 001 – 37 000	15
37 001 – 45 000	20
45 001 – 50 000	25
Above 50 000	30

Mr Njoroge earns a basic salary of Ksh 43 500, a house allowance of Ksh 12 000 and a commuter allowance of Ksh 4 500. Every month, he pays a premium of Ksh 5 000 towards a life assurance policy for which he receives tax relief of 15% of the premium paid. He also receives a personal relief of Ksh 2 400 every month.

(a) Calculate:

(i) The amount of taxable income in Ksh per month. (2 marks)

(ii) The amount of net tax paid by Mr Njoroge every month. (5 marks)

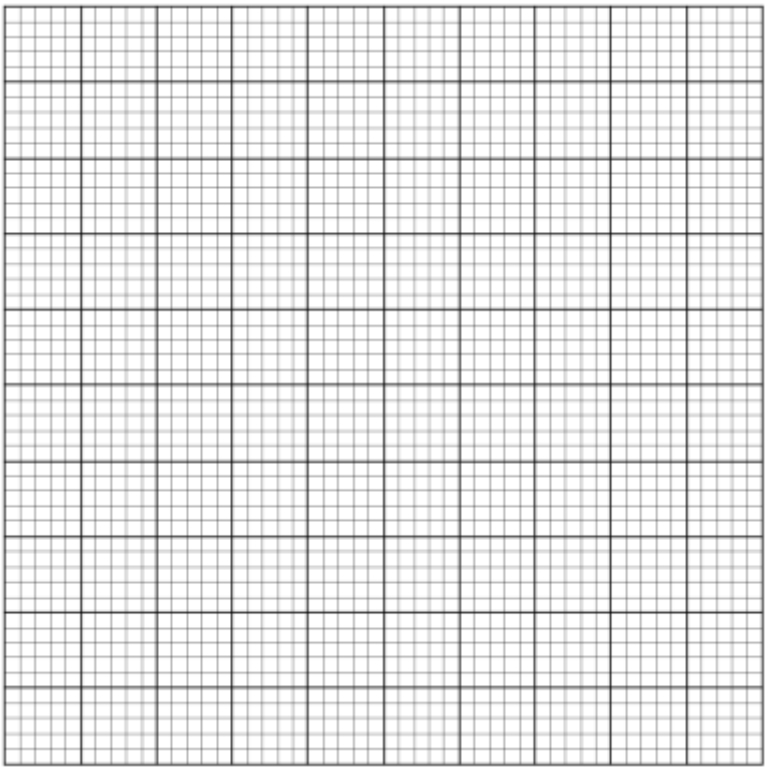
(b) If the tax rate in the first band is increased to 5% while the remaining rates for the subsequent bands remain unchanged, calculate the amount of tax that Mr Njoroge would pay. (3 marks)

18 The following distribution shows the masses to the nearest kilogram of 40 patients in a certain hospital.

Mass (Kg)	21 – 25	26 – 30	31 – 35	36 – 40	41 – 45	46 – 50	51 – 60
Frequency	1	4	9	12	8	5	1

(a) On the grid provided below, draw a cumulative frequency curve for the given information.

(3 marks)



(b) Using the curve in (a) above, determine:

(i) The median. (1 mark)

(ii) Quartile deviation. (3 marks)

(iii) The percentage of patients whose masses are 38 kg and above. (3 marks)

19 In an arithmetic progression (A.P), the 4th term and the 9th term are 30 and 45 respectively.

(a) Find the first term and the common difference of the A.P. (3 marks)

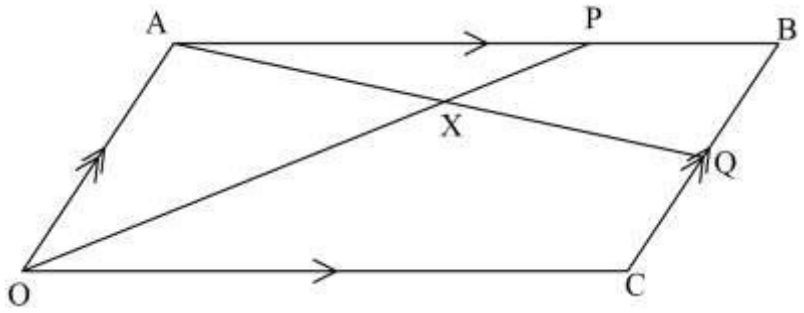
(b) The second, sixth and twelfth terms of the above A.P are the first three consecutive terms of a geometric progression (G.P). Find:

(i) The common ratio. (3 marks)

(ii) The fourth term of the G.P. (2 marks)

(iii) The sum of the first 5 terms of the G.P. (2 marks)

20 In the figure below, OABC is a parallelogram in which **OA** = **a** and **OC** = **c**. **AP** : **PB** = 3 :1 and Q is the mid point of CB. **AQ** and **OP** intersect at X.



(a) Express the following vectors in terms of **a** and **c**.

(i) **OP** (1 mark)

(ii) **AQ** (2 marks)

(b) Given that $\mathbf{OX} = h\mathbf{OP}$ and $\mathbf{AX} = k\mathbf{AQ}$;

(i) Express **OX** in two different ways. (2 marks)

(ii) Hence find the scalars h and k. (4 marks)

(c) State the ratio in which Q divides **AX**. (1 mark)

21 (a) Three quantities X, Y and Y are such that X varies directly as Y and inversely as the square root of Z. X = 120 when Y = 24 and Z = 36.

(i) Find the value of Y when X = 100 and Z = 225. (3 marks)

(ii) Find the percentage change in X if Y is increased by 20% and Z is increased by 21%. (3 marks)

(c) The cost C of feeding n students in a school is partly constant and partly varies as the number of students. Feeding 80 students during a certain period costs Ksh 9 000 and feeding 130 students during the same period costs Ksh 11 500. Find the cost of feeding 200 students over the same period of time. (4 marks)

22 A bag contains 5 red balls, 3 blue balls and some green balls, all balls being similar in shape and size. The probability of picking a green ball is 0.5. Two balls are picked randomly from the bag, one at a time and with no replacement.

(a) Find the number of green balls in the bag. (2 marks)

(b) Draw a tree diagram to represent the information above. (2 marks)

(c) Using the tree diagram above, determine the probability that:

(i) Only one of the two balls picked is green. (3 marks)

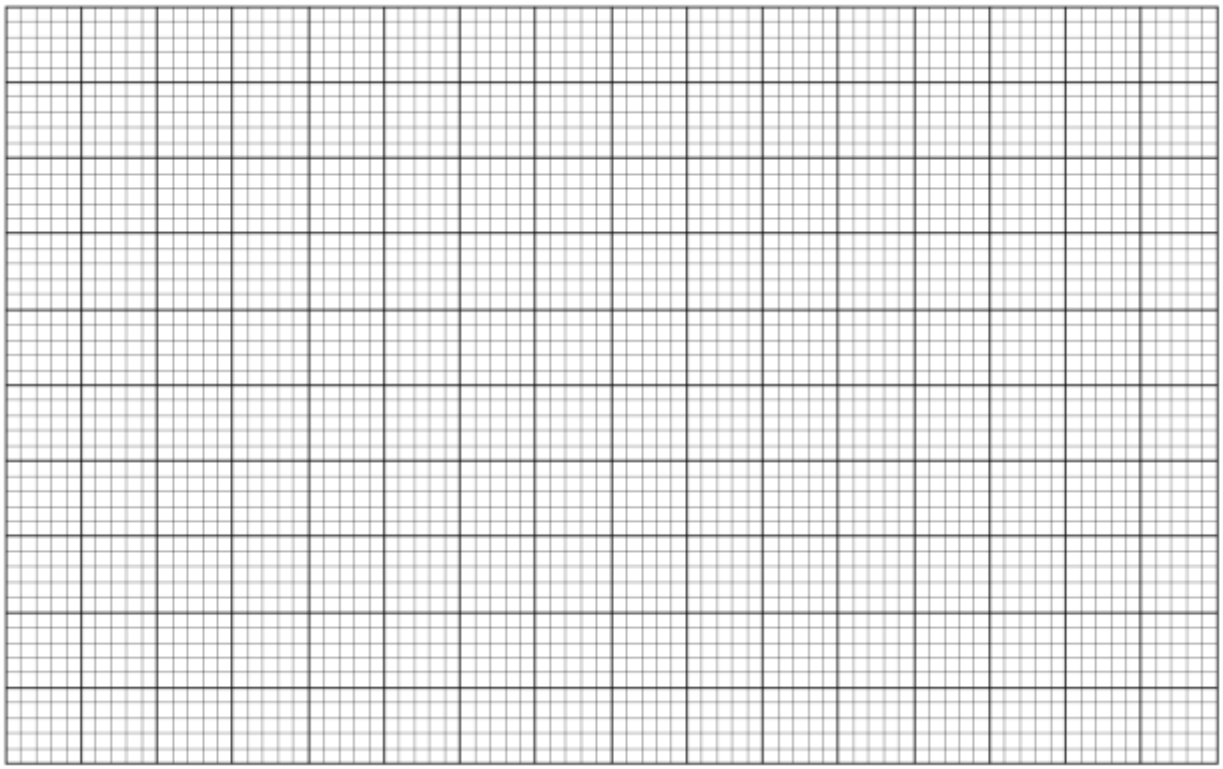
(ii) Balls of the same type are picked. (3 marks)

23 Given that $y = 2\sin x$ and $y = \cos(x+10)$.

(a) Complete the table below correct to 2 decimal places. (2 marks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
$2\sin x$	0		1.73			1	0		−1.73		−1.73		
$\cos(x+10)$	0.98			−0.17			0.98	−0.77			0.64		0.98

(b) On the same axes, draw the graphs of $y = 2\sin x$ and $y = \cos(x+10)$ for $0 \le x \le 360$. Use the scale: 1 cm to represent 30 on the horizontal axis and 2 cm to represent 1 unit on the vertical axis. (5 marks)



(c) Use the graphs in (b) above to find:

(i) The range of values of x for which $2\sin x \ge \cos(x+10)$. (2 marks)

(ii) The period of $y = 2\sin x$. (1 mark)

24 The points A', B' and C' are the images of $A(1,2)$, $B(4,2)$ and $C(4,6)$ respectively under transformation represented by a matrix $\mathbf{M} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$.

(a) Write down the coordinates of A', B' and C'. (3 marks)

(b) A'', B'' and C'' are the images of A', B' and C' respectively under another transformation whose matrix is $\mathbf{N} = \begin{pmatrix} 2 & -1 \\ 1 & 2 \end{pmatrix}$. Write down a single matrix that maps the points:

(i) A, B and C onto A'', B'' and C'' respectively. (3 marks)

(ii) A'', B'' and C'' onto points A, B and C respectively. (1 mark)

(c) Calculate the area of a triangle whose vertices are points A'', B'' and C''. (3 marks)

SECTION I (50 marks)

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

1. A translation **T** maps a point $P(-1,5)$ onto $P'(2,-3)$. Find the coordinates of another point Q whose image is $Q'(4,4)$ under **T**. (3 marks)

2. AB and BC are two sides of a regular polygon. The size of angle CAB is 15. Calculate the sum of the interior angles of the polygon. (3 marks)

3. A forex bureau in Nairobi buys and sells selected foreign currencies at the rates given in the table below.

Currency	Buying (Ksh)	Selling (Ksh)
1 South African Rand	7.25	7.75
1 UAE Dirham	36.80	38.00

A tourist arrived in Kenya from South Africa with *x* South African Rand. He converted the whole amount into Kenya shillings through an agent that charged 2% commission. While in Kenya, he spent Ksh 1 192 890 and converted the balance into UAE Dirham. If he ended up with 62 095 UAE Dirham, find *x*. (3 marks)

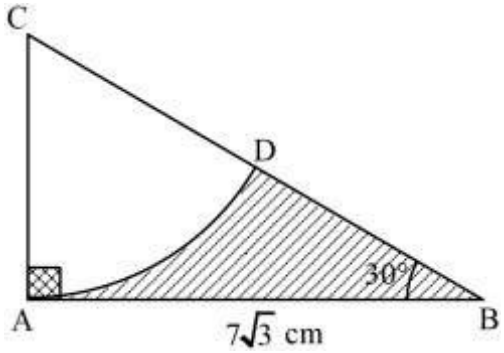
4. A supermarket has 18 apples, 30 oranges and 54 mangoes. The fruits are to be arranged in rows such that each row contains the same number of fruits of each kind. Calculate the total number of fruits in each row for which the number of rows used is maximum. (3 marks)

5. Without using a calculator, solve for x in the equation $\left(\frac{1}{49}\right)^{x} \div (343)^{x-1} = \sqrt[3]{2401}$. (3 marks)

6. Three straight lines $L_1 : 2x+3y+5=0$, $L_2 : x-2y-8=0$ and L_3 intersect at point P. The line L_3 is perpendicular to L_2. Determine the equation of line L_3 giving your answer in the form $y = \text{m}x + \text{c}$ where m and c are constants. (4 marks)

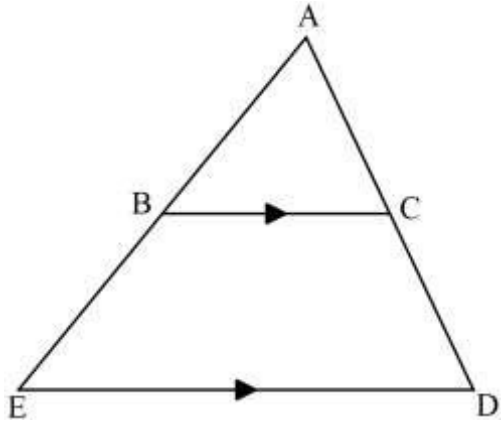
7. Solve $x-3 \leq 3x+k \quad 2x+9$ expressing your solution as a combined inequality, hence determine the sum of all the integral values of x in the solution. (3 marks)

8. In the figure below, ABC is a right triangle at A. AB = $7\sqrt{3}$ cm and $\angle ABC = 30$. AD is an arc centre C.



Taking π to be $\frac{22}{7}$, calculate the area of the shaded region. Give your answer correct to 1 decimal place. (3 marks)

9. In the figure below, AED is a triangle and BC is parallel to DE.



Given that AC:CD = 2:3 and that the area of triangle ABC is 64 cm^2, calculate the area of the quadrilateral BCDE. (3 marks)

10. Given that $\frac{\sin(6x+10)}{\cos(3x+35)}=1$, find the x hence determine the exact value of $\tan(12x)$. (3 marks)

11. A mother is eight times as old as son. In six years' time, the sum of their ages will be 48 years. How old was the mother when the son was born? (3 marks)

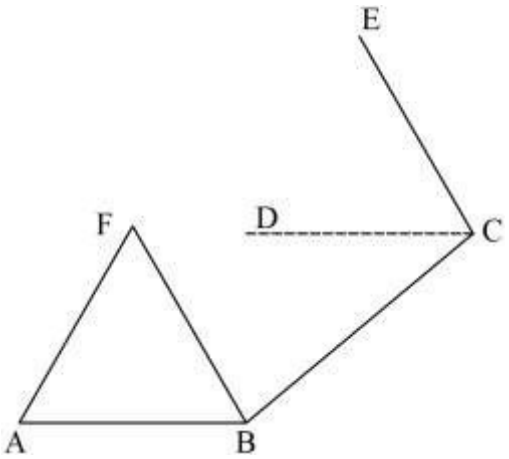
12. In a farm, the ratio of cows to goats is 1:3 and the ratio of cows to sheep is 3:5. The number of sheep is eight more than the number of cows. Find the number of goats in the farm. (3 marks)

13. Using a ruler and a pair of compasses only, construct a trapezium PQRS in which PQ is parallel to SR, PQ = 10 cm, PS = 6 cm, SR = 5 cm and $\angle QPS = 75$. Drop a perpendicular from R to meet PQ at X. Measure RX. (4 marks)

14. The position vector of A is $\mathbf{a} = 3i + 9j$. $M(5, -1)$ is the midpoint of line AB. Find the magnitude of **AB** correct to 2 decimal places. (3 marks)

15. After planning to buy a certain number of chairs for a total of Ksh 30 000, the price of each chair was lowered by Ksh 100. This enabled an hotelier to purchase 10 more chairs. Determine the number of chairs the hotelier bought. (3 marks)

16. The figure below part of the sketch of a triangular prism.



(a) Complete the sketch by showing the hidden edges using broken lines. (1 mark)

(b) Draw the net of the prism. (2 marks)

SECTION II (50 marks)

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

17. The distance between Busia and Kericho is 196 km. A matatu left Busia at 7.00 a.m. for Kericho at an average speed of 54 km/h. After 40 minutes, a van left Kericho for Busia using the same route at an average speed of 66 km/h. The two vehicles met in Kisumu.

(a) Calculate:

(i) The time when the two vehicles met. (3 marks)

(ii) The distance between Busia and Kisumu. (3 marks)

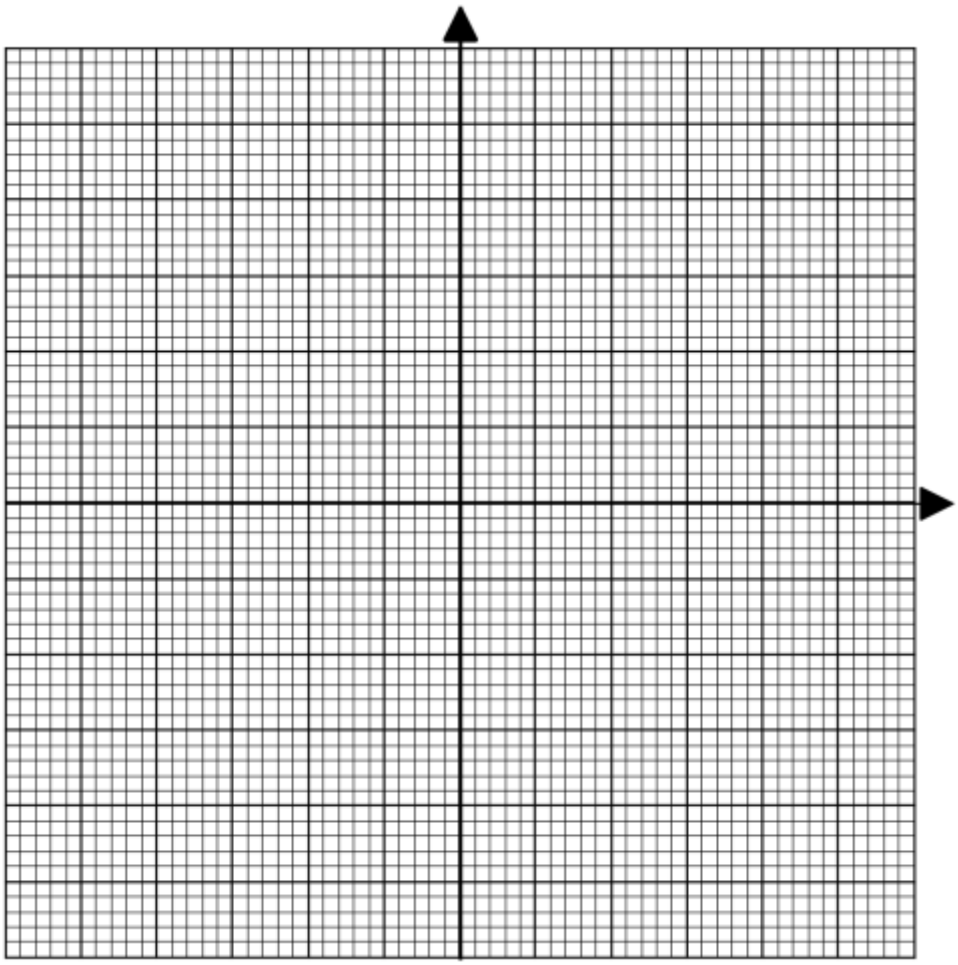
(b) On the same day, a car left Busia for Kericho using the same route at an average speed of 90 km/h and caught up with the matatu at the same time as the van. Find:

(i) The time when the car left Busia. (2 marks)

(ii) The distance of the car from Kericho at 9.54 a.m. (2 marks)

18. The coordinates of the vertices of a triangle ABC are $A(-5,-4)$, $B(-3,-4)$ and $C(-3,-2)$.

(a) Triangle $A'B'C'$ is the image of triangle ABC under an enlargement centre $(-5,-6)$ and scale factor 2. On the grid provided below, draw triangles ABC and $A'B'C'$. (3 marks)



(b) Triangle $A'B'C'$ is rotated onto triangle $A'B'C''$ with vertices at $A''(1,6)$, $B''(1,2)$ and $C''(5,2)$. Triangle $A'B'C''$ is further mapped onto triangle $A'B''C'''$ by a reflection in the line $y=1$.

(i) Draw triangle $A'B'C''$ on the same grid hence describe the rotation that maps triangle $A'B'C'$ onto triangle $A'B'C''$. (3 marks)

(ii) Draw triangle $A'B''C'''$ on the same axes. (2 marks)

(c) Identify the type of congruency between the triangles:

(i) $A'B'C'$ and $A'B'C''$. (1 mark)

(ii) $A'B'C''$ and $A'B''C'''$ (1 mark)

19. (a) Find the value of P if the matrix $\mathbf{A} = \begin{pmatrix} P & 2 \\ -3 & P+5 \end{pmatrix}$ is singular. (3 marks)

(b) A trader placed on display 8 shirts and 5 pairs of trousers valued at Ksh 49 600. If she reduced the number of shirts by 2 and increased the number of pairs of trousers on display by 2, the value of the items increases to Ksh 52 800.

(i) Taking x and y to be the prices of a shirt and a pair of trousers respectively, form a matrix equation to represent this information. (1 mark)

(ii) Determine the price of each item using matrix method. (4 marks)

(c) The trader sold each shirt at 20% profit and each pair of trousers at 25% profit. Calculate the percentage profit she made by selling a shirt and a pair of trousers. (2 marks)

20. A flower vase comprises of a cylindrical base and a frustum of a cone. The cylindrical base has a diameter of 21 cm and a height of 40 cm, while the upper part is a frustum of a cone with top diameter of 42 cm, bottom diameter of 21 cm and a slant height of 37.5 cm.

(a) Calculate the height of the vase. (3 marks)

(b) Taking $\pi = \frac{22}{7}$, calculate:

(i) The volume of the vase. (4 marks)

(ii) The area of water surface in the vase when filled to a height of 64 cm. (3 marks)

21. Four watchtowers A, B, C and D are such that A is 18 km from B on a bearing of S20 E , C is to the west of B and 20 km away, while D is south of C on a bearing of S60 E from A.

(a) Using a scale of 1:400 000, draw a scale diagram showing the relative positions of A, B, C and D. (4 marks)

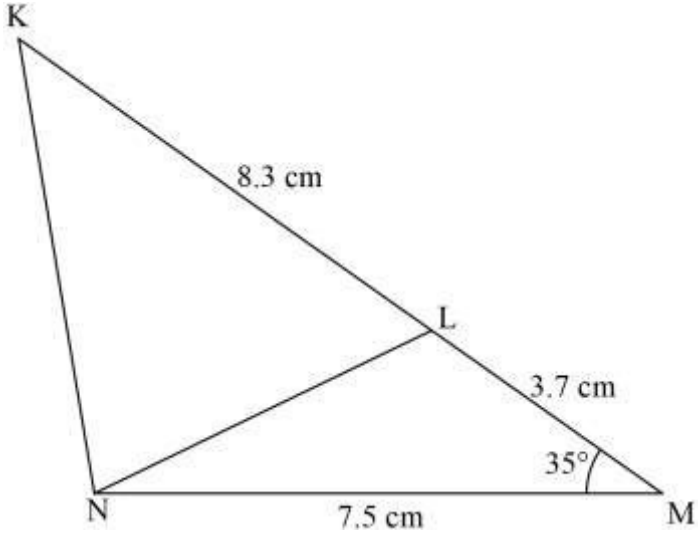
(b) Using the scale drawing, determine:

(i) The distance between B and D. (2 marks)

(ii) The compass bearing of B from D. (1 mark)

(c) A mast M is to be erected so that it is equidistant from B and C, and 20 km from D. On the same scale drawing, show the position of M and find its distance from A. (3 marks)

22. In the figure below, KL = 8.3 cm, NM = 7.5 cm, LM = 3.7 cm and $\angle KMN = 35$.



(a) Calculate the area of triangle KLN correct to 1 decimal place. (2 marks)

(b) Calculate correct to 1 decimal place:

(i) The length of LN. (3 marks)

(ii) The size of the obtuse angle NLM. (3 marks)

(iii) The radius of a circle that passes through the points L, N and M. (2 marks)

23. The marks scored by 40 students in a test were recorded in the table below.

19	14	16	19	5	15	15	13	23	21	18	11	22	25	17	9	15	12	16	22
15	3	7	12	21	11	8	17	11	18	13	17	7	20	12	18	24	10	14	29

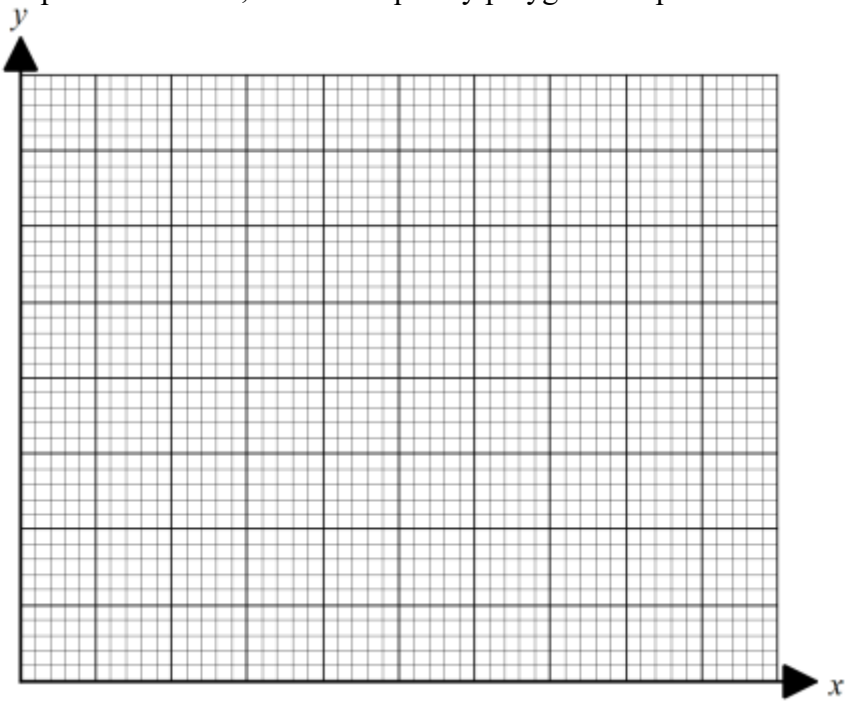
(a) Starting with 3 and using a class interval of 4, develop a frequency distribution table. (2 marks)

(b) Using the frequency distribution table in (a) above, calculate:

(i) The mean mark. (3 marks)

(ii) The median mark. (3 marks)

(c) On the grid provided below, draw a frequency polygon to represent the information. (2 marks)



24. A curve $y = x^3 + 4x^2 - 3x + \text{k}$ passes through a point $\text{A}(-2, 9)$.

(a) Find the value of k. (2 marks)

(b) Find the equation of a tangent to the curve at point A. (3 marks)

(c) Determine:

(i) The stationary points of the curve. (3 marks)

(ii) The nature of each stationary point in (c) (i) above. (2 marks)

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SECTION I (50 marks)

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

1. Determine the percentage error when $2\frac{2}{13}$ is written as decimal and truncated to 4 significant figures. (3 marks)

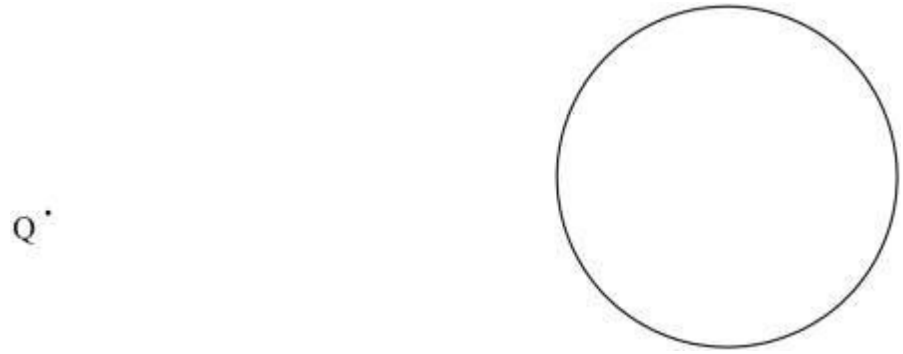
2. Given that $\sin 15 = \frac{\sqrt{6}-\sqrt{2}}{4}$, simplify $\frac{1}{\cos 75}$. (3 marks)

3. Make P the subject of the formula $\left(P+\frac{a}{b^2}\right)(b-c)=c$ and simplify your answer. (3 marks)

4. The expression $dx^2 - 56x + 16$ is a perfect square where d is a constant. Find the value of d.

(2 marks)

5. The figure below shows a circle and a point Q outside the circle.



Using a ruler and a pair of compasses only, locate the centre of the circle hence construct a tangent to the circle from Q. (4 marks)

6. Solve the equation $\log(x+3) - \log 160x = -2$. (3 marks)

7. (a) Expand $\left(1-\frac{1}{3}x\right)^6$ in ascending powers of x up to the 4th term leaving the coefficients as fractions in their simplest form. (2 marks)

(b) Use your expansion in (a) above to estimate the value of $\left(\frac{9}{10}\right)^6$. (2 marks)

8. Given that $\mathbf{OA} = 3\mathbf{i} + 4\mathbf{j} - 7\mathbf{k}$ and $\mathbf{OB} = 9\mathbf{i} - 5\mathbf{j} - \mathbf{k}$ and that R divides **AB** externally in the ratio 5:2, determine the coordinates of R. (3 marks)

9. Triangle $A'B'C'$ with vertices at $A'(1,1)$, $B'(8,1)$ and $C'(10,7)$ is the image of triangle ABC under transformation matrix $\begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$. Find the area of triangle ABC. (3 marks)

10. Tom calls Mary once each evening before he goes to bed. He calls Mary's mobile phone with probability 0.7 or her landline. The probability that Mary answers her mobile phone is 0.8, and the probability that she answers her landline is y. Given that Mary answers 74% of Tom's calls, find the value of y hence determine the probability that if Tom's call is not answered, then it is made to Mary's landline. (3 marks)

11. The wave $2y = \text{a}\cos(\text{b}x - 20)$ has an amplitude of 2.5 and period of 1080 .

(a) Find the values of a and b. (2 marks)

(b) State the phase angle of the wave. (1 mark)

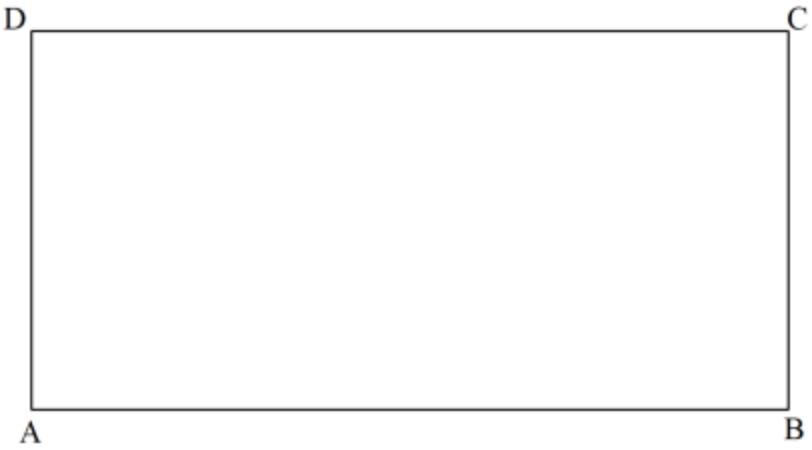
12. The deviations d from the mean $\bar{\text{x}}$ of the set of data x are given below:

x	15	18	m	23	24	m ~~6~~	28	30
d	−8	−5	y	0	1	$-y$	5	7

(a) Find the value of m and y. (2 marks)

(b) Calculate the mean absolute deviation of the data. (2 marks)

13. The figure below represents a rectangular garden ABCD.



The owner wants to plant flowers inside the garden. Each flower, F, must be closer to the edge DC than to the edge AB and angle AFB must be obtuse. Shade the region F within which the flower may be planted. (3 marks)

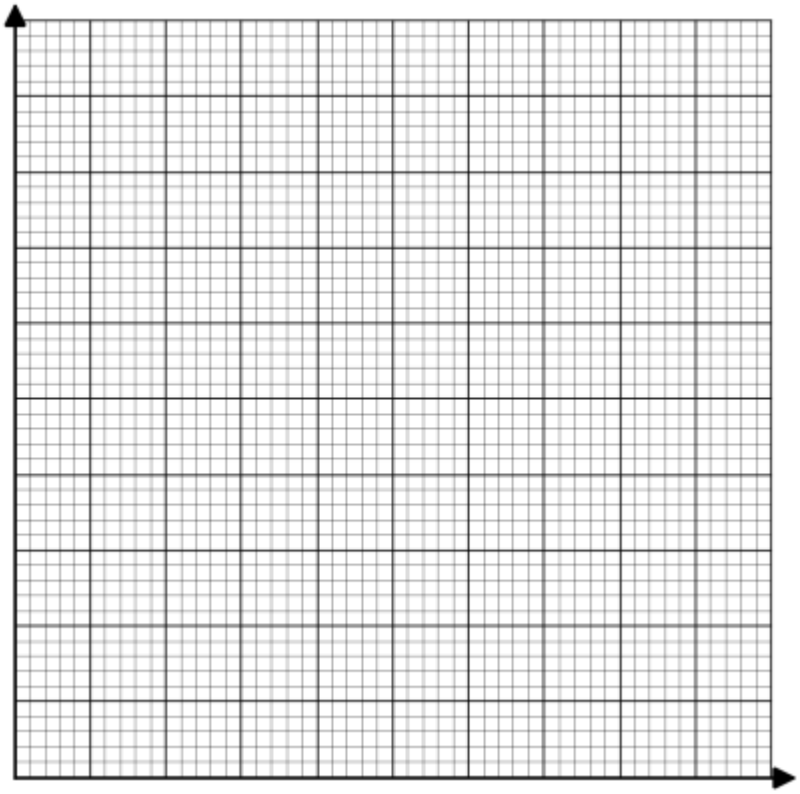
14. The cash price of a freezer is Ksh 87 600. A customer opts to buy the freezer on hire purchase terms by paying a deposit of Ksh 27 600. Determine the monthly rate of compound interest charged on the balance if the customer is required to repay by 9 equal monthly instalments of Ksh 9 500 each. (3 marks)

15. The diameter of a circle centre O has its ends at $A(-6,-2)$ and B $(2,4)$. Find the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are integers. (3 marks)

16. In an experiment involving two variables, time (t) hours and height (h) cm, the following results were obtained.

Time (t) hours	0	0.7	1.5	2.2	2.9	3.4	3.9
Height (h) cm	80	65	50	38	22	12	2

(a) On the grid provided below, plot (t, h) where t is time and h is the height. (1 mark)



(b) Use the plotted points to draw a line of best fit for the data and hence determine the rate of change of height with respect to time. (2 marks)

SECTION II (50 marks)

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

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

Monthly taxable income in Kenya shillings	Tax rate percentage (%) in each shilling
Under Ksh 13 165	10%
From Ksh 13 165 but under Ksh 22 741	15%
From Ksh 22 741 but under Ksh 32 317	20%
From Ksh 32 317 but under Ksh 41 893	25%
Ksh 41 893 and above	30%

(a) During the year, Odundo's monthly income was:
Basic Salary Ksh 53 840, House Allowance Ksh 13 200 and Commuter Allowance Ksh 8 000.
Calculate;

(i) Odundo's monthly taxable income. (1 mark)

(ii) Total income tax charged on Odundo's monthly income. (4 marks)

(b) Odundo's net monthly tax was Ksh 15 486.40. Determine the monthly tax relief allowed. (1 mark)

(c) A proposal to expand the size of the first income tax band by 25% 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:

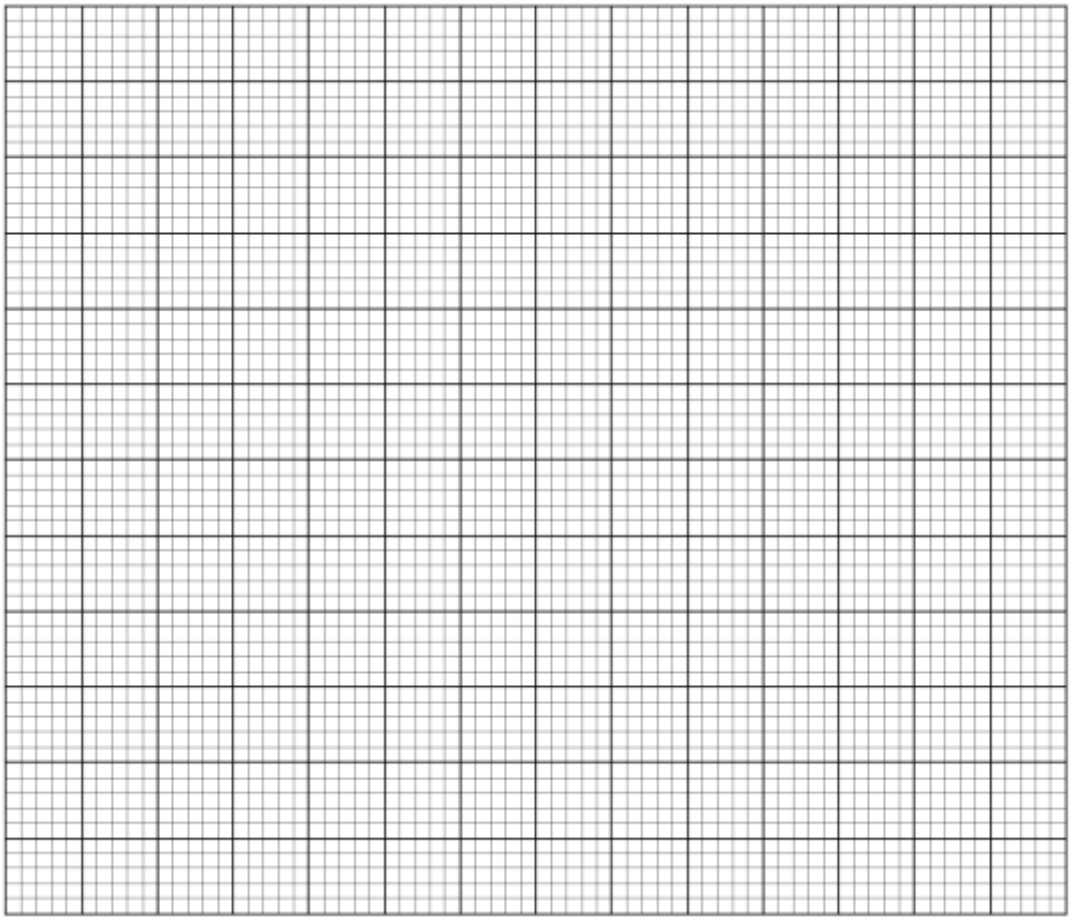
(i) The tax Odundo would pay in the first band. (1 mark)

(ii) The tax Odundo would pay in the last tax band. (3 marks)

18. The table below shows scores by sixty candidates in a Mathematics test.

Marks	0 – 9	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69
No. of candidates	3	5	9	12	15	10	6

(a) On the grid provided, draw an ogive to represent the above information. (4 marks)



(b) Use the graph to:

(i) Estimate the semi – interquartile range. (3 marks)

(ii) Determine the percentage of students that passed the test if the pass mark was set at 34 marks. (3 marks)

19. An aircraft took off from point $\mathrm{D}(y\ \mathrm{S},5\ \mathrm{W})$ at 0218 hours local time. It flew a distance of 2002 km due east to another point $\mathrm{F}(y\ \mathrm{S},31\ \mathrm{E})$. After a stopover of 15 minutes at point F, the aircraft took off and flew for 5 hours 30 minutes due north to point H. The aircraft maintained an average speed of 455 km/h for the journey from D to F and also from F to H.

(a) Taking $\pi=\frac{22}{7}$ and the radius of the earth to be 6370 km, calculate the:

(i) Position of point F (3 marks)

(ii) Position of point H (3 marks)

(b) Determine the local time at point H when the aircraft arrived. (4 marks)

20. The first, fourth and nineteenth terms of an increasing arithmetic progression (A.P) corresponds to the first three consecutive terms of an increasing geometric progression (G.P). If the first term of each progression is 3, the common difference of the A.P is d and the common ratio of the G.P is r;

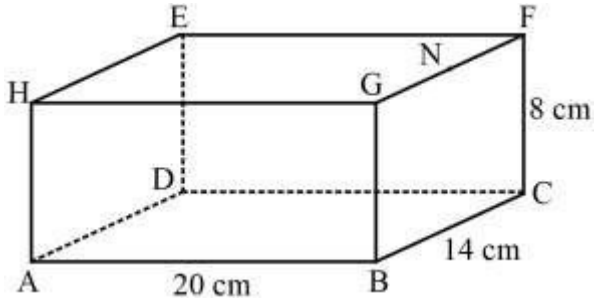
(a) (i) Give two equations involving d and r. (2 marks)

(ii) Find the values of d and r. (3 marks)

(b) Determine the sum of the first 20 terms of the A.P. (2 marks)

(c) Determine the greatest number of terms for G.P that would give a sum less than 292 968. (3 marks)

21. The figure below represents a cuboid ABCDEFGH in which AB = 20 cm, BC = 14 cm and CF = 8 cm. N is the midpoint of GF.



Calculate correct to 1 decimal place:

(a) The angle between BC and HD. (2 marks)

(b) The angle between line AF and plane ABCD. (3 marks)

(c) The angle between AND and ABCD. (2 marks)

(d) The obtuse angle between the planes ABFE and CGHD. (3 marks)

22. An organic animal feed dealer mixes maize silage with millet silage in the ratio 3:2. A bale of 10 kg of maize silage costs Ksh 600 and a bale of 10 kg millet silage costs Ksh 900.

(a) Determine the cost of 1 kg of the mixture. (3 marks)

(b) The dealer sells the mixture at a profit of 20% after allowing the customer a discount of 10% on the marked price. Calculate the marked price per kilogram. (3 marks)

(c) The feed dealer blended the mixture with another compound A in the ratio 5:4 in order to improve the quality of the mixture. The compound A cost him Ksh 1 500 per 5 kg tin. Calculate:

(i) Price per kilogram of the resultant mixture. (2 marks)

(ii) New ratio of maize and millet silage in the resultant mixture. (2 marks)

23. (a) A quantity Q varies directly as the square of P and inversely as the cube root of R. Given that Q = 15 when P = 6 and R = 27, find P when Q = 81 and R = 125. (3 marks)

(b) The square of a quantity m varies partly as the square of t and partly as cube of r. Given that m = 27 when t = 3 and r = 5, and m = 78 when t = $\sqrt{114}$ and r = 10;

(i) Find the formula connecting m, t and r. Hence, find the positive value of m when t = 8 and r = 15. (4 marks)

(ii) Find the percentage change in r when m and t are each decreased by 10%. (3 marks)

24. The vertices of a triangle PQR are $P(-3,2)$, $Q(4,3)$ and $R(x,y)$. A transformation matrix **M** maps triangle PQR onto triangle $P'Q'R'$ whose vertices are $P'(-8,6)$, $Q'(9,5)$ and $R'(-12,6)$.

(a) Find the:

(i) Matrix **M**. (3 marks)

(ii) Coordinates of R. (1 mark)

(b) Triangle $P'Q'R''$ is the image of triangle $P'Q'R'$ under a shear with y – axis invariant and $P'(-8, 6)$ is mapped onto $P''(-8, 30)$.

Determine the:

(i) Shear matrix. (2 marks)

(ii) Coordinates of Q'' and R''. (2 marks)

(iii) The single matrix which maps triangle $P'Q'R''$ onto triangle PQR. (2 marks)

SECTION I (50 marks)
*Answer **all** the questions in this section*

1 Without using a calculator, evaluate $\left(2.4\times10^{-5}\right)\div\left(9.6\times10^{-3}\right)$ giving your answer in standard form.

(2 marks)

2 Solve the simultaneous equations $\begin{aligned} 2\sin x+\cos y&=2\\ 2\sin x-2\cos y&=-1\end{aligned}$ for which $0\le x\le 90$ and $0\le y\le 90$.

(3 marks)

3 Some information about six numbers is provided as below:

- Lowest number 37
- The range 24
- The mode 43
- The median 46
- One number is a multiple of 11

Find the mean of the six numbers. (3 marks)

4 A train passes through a station at a speed of 108 km/h. The length of the station is 120 m. The train takes 7 seconds to completely pass through the station. Calculate the length of the train. (3 marks)

5 A point Q lies on the line PR below such that PQ:QR = 4:1. PT and PQ are two sides of a quadrilateral.



(a) Using a ruler, a pair of compasses and a set square, locate the point Q. (1 mark)

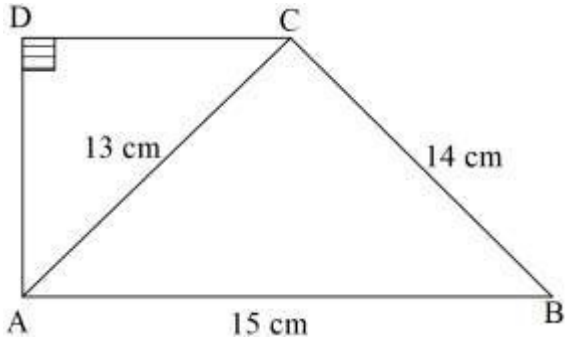
(b) Using a ruler and a pair of compasses only, construct a quadrilateral PQST such that angle PQS = 75 and angle QST is a right angle. Measure ST. (3 marks)

6 Find the value of x in the equation $81^{x-1} \times \frac{1}{9^{x+2}} = \sqrt{27}$. (3 marks)

7 A peg is 8 metres from the foot of a building. Two children Ali and Mary can spot the peg from the first floor and second floor at angles of depression 42 and 60 respectively. Calculate the height of the second floor from the first floor correct to 2 decimal places. (3 marks)

8 The dimensions of a rectangle are $(2x+1)$cm by $(x-1)$cm . The area of the rectangle is 29 cm^2 greater than the area of a square of side x cm. Find the perimeter of the rectangle. (4 marks)

9 In the trapezium ABCD, AB = 15 cm, AC = 13 cm and BC = 14 cm. The size of angle ADC = 90°.

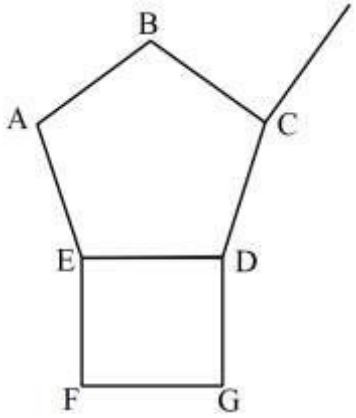


Calculate the area of the trapezium. (4 marks)

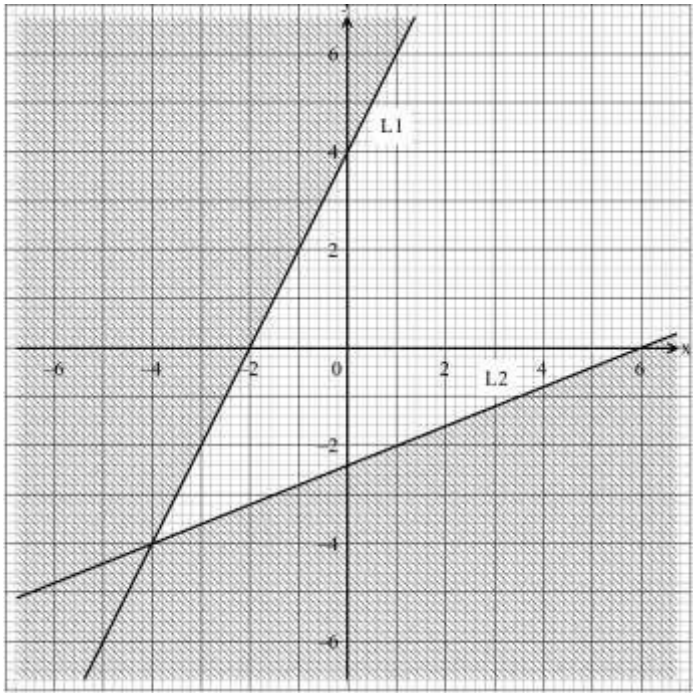
10 A water tank is in the shape of a frustum of a cone. The internal radii of the base and top of the vessel are 63 cm and 126 cm respectively and the internal height of the container is 280 cm. Calculate the radius of the water surface in the container when it is filled to a height of 140 cm. (3 marks)

11 Four bells ring simultaneously at starting and an interval of 6 seconds, 12 seconds, 15 seconds and 20 seconds respectively. How many times will they ring together between Monday 11.30 p.m. and Tuesday 2.30 a.m. (3 marks)

12 The figure below shows a regular pentagon, ABCDE, and a square, EDFG. The lines CD and DG are two sides of another regular polgon, P. Calculate the number of sides of polygon P. (3 marks)



13 A region **R** is bounded by the inequalities L_1, L_2 and L_3. L_1 and L_2 are drawn on the grid below while L_3 is $2x+3y<12$.



(a) Find the inequalities L_1 and L_2. (2 marks)

(b) On the same axes, draw L_3 and shade the unwanted region. (1 mark)

14 Shapes are triangles or rectangles and are either red or blue. The ratio of triangles to rectangles is 3:4. Of the triangles, the ratio of red to blue is 2:3 while of the rectangles, the ratio of red to blue is 4:1. Find the ratio of red shapes to blue shapes. (3 marks)

15 A measuring cylinder is filled with 110 ml of water. The mass of the empty measuring cylinder is 238.6 grams. When an object is imersed in the cylinder, the mass of the cylinder increases to 642.3 grams and the volume of water rises to 165 ml. Calculate the density of the object in g/cm^3. (3 marks)

16 Simplify $\dfrac{6ax-3ay-4bx+2by}{8ay+2by-16ax-4bx}$. (3 marks)

SECTION II (50 marks)

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

17 A salesman is paid a basic salary of Ksh 30000 and commissions for selling computers as follows:

5% for sales up to Ksh 100 000

6% for sales from Ksh 100 001 to Ksh 250 000

8% for sales in excess of Ksh 250 000

(a) In one month, the salesman sold goods worth Ksh 370 000. Determine his total earnings that month. (3 marks)

(b) In the month that followed, the salesman earned a total of Ksh 57 600 in salary and commissions. How much sales did he make? (4 marks)

(c) The marked price of each computer is Ksh 42 000. If the basic salary of the salesman is increased by 10%, and the computers are sold at 7% discount, the salesman would earn a total of Ksh 73 872 by selling x computers. Find x. (3 marks)

18 OAB is triangle in which $\mathbf{OB} = 3i - 2j$ and and $\mathbf{AB} = 4i - 10j$. M is the mid – point of **AB**.

(a) Find:

(i) The coordinates of A. (2 marks)

(ii) The distance of M from the origin. (3 marks)

(b) $A'(\beta, -2)$ is the image of A under a translation **T**. Find the image of B under **T**. (3 marks)

(c) Given that the coordinates of C is $(-3, k)$, and that A, B and C are collinear, find k. (2 marks)

19 ABCD is a rhombus in which AC is a major diagonal. The coordinates of the vertices A and C are $(-3,-1)$ and $(5, 7)$ respectively.

(a) Find:

(i) The x intercept of the line AC. (3 marks)

(ii) The equation of the minor diagonal BD. (3 marks)

(b) Given that the equation of the side AB is $3y - x = 0$, find the coordinates of D. (4 marks)

20 A closed cylinder of radius r cm and height h cm has total surface area equal to $600\pi \text{ cm}^2$.

(a) Find:

(i) An expression in terms of π for the height, h of the cylinder. (2 marks)

(ii) An expression in terms of π and r for the volume, V of the cylinder. (2 marks)

(b) (i) Calculate the height, h and the radius, r of the cylinder for which the volume, V is a maximum. (4 marks)

(ii) Hence find the maximum volume of the cylinder. (2 marks)

21 (a) Given that $\mathbf{A} = \begin{pmatrix} 5 & 3 \\ 12 & 7 \end{pmatrix}$, show that $\mathbf{A}^2 - 12\mathbf{A} + \mathbf{I}$ is a null matrix. (3 marks)

(b) A teacher ordered for 12 calculators and 10 revision books costing Ksh 22 500. Due to financial constraint, he was advised to cut the budget to Ksh 20 100 by reducing the number of calculators by two.

(i) Form and simplify two linear equations to represent this information. (1 mark)

(ii) Use matrix method to find the cost of each item. (4 marks)

(c) If the teacher bought 5 calculators and 7 revision books, represent the number of items bought in a 1×2 matrix hence find the total cost of the items. (2 marks)

22 The table below shows marks scored by students in a class.

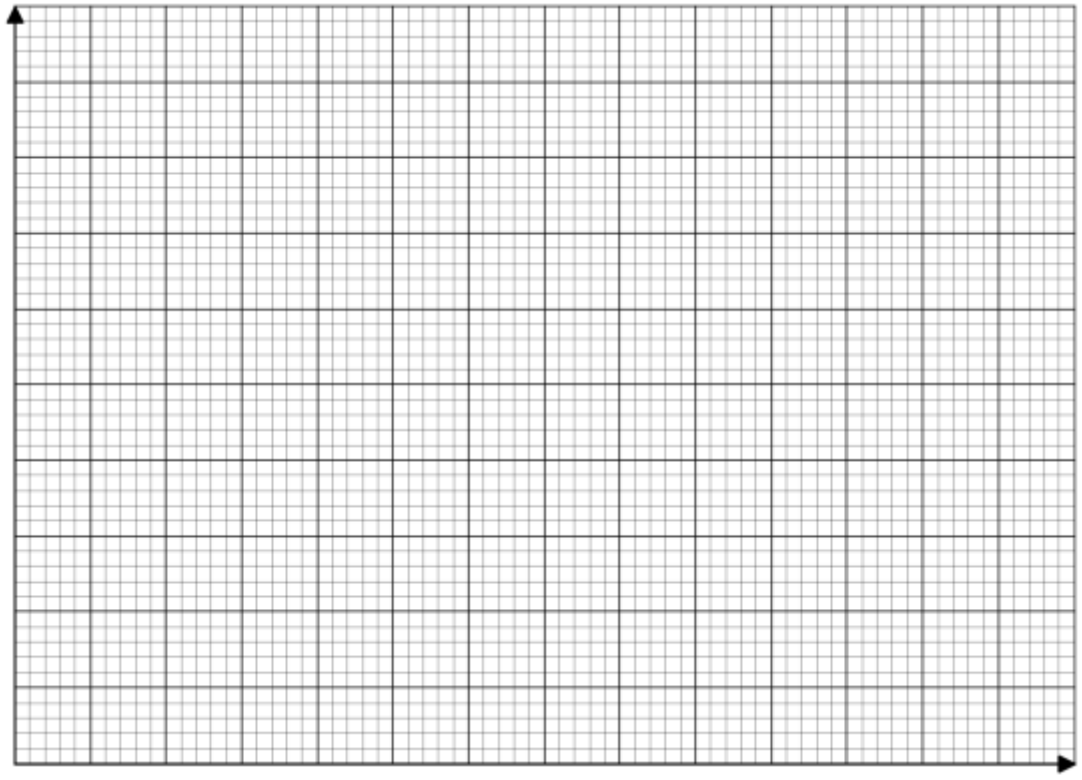
Marks	10 – 14	15 – 24	25 – 39	40 – 44	45 – 54	55 – 69
Frequency	11	8	9	4	6	t

(a) Given that the mean mark is 35.7, find:

(i) The value of t. (3 marks)

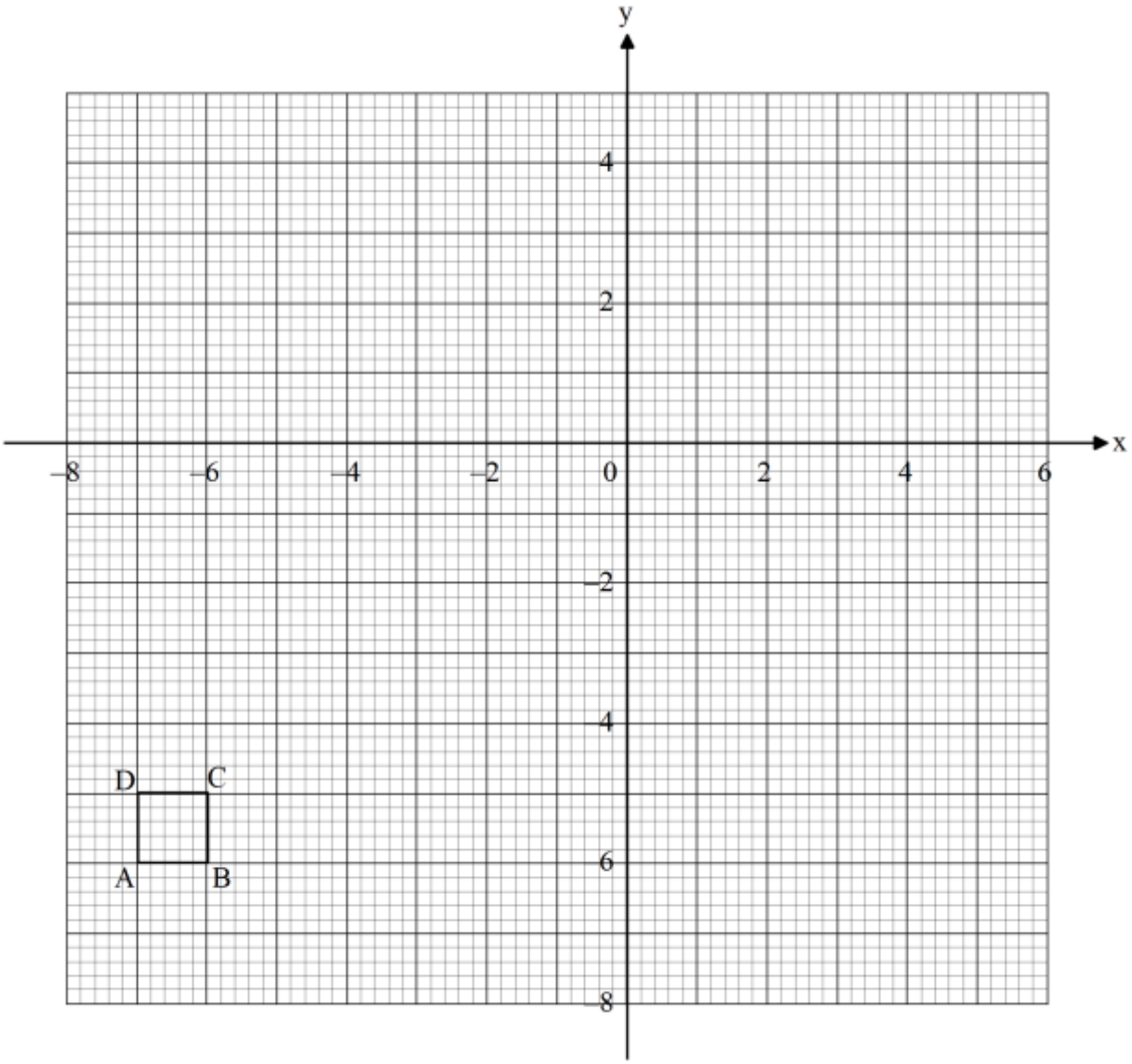
(ii) The class interval for the modal class. (1 mark)

(b) On the grid provided below, draw a histogram to represent the information in the table. (3 marks)



(c) Using the histogram in (b) above, calculate the median mark. (3 marks)

23 A square ABCD with vertices at $A(-7,-6)$, $B(-6,-6)$, $C(-6,-5)$ and $D(-7,-5)$ is drawn on the grid below. $A'B'C'D'$ is the image of ABCD under enlargement centre $(-7,-7)$ and scale factor 3.



(a) Draw $A'B'C'D'$ on the same axes. (3 marks)

(b) $A''B''C''D''$ is the image of $A'B'C'D'$ under reflection in the line $y = 0$. Draw $A''B''C''D''$ and state its vertices. (2 marks)

(c) $A''B''C''D''$ is the image of $A'''B'''C'''D'''$ under $+90$ turn about centre $(-1,-2)$.

(i) State the transformation that maps $A''B''C''D''$ onto $A'''B'''C'''D'''$. (1 mark)

(ii) On the same axes, draw and label the vertices of the square $A'''B'''C'''D'''$. (2 marks)

(d) State any two pairs of the squares that are:

(i) Directly congruent. (1 mark)

(ii) Oppositely congruent. (1 mark)

24 The equation of a curve is given by $y = 8 - 2x - x^2$.

(a) Estimate the area of the region bounded by the curve and the lines $y = 0$, $x = -4$ and $x = 4$ using:

(i) Trapezium rule with 8 strips. (3 marks)

(ii) Mid – ordinate rule with 4 strips. (3 marks)

(b) Calculate the exact area of the region bounded by the curve and the lines $y = 0$, $x = -4$ and $x = 4$.

(4 marks)

SECTION I (50 marks)
*Answer **all** the questions in this section*

1 The cash price of a cooker is Ksh 40 000. Ryan bought in on hire purchase by paying a deposit of Ksh 4 000 and the rest in 36 equal monthly instalments. If he was charged simple interest at the rate of 20% per annum, calculate the amount of each instalment. (3 marks)

2 Two taps P and Q, when opened at the same time, can fill a tank 3 hours 36 minutes. Tap P working alone takes 3 hours longer than tap Q to fill the same tank. How many hours does it take tap P to fill the tank. (3 marks)

3 Without using a calculator, express $\frac{2}{2+\sqrt{3}}-\frac{\sqrt{3}}{2-\sqrt{3}}$ in the form $a+b\sqrt{c}$ where a, b and c are integers. (3 marks)

4 A variable P varies directly as the cube of Q and inversely as the square root of R. Calculate the percentage change in Q if P is increased in the ratio 8:5 and R is decreased by 19%. (3 marks)

5 (a) Expand $\left(2-\frac{1}{4}x\right)^6$ in ascending powers of x up to the 4th term. (1 mark)

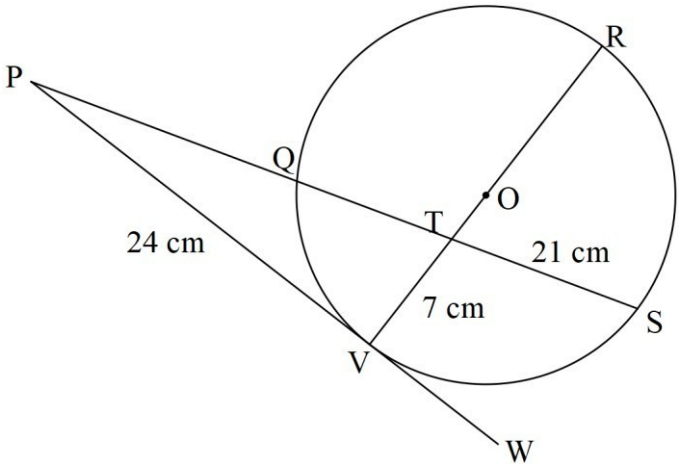
(b) Use your expansion in (a) above to find the value of $(1.9)^6$ correct to three decimal places.

(2 marks)

6 Three grades of tea A, B and C were mixed in the ratio 2:3:4 respectively. The cost per kilogram of grade A is Ksh 150, grade B is Ksh 140 and grade C is Ksh 90. Find the selling price of 12 kg of the mixture given that the mixture was sold at 15% profit. (3 marks)

FOR MARKING SCHEMES CALL OR TEXT MR CHEPKWONY ON 0724351706

7 In the figure below, O is the centre of the circle. VOR and PTS are straight lines. ST = 21 cm, TV = 7 cm, PV = 24 cm and PVW is a tangent to the circle at V.



Calculate the:

(a) Length PQ. (2 marks)

(b) Length TR. (2 marks)

8 The probability that a bus will be late in getting to a stage in the morning is $\frac{1}{5}$. The probability that Rafiki will board the bus if it is in time is $\frac{9}{10}$ and that he will board it if it is late is $\frac{1}{3}$. Using a tree diagram, find the probability that Rafiki will not board the bus. (3 marks)

9 The coordinates of A and B are $(-2, 5, 4)$ and $(1,-1,10)$ respectively. A point Q divides **AB** externally in the ratio 5:2. Find the coordinates of Q. (3 marks)

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

11 A region R lies on the upper side of line PQ below such that $\angle PRQ \geq 60$ and the area of PRQ is greater than $15\ cm^2$. Shade the region R. (3 marks)



12 The internal and external diameters of a pipe are measured as 8 cm and 10 cm each to the nearest whole number. The length of the pipe is exactly 63 cm. Calculate the percentage error in the volume of the pipe. (3 marks)

13 Solve the equation $3\log_2 x - 8\log_x 2 = 10$ (3 marks)

14 In a mathematics test of 48 students, the mean mark is 55 while the standard deviation is 20. If the 49th and 50th student scored 60 and 64 respectively, calculate the:

(a) New mean (2 marks)

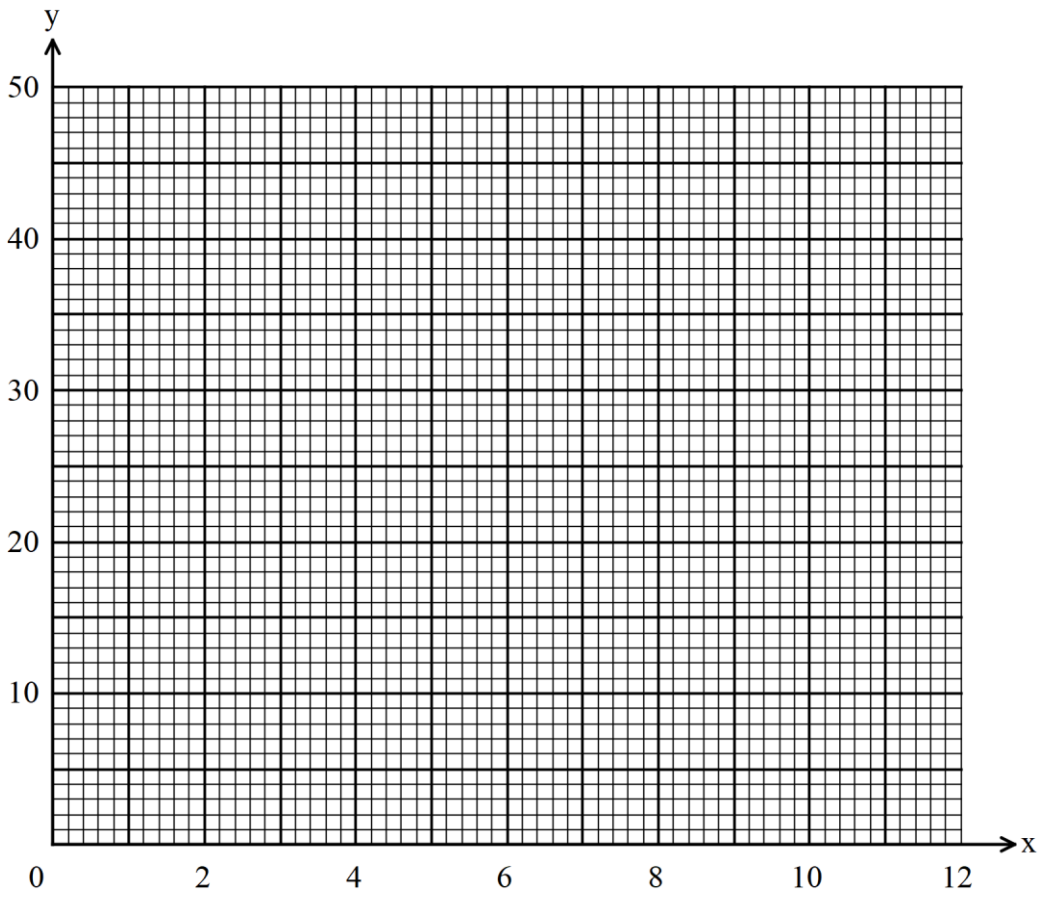
(b) New standard deviation (2 marks)

15 The vertices of a triangle ABC are $A(2,1)$ $B(2,-1)$ and $C(0,-1)$. The triangle ABC is sheared so that the vertex A maps onto $A'(0,1)$. Find the images of B and C under this shear. (3 marks)

16 Data was collected from an experiment involving two variables x and y and was recorded in the table below.

x	1	2	3	4	5	6	7	8	9	10
y	9	12	16	20	24	28	31	35	39	42

On the grid provided below, draw the line of best fit hence find the equation connecting the variables x and y. (3 marks)



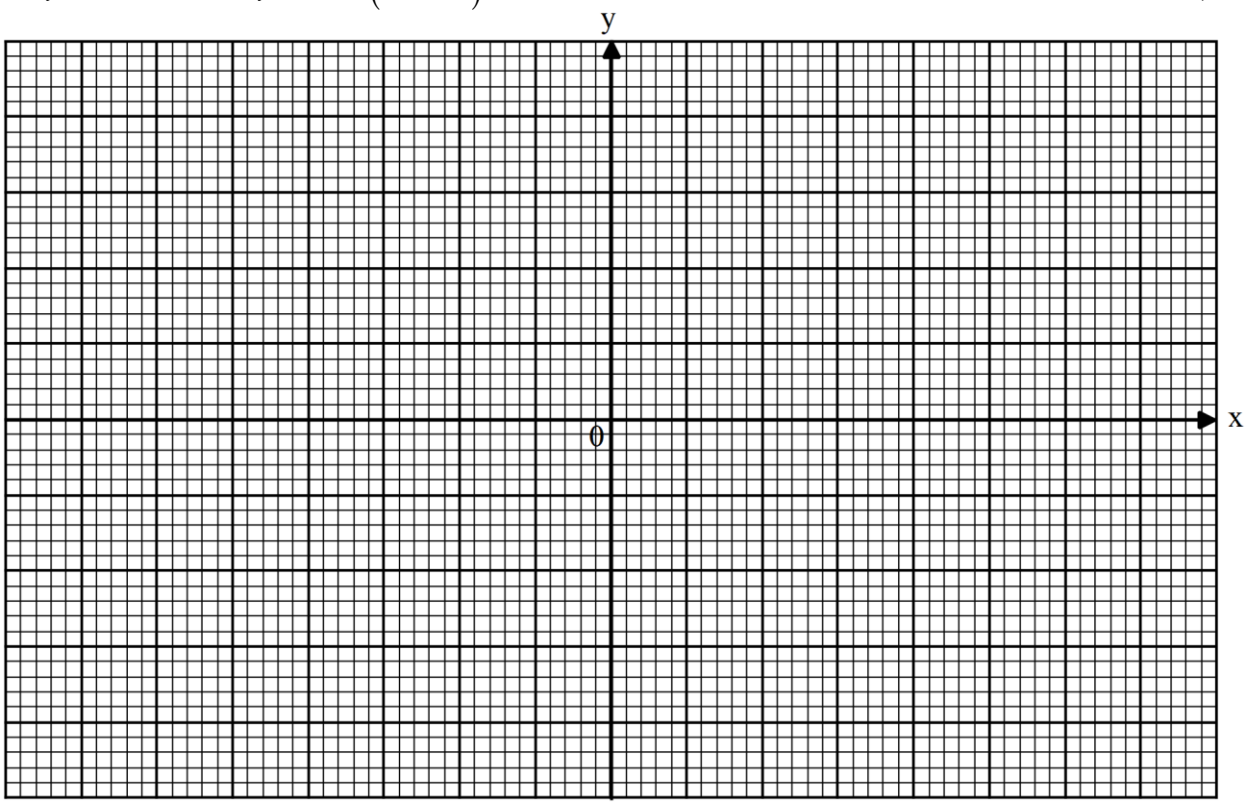
SECTION II (50 marks)

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

17 (a) Complete the table below, giving your values correct to 2 decimal places. (2 marks)

x	–180	–150	–120	–90	–60	–30	0	30	60	90	120	150	180
$1-\cos x$	2			1	0.5	0		0.13		1			2
$2\sin(x+30)$	–1	–1.73			–1	0			2	1.73			–1

(b) Using a scale of 1 cm for 30 on the x – axis and 2 cm for 1 unit on the y – axis, draw the graphs of $y = 1 - \cos x$ and $y = 2\sin(x+30)$ on the same axes for $0 \le x \le 180$. (4 marks)



(c) Use the graph above to:

(i) Find the amplitude of the curve $y = 1 - \cos x$. (1 mark)

(ii) Solve the equation $\cos x + 2\sin(x+30) = 1$ (2 marks)

(ii) Find the range of values of x for which $1 - \cos x \le 2\sin(x+30)$. (1 mark)

18 A plane left point A on Monday 1000 hours local time and flew northwards to $B(42\ N, 15\ E)$ in 6 hours at an average speed of 450 knots. After a 45 minutes stop at B, the plane flew to $C(42\ N, 165\ W)$ at a the same speed using the shortest route.

Find:

(a) The location of point A. (3 marks)

(b) The time taken to travel from B to C. (3 marks)

(c) The local time at C;

(i) When the plane left A (2 marks)

(ii) When the plane arrived at C. (2 marks)

FOR MARKING SCHEMES CALL OR TEXT MR CHEPKWONY ON 0724351706

19 In an arithmetic progression (A.P), the 2nd, 5th and 11th terms form the first three terms of a geometric progression (G.P). Given that the common difference of the A.P. is 2, find:

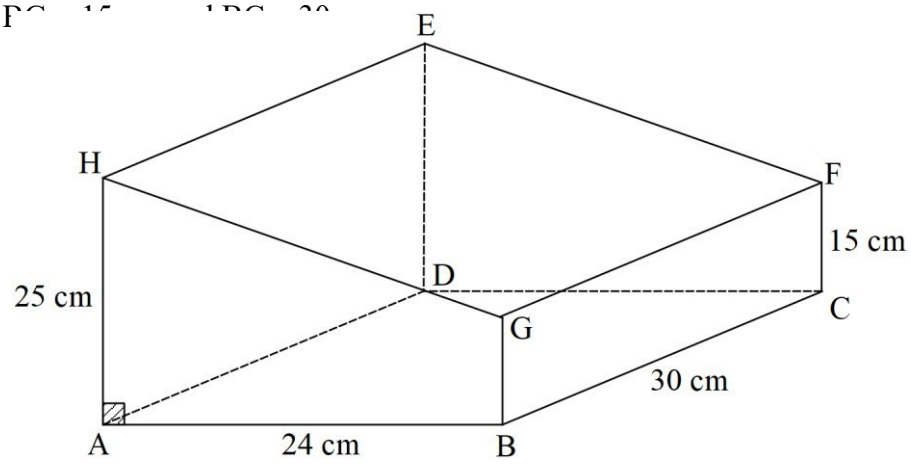
(a) Find the tenth term of the A.P. (4 marks)

(b) Calculate:

(i) The number of terms of the arithmetic progression for which the sum of the terms is 460. (3 marks)

(ii) The least number of terms of the geometric progression for which the sum of the terms is greater than 6 138. (3 marks)

20 In the figure below, ABCDEFGH is a prism whose cross – section is a trapezium. AB = 24 cm, AH = 25 cm, [illegible]



Calculate correct to 2 decimal place, the angle between:

(a) Lines HG and AB. (2 marks)

(b) Line CH and the plane ABCD. (2 marks)

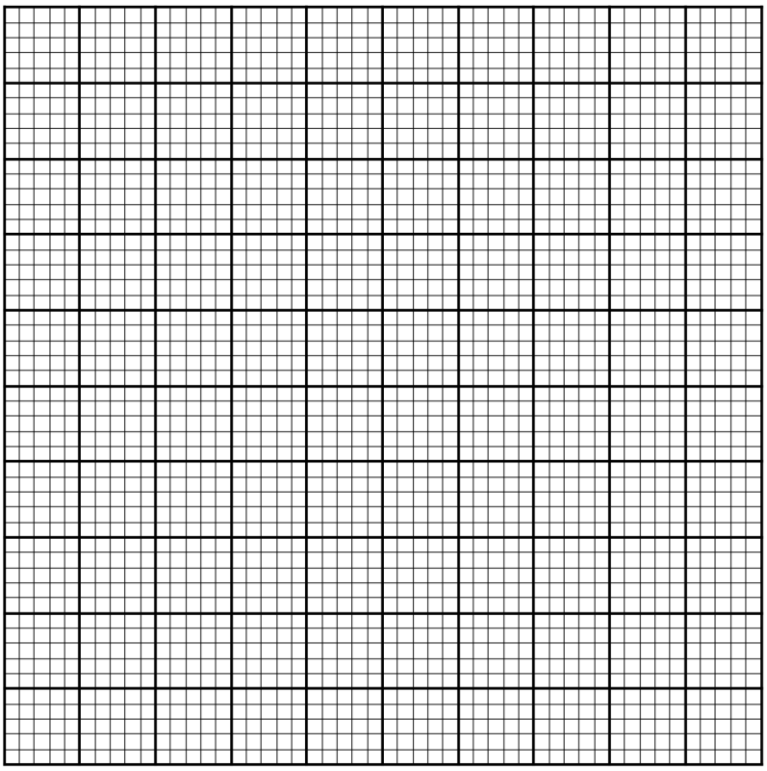
(c) Planes BCEH and EFGH. (3 marks)

(d) Line AC and AE. (3 marks)

21 The following table shows the masses of students in a school.

Mass (kg)	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59	60 – 64	65 – 69
Frequency	2	2	4	6	12	12	6	3	1

(a) On the grid provided below, draw the cummulative frequency curve for the above data. (4 marks)



(b) Use the graph to find the:

(i) Median mass. (1 mark)

(ii) Inter – quartile range. (2 marks)

(c) Find the percentage of students whose masses are at above 47 kg. (3 marks)

22 The table below shows monthly income tax rates for a certain year.

Monthly income in Kenya Shillings (Ksh)	Tax rate percentage (%) in each shilling
Up to 9 680	10
9 681 – 18 800	15
18 801 – 27 920	20
27 921 – 37 040	25
Over 37 041	30

In the month of February of that year, Jayden paid a net tax of Ksh 19 760. He was given a house allowance of Ksh 14 000 per month and commuter allowance of Ksh 8 000 per month. Jayden was also entitled to monthly personal relief of Ksh 1 350 and monthly insurance relief at the rate of 15% of the premium paid. Each month, he paid a monthly premium of Ksh 4 000 towards his life insurance policy.

(a) Calculate the:

(i) Gross tax per month. (2 marks)

(ii) Taxable income per month. (3 marks)

(iii) Basic salary per month. (2 marks)

(b) In the month of March the same year, Jayden received additional earnings. Given that he paid 25% more net tax that month, calculate the percentage increase in his earnings. (3 marks)

23 Anne and Ben are tailors. They make x jackets and y suits each week. Anne does all the cutting and Ben does all the sewing. To make a jacket takes 5 hours of cutting and 4 hours of sewing while to make a suit takes 6 hours of cutting and 10 hours of sewing. Neither tailor works for more than 60 hours a week.

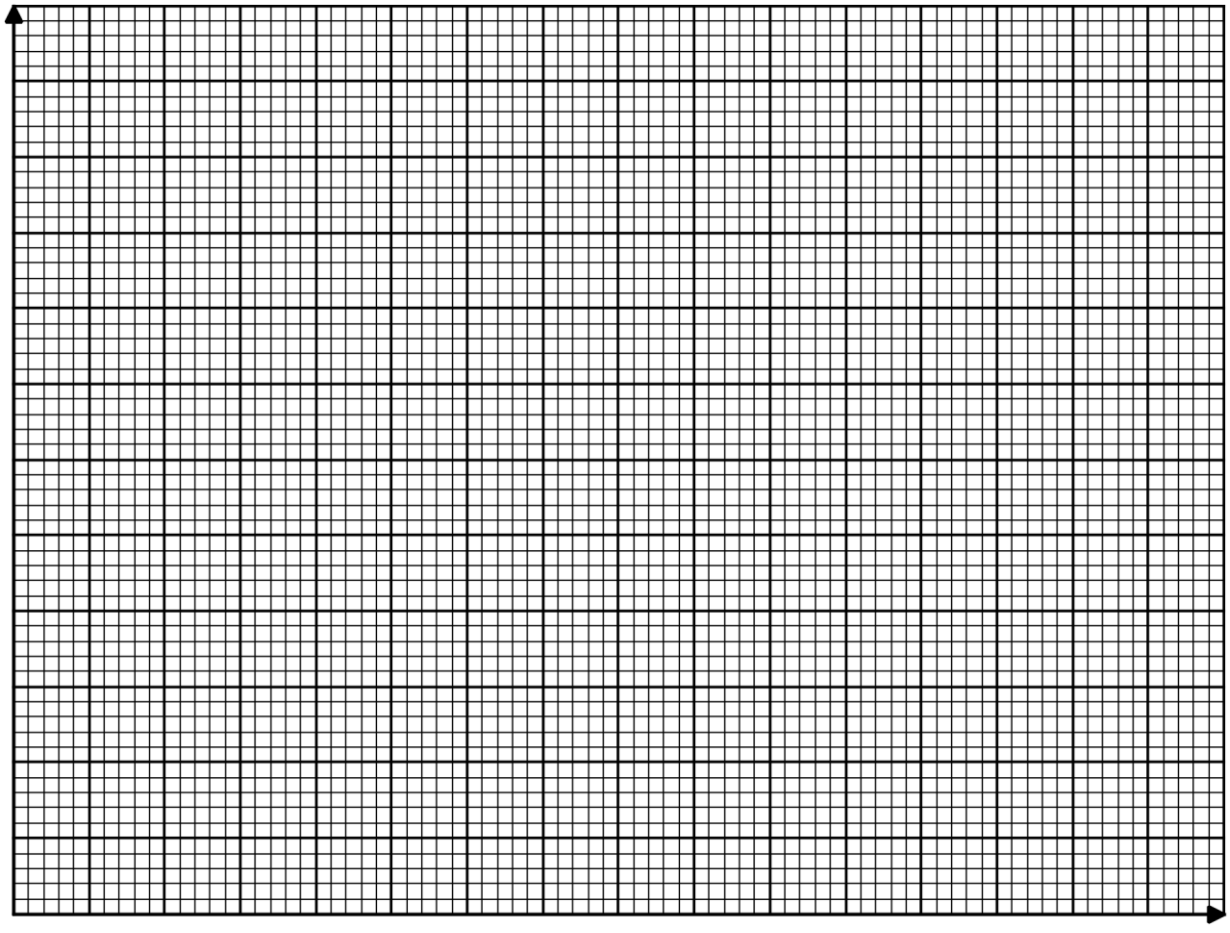
(a) Write down an equality in x and y for:

(i) Sewing (1 mark)

(ii) Cutting (1 mark)

(b) They make at least 8 jackets each week. Write down another inequality. (1 mark)

(c) Represent **all** the inequalities for the information above in a graph and shade the unwanted regions. (4 marks)



(d) The profit on a jacket is Ksh 3 000 and on a suit is Ksh 10 000. Find the maximum profit that Anne and Ben can make in a week. (3 marks)

24 The acceleration, a m/s^2 of a particle after t seconds is given by $a = 2t - 8$. The initial velocity of the particle is 12 m/s. Find:

(a) An expression for the velocity of the particle at any given time t. (3 marks)

(b) The displacement of the particle during the third second. (2 marks)

(c) The minimum velocity of the particle. (2 marks)

(d) The acceleration when the particle is initially at rest. (3 marks)

SECTION I (50 Marks)

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

1 Evaluate; $\dfrac{3\frac{1}{2}+\frac{10}{457}\left(\frac{6}{13}-\frac{1}{4}\,of\,\frac{16}{21}+\frac{11}{15}\right)}{\frac{1}{11}\left(\frac{8}{13}+\frac{5}{7}\right)-\frac{9}{91}}$ (3 marks)

2 Three bells ring at intervals of 9 minutes, 15 minutes and 21 minutes respectively. The bells will next ring together at 11:00 p.m. Find the time the bells had last rang together. (3 marks)

3 The exterior and interior angles of a regular polygon are $(x+10)^\circ$ and $(3x+50)^\circ$ respectively. Calculate the sum of the interior angles of the polygon. (4 marks)

4 (a) Solve the inequality $-8 < 5x-3 \leq 2x+4$, hence illustrate your answer on a number line. (3 marks)

(b) State the integral values in (a) above. (1 mark)

5 A Kenyan commercial bank buys and sells foreign currencies at the rate shown below.

	Buying $(Kshs)$	**Selling** $(Kshs)$
1 Euro	145.30	145.60
1 UAE Dirhams	36.68	36.92

A French tourist arrived in Kenya with 7000 Euros. She converted the whole amount to the local currency. While in Kenya she spent Kshs.426,380 and changed the balance to UAE Dirhams before leaving for Dubai. Calculate the amount, in UAE Dirhams that she received? (3 marks)

6 Simplify the expression; $\dfrac{9t^2-25a^2}{6t^2+19at+15a^2}$. (3 marks)

7 During a practical exam, Jenny broke 4 beakers and 3 test – tubes while Sam broke 2 beakers and 5 test – tubes. If Jenny was charged Kshs.475 and Sam Kshs.325 for breakages. Find the cost of each beaker and each test – tube. (3 marks)

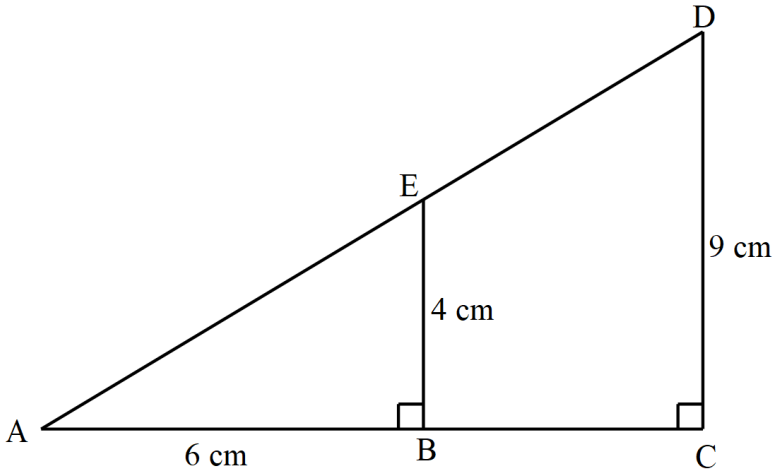
8 Solve for y in the equation; $125^{2y-5} \div 25^{y+4} = 625$ (3 marks)

9 A football match lasts 90 minutes with a break of 15 minutes at half – time. If the referee allows five minutes extra time for injuries and stoppages. At what time does a match which kicks off at 4:30 p.m. end? (2 marks)

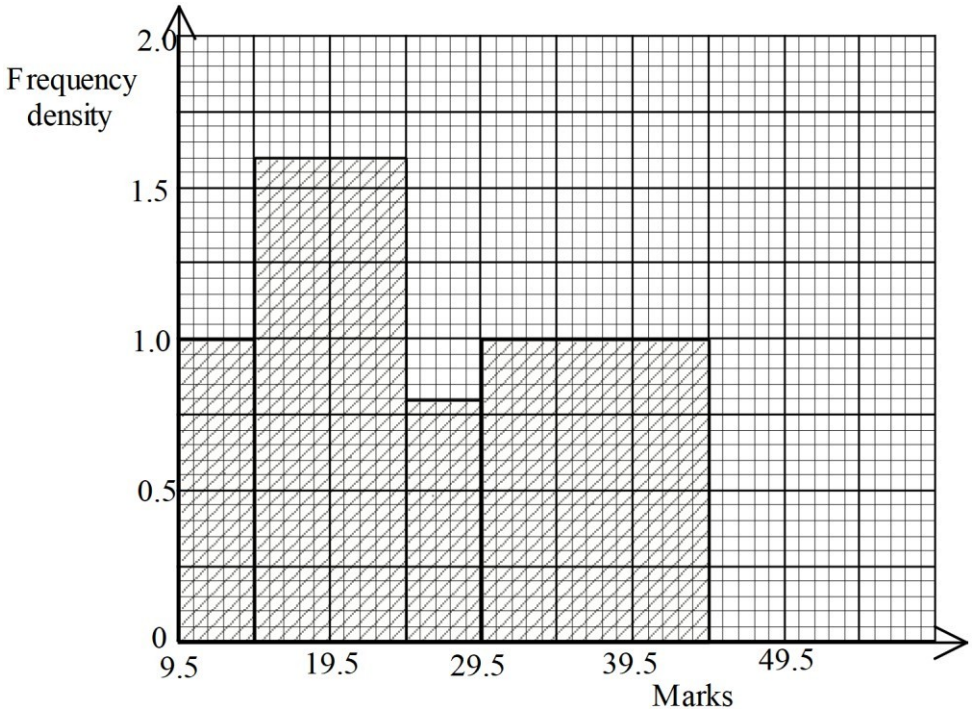
10 The mass of a solid cone radius 14 cm and height 18 cm is 4.62 kg. find its density in g/cm^3. (3 marks)

11 Given that $\mathbf{OA} = \begin{pmatrix} -2 \\ 10 \end{pmatrix}$, $\mathbf{OB} = \begin{pmatrix} x \\ -2 \end{pmatrix}$ and that the magnitude of **AB** is 13 units, find the possible values of x. (4 marks)

12 In the figure below, AB = 6 cm, BE = 4 cm, CD = 9 cm, BE is parallel to CD and angle ABE = angle ACD = 90°. Calculate the length of BC. (3 marks)



13 The figure below shows histogram of a certain set of data obtained from mathematics test.



Develop a frequency distribution table from the histogram. (3 marks)

14 Use tables of reciprocals and square roots only to evaluate; $\frac{3}{0.05584} - \sqrt{216.2}$ (3 marks)

15 Given that $\sin(2x+15) = \cos(3x-25)$. Find the exact value of $\sin 3x$. (3 marks)

16 A triangular plot of land ABC is such that AB = 34 m, AC = 66 m and $\angle BAC = 96.7^{\circ}$, calculate the length of BC to three significant figures. (3 marks)

SECTION II (50 Marks)

*Answer **any five** questions from this section in the spaces provided.*

17 (a) A line L_1 passes through the points $(4, 5)$ and $(6, -7)$. Find;

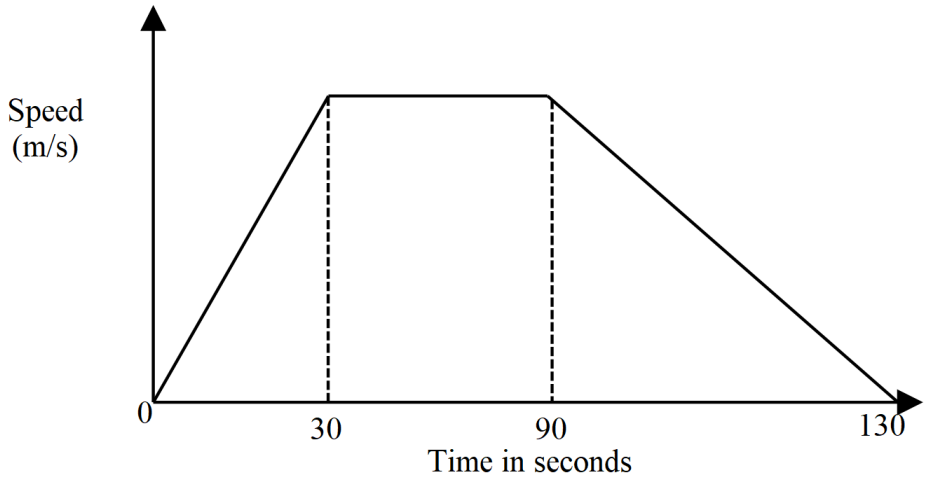
(i) equation of L_1 in the form $y = mx + c$ where m and c are constants. (3 marks)

(ii) x and y – intercepts of L_1. (2 marks)

(b) Another line L_2 is perpendicular to L_1 and passes through the point $(-21, 7)$. Find the equation of L_2 in the form $ax + by = c$ where a, b and c are integers. (2 marks)

(c) Find the point of intersection of L_1 and L_2. (3 marks)

18 The diagram below shows the speed – time graph for a bus travelling between two stations. The bus begins from rest and accelerates uniformly for 30 seconds. It then travelled at a constant speed for 60 seconds and finally decelerates uniformly for 40 seconds.



Given that the distance between the two stations is 2090 m, calculate;

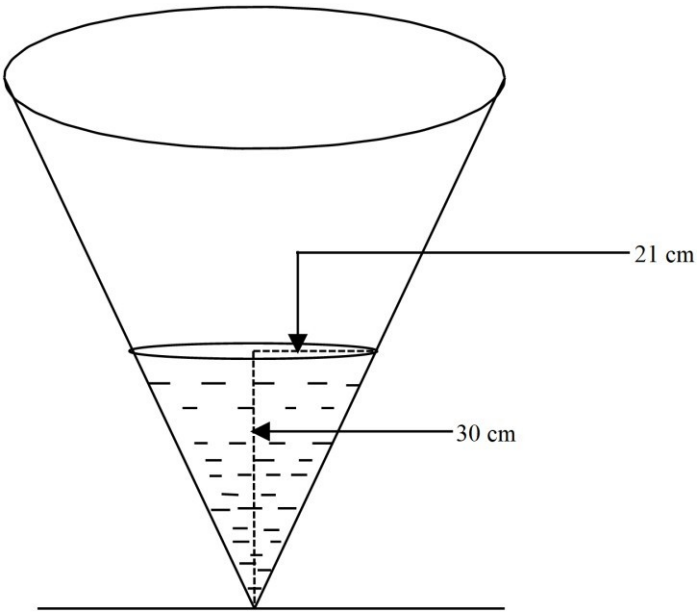
(a) The maximum speed, in km/h the bus attained. (3 marks)

(b) The acceleration. (2 marks)

(c) The distance travelled during the last 20 seconds. (2 marks)

(d) The time the bus takes to travel the first half of the journey. (3 marks)

19 The diagram below shows a conical vessel which a conical vessel which stands vertically. The vessel contains water to a depth of 30 cm. The radius of the water surface in the vessel is 21 cm.



Taking ;

(a) Calculate the volume of the water in the vessel in cm^3. (2 marks)

(b) When a metal sphere in completely submerged in the water, the level of water in the vessel rises by 6 cm. calculate;

(i) the radius of the new water surface in the vessel. (2 marks)

(ii) the volume of the metal sphere in cm^3. (3 marks)

(iii) the radius of the sphere. (3 marks)

20 (a) Given that $P = \begin{pmatrix} 8 & 5 \\ 6 & 9 \end{pmatrix}$, find P^{-1} (2 marks)

(b) Matawi bought 8 T-shirts and 5 pairs of shorts at a total cost of ksh. 4400. Had he bought 6 T-shirts and 9 pairs of shorts, he would have spent ksh. 1000 more.

(i) Form two equations to represent the above information (2 marks)

(ii) Use the matrix method to determine the cost of a T-shirt and a pair of shorts (3 marks)

(c) Three months later the price of a pair of shorts went up. Matawi bought 5 T-shirts and 5 pairs of shorts at a total cost of ksh.3650. Find the percentage increase in the price of a pair of shorts. (3 marks)

21 Five points P, Q, R, V and T lie on the same plane. Point Q is 53 km on a bearing of N 55 E of P. Point R lies S18°E of Q at a distance of 58 km. Given that point T is West of P and 114 km from R and point V is directly South of P and S 40 E from T.

(a) Using the scale 1cm to represent 10 km, draw a diagram showing the relative positions of the five points. (5 marks)

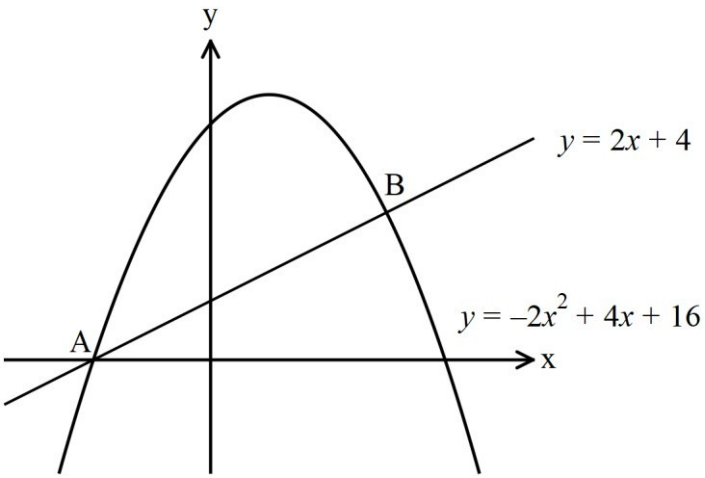
(b) From the scale drawing determine

(i) The distance, in km of point V from R. (1 mark)

(ii) The bearing of point V from Q (1 mark)

(c) Determine the area enclosed by the points PQRVT in square km. (3 marks)

22 The figure below, the graphs of $y = -2x^2 + 4x + 16$ and $y = 2x + 4$ intersect at points A and B.



(a) Find the coordinates of points A and B. (4 marks)

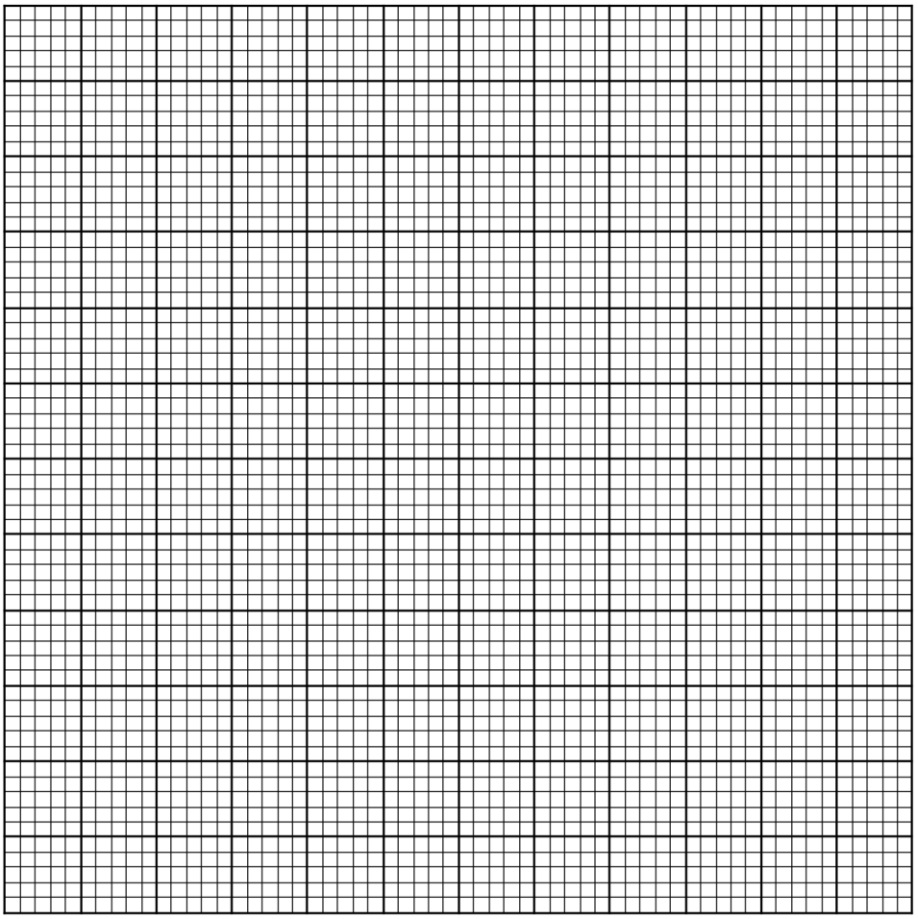
(b) Estimate the area bounded by the curve $y = -2x^2 + 4x + 16$ and the line $y = 2x + 4$ using:

(i) Trapezium rule with 6 ordinates. (3 marks)

(ii) Mid – Ordinate rule with 5 strips. (3 marks)

23 A square ABCD has vertices $A(-5,-5)$, $B(-4,-5)$, $C(-4,-4)$ and $D(-5,-4)$.

(a) On the grid below, draw the square ABCD. (1 mark)



(a) On the same axes, draw $A'B'C'D'$, the image of the square ABCD under a transformation described as enlargement, centre $(-4,-3)$ and scale factor -3. (2 marks)

(b) The square $A''B''C''D''$ with the vertices $A''(1,-5)$, $B''(4,-5)$, $C''(4,-2)$ and $D''(1,-2)$ is the image of $A'B'C'D'$ under a rotation. On the same axes, draw the square $A''B''C''D''$ hence describe the rotation. (4 marks)

(c) On the same axes, draw the square $A'''B'''C'''D'''$, the image of $A''B''C''D''$ under reflection in the line $y = 0$. (1 mark)

(d) State a pair of squares that are:

(i) Directly congruent (1 mark)

(ii) Oppositely congruent (1 mark)

24 The equation of a curve is $y = x^2(3 - x)$

(a) Find:

(i) The $x-$intercept of the curve (2 marks)

(ii) The $y-$intercept of the curve . (1 mark)

(b) (i) Determine the stationary points of the curve. (3 marks)

(ii) For each point in (b)(i) above, determine whether it is a maximum or a minimum.

(2 marks)

(c) Sketch the curve. (2 marks)

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SECTION I (50 Marks)

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

1. Simplify $\dfrac{\sqrt{3}}{2-\sqrt{3}}$ leaving your answer in the form $a+b\sqrt{c}$ where *a*, *b* and *c* are integers. (2 marks)

2. Given that $\log_{10} 3 = 0.4771$ and $\log_{10} 5 = 0.6990$. Without using mathematical tables or calculators evaluate; $\log_{10} 45$. (3 marks)

3. A bag has 5 red balls, 6 white balls and some yellow balls of the same shape and size. The probability of picking a yellow ball is 0.45. Find the probability of picking a red ball. (3 marks)

4. The length and width of a rectangular sheet of paper measured to the nearest millimetre are 29.7 cm and 13.4 cm respectively. Calculate to four significant figures, the relative error in area of the paper.
(3 marks)

5. The data below shows ages of 8 players in a football academy;

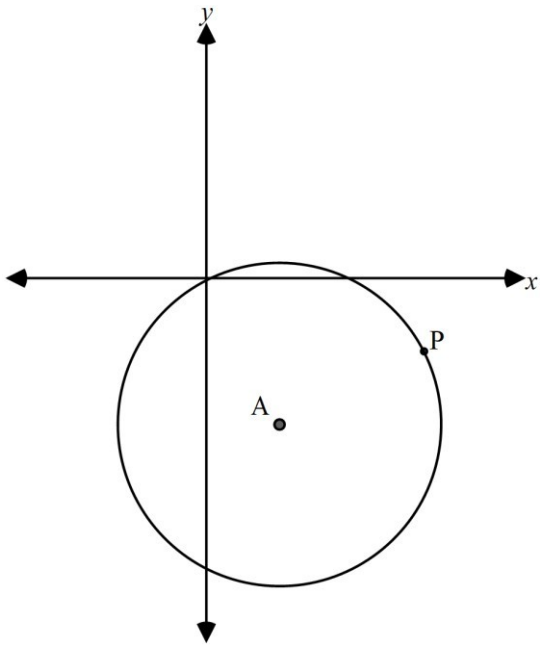
$$6,\ \ 8,\ \ 7,\ x,\ \ 13,\ \ 11,\ \ 9,\ \ 6$$

The mean age for the 8 players is 9. Find the mean absolute deviation of the data. (4 marks)

6. Make N the subject of the formula; $W = \frac{m}{8\pi}\sqrt{\frac{G\hbar N}{N}}$ (3 marks)

7. Solve for y in the equation $\tan y = \cos y$ for $0^\circ \leq y \leq 180^\circ$. (4 marks)

8. The figure below shows a circle centre $A(1, -2)$ passing through point $P(3, -1)$. Find its equation in the form $x^2 + y^2 + ax + by = c$ where a, b and c are integers. (3 marks)



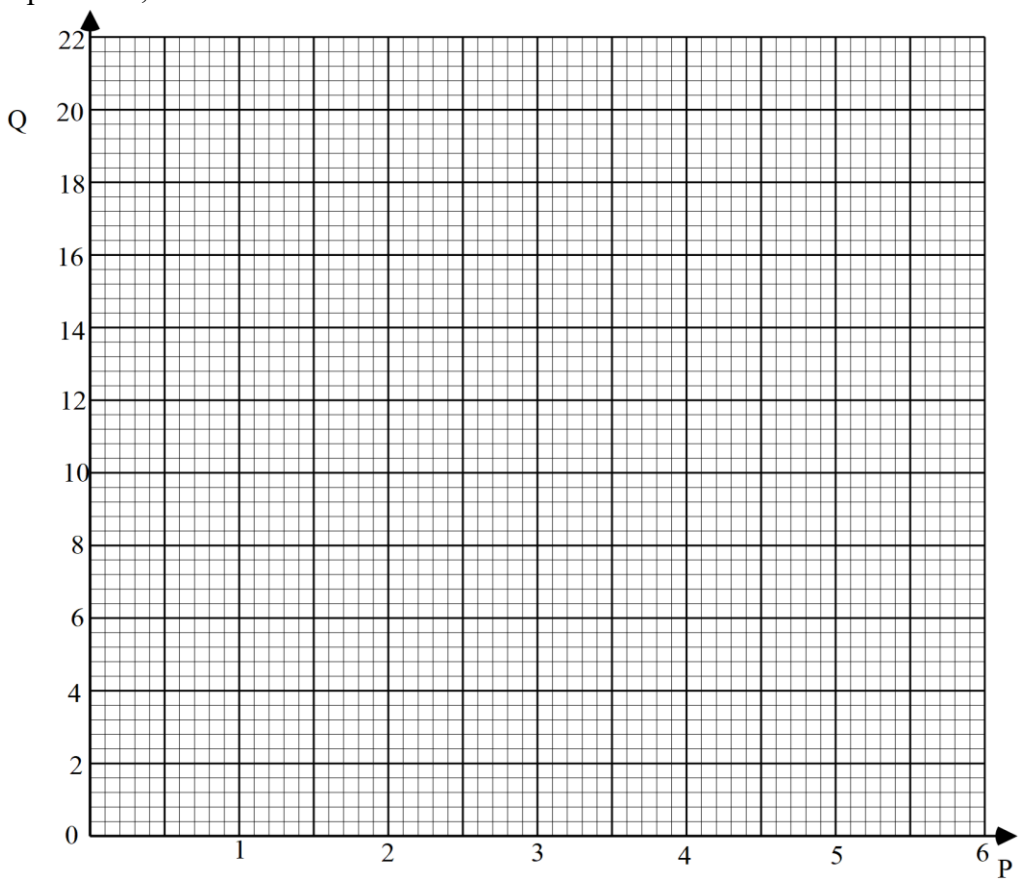
9. Tap K can fill a tank in 2 hours 48 minutes while tap N can empty the tank when full in 4 hours. The two taps were opened at 9:00 a.m. At what time will the tank be full? (3 marks)

10. Expand $\left(2+\sqrt{3}\right)^4$ hence simplify $\left(2+\sqrt{3}\right)^4-\left(2-\sqrt{3}\right)^4$ (3 marks)

11. The table below shows the relationship between the quantities P and Q.

P	0	1	2	3	4	5	6
Q	2.4	5.2	8.4	11.6	14.0	17.6	20.4

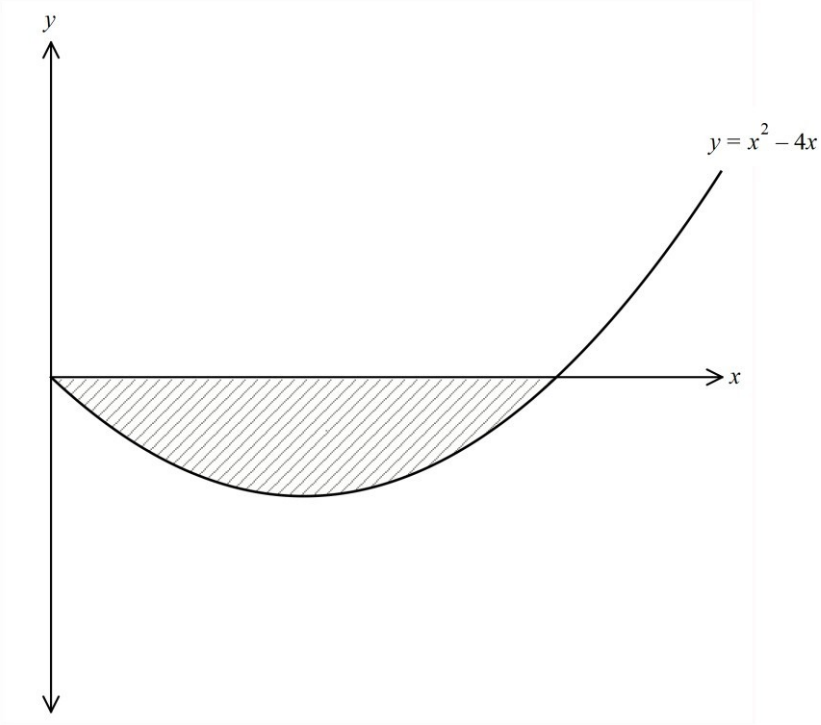
(a) On the grid provided, draw a line of best fit. (2 marks)



(b) Using the graph, find the law connecting P and Q. (2 marks)

12. Radido bought a '*tuk – tuk*' on hire purchase terms. The cash price of the '*tuk – tuk*' is Kshs.500 000. He made a down payment of Kshs.140 000 and paid monthly instalments of Kshs.25 000 for two years. Calculate the monthly rate at which compound interest was charged. (3 marks)

13. The figure below shows a graph of the function; $y = x^2 - 4x$



Calculate the exact area of the shaded region. (3 marks)

14. The image of triangle ABC with vertices at $A(-1,3)$, $B(-2,1)$ and $C(-1, 5)$ under a transformation **M** is $A'(-6,-1)$, $B'(-2,-2)$ and $C'(-10,-1)$ respectively. Determine the matrix of transformation **M**.

(3 marks)

15. Samwel wanted to buy some text – books for his top students with a budget of Sh 15 000. Before the purchase, the price of each book rose by Sh 150. As a result, he was able to buy five books less with the same amount of money. Calculate the total number of books samwel was able to buy. (3 marks)

16. (a) On the space provided below, draw a circle centre O, radius 3.2 cm (1 mark)

(b) A point X is 9 cm from the centre O, construct a tangent to the circle passing through X. (2 marks)

SECTION II (50 Marks)

*Answer **any five** questions from this section in the spaces provided.*

17. (a) A carpenter wishes to make a ladder with 18 cross – pieces. The cross – pieces are to reduce uniformly in lengths from 90 cm at the bottom to 39 cm at the top. Calculate:

(i) the length in centimetres of the eleventh cross – piece from the bottom. (3 marks)

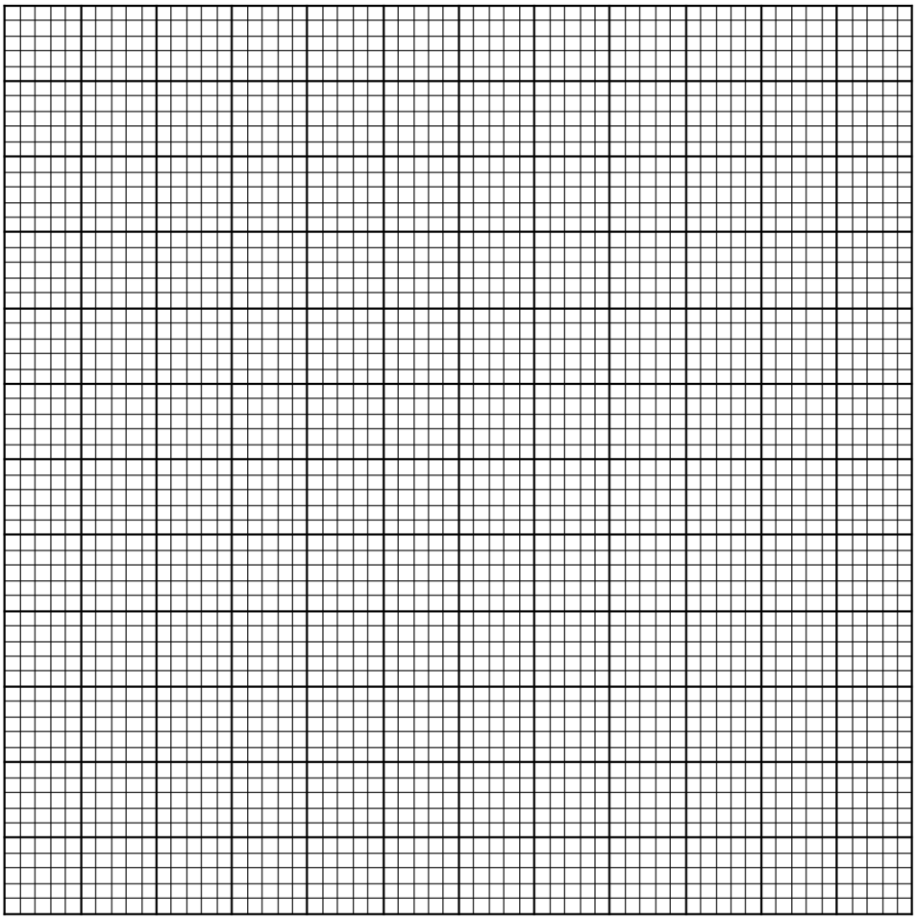
(ii) the total length of all the cross – pieces used to make the ladder. (2 marks)

(b) The average of the third and fourth terms of Geometric Progression (G.P.) is 22.5 while the second term of the same G.P. is 60. Find the first term and the common ratio of the Geometric Progression (G.P.). (5 marks)

18. The marks obtained by 50 candidates were recorded in the table below.

Marks	0 – 9	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69
Frequency	6	8	12	9	7	5	3

(a) Draw a cumulative frequency curve to represent the above data. (4 marks)



(b) Use your graph to estimate;

(i) median. (1 mark)

(ii) quartile deviation. (3 marks)

(iii) the probability that a candidate scores above 40 marks. (2 marks)

19. (a) Construct a triangle XYZ in which XY = 7 cm, YZ = 7.2 cm and XZ = 4.2 cm. Measure angle XYZ. (3 marks)

(b) A point R is located inside triangle XYZ such that;

(i) $XR > 2$ cm

(ii) R is closer to X than Y

(iii) R is closer to XY than XZ

(iv) $\angle XRY \geq 120^{\circ}$

Label and shade the locus of R. (7 marks)

20. The positions of two towns on the surface of the earth are given as $A(45^\circ S, 20^\circ W)$ and $B(45^\circ S, 80^\circ E)$.

Find;

(a) the difference in longitude. (2 marks)

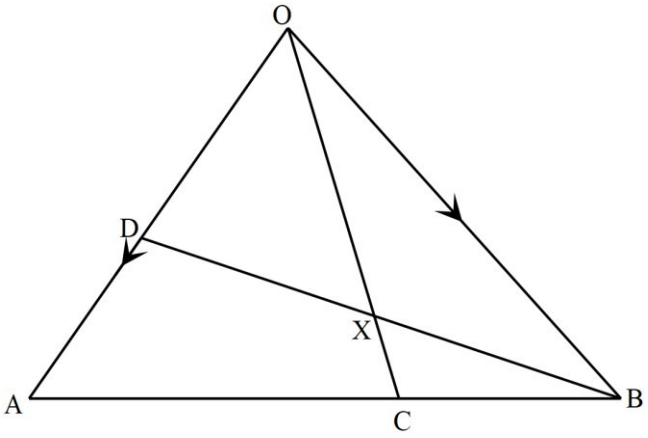
(b) the distance between the two towns leaving your answer in a simplified surd form in;

(i) kilometres; $\left(\text{taking R = 6370 and } \pi = \frac{22}{7}\right)$ (3 marks)

(ii) nautical miles. (2 marks)

(c) the local time in town A when it is 8:20 a.m. in town B. (3 marks)

21. In the figure below C is a point on AB such that **BA** = 3**BC** and D is the mid – point of OA. OC and BD intersect at X. Given that **OA** = **a** and **OB** = **b**.



(a) Write down in terms of **a** and **b** the vectors;

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

(ii) **OC** (2 marks)

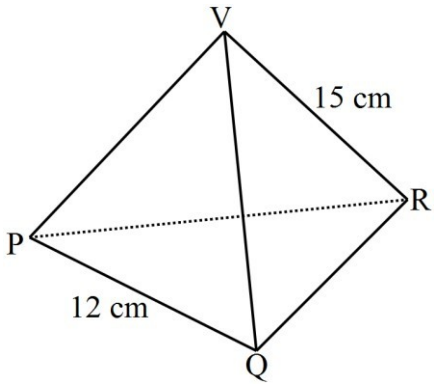
(iii) **BD** (1 mark)

(b) If $\mathbf{BX} = h\mathbf{BD}$, express OX in terms of **a**, **b** and h . (1 mark)

(c) If $\mathbf{OX} = k\mathbf{OC}$, find h and k. (4 marks)

(d) Show that B, X and D are collinear. (1 mark)

22. The figure below shows a tetrahedron PQRV. $PQ = QR = RP = 12$ cm and $VP = VQ = VR = 15$ cm.



Calculate to **one** decimal place:

(a) Height of the tetrahedron. (3 marks)

(b) Angle between VQ and the base PQR. (2 marks)

(c) Angle between VPQ and the base PQR. (2 marks)

(d) Angle between VPQ and VQR. (3 marks)

23. The table below shows income tax rates for the year 2023

Taxable Income in Kshs per month	Tax Rate (%) per month
1 – 15000	0
15001 – 27000	10
27001 – 37000	15
37001 – 45000	20
45001 – 50000	25
Above 50000	30

In November 2023, Jecky earned a basic salary of Sh. 34 320. In addition, he was entitled to a house allowance of Sh. 12 000 per month and medical allowance of Sh. 6 450. He also has a non – taxable risk allowance of Sh. 6 000 per month. He contributes to a provident fund of Sh. 7 500. He also has tax relief of Sh. 1 180 monthly.

(a) Calculate Jecky's taxable income in that month. (2 marks)

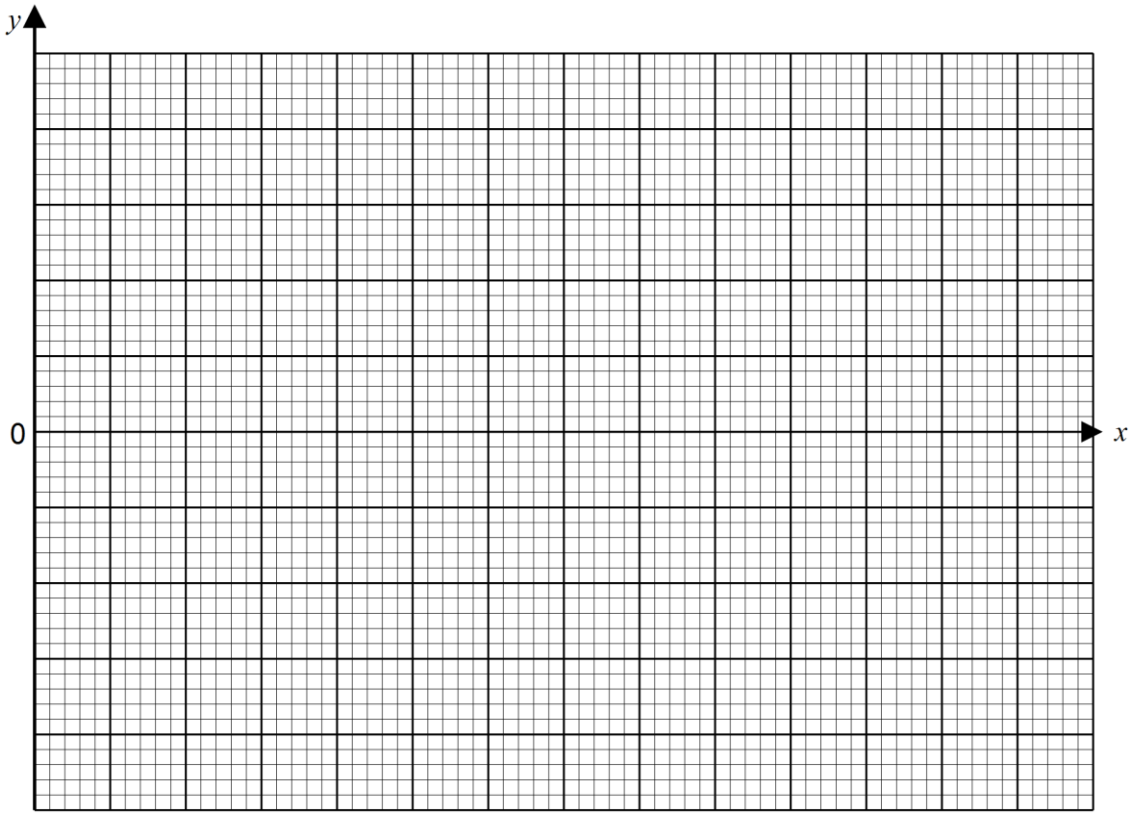
(b) Calculate Jecky's Pay As You Earn for November 2023. (5 marks)

(c) In the month of December 2023, Jecky's tax in the last band was Sh. 2 556. Calculate his net salary in December. (3 marks)

24. (a) Complete the table given below by filling in the blank spaces. (2 marks)

x	0	15	30	45	60	75	90	105	120	135	150	165	180
$y = 4\cos 2x$	4.00		2.00	0	–2.00		–4.00		–2.00	0	2.00		4.00
$y = 2\sin(2x + 30)$	1.00	1.73	2.00	1.73		0	–1.00		–2.00	–1.73		0	1.00

(b) On the grid provided, draw on the same axes, the graph of $y = 4\cos 2x$ and $y = 2\sin(2x + 30)$ for $0^o \le x \le 180^o$. Take the scale, 1 cm for 15° on the x – axis and 1 cm for 1 unit on the y – axis. (5 marks)



(c) From the graph:

(i) State the amplitude of $y = 4\cos 2x$ (1 mark)

(ii) Find the period of $y = 2\sin(2x + 30)$ (1 mark)

(d) Use your graph to solve the equation $4\cos 2x - 2\sin(2x + 30) = 0$ (1 mark)

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SERIES 12
PAPER 1

Section A: (50 marks)

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

1. Without using a calculator, evaluate: (3mks)

$$\frac{-4^2 \ of \ (-4 \div 4^2)}{84 \div 7 + 3 - -5}$$

2. A regular polygon is such that the difference between the one of its interior angles and exterior angle is 90^0. Determine the number of sides that the polygon has. Name the polygon. (3mks)

3. Solve the inequalities $3x - 8 \geq -5$ and $4 + 3x < 16$ hence write down the integral values of x that satisfy the combined inequality. (3mks)

4. The marked price of a lorry was 3,400,000. Rael bought the lorry at 10.5% discount. If the seller still made a profit of 18%. Determine the amount of money the seller had made for the lorry. (3mks)

5. A family used two-fifth of its monthly salary on school fees. Three-quarters of the remaining amount was used on family upkeep while the rest was invested. The family invest ksh.13500 monthly. Calculate the amount the family used on the school fees every month. (4mks)

6. Given that $Sin\ (\theta\ +\ 30)\ =\ Cos\ 2\theta$, find the value of $Cos\ (\theta\ +\ 40)$ (3mks)

7. Use table of square roots, a squares and reciprocals only to evaluate: (4mks)

$$\sqrt{426.8} + \frac{4}{(0.2368)^2}$$

8. Form a point T, 18m away on a level ground, the angle of elevation of the lower part of a window is $27.\ 7^0$ and that of the upper part from the same point T is 31.2^0. Calculate the height of the window to two decimal places. (3mks)

9. Evaluate without using a calculator or mathematical tables. (3mks)

$$49^{\frac{3}{2}} \times \left(\frac{256}{2401}\right)^{\frac{3}{4}}$$

10. A tourist arrived in Kenya with M US dollars. The money was converted into Kenya shillings in a bank which buys and sells foreign currencies as follow.

Currency	**Selling (ksh)**	**Selling (ksh)**
1 Sterling Pond	125.78	126.64
1 US Dollar	75.66	75.80

A tourist used ksh.5,000,000 while in Kenya then converted the balance into Starling Ponds. Given that he received 5,200 Sterling Ponds. Find the value of M.

11. A bus and a matatu left Nairobi for Eldoret a distance of 340km/hr while the matatu at 120km/hr. After 30 minutes, the matatu had a puncture which took 30 minutes to repair. Find how far from Nairobi the matatu catch up with the bus. (3mks)

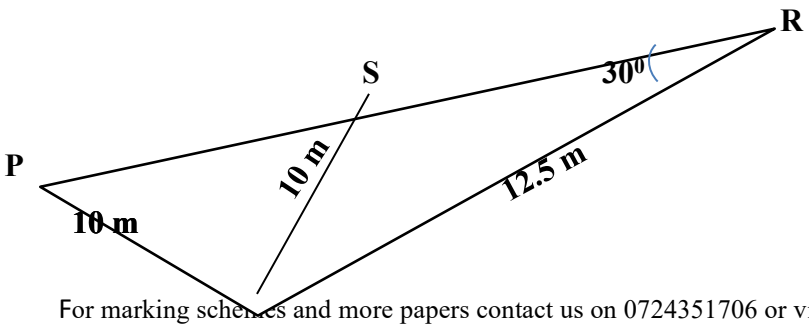
12. The position vector of the point P, Q and R are $OP = -3i + 6j$, $OQ = 2i + j$, $OR = 4i + -j$. Show that P, Q and R are Collinear (3mks)

13. Find the equation of a straight line which is equidistance from points $A\ (4, -3)$ and $B\ (2,5)$ expressing your answer in double intercept form. (3mks)

14. A point $P\ (-4, 1)$ and $Q\ (-2, -2)$ are mapped onto $P^1(2, 11)$ and $Q^1(8,2)$ by an enlargement. Find the scale factor of the enlargement. (4mks)

15. Four years ago, a father was thrice as older as his son. In five years' time, the sum of their ages will be 42years. Find how old the father was, when the son was born. (3mks)

16. The diagram below represents a flower garden PQR. $PQ = 10m$, $QR = 12.5m$ and $< QRP = 30^0$. Point S lies on PR such that QS = 10m and QSR is obtuse. Calculate the length of PS correct to 2 decimal places. (4mks)



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Q

Section II: (50 marks)
Attempt **only five** questions from this section

17. A triangle ABC is a right angle triangle at point A. The vertices of triangle are $A\ (1, -2)$, $B\ (5,4)$ and $C\ (m, n)$. The equation of line BC is $5y - x + 15$.
    (a) Determine
        (i) Equation of line AC in the form $ax + by + c = 0$ where a, b and c are integers.

        (ii) Coordinates of point C.

    (b) A line passes through point A and is parallel to line BC. Determine the x-intercept of the line.

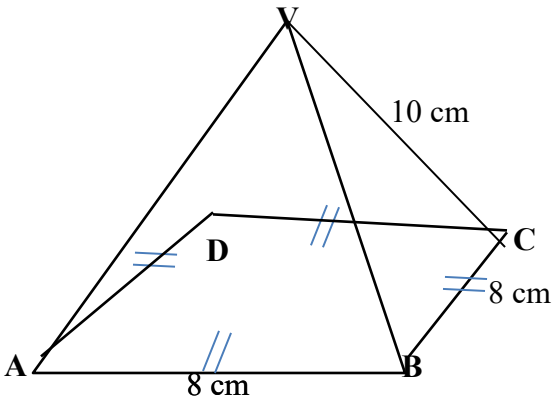
18. Two towns A and B are 400km apart. A motor cyclist travelling at an average speed of 60km/h left town A for town B at 1:20pm. A matatu travelling at an average speed of 80km/h also left town A for town B at 2:00pm.
    (a) Calculate:
        (i) The distance covered by the motor cyclist by 2:00pm. (2mks)

        (ii) The distance from town A in km, where the matatu caught up with the motor cyclist. (3mks)

(iii)The time when the matatu caught up with the motor cyclist. (2mks)

(b) A lorry traveling at an average speed of 40knm/h left town B for town A at 2:00pm. Determine the time the lorry and the matatu met. (3mks)

19. The following figure shows a right pyramid VABCD. The base ABCD of the pyramid is a square of side 8cm. the length of the slanting edges VA = VB = VC = VD = 10cm.



(a) Calculate to 2 decimal places

(i) The vertical height of the pyramid. (4mks)

(ii) The surface area of the pyramid. (4mks)

(iii) The volume of the pyramid. (2mks)

20. The corner points A, B, C and D of a ranch arc such that B is 8km directly east of A and C is 6km from B on a bearing of 30°. D is 7km from C on a bearing of 300°.

(a) Using a scale of 1cm to represent 1km, draw a diagram to show the positions of A, B, C and D. (4mks)

(b) Use the scale drawing to determine:
(i) The bearing of A from D

(ii) The distance BD in km

(iii)The perimeter of the ranch in km

21. If $x^2 + y^2 = 29$ and $x + y = 3$
(a) Determine the values of:-
(i) $x^2 + 2xy + y^2$ (2mks)

(ii) 2xy (2mks)

(iii)X^2 - 2xy+y^2 (1mk)

(iv)x – y (2mks)

(b) Find the values of x and y (3mks)

22. The frequency distribution table below represents the number of kilograms of meat sold in butchery.

Mass in kg	1 – 5	6 – 10	11 – 15	16 – 20	21 – 25	26 – 30	31 -35
Frequency	2	3	6	8	3	2	1

(a) State the modal frequency. (1mk)

(b) Calculate the mean mass. (5mks)

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(c) Calculate the median mass. (4mks)

23. A triangle ABC with vertices A(-2, 2), B(1,4) and C(-1,4) is mapped onto triangle $A^1B^1C^1$ by a reflection in the line y = x + 1.

(a) On the grid provided draw;
(i) Triangle ABC. (1mk)
(ii) The line y = x + 1 (2mks)
(iii)Triangle $A^1B^1C^1$ (2mks)

(b) Triangle $A^{11}B^{11}C^{11}$ is the image of triangle $A^{11}B^{11}C^{11}$ under a negative quarter turnabout (0,0) on the same grid, draw triangle $A^{11}B^{11}C^{11}$. (3mks)

(c) State the type of congruence between triangles;
(i) ABC and $A^1B^1C^1$ (1mk)

(ii) $A^1B^1C^1$ and $A^{11}B^{11}C^{11}$ (1mk)

24. A sales woman is paid a commission of 2% on goods worth over ksh.100,000. She is also paid a monthly salary of ksh.12,000. In a certain month, she sold 360 handbags at ksh.500 each.

(a) Calculate the sales woman earnings that month. (3mks)

(b) The following month, the saleswoman's monthly salary was increased by 10%, her total earnings that month were ksh.17,600. Calculate;

a) The total amount of money received from the sales of handbags that month. (5mks)

ii) The number of handbags sold that month. (2mks)

PAPER 2

Section A: (50 marks)

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

1. Use logarithm to evaluate: (4mks)

$$\sqrt[3]{\frac{1.654}{45.73 \times 0.56}}$$

2. The length of two similar iron bars was given as 12.5m and 9.23m. Calculate the maximum possible difference in length between the two bars. (3mks)

3. Simplify (3mks)

$$\frac{\sqrt{54} + \sqrt[3]{3}}{\sqrt{3}}$$

4. Given that $2 \log X^2 + \log \sqrt{X} = K \log X$, find the values of K. (3mks)

5. A variable P varies directly as t^3 and inversely as the square root of S. When t = 2,s = 9 and p = 16. Determine the equation connecting p, t and s, hence find p when s = 36 and t = 3. (3mks)

6. The data below represents the number of animals owned by 7 neighbours.
   9, 5, 14, 6, 8, 13 and 15. Calculate correct to the nearest whole number, the standard deviation of the number of animals. (3mks)

7. Use completing square method to solve. $3x^2 + 8x - 6 = 0$ correct to 3 significant figures. (3mks)

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

$$w = \sqrt[3]{\frac{s+t}{s}}$$

9. Given that $qi + \frac{1}{3}j + \frac{2}{3}k$ is a unit vector, find q. (3mks)

10. Expand the expression $(1 + {}^1/_2x)^5$ in ascending (4mks)
    (a) Power of x, leaving the co efficient as fractions in their simplest form.

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

11. In a transformation, an object with an area of 5cm2 is mapped onto an image whose area is 30cm2. Given that the matrix of the transformation is:

$\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$, Find the value of X. (3mks)

12. Solve for Θ without using tables given that Sin $(2\Theta - 30^0)$ – Cos $4\Theta = 0$ for $0^0 \leq \Theta \leq 90^0$ (3mks)

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

14. The perimeter of a rectangle is 48cm while its area is 108cm. form a quadratic equation to represent this situation and hence determine the dimensions of the rectangle. (5mks)

15. Three workers, working 8 hours per day can complete a task in 5 days. Each worker is paid ksh.40 per hour. Calculate the cost of hiring 5 workers if the work for 6 hours per day to complete the same task. (3mks)

16. The first term of an arithmetic sequence is -7 and the common difference is 3
(a) List the first six terms of the sequence. (2mks)

(b) Determine the sum of the first 50 terms of the sequence. (2mks)

Section II: (50 marks)
Attempt **only five** questions from this section

17. The first term of arithmetic progression (A.P) is a and the common difference d. the 7th term of the A.P is 11. The sum of the first 12 consecutive terms of the A.P is 123.

(a) (i) Form two simplified equations involving a and d to represent the information (2mks)

(ii) Find the values of a and d. (3mks)

(a) The 1st, 3rd and 8th terms of the A.P from the first 3 consecutive terms of a geometric progression (G.P). Calculate;

(i) The 6th term of the G.P. (3mks)

(ii) The sum of the first 6 terms of the G.P. (2mks)

18. He table below shows Kenya's tax rates of a certain year.

INCOME (K£ P.A)	**TAX RATES (KSH. PER £)**
1 – 5220	2
5221 – 10440	3
10441 – 15660	4
15661 – 20880	5
20881 and above	6

In that year Mr. Masika earned a basic salary of ksh.26,000 per month. He is entitled to house allowance of ksh.15,000 per month and a medical allowance of ksh.2,000 per month.

(a) Calculate;

(i) His taxable income per year in pounds. (2mks)

(ii) His monthly gross tax (4mks)

(iii)The monthly net tax if he is given a relief of ksh.1,800 per month. (2mks)

(b) Other deductions per month are as follows; N.H.I.F ksh.1,500, cooperative loan ksh.5,600, WCPS 2% of basic salary, coop shares ksh.4,000.
Find his monthly net pay. (2mks)

19. A box contains 3 brown, 9 pink and 15 white clothes pegs. The pegs are identical except for the colour.

(a) Find the probability of picking:-

(i) A brown peg. (1mk)

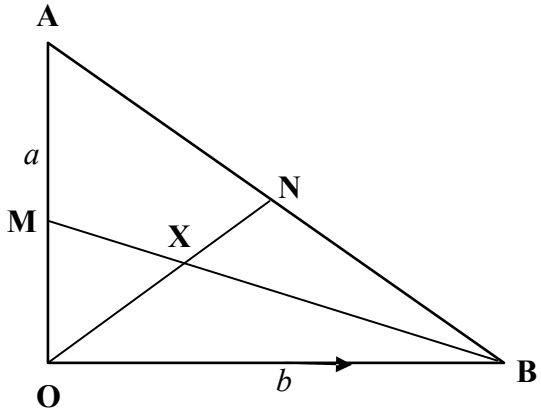
(ii) A pink or a white peg (2mks)

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

(i) A white peg and a brown peg are picked. (3mks)

(ii) Both pegs are of the same colour. (4mks)

20. In the figure below OA =a and OB = b. M is the mid-point of OA and AN:NB = 2:1



(a) Express in terms of a and b

(i) BA (1mk)

(ii) BN (2mks)

(iii) ON (2mks)

(b) Given that BX = hBM and OX = kON, determine the values of h and k. (5mks)

21. (a) Two variables P and Q are such that P varies partly as the square root of Q and partly as Q.
    (i) Determine the relationship between P and Q if Q = 16 when P = 500 and Q = 25 when P = 800 (3mks)
    (ii) Find P when Q = 36 (2mks)

    (b) A various directly as B and inversely as the squire root of C. find the percentage decrease in A when B is decreased by 10% and C is increased by 21% (5mks)

22. The table shows the frequency distribution of heights of 40 plants in a tree nursery.

Height of plants (cm)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	4	8	10	12	4	2

(a) State the modal class (1mk)

(b) Calculate:
    (i) The mean height of the plants (3mks)

    (ii) The standard deviation of the distribution using assumed mean of deviation of 25 (4mks)

(c) Determine the probability that a plant taken at random has a height greater than 40cm. (2mks)

23. The table below shows values of x and some values of y for the curve
$y = 14 + 10x - 8x^2 - 4x^3$

(a) Complete the table (2mks)

X	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
Y		-6		0		14		12	

(b) On the grid provided, draw the graph of $y = 14 + 10x - 8x^2 - 4x^3$ for $-2.5 \leq x \leq 1.5$
Use a scale: 1 cm represents 0.5units on x-axis
: 2cm represents 5 units on y-axis. (3mks)

(i) Use the graph to solve the equation $14 + 10x - 8x^2 - 4x^3$. (1mk)

(ii) By drawing a suitable line graph on the same grid, solve the equation. (4mks)

24. ABCD is a quadrilateral with vertices as follows; A(3,1), B(2,4), C(4,3) and D(5,1)

(a) On the grid provided draw ABCD and the image $A^1B^1C^1D^1$ under a transformation with matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ Find the coordinates of $A^1B^1C^1D^1$ (3mks)

(b) Describe the transformation that maps ABCD onto $A^1B^1C^1D^1$ fully. (1mk)

(c) A transformation represented by matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps $A^1B^1C^1D^1$ onto $A^{II}B^{II}C^{II}D^{II}$. Find the coordinates of $A^{II}B^{II}C^{II}D^{II}$. Plot $A^{II}B^{II}C^{II}D^{II}$ on the same grid. (3mks)

(d) Determine a single transformation that maps $A^{II}B^{II}C^{II}D^{II}$ onto ABCD. Describe this transformation fully. (3mks)

SERIES 13

PAPER 1

SECTION I (50 MKS) **Answer all the questions in this section in the spaces provided.**

1. Evaluate without using tables or a calculator the value of $\frac{1.33\times0.15}{0.19\times0.0017}$ **(3marks)**

2. When a certain number is divided by 48, 72 or 100 the remainder is 3 in each case. Find the number. **(3marks)**

3. Using logarithm table evaluate $\sqrt[3]{\frac{849.6\times2.41}{3941}}$. **(4marks)**

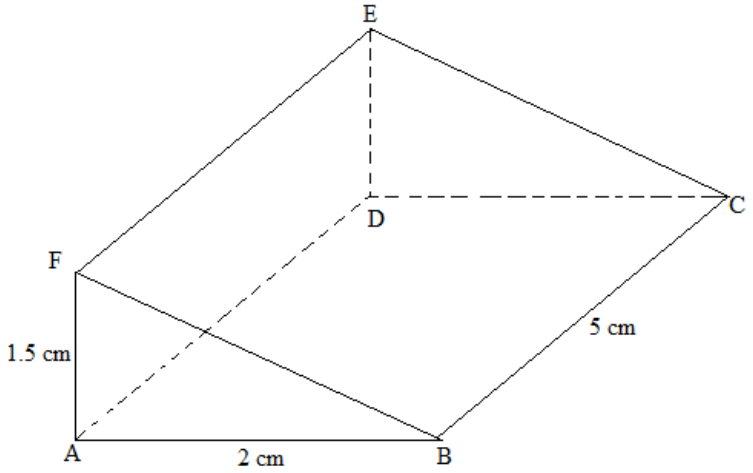
4. A 890kg culvert is made of a hollow cylindrical material with outer radius of 76cm and an inner radius of 62cm. It crosses a road of width 3m. Determine the density of the material used in its construction in Kg/m^3 correct to one decimal place.
(3marks)

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5. Evaluate the value of x in $81^{x+1} + 3^{4x} = 246$. **(3marks)**

6. Simplify the equation $\frac{4x^2-9}{2x^2+5x+3}$. **(3marks)**

7. The diagram below represents a prism whose Cross-section is a right-angled triangle. Draw the net of the solid. **(3marks)**



8. During an annual general meeting at Elimu Mixed Day, goats and chicken were slaughtered. The number of heads for both chicken and goats were 45. The total number of legs were 100. Determine the exact number of goats and chicken slaughtered. **(3marks)**

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9. In a mixed school there are 900 students, out of these 600 are girls.

(a) Find the ratio of boys to girls. **(2marks)**

(b) What is the percentage of boys in this school? **(1mark)**

10. Find the value of t in the equation $\frac{t-1}{3} - \frac{4+t}{4} = 0.$ **(3marks)**

11. The sum of interior angles of a polygon is 1980^0. Find the number of sides of the polygon and name the polygon.

(3marks)

12. Solve the following inequalities and represent the solution on a single number line. **(3mks)**

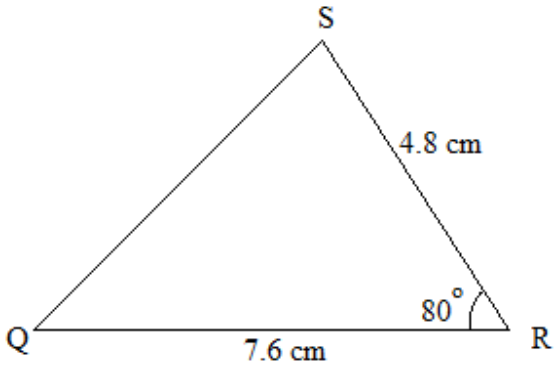
$3-2x<5$

$4-3x\geq -8$

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13. Line K whose equation is $2y - 6 = 4x$ is perpendicular to another line Q. Find the equation of line Q if it passes through point. (-2, 7).
(3marks)

14. The figure below is not drawn to scale.



Find correct to 1 decimal place;
(a) Length PQ. **(2 marks)**

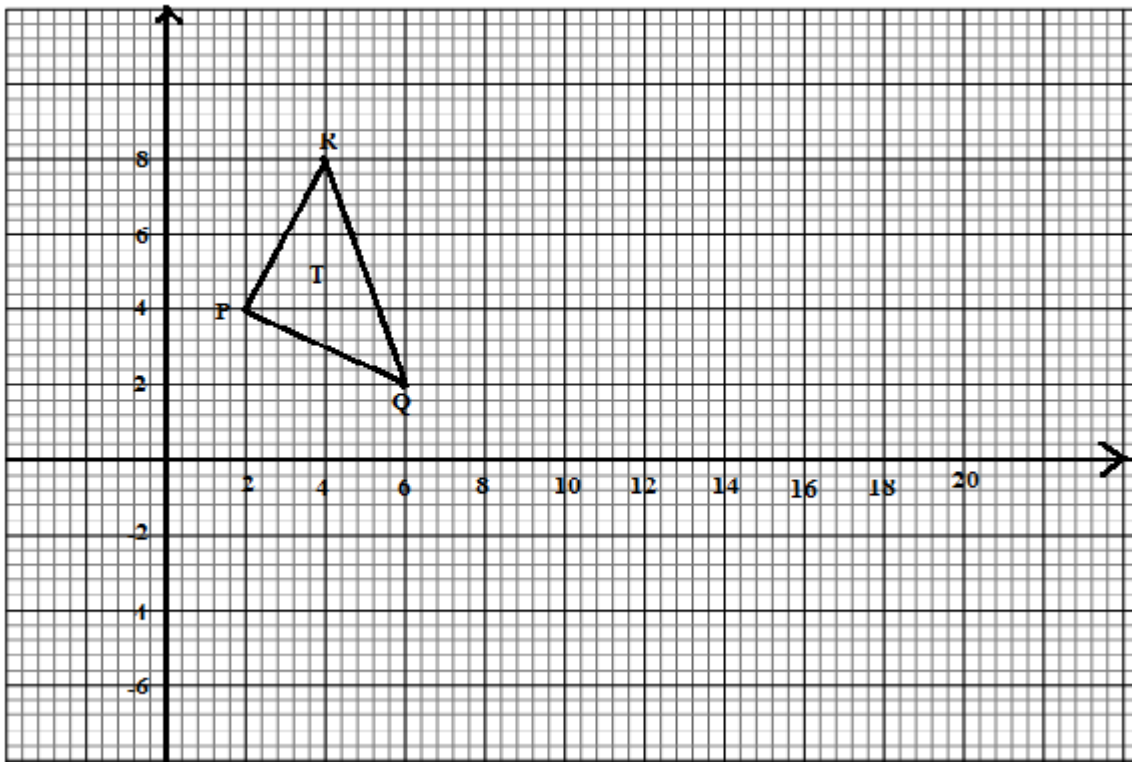
(b) Angle ABC **(2 marks)**

15. The marked price of a car ina dealers shop was Ksh.450 000. Kawira bought the car at 7% discount. The dealer still made a profit of 13%. Calculate the amount of money the dealer had paid for the car to the nearest shillings.
(3marks)

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16. The figure below shows triangle T with vertices P(2,4), Q(6,2) and R(4,8). It is mapped onto triangle T/ with vertices P/(10,0), Q/(8,-4) and R/(14, -2) by a rotation.

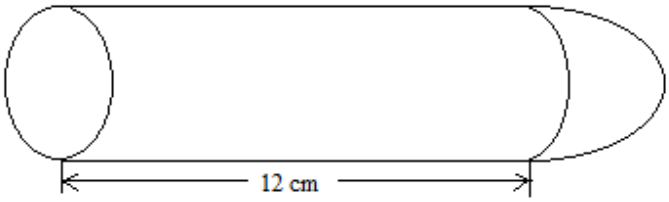
(a) Draw on the same axis T/ the image of triangle T. **(1 mark)**



(b) Determine the center and angle of rotation. (2marks)

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

17. The diagram below shows a solid made of a hemisphere and a cylinder. The radius of both the cylinder and the hemisphere is 3cm. The length of the cylinder is 12cm.



a) i) Calculate the volume of the solid. **(3marks)**

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ii) The solid fits in a box in the shape of a cuboid 15 cm by 6cmby 6cm. Calculate thevolume of the box not occupied by the solid correct to four significant figures. **(2marks)**

b) i) Calculate the total surface area of the solid correct to four significant figures. **(3marks)**

ii) The surface of the solid is to be painted. One millilitre of paint covers an area of $8cm^2$.The cost of paint is Ksh 900 per litre. Calculate the cost of the paint required. **(2marks)**

18. An expedition has 5 sections AB, BC, CD, DE and EA. B is 200m on a bearing of 050^0 from A. C is 500m from B. The bearing of B from C is 300^0. D is 400m on a bearing 230^0 from C. E is 250m on a bearing 025^0 from D.
    (a) Sketch the route **(1 Mark)**
    (b) Use the scale of 1cm to 50m to draw the accurate diagram representing the route. **(5 Marks)**
    (c) Use your diagram to determine
        (i) Distance in metres of A from E **(2 Marks)**
        (ii) Bearing of E from A **(2 Marks)**

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19. A trader bought 2 cows and 9 goats for a total of Ksh. 98,200. If she had bought 3 cows and 4 goats, she would have spent Ksh. 2, 200 less.

(a) Form two equations to represents the above information. **(2marks)**

(b) Use the matrix method to determine the cost of a cow and that of a goat. **(4marks)**

(c) The trader later sold the animals she had bought making a profit of 30% per cow and 40% per goats.

i) Calculate the total amount of money she received. **(2marks)**

ii) Determine corrects to 4 significant figures the percentage profit the trader made from the sale of animals. **(2marks)**

20. Two towns, Meru and Maua are 80km a part, Kimathi started cycling from Meru to Maua at 10:00 30a.m at an average speed of 40km/h. Mutuma started his journey from Maua to Meru at 10:30 a.m and travelled by car at an average speed of 60km/h.

(a) Calculate:

i) The time taken by Kimathi and Mutuma to meet. **(3marks)**

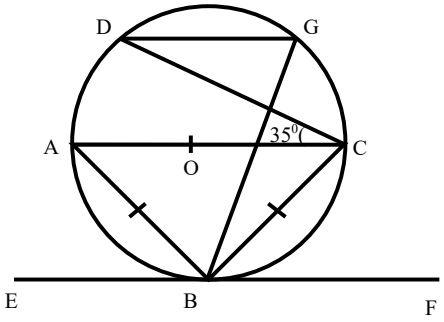
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ii) The distance from Meru when Kimathi and Mutuma met. **(2marks)**

iii) The time of the day when the two met. **(2marks)**

(b) Murianki cycled from his home to a school 6km away in 20minutes. He stopped at the school for 5 minutes, before taking a motorbike to a town 40 km away. The motorbike travelled at 75km/h. On the grid provided, draw a distance time graph to represent Murianki's journey. **(3marks)**

21. In the figure below AOC is a diameter of the circle centre O; AB = BC and $\angle ACD = 35^0$. EBF is a tangent to the circle at B. G is a point on the minor arc CD.



Giving reason

(a) Calculate the size of

(i) $\angle BAD$ **(3 Marks)**

(ii) The obtuse $\angle BOD$ **(2 Marks)**

(iii) $\angle BGD$ **(2 Marks)**

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(b) Show that ∠ABE = ∠CBF **(3 Marks)**

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

(b). The length of a floor of a rectangular hall is 9m more than its width. The area of the floor is $36m^2$.

(i). Calculate the perimeter of the floor. **(4 marks)**

(ii). A rectangular carpet is placed on the floor of the hall leaving an area of $28m^2$. If the length of the carpet is twice its width, determine the width of the carpet. **(2 marks)**

23. Using a pair of compass and ruler only construct.

(a) Triangle PQR in which PQ =5cm∠QPR = 30^0 and ∠PQR=105^0. **(3marks)**

(b) A circle that passes through the vertices of the triangle PQR. Measure its radius. **(3marks)**

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(c) The height of triangles PQR with PQ as the base. Measure the height. **(2marks)**

(d) Determine the area of the circle that has outsides the triangle correct to 2 decimal places. **(2marks)**

24. (a). The equation of a line L_1 is $7y - 5x - 20 = 0 \cdot$ Find the x-intercept of the equation **(1mark)**

b). Another line L_2 is perpendicular to L_1 and passes through (-5, 3). Find the equation of L_2. **(3marks)**

c). L_3 passes through (0,-3) and parallel to the line L_4 whose equation is $3y - 8x = 3$ find the equation of L_3. **(3marks)**

d). Calculate the coordinates of point of intersection between the lines L_1 and L_3. **(3marks)**

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PAPER 2

SECTION I (50 MKS)

SECTION I (50 MARKS)Answer ALL questions in this section.

1. Make y the subject of the formula : $v = \frac{A\sqrt{x^2 + y^2}}{y}$ (3 marks)

2. Solve for x in the equation: $Log_8(6 - 2x) - Log_8(x - 2) = {}^{-1}/_{3}$ (3 marks)

3. Three quantities *P*, *Q* and *R* are such that *P* varies directly as the cube of *Q* and inversely as the square root of R. Find the percentage change in *P* if *Q* decreases by 10% and *R* decreases to 36%. (3 marks)

4. A circle with its Centre at O (-2, 0) passes through a point (1, 4). Write down the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ (3 marks)

5. Express: $\frac{COS\ 30^0}{\tan 45^0 + \sqrt{3}}$ in surd form and simplify by rationalizing the denominator (3 marks)

6. In a transformation, an object with area 9cm² is mapped onto an image whose area is 54cm². Given that the matrix of transformation is $\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$ Find the value of X (3 marks)

7 a) Find the binomial expansion of $(1 + \frac{1}{2x})^7$ up to the 4th term with increasing powers of x. (2 marks)

b) Hence estimate the value of $(1.05)^7$ correct to 4 decimal places. **(2 marks)**

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8. A computer with a marked price of Kshs. 40000 can also be bought on hire purchase terms. Kibet bought the computer on hire purchase by making a deposit of Ksh 10000 and cleared the balance with equal 12 monthly installments of KShs. 3500 each. Determine the monthly interest rate of hire purchase to 2 significant figures. **(3 marks)**

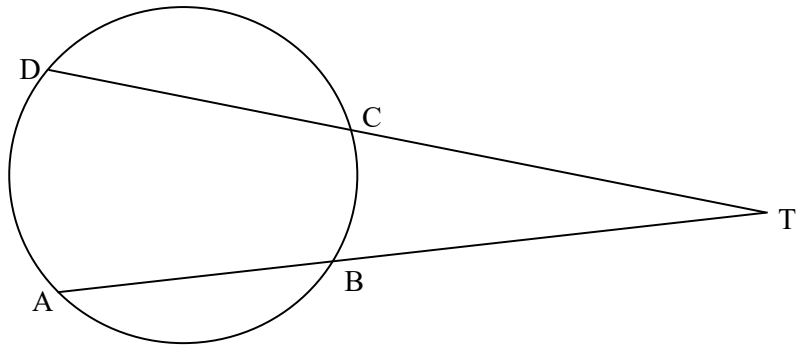
9. A dealer blends Kericho tea that costs sh 300 per 100g packet with Ketepa that costs ksh 160 per 200g packet. In what ratio must the dealer mix the two so that by selling a 100g packet of the blend for ksh 250, a profit of 25% is made? (4 marks)

10. Solve for x in the equation: $Sin\ 2\theta = -0.5$ for $0^0 \leq \theta \leq 360^0$ (3 marks)

11. Use completing of the square method to solve: $2x^2 - 6x + 4 = 0$ (3 marks)

12. A carpenter wishes to cut a 1m long piece of wood into 3 equal parts. He approximates the length of each piece to 0.33m. Calculate the percentage error due to this approximation (3 marks)

13. Calculate length DT in the figure below given AT and DT are secants that intersect at T and AB = 5 cm, BT = 4 cm and DC = 9 cm. (3 marks)



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14. An arc of a circle of diameter 7 cm subtends an angle of 1.2 radians to the Centre of the circle. What is the length of the arc? (2 marks)

15. Given matrix $A = \begin{pmatrix} x-2x & x-4 \\ x & 2 \end{pmatrix}$. Find the possible values of x if A is a singular matrix.

(3 marks)

16. Working together two taps A and B can fill a tank in 2 hours. By itself tap A can fill the tank in 6 hrs. Tap A and B are opened at the same time and after running for 1 hour, an outlet taps which can drain the full tank by itself in 12 hours is opened and Tap A is closed. Find the total time taken to fill the tank.

(4 marks)

SECTION II – 50 MARKS Answer only FIVE questions from this section.

17. In a form 4 class there are 24 girls and 30 boys. The probability that a girl participates in games is 0.4 whereas that of a boy is 0.6.

    a) A student is picked at random from the class. Find the probability that the student picked:

        i) Is a boy and will participate in games (2 marks)

        ii) Will not participate in games (2 marks)

    b) Two similar bags A and B are such that, bag A contains 3 blue balls and 7 red balls while bag B contains 4 green balls and 8 blue balls. The balls are similar in shape and size. A ball is drawn from bag A and bag B. Determine the probability that:

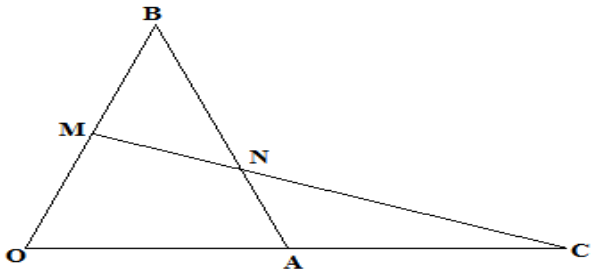
        i) One of the balls drawn is green. (2 marks)

        ii) The balls drawn are of the same colour. (2 marks)

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iii) None of the balls drawn is red (2 marks)

18. In the triangle OAB below, **OA** = **a**, **OB** = **b** and 3**OA** = 2**OC**. M divided **OB** in the ratio 1:1 .



a) Express in terms of **a** and **b** only, the vectors

i) **BA** (1 mark)

ii) **OC** (1 mark)

iii) **MC** (1 mark)

b) Given further that **MN** = h**MC** and BN = k**BA**,

i) Express vector **MN** in two different ways in terms of **a**, **b**, h and k (2 marks)

ii) Find the value of h and k. (4 marks)

c) State the ratio **MN:MC** (1 mark)

19. A group of people planned to contribute equally towards buying a plot valued at Ksh. 270,000. After the contribution, 2 members joined of the group. As a result, a refund of Ksh 1500 was made to the members who had already contributed.

a) Let the original number of people be x, express in terms of x:

i) The original contribution (1 mark)

ii) The new contribution (1 mark)

b) Find how much each member contributed finally (5 marks)

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c) Calculate the percentage decrease in the contribution per person caused by the members who joined. (3 marks)

20. The table shows income tax rates for a certain year.

Monthly taxable pay K£	Rate of tax in Ksh. Per K£
1- 434	2
435 - 866	3
867- 1298	4
1299 - 1730	5
Over 1730	6

A company employee earns a monthly basic salary and is also given taxable allowances amounting to Ksh 10480. If the employees' tax on the 5th band is Ksh 3420,

a) Calculate the employee's monthly taxable income tax in K£. (2 marks)

b) The employee is entitled to a personal tax relief of Ksh. 1056 per month. Determine the net tax. (4 marks)

c) In a certain month, the employee received a 25% increment in his basic salary. Calculate his net monthly pay. (4 marks)

21.(a) In a geometrical progression the sum of the second and third terms is 12 and the sum of the third and fourth terms is -36. Find the first term and the common ratio. **(4 marks)**

(b) In an arithmetic progression the 12th term is 25 and the 7th term is three times the second term, find;

i) The first term and the common difference **(4 marks)**

iii) The sum of the first 10 terms of the arithmetic progression. (2 marks)

22 a). The table below shows the frequency distribution of marks scored by students in a test.

Marks	1-10	11-20	21-30	31-40	41-50
Frequency	2	4	8	4	2

On the grid provided, draw a cumulative frequency curve for the data. *(3 marks)*

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b). Use your graph to determine

(i). The pass mark if only 6 students passed the exam. *(2 marks)*

(ii). The upper quartile mark *(1 mark)*

c). Find the percentage change if the upper quartile in b(ii) above was found by calculation. (3 marks)

23 a) Complete the table below for $y = -2\ sin\ x$ and $y = 3\ cos\ x$. (2 marks)

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
-2 Sin x	0.00		-1.73			-1.00	0.00			2.00	1.73		
3 Cos x	3.00		1.50			-2.60	-3.00			0.00	1.50		

b,) Draw the graph$y = -2\ Sin\ x$ and $y = 3\ cos\ x$ using 1 cm to represent 30° horizontal axis and 2 cm to represent 1 unit on the vertical axis. **(5 marks)**

c) Use the graph to solve:

i) 3 Cos x + 2sin x = 0 **(1 mark)**

ii) 1 - 2sin x = 2 (2 marks)

24. A triangle ABC with vertices at A (1,-1) ,B (3,-1) and C (1, 3) is mapped onto triangle $A^1B^1C^1$ by a transformation whose matrix is $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$.Triangle $A^1B^1C^1$ is then mapped onto $A^{11}B^{11}C^{11}$ with vertices at A^{11} (2, 2), B^{11} (6, 2) and C^{11} (2,-6) by a second transformation.

(i) Find the coordinates of $A^1B^1C^1$ ***(3 marks)***

(ii) Find the matrix which maps $A^1B^1C^1$ onto $A^{11}B^{11}C^{11}$ ***(3 marks)***

(iii) Determine the ratio of the area of triangle $A^1B^1C^1$ to triangle $A^{11}B^{11}C^{11}$ ***(1 mark)***

(iv) Find the transformation matrix which maps $A^{11}B^{11}C^{11}$ onto **ABC** ***(3 marks)***

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SERIES 14
PAPER 1

SECTION I (50MARKS)

Answer all questions in this section.

1. Without using a calculator evaluate, (3marks)

$$\frac{\text{½ of } 3\text{ ½} + 1\text{ ½ } (2\text{ ½} - {}^{2}/3)}{\text{¾ of } 2\text{ ½} + \text{½}}$$

2. Solve for x, given (3marks)

$$\frac{27^{x-1}}{3^{2x-1}} = 81^{2x}$$

3. The exterior angle of a regular polygon is equal to one – third its interior angle. Calculate the number of sides of the polygon and give its name. (3marks)

4. A bank in Kenya buys and sells foreign currencies as follows.

	buying (Ksh)	Selling (kshs.)
1 Us dollar	85.86	86.06
1 sterling pound	142.41	142.73

A tourist from united States of America converted 43521 US dollars into Kenya shillings.

i) Calculate the amount in Kenya shillings that she received (1mark)

(ii) While in Kenya, the tourist spent sh. 2437821 and converted the balance to sterling pounds. How much in Sterling pound did the tourist receive to the nearest sterling pound?

(3marks)

5. A ball is in the shape of a sphere. It weighs 125g. The material used to make it has a density of $2.5g/cm^3$. What is the volume of the material to make a dozen such balls? (3mks)

6. Find the integral values of x which satisfy the following inequality. (3marks)

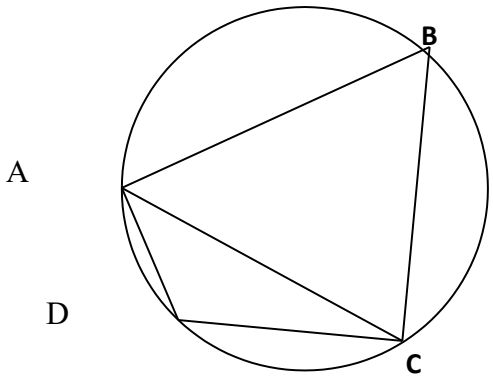
   $2x+3 \geq 5x-3 > -8$

7. Mr. Ombogo the Principal of Chiga Secondary School would wish to cover the floor of the new administration block using the square tiles. The floor is a rectangle of sides 12.8m by 8.4m. Find the area of each of the largest tiles in square metres which can be used to fit exactly without breaking. (3marks)

8. A minor arc of a circle subtends an angle of 120^0 at the Centre of the circle. If the radius is 6.25 cm, find the length of the major arc giving your answer to 4 significant figures. (Take $\pi = 3.142$). (2marks)

9. Kassim has a money box containing 100 mixed shs 5 and shs 10 coins with a total value of shs 600. How many of each type of coin does the box contain? (3marks)

10. In the figure below below A,B,C and D are points on its circumference, Chord BC=AC and angle ADC=138°



Giving reasons, calculate the angle ACB (3marks)

11. Simplify the expression $\frac{12x^2 + ax - 6a^2}{9x^2 - 4a^2}$ (3marks)

12. The co-ordinates of points A, B and C are (2, 5), (3, 7) and (6, 13) respectively. Use vectors to show that the points A, B and C are collinear. (3marks)

13. A boy whose eye level when standing is 1.6 m, stands in front of a building 30 m tall. He observes the top of the building at an angle of elevation of 42^0. Find the distance between the boy and the building leaving your answer correct to 4 significant figures. (3marks)

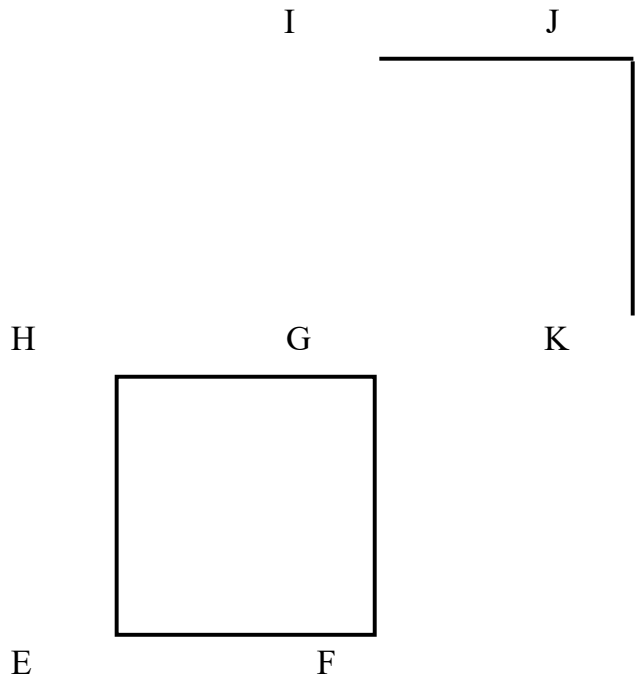
14. Two similar blocks have masses of 729g and 216g respectively. If the surface area of the smaller block is $300cm^2$, calculate the surface area of the larger block. (3marks)

15. Evaluate the following using tables of reciprocals and cubes only. Express your answer to 4 significant figures.

(3marks)

$$\frac{4}{0.2356} + 0.9873^3$$

16. The figure below shows a sketch of a solid cuboid EFGHIJKL. Complete the sketch.
(3marks)



SECTION II (50MARKS)

Answer only five questions in this section

17. Kiriari is a market Centre 600km from Kisumu town. A bus starts from Kisumu for Kiriari at 7.00am at an average speed of 80 km/h. At 8.30 am a car started from Kisumu to Kirari and moved at an average speed of 120 km/hr.

(a) The distance bus covered before the car started moving. (2marks)

(b) The relative speed for the two vehicles. (1mark)

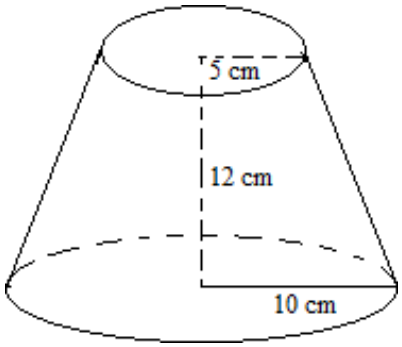
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(c) The time the car overtook the bus. (3marks)

(d) Distance covered by the car before overtaking the bus. (2marks)

(d) Distance from Kiriari to the car at the time the car was overtaking the bus. (2marks)

18. The figure below shows a frustum. The top and bottom radii are 5cm and 10cm respectively, while the vertical height of the frustum is 12cm.



Find the:-

(a) Slant height of the frustum. (3marks)

(b) Curved area of the frustum. (3marks)

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(c) Volume of the frustum. (4marks)

19. A pilot intends to fly from A to D through B and C, B is 750km from A and on a bearing of $N50^0E$. C is on a bearing of $N40^0W$ from B and their distance apart is 600km. D is on a bearing of 265^0 from C and at a distance of 1050km.

(a) Using the scale of 1cm for 100km, show the flight route (4marks)

(b) If the pilot on its way back decides to fly directly from D to A;

i) By use of compass bearing find the direction of A from D (1mark)

ii) Find the distance from D to A in kilometers. (1mark)

(c) The plane flies at 500km/h. If it leaves D at 9.00a.m at what time did it arrive at A. (2marks)

(d**).i**)Using your diagram in (a) above, (i) find the distance between A and C (1mark)

ii) Find the compass bearing of A from point C (1mark)

20. a) Find the inverse of the matrix $\begin{bmatrix} 2 & 5 \\ 4 & 3 \end{bmatrix}$ **(**2marks)

b). A transport company has two types of vehicles for hire: Lorries and buses. The vehicles are hired per day. The cost of hiring two Lorries and five buses is Sh. 156,000 and that of hiring 4 lorries and three buses is Sh. 137,000.

(i) Form two equations to represent the above information. (2marks)

(ii) Use matrix method to determine the cost of hiring a lorry and that of hiring a bus.

(3marks)

c).Find the value of x given that $\begin{bmatrix} 2x-1 & 1 \\ x^2 & 1 \end{bmatrix}$ is a singular matrix (3marks)

21. The height of 36 student in a class was recorded to the nearest centimeter as follows:-

148	159	158	163	166	155	155	179	158
161	160	157	165	165	175	173	172	178
147	168	157	172	165	154	170	157	167
155	159	173	171	168	160	172	156	167

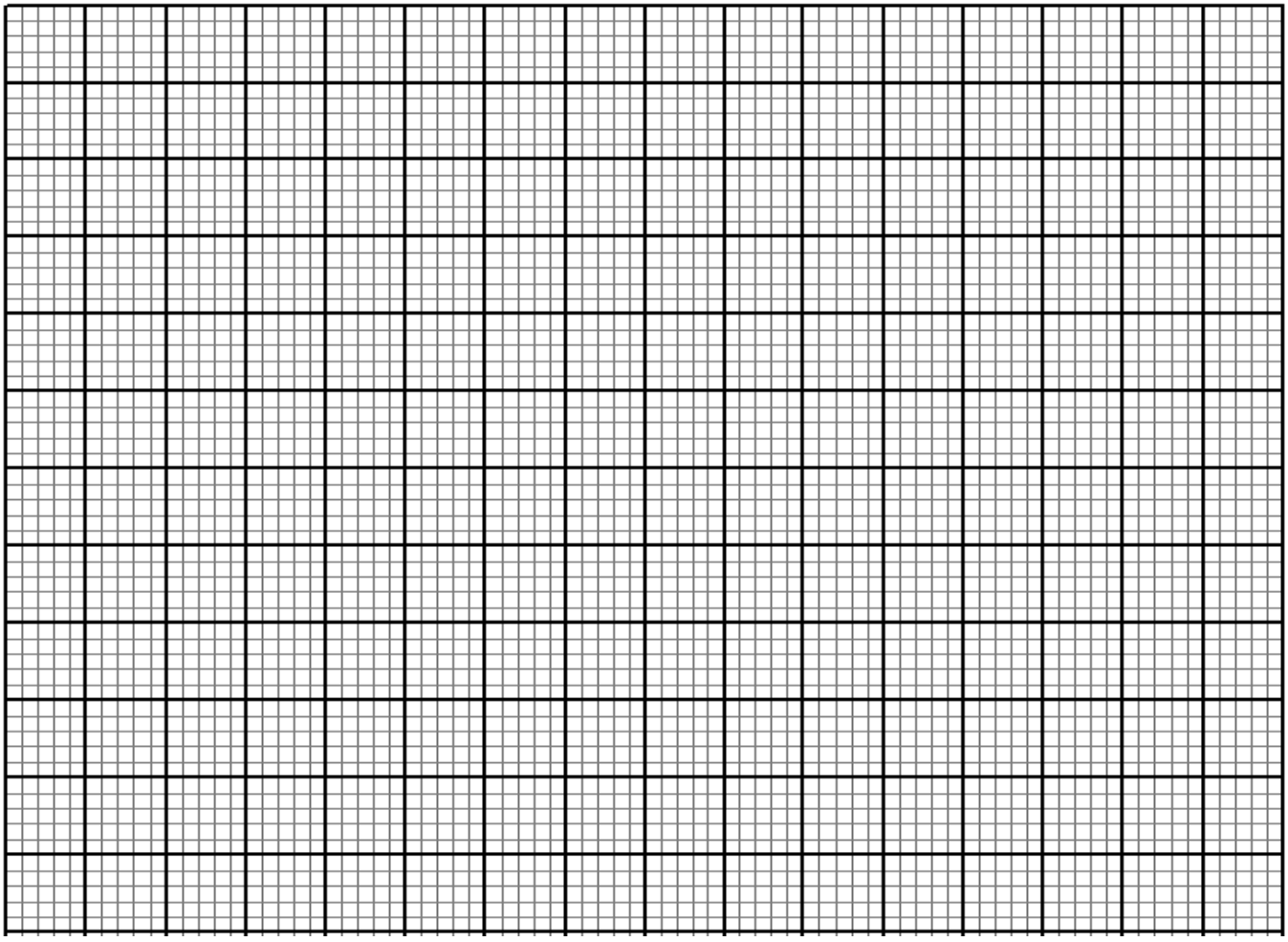
a) Make a frequency distribution table using a class interval of 5 and starting with the class 145 – 149. (2marks)

b) From the table above

(i) Calculate the exact mean mark. (3marks)

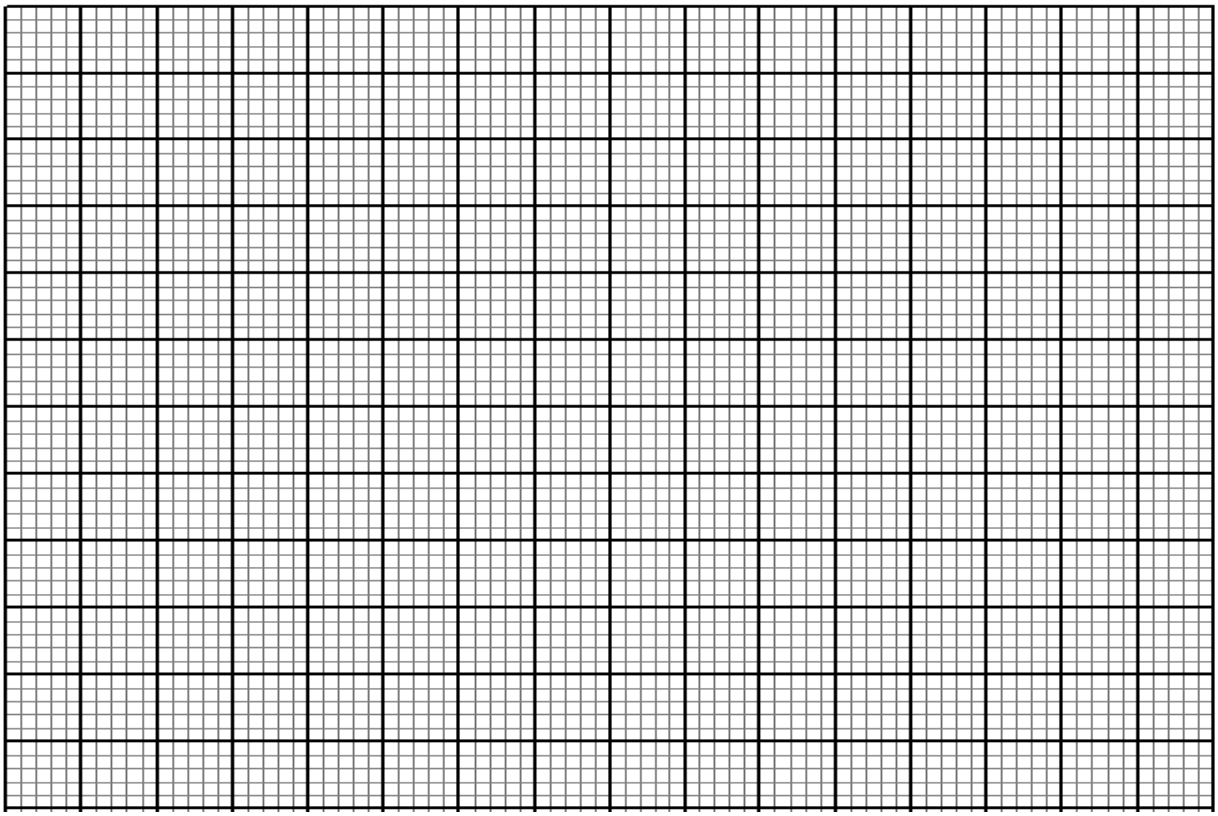
(ii) Calculate the median (3marks)

(c) Draw a frequency polygon using the table in (a) above. (2marks)



22. The coordinates of triangle ABC are A(1, 1), B(3, 1) and C(1, 3).

a) Plot the triangle ABC. (1mark)



b) Triangle ABC undergoes a translation vector $\binom{2}{2}$ Obtain the image of A'B'C' under the transformation, write the coordinates of A'B'C. (2marks)

c) A'B'C undergoes a reflection along the line X=0, obtain the coordinates and plot on the graph points A"B"C" under the transformation. (2marks)

d) The triangle A"B"C" undergoes an enlargement scale factor -1, centre origin. Obtain the coordinates of the image A"'B"'C"'. (2marks)

e) The triangle A"'B"'C"' undergoes a rotation centre (0, 0) angle - 90^{0}. Obtain the coordinates of t he image A''''B''''C''''' and draw triangle A''''B''''C''''' (2marks)

f) Which triangles are directly congruent? (1marks

23. A number of people agreed to contribute equally to buy books worth KSh. 1200 for a school library. Five people pulled out and so the others agreed to contribute an extra Shs. 10 each. Their contributions enabled them to buy books worth Shs. 200 more than they originally expected.

(a) If the original numbers of people was x, write an expression of how much each was originally to contribute. (1mark)

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

(c) Calculate the number of people who made the contribution. (5marks)

(d) Calculate how much each contributed. (2marks)

24. The equation of a straight line is given as $y = -\frac{2}{3}x - \frac{2}{3}$. The line meets the x – axis at point T.

(a). Determine the coordinates of T. (2marks)

(b). A second line L_2 is perpendicular to line L_1 at T. Find the equation of line L_2 in the form $ax + by = c$ where a, b and c are constants. (3marks)

(c). A third line L_3 passes through $(-4,1)$ and is parallel to L_1. Find;
The equation of line L_3 in the form $y = mx + c$ (2marks)

(d).The coordinates of point S at which L_3 intersects L_2. (3marks)

PAPER 2

SECTION 1 (50 MKS)

1. Use Mathematical tables to evaluate (4mks)

$$\sqrt[3]{\left(\frac{4.283\times0.9748}{log4.189}\right)}$$

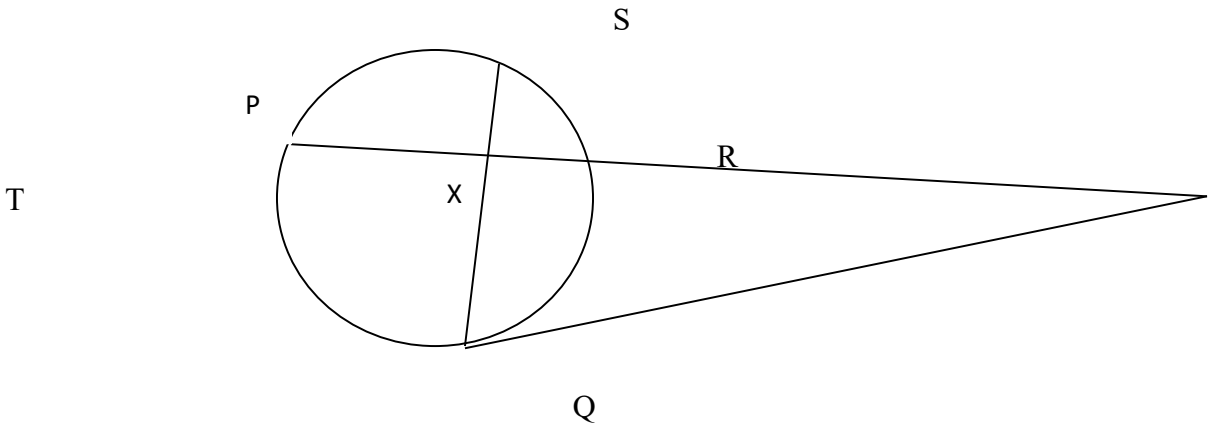
2. A student got 27 as a result of multiplying 8.8 x 2.6 by rounding off the answer to the nearest whole numbers. Calculate the percentage error that arose. (3mks)

3. Make r the subject in the formula (3mks)

$$S = \frac{rt}{\sqrt{(r^2 - t)}}$$

4. Machine A can do a piece of work in 6 hours . While machine B can do the same work in 9 hours. Machine A was set to do the work but after 3 ½ hours it broke down and machine B did the rest of the work. Find how long machine B took to do the rest of the work.

5. In the figure below QT is a tangent to a circle at Q. PXRT and QXX are straight lines PX=6cm, RT=8cm, QX=4.8cm and XS=5CM.



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a) Find the length of

i) XR (2mks)

ii) QP (2mks)

6. Express the following in surd form and simplify by rationalizing the denominator

$$\frac{1}{1 - \sin 45^0}$$ (3mks)

7. Given that Q =5m – 2n where M= $\begin{pmatrix}3\\2\end{pmatrix}$ and n = $\begin{pmatrix}4\\1\end{pmatrix}$

Find

a) Column vector Q (2mks)

b) Q' the image of Q under translation vector $\begin{pmatrix}-4\\-6\end{pmatrix}$

(1mk)

8) a) Lines NA and NB represent tangents to a circle at points A and B. use a pair of compasses and ruler only to construct the circle. Given NA=NB=6cm and <ANB = 45° (2mks)

B)Measure the radius of the circle (1mk)

9 a) Expand $(1 + 2x)^5$ up to the 4th term. (2mks)

b) Hence use the expansion to evaluate $(1.02)^5$ correct to 3 decimal places (2mks)

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10. A man invested ksh 24,000 in an account which pays 10% interest P.A . The interest is compounded quarterly. Find the amount in the account after 1 ½ years. (3mks)

11. Given that A = 3i + 2j – k , B=6i – 8j +3k and C=4A+3B find the magnitude of C. Correct to (2 sf) (3mks)

12. An equilateral triangle of sides 9cm is completely enclosed in a circle of radius rcm. Find the least value of r. (3mks)

13. Fin d the centre and radius of the circle whose equation is $X^2 + y^2 - 4y - 21 = 0$ (3mks)

14. The table below shows values of x and y for the function $y=2 \sin 3x^o$ in the range $0^o \leq X \leq 150^o$.

X^o	0	15	30	45	60	75	990	105	120	135	150
Y	0	1.4	2	1.4	0	-1.4	-2	-1.4	0	1.4	2

a) On the grid provided, draw the graph of $y=2 \sin 3x$ (2mks

b) From the graph determine the period.

15. If $4x^2 + 8x + (k-3)$ is a perfect square. Find the value of K. (2mks)

16. Find the value of X that satisfy the equation $\log(x+5) = \log_4 - \log (x + 2)$ (3mks)

SECTION 11 (50MKS)

17. Income tax for all income earned was charged at the rate shown below.

Total Income K£ p.a	Rate in Ksh per K£
1 – 1980	2
1981 – 3960	3
3961 – 6440	5
6441 – 7920	7
7921 – 9900	9

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Above 9900 10

Michael earned a salary of sh 12500 P.M In addition he was given a house allowance of sh 6550. He also gets family relief of sh 300p.m. Find

a) i) His taxable income p.a in K£ (2mks)

ii) Income tax he pays per month (6mks)

b) Apart from income tax, the following deductions are made per month
NHIF of ksh 320.
Window penson scheme 2% of gross salary.
Calculate Michael's net monthly salary (2mks)

18. The first term of an A.P is 2. The sum of the first 10 terms of the A.P is 155

i) Find the common difference of the A.P (2mks)

ii) Given that the sum of the first n terms of the A.P is 392. Find n (3mks)

b) The 3rd, 5th and 8th terms of another A.P form the first three terms of a G.P. If the common difference is 3 find

i)The first term of the G.P (3mks)

ii)The sum of the first II terms of the G.P to 4. Significant figures. (2mks)

19. A'B'C'D' is the image of ABCD under a shear parallel X-axis. D(2,4) is mapped onto D'(1,4) while A(-1,1) is mapped onto A'(1,1) if the co-ordinates of A, B, C and D are (-1, 1) (0,1) (3,4) and (2,4) respectively.

a) Draw ABCD and A'B'C'D' under shear on the grid provided and state the co-ordinates of B' and C'(3mks

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b)State the invariant line (1mk)

c)A'B'C'D' undergoes a stretch parallel to y-axis with scale factor -2 and invariant line y=3. On the same grid, draw A''B''C''D'' . (4mks)

20. A parent has two children whose age difference is 5 years twice the sum of the ages of the two children is equal to the age of the parent.

a) Taking X to be the age of the elder child, write an expression for:

i) the age of the young child (1mk)

ii) The age of the parent (1mk)

b)In twenty years time, the product of the children's ages will be 15 times the age of their parent.

i) Form an equation in X and hence determine the present possible ages of the elder child. (4mks)

ii) Find the present possible ages of the parent. (2mks)

iii) Determine the possible ages of the younger child in 20 years time. (2mks)

21. Two variables A and B are believed to be related by a law of the form $A=Mn^B+1.1$ where M and n are constants. The table below shows corresponding values of A and B

A	1.79	2.27	2.48	2.96	3.21	3.79
B	1.0	3.8	5.4	7.0	8.6	9.5

By drawing a suitable straight line graph estimate the values of M and n (10mks)

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22. In a class there are 22 girls and 35 boys. The probability of a girl completing the secondary education is 3/5 where as that of a boy is 2/3.

a)A student is picked at random from the class. Find the probability that

i) the student picked is a boy and will complete course (3mks)

ii) Student picked will complete the course (3mks)

b)Two students are picked at random. Find the probability that the student picked is a boy and a girl that both will not complete the course. (4mks)

23. The table below shows the distribution of marks scored by a group of 250 students in an exam.

Marks	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91 -100
Frequency	5	12	20	44	68	42	24	15	12	8

a) Estimate the median mark (4mks)

b(i) Using an assumed mean of 555. Calculate

i) The mean (3mks)

ii) The standard deviation (3mks)

24. a) Construct a triangle PQR such that PQ=7.5cm the ratio /_QPR: /PQR= 5:3 and /_ QRP=60^0 (3mks)

b) Construct the locus of a point S on the same side as R which moves such that its always equidistant from lines PQ and PR and produce it to intersect the locus of S at M (2mks)

c) By dropping a perpendicular from point M onto PQ at N, measure MN hence calculate the area of triangle PMQ (2mks)

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SERIES 15
PAPER 1

SECTION A.

1. Convert $2.5\dot{3}$ into improper fraction hence evaluate (3 marks)

$$\frac{2}{3}\ of\ [2.5\dot{3} \div \frac{23}{27} + -8 \times 3].$$

2. The number of students in 20 schools in a certain county were recorded as follows.

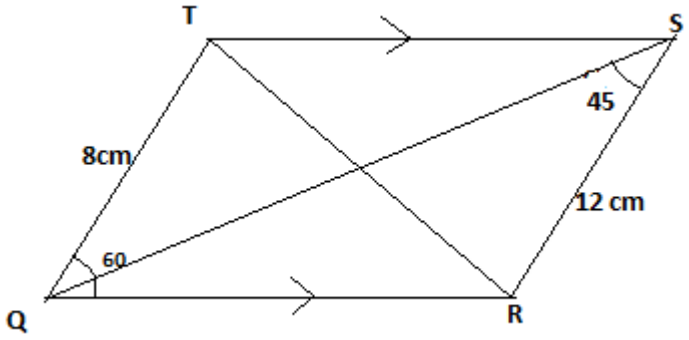
200	314	396	451	507
367	263	307	295	507
491	394	281	379	581
520	492	325	590	288

a. Complete the frequency distribution table below for the data (1 mark)

No. of students	200 - 299	300 - 399	400 - 499	500 – 599
No. of schools				

b. Find the median of the above data.(3 marks)

3. The figure below shows quadrilateral QRST in which TS is parallel to QR. QR = 7 cm, RS = 12cm, QT = 8 cm, $< TQR = 60°$ and$< RSQ = 45°$. Find the exact length of QS. (3 mks)



4. The volume of two similar cylindrical solids are $2528\ cm^3$ and $8532\ cm^3$. If the surface area of the smaller one is $176\ cm^2$, find the difference in the surface area of the two cylinders. (3 mks)

5. A regular polygon has internal angle of $150°$ and a side of length 10 cm.
   a. Find the number of sides of the polygon. (1 mark)

   b. Find the perimeter of the polygon. (1 mark)

6. Without using tables or a calculator, find the value of n if

(3 marks)

$$7^{n+1} + 7^{n-1} = 336\sqrt{7}.$$

7. When sun rays make an angle of $48°$ with the ground, the shadow cast by a vertical pole is 4 metres. How long will this shadow be when the suns angle of elevation is $38°$.

(3 mks)

8. Under shear transformation, a point A(2,2) is mapped on to $A'(2,4)$. Find the image of $B(4,3)$ under the same transformation. (4 mks)

9. Simplify $\frac{9x^2-1}{3x^2+2x-1}$ (3 marks)

10. Given that $\cos 41° \sin x° = \frac{\sqrt{5}}{3} \sin 49°$,where x is an acute angle, find without using tables and calculator;

$$\tan^2(90 - x)°$$ (3 mks)

11. Solve the inequality below and represent your answer on a number line.

$$\frac{1}{2}(5x - 4) \leq x + 5\frac{1}{2} < 3x + 1\frac{1}{2}.$$ (3 mks)

12. Use tables of cubes, reciprocals and square roots to evaluate;

$13.52^3 - \frac{(-5)}{\sqrt{0.0512}}$ (3 mks)

13. Use the rates below to answer this question.

	Buying in ksh	Selling in Ksh
1 US dollar	103.00	103.40
1 UK pound	125.30	125.95

A tourist arrived in Kenya from Britain with 9,600 UK pounds. He converted the whole amount to Kenya shillings. While in Kenya he spent 75% of this money and changed the balance to US dollars. Calculate the amount of money to the nearest US dollar that he received. (3 mks)

14. Given that $P(-3,9)$ and $Q(4,2)$, find the coordinates of R if $OR = OQ + \frac{2}{3}0P$ hence the distance of R from the origin correct to 3 significant figures. (3 mks)

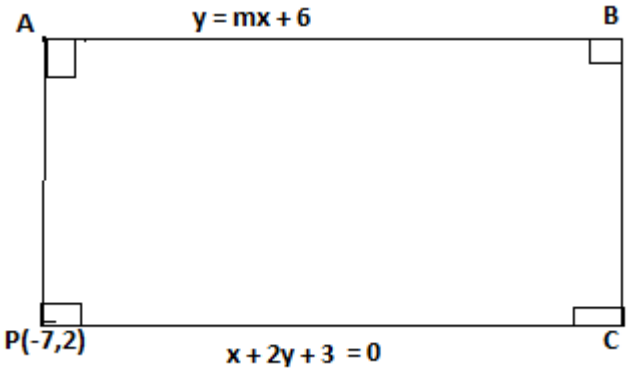
15. The equation of a curve is $y = -x^2 + 3x$. Estimate the area bounded by the curve , the lines $x = 0, x = 5\ and\ x\ axis$ using trapezium rule with 7 ordinates. (3 marks)

16. A line AB = 4.6cm is a side of a trapezium ABCD in which $< ABC = 105°, BC = 4cm, CD = 4cm$ and CD $//$ AB. Use a ruler ,a pair of compass only.
    a. Construct the trapezium ABCD.(3 mks)

    b. Locate a point T on AB such that $< ATP = 90°$.(1 mk)

SECTION B

17. The figure below shows rectangle ABCD. Use it to;



a. State the value of m and the x-intercept of line DC . (2 mks)

b. Determine ;

i. The equation of side AD in double intercept form. (3 mks)

ii. The coordinates of the vertices A,B,C.(3mks)

iii. The area of the triangle.(2 mks)

18. A train starts from rest and accelerates uniformly for a few minutes then attains its maximum speed of 90km/h. It maintains this speed for 4 minutes after which it flagged down and decelerates uniformly coming to rest. If it covered a total distance of 12km.
    a. Sketch a speed time graph to show a trains journey.(2 mks)

    b. Find the total time taken for the train to recover the whole journey. (3 mks)

    c. If the train was moving with the acceleration of 180km/h, calculate the time taken to cover this maximum speed.

    d. Calculate the time taken to cover the half of the journey. (3 mks)

19. Netia bought 7 exercise books 9 graph books from a shop A at a total cost of sh890. If she has bought 11 books and 8 graph books , he would have paid sh 140 more.
    a. Form two simultaneous equations to represent the information above.(2 mks)

    b. Using matrix method, find the price of each exercise book and a graph book that he bought.(5 mks)

    c. The price of an exercise book at shop B is 18% cheaper and that of a graph book is 5% higher than in shop A. How much would he save if he had shopped at shop B. (3 mks)

20. The boundaries PQ, QR, RT, TV and VP of an animal conservancy are straight lines such that Q is 65km on a bearing of $N48°W$ from P. R is directly south of Q and on a bearing of $120°$ from P. Point Q is 58 km on a bearing of $S50°W$ of R.
    a. Using a scale of 1cm to represent 10km, show the above information in a scale drawing. (4 mks)

    b. From the scale drawing, determine;
        i. The distance in km of PT.(1 mk)

        ii. The bearing of T from Q . (1 mk)

    c. If the points P,Q ,R, and T are the vertices of a quadrilateral PQRT which represents the area reserved for endangered species, determine this area in hectares.(4 mks)

21. Three solids, a cylinder, a sphere and a cone are such that their radii are equal. It is also given that their surface area are equal. If the volume of the sphere is $310.464\,cm^3$, find the ;

a. Radius of the sphere.(2 mks)

b. Volume of the cylinder.(3 mks)

c. Volume of the cone.(3 mks)

d. Curved surface area of the cylinder.(2 mks)

22.

a. On the grid procided below, draw quadrilateral ABCD whose vertices are at $A(2,0), B(1,3), C(5,-1) and\ D(1,-2)$(1 mk)



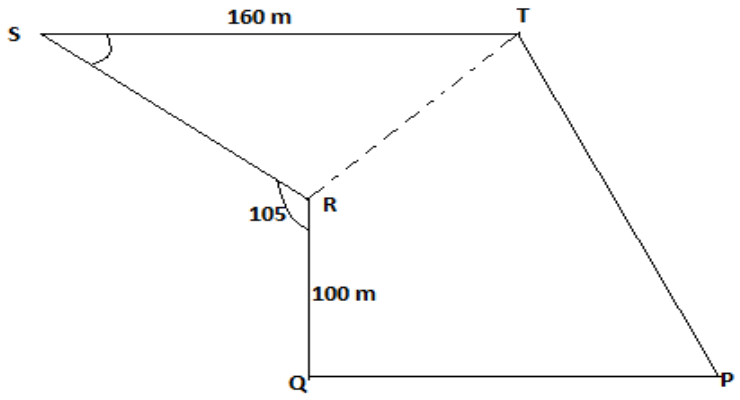
b. On the same axes , draw A'B'C'D', the image of ABCD under a translation represented by vector $T = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$. (2 mks)

c. Draw the quadrilateral $A''B''C''D''$ the image of A′B′C′D′ under a reflection in the line $y + x = 0$ on the same axes. State the coordinates of A"B"C"D". (3 mks)

d. $A'''B'''C'''D'''$ with vertices $A'''(-2,5), B'''(4,3), C'''(2,11), D'''(-6,3)$ is the image of $A''B''C''D''$ under the transformation X. Draw $A'''B'''C'''D'''$ and describe X fully. (3 marks)

e. State the type of congruency between quadrilateral ABCD and $A''B''C''D''$.(1 mk)

23. The figure below represents a piece of land in the shape of an irregular pentagon in which PQ= 240m, QR = 100m, ST = 160 m, obtuse angle QRS = 105°. $< TRS = 90°$ and $< RST = 60°$.



Calculate;

a. The size of $< QPR$ correct to 2 d.p. (2 mks)

b. The length TP correct to 1 dp. (4 mks)

c. The area of the piece of land in hectares correct to 2 d.p. (4 mks)

24. The equation of a curve is given as $y = 2x^3 - \frac{9}{2}x^2 - 5x + 3$.

a. Find

i. The value of y when x = 2. (2 mks)

ii. The equation of the tangent to the curve when x = 2. (4 mks)

b. Determine the turning points of the curve and their nature. (4 mks)

SECTION I (50 Marks)

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

1. Express $\tan 60^\circ$ in surd form, hence evaluate $\dfrac{3}{1-\tan 60^\circ}$ leaving your answer in the form $a+b\sqrt{c}$ (3 marks)

Where a , b and c are integers

2. Without using mathematical tables or calculator, evaluate; $\dfrac{\log 625+\log 25}{\log 15625-\log 125}$. (3 marks)

3. The radius of a circle was corrected to 1 decimal place as 3.5 cm. Taking $\pi = \dfrac{22}{7}$, find; .

(a) the maximum absolute error in the area of the circle. (2 mark)

(b) the percentage error in calculating the area of the circle. (2 marks)

4. Find the value of θ in the equation $\tan(2\theta + 15) = \frac{\sqrt{3}}{-1}$ where θ is obtuse angle.

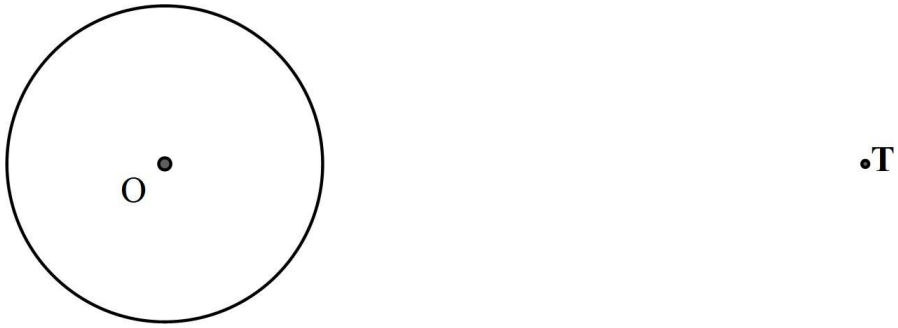
(3 marks)

5. In January 2018, the population of a county was 50, 000. It is estimated that the population increases at a compound rate of 5% every three months.Find the approximate population of the town in January 2023. (2 marks)

6. 343 small black cubes are arranged to form one large cube. The sides of the large cube are then painted red, the cubes are then dismantled and one of the small cubes picked at random.

Find the probability that the cube picked has two of its sides painted red. (3 marks)

7. The figure below shows a circle centre O with a point **T** outside the circle.

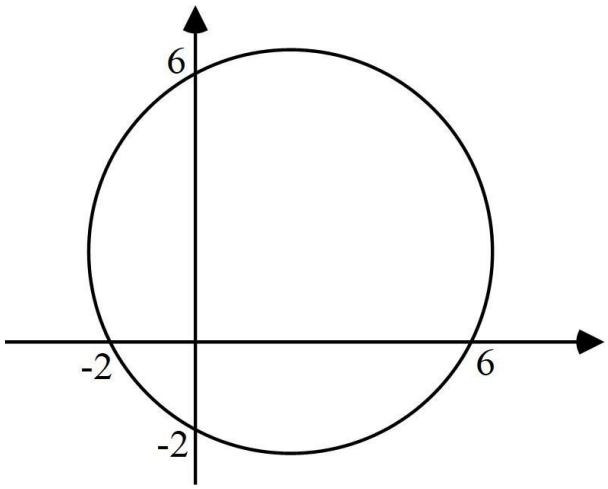


Construct a tangent to the circle passing through **T** and state its length (3 marks)

8. Simplify; $(a+3b)^5 - (a-3b)^5$. (3 marks)

9. The position vectors of points A, B and C are $2\mathbf{i}+5\mathbf{j}-3\mathbf{k}$, $7\mathbf{i}+8\mathbf{j}+4\mathbf{k}$ and $\mathbf{5i+6.8j+1.2k}$ respectively. Show that points A, B and C are collinear. (3 marks)

10. The circle shown below cuts x – axis at $(-2, 0)$ and $(6, 0)$. It also cuts y – axis at $(0, -2)$ and $(0, 6)$



Determine the;

(a) (i) the coordinates of the centre: (1 mark)

(ii) radius of the circle in surd form. (1 mark)

(b) equation of the circle in the form $x^2 + y^2 + ax + by = c$ where a, b and c are constants. (2 marks)

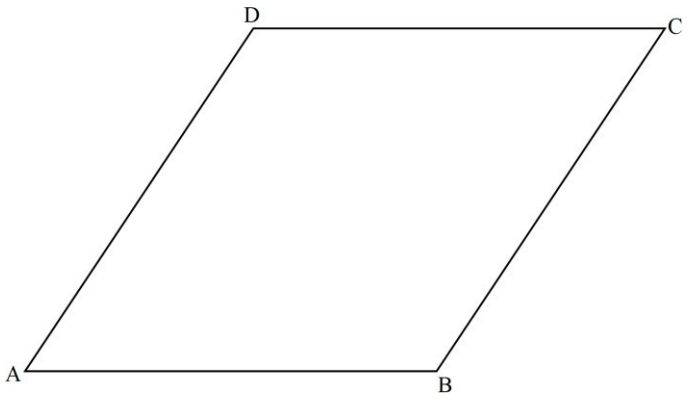
11. Two quantities P and Q are such that P varies partly as Q and partly as the inverse of Q. When Q = 1, P = -1 and when Q =3, P = 5. Express P in terms Q. (4 marks)

12. Given the function; $y = \frac{\sqrt[3]{x}}{z + r^2}$.

(a) Find the exact value of y given that when $x = 343$, $z = 0.5$ and $r = -2$ (1 mark)

(b) Make *r* the subject of the formula in the function above. (2 marks)

13. The figure below shows a rhombus ABCD.



(a) Construct the locus of points P equidistant from points AB and DC (1 mark)

(b) Shade a region Q within the rhombus such that $AQ \leq 4$ cm and Q is nearer to AB than DC. (2 marks)

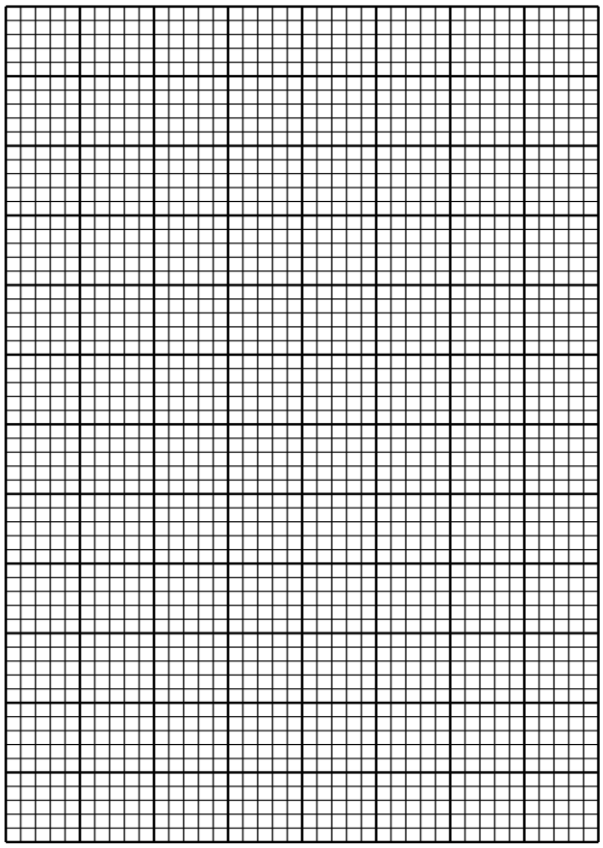
14. Given that $\int_{n}^{2} (5x - 12)\, dx = -4.5$, find the exact value of *n*. (3 marks)

15. A train pulls x full wagons and y full coaches. Eeach wagon can hold 72 kg of goods while each coach can hold 60 passengers. One kg of goods is charged ksh 200 and a passenger is charged ksh 75. The total number of coaches and wagons should be less than15.The train must pull atleast three more wagons than coaches. The total amount of money collected must exceed ksh 540,000 .Form all the linear inequalities in x and y to represent the above information (3 marks)

16. The table below shows values of A and B.

A	1	2	3	4	5	6
B	0.1	0.3	0.5	0.7	1.0	1.0

(a) On the grid provided, draw line of best fit for B against A. (3 marks)



SECTION II (50 Marks)

*Answer **any five** questions from this section in the spaces provided.*

17. Kisumu University has a water reservoir at Yala cumpas constructed in the form of a conical frustum measuring 0.3 m deep,with base and top radii as 7m and 3.5m respectively to serve a number of students in the compass

(a) Determine the capacity of the reservoir in litres. (2 marks)

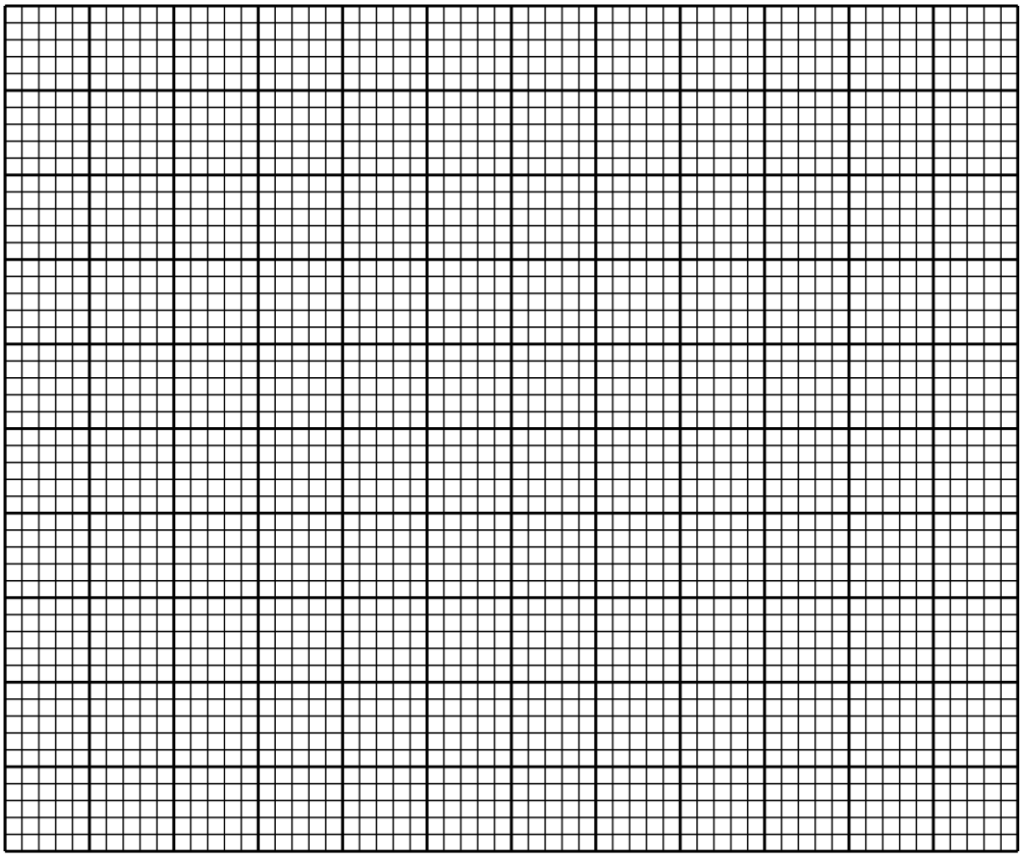
(b) Each student uses an average of 140 litres per day. The reservoir tank can last the students $3\frac{1}{2}$ days. All the students used the water for 3 days after which water supply was disconnected for 35 students. Determine the number of days the remaining water will last the remaining students. (5 marks)

(c) An inlet pipe of diameter 7.7cm fills the tank at rate of 6 m/s. Starting with the tank when empty, find the time it takes to completely fill the tank. Give your answer in exact minutes. (3 marks)

18. (a) Given that $y = 8\sin(2x-10) - 6\cos(2x-10)$, complete the table below for missing values of y, correct to 1 decimal place. (2 marks)

X	0	15	30	45	60	75	90	105	120
Y	−7.3	−2.9							

(b) On the grid provided below, draw the graph of $y = 8\sin(2x-10) - 6\cos(x-10)$ for $0^\circ \le x \le 120^\circ$.
Take scale: 1 cm for 15° on the x – axis
1 cm for 2 units on the y – axis. (4 marks)



(c) Use the graph to estimate:

(i) The maximum value of y; (1 mark)

(ii) The value of x for which (3 marks)
$4\sin(2x-10) = 3\cos(2x-10) = 1$

19. The table below shows masses of 50 patients attending a clinic on a certain day

52	61	53	62	60	60	63	74	58	66
62	64	72	16	89	77	84	70	57	44
54	75	67	81	71	55	56	93	76	68
42	23	41	40	72	35	69	43	20	46
73	33	52	37	29	53	48	50	51	27

(a) Starting with the mark of 15 as the lower class limit and using equal class size of 10 of 10, make a frequency; prepare a frequency distribution table. (2 marks)
.prepare a

;

(b) Using an assumed mean of 59.5, calculate;

(i) the mean mark. (3 marks)

(ii) the standard deviation. (3 marks)

(c) If each mark is increased by 2, write down:

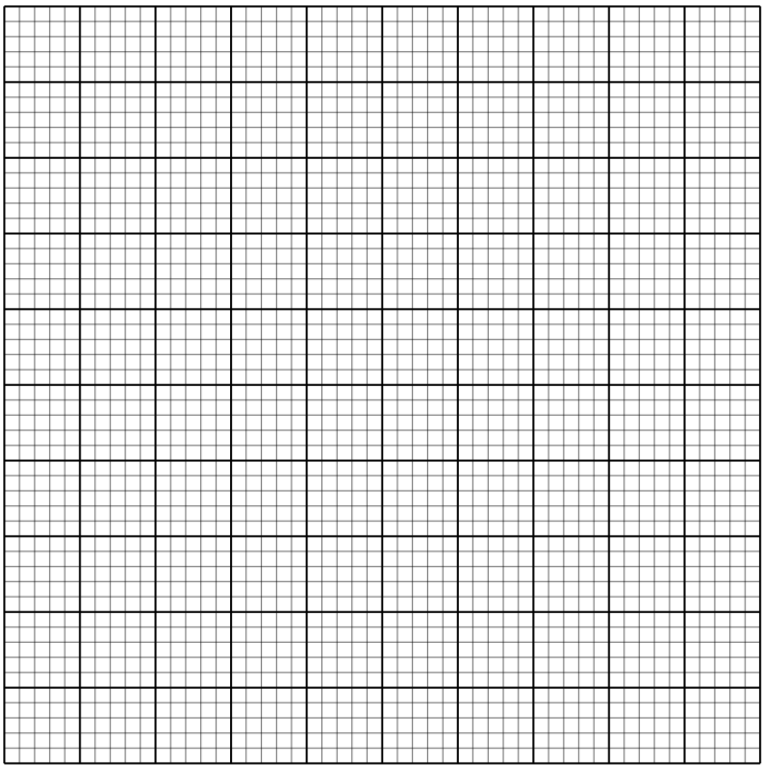
(i) the new mean mark. (1 mark)

(ii) new standard deviation. (1 mark)

20. The coordinates of a parallelogram ABCD are $A(1, -3)$, $B(n, \mu)$, $C(4, 1)$ and $D(3, 1)$

.

(a) On the grid provided, draw the parallelogram ABCD. (2 marks)



(b) Parallelogram ABCD is transformed under the transformation represented by the matrix $\mathbf{T} = \begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$

(i) Find the coordinates of A'B'C'D'. (2 marks)

(ii) On the same axes, draw A'B'C'D'. (1 mark)

(c) Find the area of the parallelogram A'B'C'D' if the area of ABCD is 12 square units. (3 marks)

(d) Find the matrix of transformation that maps A'B'C'D' onto ABCD. (2 marks)

21. The table below shows income tax rates for the year 2022.

Taxable income per month *(Kshs)*	**Tax rate in %**
1 – 4720	10
4721 – 9220	15
9441 – 13720	20
14161 – 18220	25
18221 and above	30

A tax relief of Kshss.1162 per month was allowed. In a certain month of that year, an employees' income tax in the fifth band was Kshs.1215.

(a) Calculate;

(i) The employee's total taxable income in that month. (3 marks)

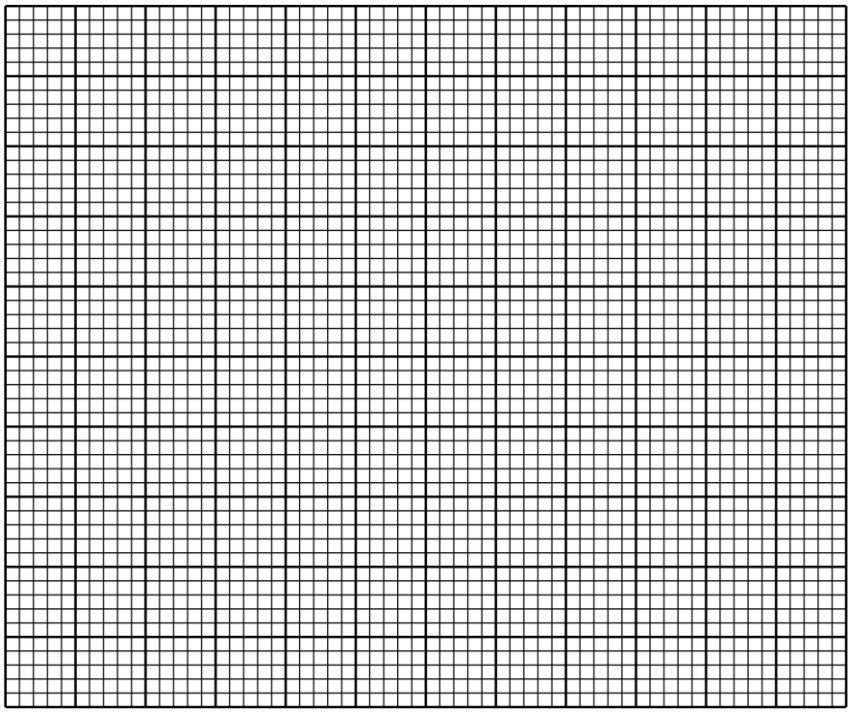
(ii) The tax payable by the employee in that month. (3 marks)

(b) The employee's other deductions include 5% of gross income as non taxable pension contribution. Calculate the employee's net monthly salary. (4 marks)

22. A quadratic equation $y = Ax^2 + Bx + k$ cuts the x – axis at the points $(-2, 0)$ and $(4, 0)$, and cuts the y – axis at the point $(0,8)$.

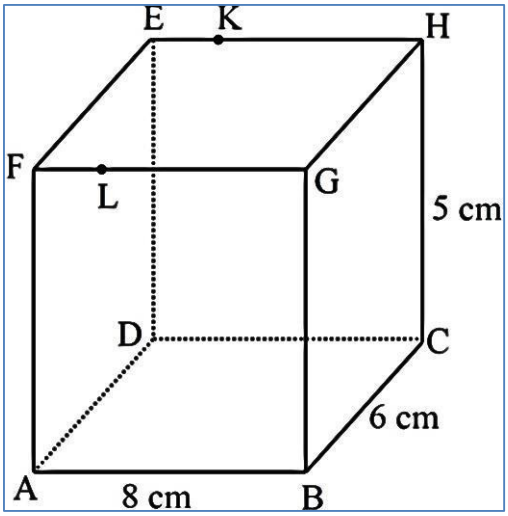
(a) Determine the values of A, B and k. (3 marks)

(b) On the grid provided below, draw the graph of $y = Ax^2 + Bx + k$ for $-3 \leq x \leq 5$.
(4 marks)



(c) Using the graph in (b) above, find the solution to the equation $x^2 - 4x - 5 = 0$.
(3 marks)

23. The figure below shows a cuboid ABCDEFGH with AB = 8 cm, BC = 6 cm and



CH = 5 cm while O is the centre of the base.

Calculate to one decimal place:

(a) the length BE; (2 marks)

(b) the angle between BE and plane ABCD; (2 marks)

(c) the angle between planes ADKL and BCKL given that points K and L divides EH and FG respectively in the ratio 1:3. (4 marks)

(d) the angle between lines OE and OH (2 marks)

24. The first term of an arithmetic progression is m and the common defference is n.The 14th term of the A.P is 11. The sum of the first 12 terms of the A.P is 123.

(a) (i) form two simplified equations involving m and n to represent the above information (2 marks)

(ii)find the values of m and n (3 marks)

(b) The 4th , 24th and 48th terms of the A.P form the 1st three consexetive terms of a geometric progression .culculate

(i) The exact 6th term of the G.P

(3 marks)

(ii) The exact sum of the first 6 terms of the G.P (2 marks)

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SERIES 16

PAPER 1

Answer **ALL** questions in this section

1. Find the LCM of $a^2 - ab - 2b^2$ and $a + b$ Hence simplify $\frac{3a}{a^2-ab-2b^2} - \frac{3}{a+b}$

(3 marks)

2. Use the tables of squares, square roots, reciprocals and cubes to evaluate: (3 marks)

$$\sqrt[3]{((45.54)^2 + \frac{30}{\sqrt{0.248}})}$$

3. Solve for y in the equation $\frac{x+2}{-2} = -\frac{1}{4}(4x + 4) + \frac{3x-4}{-2}$ (3 marks)

4. Solve for x in $\frac{1}{4} \times 2^{(-3x)2} - 2 = 0$ (3 marks)

5. Draw the net of a solid consisting of a cube of sides $4\ cm$ and a pyramid of slanting height $3.5\ cm$ at the top. (3 marks)

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6. Without using mathematical tables or calculator evaluate: (4 marks)

$$\sqrt[3]{\frac{0.4 \times 1.28}{0.0608 + 0.0032}}$$

7. In a certain committee, the ratio of men and women is 4:3. If 20 men pulled out, the new ratio of men to women is 2:3. Find the number of the committee members.

(3 marks)

8. The exterior angle of a regular polygon is equal to one third of its corresponding interior angle. Calculate the sum of interior angles of the polygon. (3 marks)

9. A salesperson is paid commission at a rate of 2% on goods above Ksh 30,000 and 3% on goods above Ksh 100,000. He is also paid a basic fee of Ksh 2,000 per month on goods worth 30,000. In the month of January, he sold goods worth Ksh 175,000. Calculate his earnings that month. (3 marks)

10. The masses of two similar cans are 6.4kg and 12,500g respectively. If the total surface are of the smaller can is 144cm^2. Determine the surface area of the larger can.

(3 marks)

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11. Given that $\boldsymbol{P} = 3\boldsymbol{a} + 2\boldsymbol{b}$ such that $\boldsymbol{a} = \begin{pmatrix}4\\1\end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix}5\\6\end{pmatrix}$ Find;

(a) the column vector **P** (2 marks)

(b) P^1 the image of P under translation vector $\begin{pmatrix}-9\\3\end{pmatrix}$ (1 mark)

12. Using a ruler and a pair of compasses only, construct a trapezium ABCD in which AB = 8 cm, AD = 5.5 cm, angle DAB = 52.5^0, angle ABC = 67.5^0 and AB is parallel to DC. Measure the shortest distance between the two parallel sides of the trapezium.

(4 marks)

13. Solve the inequality $4x - 3 \leq 6x + 1 < 3x + 16$ and hence represent the solution on the number line. (3 marks)

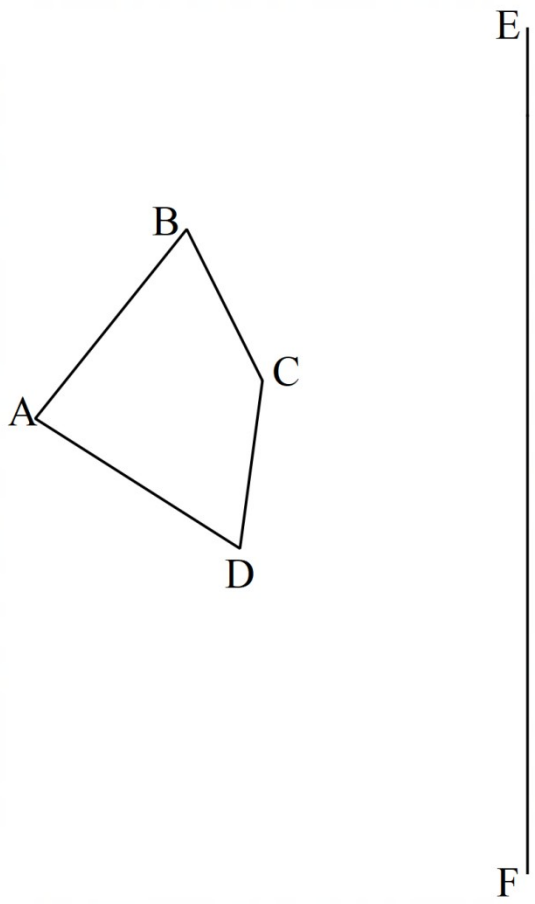
14. Simplify the expression $\frac{2x^2 - 3xy - 2y^2}{4x^{2-y^2}}$ (3 marks)

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15. A cylindrical container holds $800g$ of substance whose density is $0.8g/cm^3$. The container has a height of $15\ cm$. Find the radius of the container to one decimal place.

(3 marks)

16. The figure below shows a quadrilateral ABCD and mirror line EF.



(a) Draw a quadrilateral A'B'C'D', the image of ABCD, under a reflection in the mirror EF. (2 marks)

(b) State the type of congruency between ABCD and A'B'C'D'. (1 mark)

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SECTION II (50 MARKS)

Answer any **FIVE** questions in this section

17. **(a)** A point $Q(-1,4)$ is reflected in the line $y = 2x + 4$. Find the coordinates of Q' the image of Q. (4 marks)

(b) A translation vector T maps point $R(-4,2)$ onto $R'(-1,-2)$. Given that, T maps triangle ABC onto $A'(-1,2), B'(2,0)$ and $C'(4,3)$. Find the vector position of **A, B** and **C** in terms of $\boldsymbol{i}$ and $\boldsymbol{j}$. (3 marks)

(c) A point $M(-3,4)$ is mapped onto $M'(12,-18)$ under an enlargement scale factor of -2. By calculation, find the centre of enlargement. (3 marks)

18. Four towns **P, Q, R** and **S** are such that **Q** is $162km$ on a bearing of $\mathrm{S}36^0\mathrm{E}$ from **P** while Q is $98km$ on a bearing of 055^0 from **R.** Town **S** is due west of town **R** and on a bearing of 220^0 from town **P.**

(a) Using a scale of $1\ cm\ to\ represent\ 20\ km$, show the above information in a scale drawing. (4 marks)

(b) From the scale drawing determine:

(i) The distance, in kilometres, of **S** and **P** (2 marks)

(ii) The bearing of **P** from **R.** (2 marks)

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(c) Determine the perimeter of the map in (a) above. (2 marks)

19. A Sacho High School van left Sacho at 7:40 am for MOKASA first setters meeting at Moi Girls Eldoret travelling at an average speed of $51km/h$. On the same day, Moi High School Kabarak van left Kabarak for the same meeting travelling at a speed of $75km/h$. The two vans arrived in Moi Girls Eldoret at the same time.

(a) Given that the distance covered by Sacho Van is $31\ km$ less than Kabarak Van and the total distance covered by the two vans to Moi Girls is 269km.

(i) Calculate the distance covered by each of the van to Moi Girls Eldoret. (4 marks)

(ii) Calculate the time Moi High School Kabarak van left Kabarak. (2 marks)

(b) After $5\frac{1}{4}\ hours$ from the time of arrival the meeting ended. Moi High School Kabarak van left for Kabarak at a speed of$80km/h$. After $45\ minutes$, another personal car left Moi Girls Eldoret for Kabarak and overtook Moi High School Kabarak van at $4{:}\ 50\ pm$. Calculate the speed of the personal car. (4 marks)

20. **(a)** Given that matrix $A = \begin{pmatrix} 1 & 1 \\ 3 & 4 \end{pmatrix}$, find A^{-1} the inverse of A. (2 marks)

(b) Ogunde is at a café buying drinks for his friends. Some of them want coffee while others want tea. At this particular café, take away tea and coffee cost Ksh. 300 and Ksh. 400 respectively. If he buys 7 drinks for a total of Ksh 2,600;

(i) Form simultaneous equations to represent this information. (2 marks)

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(ii) Using A^{-1} in (a) above, solve the simultaneous equations in (i) using matrix method. (3 marks)

(c) Ogunde later came back to buy 3 cans of tea and 2 cans of coffee at discounted prices of 10% and 5% respectively. Calculate the total cost of this purchase. (3 marks)

21. A straight line L_1 passes through points $P(2,5)$ and $Q(-3,3)$.

(a) Find the equation of the line L_2 which is perpendicular to the line L_1 and passes through the $x-intercept$ of $\frac{5}{2}y - 2x - 4 = 0$. Giving your answer in the form $ax + by + c = 0$. (4 marks)

(b) Another line L_3 is parallel to the line L_2 and passes through the point of intersection of lines $x - 2y = 0$ and $3x - 5y = -3$. Find the equation of the L_3 in the form $y = mx + c$. (4 marks)

(c) Find the angle in which L_1 makes with y-axis. Give your answer to 4 s.f. (2 marks)

22. The marks scored in test by 40 students were recorded as follows:

35 85 50 55 45 52 40 73 60 41

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71 63 32 67 45 51 66 52 74 53

78 62 47 65 53 56 51 45 48 63

89 35 54 68 45 50 64 37 58 69

(a) Starting with 30 and using a class size of 10, prepare a frequency distribution table for the data (2 marks)

(b) Using the frequency distribution table in (a) above, calculate the estimate of

(i) the mean mark. (2 marks)

(ii) the median mark. (3 marks)

(c) On the same axes, draw the histogram representing the above data (3 marks)

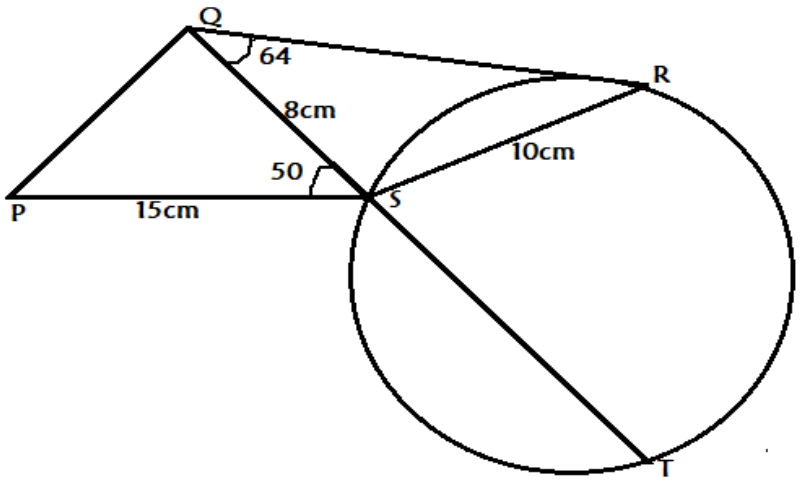
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23. There is a certain solid used in Sacho High School having a shape of square-based pyramid frustum whose top is a plane parallel to its base and slant length of $9\,cm$. Given that the top square is of side $8\,cm$ while the base square is of side $12\,cm$.

(a) Find the surface area of the frustum. (5 marks)

(b) Volume of the material used to make the frustum. (5 marks)

24. The figure below shows a quadrilateral PQRS and circle passing through points S and R. Given that QR is a tangent line to the circle at point R, $PS = 15\,cm$, $QS = 8cm$ $SR = 10cm$ and $angle\ PSQ = 50^0\ and\ angle\ SQR = 64^0$



Find, correct to 4 significant figures:

(a) the length PQ; (3 marks)

(b) the angle QSR; (2 marks)

(c) the length of the chord QT; (2 marks)

(d) the area between the chord SR and the arc SR; (3 marks)

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PAPER 2

SECTION I (50 MARKS)

Answer **ALL** questions in this section

1. If $6.1 \leq x \leq 8.2$ and $2.2 \leq y \leq 3.9$ find the minimum value of $\frac{2x+y}{-y+x}$ *(2 marks)*

2. Solve for k in $(\log_3 k)^2 - \log_3 k^{0.5} - 1.5 = 0$ *(3 marks)*

3. Make t the subject of the formula in $M = \frac{2}{3P}\sqrt{\frac{F}{2K-t}}$ *(3 marks)*

4. Three 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 increases by 5% when Y decreases by 45% *(4 marks)*

5. Solve the equation $2cos^2 x + cos\, x - 1 = 0$, where $0 \leq x \leq 360$ *(4 marks)*

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6. The roots of a quadratic equation are $\frac{2}{3}$ and $\frac{-1}{5}$ respectively. Express the equation in the form $ax^2 + bx + c = 0$ where a, b and c are integral values. *(3 marks)*

7. Simplify the expression below by rationalizing the denominator.

$$\frac{2}{2-\sqrt{3}}$$ *(2 marks)*

8. The marked price of a dining set is Ksh 22,800. The hire purchase value of the set is 35% more than the marked price. Rop bought the dining set by paying a deposit of Ksh 8,580 followed by monthly installments of Ksh 1,850 each. Calculate the monthly rate of interest. *(4 marks)*

9. Kamau started working for a company where he earned K£8,640 per annum during the first year. He recorded an increment of K£900 every year. Calculate the total amount he earned in the first 8 years. *(3 marks)*

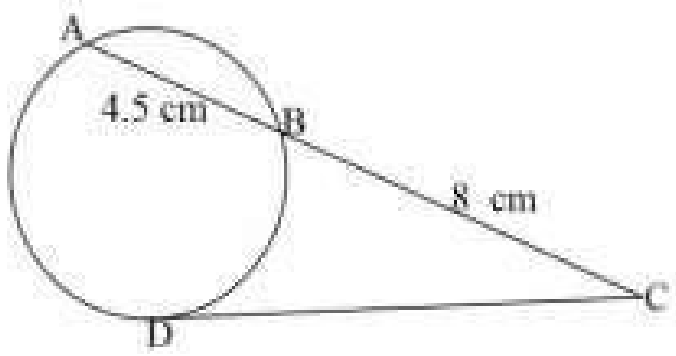
10. Points A and B have the coordinates (3, -2, 1) and (4, 1, -3) respectively. Express the column vector **AB** in terms of **i**, **j** and **k**. *(2 marks)*

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11. A triangle ABC whose area is 15.3cm^2 mapped onto ΔA'B'C' by transformation whose matrix is M = $\begin{pmatrix} 3 & -2 \\ -1 & 2 \end{pmatrix}$ find the area of ΔA'B'C'. *(2 marks)*

12. Calculate the mean absolute deviation of the set of data below: *(3 marks)*
1, 6, 4, 7, 3, 8, 4, 6, 5, 2

13. In the figure below the tangent DC meets the chord AB produced at C. $AB = 4.5cm$ and $BC = 8\ cm$. Calculate the length of DC. *(2 marks)*



14. Grade A rice costing Ksh 250 per kg is mixed with Grade B rice costing ksh. 180 per kg. In what ratio must we mix Grade A to Grade B so that a profit of 20% is realized by selling the blend at Ksh 240 per kg. *(3 marks)*

15. Points with coordinates (6, 2) and (-2, - 4) are the ends of a diameter of a circle centre O. Find the equation of the circle, expressing it in the form $x^2 + y^2 + ax + by + c = 0$ where a, b and c are constants. *(4 marks)*

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16. ***(a)*** Expand $(3 + x)^5$ in ascending powers of x up to the term in x^3. *(1 mark)*

(a) Use the expansion in (a) above to approximate the value of $(3.02)^5$ correct to 4 decimal places. *(3 marks)*

SECTION II (50 MARKS)

*Answer any **FIVE** questions in this section*

17. ***(a)*** Using a ruler and pair of compasses only, construct triangle ABC in which $AB = 7.5\ cm,\ BC = 5.3\ cm$ and angle $ABC = 60^0$. Measure AC *(3 marks)*

(b) On same side of **AB** as **C,** construct the locus of points **P** such that angle $APC = 60^0$. *(3 marks)*

(c) Construct the locus of points **R** such that $\boldsymbol{AR} = 3.0\ cm$. *(2 marks)*

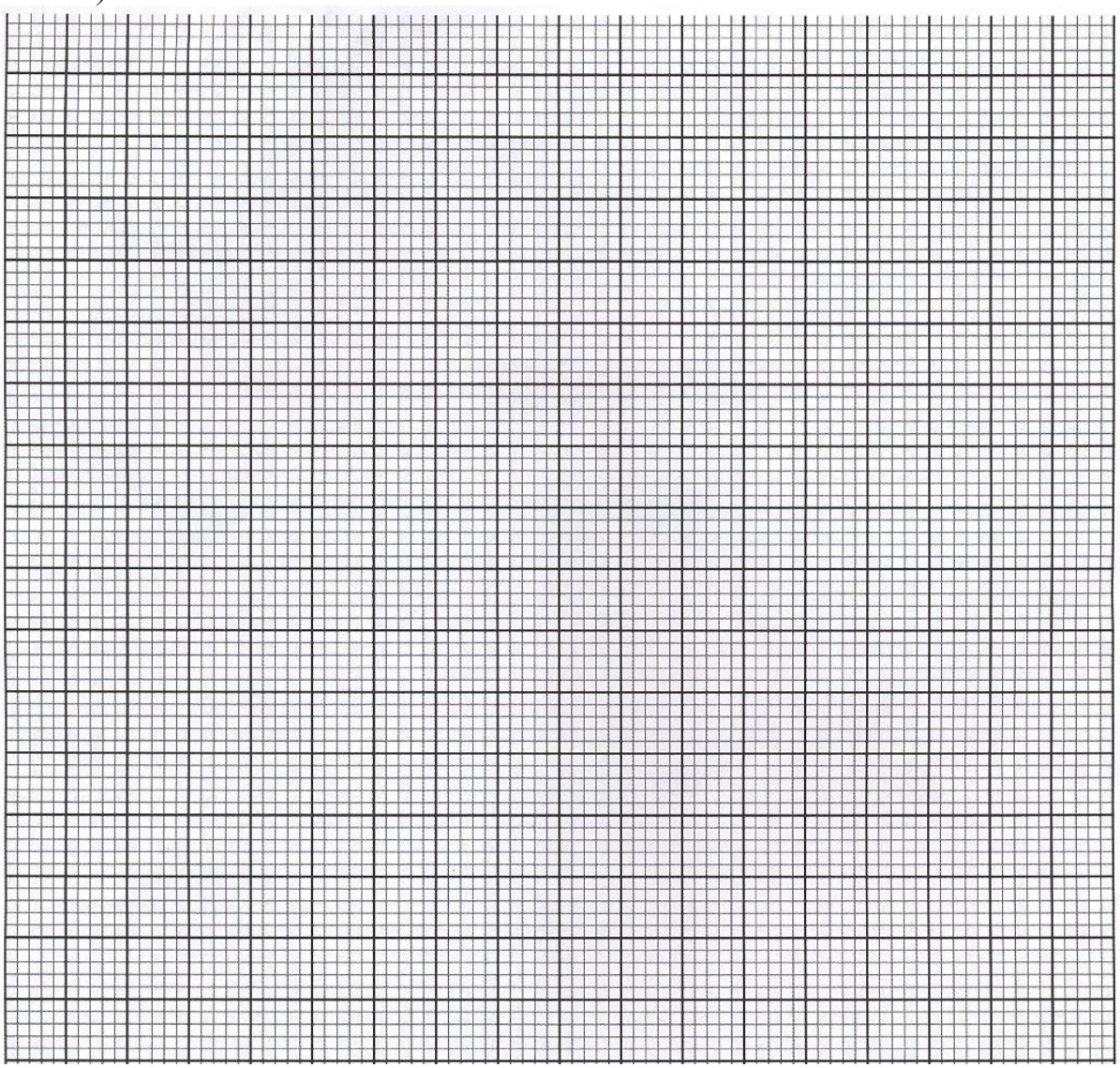
(d) Mark point T where locus P and locus R intersect. Hence, Construct locus Q equidistant from line AC and pass through point T. *(2 marks)*

18. The following table show the distribution of masses to the nearest kilogram of 80 animals in a certain farm.

Mass Kg	26-30	31-35	36-40	41-45	46-50	51-55
frequency	12	15	22	18	8	5

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(a) On the grid provided, draw a cumulative frequency curve for the given information. *(4 marks)*



(b) Using the graph in (a) above, estimate:

(i) the quartile deviation *(2 marks)*

(ii) the number of animals whose mass is at least 38 kg. *(2 marks)*

(iii) the range of masses obtained by the middle 60% of the animals. *(2 marks)*

19. The table below show the income tax rates for a certain year.

Taxable income (K£) per annum	Rate (Ksh per K£)
1 – 1500	2
1501 – 3000	3
3001 – 4500	5

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4501 - 6000	7
6001 – 7500	9
Over 7500	10

During the year, Ken's monthly income was as follows: Basic Salary Ksh. 12,500, Commuter allowance Ksh.2,620, House allowance Ksh. 1,500, Hardship allowance 30% of the basic salary. Ken is entitled to a tax relief of Ksh 1,460 per month. He pays a taxable housing levy which is 1.5% of his basic salary. He also contributes Ksh. 800 monthly towards his pension scheme. This contribution is exempted from taxation. Calculate:

(a) Ken's annual taxable income in K£. *(2 marks)*

(b) The monthly tax payable by Ken in Ksh. *(6 marks)*

(c) From his salary, the following deductions were also made every month;
NHIF Ksh 500, NSSF Ksh 720, SACCO shares Ksh 1,500. Calculate Ken's net salary per month in Ksh. *(2 marks)*

20. A team of 3 form four students are chosen from a group of 12, to represent the school in a math contest. The students comprise of five girls and seven boys.

(a) Draw a probability tree diagram to represent the possible outcome. *(2 marks)*

(b) Use the tree diagram above to calculate the:

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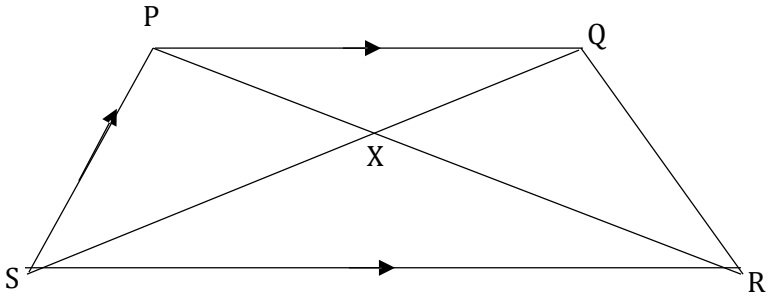
(i) Probability that all the three students are of the same gender. *(2 marks)*

(ii) Probability that there is at most two girls. *(2 marks)*

(iii) Probability that there are more boys than girls. *(2 marks)*

(iv) Probability that two boys are chosen first before a girl or two girls first before a boy. *(2 marks)*

21. In the figure below, PQRS is a trapezium, PQ is parallel to SR. Diagonals PR and SQ intersect at X and $\boldsymbol{PQ} = \frac{1}{2}\boldsymbol{SR}$, $\boldsymbol{PQ} = \boldsymbol{q}$ and $\boldsymbol{SP} = \boldsymbol{p}$. Given further that, $\boldsymbol{PX} = k\boldsymbol{PR}$ and $\boldsymbol{SX} = h\boldsymbol{SQ}$, where h and k are constants.



(a) Find in terms of $\boldsymbol{p}$ and $\boldsymbol{q}$, the vectors:

$\boldsymbol{QR}$ *(1 mark)*

(b) Find in terms of $\boldsymbol{p}$, $\boldsymbol{q}$ h *and* k, the vectors:

(i) $\boldsymbol{PX}$ *(2 marks)*

(ii) **SX** *(1 mark)*

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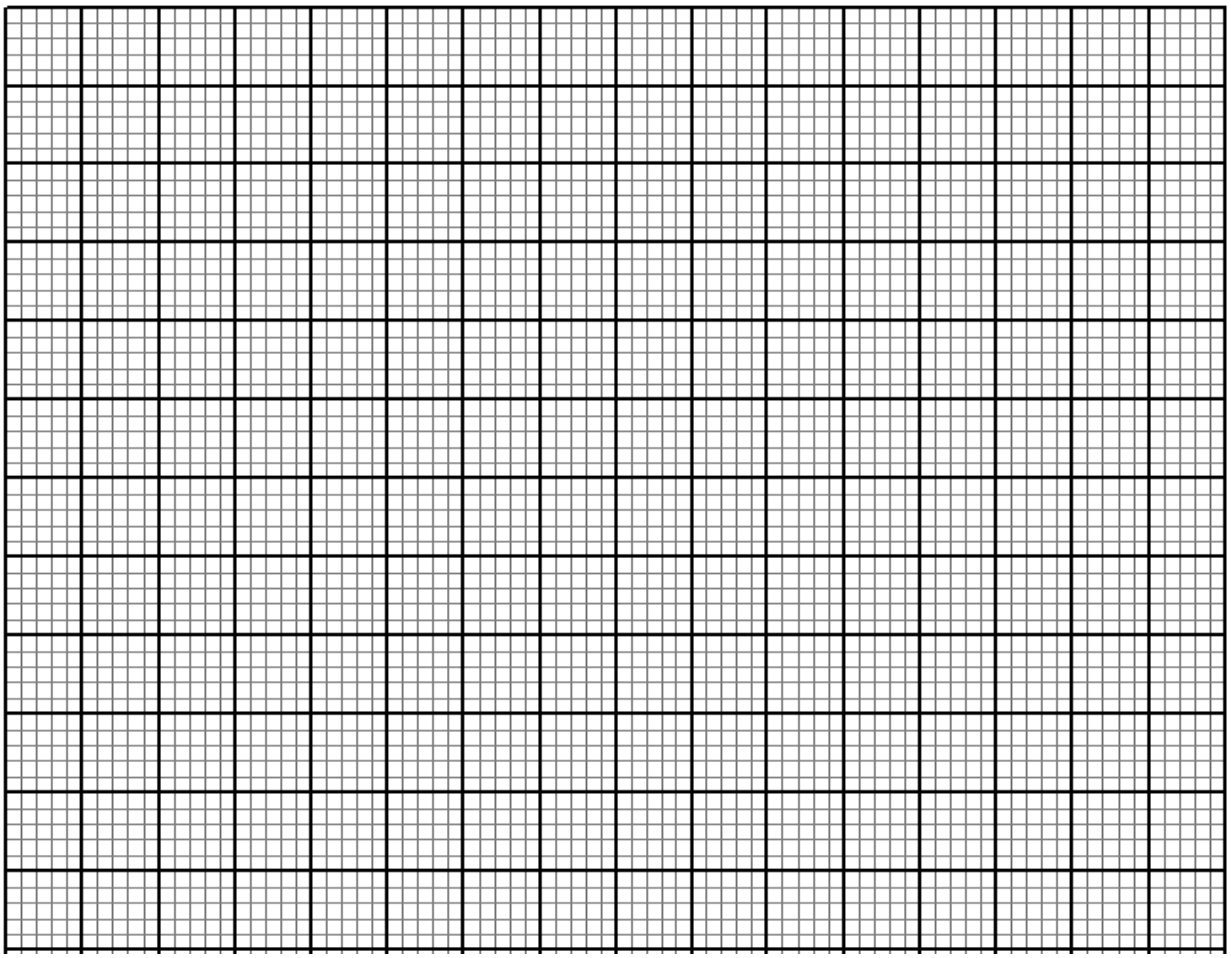
(c) By expressing **PX** in two ways, determine the values of h and k. *(5 marks)*

(d) Hence, state the ratio in which X divides SQ. *(1 mark)*

22. A triangle with vertices at P(-1,1) Q(-4,2) and R(-2,4) is transformed by a matrix $T = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ to a triangle $P^IQ^IR^I$.

(a) Determine the coordinates of triangle $P^IQ^IR^I$. *(2 marks)*

(b) On the grid provided, draw the object and the image. *(3 marks)*
(Use a scale of 1cm to represent 1 unit on the y-axis and the x-axis)

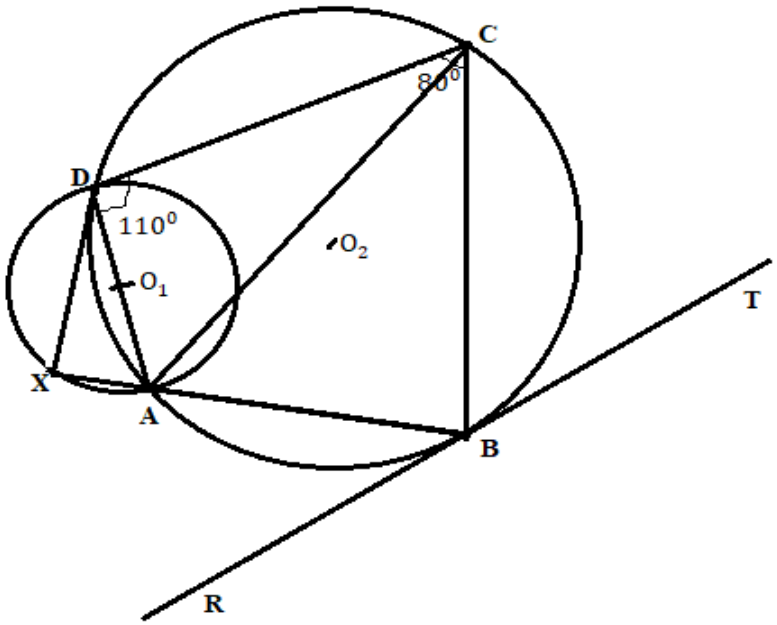


(c) Describe fully the transformation which maps PQR *onto* $P^IQ^IR^I$. *(1 marks)*

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(d) $P^I Q^I R^I$ is mapped onto $P^{II} Q^{II} R^{II}$ under a shear transformation with $x - axis$ invariant and Q^I is mapped onto $Q^{II}(6, -2)$. Determine the coordinates of $P^{II} Q^{II} R^{II}$ hence draw the triangle $P^{II} Q^{II} R^{II}$ on the same grid. *(4 marks)*

23. In the figure below, O_1 and O_2 are the centres of the smaller circle and bigger circle respectively. Line $AC = BC$. XAB is a straight line and RBT is a tangent to the bigger circle at point B. AD is a diameter of the smaller circle. Angle $ADC = 110^0$ and Angle $BCD = 80^0$.



Find the values of the following angles, stating reasons in each case:

(a) Angle AXD *(2 marks)*

(b) Angle ABC *(2 marks)*

(c) Angle ABR *(2 marks)*

(d) Angle XAD *(2 marks)*

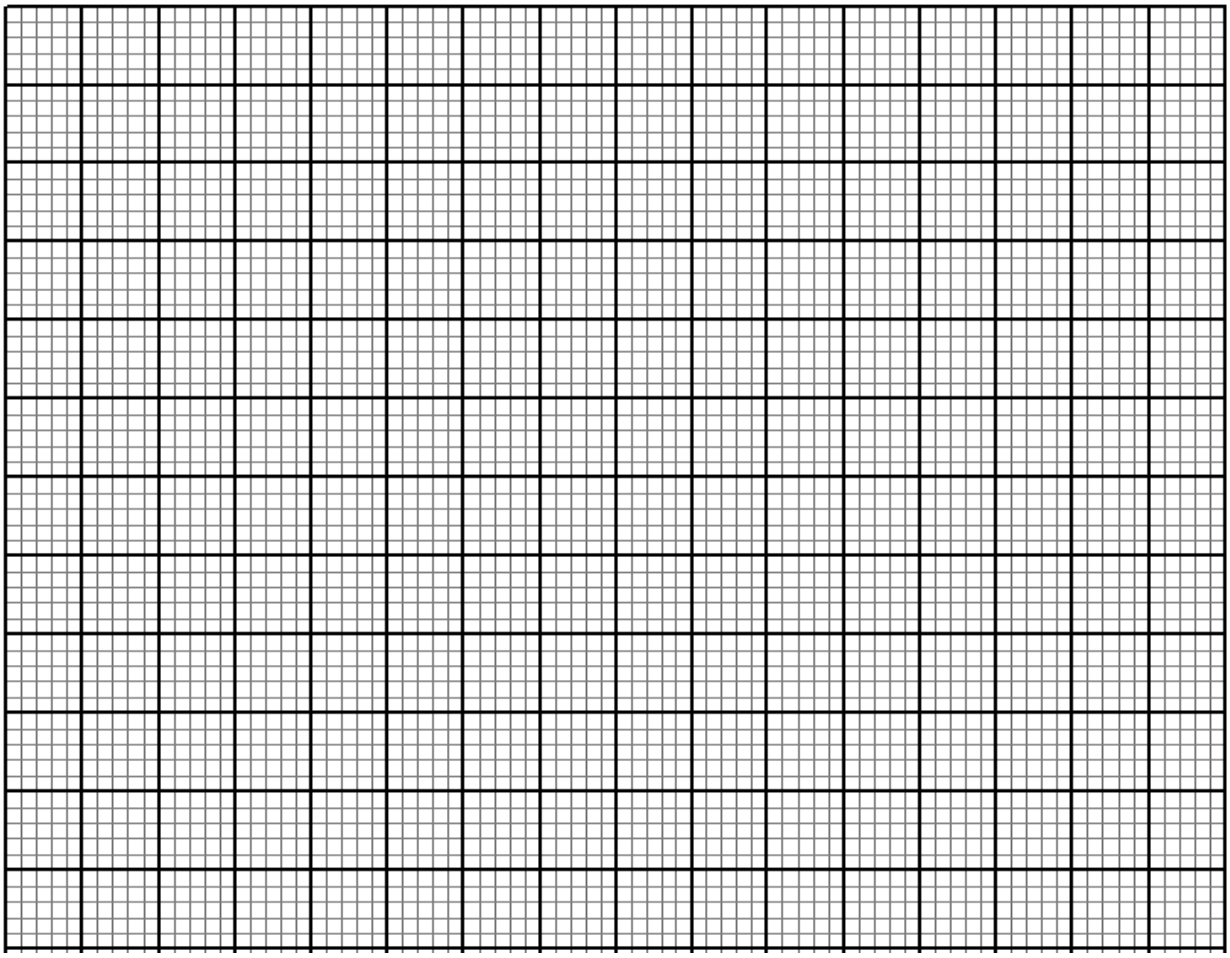
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(e) Angle AO_2B *(2 marks)*

24. (a) Complete the table below for the function $y = x^3 + 2x^2 - 3x - 4$ for $-3 \leq x \leq 2$ *(2 marks)*

x	-3	-2	-1	0	1	2		
y								

(b) On the grid provided, draw a graph of $y = x^3 + 2x^2 - 3x - 4$ *(3 marks)*
Use the scale: *1 cm represents 1 unit on both axes*



(c) *Use the graph to solve the equation:*

(i) $x^3 + 2x^2 - 3x = 4$ *(2 marks)*

(ii) $x^3 + 2x^2 - 5x - 6 = 0$ *(3 marks)*

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SECTION I (50 marks)

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

1. Simplify completely $\dfrac{9a^2y-16b^2y^3}{4by^2-3ay}$ (3 marks)

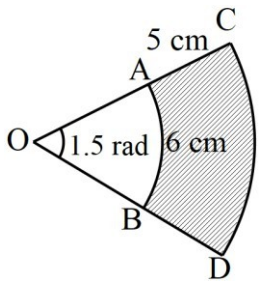
2. The average mass of students in a class of 45 students was 41kg at the beginning of the term. At the end of the term they had each gained 3kg. Calculate their total mass at the end of the term. (3 marks)

3. The straight line passing through the point M(k,-1) and N(-1,2k) is parallel to line whose equation is $2y-3x=8$. Find the value of k and hence write down the coordinates of points M and N. (3 marks)

4. The image of point A (-3, 4) under a translation, T is A^1 (2, -2). If the image of a point B under T is (0, -1). Find the coordinates of B. (2 marks)

5. A regular polygon is such that the interior angle is greater than twice its exterior angle by 45°. Calculate the number of sides of the polygon. (3 marks)

6. In the figure below, AB and CD are arcs of the sectors OAB and OCD respectively. ∠AOB = 1.5 ^{c}, AB = 6 cm and AC = 5 cm.



Calculate the area of the shaded region. (3 marks)

7. Use matrix method to solve (4 marks)

$5x + 3y = -26$

$3x - 4y = -33$

8. A vertical electric flag post is supported by a slanting piece of wire such that the angle that the wire makes with the pole is twice that which it makes with the ground. If the flag post is 7m in length, find the length of the wire. (4 marks)

9. Two similar containers are such that their areas are 630 cm^2 and 280 cm^2, if the mass of the smaller container is 720g, find the mass of the bigger container. (3 marks)

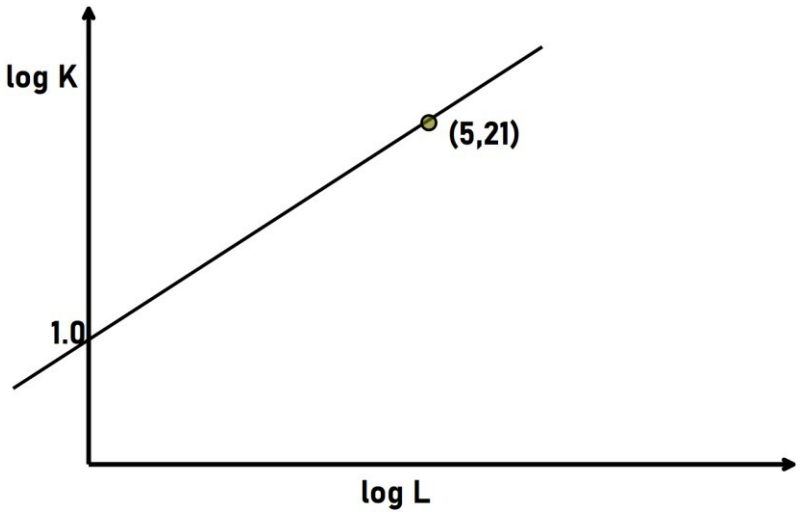
10. Determine the quadratic equation $x^2 + bx + c = 0$, in which a, b and c are integers, whose roots are $\frac{4}{3}$ and $\frac{1}{2}$. (3 marks)

11. The velocity v metres per second of a particle at time, t seconds is given by the equation $v = t^2 - 2t + 3$. Complete the table below for values of v and t hence use the mid-ordinate rule with four ordinates estimate the distance covered by the particle between $t = 0$ second and $t = 8$ seconds. (4 marks)

Time, t (s)	0	1	2	3	4	5	6	7	8
Velocity v (m/s)	3				11				51

12. A boy has a metal of density 14000kg/m^3 .He intends to use it to make a rectangular pipe with external dimensions of 18cm by 10cm and internal dimensions of 15cm by 8cm.The length of the pipe is 150cm .Calculate the mass of the pipe in kg. (3 marks)

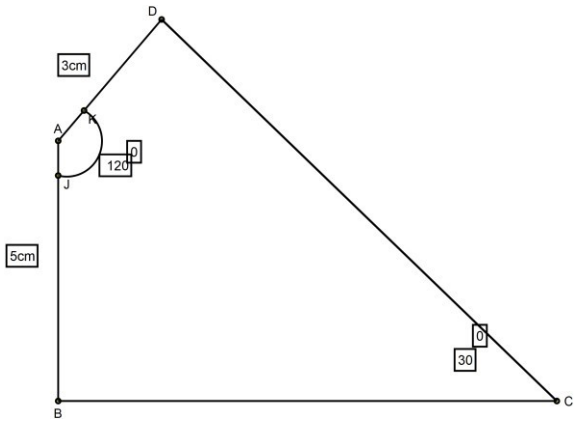
13. The graph below shows a plot of log K against log L.



Express K in terms of L. (3 marks)

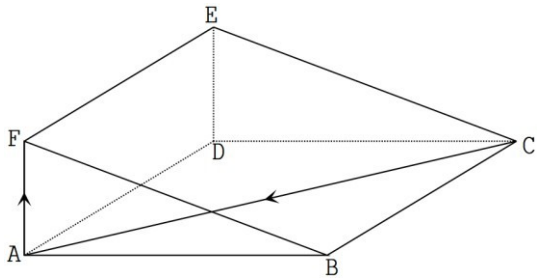
14. The distance between two stations Kakira and Luambaga is 200 km. A truck left Kakira for Luambaga at an average speed of 60 km/hr at 8.30 a.m. At 9.18 a.m., a car also left Kakira for Luambaga via the same route as the truck. If the car caught up with the bus at 11.42 a.m., calculate the distance of the vehicles from Luambaga when they met. (3 marks)

15. The figure below shows quadrilateral ABCD in which $< DAB = 120°, < DCB = 30°$ and $< ABC = 90°$ and also lengths AB=5cm and AD=3cm.



Calculate length DC to three significant figures. (3 marks)

16. The figure below shows a wedge with a string wound on its surface once from C to A to F.



Draw the net of the solid and show the path of the string if it does not cut. (3 marks)

SECTION II (50 marks)

Answer any **five** questions in this section in the spaces provided.

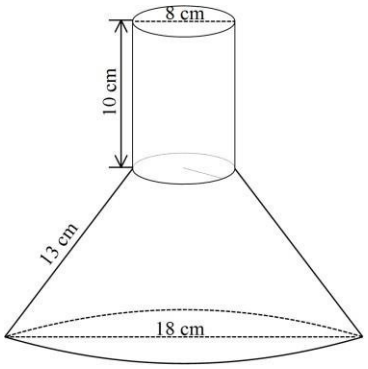
17. A teacher shared pencils amongst his learners. The girls received two thirds of the pencils while the boys received five sixths of the remainder. If the teacher still remained with 8 pencils, calculate the:

(a) number of pencils the teacher had at the beginning. (4 marks)

(b) amount of money the teacher spent in purchasing the pencils given that he was charged Ksh. 25 per every six pencils. (3 marks)

(c) number of learners in the class if each girl got three pencils and each boy two. (3 marks)

18. The figure below represents a container consisting of a cylindrical part of internal diameter 8 cm and a conical part of internal diameter 18 cm. The slant length of the conical part is 13 cm and the height of the cylindrical part is 10 cm.



Calculate in terms of π the:

a) internal surface area of the container. (5 marks)

b) volume of solid (5 marks)

19. Four pegs P, Q, R and S are on the vertices of a plain field. Q is 300 m north of P and S is 420m East of P. The bearing of R from Q is 110° and the bearing of S from R is S20°E.

a) Using a scale of 1 cm to represent 60 m, represent the information on a scale drawing. (5 marks)

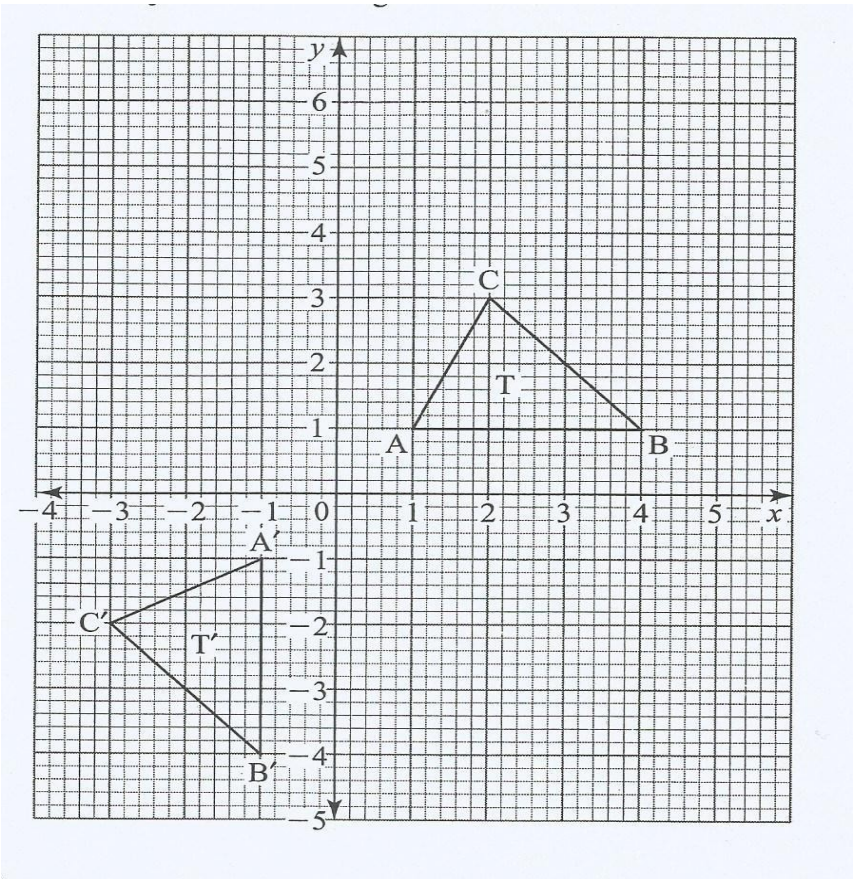
b) Using the scale drawing, determine

i) Compass bearing of R from P. (1 mark)

ii) The distance between R and S. (1 mark)

iii) The area of the region enclosed by the four pegs. (3 marks)

20. On the grid below, an object T and its image T' are drawn



a) Find the equation of the mirror line that maps T onto T′. (1 mark)

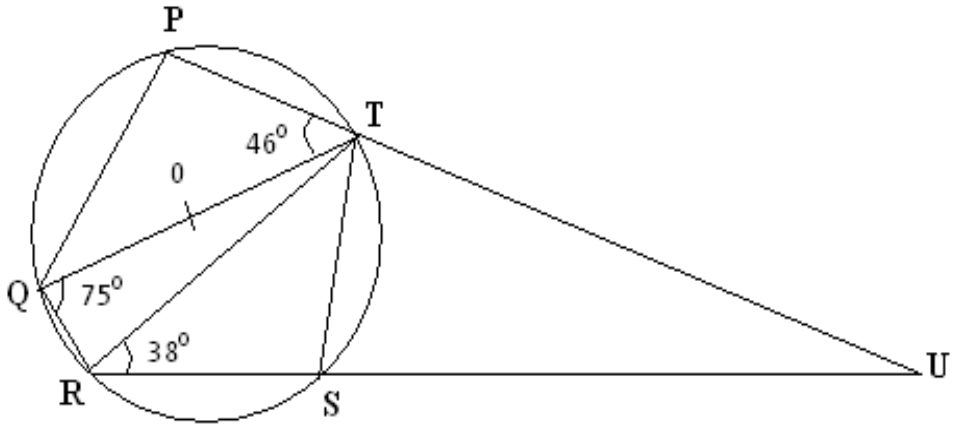
b) i)T′ is mapped onto T″ by positive quarter turn about (0,0). Draw T″and state its coordinates. (2 marks)

ii) Describe a single transformation that maps T onto T″ (2 marks)

c) T″ is mapped onto T‴ by an enlargement, centre (2, 0), scale factor -2 . Draw T‴. (2 marks)

d) Given that the area of T‴ is 12cm^2, calculate the area of T. (3 marks)

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



Determine the following, giving reason in each case.

a) Angle RST (2 marks)

b) Angle SUT (2 marks)

c) Angle PST (2 marks)

d) Obtuse angle ROT (2 marks)

e) Angle SQT (2 marks)

22. The gradient of the curve $y = 2x^3 - 9x^2 + px - 1$ at $x = 4$ is 36.

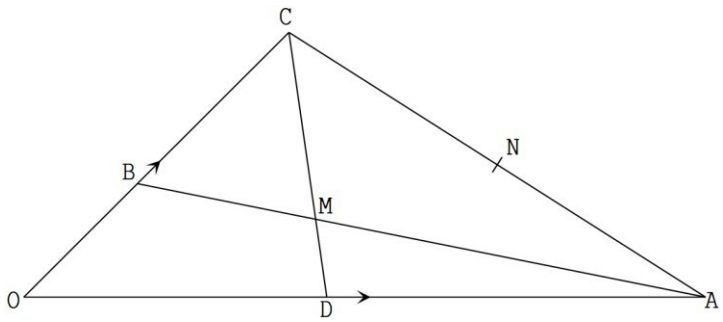
Find :

a) the value of p; (3 marks)

b) The equation of the tangent to the curve at $x = 0.5$. (4 marks)

c) Find the coordinates of the turning points of the curve (3 marks)

23. In the figure below $\vec{OB} = \underset{\sim}{b}; OC = 3\vec{OB}$ and $OA = \underset{\sim}{a}$



a) Given that $OD = \frac{1}{3}OA$ and $AN = \frac{1}{2}AC$, CD and AB meet at M. Determine in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

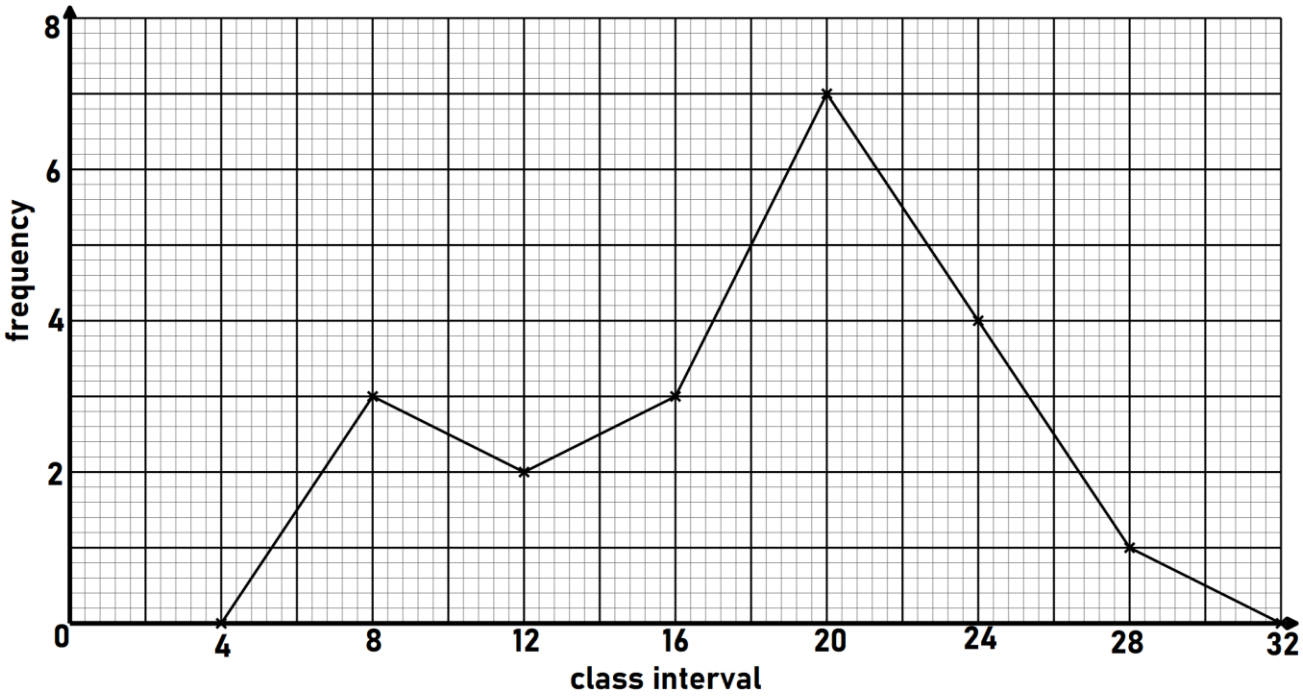
i) $\vec{AB}$ (1 mark)

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

b) Given that $\vec{CM} = k\vec{CD}$ and $\vec{AM} = h\vec{AB}$. Determine the values of the scalars k and h. (5 marks)

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

24. The figure below shows a frequency polygon on distribution of ages within a certain family.



a) Generate a Frequency Distriution Table of the data above. (3 marks)

Ages in years	Midpoints (x)	Frequency (f)

b) Use the data to estimate to one decimal place the:

i) mean of the data (3 marks)

ii) median age. (2 marks)

iii) percentage of this family members who are atleast 25 years of age. (2 marks)

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PAPER 2

SECTION I (50 marks)

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

1. A fruit blender makes a profit of 30% by selling a super mix mango juice at Kshs. 1300 for 250 ml tin. He makes a super mix mango juice by blending two varieties of mango, A and B which cost him Kshs. 3 600 and Kshs. 4 800 per litre respectively. In what proportion were the mango types A and B mixed? (3 marks)

2. Given that $\tan 67.5^\circ = 1+\sqrt{2}$. Find without using mathematical table or calculator $\tan 22.5^\circ$ in the form $a+b\sqrt{c}$. Hence state the values of a, b and c. (3 marks)

3. Solve for t in: $\log_3 8t + 2\log_3 t = -6$. (4 marks)

4. Expand $\left(2y-\frac{3}{y^2}\right)^6$ up to the term independent of y. Hence use your expansion to estimate $\left(19\frac{97}{100}\right)^6$. (3 marks)

5. Draw a line AB of length 7 cm. On one side of the line AB, construct the locus of a point C such that the area of a triangle ACB is $10.5\ cm^2$. On this locus locate two positions of C, C_1 and C_2 such that $\angle AC_1B = \angle AC_2B = 90°$. (3 marks)

6. Make Q the subject of the formula (3 marks)

$$B = \frac{3d}{k}\sqrt{\frac{X-Q^2}{5c}}$$

7. Evaluate $\int_{2}^{5}\left(x^3+2x-3\right)dx$. (3 marks)

8. Given that $\mathbf{x}=2\mathbf{i}+\mathbf{j}-2\mathbf{k}$, $\mathbf{y}=5\mathbf{i}+4\mathbf{j}-\mathbf{k}$ and $\mathbf{z}=5\mathbf{i}+3\mathbf{j}+2\mathbf{k}$, then $\mathbf{q}=3\mathbf{x}-\mathbf{y}+2\mathbf{z}$. Calculate $|\mathbf{q}|$ to 2 decimal places. (3 marks)

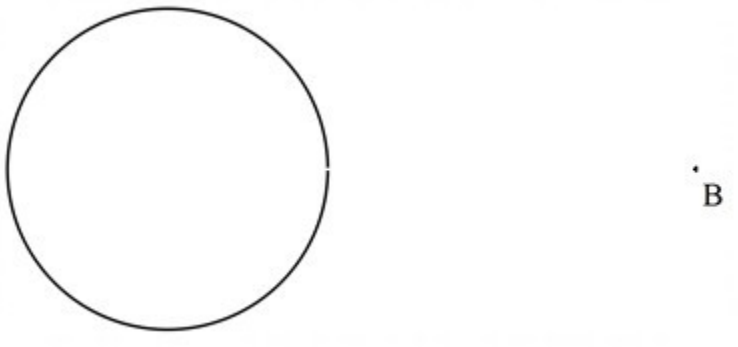
9. Calculate the standard deviation of the numbers correct to 3 decimal places. (3 marks)
3, 7, 9, 13, 17, 11

10. The equation of a trigonometric wave is $y = 4\sin\left(\frac{1}{2}x - 70\right)^0$. State the period and phase angle.

(2 marks)

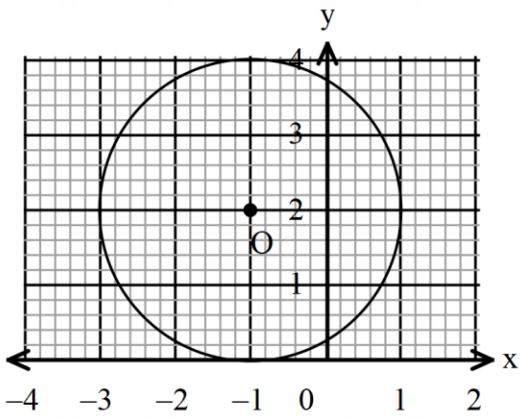
11. A ship leaves an island $\left(10^\circ N, 45^\circ E\right)$ and sails due east for 120 hours to another island. The average speed of the ship is 27 Knots. Find the position of the second island. (3 marks)

12. The figure below shows a circle and a point B outside the circle.



Using a ruler and pair of compasses, construct a tangent to the circle from B. (4 marks)

13. Below is a circle center O.



Find the equation of the circle in the form $ax^2 + by^2 + cx + dy + e = 0$. Where a, b, c, d and e are integers. (3 marks)

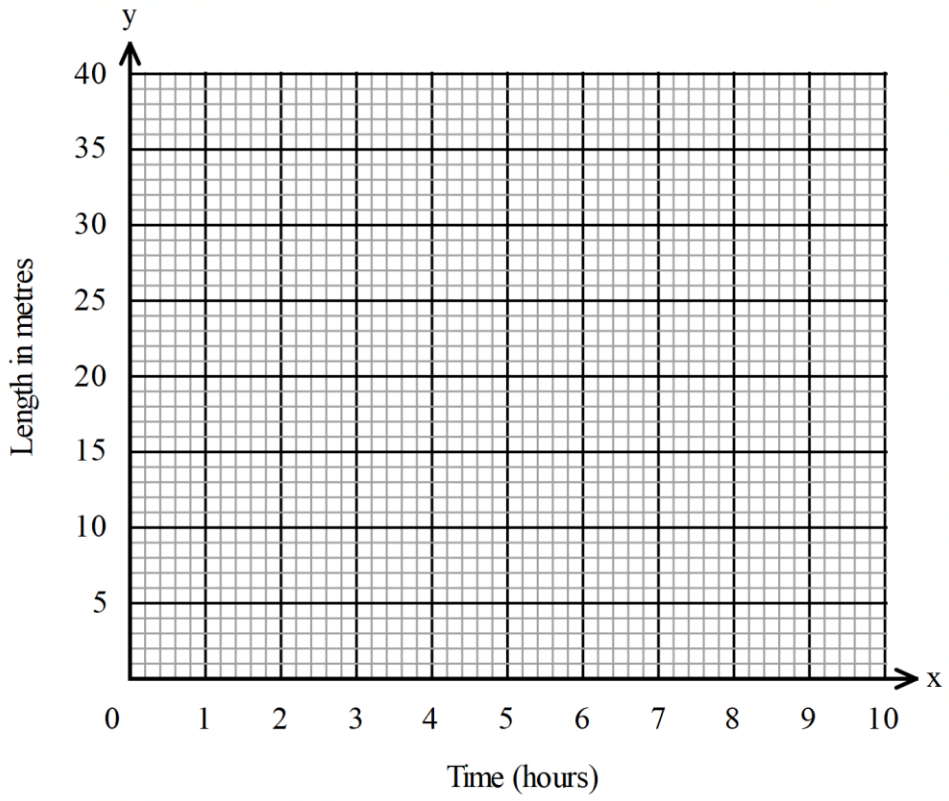
14. Given that Q is directly proportional to square of R and inversely as the cube root of P. find the relationship connecting Q, R and P, given that Q=12, R=6 and P= 27 hence find Q when R=9 and P=64. (3 marks)

15. A welder requires 6 hours to make a bed and 9 hours to make a door. It takes the welder at least 316 hours to make k beds and m doors. The labour cost of making a bed is Ksh. 1 000 and that of a door is Ksh 2 000. The total labour cost should not exceed Ksh. 34 000. The welder must make at least 20 beds and more than 14 doors in order to make a profit. Form all the linear inequalities which will represent the given information in simplest form where possible. (3 marks)

16. The length of a shadow of a tree was measured at intervals of 1 hour and recorded as shown in the table below.

Time (h)	0	2	4	6	8	10
Length (m)	37.4	17.4	10.0	5.8	2.6	0.0

a) On the grid provided, draw the graph of length against time. (2 marks)



b) Determine the gradient of the shadow length at t = 4. (2 marks)

SECTION II (50 marks)

Answer any **five** questions in this section in the spaces provided.

17. Muchiri deposited Ksh. 500 000 in a financial institution which paid a compound interest at the rate of 8% p.a. At the end of 2 years, he withdrew all the money. He then invested 75% of the amount in shares. The value of the shares depreciated at 4% p.a during the first two years of investment. In the next 36 months, the value of the shares appreciated at the rate of 8% every 3 months.

a) Calculate the amount Muchiri invested in shares. (3 marks)

b) Calculate the value of Muchiri's share:

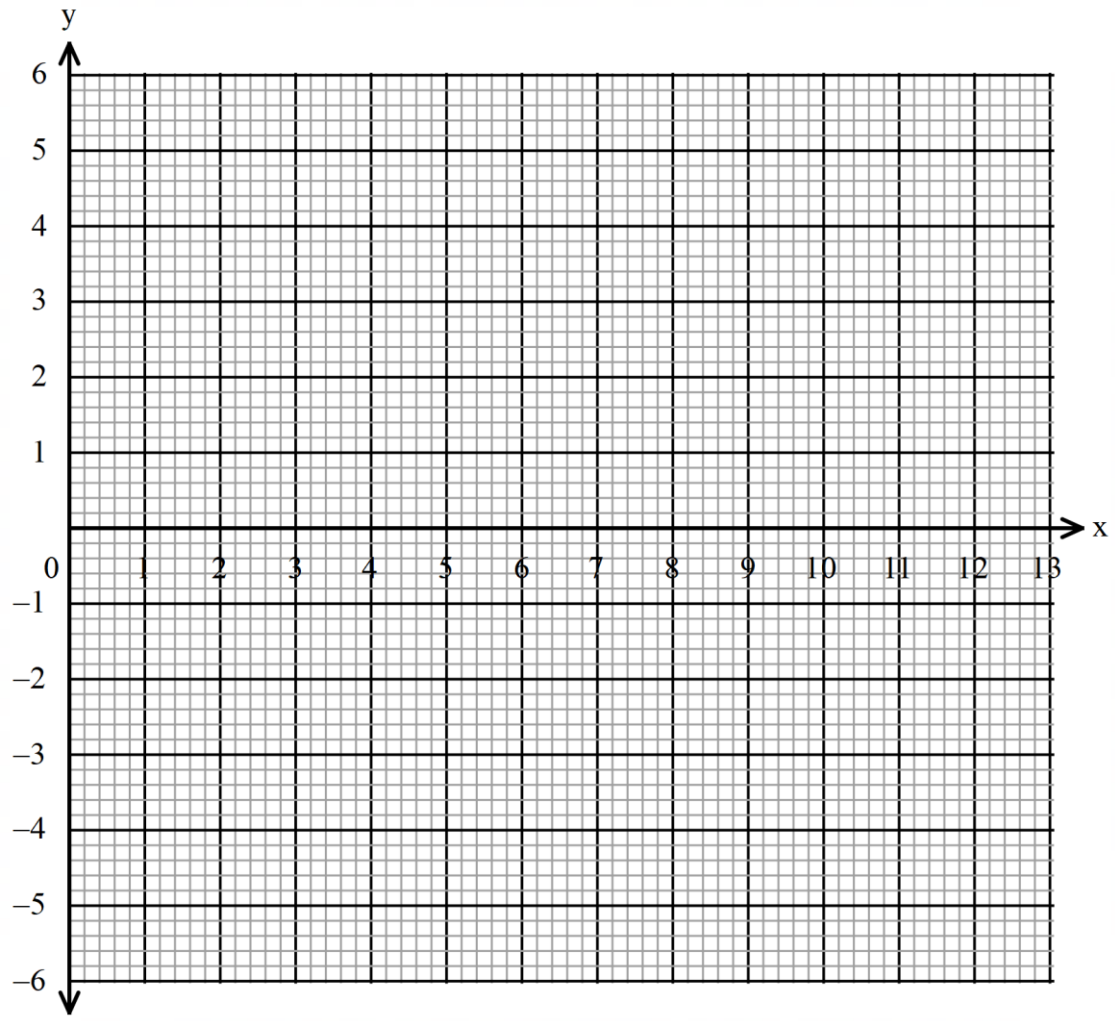
i) At the end of second year. (2 marks)

ii) At the end of 5th year, to the nearest shilling. (3 marks)

c) Calculate Muchiri's gain from the shares as a percentage. (2 marks)

18. Rectangle PQRS in which P(1,3),Q(8,3),R(8,5) and S(1,5) undergoes a shear with y = 3 as the invariant line.

a) Plot the rectangle PQRS on the grid provided. (1 mark)



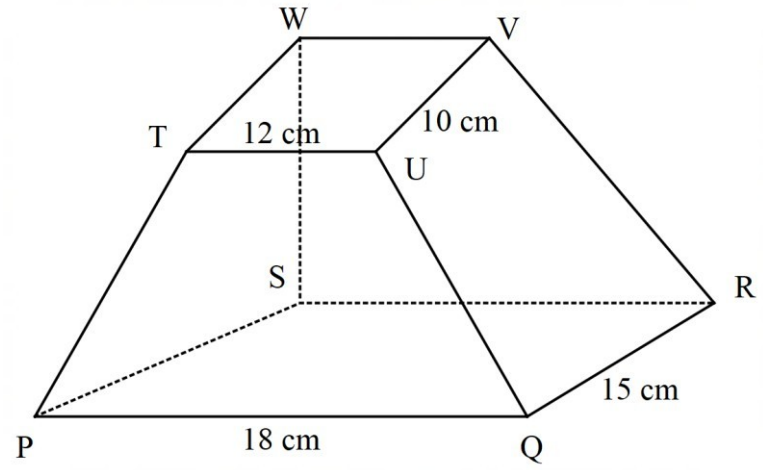
b) If the point R is mapped on to the point R' (12, 5) under this transformation, determine the coordinates of P'Q' and S'. (3 marks)

c) Plot the figure P'Q'R'S' (1 mark)

d) Find the matrix representing this transformation. (3 marks)

e) The image P'Q'R'S' was reflected on the mirror line y = 0. Draw the image P''Q''R''S'' and state its coordinates. (2 marks)

19. The figure below is a frustum of a rectangular pyramid with PQ = 18 cm, TU = 12 cm, QR = 15 cm and height 9 cm.



Calculate:

a) The height of the pyramid (2 marks)

b) Angle that the plane PQUT makes with the base PQRS. (2 marks)

c) Angle that PV makes with the base PQRS. (3 marks)

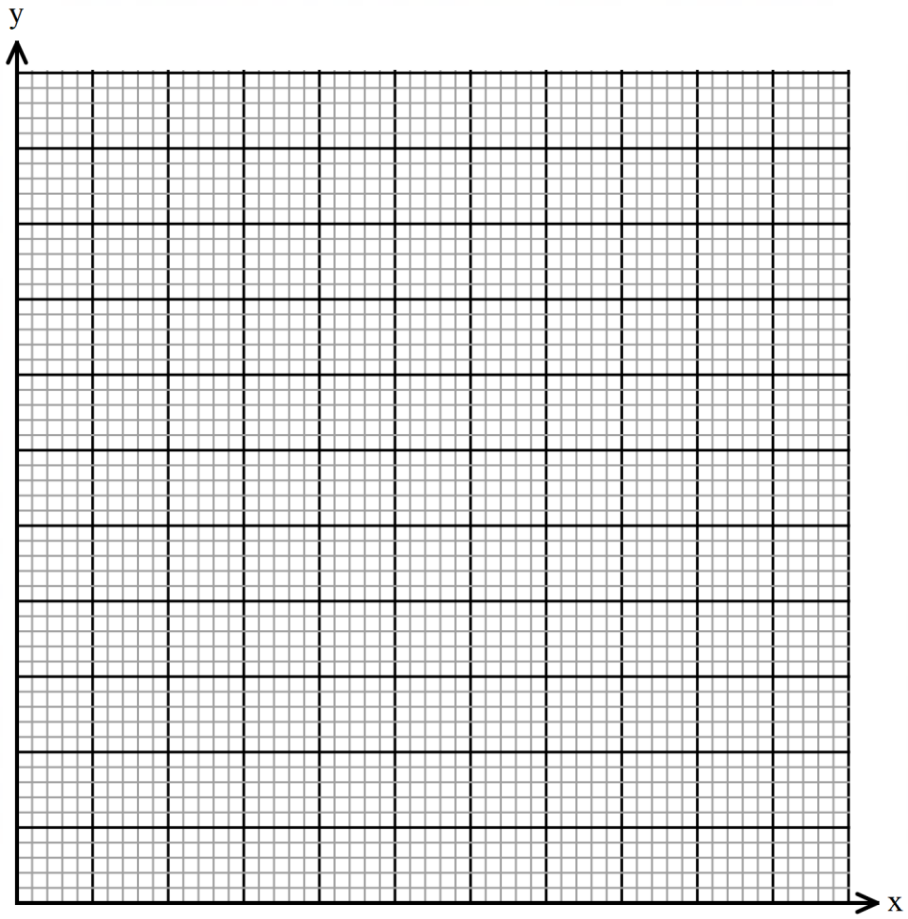
d) Angle that PR makes with line PT. (1 mark)

e) Angle that plane QRVU makes with the base PQRS. (2 marks)

20. The table below shows the marks scored by 100 form 4 students in Maranda high school.

Marks	0-10	10-20	20-30	30 – 40	40 -50	50-60	60-70	70-80	80-90	90-100
Number of students	2	4	6	10	16	30	14	10	6	2
C. F										

a) By completing the column for C.F draw the cumulative frequency curve on the grid provided.



b) Use the graph to estimate:

i) The 50th percentile. (1 mark)

ii) Semi-interquartile range. (3 marks)

iii) Pass mark given that at least 66 students passed. (2 marks)

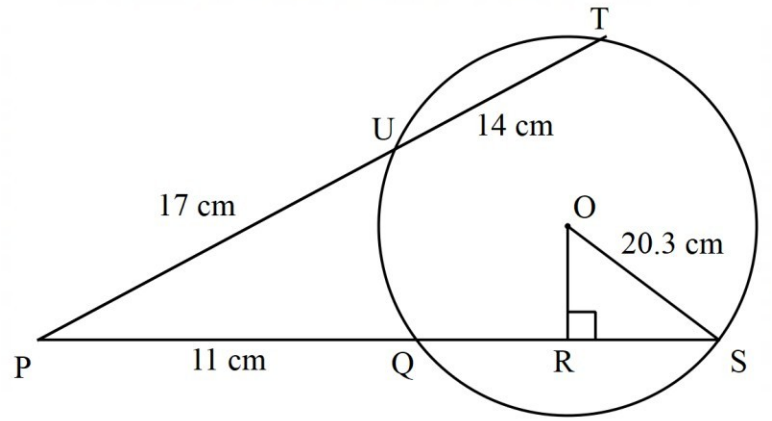
21. The product of the first three consecutive terms of a geometric progression is 5832. If the first term is **a** and the common ratio is **r**.

(a) Express r in terms of a. (2 marks)

(b) Given that the sum of the three terms above is 78, find the values of **a** and **r** hence write down two possible sequences each up to the 4th term. (5 marks)

(c) The sum of the first **n** terms of the sequence is 6558. Find **n**. (3 marks)

22. In the figure below, OS is the radius of the circle centre O. Chords SQ and TU are extended to meet at P and OR is perpendicular to QS at R. OS = 20.3 cm, PU = 17 cm, UT = 14 cm and PQ = 11 cm.



a) Calculate the length of:

i) QS (2 marks)

ii) OR (2 marks)

b) Calculate, correct to 1 decimal place:

i) The size of angle ROS. (3 marks)

ii) The length of the minor arc QS. (3 marks)

23. A candidate at Maranda boys high school is to sit for three series of exams by August 2024 in the preparation for KCSE. These exams include, pre-mock, mock and post mock 1. Given that the probability of a candidate passing first exams is 50%. However, due to revision of the previous exams the probability of passing next series of exams increases by 20%. Use this data to answer the questions that follows:

a) Draw a tree diagram to represent this data. (2 marks)

b) Calculate the probability that;

i) A candidate passes in the three trials. (2 marks)

ii) A candidate fails not exceeding twice. (3 marks)

iii) A candidate passes in the last trial. (3 marks)

24. The velocity of a particle moving in a straight line after t seconds is given by $v = 3 + 5t - 2t^2$.
Calculate:

a) The acceleration of the particle after 2 seconds. (3 marks)

b) The distance covered during the fourth second. (3 marks)

c) Find the distance covered during the first 4 seconds. (2 marks)

d) The time the particle is momentarilly at rest. (2 marks)

SERIES 18
PAPER 1

SECTION I (50 Marks)

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

1. Express 2.81 as a fraction hence evaluate $\frac{1}{12}$ *of* $26\frac{5}{2}$ $4\frac{1}{4}$ $\frac{11}{2.81}$

(3 marks)

2. A parallelogram ABCD is such that side BC = 8.8 cm, DC = 12.5 cm and BAD 60 . Find the exact area of the parallelogram. (3 marks)

3. Solve for x in the equation $81^{x-3} \times 27^{x-4} = \frac{\sqrt{6561}}{3^x}$ (3 marks)

4. Simplify $\frac{3mn \times m^2 n \times m^2 n^{\frac{1}{2}}}{12m^2 n^6}$ (3 marks)

5. A cone is formed from sector of circle diameter 21 cm that subtends an angle of 75 at the centre. Find the volume of the cone correct to 1decimal place. (3 marks)

6. A building is 8.2 m tall. A man standing on the top of the building elevates the top of a tree at 44 ^{o} and depresses the bottom of the tree at 58°. Find the height of the tree giving your answer to 2 decimal places. (3 marks)

7. Two similar buckets A and B have capacities 12 litres and 40.5 litres respectively. If the vertical height of B is 24 cm more than the vertical height of A, determine the vertical height of B. (2 marks)

8. Tree seedlings are planted on each side of a street such that the first pair of tree seedlings are opposite each other. The seedlings are planted at intervals of 9 m on one side and 12.6 m on the other side. Calculate the number of tree seedlings planted by the time another pair of seedlings are opposite each other. (3 marks)

9. Three of the interior angles of an irregular polygon measure 63 each. The remaining interior angles measure 73.5 each. Find the number of sides of the polygon hence name the polygon. (3 marks)

10. By selling 40 exercise books at sh. 640, a sales man realizes a loss of 20%. How many books should be sold at sh. 182 to realize a profit of 30%. (3 marks)

11. Use mid ordinate rule with 4 strips to estimate the area enclosed by the line $y \quad x$ and the curve $y \quad 9x\,x \quad ^2$. (4 marks)

12. A translation T maps a point P(2,1) onto P 1,2 . Given that Q 5,1 is the image of Q under the same translation, calculate the distance between P and Q. (3 marks)

13. Daniel bought 3 pens, 5 exercise books and 2 sets. A pen costs sh. 15, an exercise books cost sh. 100 and a set cost sh. 250

(a) Write a 1 3 matrix to represent items bought by Daniel. (1 mark)

(b) Write a 3 1 matrix to represent the price of the items bought by Daniel (1 mark)

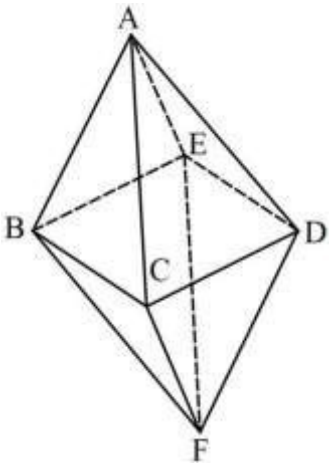
(c) Use the matrix above to find Daniel's total expenditure (2 marks)

14. Find the equation of the normal to the curve $y \quad 2x^2$ $3x$ 4 at $x \quad 2$ (3 marks)

15. Solve the inequalities 2 1 7 12 5 18x [redacted] x x and represent the solution on a number line.

(3 marks)

16. The figure below shows a regular octahedron of side 2 cm.



(a) Sketch a net of the solid. (2 marks)

(b) Hence or otherwise, show that the total surface area of the solid is $8\sqrt{3}\ cm^2$. (2 marks)

SECTION II (50 Marks)

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

17. A car travelling at 10 m/s accelerate uniformly in 100 seconds to velocity of 25 m/s. It maintains this velocity for another 150 seconds before decelerating uniformly to rest after 100 seconds. Calculate

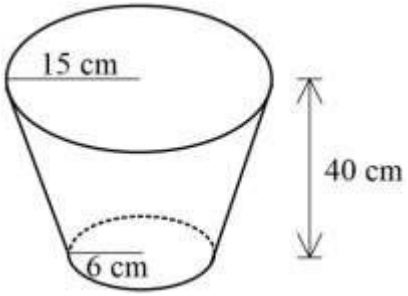
(a) The total distance covered in kilometers (3 marks)

(b) The average speed in the first 200 seconds. (3 marks)

(c) The initial acceleration (1 mark)

(d) Time taken to travel the last half of the journey. (3 marks)

18. The figure below shows a bucket in the shape of a frustum whose top radius is 15 cm and base radius is 6 cm. The height of the bucket is 40 cm.



Taking 3.142

(a) Calculate correct to 4 significant figures the surface area of the bucket. (4 marks)

(b) If the bucket is filled to a height of 30 cm, calculate:

i. The radius of the water surface (3 marks)

ii. The volume of water inside the bucket correct to 1 decimal place. (3 marks)

19. The data below shows the masses of 40 students in a class

45	65	66	67	72	79		
69	57	65	58	65	80		
66	67	49	50				
51	70	79	69	84	52	55	65
85	90	87	69	81	68	69	58
74	70	49	82	58	52	64	60

(a) Starting with a class of 45-54 and using , a uniform class width prepare a frequency distribution table.

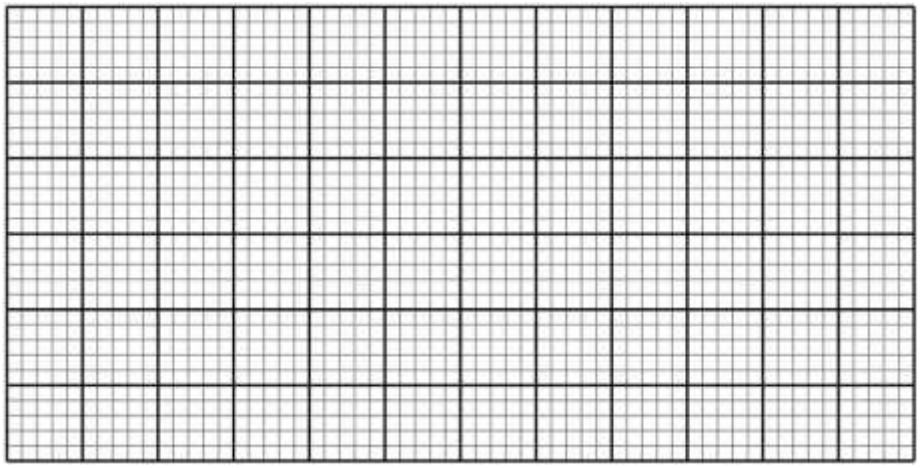
(2 marks)

(b) From the frequency distribution table above estimate.

i. Mean mass (3 marks)

ii. The median mass (3 marks)

(c) On the grid provided draw a frequency polygon (2 marks)



20. A parent has two children whose age difference is 5 years. Twice the sum of the ages of two children is equal to the age of the parent.

(a) Taking x to be the age of the elder child, write an expression for:

(i) The age of the younger child (1 mark)

(ii) The age of the parent. (1 mark)

(b) In twenty years', time, the product of the children's age will be 15 times the age of their parents

(i) Form an equation in x and hence determine the present possible ages of the elder child.
(4 marks)

(ii) Find the present possible ages of the parent (2 marks)

(iii) Find the possible sum of ages of the children in 20 years' time (2 marks)

21. The displacement S metres of a bouncing particle after t seconds is given by s [redacted] $t^3 5t^2 7t 3$. Determine

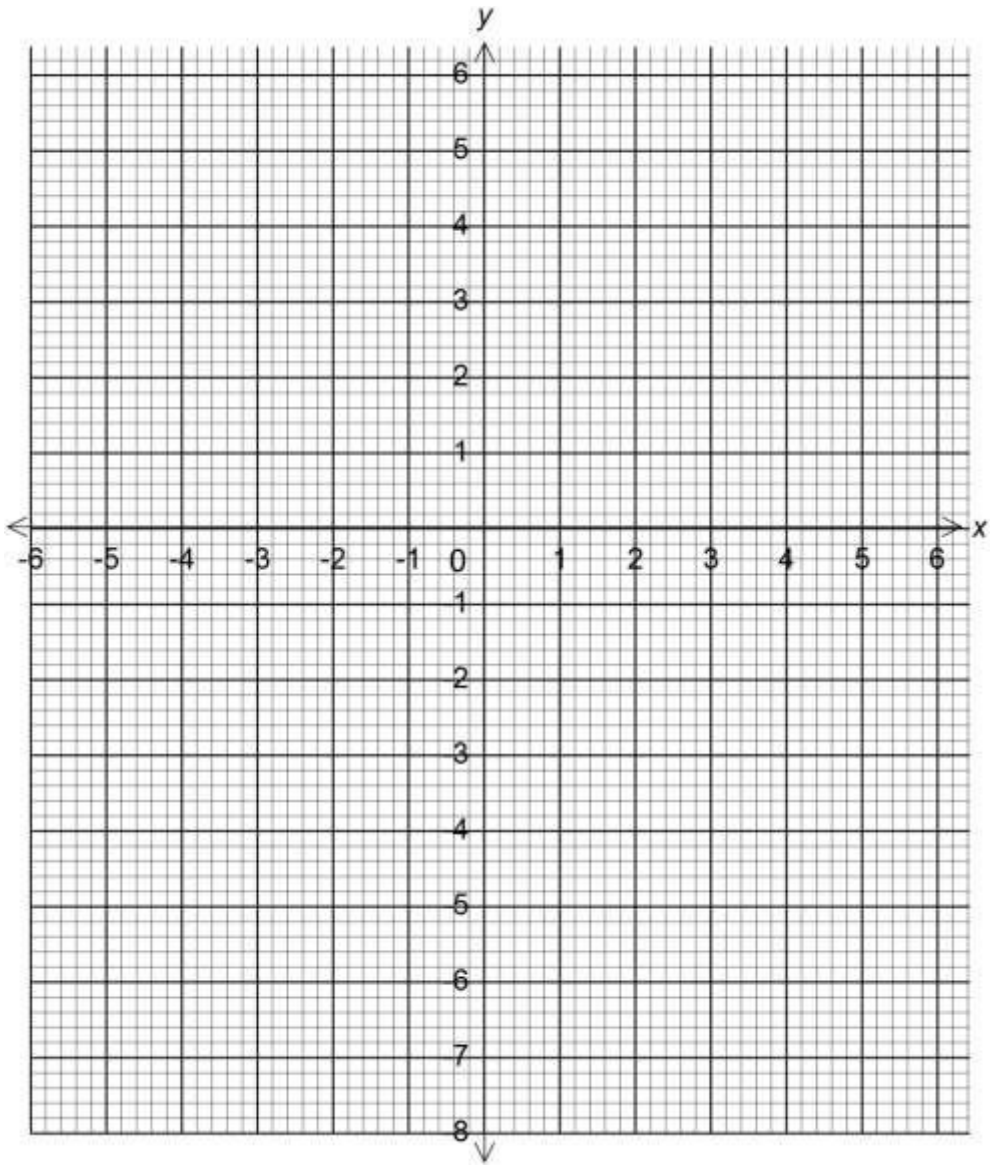
(a) The displacement of particle during the 4^h second. (2 marks)

(b) The velocity of the after 4 seconds. (3 marks)

(c) The time when the particle is momentarily at rest (3 marks)

(d) The acceleration of the particle when t 3 seconds (2 marks)

22. (a) The points A 2,6 , B 1,1 , C 3,4 and D 5,3 are vertices of quadrilateral ABCD. Plot the quadrilateral ABCD. (1 mark)



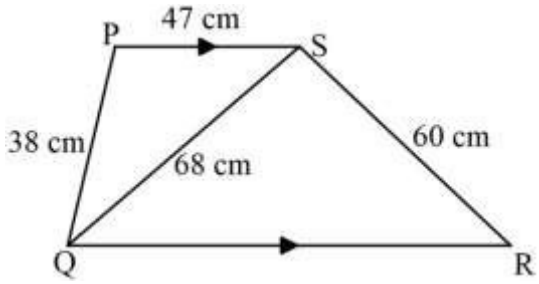
(b) Locate and write down the coordinates of the points ABCD , the images of ABCD under a rotation of positive 90° about the origin. DrawABCD (2 marks)

(c) A B C D is the image ofABC D under a reflection in the x – axis. Draw the quadrilateral ABCD and write down its coordinates. (2 marks)

(d) A B C D is the image of ABC D under enlargement . Scale factor 1 centre 0,2 . On the grid draw A B C D (3 marks)

(e) Describe a transformation that would map triangle ABC ontoA B C D (2 marks)

23. The figure PQRS is a trapezium in which PS is parallel to QR. PQ = 38 cm, PS = 47 cm, QS = 68 cm and RS = 60 cm



Calculate to 2 d.p

i. The size of angle QPS (3 marks)

ii. The size of angle SQR (2 marks)

iii. Area of triangle QRS (3 marks)

iv. Perpendicular height of the trapezium (2 marks)

24. PR represents the diagonal of a rhombus PQRS in which PRS 60 ..Complete the figure.
(2 marks)



i. Measure QS (1 mark)

ii. Construct a perpendicular from Q to meet SR produced at T. Measure QT. (2 marks)

iii. Construct a circle to touch the sides of the rhombus (2 marks)

iv. Find the area of rhombus that is outside the circle (3 marks)

PAPER 2

SECTION I: ***Answer all questions from this section***

1. Given that $\sin 15^\circ = \frac{\sqrt{6}-\sqrt{2}}{4}$, simplify $\frac{1}{cos75^\circ}$ (3mks)

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

$$w = \frac{m}{8\pi}\sqrt{\frac{G-hN}{N}}$$

3. The length of a rectangular sheet of paper is exactly 29.7cm while the width is given as 13.4 measured to the nearest millimetre. Calculate to four significant figures the relative error in the area of the paper. (3mks)

4. A quantity P varies partly as the square of Q and partly as R. When P=10, Q =6 and R=7 while when P= -4, Q=3 and R=5; find the equation connecting P, Q and R. (3mks)

5. Grade A rice is mixed with grade B rice in the ratio of 2:3. If grade A rice costs sh. 3500 per bag and grade B costs sh. 4000 per bag, at what price per kg should a shopkeeper sell the mixture in order to make a profit of 26% (3mks)

6. Solve the equation $\log(x+4) - log150x = -2$ (3mks)

7. (a) In the space provided below, draw a circle centre O, and radius 3.2 cm. (1mk)

(b) A point X is 9cm from the centre O, construct a tangent to the circle passing through X. (2mks)

8 (a) Expand $(2-\frac{1}{3}x)^{6}$ up to the term in x^3 (1mk)

(b) Use your expansion in (a) above to find the value of $(1.9)^6$ (2mks)

9 Given that the circle whose equation is $x^2 + y^2 - 4x + 10y + c = 0$ passes through a point (2, –1). Find;

(a) The value of c (1mk)

(b) Find the centre and radius of the circle (2mks)

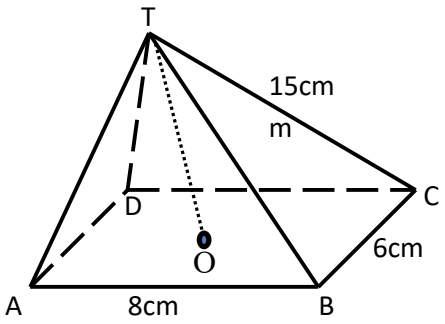
10 Find the amplitude, period and phase angle of the wave; $2y = 3\cos(\frac{9}{5}x + 20)$ (3mks)

11 The following table shows monthly income tax rates of a certain year.

Monthly income in kshs	Tax rate (%) in each shilling
0-24000	10
24001 - 32333	25
Above 32333	30

In that year, monthly relief of Ksh. 2400 was allowed. The net tax on Otweras' monthly income was ksh. 1500. Calculate Otwera's monthly income. (3mks)

12 The figure below is a right pyramid with a rectangular base ABCD and vertex T



O is the centre of the base and M is a point on OT such that $MO = \frac{1}{3}$OT. AB$= 8cm, BC = 6cm, TA = TB = TD = TC = 15cm$. Find:

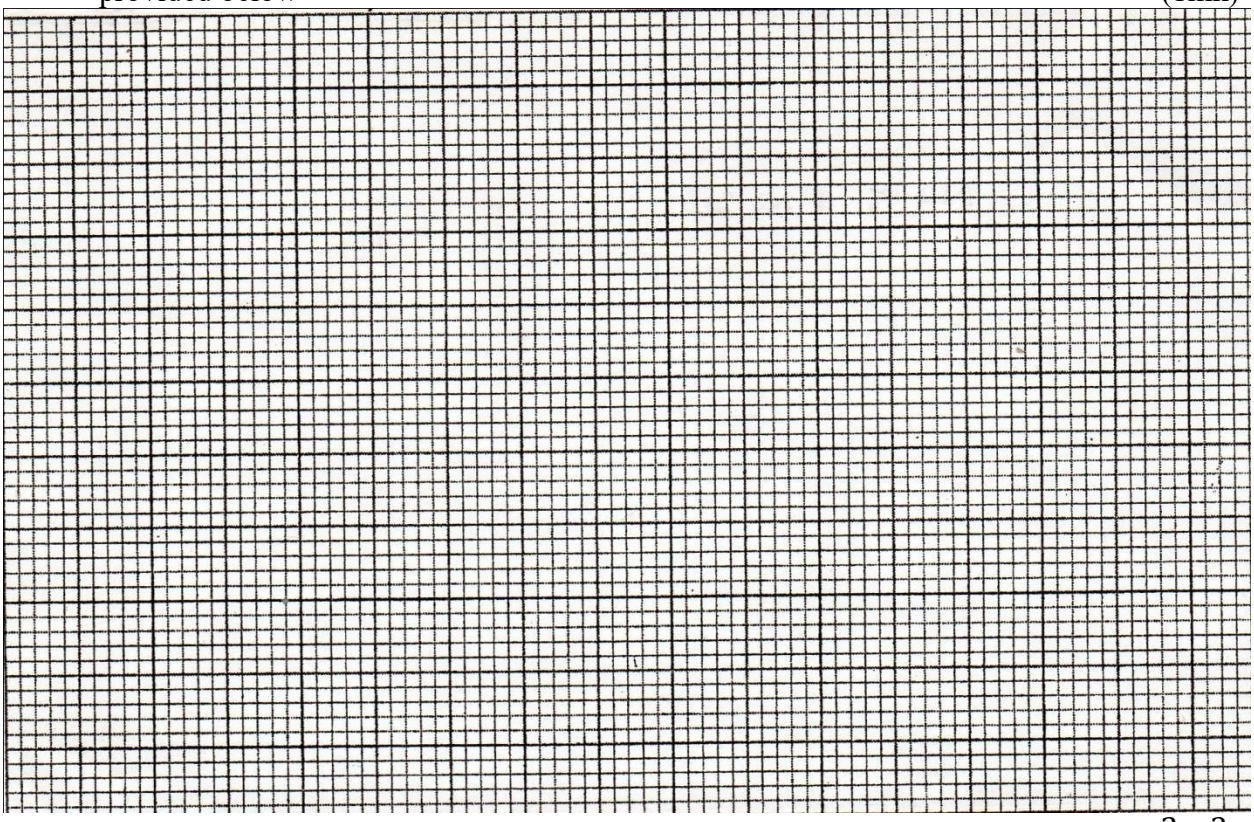
(i) The height OT of the pyramid (1mk)

(ii) The angle between the plane BMC and the base ABCD (3mks)

13 Given that $\mathbf{OP} = 2\boldsymbol{i} - 3\boldsymbol{j} + \boldsymbol{k}$, $OQ = 3\boldsymbol{i} - 4\boldsymbol{j} - 3\boldsymbol{k}$ and R divides **PQ** in the ratio $-3:2$, find the magnitude of QR to 2decimal places. (3mks)

14 Find the equation of the normal to the curve y= $(2x^2 + 1)(x - 3)$ at x= 1 (3mks)

15 (a) Plot the triangle A'B'C' with vertices at A'(1,1), B'(8,1) and C'(10, 7) on the grid provided below (1mk)

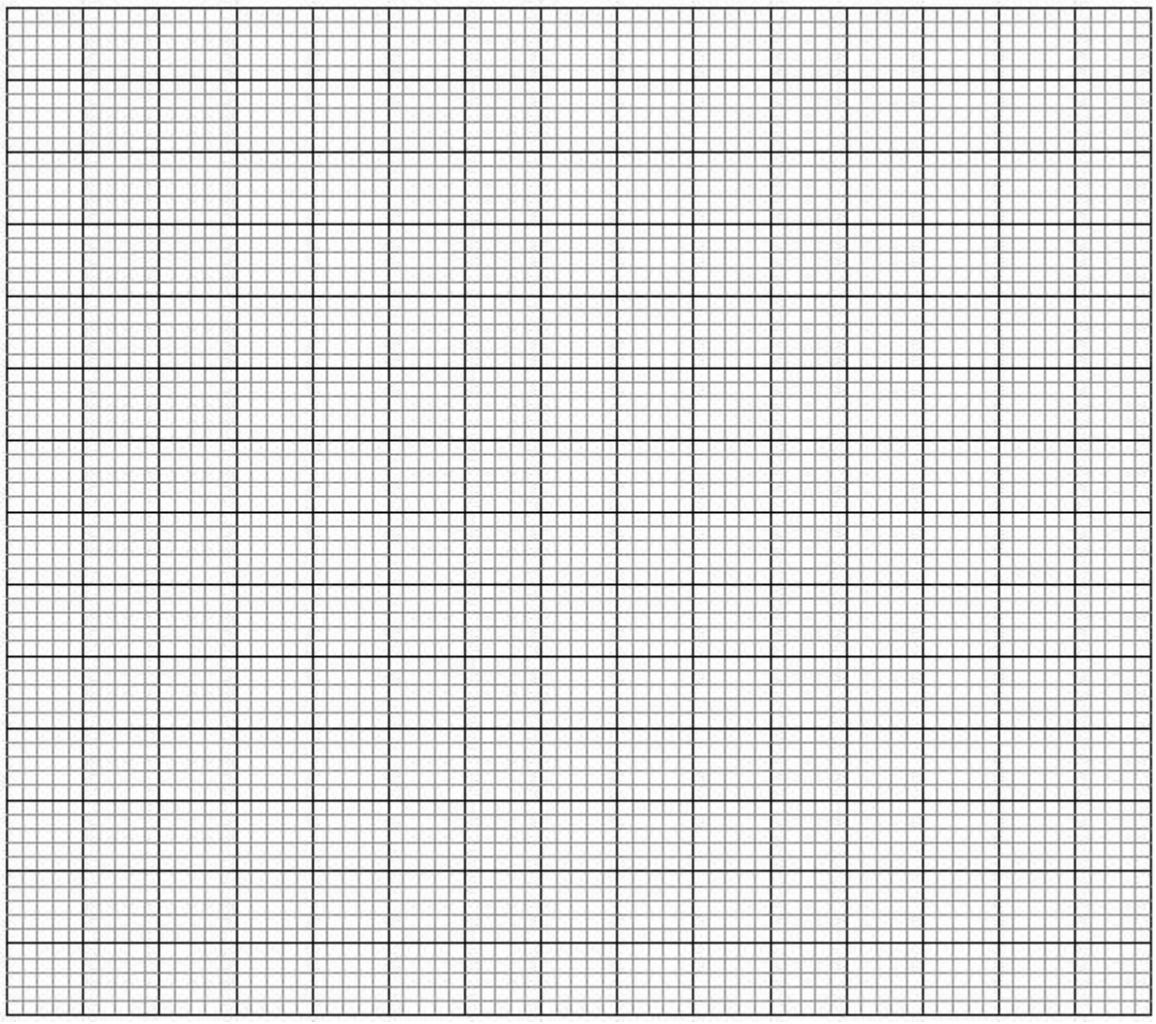


(b) A triangle A'B'C' is the image of triangle ABC under the transformation matrix $\begin{pmatrix} 2 & 3 \\ 5 & 4 \end{pmatrix}$, find the area of triangle ABC. (3mks)

16 The table below shows the vertices of t and the corresponding values of s for a given relation.

T	2	3	4	5	6	7
S	4	2.7	2	1.6	1.3	1.1

On the grid provided below, draw the graph to represent the information in the table hence calculate the rate of change of s at t= 4 (3mks)



SECTION II – 50 MARKS

Answer any FIVE questions from this section

17 The product of the first three terms of a geometric progression is 64. If the first term is a and the common ratio is r;

(a) Express r in terms of a. (3mks)

(b) Given that the sum of the first three terms is 14;

i) Find the value of a and r hence write down the two possible sequences each up to the third term. (5mks)

ii) Find the product of the fifth terms of the two sequences (2mks)

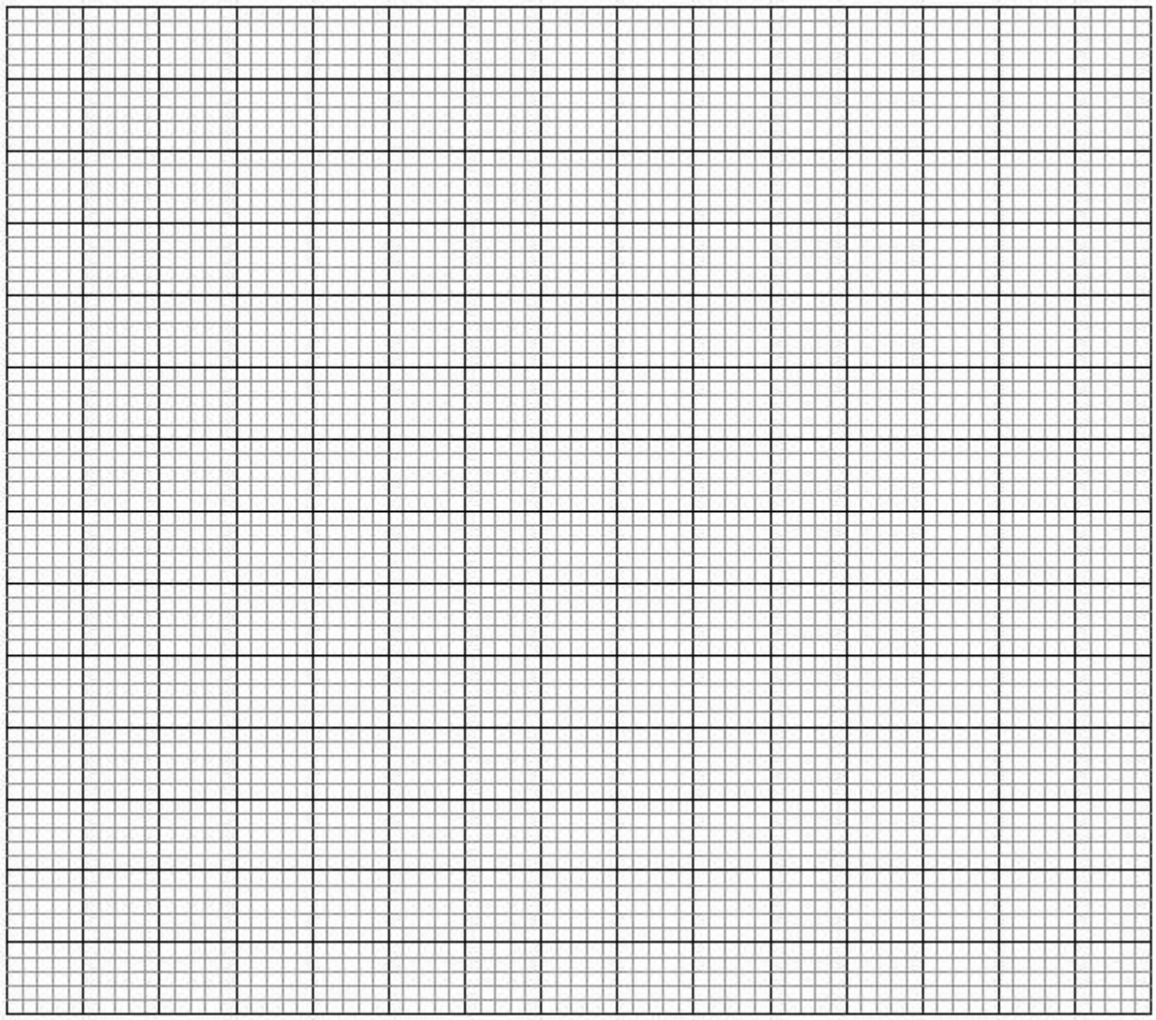
18 (a) The table below shows the values of x and some values of y for the curve $y = 14 + 10x - 8x^2 - 4x^3$. Complete the table. (2mks)

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5
$y = 14 + 10x - 8x^2 - 4x^3$									

(b) On the grid provided, draw the graph of $y = 14 + 10x - 8x^2 - 4x^3$ for $-2.5 \leq x \leq 1.5$

Use the scale; 1cm rep 0.5 units on x-axis

2cm rep 5units on y-axis (3mks)



(i) Use your graph to solve the equation $14 + 10x - 8x^2 - 4x^3 = 0$ (1mk)

(ii) By drawing a suitable line on the same grid, solve the equation.

$4x^3 + 8x^2 - 5x - 4 = 0$ (4mks)

19 At a research centre, a new drug is being tried using a sample of eighty sick pigs. Sixty of these pigs are given drugs and the rest are not. A half of those given drugs are put on a high calorie diet while three quarters of those who are not given drugs were put on the same diet. For the ones who were treated and put on a high calorie diet the probability of dying is $\frac{1}{10}$ and $\frac{2}{10}$ if not put on a high calorie diet. For the ones who are not treated and put in a high calorie diet the probability of dying is $\frac{4}{10}$ and $\frac{6}{10}$ if not put on a high calorie diet.

(a) Draw a tree diagram to represent the above information. (2mks)

(b) Calculate the probability that a pig picked at random

(i) Is given drugs, put on a high calorie diet and will die (1mk)

(ii) Is given drugs and will die (2mks)

(iii) Will die (3mks)

(iv) Is not given drugs and will not die (2mks)

20 Use a ruler and a pair of compasses only for all constructions in this question

(a) Construct a square ABCD of side 8cm (3mks)

(b) On the diagram in (a) above, construct;

(i) The locus of a point P such that it is equidistant from the sides AD and BC (1mk)

(ii) The locus of a point Q such that angle AQB $= 60^{\circ}$ (2mks)

(iii) The locus of R such that it is equidistant from the sides AB and AD (1mk)

(c) Locate by shading the region T that satisfy the following conditions;

(i) T is nearer to BC than to AD (1mk)

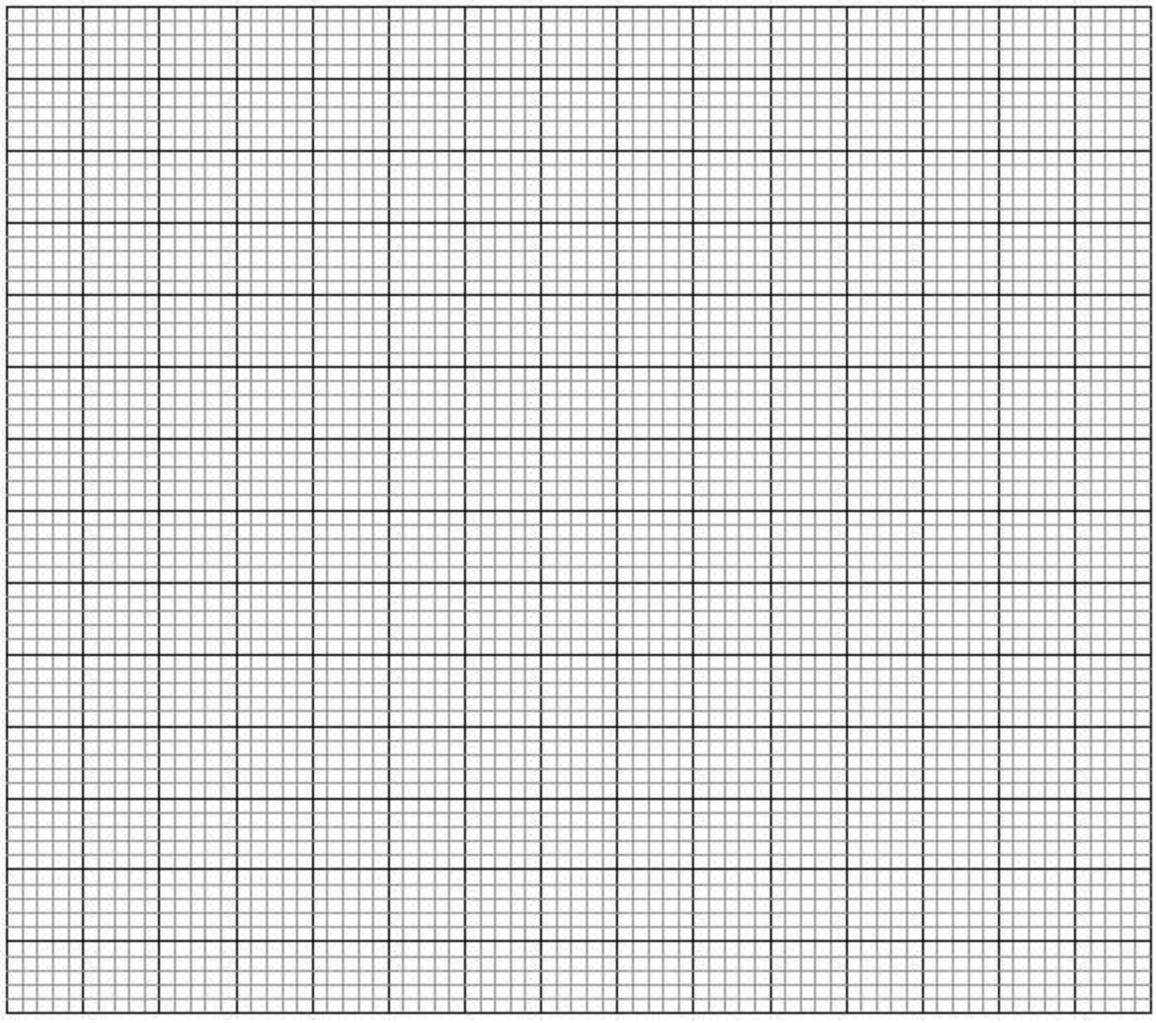
(ii) $< ATB \geq 60^{\circ}$ (1mk)

(iii) T is nearer to the side AD than to AB (1mk)

21 (a) Complete the table given below by filling in the blank spaces. (2mks)

x	0	15	30	45	60	75	90	105	120	135	150	165	180
y=4Cos2x	4.00		2.00	0.00		T	-4.00		-2.00	0.00	2.00		4.00
y=2sin(2x+30)	1.00	1.73	2.00	1.73		0.00		-1.00	-2.00	-1.73		0.00	1.00

(b)On the grid provided, draw on the same axes the graph of y=4Cos2x and y=2sin(2x+30) for $0^\circ \leq x \leq 180^\circ$. Take the scale 1cm for 15° on the x-axis and 1cm for 1 unit on the y-axis. (5mks)



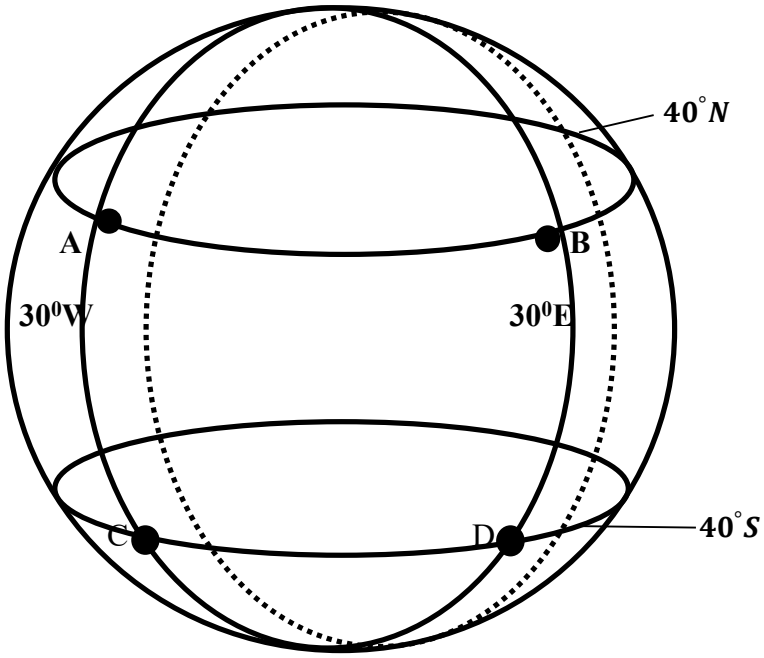
(c)From the graph;

(i) state the period of y=2sin(2x+30) (1mk)

(ii) state the range for which $4\text{Cos}2x \leq 0$ (1mk)

(iii) use the graph to solve the equation $4\text{Cos}2x - 2\sin(2x+30) = 0$ (1mk)

22 The figure below shows points on the earths' surface.



(a) State the positions of points A, B,C and D in coordinates form. (2mks)

(b) An aircraft flies from A to B along latitude 40°N, B to C along longitude $30^{\circ}E$ and C to D along latitude $40^{\circ}S$. Calculate to 4 s.f the total distance it covered in km. (Take radius of the earth $= 6370$km and $\pi = \frac{22}{7}$) (5mks)

(c) If the aircraft leaves A at 8:00a.m at a speed of 720km/h to B. At what local time is it expected at B. (3mks)

23 The following are marks scored by form four students in mathematics test

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
frequency	2	6	10	16	24	20	12	8	2

Using the assumed mean of 54.5, calculate;

(a) The mean mark (3mks)

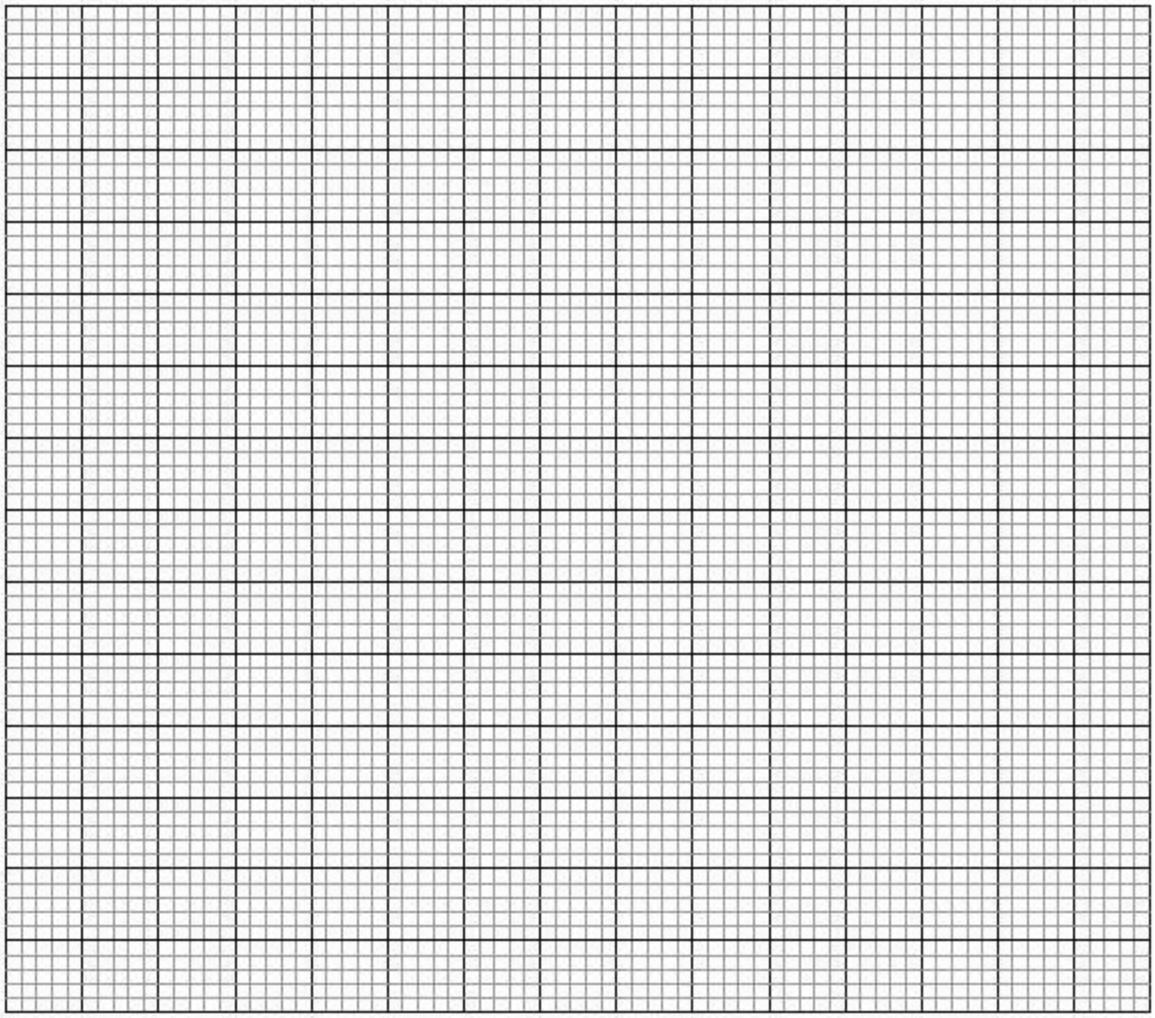
(b) The quartile deviation (4mks)

(c) The standard deviation (3mks)

24 A company has up to 40 acres of land available for planting wheat and maize. The labour costs of planting maize is ksh.900 per acre while for wheat it is ksh.1500 per acre. Maize takes 3 labourers per acre while wheat takes 6 laborers per acre. Atleast 72 labourers are to be hired and ksh. 4500 is available to cater for labour cost. The company hopes to make a profit of ksh. 3500 per acre of maize and khs. 4000 per acre of wheat. By letting the number of acres of maize be x and the number of acres of wheat to be y

(a) Write the inequalities representing the above information. (4mks)

(b) On the grid provided below, graph the inequalities in (a) above shading the unwanted regions (4mks)



(c) Determine the maximum profit that could be made by the company. (2mks)

SERIES 19

PAPER 1

SECTION 1 (50 Marks)
Answer all questions in this section.

1. Evaluate the following; (3 marks)

$$\frac{(8\frac{1}{2}-6\frac{2}{3})\div\frac{4}{9}}{\frac{2}{5}\ of\ 6\frac{1}{4}+1\frac{1}{4}}$$

2. Simplify; (3 marks)

$$(\frac{27}{125})^{-\frac{2}{3}}\times(\frac{16}{81})^{\frac{1}{4}}$$

3. In a covid-19 vaccination centre, teachers may receive their jabs from either of the two doctors stationed at the two tents. On an average, one doctor takes 2 minutes while the other doctor takes 3 minutes to serve one teacher. If the two doctors start to serve the teachers at the same time, find the shortest time it takes to vaccinate a total of 300 teachers. (3 marks)

4. Simplify the expression; (3 marks)

$$\frac{6a^2+ab-2b^2}{4a^2-b^2}$$

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5. Solve for ϑ if $\sin(2\vartheta - 50°) = \cos(\vartheta + 10°)$. (3 marks)

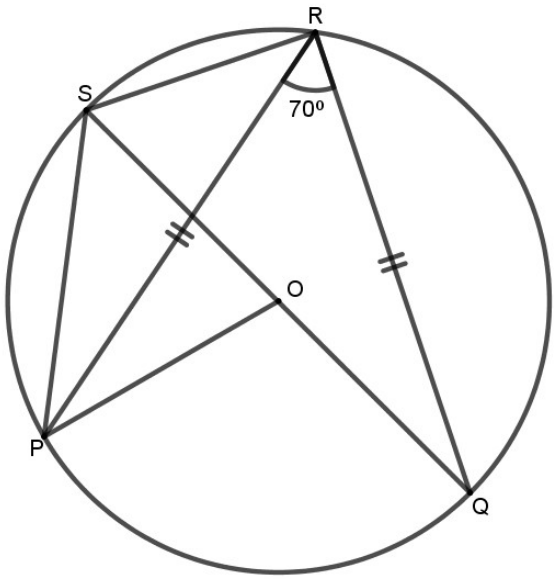
6. The velocity $V\ m/s$ of a particle projected into space is given by the formula $V = 5t^2 - 2t + 9$ where t is the time in seconds elapsed since projection. Determine the acceleration of the particle when $t = 4$ seconds. (3 marks)

7. The interior angles of a heptagon are $(2y + 35)°$, $100°$, $135°$, $150°$, 125, $(3y + 25)°$, and $(2y - 20)°$. Find the value of $\boldsymbol{y}$. (3 marks)

8. Two similar cylinders have diameter of 14 cm and 42 cm. If the larger cylinder has a volume of 12 474 cm^3, find the volume of the smaller cylinder. (3 marks)

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9. The figure below shows a circle centre O, PQRS is a cyclic quadrilateral and QOS is a straight line. Angle PRQ is 70°.



Giving reasons for your answers, find the size of

(a) Angle POQ (1 mark)

(b) Angle PRS. (2 marks)

10. Solve for x and state the integral values. (4 marks)

$$23 - 2x > x + 2 \geq -\frac{1}{4}x - 3$$

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11. Given that $\tilde{a} = 3i - 2j + 3k$ and $\tilde{b} = 2i - 4j - 3k$ where $\boldsymbol{i}, \boldsymbol{j}$ *and* $\boldsymbol{k}$ are unit vectors. Find $|2a + 2b|$ (3 marks)

12. Use the exchange rates below to answer this question

	Buying (Kshs)	**Selling (Kshs)**
1 US dollar ($)	105.00	105.40
1 UK Sterling Pound (£)	145.20	145.75

A tourist arrived in Kenya from Britain with 7,800 UK£. He converted the whole amount of money to Kenya Shillings. While in Kenya, he spent 70% of this money and changed the rest to US $. Calculate the amount of money to the nearest dollar that he received. (3 marks)

13. Construct triangle ABC in which BC = 6 cm, AB = 4.5 cm and angle $ABC = 135°$ .Drop a perpendicular from point B to line AC and determine the shortest distance from point B to line AC. (4 marks)

14. Use tables of cubes, cube roots and reciprocals to find the value of; (3 marks)

$$\frac{4}{(8.63)^3} + \left(\frac{5}{34.46}\right)^{\frac{1}{3}}$$

15. A juice seller blends three types of juices P, Q and R in the ratios $P: Q = 3: 4$ and $Q: R = 1: 2$. The blend contains 16.8 litres of R

a) Find the ratio P: Q: R (1 mark)

b) Find the required capacity of P in the blend (3 marks)

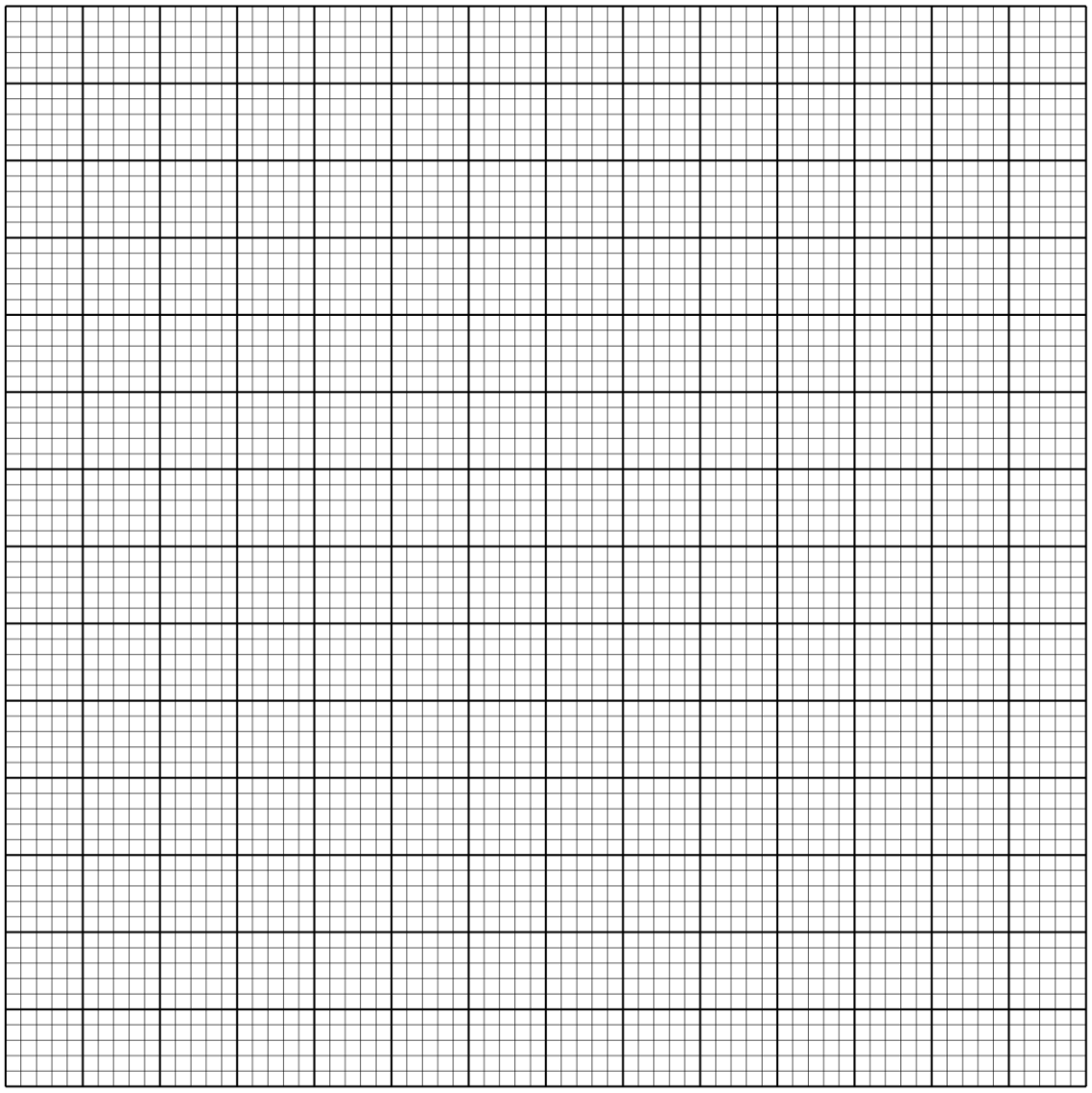
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16. A hawker bought 1948 sweets on the first day and sold 570 sweets on the same day. On the second day he sold 204 sweets more than the first day. On the third day he added 650 sweets to his stock. He sold all the sweets on the same day at the price of Sh. 5 each. Calculate the amount of money he received on the third day. (3 marks)

SECTION II (50 Marks)

Instruction: Attempt any <u>Five</u> questions only in this section in the spaces provided.

17. (a) A triangle with vertices $A(-4,2)$ $B(-6,6)$ and $C(-6,2)$ is enlarged by a scale factor -1 and center $(-2,6)$ to produce triangle $A'B'C'$. Draw triangle ABC and $A'B'C'$ and state its coordinates. (4 marks)



(b) Triangle$A'B'C'$ is then reflected in the line $y = x$ to give triangle $A''B''C''$. Draw $A''B''C''$ and state its coordinates . (3 marks)

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(c) If triangle $A''B''C''$ is mapped on to $A'''B'''C'''$ whose coordinates are $A'''(0,-2)$, $B'''(4,-4)$, and $C'''(0,-4)$ by a rotation. Find the center and angle of rotation. (3 marks)

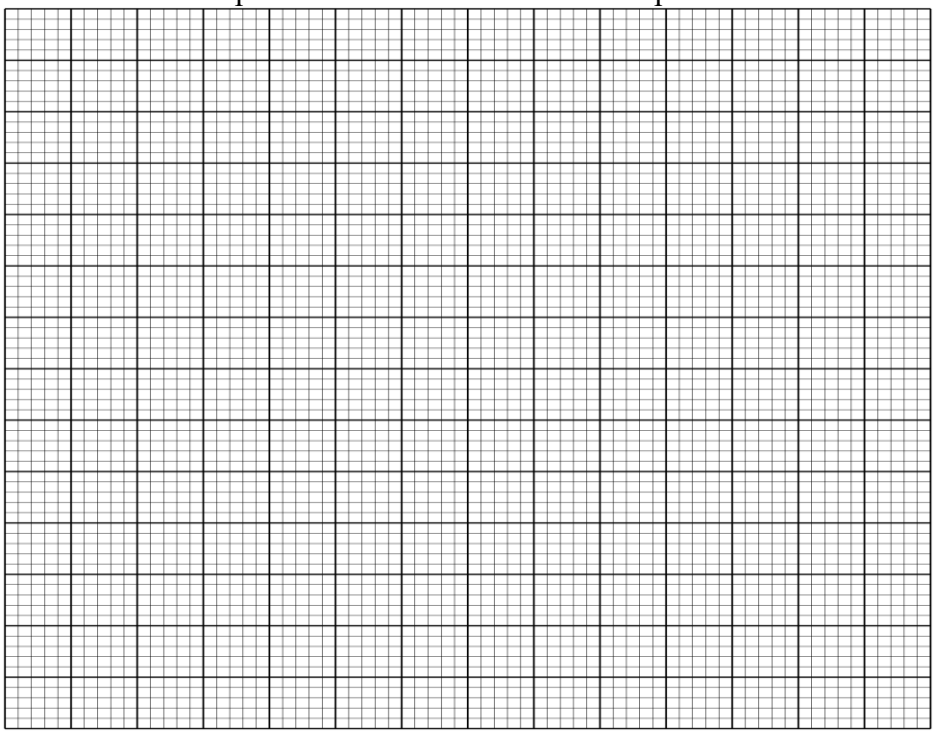
18. The table below shows heights of 50 students.

Height (cm)	$150-154$	$155-159$	$160-164$	$165-169$	$170-174$	$175-179$
Number of students	5	13	12	x	7	3

a) Determine the value of X. (1 mark)

b) Calculate the mean height (4 marks)

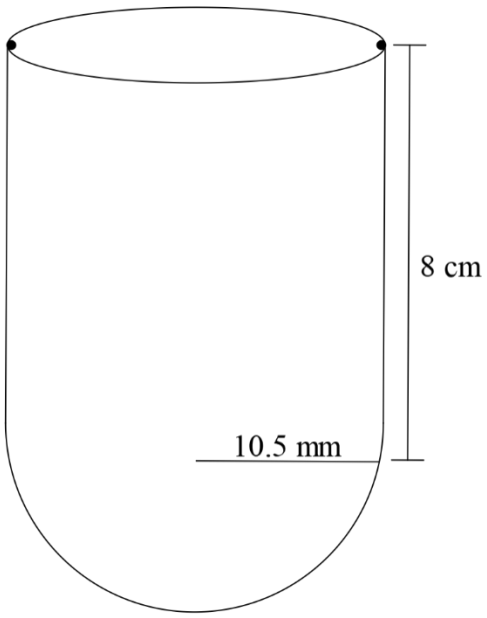
c) (i) On the grid provided, draw a histogram to represent the above information. Use a scale of 1 cm to represent 5 students and 2 cm to represent 5 cm. (2 marks)



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(ii) On the histogram, draw a vertical line to show where the median mark lies. (3 marks)

19. The figure below shows a test tube used to store laboratory reagents during a research study. One of the study reagents was filled into the test tube up to 80% full.



Calculate:

a) The volume of the reagent in the test tube. (3 marks)

b) The height of the reagent in the test tube. (3 marks)

c) The total surface area of the tube in contact with the reagent. (4 marks)

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20. A bus left Mombasa and travelled towards Nairobi at an average speed of 60km/hr. After 2hrs and 30 minutes, a car left Mombasa to Nairobi and travelled along the same road at an average speed of 100km/hr. If the distance between Mombasa and Nairobi is 500km.
    a. Determine
        i. The distance of the bus from Nairobi when the car took off. (2 marks)

        ii. The distance the car traveled to catch up with the bus. (4 marks)

    b. Immediately the car caught with the bus the car stopped for 25 minutes. Find the new average speed at which the car traveled in order to reach Nairobi at the same time as the bus (4 marks)

21. The velocity of a particle after t seconds is given by $V = t^2 - 2t + 4$.
    (a) Use the mid ordinate rule with six strips to estimate the displacement of the particle between t = 1 and t = 13 (3 marks)

    (b) Determine;
        i. The exact area of the particle between t = 1 and t = 13. (3 marks)

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ii. Acceleration of the particle at t = 4 (2 marks)

(c) Calculate the percentage error arising from the estimated area in (a) above.
(2 marks)

22. A shopkeeper planned to buy some fridges from a sum of 1.8 million shillings. Before she could buy the fridges, the price per unit was reduced by Sh. 4 000. As a result she was able to buy five more fridges using the same amount of money as originally planned.
    a) Determine the number of fridges that the shopkeeper bought. (6 marks)

    b) If two of the fridges purchased got damaged while in store and the rest were sold making a profit of 20 %, calculate her profit per fridge. (4 marks)

23. The equation of a line L_1 is $3y - 2x = 10$
    a) Find in form of $y = mx + c$ where m and c are constants,
    i. The equation of line L_2 passing through point N (-5,2) and parallel to L_1. (2 marks)

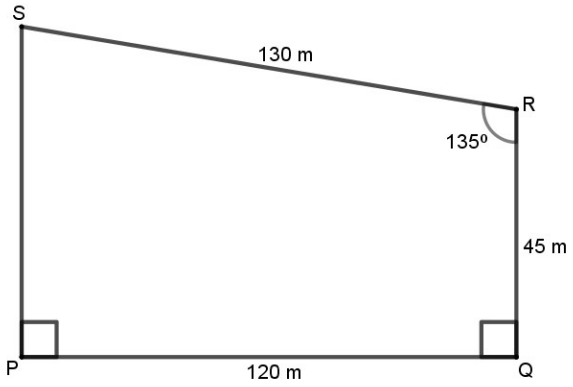
    ii. The equation of L_3 perpendicular to L_2 at M $(1, -8)$. (3 marks)

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b) Find the angle of inclination of the line L_2 with the horizontal (2 marks)

c) Find the magnitude of MN (3 marks)

24. The diagram below shows a garden in the shape of a quadrilateral PQRS in which $PQ = SR = 120m$, $QR = 45\ m$, $\angle PQR = \angle SPQ = 90°$ and $\angle QRS = 135°$



(a) Calculate to 1 decimal place:

(i) The size of angle QPR. (3 marks)

(ii) The length PS (4 marks)

(b) Calculate the area of the garden in hectares, correct to 3 decimal places. (3 marks)

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PAPER 2

SECTION 1 (50 Marks)

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

1. Use logarithms to evaluate; (4 marks)

$$\left(\frac{415.3 \times 0.0152}{\sin 75°}\right)^{\frac{1}{3}}$$

2. The base and perpendicular height of a triangle measured to the nearest ccentimetre are 12 cm and 8cm respectively. Find the absolute error in calculating area of the triangle (3 marks)

3. (a) Expand $(3+\frac{2}{x})^{5}$ up-to the term x^4. (1 mark)

(b) Hence estimate the value of $(3.5)^5$ to 4 s.f. (2 marks)

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4. Find the radius and centre of the a circle whose equation is $3x^2 + 3y^2 - 12x + 18y = 9$
(3 marks)

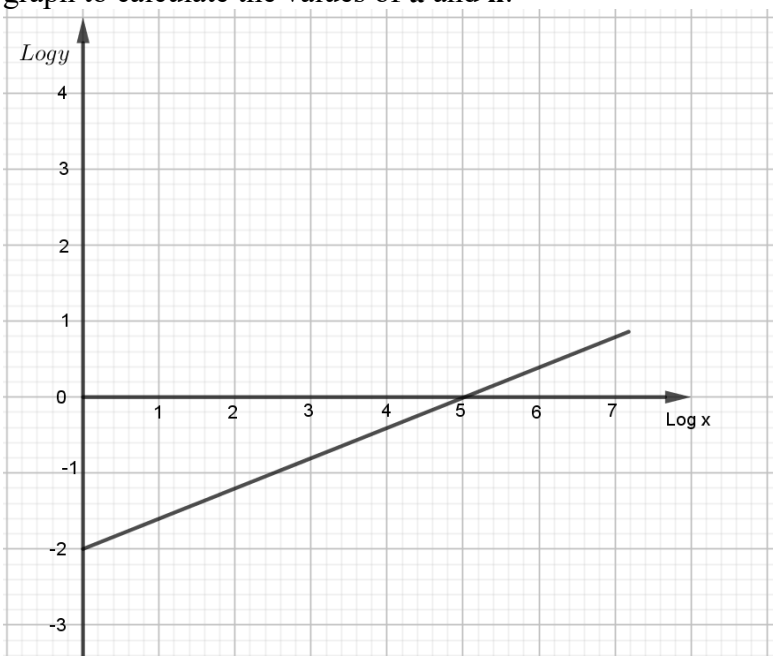
5. An aero plane leaves town A(40°N, 155°W) for town B(40°N, 25°E) using the shortest route at a speed of 300 knots. Calculate the time it takes to travel from A to B.
(3 marks)

6. The third term and the sixth term of a geometric series are $3\frac{1}{3}$ and $11\frac{1}{4}$ respectively. Calculate the;
   a) Common ratio (2 marks)

   b) First term (1 mark)

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7. The graph below is part of a straight line obtained from initial equation $y = ax^n$. Use the graph to calculate the values of **a** and **n**. (4 marks)



8. Given that $A = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 3 \\ 2 & -1 \end{pmatrix}$, find matrix C where $AC = B$. (3 marks)

9. A quantity P is partly constant and partly varies inversely as square of t. P = 6 when t = 6 and P = 18 when t = 3. Find t when P = 11. (3 marks)

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10. A mobile phone can be purchased in cash Ksh. 30,000 or by paying Ksh. 1,750 for 24 months. Calculate the rate of interest charged on instalment buying. Give your answer correct to 2 decimal places. (3 marks)

11. Solve for x in $3\log_3 x + 4 = \log_3 24$ (3 marks)

12. Solve for x in the equation

$6\sin^2 x - \cos x - 5 = 0$ for $0° \leq x \leq 360°$ (3 marks)

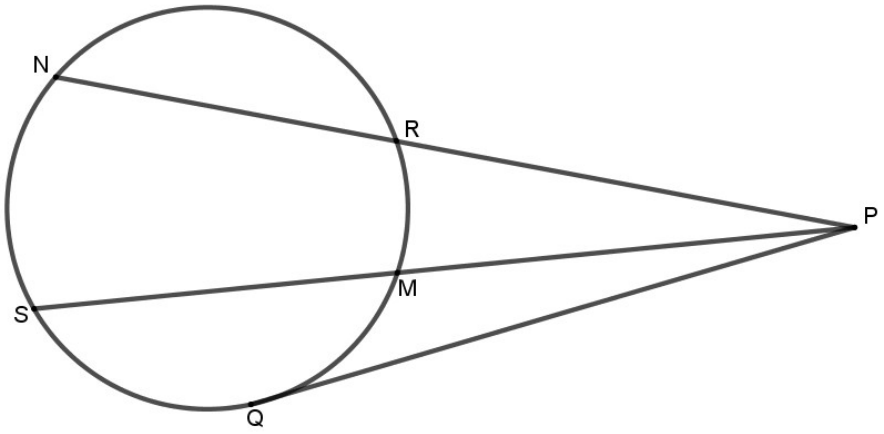
13. Two brands of tea costing Sh. 160 and Sh. 140 per kilogram respectively are mixed in the ration 2: 3 by mass. The mixture is sold at Sh. 240 per kilogram. Find the percentage profit made. (3 marks)

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14. Triangle $A'B'C'$ is the image of triangle ABC under transformation represented by the matrix $\begin{pmatrix} 3 & 1 \\ 5 & 4 \end{pmatrix}$. If the area of triangle $A'B'C'$ is 140 cm^2, find the area of triangle ABC

(3 marks)

15. Given that PR = 2cm, PN = 12cm and PM = 3cm. Find the length of:



(i) PS (2 marks)

(ii) PQ (1 mark)

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16. Given that $\tan x = \frac{1}{\sqrt{3}}$, find the value of $tanx + \cos x$. (3 marks)

SECTION II (50 Marks)

Answer any Five questions only in this section.

17. In a science class, $\frac{2}{3}$ of the class are boys and the rest are girls. 80% of the boys and 90% of the girls are right handed. The probability that the right handed student will break a test tube in any session is $\frac{1}{10}$ and that for the left handed student is $\frac{3}{10}$,regardless of whether boy or girl.

(a) Draw a tree diagram to represent this information (2 marks)

(b) Using the tree diagram drawn, find the probability that:

(i) A student chosen at random from the class is left handed (2 marks)

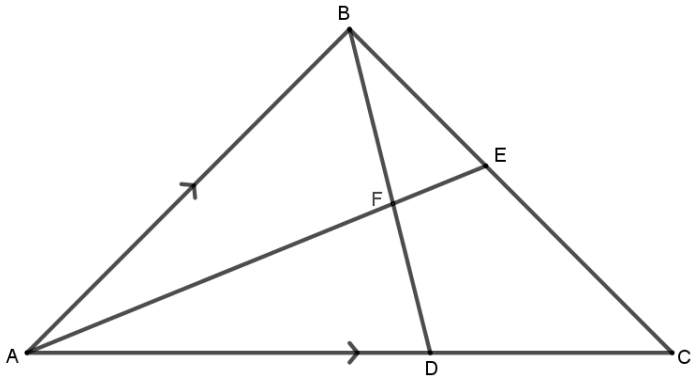
(ii) A test tube is broken by a left handed student. (2 marks)

(iii) A test tube is broken by a right handed student. (2 marks)

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(iv) A test tube is not broken in any session (2 marks)

18. In a triangle ABC, E is the midpoint of BC, D is a point on AC such that AD: DC = 3: 2 and F is the point of intersection of AE and BD. Vectors $AB = \tilde{b}$ and $AC = \tilde{c}$



(a) Express the following vectors in terms of $\tilde{\boldsymbol{b}}$ and $\tilde{\boldsymbol{c}}$ only

(i) AE (2 marks)

(ii) BD (1 mark)

(b) By expressing vectors BF in two ways, find the ratio BF: FD given that BF = hBD and AF = tAE where h & t are constants (5 marks)

(c) Hence find vector BF in terms of b and c only (2 marks)

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19. The table below shows the rates at which income tax is charged on annual income.

Annual taxable income (K£)	Rates (Sh per K£)
$1 - 2800$	3
$2801 - 4600$	5
$4601 - 7200$	6
$7201 - 9000$	7
$9001 - 11\,800$	9
$11\,801 - 13\,600$	10
Over 13 600	12

A company employee earns a basic monthly salary of Ksh. 18 600 and a house allowance of 15% of his basic salary. If the employee is married and claims a monthly family relief of Sh. 250, calculate;

a) His annual taxable income in Kenya pounds. (2 marks)

b) His net salary per month. (8 marks)

20. The marks obtained by 50 students in an examination were recorded in the table below

Marks	$0 - 9$	$10 - 19$	$20 - 29$	$30 - 39$	$40 - 49$	$50 - 59$	$60 - 69$	$70 - 79$
Number of student	3	6	10	12	9	5	3	2

Using 44.5 as the assumed mean, calculate

(i) The actual mean mark (4 marks)

(ii) The standard deviation to 2 decimal place (3 marks)

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(iii)The quartile deviation (3 marks)

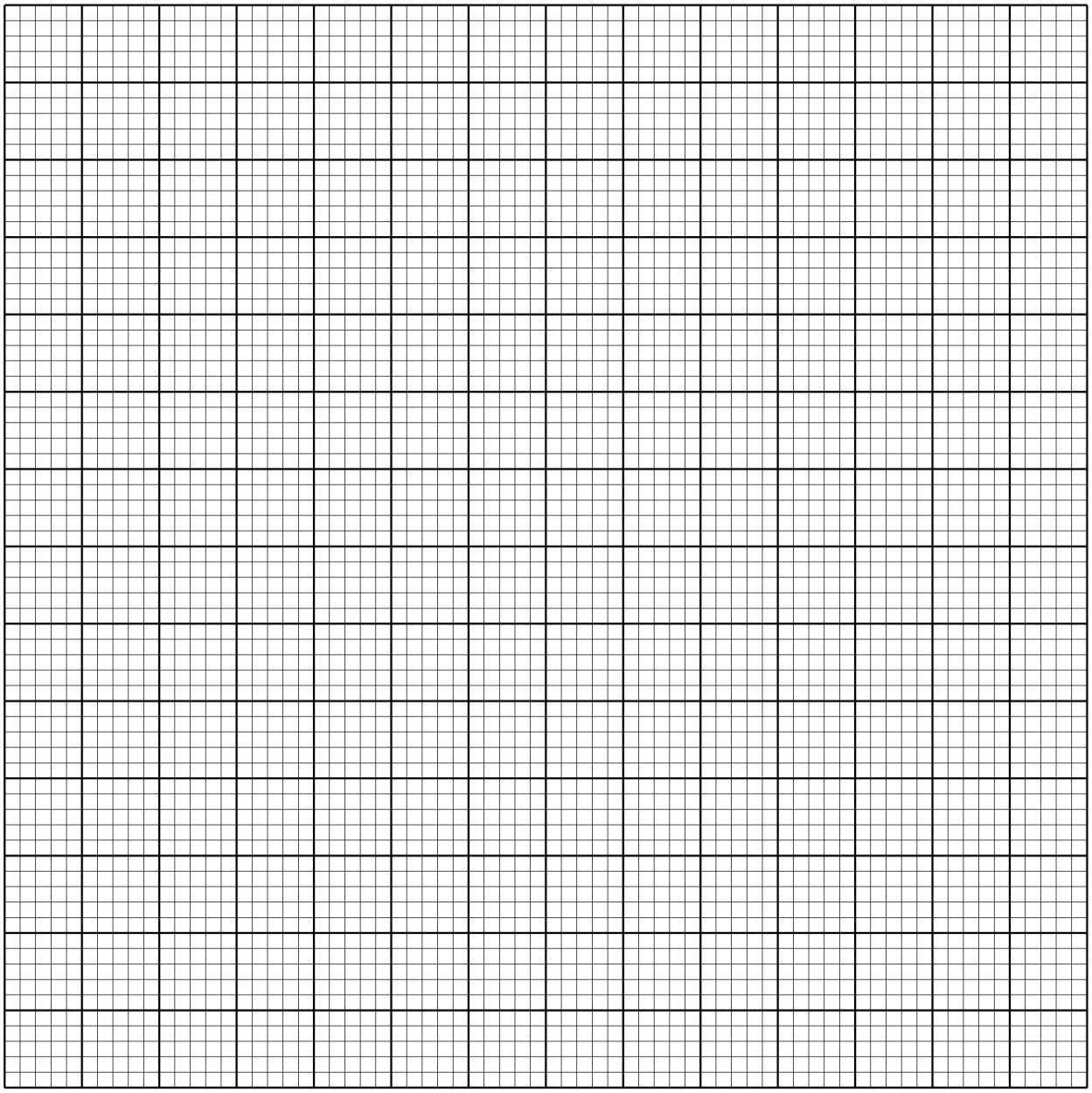
21. Given that $y = 2\,sin2x$ and $y = 3\,cos\,(x + 45°)$

(a) Complete the table below: (2 marks)

x	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
$2\sin 2x$	0		1.97		0.68	-0.68	-1.73		-1.28	0
$3\cos(x + 45°)$	2.12	1.27		-0.78		-2.46			-2.72	-2.12

(b) Use the data to draw the graph of $y = 2\sin 2x$ and $y = 3\,cos\,(x + 45°)$ for $0° \leq x \leq 180°$ on the same axis on the grid provided below. (5 marks)

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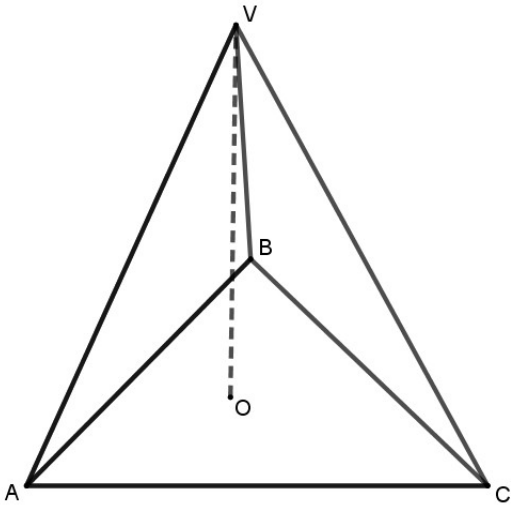


(c) State the amplitude and period of each curve (2 marks)

(d) Use the graph to solve the equation $2\sin 2x - 3\cos(x + 45°) = 0$ for $0° \leq x \leq 180°$ (1 mark)

22. VABC is a pyramid standing on an equilateral triangular base ABC whose sides are 6 cm. VO is the perpendicular height. $VA = VB = VC = 15\ cm$.

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Calculate to 2 d.p.

a) Height VO. (3 marks)

b) The inclination of VAB to ABC. (2 marks)

c) The inclination of VB to ABC. (3 marks)

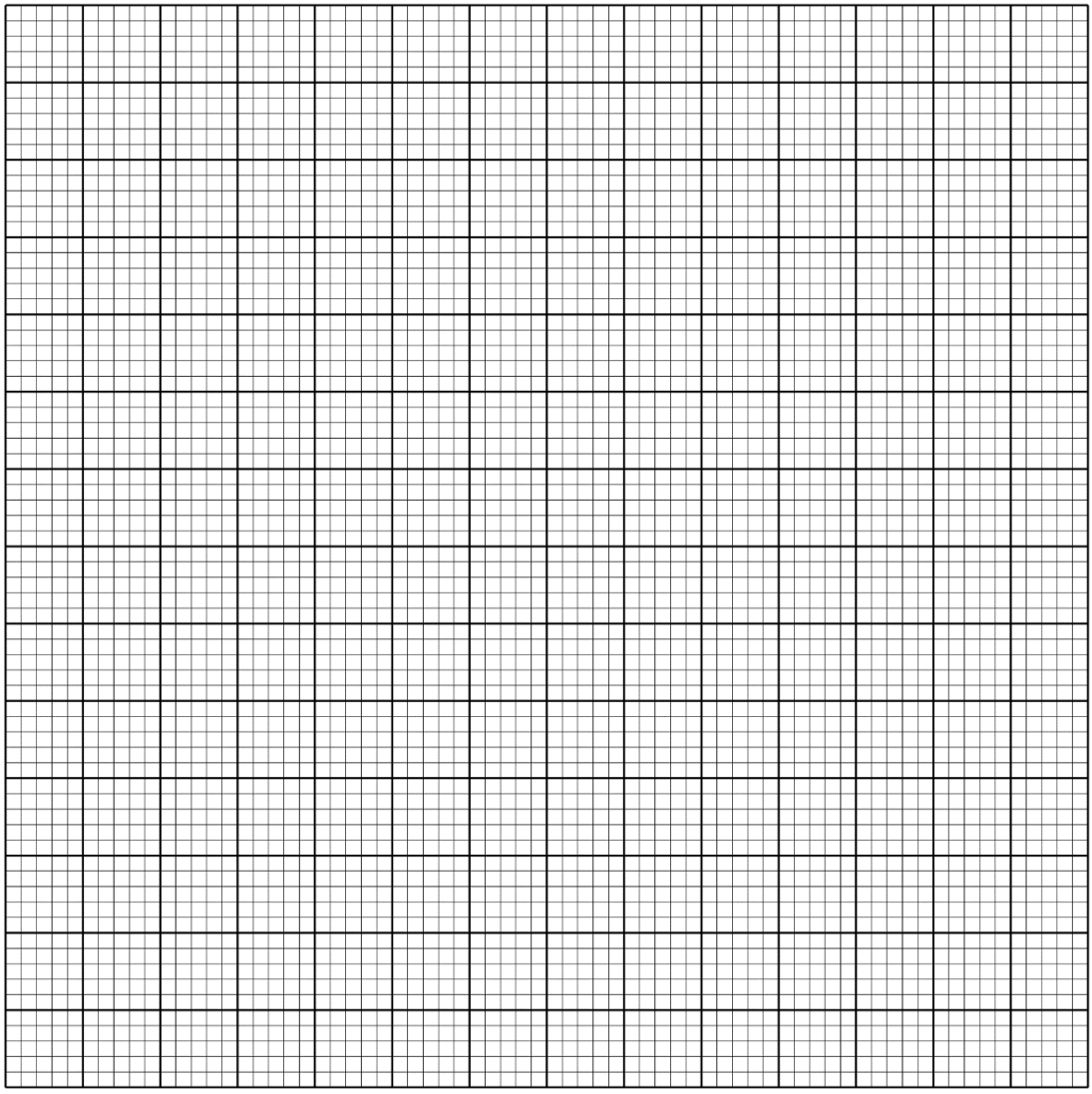
d) The volume of the pyramid. (2 marks)

23. A small scale farmer wishes to buy some sheep and goats for rearing. Sheep cost Sh 400 and a goat cost Sh.300.The farmer has enough space for only 20 animals and may spend at most Sh. 6 800. The number of goats should not exceed twice the number of sheep.

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a) By letting x and y to represent the number of sheep and goats he can buy respectively, write down all inequalities from the above information. (4 marks)

b) Represent the inequalities on the grid provided (4 marks)



c) From your graph, find the maximum number of animals he can buy at the lowest cost (2 marks)

24. The displacement of a particle S metres, t seconds after passing a fixed point O is given by $S = 3 + 2t - 5t^{2}$.

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Calculate:

a) The displacement of the particle 2 seconds later (2 marks)

b) The time taken for the particle to return to O (3 marks)

c) The maximum displacement of the particle (3 marks)

d) The initial velocity of the particle (2 marks)

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SERIES 20
PAPER 1

SECTION I – 50 Marks

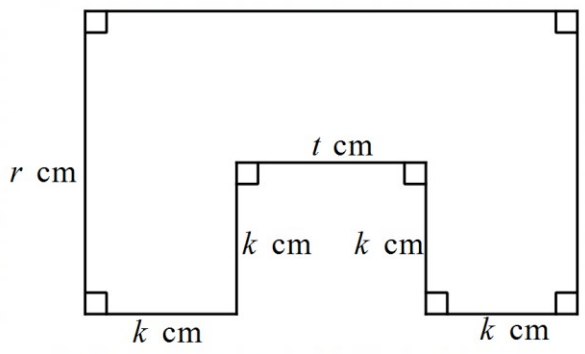
Answer ***all*** the questions in this section

1. Three techs, Eric, Isaac and Nyakaru contributed some money to purchase a server. Eric contributed $\frac{1}{3}$ of the total amount. Isaac contributed $\frac{3}{8}$ of the remaining amount and Nyakaru contributed the rest. The difference between Nyakaru's and Isaac's contribution was Ksh. 40000. Calculate the cost of the server. (3 marks)

2. A square wall of a washroom is to be covered by rectangular tiles of dimensions 600 mm by 420 mm. Calculate:
   (a) the least area of the wall in square metres that can be covered by such tiles. (3 marks)

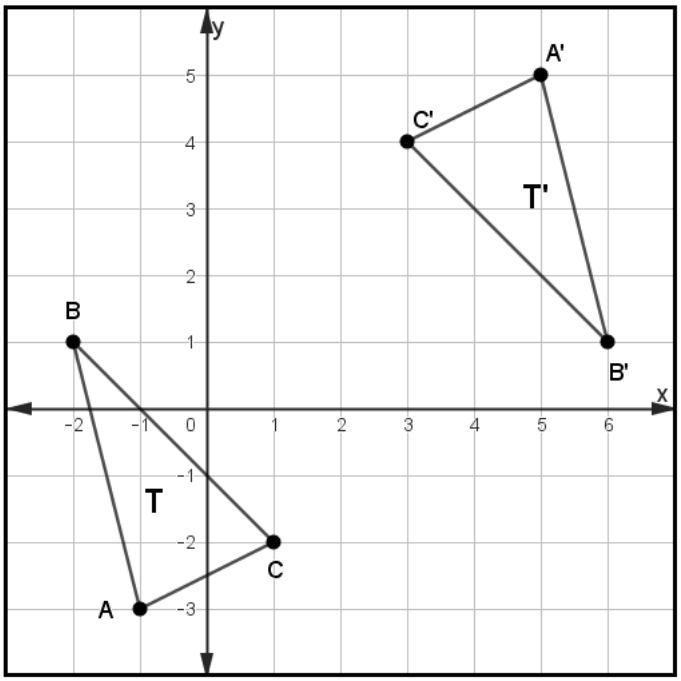
   (b) the number of such tiles required to cover the area in (a) above. (1 mark)

3. Find the perimeter of the figure below. (2 marks)



4. Two similar cylindrical containers are such that their capacities are 160 ml and 540 ml respectively. Given that the difference in their heights is 4 cm, calculate the height of the larger cylinder. (3 marks)

5. The figure below show triangle T and its image triangle T′ under a transformation described by **M**.



Describe **M** fully (3 marks)

6. Find the number of revolutions made by cylindrical roller of diameter 1.02 m and height 1.3 m. If it rolls over a surface area of 291.72 m^2. Use $\pi = \frac{22}{7}$ (3 marks)

7. Two buses A and B leave the same station. Bus A heads due East while bus B heads due North. The north bound bus travelled 10 km/h faster than the east bound bus. After 5 hours, the two buses are 250 km apart. Calculate the speed of the north bound bus. (4 marks)

8. (a) Find the integral values that satisfy the inequalities below. (3 marks)

$$\frac{3x+2}{4} < \frac{2x+3}{5} \leq \frac{4x+15}{6}$$

(b) Hence show the solution on a number line. (1 mark)

9. If 5 men can construct 2 cottages in 21 days, how many more men, working at the same rate, will be needed to construct 6 cottages in the same period? (3 marks)

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10. A trader in Gikomba market sold a bag of potatoes at Ksh. 1 140, giving a discount of 5%. If she made 15% profit from the selling price, find the buying price of the bag of potato, to the nearest shilling. (3 marks)

11. The curved surface area of a cylindrical container is 1980 cm^2. If the radius of the container is 21 cm, calculate to one decimal place the capacity of the container. Take $\pi = \frac{22}{7}$. (3 marks)

12. Solve for x in the equation (3 marks)
$9^{x+1} + 3^{2x} = 810$

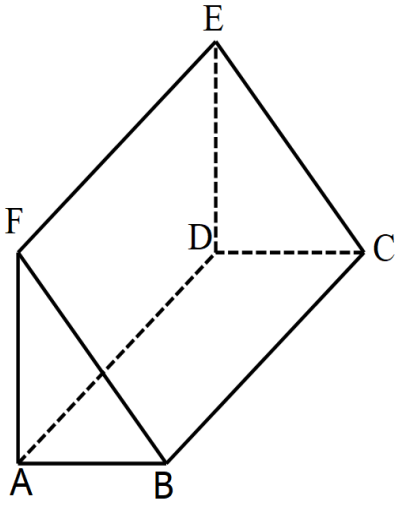
13. Given that $\log 4 = 0.6021$ and $\log 6 = 0.7782$, without using mathematical tables or calculator, evaluate $\log 0.096$. (3 marks)

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14. Two regular polygons have sides n and $n+3$. Given that the ratio of the sum of their interior angles is 1: 2, calculate the value of n. (3 marks)

15. Solve for θ in the equation $2\sin(3\theta-40)^0 = 1$ for $0^0 \leq \theta \leq 180^0$. (3 marks)

16. The figure below shows a solid ABCDEF. Draw the net of the solid. (2 marks)



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SECTION II – 50 Marks

*Answer **any five** questions in this section*

17. Jenipher and Linda decided to start an investment jointly. Jenipher contributed Ksh 500 000 while Linda contributed Ksh 600 000. They agreed that at the end of every year, the profit will be distributed as follows:
    - 15% - shared equally between them
    - 20% - meeting operational costs of the investment

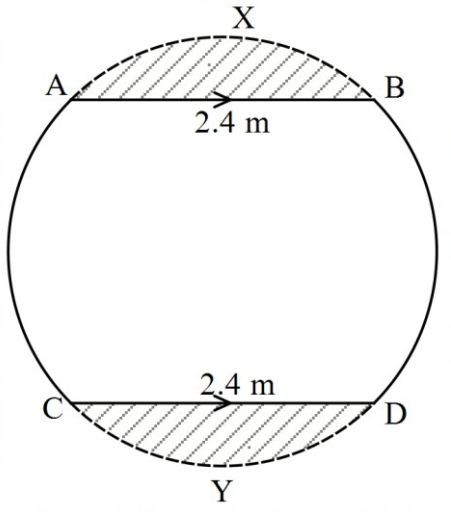
    The rest of the profit shall be shared in the ratio of their contribution.
    At the end of the first year, the business realized a profit of Ksh 649 000

    (a) How much money was set aside for meeting the operational costs of the investment? (2 marks)

    (b) What was Linda's share of the profit at the end of the year? (4 marks)

    (c) Jenipher decided to buy bee hives with her share of the profit, at a cost of Kshs 45 000 per hive. How much money did she remain with after buying the hives? (4 marks)

18. The diagram below represents the cross-section of a petroleum tanker made from a circle centre. AB and CD are equal chords measuring 2.4 m and are 1 m apart on either side of the centre O of the circle. AXB and DYC are segments cut from the circle to form the cross-section. The tanker is 8.5 metres long.



    Calculate:

    (a) the radius of the circle. (1 mark)

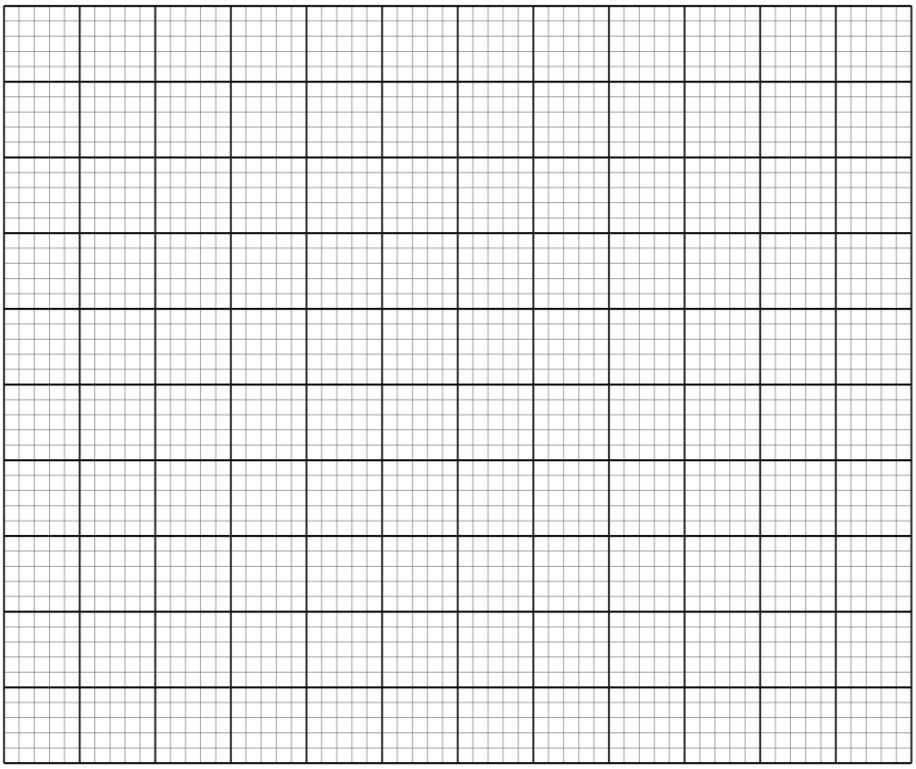
(b) the area of the cross-section. Use $\pi = 3.142$ (6 marks)

(c) the capacity of the tank to the nearest one thousand litres. (3 marks)

19. a) Complete the table below for the curve $y = x^3 - 5x^2 + 2x + 9$ for $-2 \leq x \leq 5$. (2 marks)

x	-2	-1	0	1	2	3	4	5
y			9					

(b) On the grid provided, draw the graph of $y = x^3 - 5x^2 + 2x + 9$ for $-2 \leq x \leq 5$. (3 marks)



(c) Use the graph in (b) above to find the roots to the following equations:

(i) $x^3 - 5x^2 + 2x + 9 = 0$ (2 marks)

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(ii) $x^3 - 5x^2 + 6x = -5$ (3 marks)

20. The table below shows marks scored by students in a Mathematics contest

Mass (kg)	5 – 14	15 – 29	30 – 49	50 – 54	55 – 62
Number of students	2	12	24	10	12

(a) Calculate the mean marks (4 marks)

(b) Draw a histogram to represent the information above. (3 marks)



(c) On the histogram in (b) above, use a vertical line to show where the median lies. Show your workings. (3 marks)

21. A curve $y = x^3 + 4x^2 - 3x + k$ passes through a point $P(-2, 9)$

(a) find the value of k (2 marks)

(b) Find the equation of a tangent to the curve at P. (3 marks)

(c) Determine the:

(i) stationary points of the curve (3 marks)

(ii) nature of each stationary point in (c) (i) above. (2 marks)

22. In a triangle OAB, $\boldsymbol{OA} = 12\boldsymbol{a}$ and $\boldsymbol{OB} = 12\boldsymbol{b}$. P and Q are points on OA and OB respectively such that $3\boldsymbol{OP} = \boldsymbol{OA}$ and $\boldsymbol{OQ} = \frac{1}{3}\boldsymbol{OB}$. M is the midpoint of AB

(a) Express the following vectors in terms of a and b;

(i) $\boldsymbol{OM}$ (1 mark)

(ii) $\boldsymbol{PB}$ (1 mark)

(b) Given further that $\boldsymbol{OM}$ and $\boldsymbol{BP}$ intersect at R such that $\boldsymbol{PR} = k\boldsymbol{PB}$ and $\boldsymbol{OR} = h\boldsymbol{OM}$

(i) Express $\boldsymbol{PR}$ in two ways (2 marks)

(ii) Hence, find the values of h and k (3 marks)

(c) Show that A, R and Q are collinear. (3 marks)

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23. Two vertices of a triangle PQR are P$(-2, 4)$ and Q$(4, 8)$:

(a) Find the equation of the line PQ in the form $y = mx + c$, where m and c are constants. (3 marks)

(b) Find the equation of the perpendicular bisector of the line PQ in the form $ax + by = c$, where a, b and c are integers (4 marks)

(c) Given that PQ is perpendicular to PR at R, and the equation of the line QR is $5x - y = 38$, find the co-ordinates of R.

(3 marks)

24. The distance from Garsen to Lamu is 196 km. A matatu left Garsen at 8.30 a.m. for Lamu at an average speed of 54 km/h. After two-thirds of an hour, a van left Lamu for Garsen along the same route at an average speed of 66 km/hr. The two vehicles met in Mpeketoni.

(a) Calculate:

(i) the time of the day the two vehicles met. (3 marks)

(ii) the distance between Garsen and Mpeketoni (3 marks)

(b) On the same day, a car left Kilifi for Lamu using the same route at an average speed of 90 km/h and caught up with the matatu at the same time as the van.
Find:

(i) the time when the car left Kilifi (2 marks)

(ii) the distance of the car from Lamu at 11a.m. (2 marks)

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PAPER 2

SECTION I – 50 Marks

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

1. (a) Work out
36957×0.02164 (1 mark)

(b) An approximate value is obtained by truncating each value correct to two significant figures. Determine the percentage error arising from this approximation correct to three decimal places. (3 marks)

2. Given that $\cos 15^0 = \dfrac{\sqrt{6}+\sqrt{2}}{4}$, find $\dfrac{1}{\sin 105^0}$. Do not use a calculator nor a mathematical table. (3 marks)

3. The trigonometric function $2y = a\sin(bx - 40)^0$ has an amplitude of 2.5 and a period of 1440^0

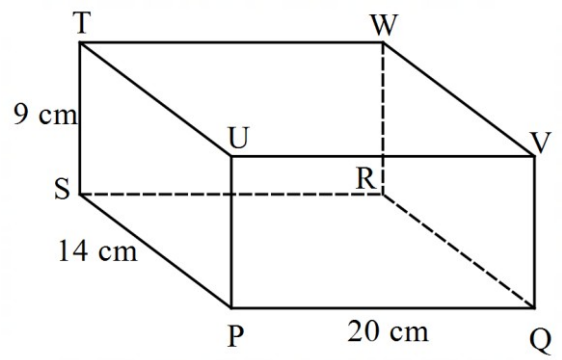
(a) State the phase angle of the function. (1 mark)

(b) Find the values of a and b. (2 marks)

4. (a) Find the inverse of the matrix $\begin{pmatrix} 3 & 2 \\ 5 & 4 \end{pmatrix}$ (1 mark)

(b) Hence, find the coordinates of the intersection point of the lines whose equations are $2y+3x=4$ and $2.5x+2y=4.5$ (3 marks)

5. The figure below represents a cuboid PQRSTUVW such that PQ = 20 cm, PS = 14 cm and ST = 9 cm.



Calculate, correct to 2 decimal places, the obtuse angle between lines UW and SQ. (3 marks)

6. The coordinates of A and B are $(1,-6,3)$ and $(4,0,-3)$ respectively. A point T divides AB in the ratio 1:3. Find the position vector of T in terms of unit vectors. (3 marks)

7. A transformation whose matrix is $\begin{pmatrix} 2 & 6 \\ 4 & -3 \end{pmatrix}$ maps a quadrilateral ABCD onto another quadrilateral A′B′C′D′ whose area is 540 square units. Find the area of the quadrilateral ABCD. (3 marks)

8. There are two examiners A and B marking a Mathematics contest. The table below summarises how each of the examiners marks a bunch of ten papers.

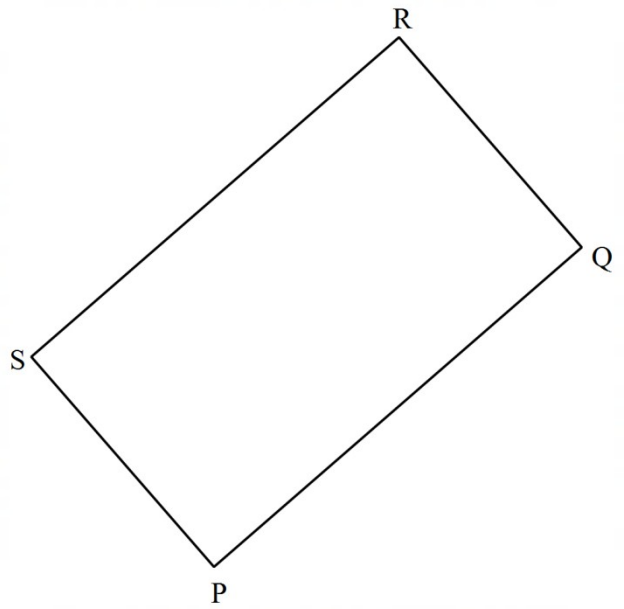
Examiner	Number of questions marked accurately	Number of questions marked with deviation
A	6	4
B	7	3

Calculate the probability that either of the examiners mark with deviation. (2 marks)

9. A firm has a fleet of vans and trucks. Each van can carry 9 crates and 3 cartons while each truck can carry four crates and 10 cartons. The firm has to deliver not more than 36 crates and at least 30 cartons. If x vans and y trucks are available for the delivery, write down the inequalities that represent the information above. (3 marks)

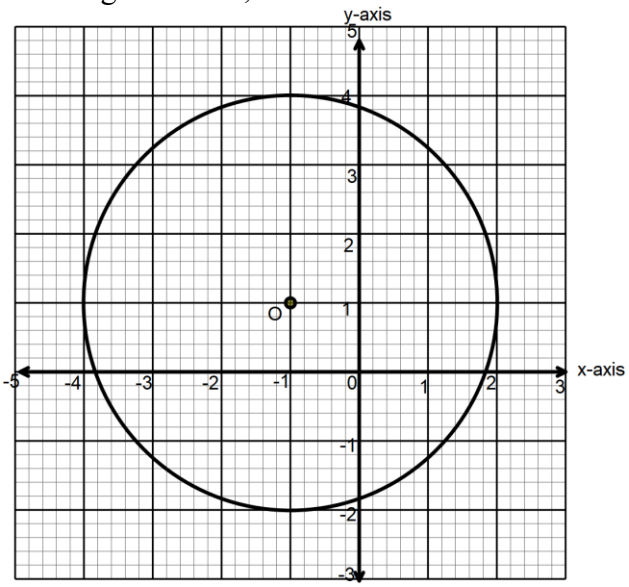
10. Make r the subject of the formula: $A = \pi(R^2 - r^2)$ where A is the area between two concentric circles of radii R and r. (3 marks)

11. The figure below shows a rectangular grazing field PQRS



A water trough T is to be constructed within the field. The trough must be nearer to the edge PQ than it is to the edge SR. Angle $STR \geq 90^0$. Shade the region T within which the water trough may be constructed. (3 marks)

12. In the figure below, O is the centre of the circle.



Find the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$, where a, b and c are constants.

(3 marks)

13. (a) Expand $\left(1-\frac{1}{3}x\right)^6$ in ascending powers of x up to the fourth term. Leave the coefficients as fractions in their simplest forms. (1 mark)

(b) Use the expansion in (a) above to estimate the value of $\left(\frac{9}{10}\right)^6$ (2 marks)

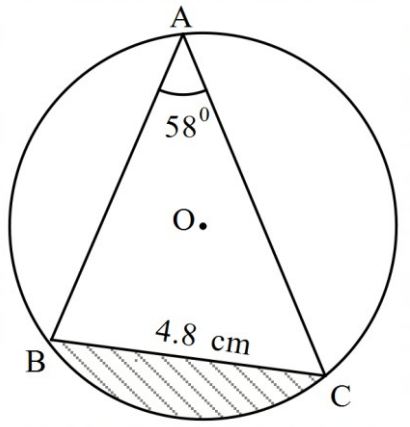
14.

15. The table below shows the rainfall distribution (in mm) in a weather station for six months of a year

	January	February	March	April	June	July
Rainfall (mm)	105	82	86	126	130	137

Calculate the mean absolute deviation for the station (3 marks)

16. In the figure below, O is the centre of the circle. BC = 4.8 cm and $\angle ABC = 58^0$



Calculate the area of the shaded area, correct to three decimal places. Use π = 3.142 (4 marks)

SECTION II – 50 Marks

Answer any ***five*** questions in this section

17. Income tax rates for a certain year in Kenya were as follows

Taxable income (Ksh. per month)	Tax Rate (% in each Ksh.)
Up to 13100	10
13101 – 22600	15
22601 – 32100	20
32101 – 41600	25
41601 and over	30

(a) In that year, Sarah's monthly income was as follows: Basic salary Ksh. 72940, house allowance Ksh. 16160 and commuter allowance Ksh. 8000.
Calculate:

(i) Sarah's monthly taxable income. (1 mark)

(ii) Total income tax charged on Sarah's monthly income. (4 marks)

(b) Sarah's net monthly tax was Ksh. 21260. Determine the monthly tax relief allowed. (1 mark)

(c) A proposal to expand the size of the first income tax band by 20% while retaining the size of the next three tax bands was made. the tax rates would remain the same in each band.
With this proposal, calculate:

(i) The tax Sarah would pay in the first band (1 mark)

(ii) The tax Sarah would pay in the last tax band (3 marks)

18. Lourine uses a drone to deliver cakes to her clients. On a given day, the drone travelled a distance of 30 km on a bearing of 074^0 to drop a cake to Nyagot and then it flew to Zoe's home to drop another cake. Zoe's house is 25

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km from Nyagot's house on a bearing of S50^{0}E. After dropping the cake at Zoe's house, the drone flew a distance of 40 km on a bearing of 245^0 to drop the last cake at Atieno's store. The drone then proceeded back to Lourine's house.

(a) Using a scale of 1: 500,000, show the relative positions of these places. (4 marks)

(b) Using the scale diagram, determine;

(i) bearing of Nyagot's house from Atieno's store. (1 mark)

(ii) distance between Zoe's house and Lourine's house. (2 marks)

(c) Lourine plans to have a distribution store that is equidistant from the homes of Nyagot, Zoe and Atieno's store.

(i) Locate the position of the store. (2 marks)

(ii) What is the distance of the store from Lourine's house? (1 mark)

19. Two towns on the earth's surface are such that A $\left(75^0 N, 100^0 E\right)$ and B $\left(75^0 N, 80^0 W\right)$. A pilot can fly from A to B along the parallel of latitude, or along the great circle through the North Pole.

(a) Determine the difference in distances of the two routes. Give the answer to the nearest kilometre. Use $\pi = \frac{22}{7}$ and $R = 6370$ km. (5 marks)

(b) At 3.20 p.m., the pilot had to fly from B due west at 300 knots for 2 hours to town C
Determine:

(i) the longitude of town C to the nearest whole number (3 marks)

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(ii) the local time at C when he landed. Give the answer in 24-hour clock system. (2 marks)

20. (a) The nth term of a sequence is given by $3n+12$ and the sum of all the terms in the sequence is 870

(i) Write down the first four terms of the sequence. (1 mark)

(ii) Determine the last term of the sequence. (4 marks)

(b) The second of a geometric progression is 64 and the fifth term is 8.
Find:

(i) the common ratio and the first term. (3 marks)

(ii) the sum of the first 11 terms of the progression. (2 marks)

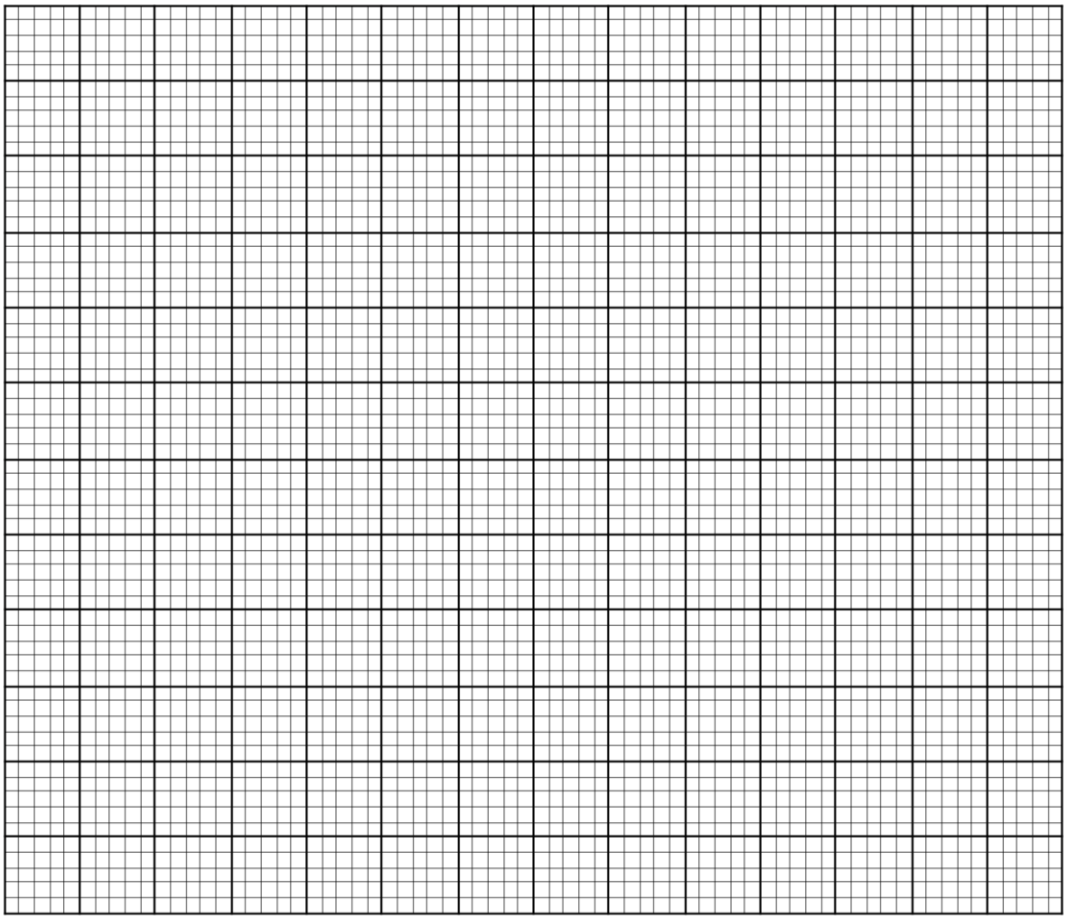
21. The table below shows the marks scored by 60 students in a Mathematics exam.

Marks (%)	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90	91 – 100
Number of Students	2	4	9	y	13	10	8

(a) Find the value of y (1 mark)

(b) On the grid provided, draw an ogive to represent the information above. (4 marks)

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(c) Use the graph to

(i) estimate the semi-interquartile range (3 marks)

(ii) determine the percentage of students that passed the exam if the pass mark was set at 45% (3 marks)

22. Water flows through a cylindrical pipe of diameter 4.2 cm at the rate of 50 metres per minute.

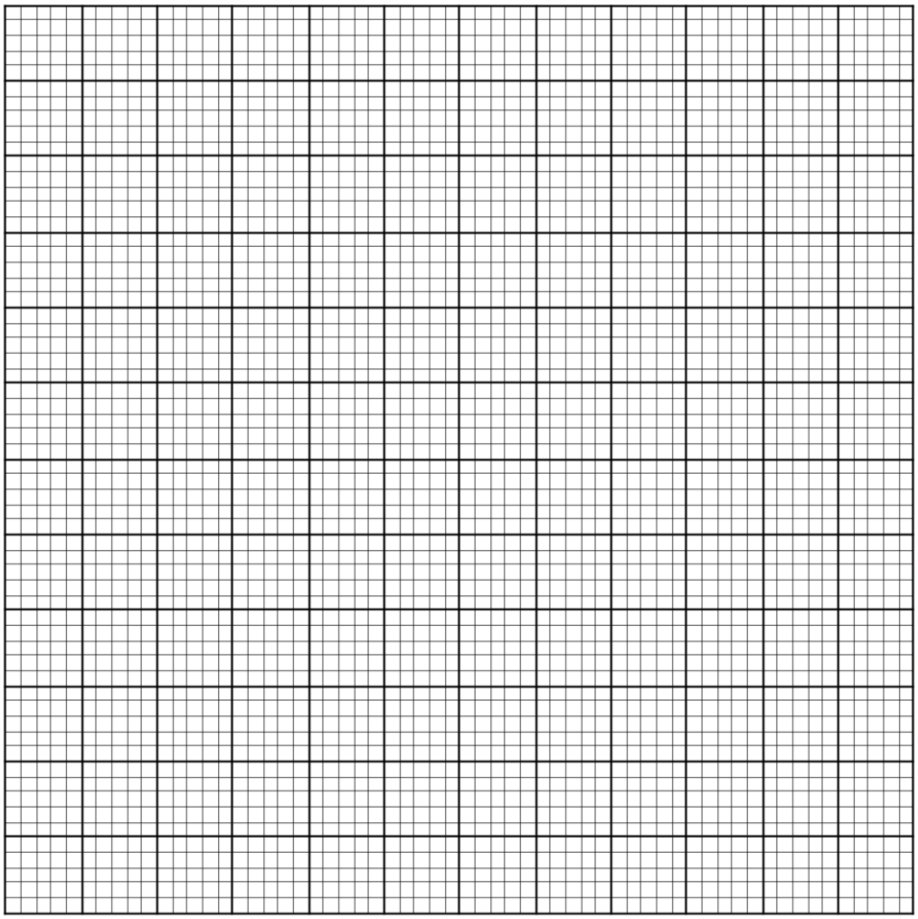
(a) Calculate the capacity of water delivered by the pipe in one minute. (3 marks)

(b) A cylindrical storage tank 3 metres deep is filled by water from this pipe and at the same rate of flow. Water begins flowing into the empty storage tank at 8.30 p.m. and is full 3.10a.m. the next day. Calculate the area of cross-section of the tank in m^2. (4 marks)

(c) A family consumes the capacity of this tank in one month. The cost of water is Ksh. 50 per one thousand liters plus a fixed basic charge of Ksh. 1650. Calculate the cost of the family's water bill for one month. (3 marks)

23. $ABCD$ is a trapezium in which $A(2,1)$, $B(2, 4)$, $C(4, 3)$ and $D(4,1)$.

(a) (i) On the grid provided, draw the quadrilateral $ABCD$ and its image $A'B'C'D'$ under a transformation whose matrix is $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. (3 marks)



(ii) State the coordinates of $A'B'C'D'$ (1 mark)

(b) $A''B''C''D''$ with coordinates $A''(-1,-2)$, $B''(-4,-2)$, $C''(-3,-4)$ and $D''(-1,-4)$ is the image of $A'B'C'D'$ under a transformation $\boldsymbol{T}$.

(i) On the same grid, draw $A''B''C''D''$. (1 mark)

(ii) Determine the matrix of $\boldsymbol{T}$. (2 marks)

(iii) Describe **T** fully. (1 mark)

(c) Find a single matrix **M** that maps $A''B''C''D''$ onto $ABCD$. Hence describe the transformation that maps $A''B''C''D''$ onto $ABCD$. (3 marks)

24. The acceleration of a particle moving along a straight line is $(4-t)$ m/s^2 and its velocity is v m/s after time t seconds.

(a) If the initial velocity of the particle is 3 m/s;

(i) express the velocity v in terms of t. (3 marks)

(ii) find the velocity of the particle after 3 seconds. (2 marks)

(b) Calculate;

(i) the time taken to attain maximum velocity. (2 marks)

(ii) the displacement of the particle by the time it attains the maximum velocity. (3 marks)

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SERIES 21

PAPER 1

SECTION I. (50 marks)

Answer all questions in this section

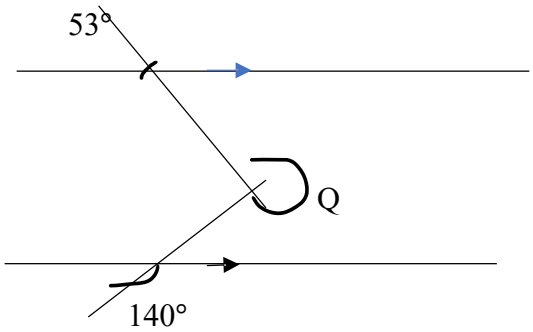
1. Simplify completely. $\frac{1}{2}+\frac{2}{5}\div\frac{3}{5}+\frac{7}{10}\times\frac{6}{7}-(1\frac{1}{2}\times\frac{1}{3})$ (3mks)

2. The sum of interior angles of a triangle is given by the expression 2a+b while that of a quadrilateral is given by the expression 13a-b. calculate the values of a and b.
(3mks)

3. Use reciprocal tables to evaluate. $1\div\frac{1}{9.31}+\frac{1}{8.934}$ (3mks)

4. Express $2.8\dot{3}$ as a fraction leaving your answer in the form $\frac{p}{q}$ (3mks)

5. In the diagram below, find the size of the angle labelled Q. (3mks)



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6. Evaluate without using a calculator or math table. (3mks)

$$\frac{0.0064\times6.25}{0.08\times0.0025\times0.4}$$

7. Find all the integral values of x which satisfy the inequality

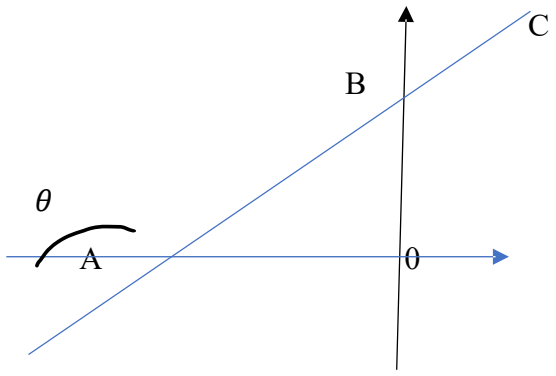
$3(1+x) < 5x - 11 < x + 45$ (3mks)

8. The arc length of a circle is a $\frac{1}{5}^{th}$ of its circumference. If the area of the circle is 246.5cm^2, find:

a. The angle subtended by the arc at the centre of the circle. (2mks)

b. The area of the sector enclosed by the arc. (2mks)

9. Find the angle θin degrees from the figure below. The equation of line ABC is $2x - 3y + 6 = 0$ (3mks)



10. Solve for $x$in the equation. (3mks)

$32^{(x-3)} \div 8^{(x-4)} = 64 \div 2^x$

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11. Line AB drawn below is a side of as trapezium ABCD.

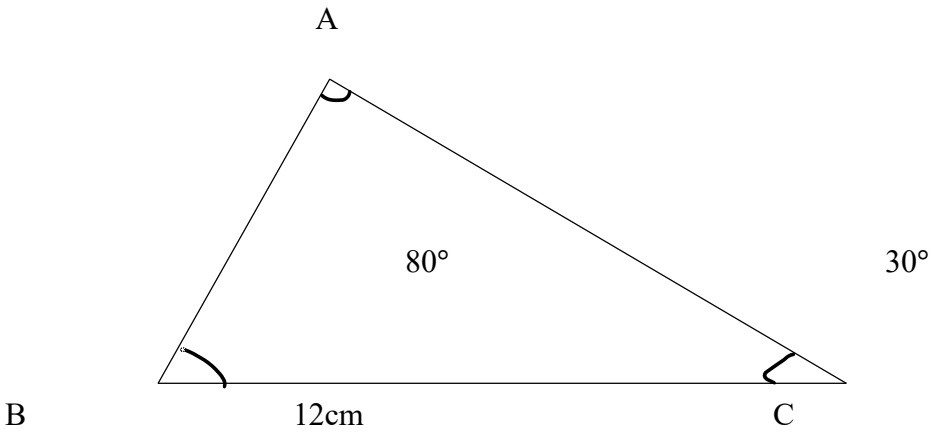


a. using a ruler and a pair of compasses only, complete trapezium ABCD in which AB is parallel to DC, <BAC =67.5°, AD= 5cm.BC=5.5cm and <ABC is acute.
(3mks)

b. Measure the length of DC. (1mk)

12. Fatuma left Mumias for Nairobi on Tuesday at 2.30 am she arrived at Londiani after 3hrs 12 minutes. she stayed in londiani for 36 hrs and then left for Nairobi. she took 5hrs 25 minutes to arrive in Nairobi. Determine the day and time in 12hour system Fatuma arrived in Nairobi. (3mks)

13. The diagram below is triangle ABC in which BC=12cm, <ABC=80° and <ACB= 30°.



Calculate, correct to 4 significant figures the area of triangle ABC. (3mks)

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14. Given that **q**=5**t**-3**f** where **t**=$\begin{pmatrix} -2 \\ -3 \end{pmatrix}$ and **f**=$\begin{pmatrix} 1 \\ -2 \end{pmatrix}$, find

a. The column vector **q** (2mks)

b. Given that $T^1(3,2)$ is the image of T(0,-2) under a translation, find the translation vector. (1mk)

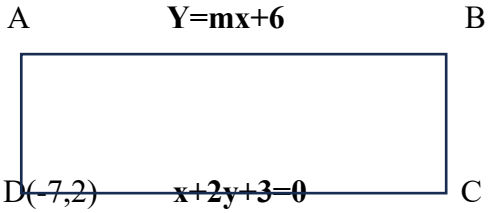
15. A piece of copper wire is bent in the shape of an isosceles triangle. The vertical angle is 40° and the height of the triangle is 5 cm. Find the length of the copper wire correct to 1 decimal place. (3mks)

16. An empty specimen bottle has a capacity of 300ml and a mass of 280g. calculate the mass of the bottle when it is full of a liquid whose density is 1.2g/cm^3. (3mks)

SECTION II (50 marks)

Answer any five questions in this section.

17. The figure below shows rectangle ABCD. Use it to;



a. State the value of m and the x-intercept of line DC. (2mks)

b. Determine;

i. The equation of side AD in double intercept form. (3 mks)

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ii. The coordinates of the vertices A,B,C. (3mks)

iii. The area of the triangle ABC. (2mks)

18. 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 Ksh 4 000. This reduction in price enabled the retailer to buy five more computers using the same amount of money as originally planned. Taking x to be the price of each computer before the price decrease.
(a) Determine in terms of x the number of computers the retailer would have bought if the price wasn't reduced. (1 mark)

(b) Determine in terms of x the number of computers the retailer bought after price reduction. (1 mark)

(c) Determine the value of x. (4 marks)

(d) 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.
(4 marks)

19. Without using a set square or a protractor, construct

a) Triangle ABC such AB= 6cm, BC = 4cm and <ABC= 30^0 Measure angle BAC. (2mks)

b) Measure length AC. (1mk)

c) Draw an escribed circle touching AB, AC and BC. (3mks)

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d) Measure the radius of the circle. (1mk)

e) Find the differences in areas between that of a triangle and the circle. (3mks)

20. The masses, in kilograms, of patients who attended a clinic on a certain day were recorded as follows.

38 52 46 48 60 59 62 73 49 54 49 41 57

58 69 72 60 58 42 41 79 62 58 67 54 60

65 61 48 47 69 59 70 52 63 58 59 49 51

44 67 49 51 58 54 59 39 59 54 52

(a) Starting with the class 35 – 39, and a class width of 5 and make a frequency distribution table for the data (2 marks)

(b) Calculate;
(i) The mean mass; (2 marks)

(ii) The median mass. (3 marks)

(c) On the grid provided draw a histogram to represent the data. (3 marks)

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21. X, Y and Z are three quantities such that X varies directly as the square of Y and inversely as the square root of Z.

a) Given that X = 18 when Y = 3 and Z = 4, find X when Y = 6 and Z = 16. (5 marks)

b) If Y increases by 10% and Z decreases by 19%, find the percentage increase in X. (5 marks)

22. a. On the grid provided below, draw quadrilateral ABCD whose vertices are at (2,0), $B(1,3)$, $C(5,-1)$ $and\ D(1,-2)$(1 mk)

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b. On the same axes , draw A'B'C'D', the image of ABCD under a translation represented by vector $T=\begin{pmatrix}-1\\2\end{pmatrix}$. (2 mks)

c. Draw the quadrilateral $A''B''C''D''$ the image of A′B′C′D′ under a reflection in the line $y + x = 0$ on the same axes. State the coordinates of A"B"C"D". (3 mks)

d. $A'''B'''C'''D'''$ with vertices $A'''(-2,5), B'''(4,3), C'''(-4,11), D'''(-6,3)$ is the image of $A''B''C''D''$ under the transformation X. Draw $A'''B'''C'''D'''$ and describe X fully. (3 marks)

e. State the type of congruency between quadrilateral ABCD and $A''B''C''D''$.(1 mk)

23. Three solids, a cylinder, a sphere and a cone are such that their radii are equal. It is also given that their surface area are equal. If the volume of the sphere is $310.464\,cm3$,

find the;

a. Radius of the sphere. (2mks)

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b. Volume of the cylinder. (3mks)

c. Volume of the cone. (3 mks)

d. Curved surface area of the cylinder. (2 mks)

24. The equation of a curve is given as $y = 2x^3 - \frac{9}{2}x^2 - 5x + 3$.

a. Find ;

i. The value of y when x = 2 (2mks)

ii. The equation of the tangent to the curve when x = 2. (4 mks)

c. Determine the turning points of the curve and their nature. (4 mks)

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PAPER 2

SECTION I (50 MARKS)

Answer all the questions in this section.

1. Given that $xy^n = 475$ and that $x = 2.5$ and $y = \sqrt{10}$ find n giving your answer to two decimal places. (3marks)

2. Solve for x in the equation: (3 marks)

   $\frac{1}{2}\log_2 81 + \log_2 (x^2 - {}^x/_3) = 1$

3. A merchant blends 350kg of tea costing Sh. 84 per kg with 140kg of tea costing Sh. 105 per kg. At what price must he sell 1kg of the mixture to gain 25% (3 marks)

4. Calculate the quartile deviation of the following set of data; 8, 11, 16, 22, 15, 7, 10 and 35. (3marks)

5. Simplify: $\frac{3}{1-\sqrt{2}} - \frac{2}{1+\sqrt{2}}$ (3marks)

6. Write down the first four terms of the expansion $(2-3x)^7$ in ascending powers of x.Hence find the value of $(2.06)^7$ correct to three significant figures (4marks)

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7. Make h the subject of the formula (3marks)

$$q = \frac{1+rh}{1-ht}$$

8. A transformation is represented by the matrix R $= \begin{pmatrix} x & -3 \\ 2 & 5x \end{pmatrix}$ which maps an object of area $10cm^2$ onto an image area $450cm^2$.Find the square of the value of x. (3marks)

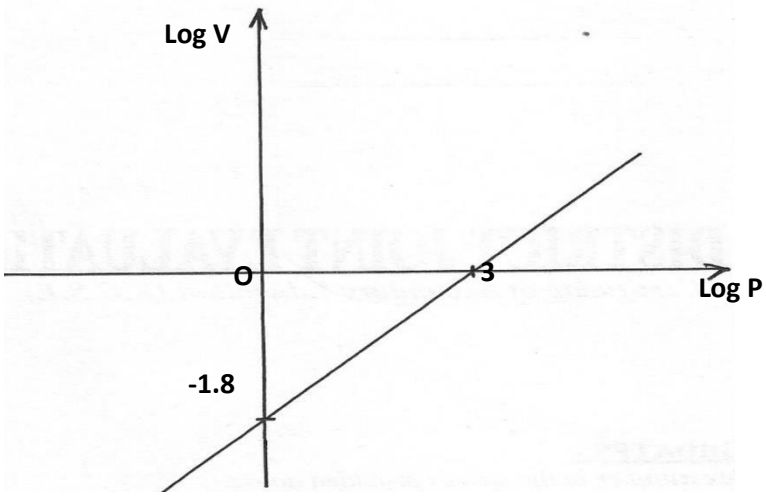
9. Solve the equation $2sin^2x + 5cosx + 2 = 4$ for $0^0 \leq x \leq 360^0$ (3marks)

10. Find the equation of a circle that has a diameter whose end points are at (2,7) and (-6, 15) in the form $x^2 + y^2 + ax + by + c = 0$ where a,b and c are integers (3 marks)

11. Use the inverse of $\begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}$ to solve the equations. (3marks)

5x + 3y = 4
4y + 6x = 10

12. The graph below is part of the straight line graph obtained from the initial equation $V=ap^n$



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(a) Write down the equation of the straight line in the form y = mx+c (1mark)

(b) Use the graph to calculate the values of a and n (2marks)

13. The sides of a triangle were measured and recorded as 4cm, 6.2cm and 9.50cm. Calculate the percentage error in its perimeter, correct to 2 decimal places (3marks)

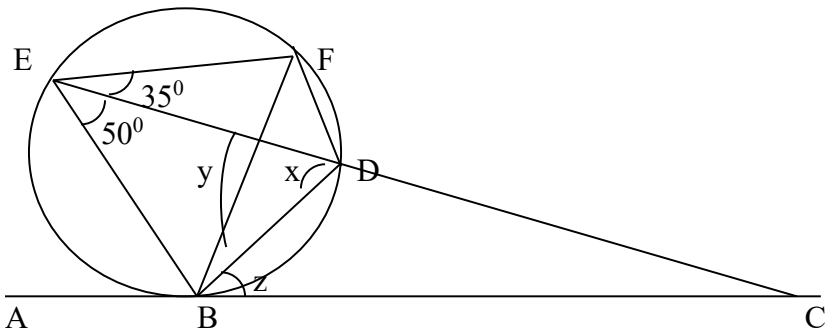
14. Two taps P and Q can each fill an empty tank in 3 hours and 6 hours respectively. A drainage pipe R can empty the full tank in 5 hours. Taps P and R are opened for 5 hours then closed

(a) Determine the fraction of the tank that is filled after these five hours (2marks)

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

15. The second and fifth terms of a geometric progression are 16 and 2 respectively. Determine the common ratio and the first term. (3 marks)

16. In the figure below, ABC is a tangent at B and CDE is a straight line $\angle BED = 50^0$, $\angle DEF = 35^0$ and $\angle ECB = 25^0$.



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Calculate x, y and z. (3 marks)

SECTION II (50 MARKS):

ANSWER FIVE QUESTIONS IN THIS SECTION.

17. A bag contains 5 red, 4 white and 3 blue beads. Two beads are selected at random, one at a time without replacement.
    (a) Draw a tree diagram and list the probability space. (3 marks)

    (b) Find the probability that
    (i) The last bead selected is red. (2 marks)

    (ii) The beads selected were of the same colour (2 marks)

    (iii) At least one of the selected beads is blue (3 marks)

18. Complete the table below for the functions $y = 3\sin 3\theta$ and $y = 2\cos(\theta + 40^0)$ (2 marks)

θ^0	0^0	10^0	20^0	30^0	40^0	50^0	60^0	70^0	80^0	90^0
$3\sin 3\theta$	0	1.50		3.00			0.00			-3.0
$2\cos(\theta + 40^0)$	1.53	1.29			0.35			-0.69		-1.29

    (a) On the grid provided, draw the graphs of $y = 3\sin 3\theta$ and $y = 2\cos(\theta + 40^0)$ on the same axis. Take 1 cm to represent 10^0 on the x-axis and 4 cm to represent 2 unit on the y – axis. (5 marks)

    (b) From the graph find the roots of the equation.
    (i) $\frac{3}{4}\sin 3\theta = \frac{1}{2}\cos(\theta + 40^0)$ (2 marks)

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(ii) 2 Cos $(0 + 40^0) = 0$ in the range $0 \leq \theta \leq 90^0$ (1 mark)

19. (a) Using a ruler and pair of compasses only, construct triangle ABC in which AB = 9cm, BC = 8.5cm and angle BAC = 60^0 (3 marks)

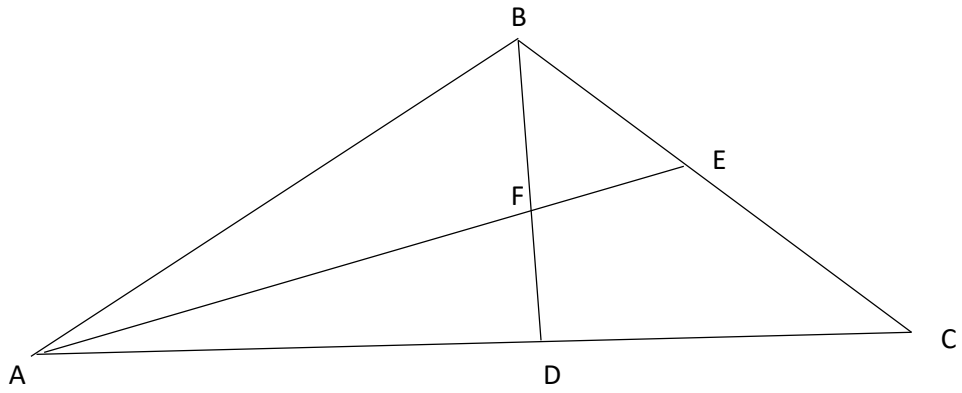
(b) One the same side of AB as C:

(i) Determine the locus of a point P such that $\angle APB = 60^0$ (3 marks)

(ii) Construct the locus of R such that AR >4cm (2 marks)

(iii) Determine the region T such that $\angle ACT \geq \angle BCT$ (2 marks)

20. In a triangle ABC, E is the mid –point of BC, D is a point on AC such that $2AD = 3DC$ and F is the point of intersection of AE and BD. Vectors $\boldsymbol{AB} = \boldsymbol{b}$ and $\boldsymbol{AC} = \boldsymbol{c}$.



(a) Express vectors $\boldsymbol{AE}$ and $\boldsymbol{BD}$ in terms of $\boldsymbol{b}$ and $\boldsymbol{c}$ (2marks)

(b) Given that $\boldsymbol{BF} = h\boldsymbol{BD}$ and $\boldsymbol{AF} = k\boldsymbol{AE}$ express $\boldsymbol{BF}$ in two ways (2marks)

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(c) Find h and k. (4marks)

(d) Show that points B, F and D are collinear. (2marks)

21. A, B and C have coordinates (1, 2), (2, 4) and (4, 4) respectively. Matrix $M = \begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix}$ maps ABC onto $A_1B_1C_1$.

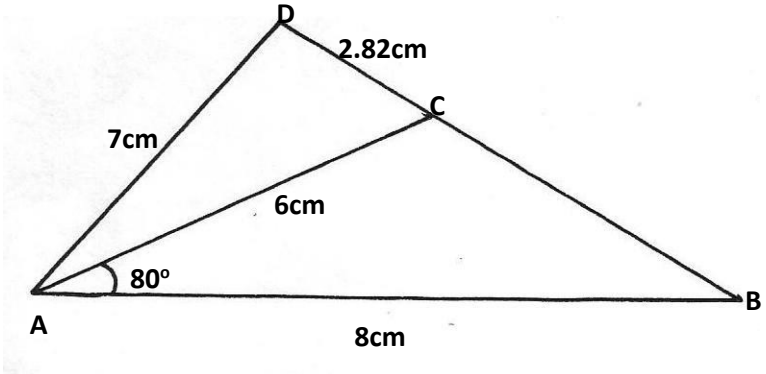
a) Determine the coordinates of $A_1B_1C_1$ (3marks)

b) Matrix $N = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ maps $A_1B_1C_1$ onto $A_2B_2C_2$, determine the coordinates of$A_2B_2C_2$(3marks)

c) Determine matrix P which maps ABC onto $A_2B_2C_2$(2marks)

d) Find the matrix Q which maps $A_2B_2C_2$ onto ABC (2marks)

22. In the figure below (not drawn to scale), AB=8cm, AC=6cm, AD=7cm, CD=2.82cm and angle CAB=80°



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Calculate to 2 decimal places

(a) the length BC (2marks)

(b) the size of angle ABC (3marks)

(c) the size of angle CAD (3marks

(d) the area of triangle ACD (2marks)

23. At the beginning of the year 2010, Andrew bought two houses, one in Kakamega and another one in Mumias, each at Ksh.1,240,000. The value of the house in Kakamega appreciated the rate of 12% p.a

(a) Calculate the value of the house in Kakamega after 9 years, to the nearest shillings(2marks)

(b) After n years, the value of the house in Kakamega was Ksh. 2741245 while the value of the house in Mumias was Ksh. 2917231

(i) Find n (4marks)

(ii) Find the annual rate of appreciation of the house in Mumias (4marks)

24. P varies directly as the square of Q and inversely as R.

(a) Given that P=2 when R=5 and Q=4, find the positive value of Q when P=4.5cm and R=5 (5marks)

(b) If Q increases by 5% and R decreases by 10%, find the percentage change in P (5marks)

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SERIES 22
PAPER 1

SECTION A :50 MARKS

INSTRUCTIONS :ATTEMPT ALL QUATIONS IN THIS SECTION.

1. Without using mathematical tables or a calculator, evaluate. (3marks)

$$\frac{13-(-23)}{3\times(-4)} - \frac{-4^2\times6-12}{54\div(-6)\times3}$$

2. Solve the equation (3marks)

$$8^{x+2} - 2^{3x-1} - 120 = 0$$

3. Given that $\sin(\frac{2}{3}x + 20) - Cos\left(\frac{5}{6}x + 10\right) = 0$, without using tables or a calculator, determine the value of x, hence determine the value of Tan (x+20) (4marks).

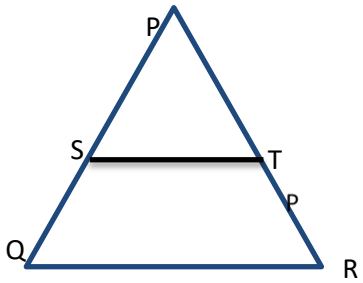
4. Expand and simplify (2marks).

$$(3x-2y)^2 - (3x + 2y)^2$$

5. The position vector of P is **OP = 2i - 3j** and M is the mid-point of PQ ,Given that **OM = -2i + 4j** .Obtain the vector PQ. (3marks).

6. If Tan $x^{0} = \frac{12}{5}$, Find the value of $\frac{\boldsymbol{Sin\ x+2\ Cos\ x}}{\boldsymbol{1-Sin\ X}}$ (3marks)

7. The fig 1 .below shows triangle PQR in which PR=12cm ,T is a point on PR such that TR=4cm ,line ST is parallel to QR .If the area of triangle PQR is 336cm^2,Find the area of the quadrilateral QRTS. (3marks).



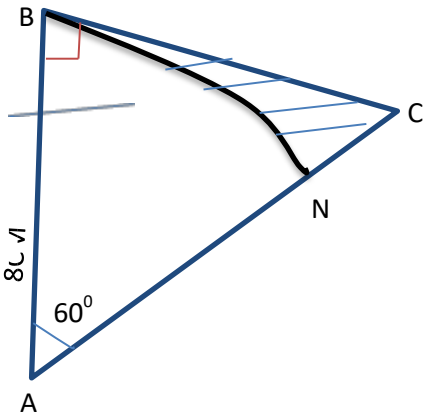
8. A Cutlery shop sells forks ,spoons and knives in boxes of 12,15 and 9 respectively .A box of forks sells at ksh 360 while of spoons sells at 525 and that of knives sells at ksh 225 .A Hotelier wants to buy an equal number of each item .Calculate the least amount of money he can spent. (3marks).

9. Given that $-2-5x \leq \frac{1}{3}(x+7) \leq 6-\frac{1}{3}x$ and that x is an integer .Find the integral values of X (3marks).

10. Find the area bounded by the curve y $= \frac{1}{2}x^2 - 2,$ the x-axis and the line X=0 and X=6 using the mid-ordinates rule with six strips (3marks).

11. Use tables of reciprocals ,cubes roots and square to evaluate to 2 .d.p (3marks)
$(\sqrt[3]{0.6589} + \frac{3}{0.3691})^2$

12. ABC is a right angled triangle where <BAC=60^0 and AB=8cm .ABN is a sector of a circle, Centre A .Find the perimeter of the shaded region to **3 S.F.** (3marks).



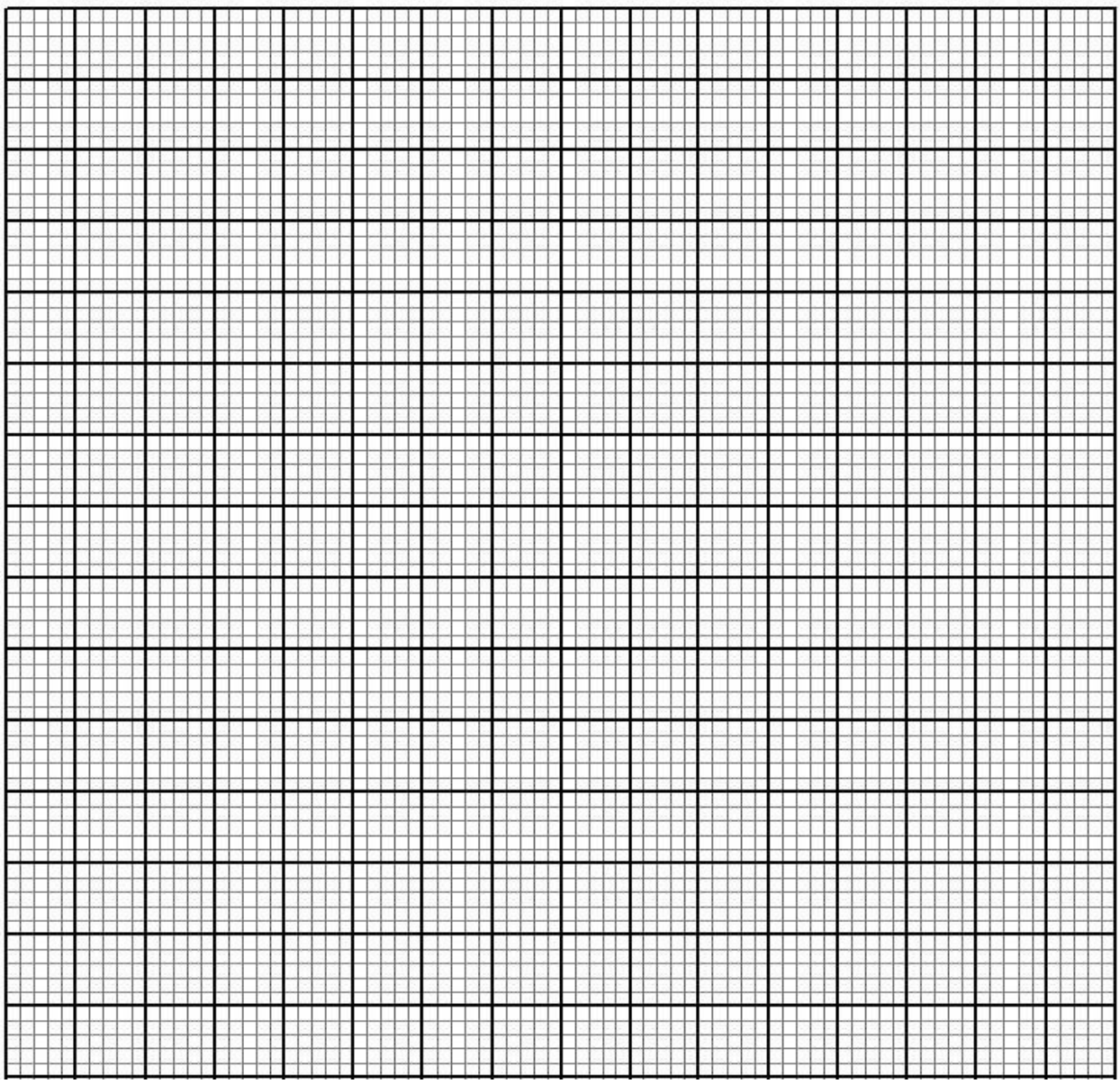
13.A straight line passes through the point (-3,-4) and is perpendicular to the line whose equations is 3x+2y=11,and intersect the x-axis and y-axis at point A and B respectively .Find the length AB. (4marks).

14. The following data was obtained from a form IV examination results .

Marks	20-24	25-34	35-39	40-54	55-59
No .of students	8		6	6	4
Heights		4.0		0.8	

a) Complete the tables above (2marks).

b) Draw a histogram to represent the above information. (2marks).



15.Under translation T the image of a point A (-3,5) is A'(-4,-7).Find the coordinates' of a point B whose image is B'(7,-3) under the same translation (3marks)

16.Construct the net of an Hexagonal pyramid of side 3cm and slant height 4cm (3marks).

SECTION B:50MARKS

INSTRUCTIONS:ATTEMPT ONLY FIVE QUATIONS IN THIS SECTION.

17. The date below represents marks scored by 50 students in a test

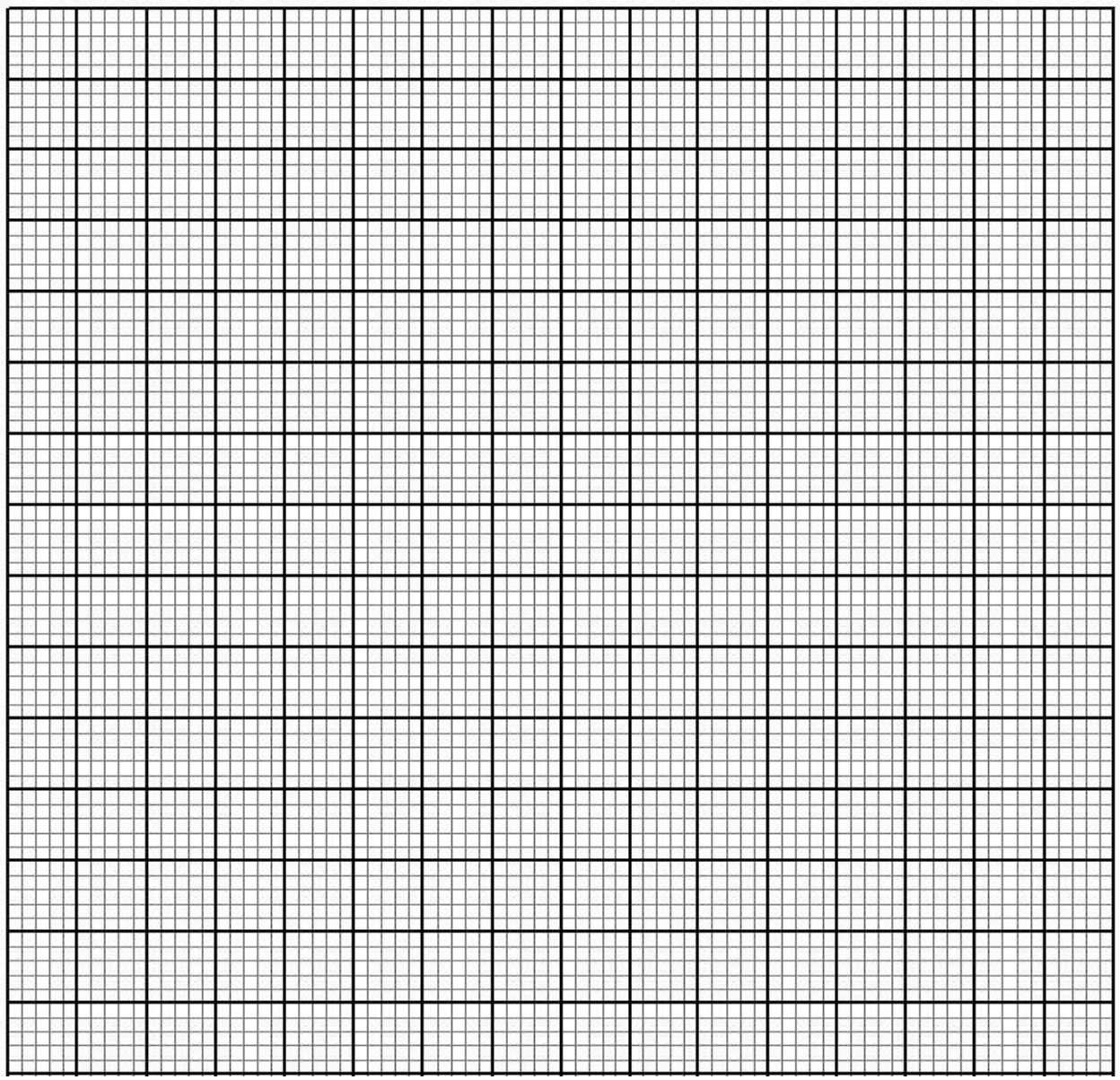
46	73	48	73	62	58	67	61	67	67
51	75	60	52	63	56	74	64	53	68
59	81	61	57	66	66	76	55	84	70
61	51	65	59	49	54	83	63	79	69
65	58	66	62	53	66	50	64	68	71

a)Using a class width of 5 and starting with the score of 46 marks, make a frequency distribution table for the date. (3marks).

b)Calculate

i)The mean mark (2marks).

ii)The median mark (2marks). iii)On the grid provided draw a frequency polygon for the data. (3marks).



18.Three partners Peter ,Kioko and Emmanuel contributed a total of ksh 480,000 In the ratio 4:5:7 to buy 8 hectares piece of land .The partners set aside ¼ of the land for social amenities and sub-divided the rest into 15m by 25m plot .

a) Find

i)The amount of money contributed by Peter . (2marks).

ii)The Number of plots that were obtained (2marks).

b)The partners sold the plots at ksh 80,000 each and spent 20 5 of the profit realized to pay administrative costs. They shared the rest of the profit in the ratio of their contribution .

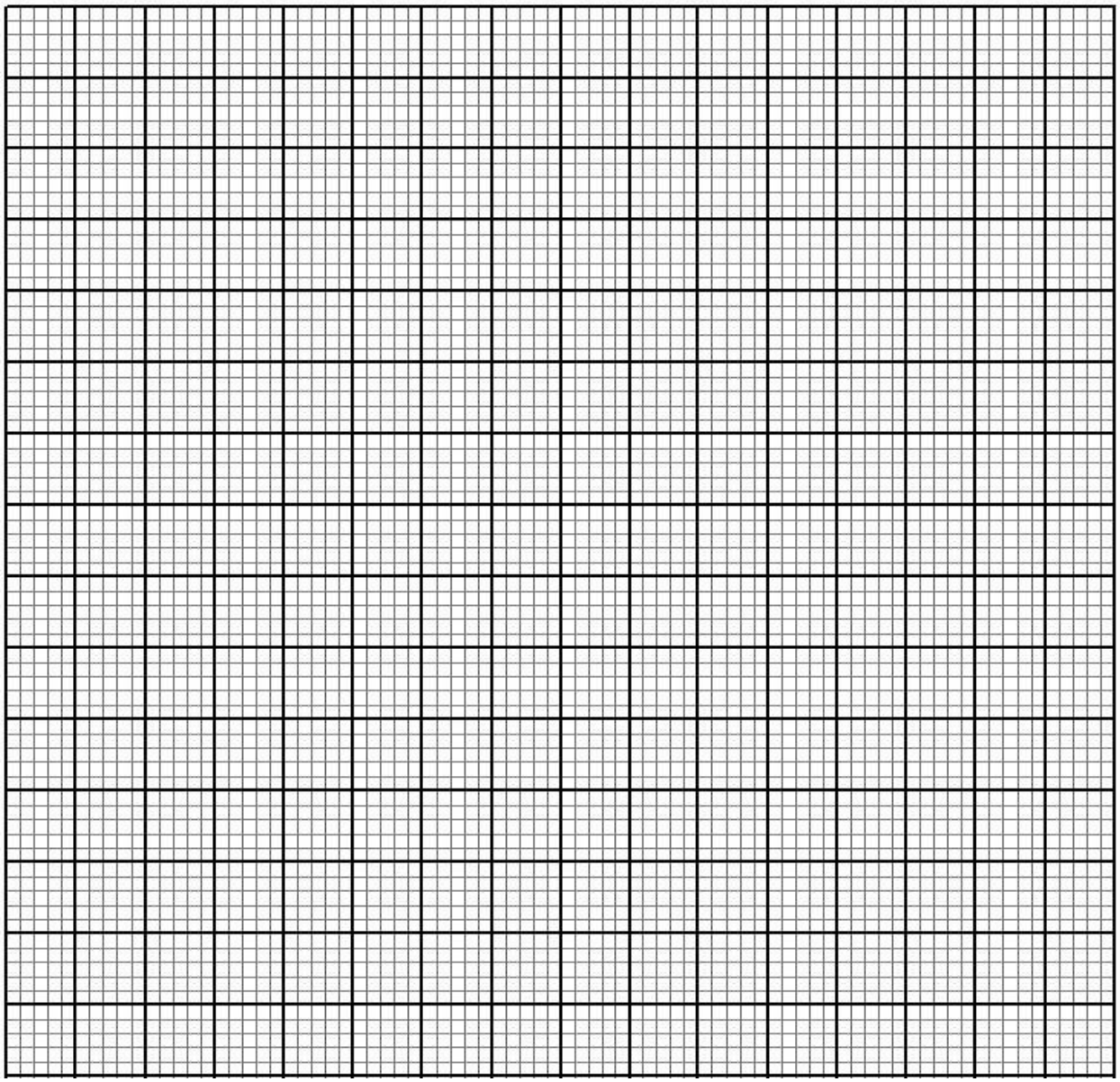
i)Calculate the net profit realized (4marks).

ii)Find the difference in the amount of profit earned by Peter and Kioko (2marks).

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

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

b) On the grid provided below , draw the graph of $y= -x^2+3x+4$ (3marks)



c) Use your graph in (a) above to solve the quadratic equations below

i) $-x^2+3x+4=0$. (2marks).

ii) $-x^2+5x=0$ (3marks).

20.Find the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 6 & 5 \end{pmatrix}$ (2marks).

b) In the month of June 2013,a cereal dealer sold 140 bags of rice and 105 bags of wheat at a total of ksh 805,000.The following month he sold 210 bags of rice and 175 bags of wheat at a total of ksh 1.26 million .Using matrix method ,Find the selling price of each bag of rice and that of each bag of wheat (4marks).

c) In August 2013,he increased the selling price of a bag of rice by 8 % but reduced the price of a bag of wheat by 4%.In that month he sold half as many bags of rice as he sold in July and twice as many bags of wheat as he sold in June .Calculate by matrix method the amount of money he got from the sales of August
(4marks).

21.A village Q is 7km from village P on a bearing of $N45^0E$.Village R is 5km from village Q on a bearing of 120^0 and a village S is 4km from village R on a bearing of 270^0.

a) Taking a scale of 1m to represent 1km ,locate the three villages. (3marks)

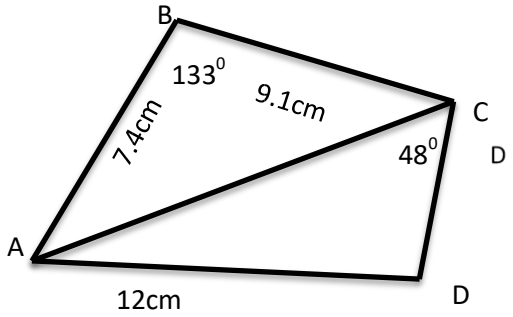
b) Use the scale drawing to find the

i) Distance and bearing of the village R from village P (2marks).

ii) Distance and bearing of village P from village S (2marks).

iii) Area of the polygon PQRS to the nearest 4s.f (3marks).

22. In the quadrilateral ABCD below AB=7.4cm ,BC=9.1 cm AD=12cm , angle ABC= 133 and angle ACD =48^0.



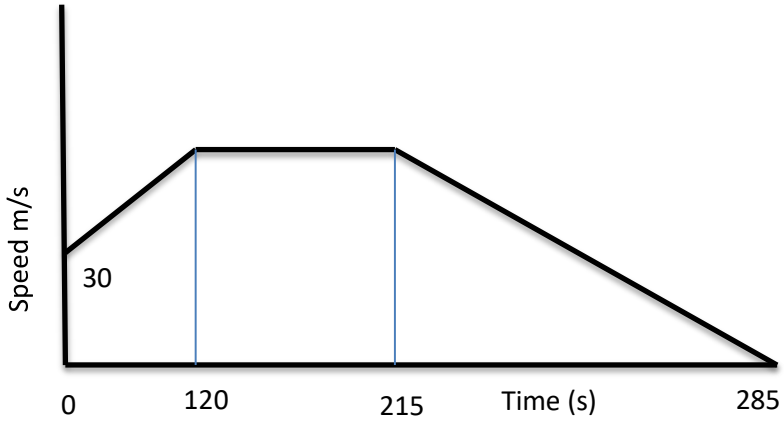
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a) Calculate the size of the angle ADC .Give your answer correct to 3 S.F (5marks).

b) Calculate the shortest distance from D to the line AC. (2marks).

c) Calculate the area of the quadrilateral ABCD and give your answer correct to 2 s.f (3marks).

23 .The diagram below represents a speed time graph for a train travelling between two stations



a) If the distance between two stations is 16050m, Calculate ,

i) The maximum speed attained by the train in m/s (3marks).

ii) The distance travelled the last 14 seconds (2marks)

b)Two towns Voi and Kitui are 409 km apart. An express bus travelling at an average speed of 60km/hr left Voi for Kitui at11:25 a.m .A car left Kitui on the same day for Voi at 12:55p.m and met with the bus at 3:07.p.m .

i)Determine the average speed of the car (3marks).
ii)Mtito Andei lies 160km from Voi .How far from Mtito Andei did the two vehicles meet. (2marks).

24. The equation of a curve is given by the curve $y = x^3 - 6x^2 + 9x$,Find

a) i) The coordinates of the stationary points of the curve (3marks).

ii) Determine the nature of the stationary points. (2marks).

b) The coordinates of the x-intercept (3marks).

d) Sketch the curve. (2marks)

PAPER 2

SECTION I(50 Marks)

Answer all the questions in this section

1. Given that $x = 2\ \ \overline{3} + 3\ \ \overline{2}$ and $y = 3\ \ \overline{2} - 2\ \ \overline{3}$ and that $\frac{x}{y} = a + b\ \ \overline{c}$ where a, b and c are integers, determine the values of a, b and c. (3 marks)

2. Use matrix method to solve the equations (4 marks)

$$Log_2\ 2x + y\ = 3$$
$$Log_{17}\ 3x + 4y\ = 1$$

3. The mass of a solid metallic cylinder varies jointly as its height and square of its radius. A cylinder with radius 8cm and height 25cm has a mass of 9.6kg. find the mass of a similar cylinder, made of the same metal,having a radius of 6cm and height 35cm.(3 marks)

4. Two lines x+2y= -1 and 2x+3y=3 intersect at a point R. Find the equation of a circle, centre R, radius 5, giving your answer in the form $x^2+y^2+ gx + fy + c = 0$ (4 marks)

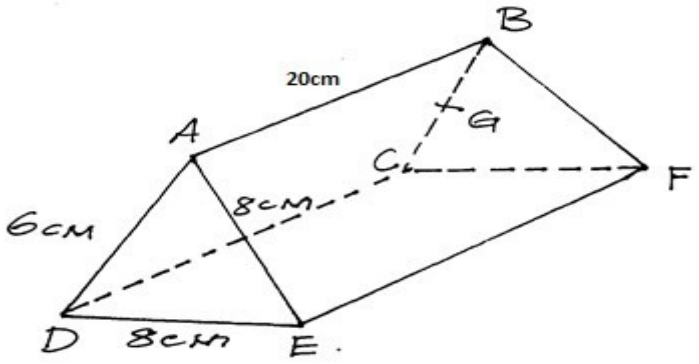
5. In what ratio should sugar costing ksh.46 per kg and ksh.74 per kg be mixed to produce a sugar blend costing ksh.60 per kg after making a profit of 20%.(3 marks)

6. Matrix $\begin{matrix} 2 & x+1 \\ x & 1 \end{matrix}$ has a negative determinant. It maps a quadrilateral whose area is $2cm^2$ onto its image whose area is $8cm^2$. Find the possible values of x. (3 marks)

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

8. A wire model of the earth has a radius of 7m, find the shortest distance between points A$(22^0N, 111^0E)$ and point B $(48^0N, 69^0W)$ on the model, give your answers to 3 decimal places. $use\ \pi = \frac{22}{7}$ (3 marks)

9. 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 (1 mark)

ii) AG (1 mark)

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

10. (a) Find the first 3 terms in ascending powers of x of $(2 - x)^5$ (2 marks)

(b) Hence find the value of the constant K, for which the coefficient of x in the expansion of $(K + x)(2 - x)^5$ is -8 (2 marks)

11. T.V is being sold on hire purchase terms. Cash price is Ksh.86000. The hire purchase price is35% morethanthecashprice.Jackpaidadepositand8 equalmonthlyinstalments toclear the bill. Determine the value of the deposit if the rateof interest per month was 5.703% compounded monthly. (3 marks)

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

13. $3x^2-4x+1$ is the gradient function of the curve that passes through the point (1,-2). Find the equation of the curve (3 marks)

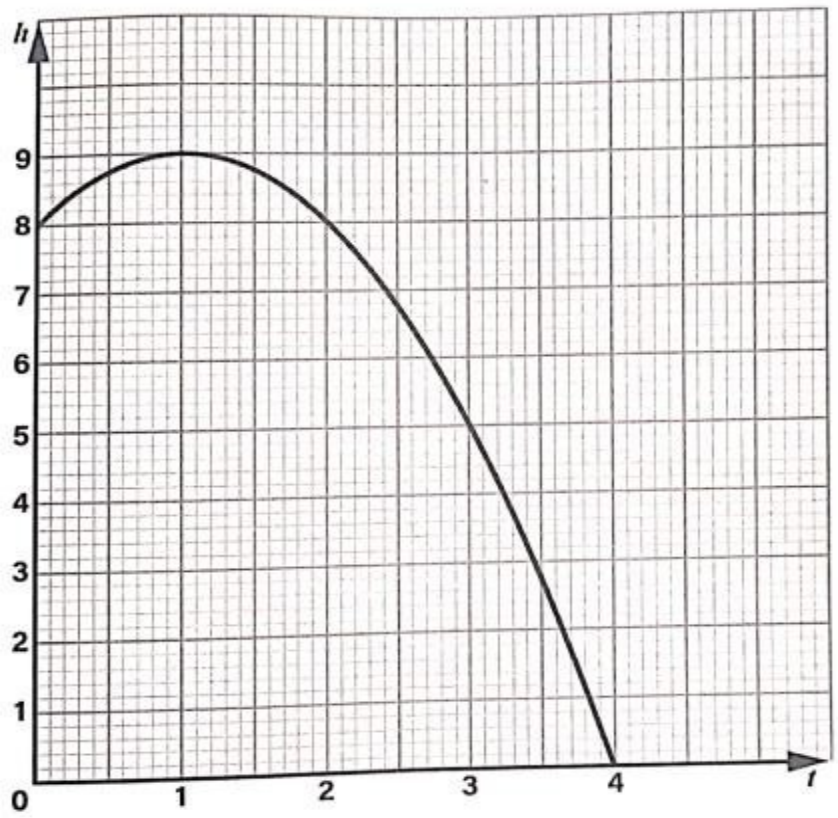
14. Two straight lines l_1 and l_2 intersect at a point P. Q and R are on the lines l_1 and l_2 respectively such that PQ = 5cm, PR=7cm and $\angle RPQ = 50^0$

(a) Draw the two lines (1 mark)

(b) Using a ruler and pair of compasses only, draw a circle which is tangent to line PR at R and passes through Q. (2 marks)

15. The coordinate of a point A and B are (2,5) and (2,1) respectively. In what ratio does a point C(2,4) divide line AB (3 marks)

16. A stone was throne upwards from a point 8 metres above the ground. The following graph shows the height, h metres of the stone above the ground at time t seconds in the interval $0 \leq t \leq 4$.



Determine the rate of change of h at t = 2 seconds. (3 marks)

SECTION II (50 Marks)

Answer ONLY FIVE questions in this section

17. Jane deposited money in equity bank at the end of every week. Her first deposit was ksh 500 and the subsequent weekly deposits were ksh 800. The account is interest free.

a) If she wanted to raise the amount to kshs 20,000,determine the number of weeks she will take. (3 marks)

b) At the beginning of the 20th week, jane withdrew the amount and invested in pyramid scheme. This scheme collapsed and the amount refunded was 10% less. Determine how much she received. (3 marks)

c) She used the amount in (b) above to buy shares at the beginning of a certain year, if at the end of the year, she increases her investment by kshs 6000. Calculate how long it will take for her total investment to be kshs 80,000. (leave your answer to the nearest year). (4 marks)

18. The table below shows the distribution of ages in the years of 50 adults who attended a clinic.

Age	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80
Frequency	4	10	14	12	7	3

a) Using a working mean of 45.5, calculate;

i) The mean (3 marks)

ii) The standard deviation (3 marks)

b) Calculate;

i) The 7th decile (2 marks)

ii) The middle 70% of the ages (2 marks)

19. a) A triangular garden ABC is such that AB =8 cm, angle BAC = 45^0 and angle ABC = 75^0. Using a ruler and a pair of compasses only, draw the triangle ABC. (3 marks)

b) A water tap P is to be mounted in the garden that is equal in distance from A, B and C on the diagram in (a) above. Show the position of P. (2 marks)

c) A section of the plot is enclosed such that a region R is formed under the following conditions;
i) CR ≥ 1.5 cm (1 mark)

ii) R is more than 2 cm from line AB (2 marks)

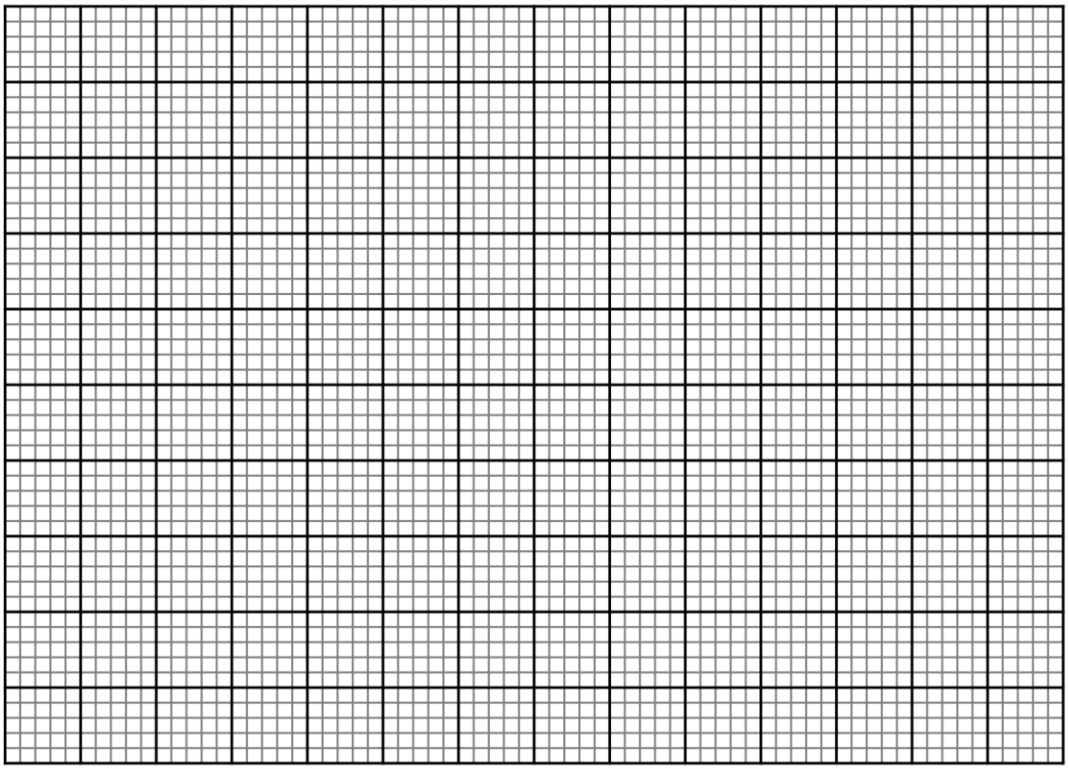
iii) R is nearer to CB than AC. Shade the region R. (2 marks)

20. The table below shows the functions of $y = \cos x^0$ and $y = 2\cos\frac{1}{2}x^0$

X^0	0^0	30^0	60^0	90^0	120^0	150^0	180^0	210^0	240^0	270^0	300^0	330^0	360^0
$\cos x^0$	1.00		0.50			-0.87		-0.87		0.00	0.50		1.00
$2\cos\frac{1}{2}x^0$	2.00	1.93		1.41		0.52	0.00		-1.00		-1.73		-2.00

a) Complete the table above by filling in the blank spaces. (2 marks)

b) On the grid provided, draw the graphs of $y = \cos x^0$ and $y = 2\cos\frac{1}{2}x^0$ for $0^0 \leq x \leq 360^0$. Use scale of 1 cm to represent 30^0 on the x – axis and 1 cm to represent 0.5 units on the y – axis. (4 marks)

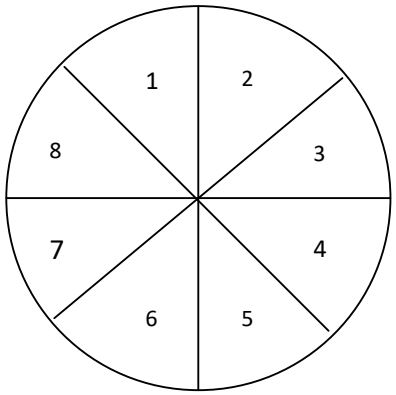


c) Use the gragh;

i) Find the period and amplitude of $y = 2\cos\frac{1}{2}x^0$(2 marks)

ii) Describe the transformation that maps the graph of $y = \cos x^0$ onto the graph of $y = 2\cos\frac{1}{2}x^0$ (2 marks)

21. A circular board has eight equal sectors marked on it. When the arrow on the spinner is spun, it is equally likely to stop in any of the sectors marked 1 to 8, as shown in the diagram below. The spinner is spun once.



a) What is the probability that the score will be

i. A square number (2 marks)

ii. A prime number, or more than six, or both? (2 marks)

b) When the spinner is spun twice, find the probability that:

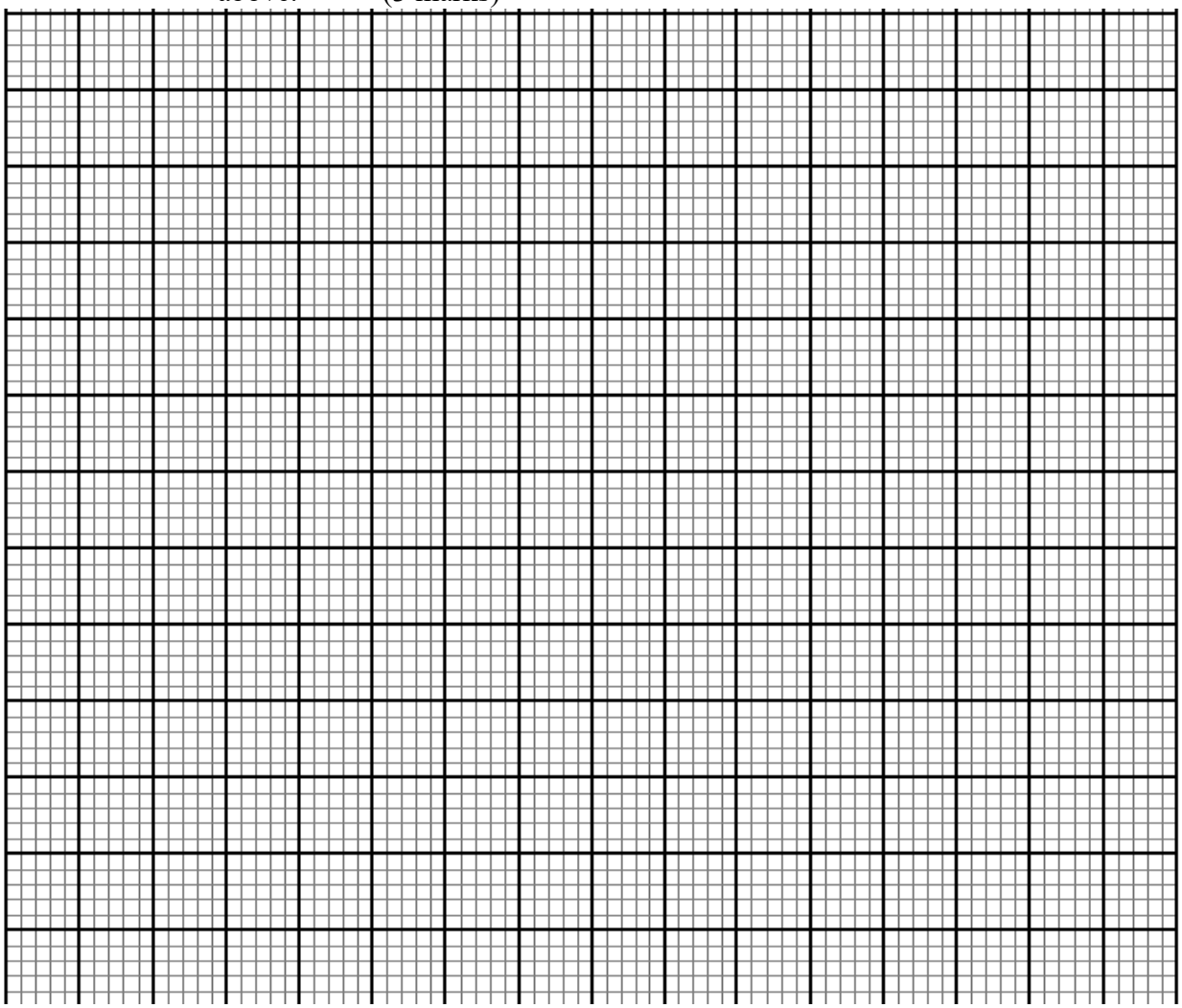
i. The sum of two scores will be 8 (3 marks)

ii. The difference of the two scores will be 3 (3 marks)

22. An Auto spare dealer sells two types of lubricant A and B in his shop. While purchasing, type A cost Ksh 40 per 100ml tin and type B cost Ksh 60 per 100ml tin. He decided to buy at least 30 tins altogether of type A and B with Ksh 1500 available. He decides that at least one third of the tins should be of type B. He buys x tins of type A and y tins of type B.

a) Write down three inequalities which represent the above information(3 marks)

b) On the grid provided below, draw a graph to represent the inequalities in (a) above. (3 marks)



c) Determine how many tins of each type that he should buy to maximize his profit if he makes a profit of Ksh 10 on each type A and a profit of Ksh 20 on each type B tin. (2 marks)

d) Calculate his maximum possible profit. (2 marks)

23. PQRSis a trapezium where PQ is parallel to SR. PR and SQ intersects at X so that $SX = kSQ$ and $PX = hPR$, where h and k are constants. Vectors $PQ = 3q$, $PS = s$ and $SR = q$.

a) Show this information in a diagram (1 mark)

b) Express SQ interms of q and s (1 mark)

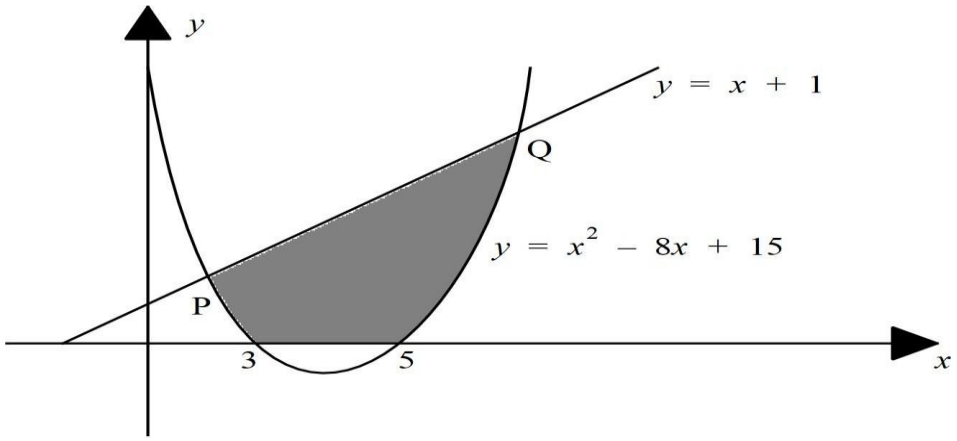
c) Express SX interms of k, q and s (1 mark)

d) Express SX interms of h, q and s (1 mark)

e) Find h and k (4 marks)

f) In what ratio does X divide SQ (2 marks)

24. The following figure is a sketch of a curve whose equation is $y = x^2 - 8x + 15$. The curve cuts the x- axis at x = 3 and x = 5 and intersects the line $y = x + 1$ at points P and Q.



a) Determine the co-ordinatesofpointsPandQ. (2 marks)

b) Calculate the exact area of the region enclosed by the curve and the line $y = x + 1$ (4 marks)

c) Determine the exact area of the region below the x – axis. (3 marks)

d) Find the area of the shaded region. (1 mark)

SECTION I (50 MARKS)
*Answer **all** the questions in this section*

1. Mr. Oralph withdrew some money from a bank. He spent $\frac{3}{8}$ of the money to pay for Grace's school fees and $\frac{2}{5}$ to pay for Namaje's fees. If he remained with Kshs. 12,330,calculate the amount of money he paid for Namaje's school fees. (4 marks)

2. A straight line L passes through the point $(3, -2)$ and is perpendicular to a line whose equation is $2y - 4x = 1$. Find the equation of L in the form $y = mx + c$, where m and c are constants**.** (3 marks)

3. A Kenyan company received US Dollars 200,000.The money was converted into Kenya shillings in a bank which buys and sells foreign currencies as follows:

	Buying (in Kenya shillings)	Selling (in Kenya shillings)
1 US Dollar	77.24	77.44
1 Sterling Pound	121.93	122.27

(a) Calculate the amount of money, in Kenya shillings, the company received. (2 marks)

b) The company exchanged the Kenya shillings calculated in (a) above, into sterling pounds to buy a car from Britain. Calculate the cost of the car to the nearest sterling pound. (2 marks)

4. Tap A fills a tank in 6 hours, tap B fills it in 8 hours and tap C empties it in10 hours. Starting with an empty tank and all the three taps are opened at the same time, how long will it take to fill the tank? (4 marks)

5. Given that $\sin(90-x)^0 = 0.8$, when x is a cute angle, find without using mathematical tables the value of $\tan x$. (2 marks)

6. The length of a rectangle is increased by 20% , while the width is decreased by 10% . Find the percentage change in area. (3 marks)

7. Three bells ring at intervals of 15 minutes, 21 minutes and 30 minutes. The bells will next ring together at 12: 30 pm .Find the time the bells had last rang together. (3 marks)

8. Simplify fully the expression (3 marks)

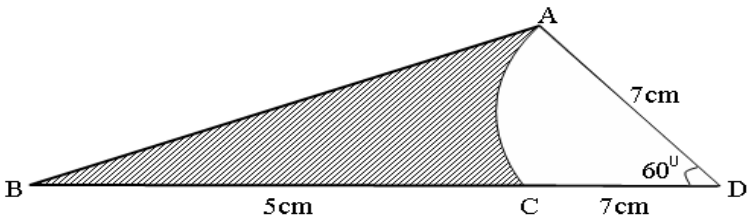
$$\frac{6x^2 - 9xy - 6y^2}{8x^2 - 2y^2}$$

9. Solve $4 \leq 3x - 2 < 9 + x$,hence list the integral values that satisfies the inequality. (3 marks)

10. The sum of interior angles of a regular polygon is 1800^0 . Find the size of each exterior angle. (3 marks)

11. The first three terms of a sequence are given a 10, 14 and 18. Find the sum of the first 10 terms of the sequence. (2 marks)

12. In the figure below, AC is an arc of a circle centre D. Angle ADC = 60^0, AD = DC = 7cm and CB = 5cm.



Calculate

a) The area of triangle ADB (2 marks)

b) The area of the shaded region. (2 marks)

13. Use the table of reciprocals, cube roots and square roots to evaluate; leaving your answer in 4 d.p. (4 marks)

$$\frac{3}{\sqrt[3]{6.859}} + \sqrt{0.2468}$$

14. A square brass plate of side 20mm has a mass of 1.05kg. The density of the brass is $8.4g/cm^3$. Calculate the length of the plate in centimeter. (3 marks)

15. The production of wool in grams of 20 sheep on a certain month was recorded as follows ; 22, 26, 15, 19, 22, 16, 27, 22, 20, 18, 28, 30, 22, 20, 15, 16, 22, 20, 17,18.

    Determine;

    a) The mode (1 mark)

    b) Median (2 marks)

16. A transformation whose matrix is given by $\begin{pmatrix} 2x-1 & -3 \\ 2 & x \end{pmatrix}$ maps a triangle with area 8 cm^2 onto another triangle with area 72 cm^2, calculate the value of x (3 marks)

SECTION II (50 Marks)

Answer any ***five*** questions in this section in the spaces provided

17. A straight line L passes through P $(-2, -1)$ and $Q\ (x, y)$. It has a gradient of - $\frac{2}{3}$.

    (a) Find the equation of the line L in the form $ax + by = c$, where a, b and c are integers. (3 marks)

    (b) The line L is perpendicular to another line M. If the two lines meet at point P, find the equation of the line M in the form $\frac{x}{a} + \frac{y}{b} = 1$. (4 marks)

c) If the line M is parallel to line N which passes through point $R(-1, 2)$, find the equation of the line N. (3 marks)

18. Using a ruler and a pair of compasses only construct triangle ABC such that angle BAC= 90^0, AC= 5 cm and BC = 10 cm. (3 marks)

(a) Circumscribe a circle on the triangle ABC constructed above (3 marks)

(b) Measure the radius of the circle (1 mark)

(c) Find the difference in the area of the circumcircle and the triangle. (3 marks)

19. A and B are two points on latitude 40^0 N. The two points lie on the longitude 80^0 W and 100^0 E respectively. (taking $\pi = \frac{22}{7}$ and R = 6370 km) .

(a) Calculate;
(i) The distance from A to B along the parallel of latitude. (3 marks)

(ii) The distance from A to B along the greater circle. (3 marks)

(b) Two planes P and Q left A for B at 400 knots and 600 knots respectively. If P flew along the great circle and Q along the parallel of latitude, which one arrived earlier and by how much? Give your answer to the nearest minute. (4 marks)

20. (a) Complete the table below for the equation $y = x^3 + 4x^2 - 5x - 5$ for $-5 \leq x \leq 2$ (2 marks)

x	-5	-4	-3	-2	-1	0	1	2
y		15					-5	

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

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

(d) By drawing a suitable straight line on the graph, solve the equation $x^3 + 4x^2 - 5x - 5 = -4x + 1$ (3 marks)

21. The displacement, S meters of a moving particle after t seconds is given by $S = 2t^3 - 5t^2 + 4t + 3$
Determine:

(a) The velocity of the particle when $t = 4$ seconds (3 marks)

(b) The value of t when the particle is momentarily at rest (3 marks)

(c) The displacement when the particle is momentarily at rest (2 marks)

(d) The acceleration of the particle when $t = 10$ seconds (2 marks)

22. A bus left Bondo at 8:00 a. m. and travelled towards Kisumu at an average speed of 80 km/hr. At 8:30 a.m. a car left Kisumu for Bondo at an average speed of 120 km/hr. Given that the distance between Bondo and Kisumu is 400 km. Calculate:

(a) The time the car arrived in Bondo (2 marks)

(b) The time the two vehicles met. (4 marks)

(c) The distance from Bondo to the meeting point (2 marks)

(d) The distance of the bus from Kisumu when the car arrived in Bondo. (2 marks)

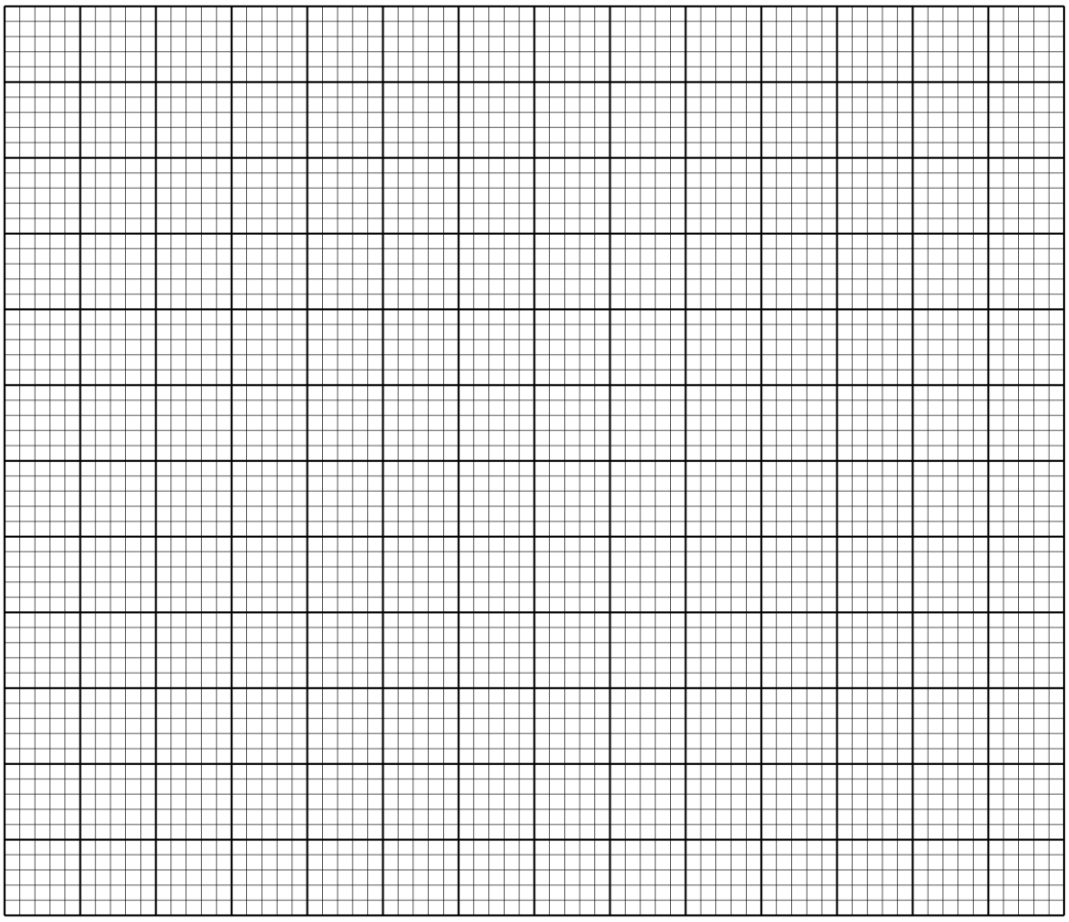
23. A solid consists of a cone and hemisphere. The common diameter of the cone and hemisphere is 16 cm and the height of the cone is 6 cm. Using π=3.142
Calculate correct to two decimal places:
(a) The surface area of the solid (3 marks)

(b) The volume of the solid (4 marks)

(c) If the density of the material used to make the solid is 1.5 g/cm^3, calculate its mass in kilograms (3 marks)

24. The coordinates of a triangle ABC are $A(1, 1)$, $B(3, 1)$ and $C(1, 3)$.

(a) Plot the triangle ABC on the grid provided. (1 mark)



(b) Triangle ABC undergoes a translation vector $\binom{2}{2}$. Obtain $A'B'C'$, the image of ABC under the transformation, write the coordinates of $A'B'C'$. (3 marks)

(c) $A'B'C'$ undergoes a reflection along the line $x = 0$ to obtain $A''B''C''$. On the same pair of axes, plot $A''B''C''$ and state its coordinates . (2 marks)

(d) $A''B''C''$ undergoes an enlargement scale factor -1, centre (0, 0) to obtain $A'''B'''C'''$. Draw triangle $A'''B'''C'''$ (2 marks)

(e) Describe fully, the transformation that maps triangle $A^{IV}B^{IV}C^{IV}$ with coordinates $A^{IV}(-3, -3)$, $B^{IV}(-3, -5)$ and $C^{IV}(-5, -3)$ onto triangle. (2 marks)

PAPER 2

SECTION I (50 marks)

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

1. Evaluate without using tables or calculators. (3 marks)

$$\frac{\log \frac{1}{2} + \log 64}{\log\left(\frac{1}{32} \div \frac{1}{8}\right)}$$

2. Make w the subject of the formulae. $2x = \sqrt{\frac{2w+8}{3w-5}}$ (3marks)

3. Two pipes, P and Q can fill an empty tank in 3 hours and 4 hours respectively. It takes 5 hours to fill the tank when an outlet pipe R is opened the same time with the inlet pipes. Calculate the time pipe R takes to empty the tank. (3 marks)

4. Given that ***OM=i – 3j + 4k, ON= 6i + 3j – 5k*** and ***OQ* = 2OM + 5ON**, find the magnitude of **OQ** to 3 significant figures. (3 marks)

5. A triangle ABC is such that a =14.30 cm, b =16.50 cm and B =56º. Find the radius of a circle that circumscribes the triangle. (3 marks)

6. The third and sixth terms of a geometric progression (G.P.) are -64 and 8 respectively. Find;

(a) The common ratio, (2marks)

(b) The first term of the G.P. (1mark)

7. Calculate the standard deviation of the set of numbers
29. 31, 28, 29, 31. 46, 39, 31, (3 marks)

8. Grace deposited Ksh 16 000 in a bank that paid simple interest at the rate of 14% per annum. Joyce deposited the same amount of money as Grace in another bank that paid compound interest semi-annually. After 4 years, they had equal amounts of money in the banks.

Determine the compound interest rate per annum, to I decimal place, for Joyce's deposit.(3 marks)

9. Simplify $\frac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}}$, leaving the answer in the form a + b $\sqrt{c}$, where a, b and c are rational numbers

(3 marks)

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

Mo	Monthly income in Ksh	Tax r	Rate in each Ksh
	1 – 9680		10%
	9681 – 18800		15%
	18801 – 27920		20%
	27921 – 37040		25%
	Over 37040		30%

In that year, a monthly personal tax relief of Ksh. 1056 was allowed. If the monthly income tax paid by an employee was Ksh 4249 calculate his monthly taxable income. (3 marks)

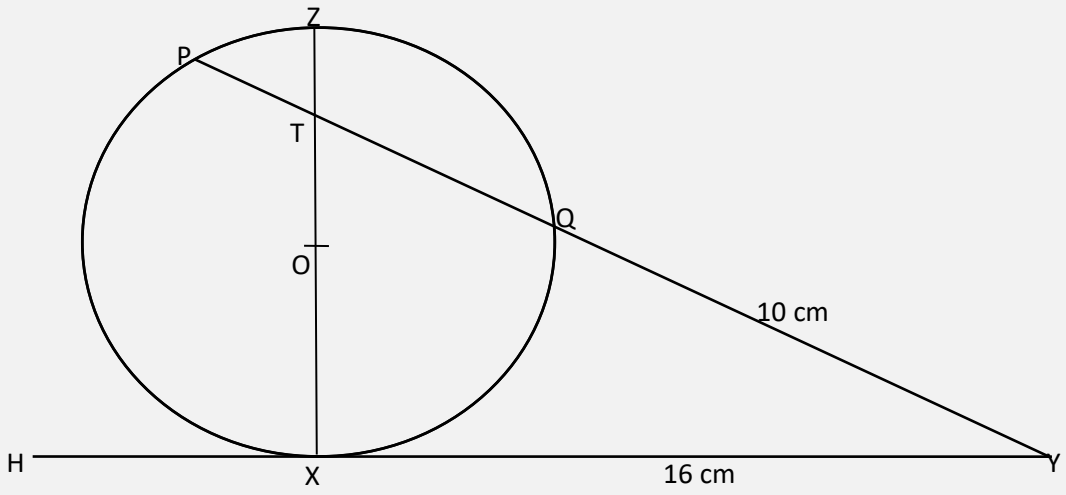
11. Grade I coffee cost sh 500 per kilogram while grade II coffee costs sh 400 per kilogram. The grades are mixed to obtain a mixture that costs sh 420 per kilogram. In what ratio should the two grades be mixed? (3 marks)

12. The base length and height of parallelogram were measured as 8.4 cm and 4.5 cm respectively. Calculate the percentage error in the area of the parallelogram. (3 marks)

13. The equation of a circle is $x^2 + y^2 + 6x — 14y + 58 = r^2$ If the circle passes through the point (2, 7). Determine its radius and the coordinates of it centre. (4 marks)

14. Find the gradient of the curve $y = x^2\left(x + \frac{1}{2} - \frac{1}{x}\right)$ at point $\left(1, \frac{1}{2}\right)$ (3marks)

15. In the figure below, the tangent HXY meets chord PQ produced at Y. Chord XZ passes through the centre, O, of the circle and intersects PQ at T. Line XY = 16 cm and QY = 10 cm.



(a) Calculate the length PQ. (2 marks)

(b) If ZT = 4 cm and PT: TQ = 3:5, find XT. (2 marks)

16. Quantity P varies partly as Q and partly varies inversely as square of Q. When Q = 1, P = 1 and when Q = ½, P = -3. Find the equation of the relationship connecting P and Q. (3 marks)

SECTION II (50 Marks)

Answer any five questions from this section.

17. A certain Sub-county advertised for a tender to construct its headquarters. Two contractors A and B assessed the work. Contractor A indicated would do the same work in 12 months while contractor B indicated would do the same work in 18 months. The two contractors were awarded the tender. Contractor B did the work for three months then it was joined by contractor A.

(a) Determine;

(i) The fraction of the work done by contractor B in 3 months, (2 marks)

(ii) How long the two contractors took to complete the remaining work. (4 marks)

(c) Given that contractors A and B would incur expenditure amounting to sh 120 000 per month and sh 90 000 per month respectively, calculate the total expenditure of each contractor. (4 marks)

18. An examination involves a written test and a practical test. The probability that a candidate passes the written test is $\frac{6}{11}$ if the candidate passes the written test, then the probability of passing the practical test is $\frac{3}{5}$, otherwise it would be $\frac{2}{7}$

(a) Illustrate this information on a tree diagram. (2marks)

(b) Determine the probability that a candidate is awarded

(i) Credit for passing both tests. (2marks)

(ii) Pass for passing the written test. (2marks)

(iii) Retake for passing one test. (2marks)

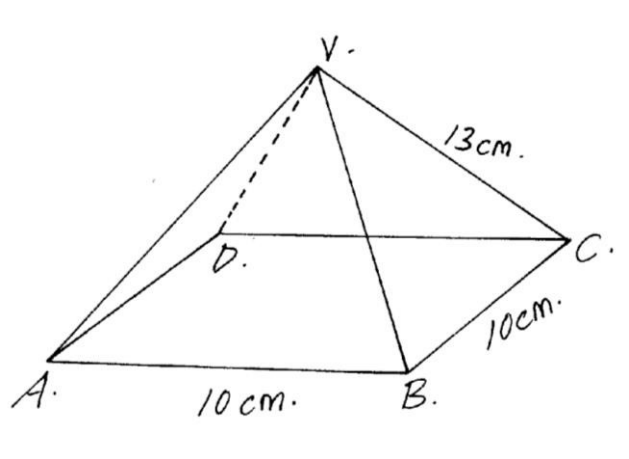
(iv) Fail for not passing the written test. (2marks)

19. (a) Construct triangle PQR with PQ = 7.2cm, QR = 6.5cm and angle PQR = 48^0 (3marks)

(b) The locus L1, of points equidistant from P and Q, and locus , L2 of points equidistant from P and R, meet at M. Locate M and measure QM (4marks)

(c) A point x moves within triangle PQR such that QX ≥ QM. Shade and label the locus of X. (3marks)

20. The figure below shows a square ABCD point V is vertically above middle of the base ABCD. AB = 10cm and VC = 13cm.



Find;

(a) The length of diagonal AC (2marks)

(b) The height of the pyramid (2marks)

(c) The acute angle between VB and base ABCD. (2marks)

d) The acute angle between BVA and ABCD. (2marks)

e) The angle between AVB and DVC. (2marks)

21. The table below shows the distribution of ages in years of 50 adults who attended a clinic:-

Age	21-30	31-40	41-50	51-60	61-70	71-80
Frequency	15	11	17	4	2	1

(a) State the median class (1 mark)

(b) Using a working mean of 45.5, calculate:-

(i) The mean age (3 marks)

(ii) The standard deviation (3 marks)

(iii) Calculate the 6th decile. (3 marks)

22. An aircraft leaves A(60^0N,13^0W) at 1300 hours and arrives at B(60^0N, 47^0E) at 1700 hrs

(a) Calculate the average speed of the aircraft in knots. (3marks)

(b) Town C (60^0N, 133^0W)has a helipad. Two helicopters S and T leaves B at the same time. S moves due West to C while T moves due North to C. If the two helicopters are moving at 600 knots.

(i) The time taken by S to reach C (2marks)

(ii) The time taken by T to reach C (2marks)

(c) The local time at a town D (23^0N, 5^0W) is 1000 hours. What is the local time at B.? (3marks)

23). A certain uniform supplier is required to supply two types of shirts: one for girls labelled G and the other for boys labelled B. The total number of shirts must not be more than 400.He has to supply more of type G than of type B. However the number of type G shirts must not be more than 300 and the number of type B shirts must not be less than 80. By taking x to be the number of type G shirts and y the number of type B shirts,

(a) Write down in terms of x and y all the inequalities representing the information above. (3 marks)

(b) On the grid provided draw the inequalities and shade the unwanted regions. (4marks)

(c) Given that type G costs Shs. 500 per shirt and type B costs Shs. 300 per shirt.

(i) Use the graph in (b) above to determine the number of shirts of each type that should be made to maximize profit. (1mark)

(ii) Calculate the maximum possible profit. (2marks)

24. A transformation represented by the matrix $\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$ maps the points A(0, 0), B(2, 0), C(2, 3) and D(0, 3) of the quad ABCD onto $A^1B^1C^1D^1$ respectively.

a) Draw the quadrilateral ABCD and its image $A^1B^1C^1D^1$. (3marks)

b) Hence or otherwise determine the area of $A^1B^1C^1D^1$. (2 marks)

b) Another transformation $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ maps $A^1B^1C^1D^1$ onto $A^{11}B^{11}C^{11}D^{11}$.

Draw the image $A^{11}B^{11}C^{11}D^{11}$. (2mks)

c) Determine the single matrix which maps $A^{11}B^{11}C^{11}D^{11}$ back to ABCD. (3mks)

SECTION I (50 MARKS)

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

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

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

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

$$\sqrt{\frac{0.504\ X14.3\ X910}{0.28\ X\ 1.17\ X\ 28.6\ X7}}$$

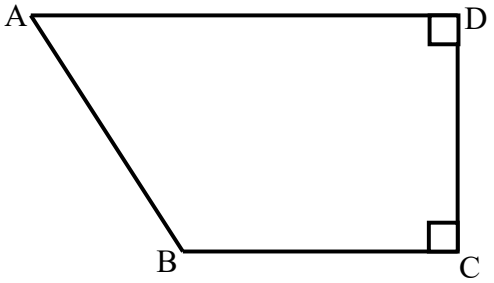
3. Find the value of x if (3 Marks)

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

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

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

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



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

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

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

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

10. Simplify the following. (3 Marks)

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

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

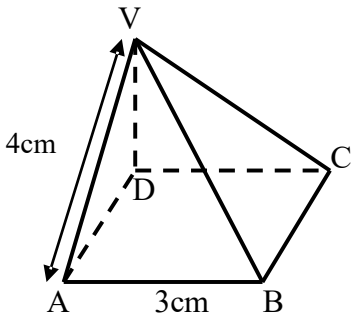
12. The line which joins the point A (3, k) and B (-2, 5) is parallel to the line whose equation is $5y + 2x - 7 = 0$. Find the value of k. (3 Marks)

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

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

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

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



(a) Draw a labelled net of the pyramid. (2 Marks)

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

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

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

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

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

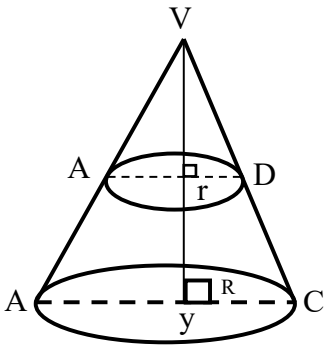
SECTION II (50 MARKS)
Answer only five questions in this section in the spaces provided.

17. A group of people planned to contribute equally towards buying land at a price of Shs 180,000. However 3 members of the group withdrew from the project. As a result, each of the remaining members were to contribute KShs. 3000 more.
    (a) Find the original number of members in the group. (6 Marks)

    (b) How much would each person have contributed if the 3 people had not withdrawn. (2 Marks)

    (c) Calculate the percentage increase in the contribution per person caused by the withdrawal.(2 Marks)

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



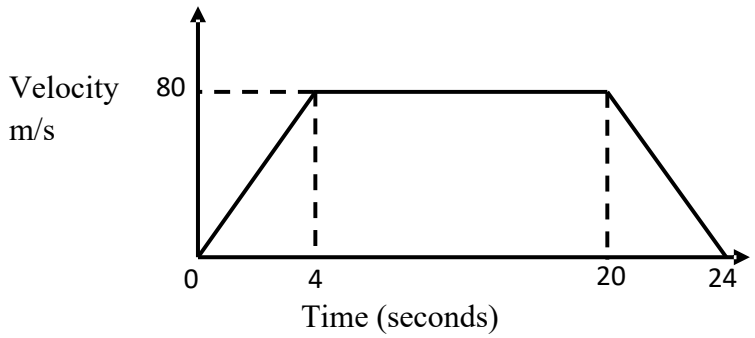
(a) Find the ratio r:R. (1 Mark)

(b) Given that r = 7cm, find R. (2 Marks)

(c) If the height VY of the original cone is 45cm. Calculate to the nearest whole number the volume of the frustum. (Take $\pi = \frac{22}{7}$) (4 Marks)

(d) The frustum represents a bucket which is used to fill a rectangular tank measuring 1.5m long, 1.2m wide and 80cm high with water. How many full buckets of water are required to fill the tank. (3 Marks)

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



(i) Find the total distance travelled by the car. (2 Marks)

(ii) Calculate the deceleration of the car. (2 Marks)

(b) A car left Nairobi towards Eldoret at 7.12 a.m. at an average speed of 90km/h. At 8.22 a.m, a bus left Eldoret for Nairobi at an average speed of 72km/hr. The distance between the two towns is 348km. Calculate:

(i) the time when the two vehicles met. (4 Marks)

(ii) the distance from Nairobi to the meeting place. (2 Marks)

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

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

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

(b) Calculate to 2 decimal places:

(i) the mean mark (4 Marks)

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

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

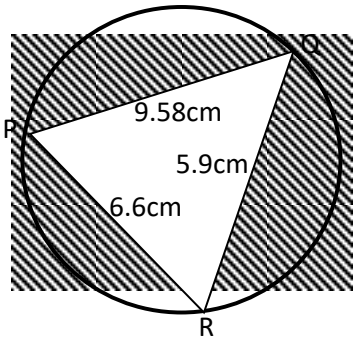
(a) How much profit did he make per kilogram of the mixture? (4 Marks)

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

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

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

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



Find;

(a) size of angle QPR (3 Marks)

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

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

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

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

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

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

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

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

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

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

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

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

SECTION I (50 MARKS)

Answer ALL questions in the spaces provided.

1. Agotho has a rectangular plot that was measured to the nearest meter and found to be 80m in length and 60m in width. Determine the percentage error in its perimeter. (3 marks)

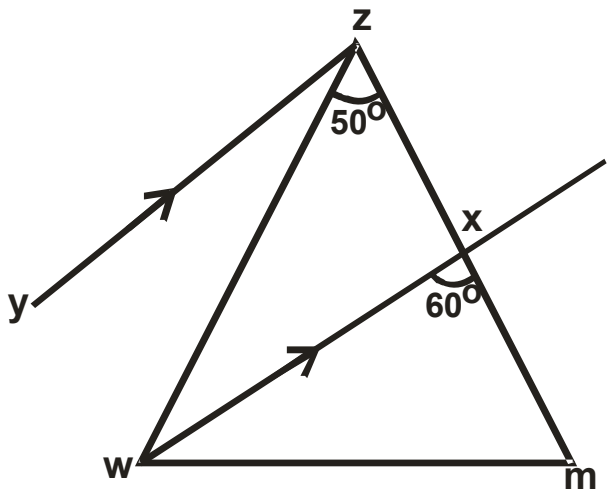
2. Determine the inverse of the matrix $\begin{pmatrix} 4 & 3 \\ 5 & -2 \end{pmatrix}$. Hence find the coordinates of the point at which the two lines $4x - 18 = -3y$ and $5x - 2y = 11$ intersect. (4 marks)

3. Solve the equation.

$5^{2x+1} - 3(5^{x+1}) + 10 = 0$ (4 marks)

4. Solve for x in the equation cos x = sin (3x – 30). Hence determine the value of tan x leaving your answer in surd form. (3 marks)

5. In the figure below, yz is parallel to wx. Angle wzx = 50 º and angle wxm = 60 º. Determine the size of angle yzw. (2 marks)



6. Kaula has two types of coffee, costing Ksh.120 and Ksh.200 respectively. He mixed them in the ratio 6 : 5 by weight.

a) Determine to the nearest shilling the cost of one kilogramme of the mixture. (2 marks)

b) Find the percentage profit on the cost price if the mixture was sold at Ksh 250.
(give your answer in 2 d.p). (2 marks)

7. Rationalise the denominator and simplify leaving your answer in the form $\sqrt{a} + b$. (3 marks)

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

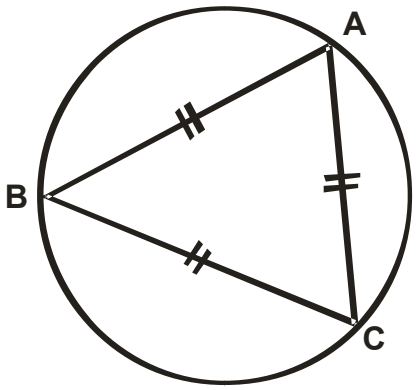
8. Use squares, square roots and reciprocals tables only to evaluate;

$$\frac{3}{\sqrt{42.15}} + \frac{4}{(3.152)^2}$$ (4 marks)

9. Make h the subject of the formula in

$m = \frac{p}{\sqrt{h} + k^2}$ (3 marks)

10. The diagram below shows an equilateral triangle ABC inscribed in a circle of radius 9cm. Calculate the length of the sides of the triangle (2 d.p) (2 marks)



11. Simplify $\frac{9x^2 - 1}{3x^2 + 2x - 1}$ (3 marks)

12. Use the trapezium rule to estimate the area bounded by the curve $y + x^2 = 4$ and the lines $y = 0$, $x = -2$ and $x = 2$ using four strips. (3 marks)

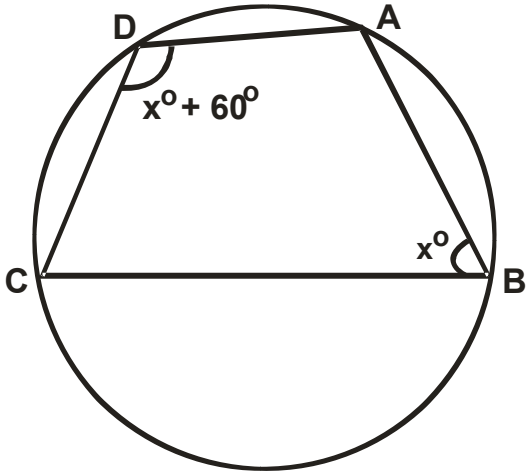
13. A circle of radius 3cm has its centre at $(3, -2)$. Express the equation of the circle in the form $x^2 + y^2 + mx + ny + c = 0$. Where m, n and c are constants. (3 marks)

14. Find the equation of the normal to the curve $y = (x^2 + 1)(x - 2)$ when $x = 2$. (4 marks)

15. a) Expand $(1-\frac{1}{2}x)^5$ (1 mark)

b) Use the expansion upto x^3 in (a) above to evaluate $(0.98)^5$ correct to 4 d.p (2 marks)

16. The figure below shows a quadrilateral ABCD which is cyclic. Solve for x. (2 marks)



SECTION II (50 MARKS)

*Answer only **FIVE** questions from this section in the spaces provided.*

17. Mr. Kobe is a civil servant who earns a monthly salary of Ksh.21200. He has a house allowance of Ksh.12000 per month, other taxable allowances are commuter Ksh.1100, medical allowance Ksh.2000. He is entitled to a personal relief of Ksh.1240 per month.
Using the income rates below, solve the questions that follow.

Income in Ksh. per month	Rates in Ksh per sh 20
1 – 8,400	2
8401 – 18,000	3
18001 – 30,000	4
30001 – 36,000	5
36001 – 48,000	6
Above 48,000	7

Determine;

a) i) His monthly taxable income. (2 marks)

ii) Net tax (PAYEE) (5 marks)

b) In addition to the PAYEE, the following deductions were made. Ksh.250 for NHIF, Ksh.120 service charges,he repays a loan at sh.4500 and contributes towards savings at sh.1800 every month. Calculate his net salary per month. (3 marks)

18. A triangle ABC has vertices A(-2, 6) B(2, 3) and C(-2, 3). Triangle A $^{1}B^{1}C^{1}$ is the image of triangle ABC under a reflection in the line x = -3.

a) Draw triangle ABC and its image $A^{1}B^{1}C^{1}$ on the same axis. (2 marks)

b) Triangle $A^{1}B^{1}C^{1}$ is mapped onto $A^{11}B^{11}C^{11}$ under a translation vector$\binom{10}{2}$. Given that A^{111}(6,-6) B^{111}(2, -3) and C^{111}(6, -3) are the images of $A^{111}B^{111}C^{111}$ under another translation.

i) Draw triangle $A^{11}B^{11}C^{11}$ (2 marks)

ii) Determine and describe fully the transformation that maps triangle $A^{11}B^{11}C^{11}$ onto triangle $A^{111}B^{111}C^{111}$ (3 marks)

iii) Describe fully the transformation that would map triangle ABC onto triangle $A^{111}B^{111}C^{111}$ (3 marks)

19. a) From whole numbers 1 to 10, a number is selected at random, find the probability that, the number selected is a prime or a multiple of 3. (2 marks)

b) A tetrahedron is thrown and a coin is tossed.

i) List down all the possible events in the probability space. (1 mark)

ii) Find the probability of getting atleast 2 and a head. (2 marks)

c) i) A bag contains 6 white marbles and some brown ones. If the probability of picking a brown marble is 0.6, find the number of marbles in the bag. (3 marks)

ii) Two marblesare then picked, one at a time from the bag in c(i) above, with replacement. Find the probability that the marbles picked are of different colours. (2 marks)

20. Three villages PQR are located from central town X which is on a bearing of 340 º from another town Y. Village Q is east of town X and 6km from town Y, on the bearing of 040 º while village P is on a bearing of 045º from town X. Village R and P are due north of town Y. Village R is on a bearing of 250 º from village Q.

a) By scale drawing represent the above information in a diagram. (7 marks)

b) From the diagram find;

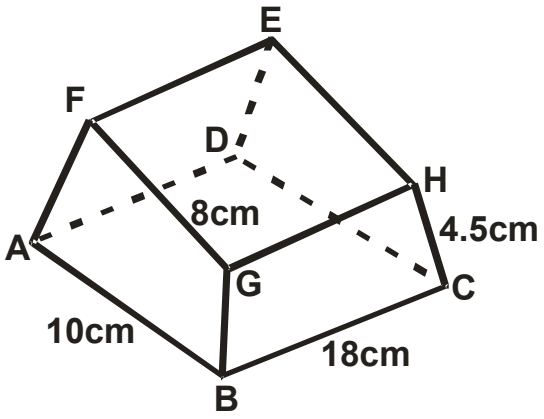
i) The bearing of village R from town X. (1 mark)

ii) The distance between;

Village P and Q (1 mark)

Village R and town Y (1 mark)

21. ABCDEFGH is a prism where ABCD, FGHE, BCHG and ADEF are rectangles while AFGH and DCHE are trapezia. AB = 10cm, FG = 8cm, BC = 18cm and CH = 4.5cm.



a) Calculate the length of AH. (4 marks)

b) Calculate the angle between planes ABCD and BCHG. (2 marks)

c) The angle between the plane ABCD and ABHE (2 marks)

d) The volume of the prism. (2 marks)

22. a) Complete the table for $0^o \leq x \leq 360^o$ for the functions y = sin x and y = $\frac{1}{2}\sin 2x$ (2 marks)

x	0	30	60	90	120	150	180	210	240	270	300	330	360
$\frac{1}{2}\sin 2x$	0.00		0.43			0.25	0		-0.43		-0.43		0
Sin x	0.00	0.5		1			0	-0.5			-0.87		0

b) Using a scale of 1cm represent 30° on the x-axis and 4cm to represent 1 unit on the y-axis, draw the graph of y = $\frac{1}{2}\sin 2x$ and y = sin x° for $0^o \leq x \leq 360^o$ on the same axis. (5 marks)

c) Use your graph to find the range $\frac{1}{2}\sin 2x \leq \sin x$ (1 mark)

d) State the period and amplitude for the curve y = $\frac{1}{2}\sin 2x$ (2 marks)

23. The displacement s metres of a particle moving along a straight line after t seconds is given by $s = -2t^3 + \frac{3}{2}t^2 + 3t + 4$

a) Find its initial acceleration. (3 marks)

b) Calculate;

i) The time the particle was momentarily at rest. (3 marks)

ii) Its displacement by the time it comes to rest momentarily. (2 marks)

c) Calculate the maximum velocity attained. (2 marksA certain carpenter has been contracted by a college to supply a number of beds and doors. He has to supply almost 100 items. He has a total of 480 man hours to do the work. In addition, the following conditions should be met.

	Beds	Doors
Minimum number of items	10	20
Man hours per item	2	6
Profit per item	200	300

Taking x to represent the number of beds and y the number of doors:

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

b) Represent the inequalities on the grid provided. (4 marks)

c) Find the maximum profit that can be got from the supply. (2 marks)

SECTION I (50 marks)

Answer all questions in this section in the spaces provided

1. Evaluate $\dfrac{-4\{(-4+-15\div 5)+-3-4\div 2\}}{84\div -7+3--5}$ (3 marks)

2. Express $3.\dot{7}\dot{5}$ in the form $a\dfrac{b}{c}$ hence find the absolute value in $\dfrac{b}{c}-a$. (3 marks)

3. Given that $\dfrac{\sin(2a+20)^0}{\cos\left(\frac{1}{2}a-60\right)^0}=\tan 45^0$, find the value of a (3 marks)

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4. A *forex* bureau in Nairobi buys and sells selected foreign currencies at the rates given in the table below.

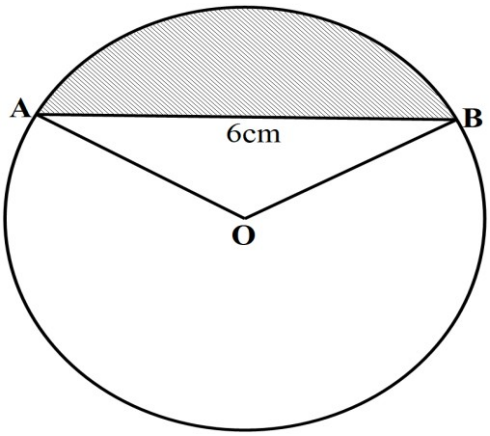
Currency	**Buying (Ksh)**	**Selling (Ksh)**
1 *South African Rand*	7.00	7.70
1 *United Arab Emirates Dirham*	36.14	37.50

A tourist arrived in Kenya from South Africa with $8{,}546{,}000$ South African Rand. He converted the whole amount to Kenya shillings through an agent at a commission 2%. While in Kenya, he spent $\frac{1}{4}$ of this money and changed the balance to UAE Dirham. Calculate the amount of UAE Dirhamthat he received. (3 marks)

5. The position vector of P and Q are $\mathbf{OP} = -5\mathbf{i} + 4.5\mathbf{j}$ and $\mathbf{OQ} = 3\mathbf{i} - 1.5\mathbf{j}$.
Evaluate magnitude of PQ(3 marks)

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6. The figure below shows a circle centre O radius $3\sqrt{2}$ cm. Given that the length of chord AB = 6 cm, calculate the area of the shaded region leaving your answer in terms of π. (4 marks)



7. Use squares, square roots and reciprocals tables to evaluate, to 4 significant figures, the expression:
$\frac{1}{\sqrt{27.56}} + \frac{3}{(0.071)^2}$ (3 marks)

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8. Three space crafts in different orbits go around the earth at intervals of 3, 6 and 7 hours respectively. An engineer at an observatory on earth first observes the three crafts cruising above one another at 6.35 a.m. At what time in a similar configuration if the all revolve around the earth from east to west? (3 marks)

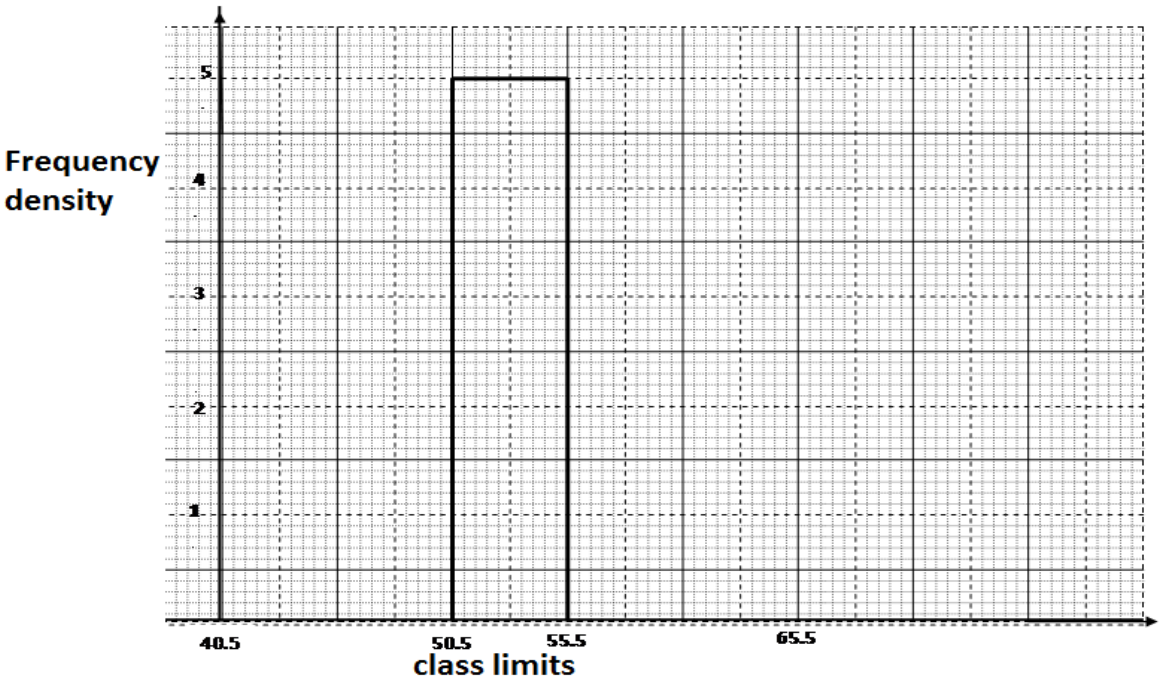
9. The cost of providing a commodity consists of transport, labour and raw materials in the ratio 8:4:12 respectively. If the transport cost increases by 12%, labour cost by 18% and raw materials by 40%, find the percentage increase of producing the new commodity. (3 marks)

10. A water tank has a capacity of 50 litres. A similar model tank has a capacity of 0.25litres. if the larger tank has a height of 100cm. calculate the height of the model tank. (3mks)

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11. The following data was obtained from the mass of a certain animal. Complete the table and the histogram below. (3 marks**)**

Mass(kg)	frequency
41-50	20
51-55	
56-65	40



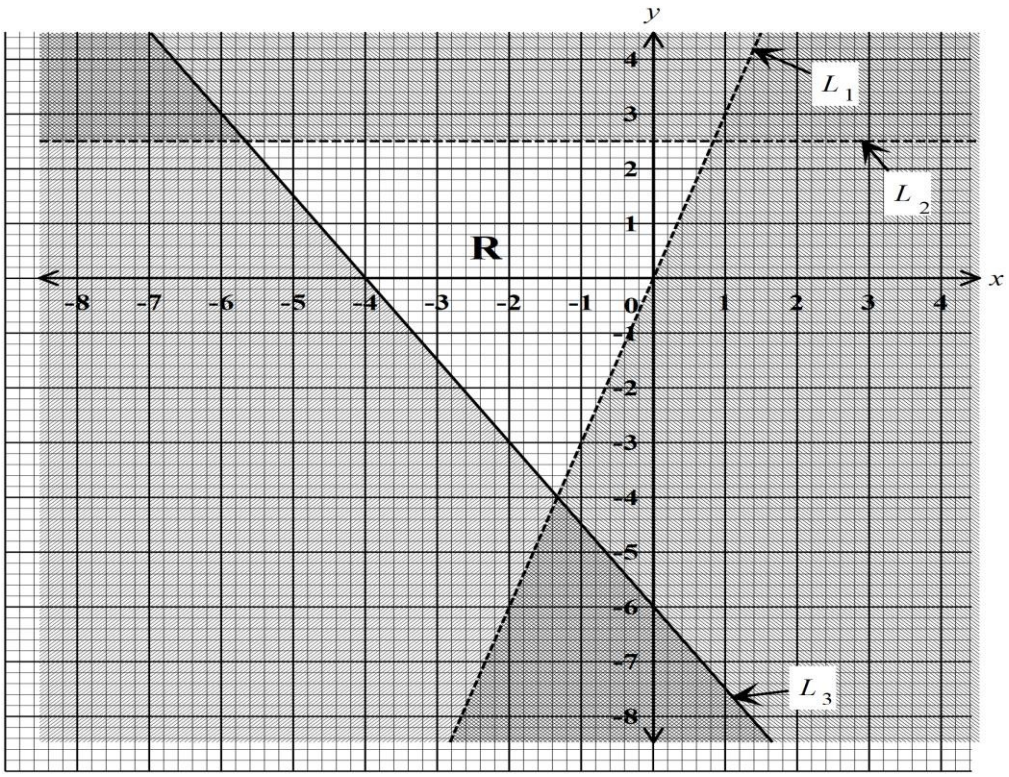
12. Find the inverse of the matrix $\begin{pmatrix} 1 & 1 \\ 3 & 1 \end{pmatrix}$ hence determine the point of intersection of the lines. (4mks)

y + x = 7

3x + y = 15

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13. Form the three inequalities that satisfy the given region (3 marks)



14. A boat is at point P, a distance of 100km from the bottom of a hill. The angle of elevation of the top of the hill is 30° from P. The boat sails straight towards the hill to a point Q from where the angle of elevation to the top of the hill is now 60°. Calculate the distance PQ (3 marks)

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15. Using a ruler and a pair of compasses only, construct a parallelogram ABCD in which AB = 7.2cm BC= 4.5cm and angle DAB = 105^0. Drop a perpendicular from D to BA produced at M. Measure the length of DM. (3 marks)

16. Simplify completely $\dfrac{9a^2y - 16b^2y^3}{4by^2 - 3ay}$ (3mks)

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SECTION II: (50 MARKS)

Answer only FIVE question from this section.

17. Given that a line L_1 passes through the points A(-1, 5) and B (3, -1), find

a) The equation of line L_1 in the form $\mathbf{y = mx + c}$ (2 marks)

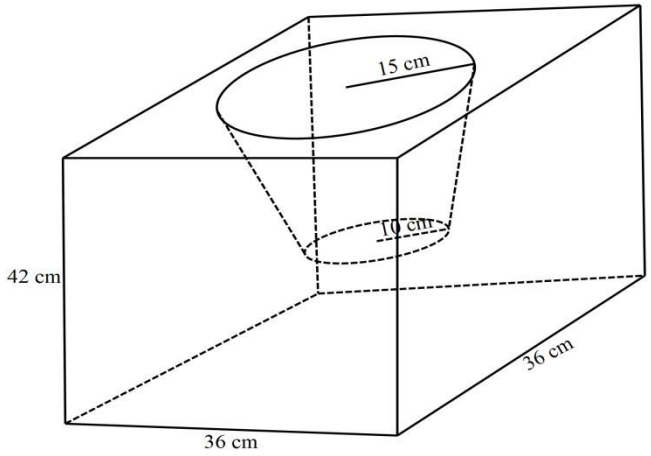
b) The equation of a line $\mathbf{L_2}$, which is a perpendicular bisector of $\mathbf{L_1}$. Leave your answer in the form $\mathbf{ax + by = c}$ where **a, b, c** are integers (3 marks)

c) Given that another line $\mathbf{L_3}$ is parallel to $\mathbf{L_2}$ and passes through point (-3, -5) and intersects lines $\mathbf{L_1}$ at point P. Find the equation of $\mathbf{L_3}$ in the form $\mathbf{ax + by + c = 0}$ (2 marks)

d) The coordinates of the point of intersection of lines $\mathbf{L_1}$ and $\mathbf{L_3}$ (3 marks)

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18. The figure below is a solid cuboid with a square base of 36 cm and a height of 42 cm. A conical frustum with a vertical height of 12 cm is drilled. The top and the bottom radii of the frustum is 15 cm and 10 cm respectively.
(Use $\pi = 3.142$)



a) Calculate the slant height of the frustum. (3 marks)

b) Calculate:

(i) The total surface area of the solid. (4 marks)

(ii) The volume of the solid. (3 marks)

FOR MS CALL 0724351706

19. (a)Given that matrix $\mathbf{A} = \begin{pmatrix} 5 & 8 \\ 5 & 6 \end{pmatrix}$, find $\mathbf{A}^{-1}$ (2 marks)

(b) Maya bought 25kgs of sugar and 40kgs of rice for Ksh. 11400 from a wholesale shop. Wanjiku bought twice the amount of sugar Maya bought and 60 kgs of rice from the same wholesale shop and spent Ksh. 8200 more than Maya. Taking x to represent the price of one kg of sugar and y to represent the price of one kg of rice:

(i) Form two simplified equations representing the above information. (1 mark)

(ii)Use matrix method to determine the price of each item. (4 marks)

(c)The following month, the price of sugar increased in the ratio 5:4 while that of rice increased by 25%. Use matrix method to determine Maya's expenditure for this month if she bought the same quantities of sugar and rice. (2 marks)

(d) Hence find the percentage increase on Maya's expenditure. (1 mark)

FOR MS CALL 0724351706

20. (a) In the beginning of the year 2020, the size of Chalbi desert in Marsabit was approximately 75800 ha. The county government supported a tree planting exercise whose target was to reduce the size of the desert by 3.5% p.a. Determine the size of the desert at the end of the year 2025 to the nearest hectares. (3 marks)

(b) In the beginning of the year 2020, the forest cover in Baringo county was approximately 45000ha. The county government supported a tree planting exercise aimed at increasing the forest cover by 2% every 3 months. Determine the size of the forest cover to the nearest hectares by the end of the year 2025 (3 marks)

(c) Find the number of years at which the forest cover in Baringo county will be equivalent to Chalbi desert in the year 2025 rounded off to the nearest 100 ha in (a) above. (4 marks)

FOR MS CALL 0724351706

21. Two friends Jane and Bob live 40 km apart. One-day Jane left her house at 9.00 a.m. and cycled towards Bob's house at an average speed of 15 km/h. Bob left his house at 10.30 a.m. on the same day and cycled towards Jane's at an average speed of 25 km/h.
    (a) Determine:
        (i) The distance from Jane's house to where the two friends met. (4 marks)

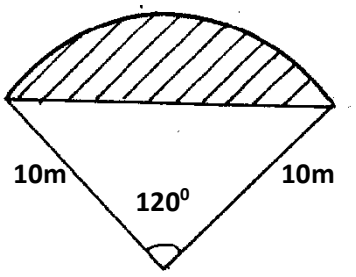
        (ii) The time they met. (2 marks)

        (iii) How far from Bob's house when they met. (2 marks)

    (b) The two friends took 10 minutes at the meeting point and then cycled to Bob's house at an average speed of 12 km/h. Find the time they arrived at Bob's house. (2 marks)

FOR MS CALL 0724351706

22. The ends of the roof of a workshop are segment of a circle of radius 10m. The roof is 20m long. The angle at the center is 120^0 as shown in the figure below.



(a) Calculate:

(i) The area of one end of the roof. (4mks)

(ii) The area of the curve surface of the roof. (2mks)

(b) What would be cost to the nearest shilling of covering the two ends and the curved surface with galvanized iron sheet costing sh.80 per square meter. (4mks)

FOR MS CALL 0724351706

23. Five points, P, Q, R, V and T lie on the same plane. Point Q is 53km on the bearing of 055^0 of P. Point R lies 162^0 of Q at a distance of 58km. Given that point T is west of P and 114km from R and V is directly south of P and S40^0E from T.
    a) Using a scale of 1:1,000,000, show the above information in a scale drawing. (3 marks)

    b) From the scale drawing determine:
        i) The distance in km of point V from R. (2 marks)

        ii) The bearing of V from Q. (2 marks)

        iii) Calculate the area enclosed by the points PQRVT in squares kilometers. (3 marks)

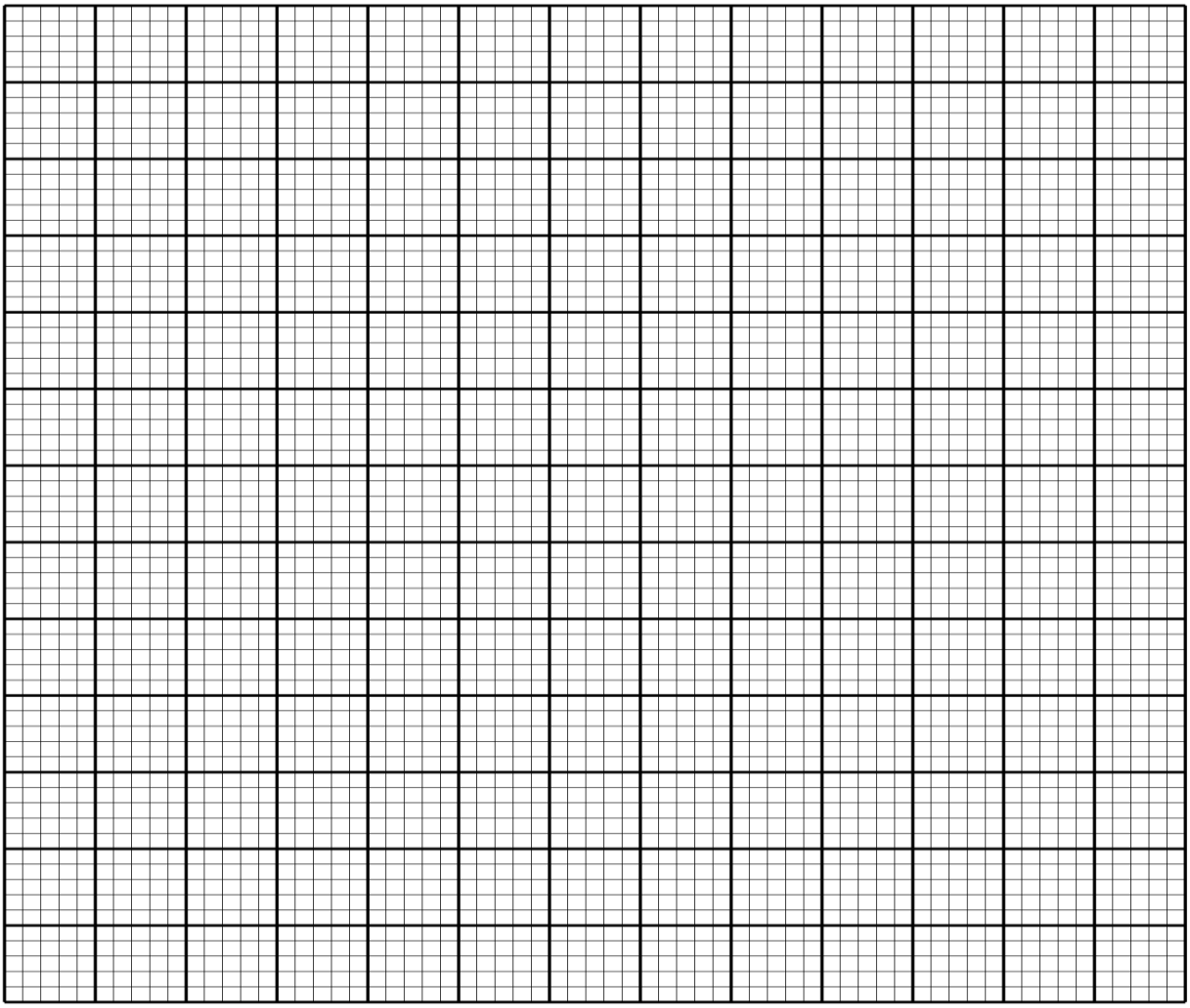
FOR MS CALL 0724351706

24. (a) On the grid provided below, plot the polygon A(3, 7), B(5, 5), C(3, 1), D(1, 5) on a cartesian plane
(2mks)

(b) $A^1B^1C^1D^1$ is the image of ABCD under a translational $T\begin{pmatrix}-6\\-9\end{pmatrix}$. Plot $A^1B^1C^1D^1$ and state its coordinates. (2mks)

(c) Plot $A^{11}B^{11}C^{11}D^{11}$, the image of $A^1B^1C^1D^1$ after a rotation about (-1, 0) through a positive quarter turn. State its coordinates. (3mks)

(d) $A^{111}B^{111}C^{111}D^{111}$ is the image of $A^{11}B^{11}C^{11}D^{11}$ after a reflection in the line Y=x + 2. Plot $A^{111}B^{111}C^{111}D^{111}$and state its coordinates (3mks)



FOR MS CALL 0724351706

PAPER 2

SECTION I (50MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION

1. Three grades A,B and C of rice were mixed in the ratio 3:4:5 . The cost per kg of each of the grades was ksh.120, ksh. 90 and ksh .60 respectively. Calculate;
   a. The cost of one kg of the mixture. (2mrrks)

   b. The selling price of a kg of the mixture, given that the mixture was sold at 8% profit. (2mks)

2. Make S the subject of the formula in $w = \sqrt{\frac{s+t}{s}}$ (3mks)

3. The cash price of agas cooker was ksh. 60000 .On hire purchase terms , adeposit of ksh. 7500 was paid followed by 11 monthly instalment of ksh. 6000 each .Calculate the percentage increase in hire purchase price to the cash price. (3mks)

4. Using completing square method ,solve for possible values of X in $\frac{x+3}{24}=\frac{1}{x-2}$ (3mks)

5. The position vectors of points X and y are (3mks)
   $2i+j-3k and 3i+2j-2k$ respectively. Find $|xy|$

6. The equation of a circle is given as $4x^2+4y^2-8x+20y-7=0$. Find the coordinates of the centre and the radius of the circle. (3mrks)

7. Expand $(1-x)^5$ up to x^3 hence approximate the value of $(0.98)^5$ correct to 3sf (4mks)

8. Determine the interquartile range for the following data
   4,9,5,4,7,6,2,1,6,7,8. (3mrks)

9. Write $\sin 45°$ in the form $\frac{1}{\sqrt{a}}$ where a is a positive integer .Hence simplify $\frac{\sqrt{8}}{1+\sin 45°}$
   (3mks)

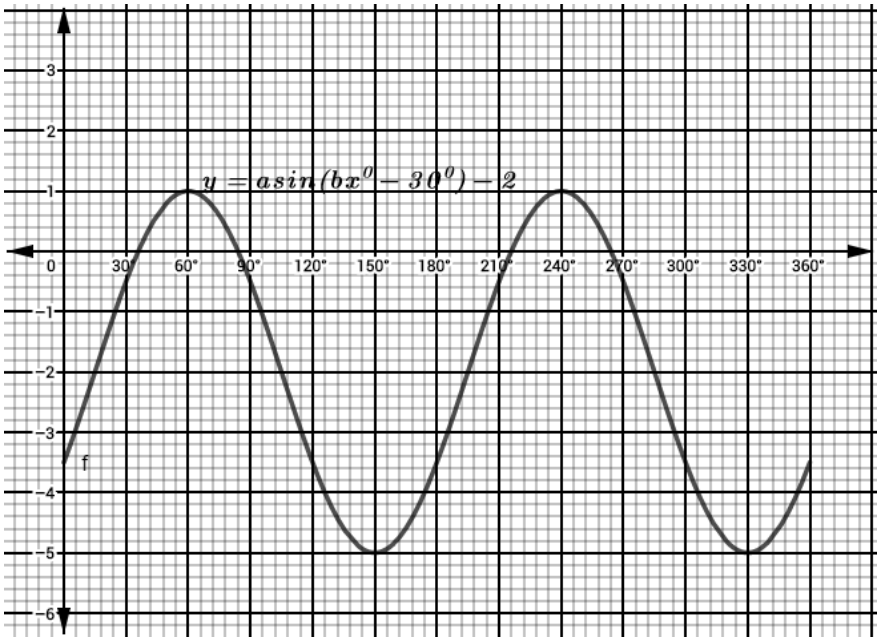
10. Atailor intended to subdivide a piece of cloth into 7 equal parts . she approximated $\frac{1}{7}$ to 0.14m.
    Calculate th % error in the approximation. (3mks)

11. Without using mathematical table or calculator , evaluate

$$\frac{5}{6}\log_{10} 64 + \log_{10} 50 - 4\log_{10} 2$$ (3mks)

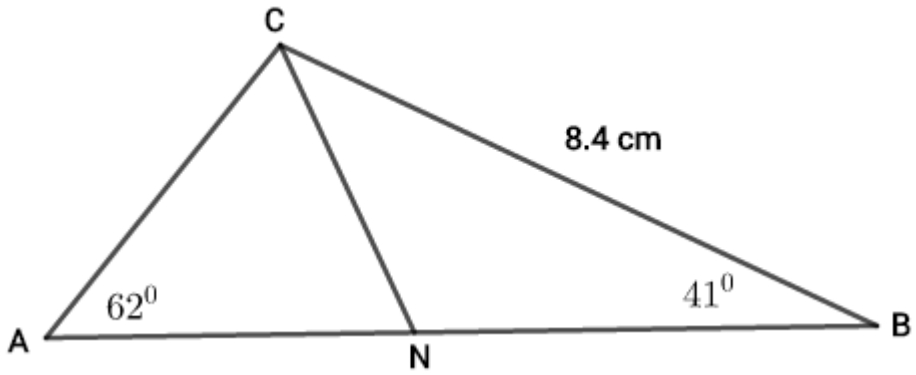
12. The 5th term of an **AP** is82 and the 12th term is 103 . Find the 1st term and the common difference. (3mks)

13. The figure below show a graph for the function of $y = a\sin(bx° - 30°) - 2$



Using the graph above find the values of **a** and **b** (4mks)

14. In the figure below $\angle CAB = 62°$ and $\angle CBA = 41°$,BC = 8.4CM and CN is the bisector of angle ACB.



Calculate the length CN to 1 d.p (3mrks)

15. An arc 11cm long subtends an angle of 70^0 at the centre of a circle. Calculate the length correct to one decimal place of a chord that subtends an angle of 90^0 at the centre of the same circle. (3mks)

16. In a transformation, an object with an area of $5cm^2$ is mapped onto an image whose area is $30cm^2$. given that the matrix off the transformation is $\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$ find the value of X

(3mks)

SECTION II (50MARKS)

Answer any 5 questions in this section.

17. The cost **p** of producing **q** items varies partly as q and as the inverse of **q** . To produce two items , it costs ksh. 135 and to produce three items it costs ksh. 140 . Find ;

a. The constants of the proportionality and hence state the law connecting **P** and **q** **(**5mks**)**

b. The cost of producing 10 items . (2mks)

c. The number of items produced at a cost of ksh. 756. (3mks)

18. The marks scored by 40 students in a test were recorded as shown below;

Marks	48 - 52	53 - 57	58 - 62	63 - 67	68 - 72	73 - 77
No of students	3	4	t	12	8	3

a. Find the value of t and state the lower boundary of the modal class. (3mks)

b. Using the assumed mean of 64, calculate ;
i. The mean mark. (3mks)

ii. Standard deviation . (3mks)

c. If the marks recorded were less by one for every student. Determine ;
i. The new mean mark (1mk)

ii. The new standard deviation (1mk)

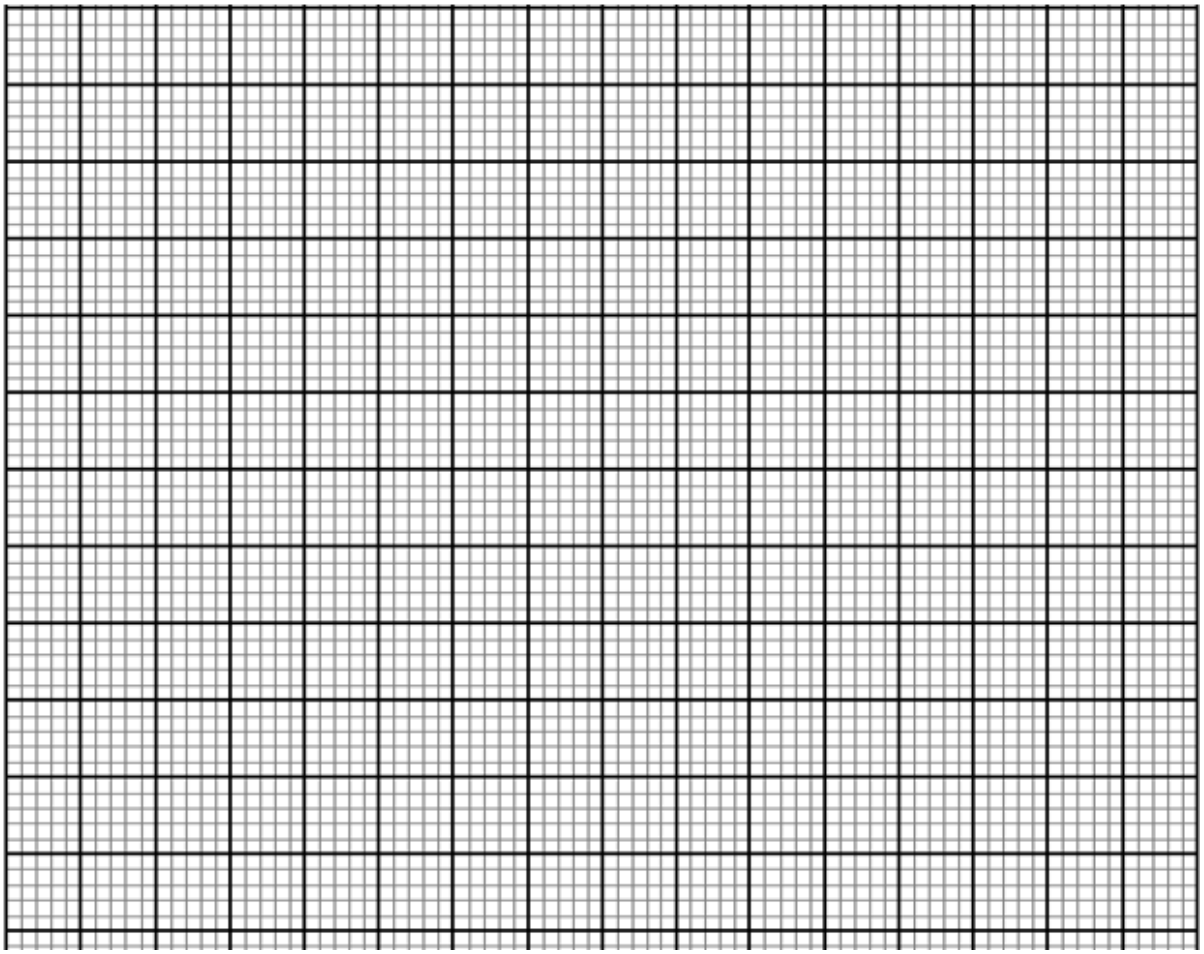
19. The table below shows values of x and some values of y for the curve of $y = x^3 - 2x^2 - 9x + 8$ for $-3 \leq x \leq 5$.

a. Complete the table below (2mks)

X	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**
$y = x^3 - 2x^2 - 9x + 8$	**-10**		**14**	**8**		**-10**		**4**	

b. On the grid provided , draw the graph of $y = x^3 - 2x^2 - 9x + 8$ using the scale of

1 cm represent 1 unit on the x – axis and 2 cm represent 10 units on the y – axis. (3mks)



c. i. Use the graph to solve the equation $x^3 - 2x^2 - 9x + 8 = 0$ (1mk)

ii.By drawing a suitable straight line on the graph to solve the equation ;

$x^3 - 2x^2 - 11x + 6 = 0$ (4mrks)

20. Two bags **A** and **B** contain identical balls except for the colour. Bag **A** has 4 red balls and 2 yellow balls; Bag **B** contains 2red 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. (4mks)

b. If two balls are drawn from each bag one after the other without replacement , find the probability that ;

i. The two balls drawn from bag **A** or bag **B** are red. (4mks)

ii. All the four balls drawn are red. (2mks)

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

Monthly income (ksh)	Tax rate in each shillings %
0 ----------10164	10%
10165----------19740	15%
19741----------29316	20%
29317----------38892	25%
Over 38892	30%

A tax relief of ksh. 1162 per month was allowed . In a certain month of that year , an employee's tax charged in the fifth band was ksh. 632.40.

a. Calculate ;

i. The employees total taxable income in that month. (2mks)

ii. The tax payable by the employee in that month. (5mks)

b. The employee's income included a house allowance of ksh. 15000 per month. The employee contributed 5% of the basic salary to a co-operative society. Calculate the employee net pay for that month. (3mks)

22. On the same diagram , construct ;

a.

i. Triangle **ABC** such that **AB** = 9 cm , **AC** = 7 cm and angle **CAB** = 60^0 . (2mks)

ii. The locus of a point **P** such that **P** is equidistant from **A** and **B** . (1mk)

iii. The locus of **Q** such that **CQ** $\leq$ 3.5 cm (1mk)

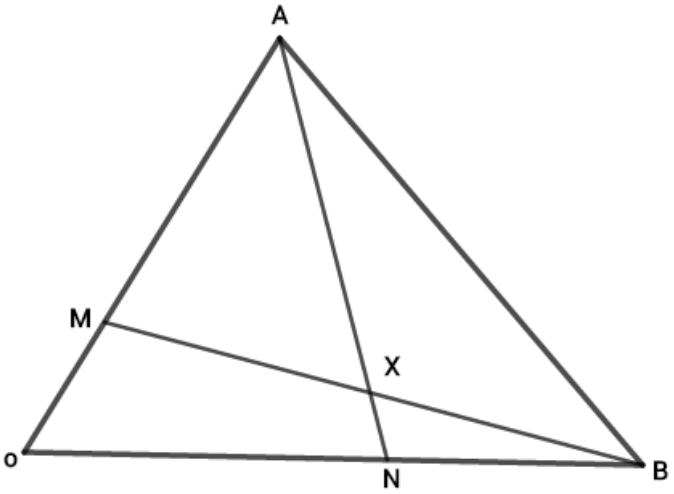
b. On the diagram in part (**a**) above ;

i. Shade the region **R** containing all the points enclosed by the locus **P** and **Q** such that **AP** ≥ **BP** (2mks)

ii. Find the area of the region shaded in part (**b**) **i**. above. (4mks)

23. The figure below shows triangle **OAB** in which **M** divides **OA** such that

OA : **MA** = 5 : 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**

i. **AN** (1mk)

ii. **BM** (1mk)

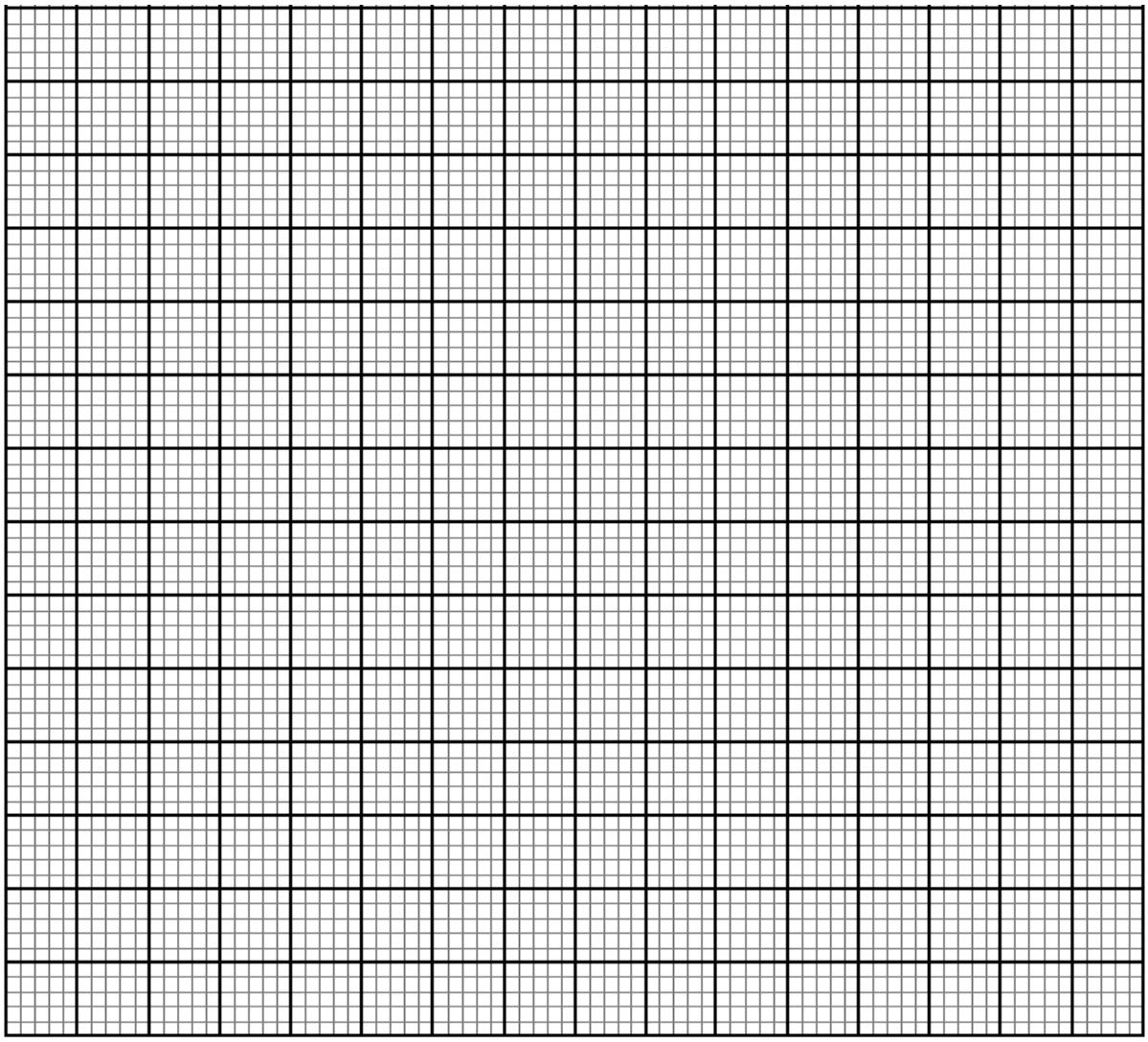
b. If **AX** = **s AN** and **BX** = **t BM**, where s and t are constant, write two expressions for **OX** in terms of **a** , **b** , **s** and **t** hence find the values of **s** and **t**. (6mks)

c. State the ratio in which **X** divides **AN**. (2mks)

24. The coordinates of the vertices of a rectangle **PQRS** are **P**(1 , 1), **Q**(6 , 1), **R**(6 , 4) and **S**(1 , 4).

a. i. Find the coordinates of the vertices of its image $\mathbf{P^I\ Q^I\ R^I\ S^I}$ under the transformation defined by the matrix $\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}$ (2mks)

ii) On the grid provide, draw triangle **PQRS** and its image. (2mks)



iii. On the same grid , draw the image $\mathbf{P^{II}\ Q^{II}\ R^{II}\ S^{II}}$ of $\mathbf{P^I\ Q^I\ R^I\ S^I}$ under the transformation given by $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ (3mks)

b. Find a single matrix which will map $P^{II}\ Q^{II}\ R^{II}\ S^{II}$ onto PQRS (3mks)

SERIES 26
PAPER 1

SECTION I (50 Marks)

Answer all the questions in this section

1. Express $6.7\dot{5}$ in the form $p\frac{q}{t}$ hence find the absolute value of (3 marks)
   $p-\frac{q}{t}$

2. A business woman bought two bags of maize at the same price per bag. She discovered that one bag was of high quality and the other of low quality. On the high quality bag, she made a profit by selling it at Ksh. 1040, while on the low quality bag, she made a loss by selling it at Ksh. 880. If the profit was three times the loss. Calculate the buying price per bag. (3 marks)

3. Find the values of a and b in the equation below. (2 marks)
   $5^a \times 7^b = 6125$

4. A foreign exchange bureau in Mombasa buys and sells selected foreign currencies at the rates shown in the table below.

Currency	**Buying (Ksh)**	**Selling (Ksh)**
1 South African Rand	7.48	7.95
1 Chinese Yuan	20.03	20.20

A tourist arrived in Kenya from South Africa with 7,435,000 South African Rands. She converted the whole amount to Kenya shillings through an agent at a commission of 2%. While in Kenya, she spent 25% of this money and converted the balance to Chinese Yuan. Calculate the amount of Chinese Yuan that she received.
(3 marks)

5. Simplify the expression. (4 marks)

$$\frac{a - 4ab + a^2 - 4b}{4b^2 - a^2b - ab - 4ab^2}$$

6. Given that $a = -2$, $b = 5$ and $c = -1$, evaluate (3 marks)

$$\frac{4a^3 + 5b - c}{\frac{1}{3}(c^2 - a^2)}$$

7. The size of an interior angle of a regular polygon is 144^0. Find the sum of its interior angles (3 marks)

8. Use logarithms only, correct to 4 significant figures to evaluate (4 marks)

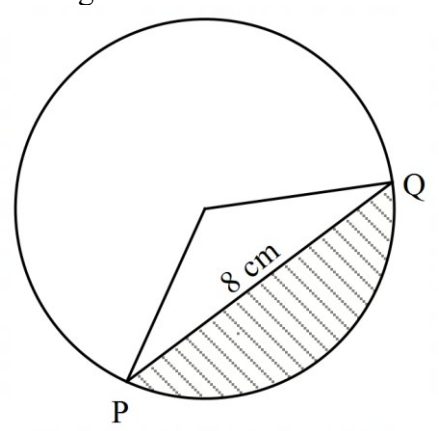
$$\sqrt[3]{\frac{23.45 \cos 67.89^0}{31.6^2}}$$

9. The surface areas of two similar solids are 528 cm^2 and 1188 cm^2. If the volume of the smaller solid is 1350 cm^3, calculate the volume of the larger solid. (3 marks)

10. Find the value of θ given that; (3 marks)

$$\frac{\cos\left(\frac{1}{2}\theta - 60\right)^{0}}{\sin(2\theta + 20)^{0}} = \tan 45^{0}$$

11. The figure below shows a circle centre O radius $4\sqrt{2}$ cm. The length of chord PQ = 8 cm.



Calculate the area of the shaded region. Leave your answer in terms of π (4 marks)

12. Simplify; (3 marks)

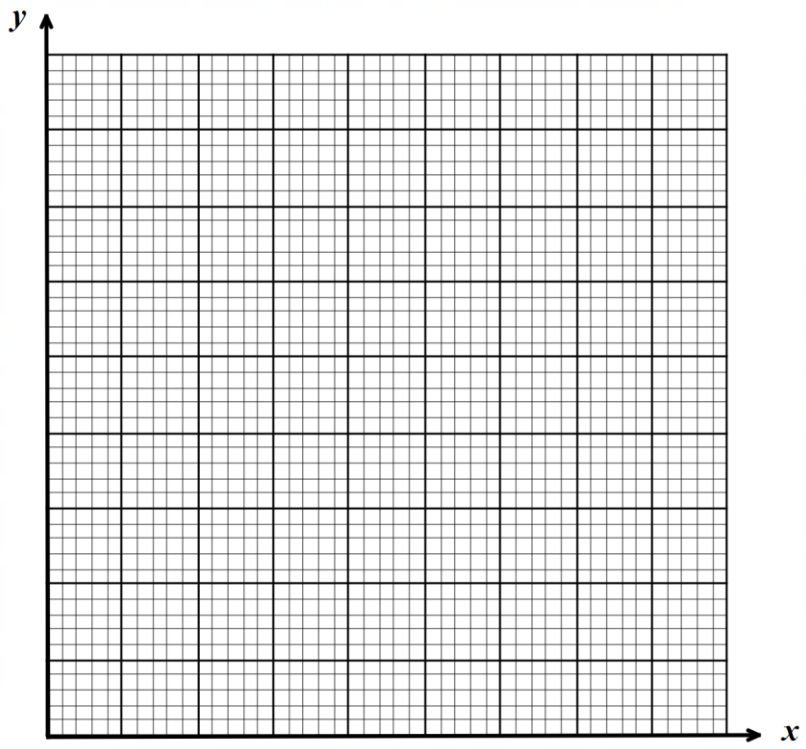
$$\frac{3^{n+3} - 3 \times 3^{n-1}}{4 \times 3^{n-1}}$$

13. On the grid provided below, show and mark the region R defined by the following inequalities: (3 marks)

$L_1 = y \leq x$

$L_2 = \frac{x}{8} + \frac{y}{4} \geq 1$

$L_3 = x < 5$



14. In a 4 by 400 metres relay race, athletes A, B, C and D took 42.91 seconds, 42.95 seconds, 43.11 and 43 seconds respectively to do their race. An average of one second is spent on each button exchange. Calculate the time they started the race if they completed at 8:24:36 p.m. (3 marks)

15. Expand and simplify: (2 marks)
$(3x - 2y)^2 - (2y + 3x)^2$

16. Using a ruler and a pair of compasses only, construct a trapezium KLMN such that KL=7.2 cm, KN=4.3 cm, $\angle$NKL =90^0 and $\angle$KLM = 52.5^0 and KL is parallel NM

Measure NM (4 marks)

SECTION II – 50 Marks

Answer any *five* questions in this section.

17. In a Mathematics test, 48 students scored the following marks:

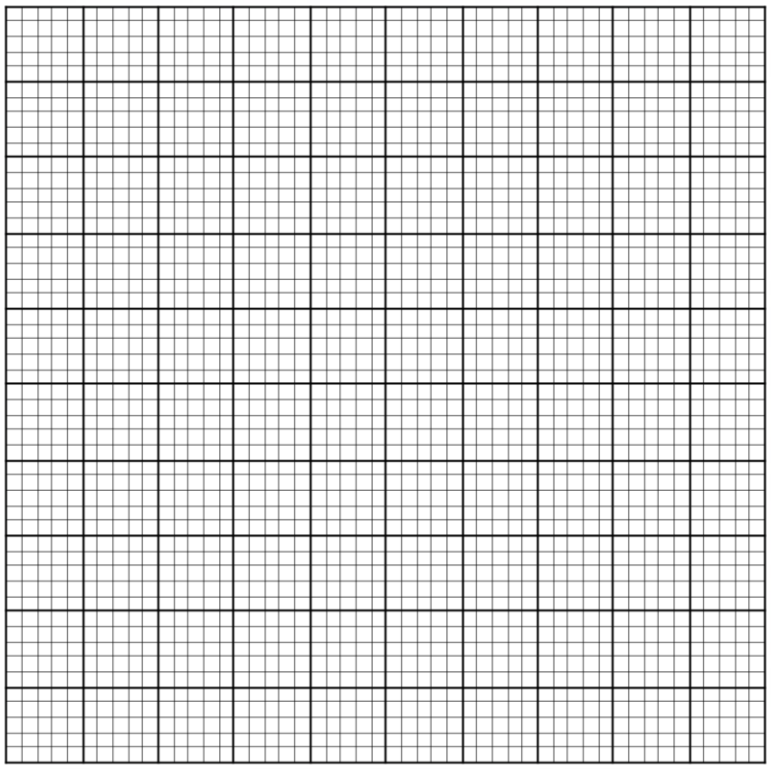
89	75	56	90	68	74	85	69
90	70	83	75	87	55	86	70
88	74	90	75	96	71	84	71
87	84	58	43	65	70	93	98
62	86	56	80	64	59	73	69
40	63	89	84	80	60	56	74

(a) Using a class interval of 10 and starting with the least mark recorded, make a frequency distribution table for the data. (2 marks)

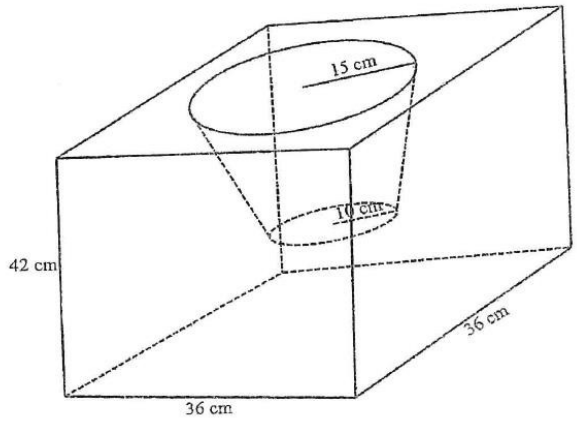
(b) Using the frequency distribution table in (a) above, calculate the mean mark. (4 marks)

(c) Identify the median class. (1 mark)

(d) On the grid provided, draw a frequency polygon for the data. (3 marks)



18. The figure below shows a solid cuboid with a square base of side 36 cm and height of 42 cm. A conical frustum with a vertical height of 12 cm is drilled. The top and bottom radii of the frustum are 15 cm and 10 cm respectively. Use π=3.142



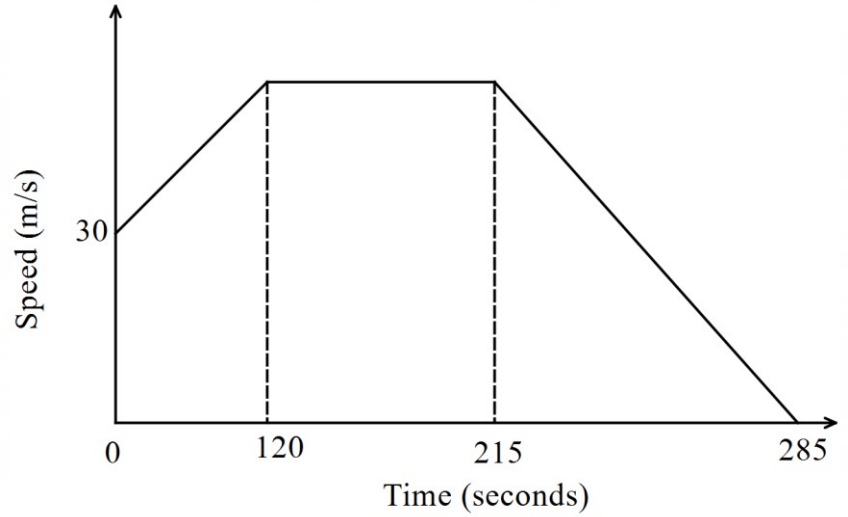
Calculate

(a) the slant height of the frustum (2 marks)

(b) the percentage of the volume of the frustum to the volume of the cuboid (5 marks)

(c) the volume of the solid. (3 marks)

19. (a) The figure below shows a speed-time graph of a train travelling between two terminuses



If the distance between the two terminuses is 16.05 km, calculate the maximum speed attained by the train. (3 marks)

(b) Towns M and N are 409 km apart. An express bus travelling at an average speed of 60 km/h left town M for town N at 9.45 a.m. A car left town N on the same day at 11.15 a.m. and met with the bus at 1327 hours.

(i) Determine the average speed of the car in km/h (5 marks)

(ii) The distance from M to the meeting point. (2 marks)

20. The second, third and fourteenth terms of an increasing Arithmetic Progression (AP) from the first three terms of Geometric Progression (GP). The tenth term of AP is 18.

(a) (i) Using a as the first term and d as the common difference, write down expressions for the second, third and the fourteenth terms of the AP. (1 mark)

(ii) Hence determine the values of a and d. (4 marks)

(b) Calculate

(i) S_{10} for the AP (2 marks)

(ii) S_5 for the GP (3 marks)

21. A line T passes through $(-5, 4)$ and $(3, -2)$

(a) Find the equation of T in the form $y = mx + c$, where m and c are constants. (2 marks)

(b) Find the equation of line D, the perpendicular bisector of line T. Leave your answer in the form $ax + by + c = 0$, where a, b and c are integers. (3 marks)

(c) Another line Y is parallel to line T at the point $(-8, 0)$ and interssect with line D at point Z. Find the coordinates of Z. (3 marks)

(d) Calculate the obtuse angle line Y makes with the x-axis correct to the nearest degree. (2 marks)

22. A salesman earns a basic salary of Ksh. 25000 per month. In addition, he is paid commissions as follows:
    - For sales up to Ksh. 50000 – 0%
    - For sales above Ksh. 50000
        (i) For the first Ksh. 25000 – 2%
        (ii) For the next Ksh. 25000 – 3%
    - For any sales above Ksh. 100000 – 5%

(a) During one month, he sold goods worth Ksh. 135000

(i) How much commission did he earn that month? (3 marks)

(ii) Calculate his total pay for the month. (2 marks)

(b) In another month, he received a total pay of Ksh. 40000. Calculate the total sales for that month. (5 marks)

23. (a) A hot water tap H can fill a bathtub in 5 minutes while a cold water tap C can fill the same bathtub in 3 minutes. The drain pipe D can empty the full bathtub in 3 minutes 45 seconds. Given that the bathtub is empty and that the two taps and the drain pipe are fully open for one and a half minutes, after which the drain pipe is closed, how much longer it will take to fill the bathtub? (4 marks)

(b) A quantity $\mathbf{B}$ varies partly as the square of a quantity $\mathbf{M}$ and partly as the inverse of another quantity $\mathbf{N}$. $\mathbf{B}$, $\mathbf{M}$ and $\mathbf{N}$ are such that when $\mathbf{M} = 2$, $\mathbf{N} = 4$ and $\mathbf{B} = 11.5$ while when $\mathbf{M} = 3$, $\mathbf{N} = 5$ and $\mathbf{B} = 26.6$

(i) Write an expression of $\mathbf{B}$ in terms of $\mathbf{M}$ and $\mathbf{N}$. (4 marks)

(ii) Find the value of B when $\mathbf{M} = 5$ and $\mathbf{N} = 6$. (2 marks)

24. Betty and Joan entered into a business partnership in which they contributed Ksh. 320000 and Ksh. 400000 every year respectively. After one year, Kevin joined the business and contributed Ksh. 240000.

(a) Calculate the ratio of their investment after three years of business. (3 marks)

(b) The three partners agreed that 30% of the profits after the three years be used to cater for the costs of running the business, while the remaining would be shared proportionally according to their ratio of contributions. If at the end of the third year, the business realised a profit of Ksh. 561000, calculate the share each person got. (4 marks)

(c) If each of them re-invested their shares back in the business, find their new individual investments at the beginning of the fourth year. (3 marks)

PAPER 2

SECTION I (50 Marks)

Answer all the questions in this section

1. The base and height of a right angled triangle were measured as 6.4 cm and 3.5 cm respectively. Determine to 1 decimal place the percentage error in calculating the area of the triangle (3 marks)

2. Find the value of x that satisfies the equation $\log(2x - 11) - \log 2 = \log 3 - \log x$ (4 marks)

3. Five men working 8 hours a day take 2 days to cultivate an acre of land. How many days would four men working 10 hours a day at double rate take to cultivate 3 acres of land? (3 marks)

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4. Simplify the expression below leaving your answer in the form $a + b\sqrt{c}$ where a, b and c are integral values. (3 marks)

$$\frac{\sqrt{48}}{\sqrt{5} - \sqrt{3}}$$

5. Two parallel chords of dimensions 15.6 cm and 13 cm are such that they are on the same side of the centre of a circle centre O and radius 12 cm. Calculate the perpendicular distance between the two chords, correct to 2 decimal places. (3 marks)

6. Frank bought a motor cycle on hire purchase terms. The cash price of the motor cycle was Kshs. 125000. He paid 15 equal monthly installments of Kshs. 13500 each. Calculate the monthly rate at which compound interest was charged. (4 marks)

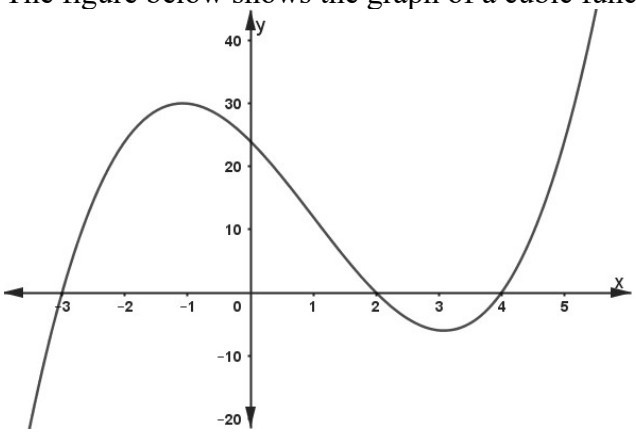
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7. Make n the subject of the formula (3 marks)

$$Q = \frac{\sqrt[3]{P^2 - n^3}}{n}$$

8. A bag has 3 red balls, 6 blue ball and some green balls of the same shape and size. The probability of picking a green ball is 0.5. Find the probability of picking either a green or a blue ball. (3 marks)

9. The figure below shows the graph of a cubic function.



Write the equation of the function in the form $y = x^3 + ax^2 + bx + c$, where a, b and c are constants. (3 marks)

FOR MS CALL 0724351706

10. Given that $\mathbf{A} = \begin{pmatrix} 1 & k \\ 3 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -3 & 5 \\ 1 & -2 \end{pmatrix}$, find k if the determinant of **AB** is 9 (3 marks)

11. Determine the independent term in the expansion of (2 marks)
$\left(2x - \frac{1}{3x^2}\right)^6$

12. A trader bought two grades of rice; grade A at Ksh.109 per kilogram and grade B at Ksh. 81.50 per kilogram. She blended the two grades of rice in the ratio $5: n$ and by selling the blend at Ksh. 112.80 per kilogram, a profit of 20% was realised. Determine the value of n. (3 marks)

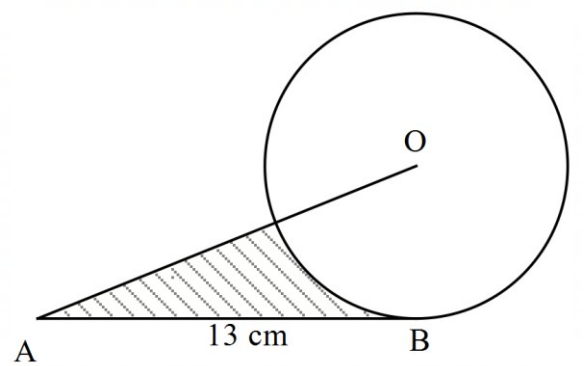
13. Use trigonometric identities to show that: (3 marks)
$\frac{\tan^2\theta + 1}{\tan^2\theta} = \frac{1}{1 - \cos^2\theta}$

FOR MS CALL 0724351706

14. Draw a line PQ=9 cm. On the upper side of line PQ, construct the locus of a point T such that the area of triangle ATB = 13.5 cm^2. On the locus of T, locate and label points T_1 and T_2 such that $\angle PT_1Q=\angle PT_2Q=90^0$ (4 marks)

15. Determine the centre and radius of a circle whose equation is given by; (3 marks)
$2x^2 + 2y^2 - 32x + 48y + 254 = 0$

16. In the figure below, AB is a tangent to the circle centre O at B. The radius of the circle is 5 cm and AB = 13 cm.



Calculate the shaded area. Use $\pi = 3.142$. (3 marks)

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SECTION II – 50 Marks
Answer any *five* questions in this section.

17. The table below shows income tax rates for the year 2020

Taxable income (Ksh. per month)	**Tax Rate (% per Ksh)**
1 – 15000	0
15001 – 27000	10
27001 – 37000	15
37001 – 45000	20
45001 – 50000	25
Above 50000	30

In June 2022, Eric earned a basic salary of Ksh. 34320. In addition, he was entitled to a house allowance of Ksh. 12000 per month and medical allowance of Ksh. 6450. He also has a non-taxable risk allowance of Ksh. 6000 per month. He contributes to a provident fund of Ksh. 7500. He also has tax relief of Ksh. 1180 monthly.

(a) Calculate Eric's taxable income in that month. (2 marks)

(b) Calculate Eric's Pay As You Earn for June 2022. (5 marks)

(c) In the month of July 2022, Eric's tax in the last band was Ksh. 2556. Calculate his net salary in July. (3 marks)

FOR MS CALL 0724351706

18. The table below shows the frequency distribution of the heights of 100 seedlings in a tree nursery.

Height (cm)	Number of seedlings (f)	Midpoint (x)	$d = \frac{x - 55.5}{10}$	fd	fd^2
1 – 10	3				
11 – 20	5				
21 – 30	8				
31 – 40	11				
41 – 50	12				
51 – 60	18				
61 – 70	20				
71 – 80	10				
81 – 90	7				
91 – 100	6				
	$\Sigma f = 100$			$\Sigma fd =$	$\Sigma fd^2 =$

(a) Complete the table (4 marks)

(b) State the modal class (1 mark)

(c) Calculate

(i) Mean (2 marks)

(ii) standard deviation (3 marks)

FOR MS CALL 0724351706

19. A farm is quadrilateral in shape with vertices at A, B, C and D such that B is 160 metres from A on a bearing of 090^0. C is 140 metres from A on a bearing of 130^0, and D is 260 metres to the west of C and on a bearing of 240^0 from A

(a) Sketch the relative positions of A, B, C and D. (1 mark)

(b) Calculate:

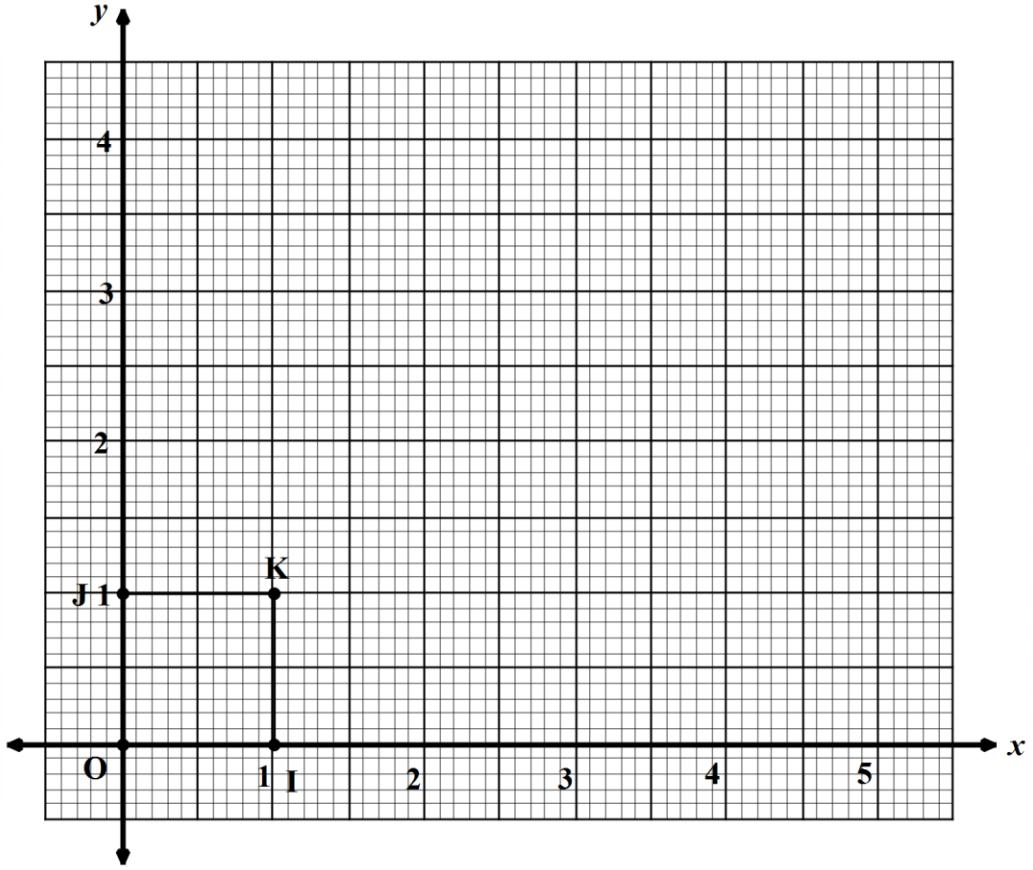
(i) The distance BC, correct to 1 decimal place. (3 marks)

(ii) The bearing of C from D to the nearest degree. (3 marks)

(c) Find the area of the farm in hectares, correct to 3 significant figures. (3 marks)

FOR MS CALL 0724351706

20. The grid below shows the unit square OIKJ such that O(0, 0), I(1, 0), K(1, 1) and J(0, 1)



(b) O′I′K′J′ is the image OIKJ after a transformation **M** such that O′(0, 0), I′(4, 0), K′(4, 1) and J′(0, 1)

(i) On the same grid, draw O′I′K′J′ (1 mark)

(ii) Describe fully the transformation **M**. (3 marks)

(iii) Find the matrix of **M**. (1 mark)

FOR MS CALL 0724351706

(c) $O''I''K''J''$ is the image of $O'I'K'J'$ under a transformation described by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$

(i) Find the coordinates of $O''I''K''J''$ (2 marks)

(ii) On the same grid, draw $O''I''K''J''$ (1 mark)

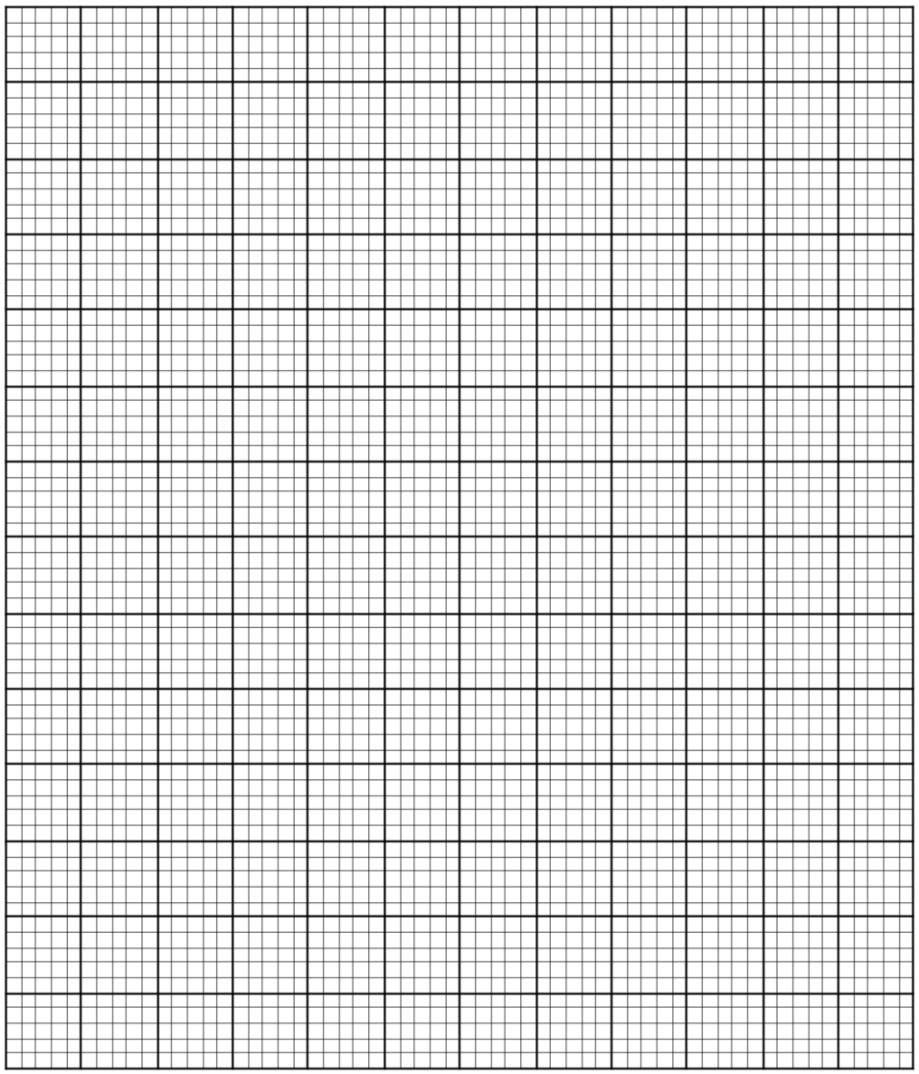
(d) Describe a single transformation that maps $OIKJ$ onto $O''I''K''J''$. (2 marks)

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21. (a) Complete the table given below for the functions $y = -3\cos 2x$ and $y = 2\sin(\frac{3}{2}x + 30)^0$ for $0^0 \leq x \leq 180^0$ (2 marks)

x^0	0	20	40	60	80	100	120	140	160	180
$-3\cos 2x$	-3.00			1.50	2.82	2.82		-0.52	-2.30	
$2\sin(\frac{3}{2}x + 30)^0$	1.00		2.00	1.73		0.00	-1.00			-1.73

(b) Using the grid provided, draw the graphs of $y = -3\cos 2x$ and $y = 2\sin(\frac{3}{2}x + 30)^0$ for $0^0 \leq x \leq 180^0$ on the same pair of axes. Take 1cm to represent 20^0 on the $x-$ axis and 2cm to represent 1 unit on the $y-$ axis. (5 marks)



(c) From the graphs in (b) above, find;

(i) the period of $y = 2\sin(\frac{3}{2}x + 30)^0$ (1 mark)

(ii) the values of x given that $2\sin(\frac{3}{2}x + 30)^0 + 3\cos 2x = 0$ (2 marks)

FOR MS CALL 0724351706

22. Awuor was paid an initial salary of Kshs. 180000 per annum with a fixed annual increment. Wasonga was paid and initial salary of Kshs. 150000 per annum with a 10% increment compounded annually.
(a) Given that Awuor's annual salary in the 11th year was Kshs. 288,000, determine:

(i) Her annual increment. (2 marks)

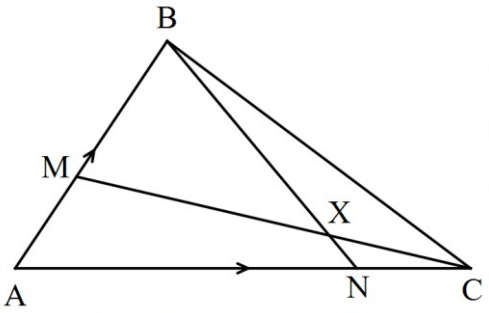
(ii) The total amount of money Awuor earned during the 11 years. (2 marks)

(b) Determine Wasonga's monthly earning, correct to the nearest 10 shillings during the 11th year (3 marks)

(c) Calculate the number of years it will take Awuor's total earnings to be Ksh. 1022400. (3 marks)

FOR MS CALL 0724351706

23. In the triangle ABC shown below, $\mathbf{AB} = \boldsymbol{a}$ and $\mathbf{AC} = \boldsymbol{c}$. Point M lies on AB such that AM: MB=2: 3 and point N lies on AC such that AN: NC = 5: 1. Lines BN and MC at X



(a) Express the following in terms of $\boldsymbol{a}$ and $\boldsymbol{c}$;

(i) **BN**; (1 mark)

(ii) **CM.** (1 mark)

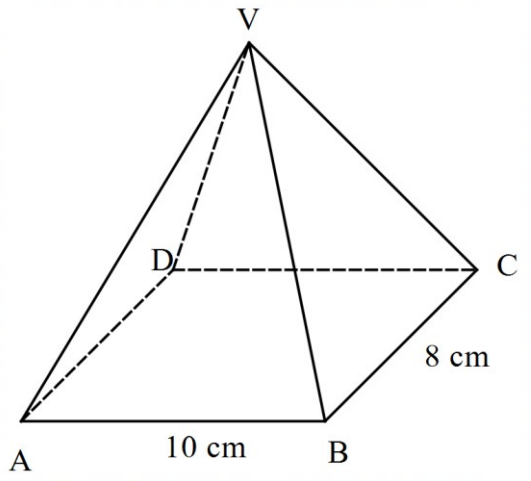
(b) Given further that $\mathbf{BX} = h\mathbf{BN}$ and $\mathbf{CX} = k\mathbf{CM}$ where h and k are constants

(i) Write two different expressions for **AX** in terms of $\boldsymbol{a}$, $\boldsymbol{c}$, h and k. (4 marks)

(ii) Hence find the values of h and k. (4 marks)

FOR MS CALL 0724351706

24. The figure below shows a right pyramid VABCD standing on a rectangular base of length 10 cm and width 8 cm. The diagonals of the base intersect at O and M is the midpoint of BC. The vertical height OP of the pyramid is 12 cm and that all the slant edges are equal.



Calculate correct to 2 decimal places:

(a) The length of VM, (2 marks)

(b) (i) State the projection of VB on the plane ABCD. (1 mark)

(ii) Calculate the angle VB makes with the plane ABCD. (3 marks)

(c) The angle between planes VAD and ABCD. (2 marks)

(d) The volume of the pyramid. (2 marks)

FOR MS CALL 0724351706

SERIES 27
PAPER 1

1. Without using mathematical tables or calculate, evaluate

$$\sqrt{\frac{1408 \times 0.594 \times 0.012}{6.05 \times 125}}$$

Leaving your answer as a simplified fraction (3mks)

2. The length of three wires were 30m, 36m and 84m. Pieces of wire of equal length were cut from the three wires. Calculate the least number of pieces obtained. (3mks)

3. Without using calculator, solve for n in the equation:

$1-(\frac{1}{2})^n = \frac{7}{8}$ (3mks)

4. Solve the following inequalities and state the integral values

$2x-2 \leq 3x+1 < x+11$ (3mks)

5. One interior angle of a polygon is equal to 80° and each of the other interior angles are 128°. Find the number of sides of the polygon. (3mks)

6. Two similar solids have surface areas 48cm² and 108cm² respectively. Find the volume of the smaller solid if the bigger one has a volume of 162cm³.

(3mks)

7. A triangle flower garden has an area of 28m². Two of its edges are 14m and 8m. Find the angle between the two edges. (3mks)

8. a) Using a pair of compasses and a ruler only, construct a triangle ABC such that AB=4cm, BC=6cm and angle ABC= 135° (2mks)

b) Construct the height of triangle ABC in (a) above taking AB as the base, hence calculate the area of triangle ABC. (2mks)

9. A watch which looses a half a minute every hour. It was read the correct time at 0445hours on Monday. Determine in twelve-hour system the time the watch will show on Friday at 1845hours the same week. (3mks)

10. Use reciprocal and cube root tables to evaluate

$$^{5}/_{63.34} - \sqrt[3]{0.0169}$$ (3mks)

11. Simplify the expression (3mks)

$$\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$$

12. Akenya company received US Dollars M. The money was converted into Kenyan shillings in a bank which buys and sells foreign currencies

	Buying (in Ksh.)	Selling (in Ksh.)
1 Sterling pound	125.78	126.64
1 US Dollar	75.66	75.86

a) If the company received Ksh.15,132,000. Calculate the amount, M received in US Dollars (2mks)

b) The company exchanged the above Kenya shillings into sterling pounds to buy a car in Britain. Calculate the cost of the car to the nearest sterling pound.

(2mks)

13. A trade sold address for Ksh.7,200 allowing a discount of 10% on the marked price. If the discount had not been allowed, the trader would have made a profit of 25% on the sale of the dress. Calculate the price at which the trader bought the dress. (3mks)

14. A certain two-digit number is equivalent to five times the sum of the digit. It is found to be 9 less than the number formed when the digit are interchanged. Find the number. (4mks)

15. A man standing 20m away from the foot of a vertical pole observes the top of the pole at an angle of elevation of 30°. He begins to walk along a straight line on level ground towards the pole. Calculate how far he walked before the angle of elevation of the top of the pole becomes 80°. (3mks)

16. Find the acute angle y if $\sin 4y = \cos 2y$ (2mks)

SECTION II

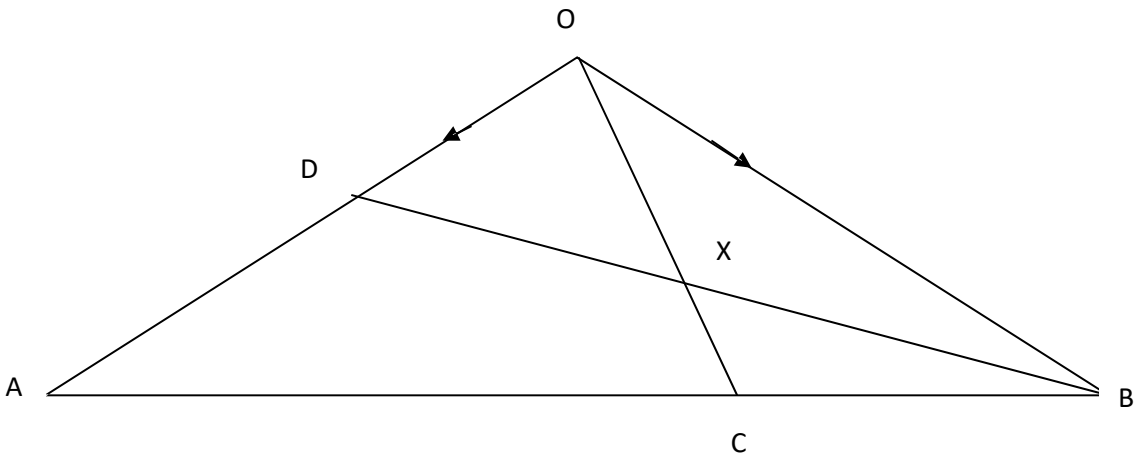
17. Mambo poured spirit into a test tube which has a hemispherical bottom of inner radius 1.5cm. He noted that the spirit is 8cm high.

a) What is the area of surface in contact with spirit? (4mks)

b) Calculate volume of spirit in the test tube (4mks)

c) Mambo obtained the mass of the spirit as 10g. Calculate the density of the spirit. (2mks)

18. The figure below, c is appoint on AB such that AC: CB = 3 and D is the mid-point of OA. OC and BD intersect at X.



Given that OA = a and OB = b

a) Write the vectors below in terms of a and b

i. AB (1mk)

ii. OC (2mks)

iii. BD (1mk)

b) If BX= hBD express OX in terms of a, b, and h (1mk)

c) If OX= kOC, Find h and k (4mks)

d) Hence express OX in terms of a and b only (1mk)

19. A straight line L_1 has a gradient $-\frac{1}{2}$ and passes through point p (-1,3).

Another L_2 passes through the points Q(1,-3) and R(4,5). Find

a) The equation of L_1 (2mks)

b) The gradient of L_2 (1mk)

c) The equation of L_2 (2mks)

d) The equation of a line passing through a point S (0,5) and is perpendicular to L_2 (3mks)

e) The equation of a line through R parallel to L_1 (2mks)

20. A certain number of people agreed to contribute money to buy novels worth sh.1,200. Five of them pulled out and the remaining agreed to contribute an extra sh.10 each. Their contribution brought novels 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. (1mk)

b) Write down two expressions on how much each contributed after the five pulled out and reduced it to a single equation. (2mks)

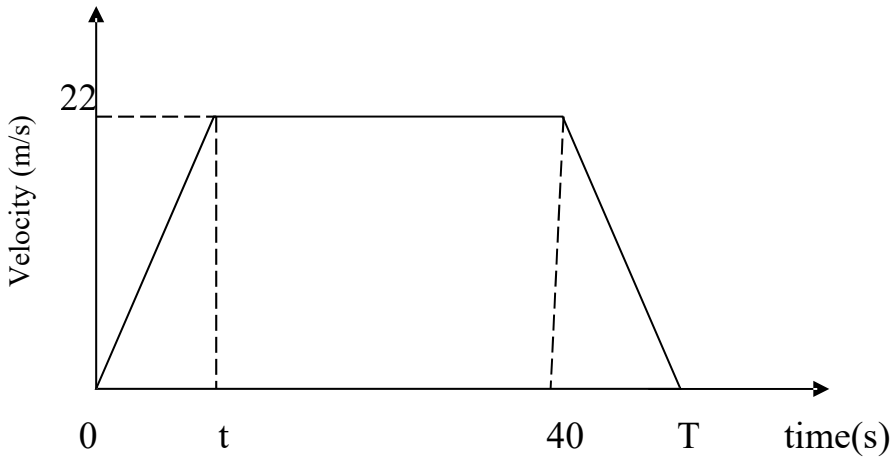
c) Calculate how many people made the contribution. (5mks)

d) How much did each contribute? (2mks)

21.a) In 2001 the total cost of manufacturing an article was Ksh.1250 and this was divided between the cost of material, labour and transport in the ratio 8:14:3. In 2004, the cost of material was doubled, labour cost increased by 30% and transport costs increased by 20%. Calculate the cost of manufacturing the article in 2004. (6mks)

b) For the same article in (a) above, the cost of manufacturing in 2005 was sh.1981 as a result of increase in labour costs only. Find the percentage increase in labour cost of 2004. (4mks)

22. The figure below shows a velocity time graph of a car journey



The car starts from rest and accelerates at 2.75m/s² for t seconds until its speed ids 22m/s. it then travels at this velocity until 40seconds after starting. It brings it uniformly to rest. The total journey is 847m long and takes T seconds.

Calculate

i. The value of t (3mks)

ii. Distance travelled during the first t seconds (2mks)

iii. The value of T (3mks)

iv. The final deceleration (2mks)

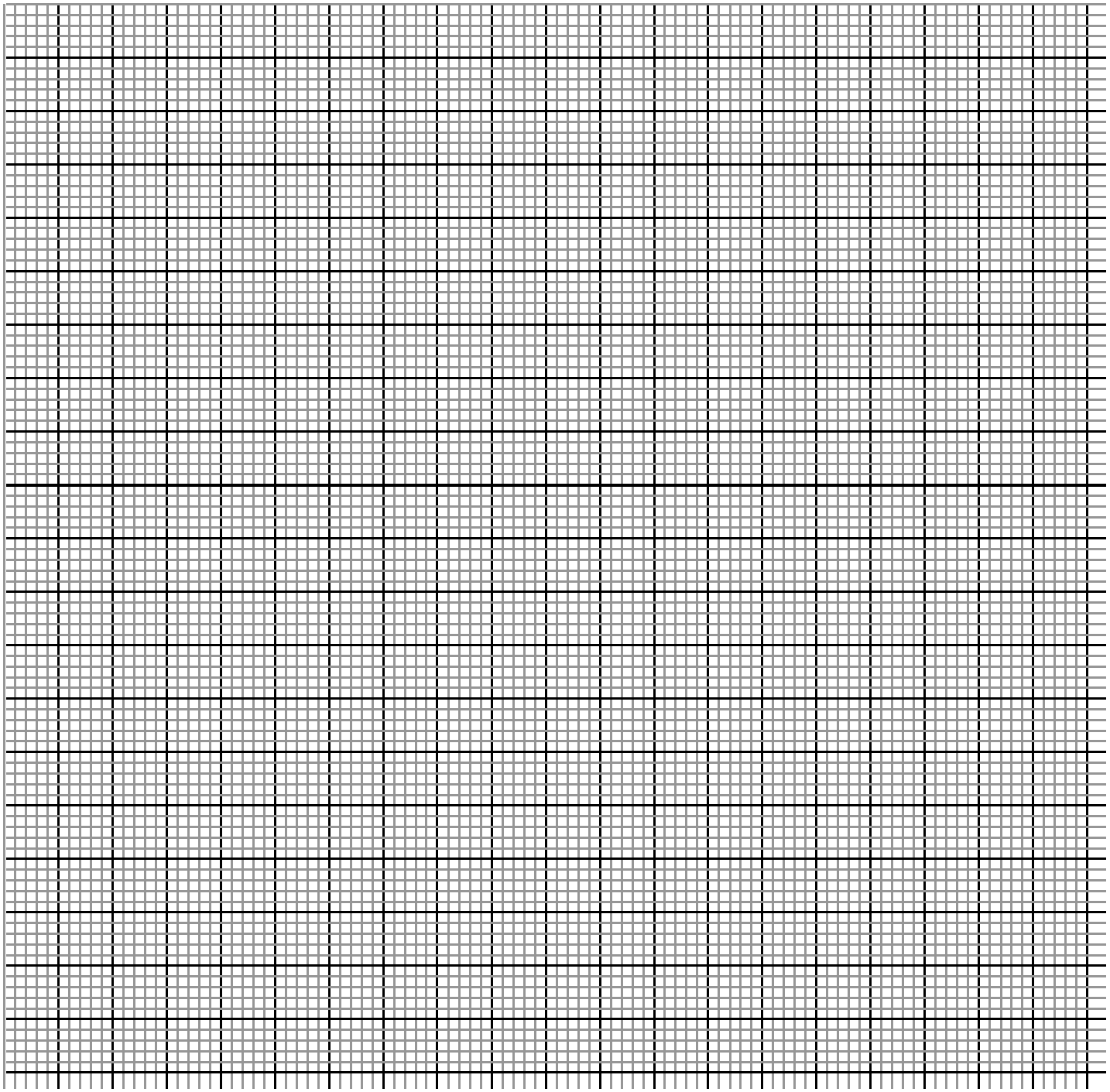
23. The following are masses of 25 people taken in a clinic.

20	35	29	45	60
60	56	29	48	37
56	64	24	28	32
35	45	48	52	55
54	55	36	39	35

a) Using a class width of 8 and starting with the lowest mass of the people, make a frequency distribution table for the data (3mks)

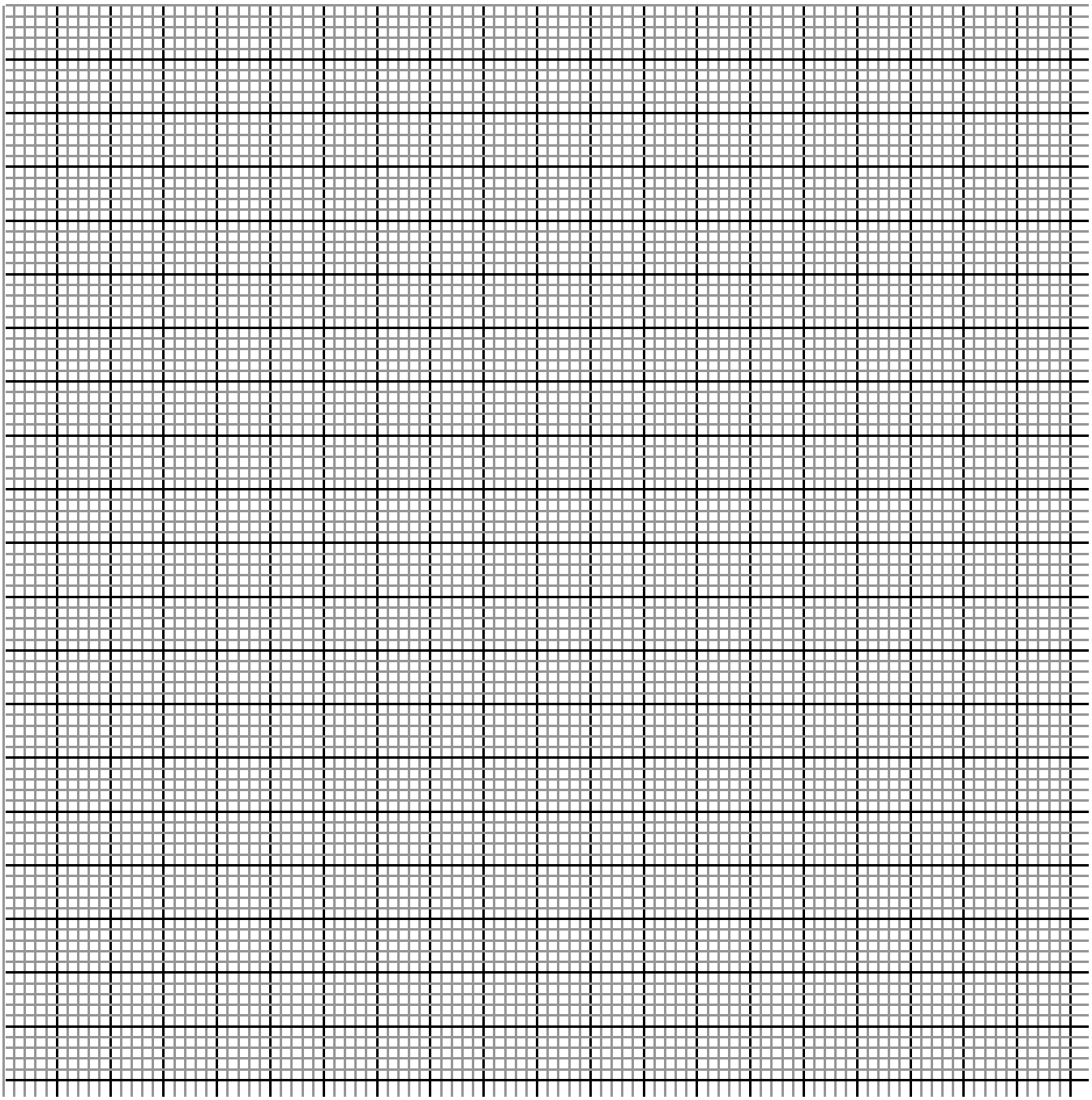
b) Calculate the median mass of the people. (3mks)

c) On the grid provided, draw a histogram to represent the information (4mks)



24. A triangle with A(-4,2), B (-6,6) and C(-6,2) is enlarged by a scale factor -1 and centre (-2,6) to produce triangle A′B′C′.

a) Draw triangle ABC and A′B′C′ and state its coordinates (4mks)



b) Triangle A′B′C′. Is then reflected in the line y = x to give triangle A′′B′′C′′. Draw triangle A′′B′′C′′ and state its coordinates. (3mks)

c) If triangle A′′B′′C′′ is mapped onto A′′B′′C′′ whose co-ordinates are A′′′ (0,-2), B′′′ (4,-4) and C′′′(0,-4) by rotation. Find the centre and angle of rotation. (3mks)

SECTION 1 (50 Marks)

Answer All the Questions in this section in the spaces provided.

1. Given that $\frac{\sqrt{5}+3}{\sqrt{5}-2} = a + b\sqrt{c}$ where a, b and c are integers, find the values of a, b and c

(2mks)

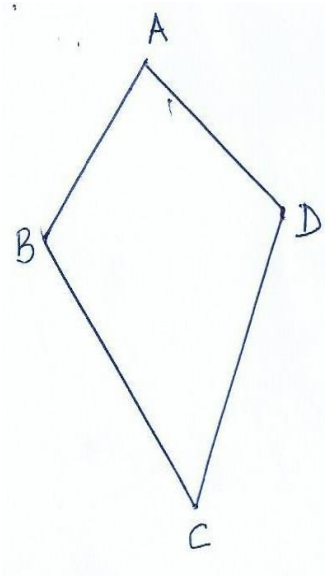
2. A quantity M varies inversely as the square of another quantity N. When M = 0.625, N = 4.
Determine the value of M when N = 0.2 (3mks)

3. Simplify; $\frac{2x^2-72}{2x^2-7x-30} + \frac{x-4}{2x+5}$ (4mks)

4. Make r the subject of the formula: $p = \sqrt[3]{\frac{r+r}{r}}$ (2mks)

5. A box contains x red pens and (x – 8) identical blue pens. The probability that a red pen is picked at random from the box is 0.6. find the total number of pens in the box (3mks)

6. The figure below shows a kite ABCD. AB = AD = 15cm and BC = CD.

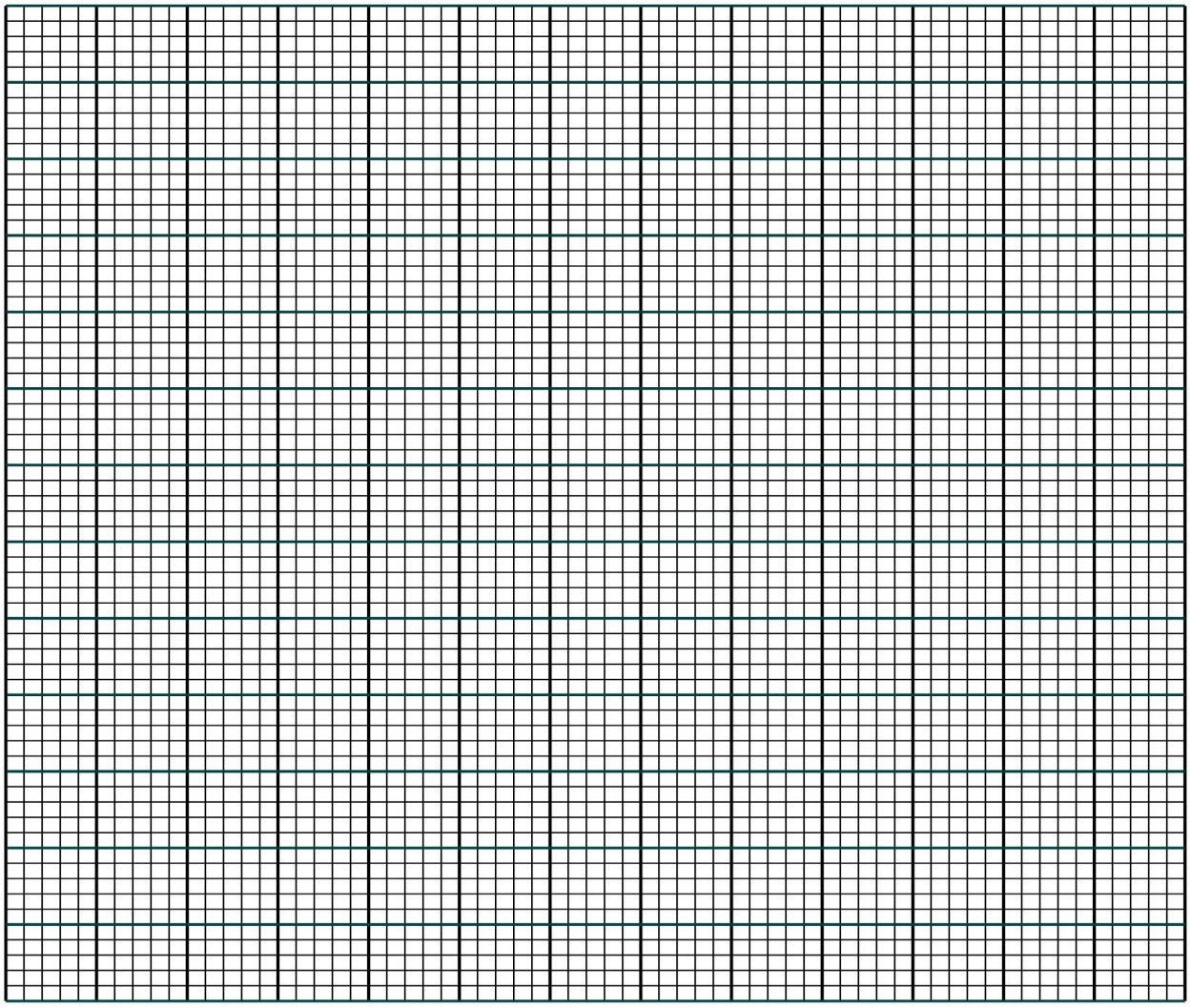


Given that BD = 18 cm and the area of the kite is 270cm^2, find the length BC of the kite (3mks)

7. Without using calculator or mathematical tables, evaluate (3mks)
$\frac{5}{6}\text{Log}_{10}\ 64 + \text{Log}_{10}\ 50 - 4\ \text{Log}_{10}\ 2$

8. A basketball team scored the following points in 6 matches: 10, 12, 14, 16, 28 and 30. Using an assumed mean of 15, determine the standard deviation of the scores correct to 2 decimal places. (4mks)

9. The equation of a circle is $x^2 + y^2 - 4x + 6y + 4 = 0$. On the grid provided below, draw the circle (4mks)



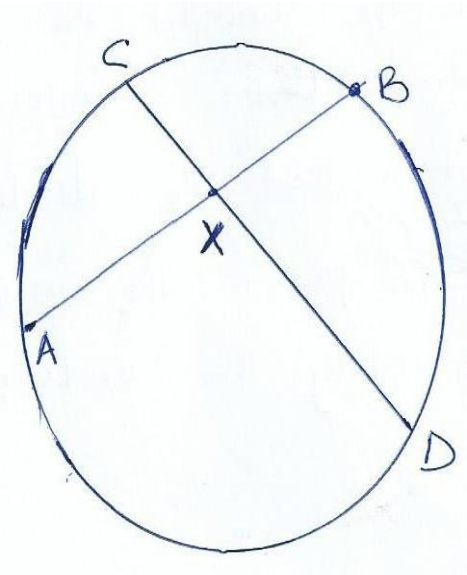
10. The cash price of a smart phone is kshs.30,000. Wafula bought the phone by paying a deposit of kshs.2,000 followed by 8 equal monthly instalments. Given that the dealer charges interest at the rate of 4.4% per month, calculate the amount Wafula paid monthly as instalment. (Answer to the nearest shillings) (4mks)

11. The length and width of a rectangle are given as 4.5 cm and 2.5 cm respectively. Calculate the percentage error in calculating

a) The area of the rectangle (2mks)

b) The perimeter of the rectangle (2mks)

12. The figure below shows a circle with two intersecting chords AB and CD



Given that AX = 5cm, XB = 4cm and CX = 2cm find the length of the chord CD. (2mks)

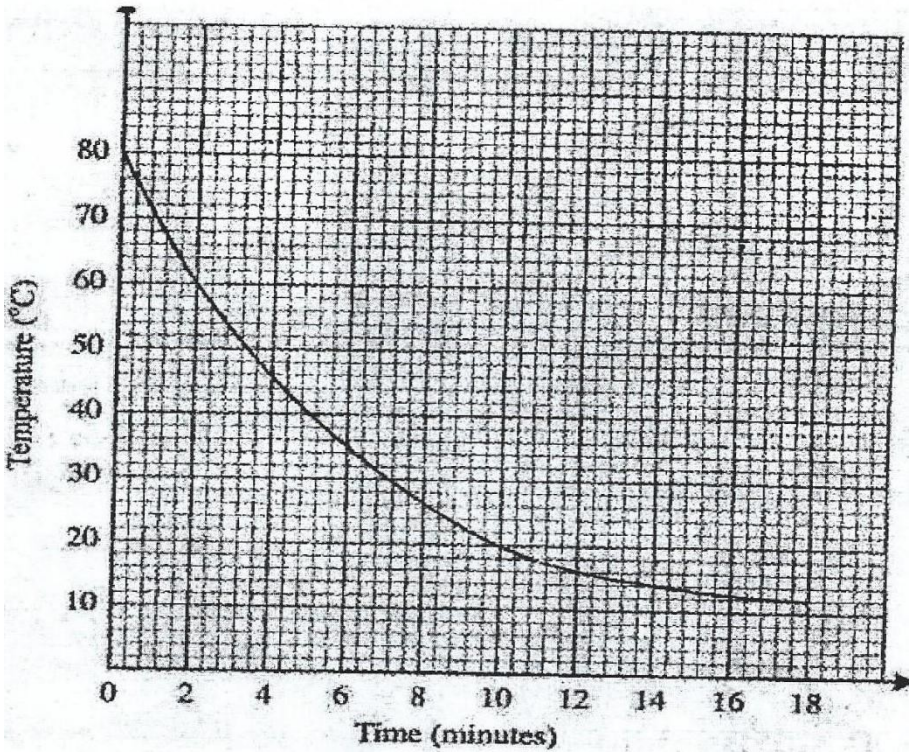
13. In a mathematics contest, there are 30 questions to be answered. Every question correctly answered scores 3 points; a question wrongly answered scores 1 point whereas, a question not answered scores -1 point.

    i) What is the maximum point of the contest (1mk)

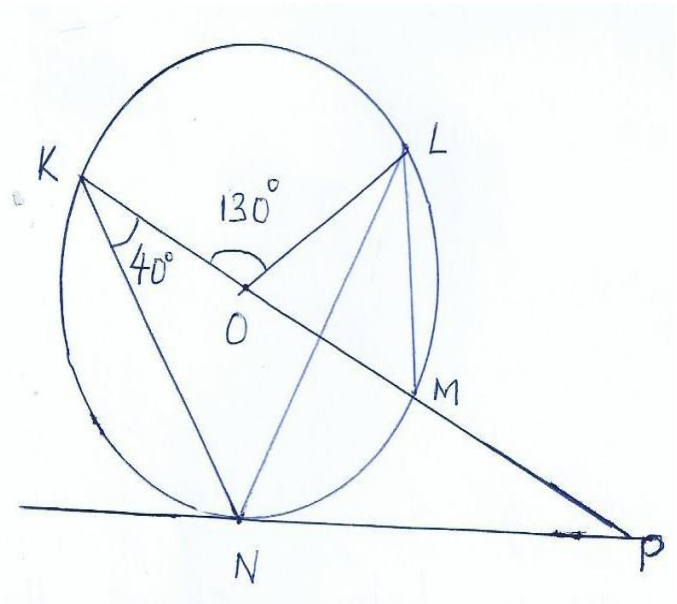
    ii) Lydia answered 18 questions correctly, 5 questions wrongly and the rest were not attempted. How many points did she get? (2mks)

14. Solve for ⍬given that $\sin^2 ⍬ = \frac{3}{2}$ ⍬⍬⍬⍬ $- 1 = 0$ for $0^0 \leq ⍬ \leq 360^0$ (3mks)

15. The graph below shows the variation between temperature and time for a cooling liquid. Determine the average rate of cooling between the second and tenth minutes (3mks)



16. In the figure below, K, L, M and N are points on the circumference of the circle, centre O. The points K, O, M and P are on a straight line. PN is a tangent to the circle at N. Angle KOL = 130^0 and angle MKN= 40^0



Find the value of the following angles

a) MLN (1 mk)

b) LNP (2mks)

SECTION II (50 Marks)

Answer Any Five questions from this section in the spaces provide

17. A dealer mixes three types of paints A, B and C in the ratio A:B = 3:5 and B:C = 1:3. The cost of each type of paint A, B and C are ksh.92, kshs.115 and kshs.138 respectively. The mixture is to contain 60 litres of paint C.

    a) Find the ratio A : B : C (2mks)

    b) Find the number of litres of paint B in the mixture (2mks)

    c) Find the cost per litre of the mixture (3mks)

d) Find the profit made if the mixture is sold at kshs.152.40 per litre (3mks)

18. The income tax rates of a certain year were as shown in the table below

Monthly Taxable income (kshs.)	% tax (kshs)
0 – 9680	10
9681 – 18800	15
18801 – 27920	20
27921 – 37040	25
Over 37040	30

That year, an employee's monthly earnings were as follows;-

Basic salary kshs. 28,600
House allowance ksh.15,000
Medical allowance kshs.3,200.
Transport allowance kshs.1,540
The employee was entitled to a monthly tax relief of kshs1056.

a) Calculate the employee's taxable income per month (2mks)

b) Calculate the employee's
   i) Gross tax per month (4mks)

ii) Net tax per month (2mks)

c) In addition to the net tax, the following deductions are made from the employee's gross income every month.
NHIF kshs.500
Education insurance scheme kshs.1200
WCPS 2% of her basic salary

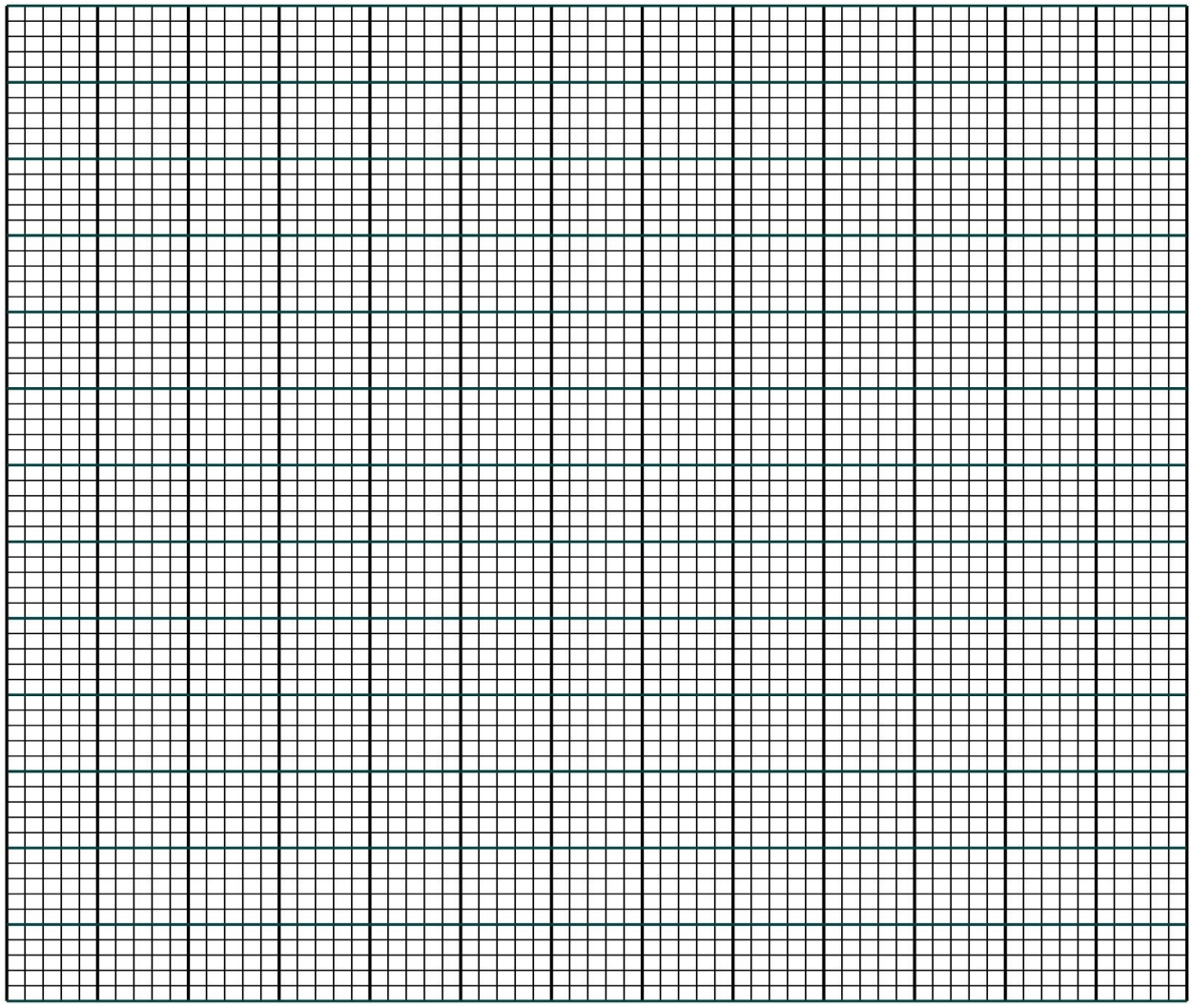
Calculate the employee's monthly earnings after all the deductions (2mks)

19. The table below shows value of x and some values of y for the function $y = x^3 – 2x^2 – 9x + 8$ for $-3 \leq \text{□} \leq 5$.

x	-3	-2	-1	0	1	2	3	4	5
$y=x^3- 2x^2 – 9x + 8$		10		8		-10			

a) Complete the table by filling the values of y (2mks)

b) On the grid below, draw a graph of $y = x^3 – 2x^2 – 9x + 8$ for $-3 \leq \text{□} \leq 5$ (3mks)
Use the scale; 1 cm represents 1 unit on x – axis
2 cm represents 10 units on y – axis



c) Use the graph to solve the equation

i) $x^3 - 2x^2 - 9x + 8 = 0$ (1mk)

ii) $x^3 - 2x^2 - 11x + 6 = 0$ (4mks)

20. a) The 5th term of an AP is 82 and the 12th term is 103.
Find

i) the first term and the common difference (4mks)

ii) the sum of the first 21 terms of the AP (2mks)

b) A farmer decides to save his money by making bank deposits every month. Each month's deposit is 10% more than the deposit of the previous month. The deposit for the 5th month was kshs.1,464.1
Determine

i) the deposit the farmer made in the 1st month (2mks)

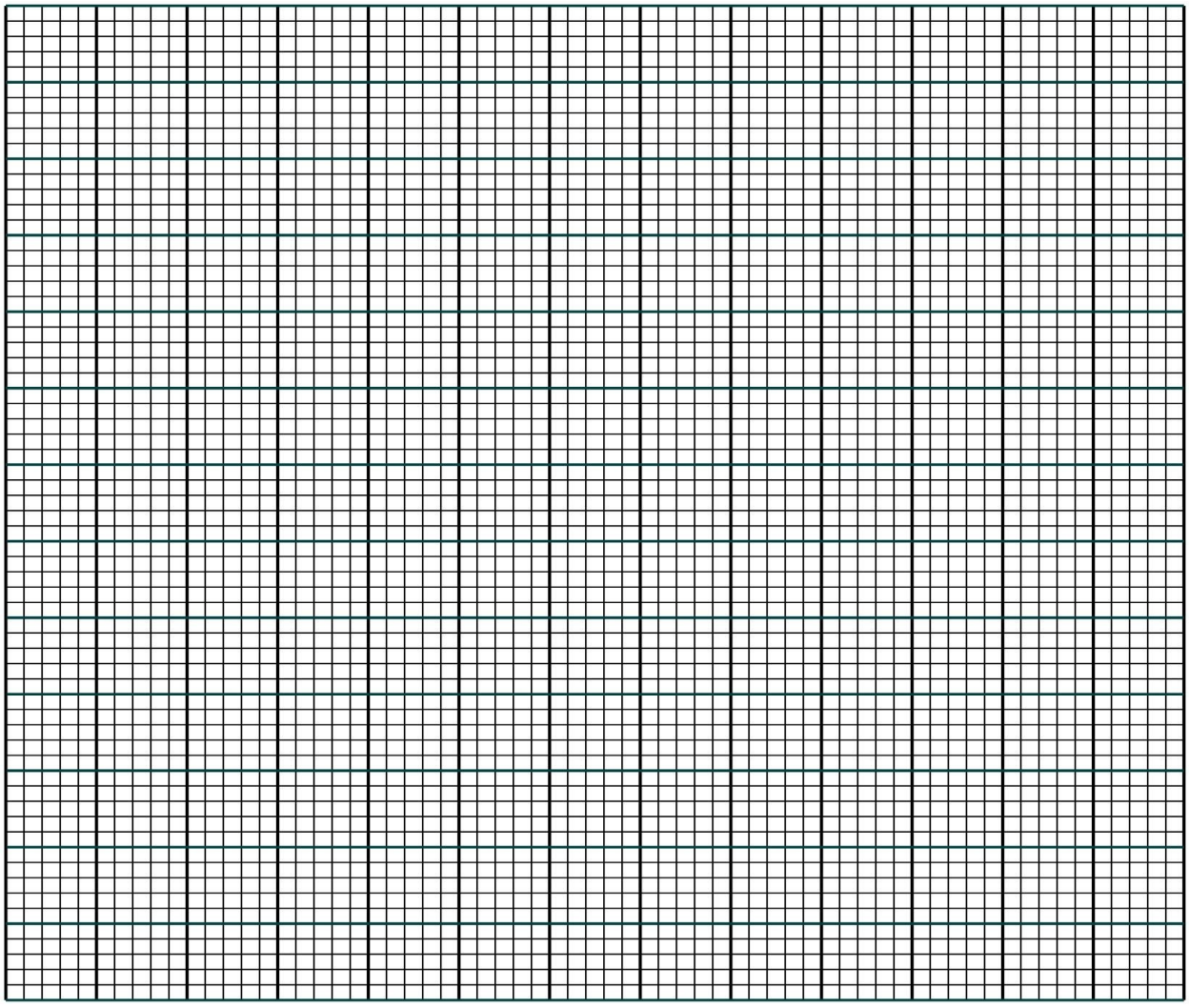
ii) the total amount of money in the bank after 1 year (answer to the nearest shilling) (2mks)

21. The marks scored by 40 students in the Geography exam were as shown in the table below.

Marks	42 -46	47 - 51	52 - 56	57 - 61	62 - 66	67 – 71
No of students	3	4	10	12	3	3
Cumulative frequency						

a) Complete the table by filling in the values of cumulative frequency (1mk)

b) On the grid provided, draw a cumulative frequency curve (ogive curve) to represent the data (3mks)



c) Determine from the curve

i) The medium mark (1mk)

ii) The pass mark of the exam if 21 students passed (2mks)

iii) The probability that a student picked at random from the class scored above 60 marks (3mks)

22. Points A (60°N, 07^{0}E) and B (60^{0}N, 53^{0}W) are on the surface of the earth.
A plane flew from A due west to B at an average speed of 180 knots

a) Determine

i) The distance covered by the plane (1mk)

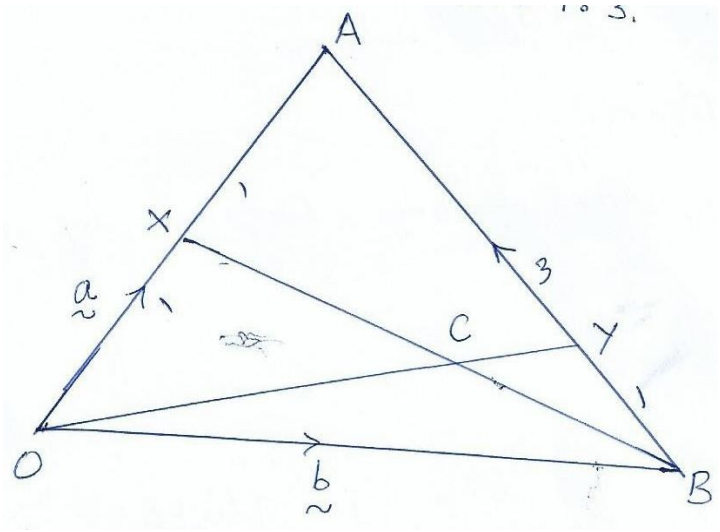
ii) The time of flight (2mks)

b) From B, the plane flew due south to point C a distance of 4260 nm from B

i) Find the position of point C (3mks)

ii) Find the arrival time at C (local time) given that the plane left A on Monday 0000 hrs local time and flew at the same speed for the entire journey. (4mks)

23. In the figure below OA = a, OB =**b** and BX meets oy at C. CX: OA = 1:2 and BY :YA = 1:3



a) Express in terms of **a** and **b**

i) **BA** (1mk)

ii) **OY** (2mks)

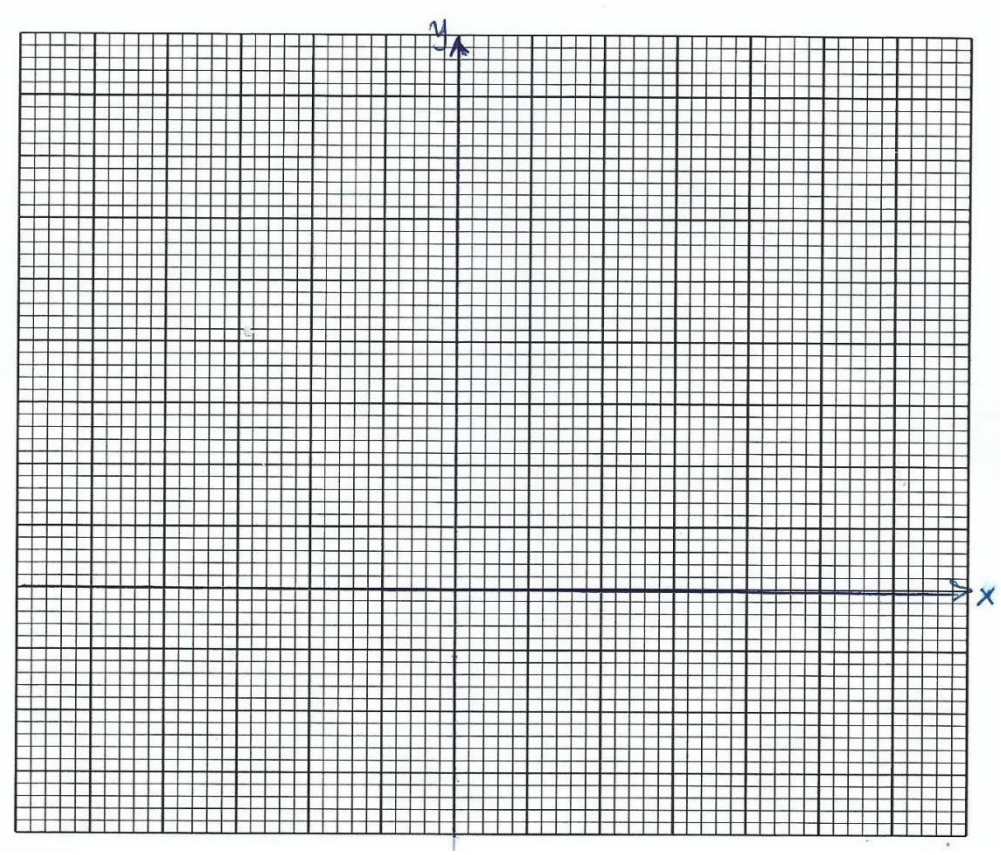
iii) **BX** (1mk)

b) Given that **OC** = h**OY** and **BC** = k**BX** . Determine the values of the scalars h and k (6mks)

24. A trapezium PQRS with vertices P QRS with vertices P (2,2), Q (6,2), R(6,4) and S(2,8) is mapped onto $P^1Q^1R^1S^1$ by a transformation matrix M = $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

a) Find the coordination of $P^1Q^1R^1S^1$ (2mks)

b) On the grid provided draw PQRS and its image $P^1Q^1R^1S^1$ (2mks)



c) i) On the same grid draw $P^{11}Q^{11}R^{II}S^{II}$ with vertices $P^{11}(1,-1)$, $Q^{II}(3, -1)$, $R^{II}(3, -2)$ and $S^{II}(1, -4)$ (1mk)

ii) Describe a matrix of transformation that maps $P^{1}Q^{I}R^{I}S^{I}$ onto $P^{II}Q^{II}R^{II}S^{II}$ (2mks)

iii) Determine the matrix of transformation that maps $P^{II}Q^{II}R^{II}S^{II}$ onto PQRS (3mks)

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SERIES 28
PAPER 1

SECTION I (50MKS)

1. A rally car travelled for 2 hours 40 minutes at an average speed of 120km/h. the car consumes an average of 1 litre of fuel for every 4 kilometers. A litre of fuel costs Ksh.59. Calculate the amount of money spent on fuel. (3mks)

2. One interior angle of a polygon is equal to 80^0 and each of the other interior angles are 128°. Find the number of sides of the polygon. (3mks)

3. (a) Using a pair of compasses and a ruler only construct a triangle ABC and such that AB= 4cm, BC =6cm and angle ABC=135°. (2mks)

   (b) Construct the height of triangle ABC in (a) above taking AB as the base, hence Calculate the area of triangle ABC. (2mks)

4. Solve the following inequalities and state the integral values (3mks)

$2x - 2 \leq 3x + 1 < x + 11$

5. Without using mathematical tables or calculators, **evaluate** $\sqrt{\frac{1408 \times 0.594 \times 0.012}{6.05 \times 125}}$ leaving your answer as a simplified fraction (3mks)

6. Two similar solids have surface areas $48cm^2$ and $108cm^2$ respectively. Find the volume of the smaller solid if the bigger one has a volume of $162cm^3$. (3mks)

7. A triangle flower garden has an area of $28m^2$. Two of its edges are 14 metres and 8 metres. Find the angle between the two edges. (3mks)

8. A watch which looses a half a minute every hour.It was set read the correct time at 0445hr on Monday. Determine in twelve hour system the time the watch will show on Friday at 1845hr the same week. (3mks)

9. Simplify the expression: $\frac{9t^2 - 25a^2}{6t^2 + 19at + 15a^2}$ (3mks)

10. Use reciprocal and cube root tables to evaluate (3mks)

$$\frac{5}{63.34} - \sqrt[3]{0.0169}$$

11. A Kenya company received US Dollars M. The money was converted into Kenya Shillings in a bank which buys and sells foreign currencies.

	Buying (in Ksh)	Selling (in (Ksh)
1 Sterling Pound	125.78	126.64
1 Us Dollar	75.66	75.86

(a) If the company received Ksh.15, 132,000, calculate the amount, M received in US Dollar. (2mks)

(b) The company exchanged the above Kenya shillings into Sterling pounds to buy a car in Britain. Calculate the cost of the car to the nearest Sterling pound (2mks)

12. A trader sold a dress for Ksh 7200 allowing a discount of 10% on the marked price. If the discount had not been allowed the trader would have made a profit of 25% on the sale of the suit. Calculate the price at which the trader bought the dress. (3mks)

13. Use logarithms tables to evaluate. (4mks)

$$\sqrt[3]{\frac{36.72\times(0.46)^2}{185.4}}$$

14. A certain two-digit number is equivalent to five times the sum of the digits. It is found to be 9 less than the number formed when the digits are interchanged. **Find** the number. (3mks)

15. A man standing 20m away from the foot of a vertical pole observes the top of the pole at an angle of elevation of 30^0. He begins to walk along a straight line on level ground towards the pole. **Calculate** how far he walked before the angle of elevation of the top of the pole becomes 80^0. (3mks)

16. Find the acute angle y if $\sin 4y = \cos 2y$ (2mks)

SECTION B (50MKS)

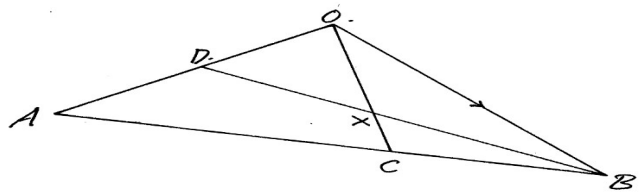
17. Mambo poured spirit into a test tube which has hemispherical bottom of inner radius 1.5cm. He noted that the spirit is 8cm high.

(a) What is the area of surface in contact with spirit? (4mks)

(b) Calculate volume of spirit in the test tube. (4mks)

(c) If Mambo obtained the mass of the spirit as 10g. Calculate the density of the spirit. (2mks)

18. The figure below C is a point on AB such that AC**:** CB=3:1 and D is the mid –point of OA. OC and BD intersect at X.



Given that **OA** = **a** and **OB** = **b**

(a) Write the vectors below in terms of **a** and **b**.

(i) **AB** (1mk)

(ii) **OC** (2mks)

(iii) **BD** (1mk)

(b) If **BX** = h **BD**, express **OX** in terms of **a**, **b**, and h. (1mk)

(c) If **OX** = K**OC**, find h and k. (4mks)

(d) Hence express **OX** in terms of **a** and **b** only. (1mk)

19. A straight line L_1 has a gradient $^{-}½$ and passes through point P (-1, 3). Another line L_2 passes through the points Q (1, -3) and R (4, 5). Find.

(a) The equation of L_1. (2mks)

(b) The gradient of L_2. (1mk)

(c) The equation of L_2. (2mks)

(d) The equation of a line passing through a point S (0, 5) and is perpendicular to L_2. (3mks)

(e) The equation of a line through R parallel to L_1. (2mks)

20. A certain number of people agreed to contribute to buy novels worth sh. 1200. Five of them pulled out and the others agreed to contribute an extra Sh. 10 each. Their contribution brought novels 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. (1mk)

b) Write down two expressions on how much each contributed after the five pulled out and reduced them to a single equation. (2mks)

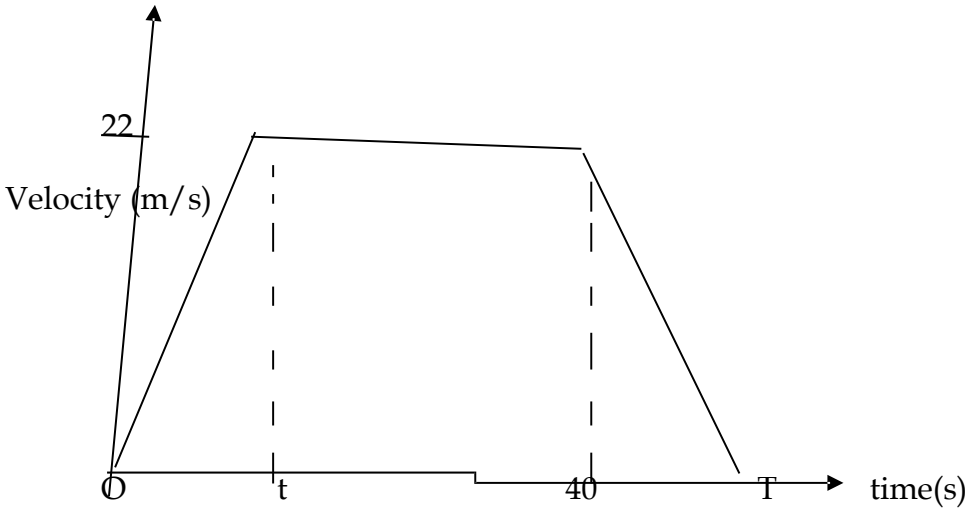
c) Calculate how many people made the contribution (5mks)

d) How much did each contribute? (2mks)

21. (a) In 2001 the total cost of manufacturing an article was Sh.1250 and this was divided between the cost of material, labour and transport in the ratio 8: 14: 3. In 2004 the cost of the material was doubled, labour cost increased by 30% and transport costs increased by 20%.
Calculate the cost of manufacturing the article in 2004. (6mks)

(b) For the same article in (a) above, the cost of manufacturing in 2005 was sh. 1981 as a result of increase in labour costs only. Find the percentage increase in labour cost of 2004. (4mks)

22. The figure below shows a velocity – time graph of a car journey.



The car starts from rest and accelerates at 2.75m/s^2 for t seconds until its speed is 22m/s. It then travels at this velocity until 40 seconds after starting. Its breaks bring it uniformly to rest. The total journey is 847m long and takes T seconds.

Calculate the

(i) Value of t (3mks)

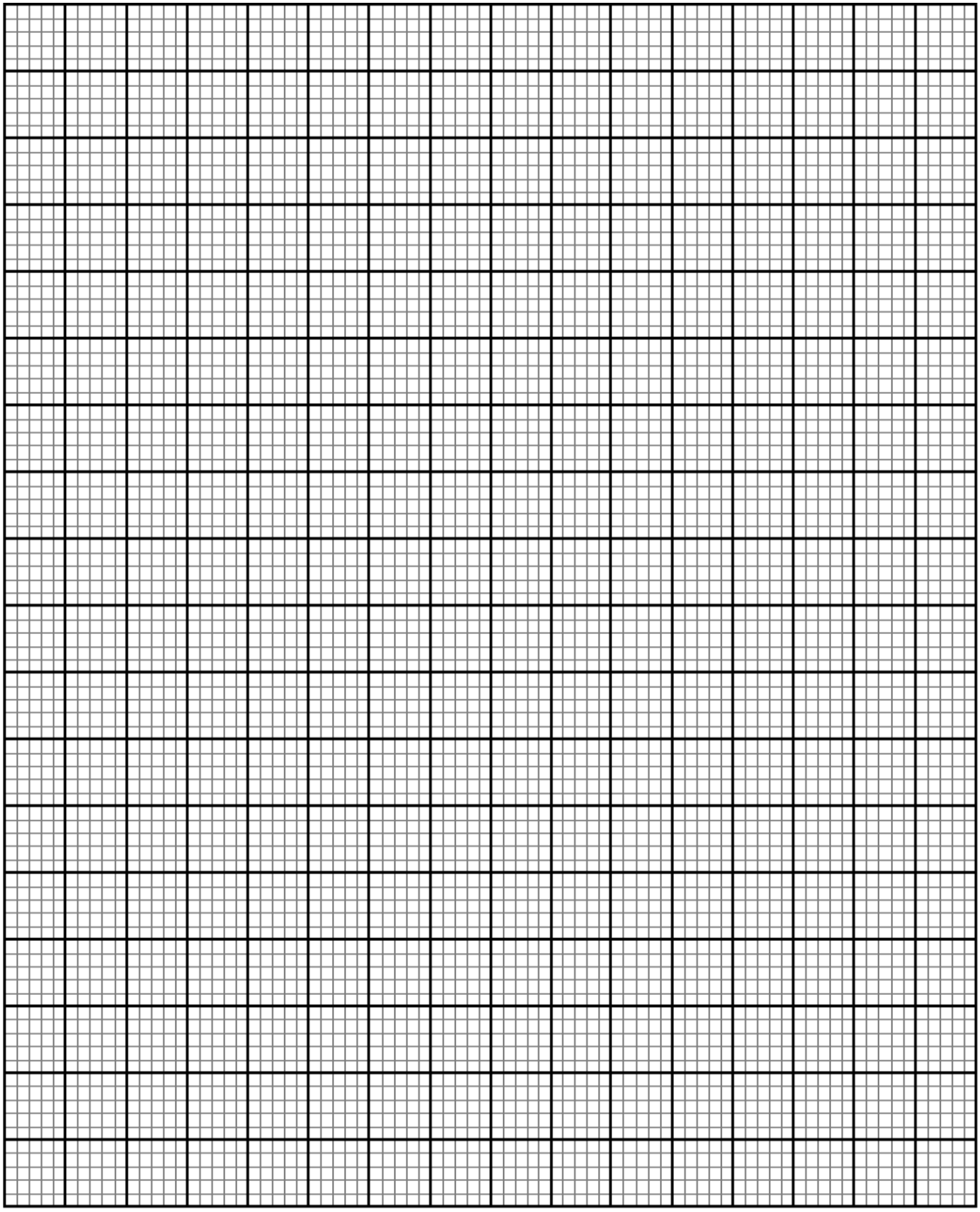
(ii) Distance travelled during the first t seconds (2mks)

(iii) Value of T (3mks)

(iv) Final deceleration (2mks)

23. A triangle with A(-4, 2), B(-6, 6) and C(-6, 2) is enlarged by a scale factor -1 and centre (-2, 6) to produce triangle $A^1B^1C^1$.

a) Draw triangle ABC and $A^1B^1C^1$.and state its coordinates (4mks)



b) Triangle $A^1B^1C^1$ is then reflected in the line y = x to give triangle $A^{11}B^{11}C^{11}$.draw $A^{11}B^{11}C^{11}$.and state its coordinates 3mks

c) If triangle $A^{11}B^{11}C^{11}$ is mapped onto $A^{111}B^{111}C^{111}$ whose co-ordinates are $A^{111}(0, -2)$, $B^{111}(4, -4)$ and $C^{111}(0, -4)$ by a rotation. Find the centre and angle of rotation. (3mks)

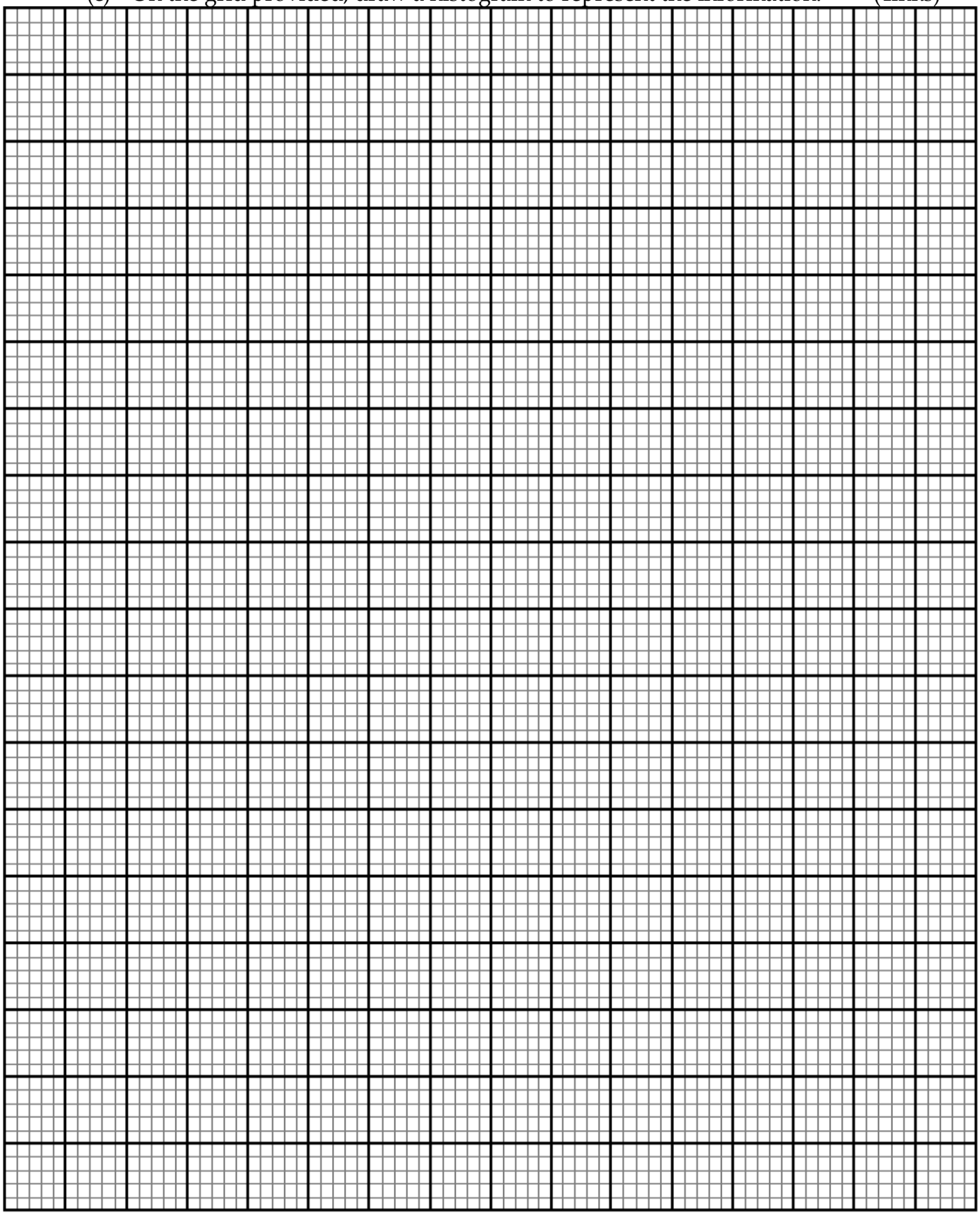
24. The following are masses of 25 people taken in a clinic.

20	35	29	45	60
66	56	29	48	37
59	64	24	28	32
35	45	48	52	55
54	55	36	39	35

(a) Using a class width of 8 and starting with the lowest mass of the people. Make a frequency distribution table for the data. (3mks)

(b) Calculate the median mass of the people. (3mks)

(c) On the grid provided, draw a histogram to represent the information. (4mks)



PAPER 2

SECTION I (50MKS)

1. Simplify by rationalising the denominator
$$\frac{\sqrt{2} + \sqrt{3}}{\sqrt{6} - \sqrt{3}}$$ (3mks)

2. Find the value of x in the equation $\log_{10}(2x-1) + \log_{10} 3 = \log_{10}(8x-1)$. (3mks)

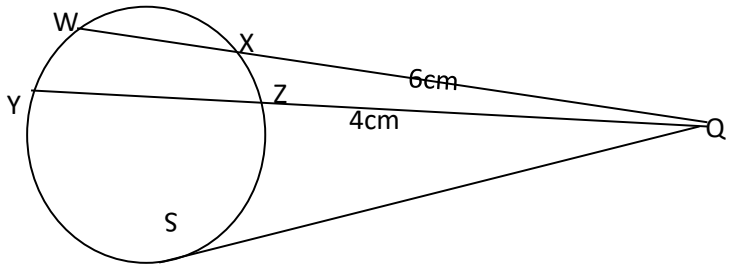
3. Find the compound interest on sh. 200,000 for 2 years at 14% pa. Compounded semi-annually. (3mks)

4. The ratio of 12th to 10th term in a geometric series is 9:1. Find the common ratio. (3mks)

5. i) Expand $(2 - \frac{1}{4}x)^5$ (2mks)

ii) Use your expansion to find the value of $(1.96)^5$ correct to 3 decimal places (2mks)

6. Chord WX and YZ intersect externally at Q. The secant WQ = 11cm and QX = 6cm while ZQ = 4cm.



(a) Calculate the length of chord YZ. (2mks)

(b) Using the answer in (a) above, find the length of the tangent SQ. (2mks)

7. Given that $\begin{bmatrix} y-1 & y+1 \\ 3y & y \end{bmatrix}$ is a singular matrix, find the possible values of y. (3mks)

8. The masses to the nearest kg of 50 adults were recorded as follows:

Mass (kg)	Frequency (f)
45 – 50	2
51 – 56	10
57 – 62	11
63 – 68	20
69 – 74	6
75 – 80	1

Calculate the quartile deviation. (3mks)

9. P varies as the cube of Q and inversely as the square root of R. If Q is increased by 20% and R decreased by 36%, find the percentage change in P. (3mks)

10. Solve $8\cos^2 x - 2\cos x - 1 = 0$ (3mks)

11. Make χ the subject of the formula:

$$A = \sqrt{\frac{3 + 2\chi}{5 - 4\chi}}$$ (3mks)

12. The position vectors of A and B are given as **a**= 2**i**-3**j**+4**k** and **b**= -2**i**-**j**+2**k** respectively. Find to 2decimal places, the length of the vector $\overrightarrow{AB}$. (3mks)

13. Find the centre and the radius of a circle whose equation is
$x^2-6x+y^2-10y+30=0$ (3mks)

14. A point (x, y) is mapped onto (13, 13) by two transformations M followed by T where
T = $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$ and x = $\begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$. Find the point (x y) (3mks)

15. Given that $2 \leq A \leq 4$ and $0.1 \leq B \leq 0.2$. Find the minimum value of $\frac{AB}{A - B}$

(3mks)

16. In a transformation, an object with area $9cm^2$ is mapped onto an image whose area is $54cm^2$. Given that the matrix of transformation is $\begin{bmatrix} x & x-1 \\ 2 & 4 \end{bmatrix}$ find the value of x

(3mks)

SECTION II (50MKS)

17. The table below shows the rates of taxation in a certain year.

Income in K£ pa	Rate in Ksh per K£
1 – 3900	2
3901 – 7800	3
7801 – 11700	4
11701 – 15600	5
15601 – 19500	7
Above 19500	9

In that period, Juma was earning a basic salary of sh. 21,000 per month. In addition, he was entitled to a house allowance of sh. 9000 p.m. and a personal relief of ksh.105 p.m He also has an insurance scheme for which he pays a monthly premium of sh. 2000. He is entitled to a relief on premium at 15% of the premium paid.

(a) Calculate how much income tax Juma paid per month. (7mks)

(b) Juma's other deductions per month were cooperative society contributions of sh. 2000 and a loan repayment of sh. 2500. Calculate his net salary per month. (3mks)

18. Wainaina has two dairy farm A and B. Farm A produces milk with 3 ½ percent fat and farm B produces milk with 4 ¾ percent fat. Determine;
    (a) The total mass of milk fat in 50kg of milk from farm A and 30kg from farm B. (3mks)

    (b) The percentage of fat in a mixture of 50kg of milk from A and 30kg of milk from farm B. (2mks)

    (c) Determine the range of values of mass of milk from farm B that must be used in a 50kg mixture so that the mixture may have at least 4 percent fat. (5mks)

19. A cupboard has 7 white cups and 5 brown ones all identical in size and shape. There was a blackout in the town and Mrs. Kamau had to select three cups, one after the other without replacing the previous one.

(a) Draw a tree diagram for the information. (2mks)

(b) Calculate the probability that she chooses.

(i) Two white cups and one brown cup. (2mks)

(ii) Two brown cups and one white cup. (2mks)

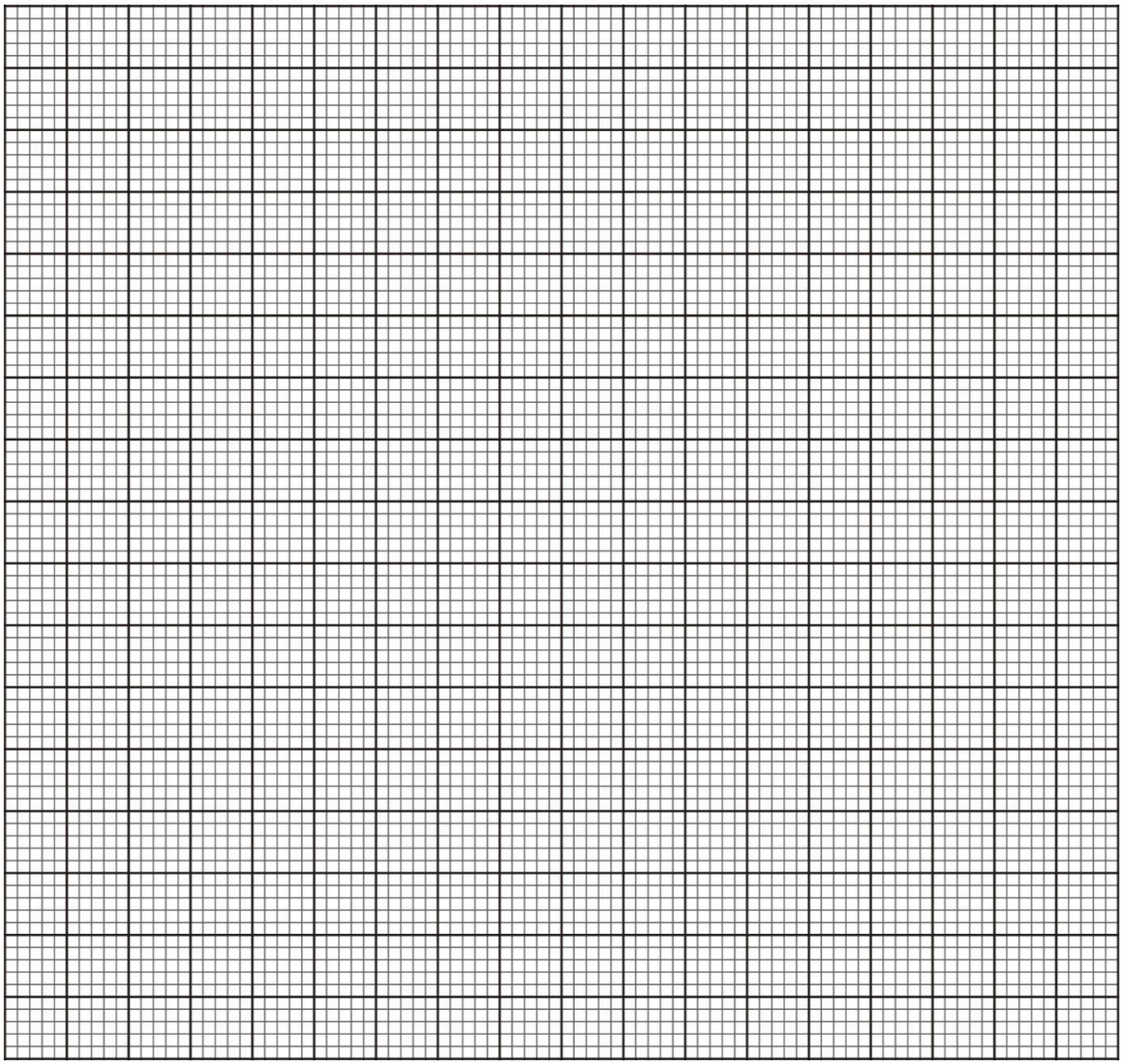
(iii) At least one white cup. (2mks)

(iv) Three cups of the same colour. (2mks)

20. (i) complete the table below, giving the values correct to 2 decimal places (2mks)

X^0	0^0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0	135^0	150^0	165^0	180^0
Cos $2X^0$	**1.00**	**0.87**		**0.00**	**-0.5**		**-1.00**		**-0.5**	**0.00**	**0.50**	**0.87**	**1.00**
Sin (X^0+30^0)	**0.50**	**0.71**	**0.87**	**0.97**	**1.00**		**0.87**	**0.71**	**0.50**		**0.00**		**-0.50**

(ii) Using the grid provided draw on the same axes the graph of $y=\cos 2X^0$ and $y=\sin(X^0+30^0)$ for $0^0 \leq X \leq 180^0$. (4mks)



(iii) Find the period of the curve $y=\cos 2x^0$ (1mk)

(iv) Using the graph, estimate the solutions to the equations;

(a) $\sin(X^0+30^0)=\cos 2X^0$ (1mk)

(b) $\text{Cos } 2X^0=0.5$ (1mk)

21. The For a sample of 100 bulbs, the time taken for each bulb to burn was recorded. The table below shows the result of the measurements.

Time(in hours)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74
Number of bulbs	6	10	9	5	7	11	15	13	8	7	5	4

(a) Using an assumed mean of 42, calculate

(i) the actual mean of distribution (4mks)

(ii) the standard deviation of the distribution (3mks)

(b) Calculate the quartile deviation (3mks)

22. (a) Using a ruler and a pair of compasses only, construct a parallelogram ABCD such that AB=9 cm, AD=7 cm and angle BAD=60°. (3mks)

(b) On the same diagram, construct:

(i) The locus of a point P such that P is equidistant from AB and AD; (1mk)

(ii) The locus of a point Q such that Q is equidistant from B and C; (1mk)

(iii) The locus of a point T such that T is equidistant from AB and DC; (1mk).

(c) (i) Shade the region R bounded by the locus of P, the locus of Q and the locus of T. (1mk)

(ii) Find the area of the region shaded in (d)(i) above. (3mks)

23. The points A (1,4), B(-2,0) and C (4,-2) of a triangle are mapped onto $A^1(7,4)$, $B^1(x,y)$ and C^1 (10,16) by a transformation N = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$. Find

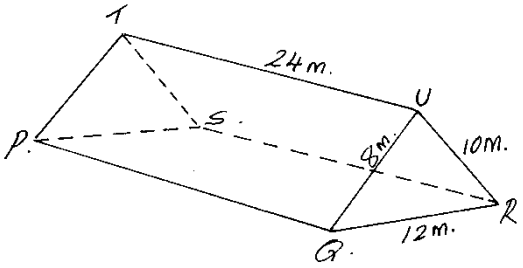
(i) Matrix N of the transformation (4mks)

(ii) Coordinates of B^1 (2mks)

(iii) $A^{II}B^{II}C^{II}$ are the image of $A^1B^1C^1$ under transformation represented by matrix M = $\begin{pmatrix} 2 & -1 \\ 0 & 0 \end{pmatrix}$ Write down the co-ordinates of $A^{II}B^{II}C^{II}$ (2mks)

(vi) A transformation N followed by M can be represented by a single transformation K. Determine K (2mks)

24. The roof of a ware house is in the shape of a triangular prism as shown below



Calculate

(a) The angle between faces RSTU and PQRS (3mks)

(b) The space occupied by the roof (3mks)

(c) The angle between the plane QTR and PQRS (4mks)

SECTION I (50 Marks)

Answer all questions in the spaces provided in this section.

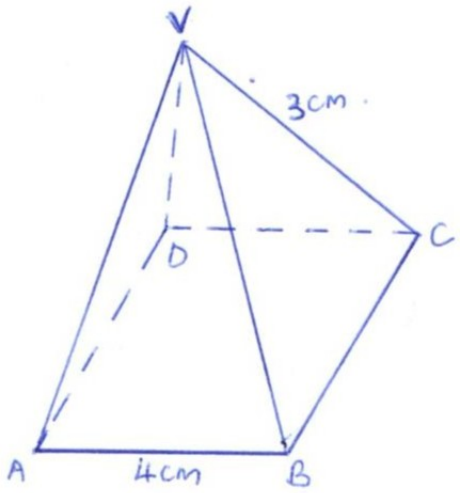
1. Evaluate without using a calculator; (3 marks)

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

2. Solve for $x$in the equation $125^{-x}\times 5^{2(x-2)}=25^{(x+2)}$ (3 marks)

3. A cylindrical tank of diameter 1.4 m and height 1.2 m is two – thirds full of water. The tank if filled using a cylindrical bucket of diameter 35 cm and diameter 20 cm. Find the number of buckets required to fill the tank. (3 marks)

4. The figure below shows a right pyramid with a square base of side 4 cm and a slant height of 3 cm. Draw the net of the pyramid. (3 marks)



5. A square room is covered by a number of whole rectangular slabs of sides 60 cm by 42 cm. calculate the least possible area of the room in square metres. (3 marks)

6. The distance from **A** to **B** is d km and that from **B** to **C** is x km. if a bus maintains an average speed of 50 km/h between **A** and **B** and 60 km/h between **B** and **C**, it takes 3 hours to travel from **A** to **C**. If it maintains 60 km/h between **A** and **B** and 50 km/h between **B** and **C**, the journey takes 8 minutes less. What is the distance from **A** to **C** via **B**? (4 marks)

7. (a) Using a ruler and a compass only, construct triangle ABC in which BC = 8 cm, angle ABC = 30° and angle ACB = 45° . (2 marks)

(b) At A drop a perpendicular to meet BC at D and measure AD. (2 marks)

8. The position vectors of A and B are $\begin{pmatrix}2\\5\end{pmatrix}$ and $\begin{pmatrix}8\\-7\end{pmatrix}$ respectively. Find the magnitude of the vector $\overrightarrow{AB}$ (3 marks)

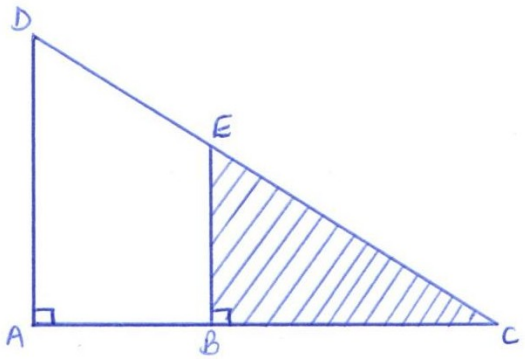
9. A man sets off by bus on a journey of 130 km. after the bus has travelled 119 km at an average speed of $42\ km/hr$, it breaks down and he is immediately given a lift by a passing cyclist who takes him to his destination at average speed of 66 km/h.

   Calculate;

   a) The time taken for the whole journey. (2 marks)

   b) His average speed for the whole journey. (2 marks)

10. Find the area of the shaded region in the figure below given that AD = 15 cm, BE = 3 cm, AB = 3 cm, $\angle DAB = \angle EBC = 90°$. (3 marks)



11. Write the expression below in surd form and rationalize the denominator. (3 marks)

$$\frac{1 - \cos 60°}{1 + \tan 30°}$$

12. Solve the equations below using matrix method. (3 marks)

$x + y = 8$

$2y - 3x = 1$

13. Expand and simplify $(1-4x)^6$ up to the expansion of the term in x^3. (3 marks)

14. Use reciprocals tables to evaluate $\frac{10}{0.625}+\frac{4}{1.5}$ (3 marks)

15. At the end of his stay in Kenya, a French tourist had 3 420 French francs which he decided to change into Euros. Given the exchange rate was;

    1 French franc = Ksh. 11.25

    1 Euro = Ksh. 72.50

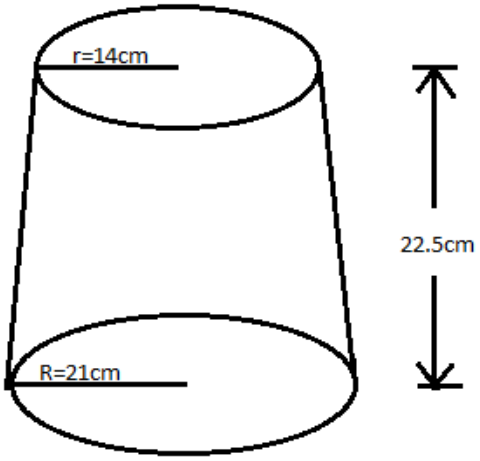
    Calculate the number of Euros he received if the bank charged him 2% commission. (3 marks)

16. A number ***m*** is such that if its reciprocal is added to three times itself the result is 4. Form an equation in ***m*** and solve it. (3 marks)

SECTION II (50 Marks)

Answer ONLY FIVE questions in the spaces provided.

17. The diagram represents a solid frustum with base radius 21cm and top radius 14cm. The frustum is 22.5cm high and is made of a metal whose density is 3 g/cm^3. (Take $\pi = \frac{22}{7}$)



a) Calculate

(i) The volume of the metal in the frustum. (5 marks)

(ii) The mass of the frustum in kg. (2 marks)

b) The frustum is melted down and recast into a solid cube. In the process 20% of the metal is lost. Calculate to 2 decimal places the length of each side of the cube. (3 marks)

18. A line L_1 passes through the points $(-2, 3)$ and $(-1, 6)$ and is perpendicular to L_2 at $(-1, 6)$.

a) Find the equation of L_1. (2 marks)

b) Find the equation of L_2 in the form $ax + by - c = 0$ where a, b and c are constants. (2 marks)

c) Given that another line L_3 is parallel to L_1 and passes through point $(1,2)$, find the x and y intercepts of L_3. (3 marks)

d) Find the point of intersection of L_2 and L_3. (3 marks)

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

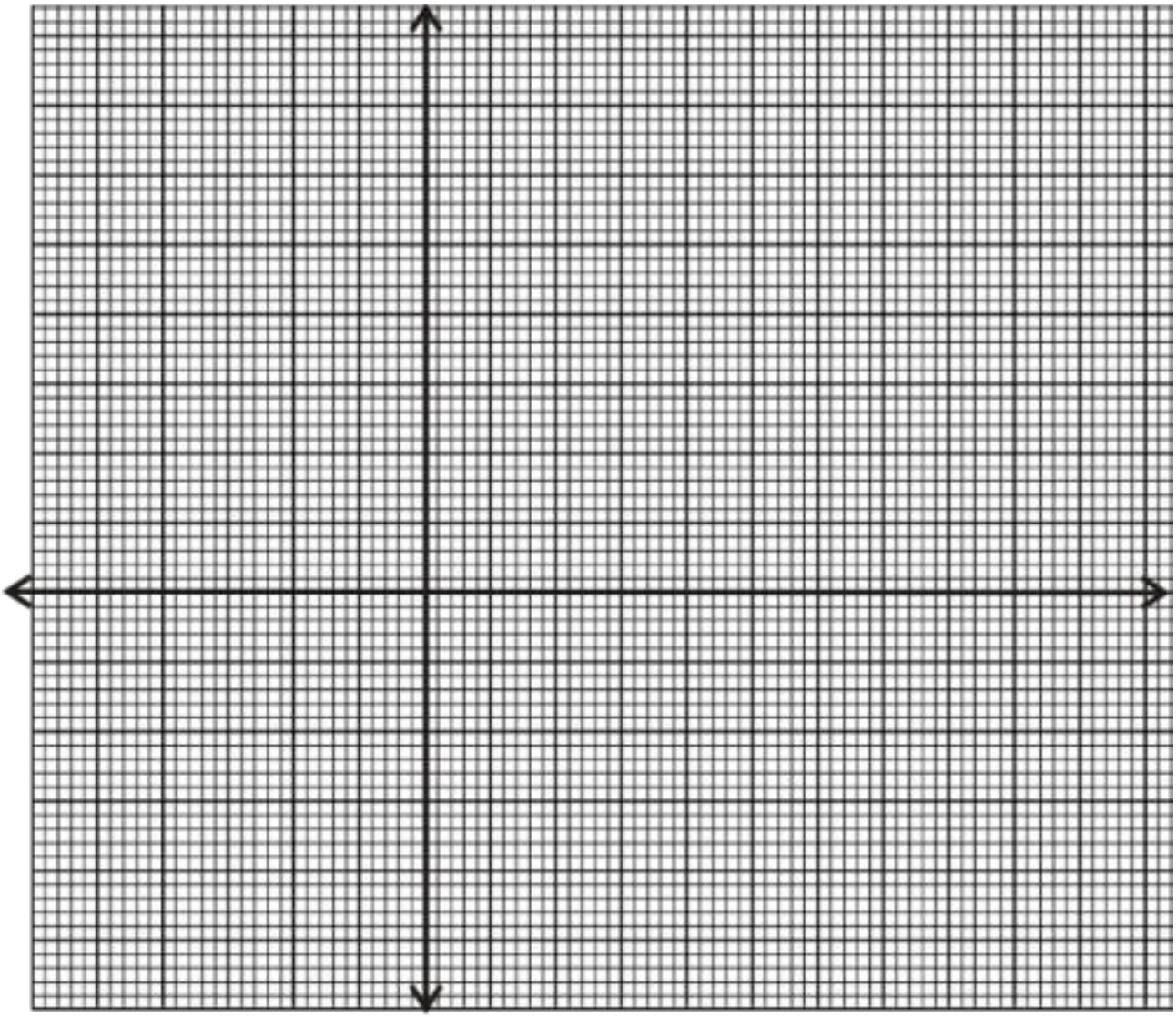
x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
y	38		21		10		5		6		13		26		45		70

b. Use the completed table and mid ordinate rule to estimate the area bounded by the curve, the $x-$ axis and the lines $x = -3$ and $x = 5$ (3 marks)

c. Use calculus to calculate the actual area in part b above. (3 marks)

d. Calculate to 3 significant figure the percentage error when mid ordinate rule is used to estimate the area. (2 marks)

20. On the grid provided, draw the square whose vertices are
$A(6,-2), B\ (7,-2), C\ (7,-1)\ and\ D\ (6,-1)$.



(b) On the same grid, draw:

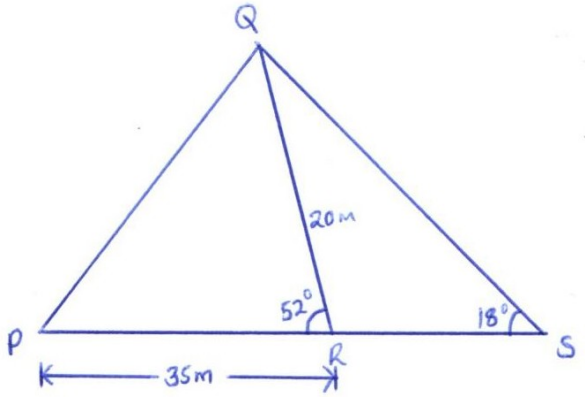
(i) $A'B'C'D'$ the image of ABCD, under an enlargement scale factor 3 centre $(9,-4)$ (3 marks)

(ii) $A''B''C''D''$ the image of $A'B'C'D'$ under a reflection in the line $x = 0$ (2 marks)

(iii)$A'''B'''C'''D'''$ the image of $A''B''C''D''$ under a rotation of $+90°$ about (0,0).(2 marks)

(c) Describe a single transformation that maps $A'B'C'D'$ onto $A'''B'''C'''D'''$. (2 marks)

21. The figure below represent two neighboring plots with QR as their common boundary.



Find to 2 decimal places,

i. The length of boundary PQ. (3 marks)

ii. The length of boundary RS. (3 marks)

iii. The angle RQS. (1 mark)

iv. Area of triangle QRS. (3 marks)

22. The velocity $V\ m/s$ of a particle projected into space is given by the formula $V = 5t^2 - 2t + 9$ where t is the time in seconds elapsed since projection. Determine;

a. The acceleration of the particle when $t = 4$ seconds. (3 marks)

b. The value of t which minimizes the acceleration. (2 marks)

c. The velocity of the particle when acceleration is minimum. (2 marks)

d. The total distance covered by the particle between $t = 1$ to $t = 4$ seconds. (3 marks)

23. (a) The ratio of Juma's and Akinyi's earnings was 5: 3. Juma's earnings rose to Ksh 8 400 after an increase of 12%. Calculate the percentage increase in Akinyi's earnings given that the sum of their earnings was Ksh. 14 100 (6 marks)

(b) Juma and Akinyi contributed all the new earnings to buy maize at Ksh 1 175 per bag. The maize was then sold at ksh 1 762.50 per bag. The two shared all the money from the sales of the maize in the ratio of their contributions. Calculate the amount that Akinyi got. (4 marks)

24. The equation of a curve is given by $y = x^3 + 4x^2 - 3x$.

a) Find the value of y when $x = 1$ (1 mark)

b) Determine the stationary points of the curve. (5 marks)

c) Find the equation of the normal to the curve at $x = 1$. (4 marks)

Grand Total

SECTION I (50 Marks)

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

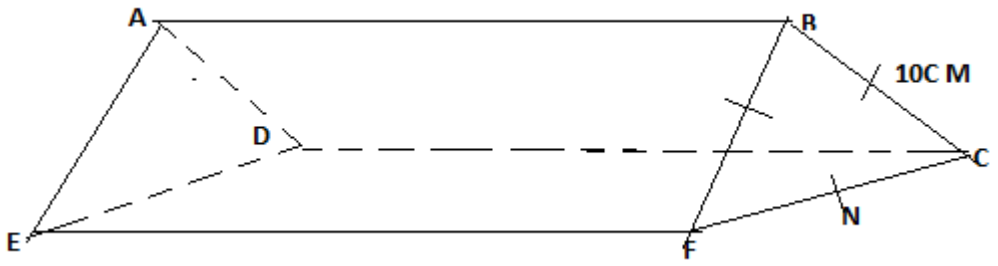
1. Solve for x in the equation (2 marks)

$$log\ (5x - 15) - log(2x - 3)\ = 1$$

2. Given that z varies directly as the square of x and inversely as the square root of y. If $x = 2$, $y = 9$ when $z = 3$, find z when $x = 3$ and $y = 4$. (3 marks)

3. Calculate the exact value of compound interest earned on Sh. 20 000 for $1\frac{1}{2}$ years at the rate of 12% p.a, compounded half yearly. (3 marks)

4. The triangular prism shown below has the sides AB =DC =EF = 12 cm. The ends are equilateral triangles of sides 1ocm. The point N is the midpoint of FC (3Marks)

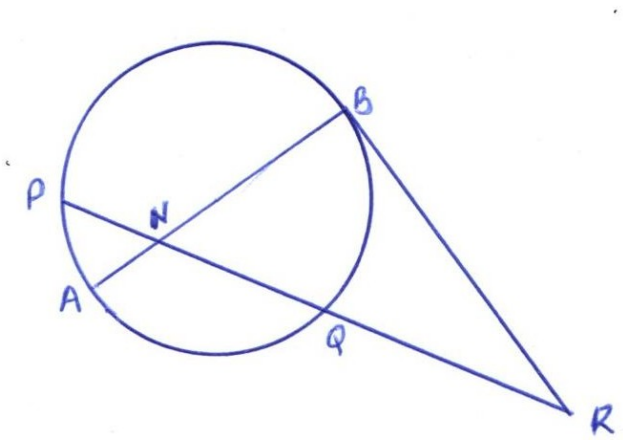


a) Find the length of BN (1 mark)

b) Find the angle between the line EB and the plane CDEF (2 marks)

5. Evaluate $\frac{1+\sqrt{5}}{2+\sqrt{5}}+\frac{1-\sqrt{5}}{2-\sqrt{5}}$ (3 marks)

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



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

a) NR (2 marks)

b) AN (2 marks)

7. Solve the quadratic equation by completing the square method. (3 marks)

$2x^2 - 5x = -3$

8. Mogutu and Onacha working together can do a piece of work in 6days. Mogutu working alone takes 5days longer than Onacha. How many days does it take Onacha to do the work alone? (3 marks)

9. In an experiment, water was heated and its temperature changes recorded at intervals of 2 minutes as shown in the table below.

Time (Min)	0	2	4	6	8	10	12	14	16
Temperature (℃)	25	35	42.5	50	60	67.5	77.5	85	92.5

a) On the grid provided, plot the points and draw the line of best fit. (3 marks)

b) Use the line of best fit to estimate the time taken for the temperature of the water to be 75℃. (1 mark)

10. State the amplitude and the phase angle of the curve $4y = \cos(5x - 40^{0})$ (2 marks)

11. Calculate the semi-interquartile range of 3,4,1,2,3,6,8,5,7,9. (3 marks)

12. Points A and B lie on latitude $15°$N andtheir longitudes differ by $25°$. An aircraft takes 8 hours to fly between the points. Calculate its speed in knots. (3 marks)

13. Given the points P(-6,-3) , Q(-2,-1) and R(6,3) express Vectors $\overrightarrow{PQ}$ and $\overrightarrow{QR}$ as column vectors and hence show that the points P,Q and R are collinear (4 marks)

14. During inter-school competitions, rugby and football teams from Ranje sec school took part. The probability that the rugby would win their first match was $\frac{1}{8}$ while that the handball team could lose was $\frac{4}{7}$. Find the probability that at least one team won the first match. (3 marks)

15. The original area of an object after two successive transformations given by $\begin{bmatrix} 2 & 1 \\ 3 & 5 \end{bmatrix}$ and $\begin{bmatrix} 3 & 1 \\ 0 & 1 \end{bmatrix}$ in that order becomes 168 square units. Find the original area of the object. (3 marks)

16. Evaluate $\int_{-1}^{3}(3x+1)(2x-2)$ (4 marks)

SECTION II (50 Marks)
Answer ONLY FIVE questions in this section

17. An arithmetic progression of 41 terms is such that the sum of the first five terms is 560 and the sum of the last five terms is -250. Find:

a) The first term and the common difference (5 marks)

b) The last term (2 marks)

c) The sum of the progression (3 marks)

18. A pavement is of length $(x-1)m$ and width $(x-8)m$. The area of the pavement is $4.56\ m^2$.

a) (i) Write a quadratic equation for the area of the pavement in the form $ax^2+bx+c=0$ where a, b and c are constants. (2 marks)

(ii) Using the method of completing square, find the actual length and width of the pavement. (6 marks)

b) The pavement is covered with rectangular tiles measuring 0.4 m by 0.3 m. determine the number of tiles used to cover the pavement completely. (2 marks)

19. The table below shows the masses measured to the nearest Kg of 200 people.

Mass kg	40-49	50-59	60-69	70-79	80-89	90-99	100-109
No of people	9	27	70	50	26	12	6

a) Draw a cumulative frequency curve for the data above. (4 marks)

b) Use your graph to estimate

i. The median mass. (1 mark)

ii. The number of people whose mass lies between 70.5 kg and 75.5 kg (1 mark)

c) From your graph find

i. The lower quartile (1 mark)

ii. the upper quartile (1 mark)

iii. the interquartile range (2 marks)

20. 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)

21. Given that $y = 2\sin 2x$ and $y = 3\cos(x + 45°)$;

a) Complete the table below

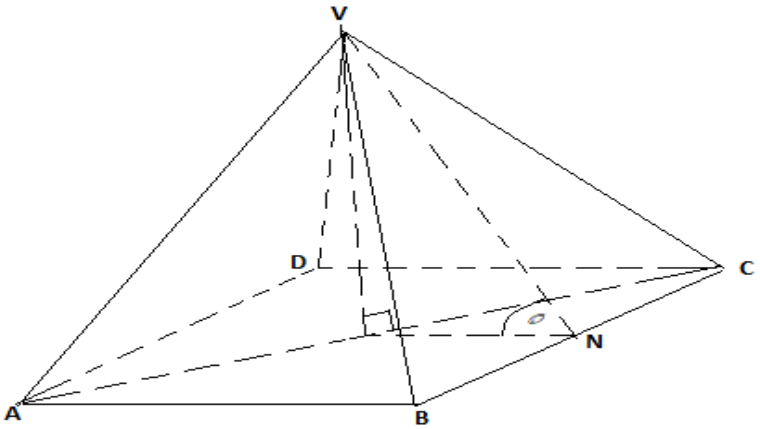
$x°$	0	20	40	60	80	100	120	140	160	180
$2\sin 2x°$	0.00		1.97		1.68	-0.68	-1.73		-1.28	0.00
$3\cos(x + 45°)$	2.12	1.27		-0.78		-2.46			-2.72	-2.12

b) Use the data to draw the graphs of $y = 2\sin 2x°$ and $y = 3\cos(x + 45°)$ for $0° \leq x \leq 180°$ on the same axes. (3 marks)

c) State the amplitude and period of each curve. (2 marks)

d) Use the graph to solve the equation $2\sin 2x - 2\cos(x + 45°) = 0$ for $0° \leq x \leq 180°$. (2 marks)

22. The figure below shows a right pyramid standing on a rectangular base ABCD. AB = 8cm, BC = 15cm and each slant edge is 12 cm long M is the midpoint of BC.



Calculate to one decimal place

a) the vertical height of the pyramid (3 marks)

b) the volume of the pyramid (2 marks)

c) the angle between plane VBC and the base (3 marks)

d) the angle between line VA and the plane ABCD (2 marks)

23. Income rates for income earned were charged as follows.

Income in sh. per month	Rate in Ksh. per sh.20
1 – 8, 400	2
8401 – 18, 000	3
18001 – 30, 000	4
30, 001 – 36, 000	5
36, 001 – 48, 000	6
48, 001 and above	7

A civil servant earns a monthly salary of ksh.19, 200. His house allowance is ksh.12, 000 per month. Other allowances per month are transport ksh.13, 000 and medical allowance ksh.2, 300. He is entitled to a family relief of ksh.1, 240 per month. Determine

(a) (i) His taxable income per month (2 marks)

(ii) Net tax (5 marks)

(b) In addition, the following deductions were made.

NHIF sh.230

Service charge ksh.100

Loan repayment ksh.4, 000

Cooperative shares of ksh.1, 200

Calculate his net salary per month (3 marks)

24. Radon Company has two types of machines A and B for juice production. Type A machine can produce 800 litres per day while type B machine can produce 1 600 litres per day. Type A machine needs four operators and type B need seven operators. At least 8 000 litres must be produced daily and the total number of operators should not exceed 41. There should be two or more machine of each type.
Let x be the number of machines of type A and y for type B.
a) Form all inequalities in x and y to represent the above information. (4 marks)

b) In the grid provided below, draw the inequalities and shade the unwanted region. (4 marks)

c) Use the graph in (b) above to determine the least number of operators required for maximum possible production. (2 marks)

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SERIES 30
PAPER 1

SECTION A (50 MARKS)

1. Evaluate $\dfrac{\frac{3}{4}+1\frac{5}{7}\div\frac{4}{7}of\,2\frac{1}{3}}{\left(1\frac{3}{7}-\frac{5}{8}\right)x\frac{2}{3}}$ (3mks)

2. A fruit juice dealer sell the juice in packet of 300ml, 500ml and 750ml. find the size of the smallest container that can fill each of the packets and leave a remainder of 200ml. (3mks)

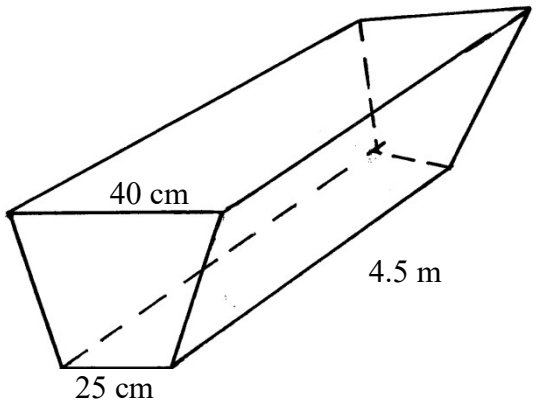
3. Without using table or calculators, evaluate $\sqrt{\dfrac{0.0032+0.0608}{1.44x0.4}}$ (3mks)

4. Simplify the following quadratic expression. $\dfrac{8b^2-50a}{(2b+5a)^2}$ (3mks)

5. In a fundraising committee of 45 people, the ratio of men to women is 7:2. Find the number of women required to join the existing committee so that the ratio of men to women is changed to 5: 4. (3mks)

6. A student expanded $(x+y)^2$ incorrectly as x^2+y^2 calculate the percentage error in the answer if x = 4 and y = 6 (3mks)

7. The figure below shows a trough which is 40 cm wide at the top and 25 cm wide at the bottom. The trough is 20cm deep and 4.5 m long. Calculate the capacity of the trough in litres. (3mks)

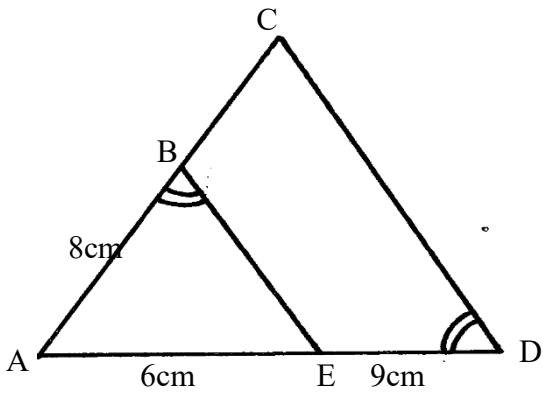


8. Jemima's team entered a contest where teams of students compete by answering questions that earn either 3 points of 5 points. Jemima's team scored 44 points after answering 12 questions correctly. How many five-points questions did the team answer correctly. (3mks)

9. Using compass and ruler only construct a triangle ABC such that AB= 6cm ,BC = 5cm and angle ABC = 67.5º measure the length of AC. (3mks)

10. Use table of reciprocals only to work out : $\frac{13}{0.156} - \frac{3}{0.6735}$ (3mks)

11. In the figure below, angle ABE is equal to angle ADC AE = 6cm, ED = 9cm and AB = 8cm, calculate the length of BC. (3mks)



12. Simplify the expression below leaving your answer in rationalized surd form of $a + b\sqrt{c}$

$$\frac{1+\tan 120^{o}}{1+Cos\ 330^{o}}$$

(4mks)

13. The two sides of a triangle are given 6 cm and 5 cm. the angle between them is 130°. calculate the area of the triangle (giving your answer to 2 decimal places) (3mks)

14. Given that $K\underset{\sim}{m} + h\underset{\sim}{n} = \underset{\sim}{r}$ and that $\underset{\sim}{m} = \begin{pmatrix}-3\\-2\end{pmatrix}$ $\underset{\sim}{n} = \begin{pmatrix}0\\4\end{pmatrix}$ and $\underset{\sim}{r} = \begin{pmatrix}-6\\0\end{pmatrix}$. Find the scalars k and h (3mks)

15. A Kenyan bank buys and sells foreign currencies as shown.

	Buying (Kshs.)	Selling (Kshs.)
1 Euro	84.15	84.26
100 Japanese Yen	65.37	65.45

A Japanese travelling from France to Kenya had 5000 Euros. He converted all the 5000 Euros to Kenya shillings at the bank. While in Kenya, he spent a total of Kshs. 289,850 and then converted the remaining Kenya shilling to Japanese Yen. Calculate the amount in Japanese Yen that he received. (3mks)

16. The length of a rectangular mat is 1.5 m longer that its width, Find the length of the mat if its area is 6.5 m^2(give your answer to 4 significant figures) (3mks)

SECTION II

Answer only five questions from this section

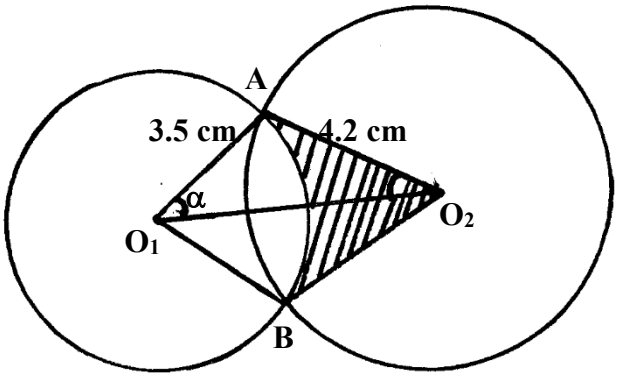
17. Five towns V,W,X,Y and Z are situated such that W is 200km east of V. X is 300km from W on a bearing of 150º. Y is 350km on a bearing of 240º from X. Z is 150º from V but 200º from X. Draw the diagram representing the position of the towns. (use a scale of 1cm to represent 50km) . (5mks)

(b) From the diagram determine
(i) the distance in km of V from Z (1mk)

(ii) The bearing of Y from W (1mk)

(c) A plane heading to town X takes off from town Y and flies upwards at a constant angle which is less than 90°. After flying a distance of 350km in the air it sees town X at an angle of depression of 50°. Calculate the distance of the plane from X at this point to the nearest km. (3mks)

18. Two circles of radii 3.5 and 4.2 cm with centres O_1 and O_2 respectively intersect at points A and B as shown in the figure below. The distance between the two centres is 6 cm.



Calculate

(a) The size of $\angle AO_1B$ (to the nearest degree) (3mks)

(b) The size of $\angle$ A O_2 B (to the nearest degree) (3mks)

(c) The area of quadrilateral O_1AO_2B, correct to 2 decimal places. (2mks)

(d) The shaded area correct to 2 significant figures. (take $\pi\ ^{22}/_{7}$) (2mks)

19 (a) Complete the table below for the function y = 2 x ^{2} + 4 X -3

X	-4	-3	-2	-1	0	1	2
$2x^2$	32		8	2	0	2	
4x-3			-11		-3		
Y			-3			3	13

(b) Draw the graph of the function $y = 2x^2 + 4x - 3$ on the grid provided. (3mks)

(c) Use your graph to estimate the roots of the equation $2x^2 + 4x - 3 = 0$ (1mk)

(d) Use your graph to obtain the roots of the equation $2x^2 + x - 5 = 0$ to 1 decimal place. (3mks)

(e) Draw the line of symmetry to pass through the turning point of this curve. (1mk)

20. The table below shows patients who attend a clinic in one week and were grouped by age as shown in the table below.

Age x years	$0 \leq x < 5$	$5 \leq x < 15$	$15 \leq x < 25$	$25 \leq x < 45$	$45 \leq x < 75$
Number of patients	14	41	59	70	15

(a) Estimate the mean age (4mks)

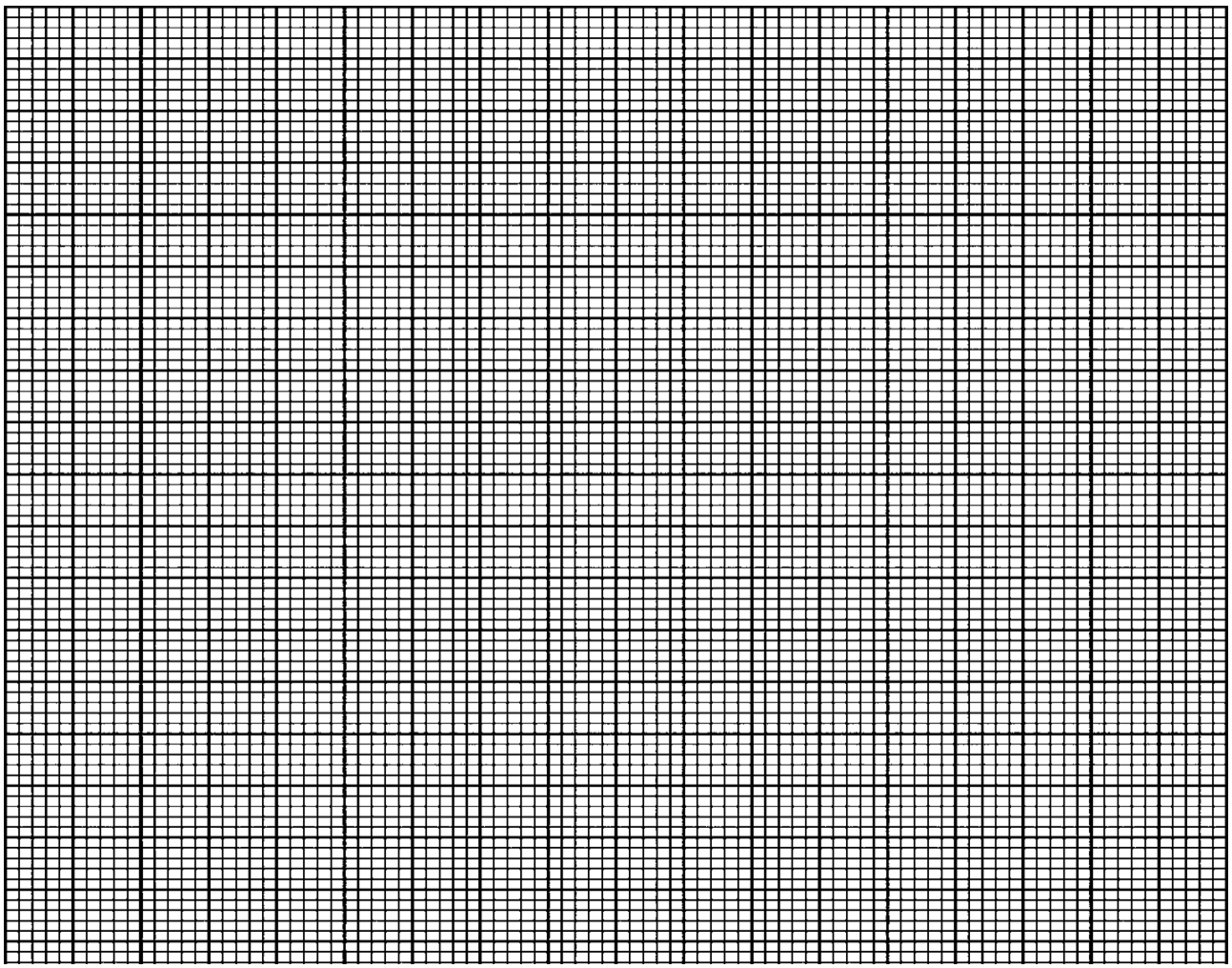
(b) On the grid provided draw a histogram to represent the distribution. (3mks)
Use the scales: 1cm to represent 5 units on the horizontal axis 2 cm to represent 5 units on the vertical axis.

(c) (i) State the group in which the median mark lies (1mk)

(ii) A vertical line drawn through the median mark divides the total area of the histogram into two equal. Using this information estimate the median mark. (2mks)

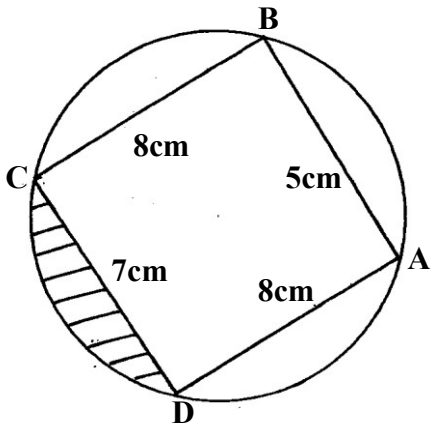
21. (a) Show by shading the unwanted region, the region which satisfies the following inequalities (8mks)

$y > -3$
$4y \leq 5x + 20$
$2y < -5x + 10$
$4y \leq -3x - 12$



(b) Calculate the area of this region in a square units (2mks)

22. The figure below (not drawn to scale) shows a quadrilateral **ABCD** inscribed in a circle. **AB** = 5cm, **BC** = 8cm,**CD** = 7cm and **AD** = 8cm. **AC** is one of the diagonals of length 10cm.

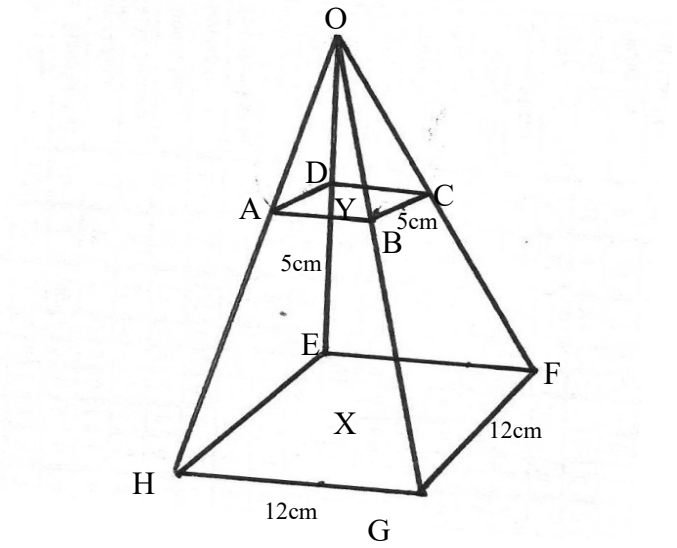


(a) Find the size of angle **ABC**. (3mks)

(b) Find the radius of the circle. (2mks)

(c) Hence, calculate the area of the shaded region. (5mks)

23.



The diagram shows a frustum ABCDEF GH formed from a smaller pyramid ABCDO. The base the top of the frustums are squares of sides 12cm and 5 cm respectively. If Ob = 6cm and each of the slant edges of the frustum is 15 cm long. Calculate to 1 decimal place:

(a) the height OY of the small pyramid (3mks)

(b) the vertical height X Y of the frustum (4mks)

(c) the volume of the frustum (3mks)

24. The table below shows the income tax rates

Total income per month In Kenya Pounds			Rate in shillings per pound
1	-	325	2
326	-	650	3
651	-	975	4
976	-	1300	5
1301 and above			7

Mr. Musango earned a basic salary of shs. *x* and a house allowance of shs. 3000 per month. He claimed a tax relief for a married person of shs. 455 month. He paid shs. 1794 income tax per month.

a) Calculate Mr. Musango's basic salary in shs. per month (6mks)

b) Apart from the income tax, the following monthly deductions are made. Service charge – shs. 100, health insurance fund – shs 280 and 2% of his basic salary as widow and children pension scheme.

Calculate:

i) The total monthly deductions (2mks)

ii) Mr. Musango's net income p.m (2mks)

PAPER 2

SECTION I

1. Use logarithms tables to evaluate

$$\sqrt[3]{\frac{36.72\times(0.46)^2}{185.4}}$$ (4mks)

2. T is a transformation represented by the matrix $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ under T, a square of area $10cm^2$ is mapped onto a square of area $110cm^2$. Find the value of x (3mks)

3. Given that $2\cos(2x-30^0)=-\frac{6}{5}$ find x where $180^0 \le x \le 360^0$ (3mks)

4. Make A the subject of the formula

$$T=\frac{2m}{n}\sqrt{\frac{L-A}{3K}}$$ (3mks)

5. A quantity P is partly constant and partly varies inversely as square of t. P = 6 when t = 6 and p = 18 when t = 3. Find t when p = 11 (3mks)

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6. i) Expand $\left(5+\frac{x}{2}\right)^6$ up to the term in x^3. (2mks)

ii) Use your expansion to estimate the value of $\left(\frac{11}{2}\right)^6$. Correct to one decimal place. (2mks)

7. Solve for x in the equation. (3 Mks)

$\text{Log}_8 (x + 6) - \text{Log}_8 (x - 3) = \frac{2}{3}$

8. Solve for x and y in the simultaneous equation below. (3 mks)

$xy + 6 = 0$
$x - 2y = 7$

9. The size of each interior angle of a regular polygon is five times the size of the exterior angle. Find the number of sides of the polygon. (3mks)

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10. If $\frac{1}{3-\sqrt{5}} - \frac{2+2\sqrt{5}}{3+\sqrt{5}} = a + b\sqrt{c}$, find the value of a, b and c (3 mks)

11. The data below shows marks scored by 8 form four students in Molo district mathematics contest 44, 32, 67, 52, 28, 39, 46, 64.Calculate the mean absolute deviation. (3 Mks)

12. Steve deposited ksh.50, 000 in a financial institution in which interest is compounded quarterly. If at the end of second year he received a total amount of ksh79, 692.40. Calculate the rate of interest p.a (3 Mks)

13. The points with coordinates (5,5) and (-3,-1) are the ends of a diameter of a circle
Centre A
Determine:
(a) The coordinates of A (1mk)

(b) The equation of the circle, expressing it in form $x^2 + y^2 + ax + by + c = 0$ Where a, b, and c are constants (2mks)

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14. Pipe x can fill an empty tank in 3 hours while pipe y can fill the same tank in 6 hours. When the tank is full, it can be emptied by pipe z in 8 hours. pipe x and y are opened at the same time when the tank is empty. If one hour later pipe z is also opened, find the total time taken to fill the tank. (3marks)

15. Fatima bought maize and beans from Kami. She mixed the maize and beans in the ratio 3: 2 she bought the maize at sh.90 per kg and the beans at sh.150 per kg. If she was to make a profit of 30% what would be the selling price of 1kg of the mixture. (3mks)

16. Given $A=\begin{pmatrix}7 & 4\\ 5 & 3\end{pmatrix}$ and $B=\begin{pmatrix}2 & 11\\ 1 & 6\end{pmatrix}$ find A^{-1} B^{-1} (3mks)

SECTION II

17. a) A figure whose co-ordinates are A(-2, -2), B(-4, -1), C(-4, -3) and D (-2, -3) undergoes successive transformations ERS; where E, R and S are transformations represented by the matrices,

$E=\begin{pmatrix}-2 & 0\\ 0 & -2\end{pmatrix}, S=\begin{pmatrix}0 & -1\\ -1 & 0\end{pmatrix}$ *and* $R=\begin{pmatrix}0 & 1\\ -1 & 0\end{pmatrix}$

On the grid provided, show the figure ABCD and its image under the successive transformations ERS. (6mks)

b) Find the matrix representing the single transformation mapping the image found in (a) above back the object figure ABCD. (2mks)

c) Triangle PQR has vertices at P(2, 2), Q(4, 1) and R(6, 4). On the same grid, show the image of triangle PQR under a shear with line y = 2 invariant and point R(6, 4) is mapped onto R^1(2, 4). (2mks)

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Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
Frequency	2	6	10	16	24	20	12	8	2

18. The following are marks by form four students in a mathematics test.

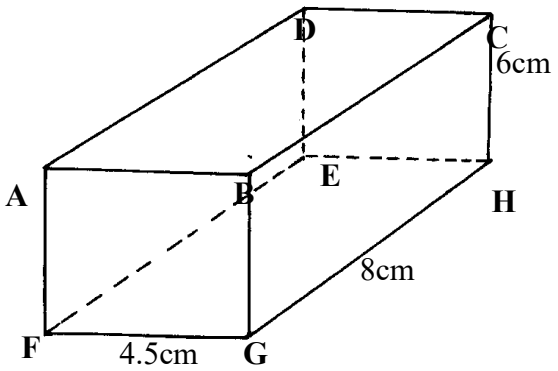
Using an assumed mean of 54.5, calculate the

(a) Mean mark (4mks)

(b) Variance (4mks)

(c) Standard deviation (2mks)

19. The diagram below represents a Cuboid **ABCDEFGH** in which **FG** =4.5cm, **GH** =8cm **HC**=6m



(a) Calculate the length **FC** (2mrks)

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(b) (i) The size of the angle between the lines **FC** and **FH** (2mks)

(ii) Size of the angle between the line **AB** and **FH.** (2mks)

(c) The size of the angle between the planes **ABHE** and the plane **FGHE.**(2mks)

(d) The total surface area of the cuboid (closed) (2mks)

20. Complete the table below, giving all your values correct to 2 d. p. for the functions $y = cos\ x$ and $y = 2cos\ (x + 30)^0$

x^0	0^0	60^0	120^0	180^0	240^0	300^0	360^0	420^0	480^0	540^0
Cos x	1.00			-1.00		0.50				
2cos(x + 30)	1.73		-1.73		0.00					

(b) For the function $y = 2cos\ (x + 30)^0$
State:
(i)The period (1mk)

(ii)Phase angle (1mk)

(c) On the same axes draw the waves of the functions$y = cos\ x$ and $y = 2cos\ (x + 30)^0$ for $0^0 \leq x \leq 540$.Use the scale 1cm rep 30^0 horizontally and 2cm rep 1 unit vertically. (4mks)

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(d)Use your graph above to solve the inequality $2\cos(x + 30^\circ) \leq \cos x$ (2mks)

21. A teacher had 5 red, 6 black and 9 blue pens in a box. The pens were all identical except for the colour.

(a) If one pen is picked from the box, what is the probability that it is

(i) Red. (1mk)

(ii) Not black. (1mk)

(a) The teacher asked a student to pick two pens from the box, one at a time, without replacement. Find the probability that

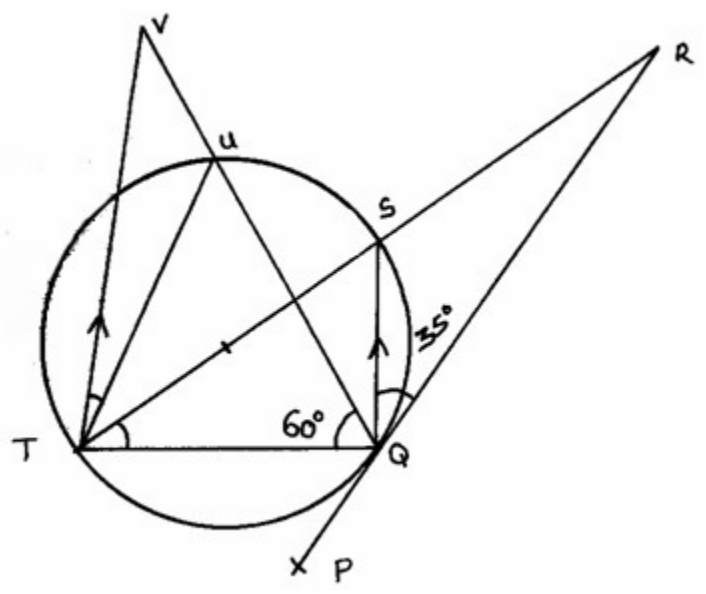
(i) Both pens are of the same colour. (3mks)

(ii) They are of different colours. (2mks)

(b) If the first student was allowed to take away two blue pens and another student was asked to pick two pens without replacement. What is the probability that the second student picked pens of same colour? (3mks)

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22. In the figure below, PQR is the tangent to the circle at Q. TS is a diameter and TSR and QUV are straight lines. QS is parallel to TV. Angle SQR = 35° and TQV = 60°.



(a) Find the following angles, giving reasons for each answer.

(i) QTS. (2mks)

(ii) QRS. (2mks)

(iii) QVT. (2mks)

(iv) UTV. (2mks)

(v) QUT. (2mks)

23. Use ruler and a pair of compasses only in this question

a) Construct triangle ABC such that AB = 6cm, AC=BC and angle ACB = 135° 4mks

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b) On one side only construct the locus of P such that:

i) < APB = 67.5° 1mk

ii) area of triangle , APB = 9cm² 3mks

c) i) Locate P1 and P2 the two possible positions of P which satisfy the two conditions above 1mk

ii) Measure the distance between P1 and P2. 1mk

24. An arithmetic progression has the first term a and the common difference d.

(a) Write down the third, ninth and twenty – fifth terms of the progression. (3 Mks)

(b) The progression is increasing and the third, ninth and twenty-fifth terms form the first three Consecutive terms of a geometric progression. If the sum of the seventh term and twice the sixth term of the arithmetic progression is 78.

Calculate

(i) The first term and the common difference (5 Mks)

(ii) The sum of the first nine terms of the arithmetic progression (2 Mks)

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SERIES 31
PAPER 1

SECTION I (50 MARKS) **Attempt all questions in this section**

1. Evaluate $\dfrac{-4 \text{ of } (-4 + -5 \div 15) + -3 - 4 \div 2)}{84 \div -7 + 3 - -5}$ (3 mks)

2. Simplify $\dfrac{9x^2 - 1}{3x^2 + 2x + 1}$ (1 mk)

3. Evaluate without using a calculator or mathematical table leaving your answers as a simplified fraction. (2 mks)

$$\frac{\frac{4}{11} \text{of} \frac{3}{4} - \frac{1}{20}}{\left(3 + \frac{1}{3}\right) \div \left(1 + \frac{1}{10}\right)}$$

4. A poultry farmer has twenty times as many hens as turkey and three quarters as many ducks as turkeys.

   (a) If there are t, turkeys, write down a simplified expression in terms of t for the total number of birds on the farm. (1 mk)

   (b) Give that he has 72 ducks, calculate as a percentage the sum of turkeys and ducks to the number of hens in the farm. (2 mks)

5. Use tables of reciprocals only to work out. (3 mks)

$$\frac{5}{0.0396} + \frac{12}{0.593}$$

6. A straight lines passes through points A(-2,6) and B(4, 2).

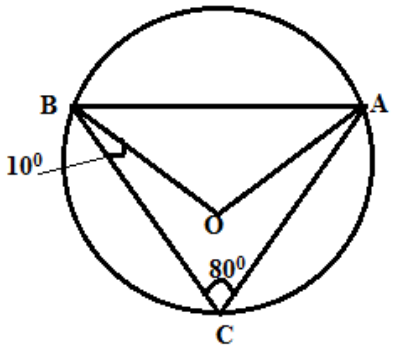
(a) M is the midpoint of line AB. find the coordinates of N. (2 mks)

(b) Determine the equation of a straight line passing through point M and is perpendicular to AB. (2 mks)

7. An open right circular core has radius of 5cm and a perpendicular height of 12cm. Calculate the surface area of the core. (take $\pi = 3.142$). (3 mks)

8. Moraa spends a total of sh. 970 on buying 3 text books and 5 pens. if had bought 2 textbooks and 8 pens she would have saved sh. 90. Find the cost of one textbook. (3 mks)

9. In the figure below O is the centre of the circle. $<BCA = 80^0$ and $<CBO = 10^0$. Determine the size of $<CAB$. (3 mks)



10. The table below shows speeds of vehicles measured to the nearest 10km/h as they passed a certain point.

Speed(km/h)	30	40	50	60	70	80	90	100	110
Frequency	1	4	9	14	38	47	51	32	4

a) Calculate the mean speed of vehicles (3 marks)

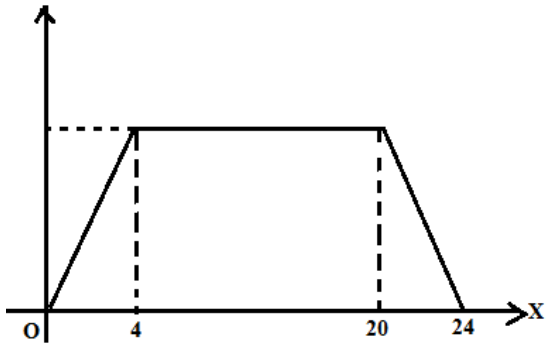
b) State the modal speed (1mark)

11. Find the of x if. (3 mks)

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

12. The image of a point K(1,2) after translation is K^1 (-1,2). what is the coordinate of the point R whose image is R^1 (-3,3) after undergoing the same translation. (3 mks)

13. The figure below is a velocity time graph for a car.



(a) Find the total distance travelled by the car (2 mks)

(b) Calculate the deceleration of the car. (2 mks)

14. Security light poles have been erected along both sides of a street in Kisii town. The poles are 50m apart along the left hand side of the road while they are 80m apart along the right hand side. At one end of the road the poles are directly opposite each other. How many poles will be erected by time the poles are directly opposite each other at end of the road? (3 mks)

15. The exterior angle of a regular polygon is equal to one third of the interior angle. Calculate the number of number of sides of the polygon. (3 mks)

16. Solve the following inequality and state the integral values

$\frac{1}{2}(24-4x) > 6\ (3x-\frac{4}{3}) \geq -\frac{2}{3}(42+3x)$ (3 mks)

SECTION II

Attempt only FIVE questions from this section

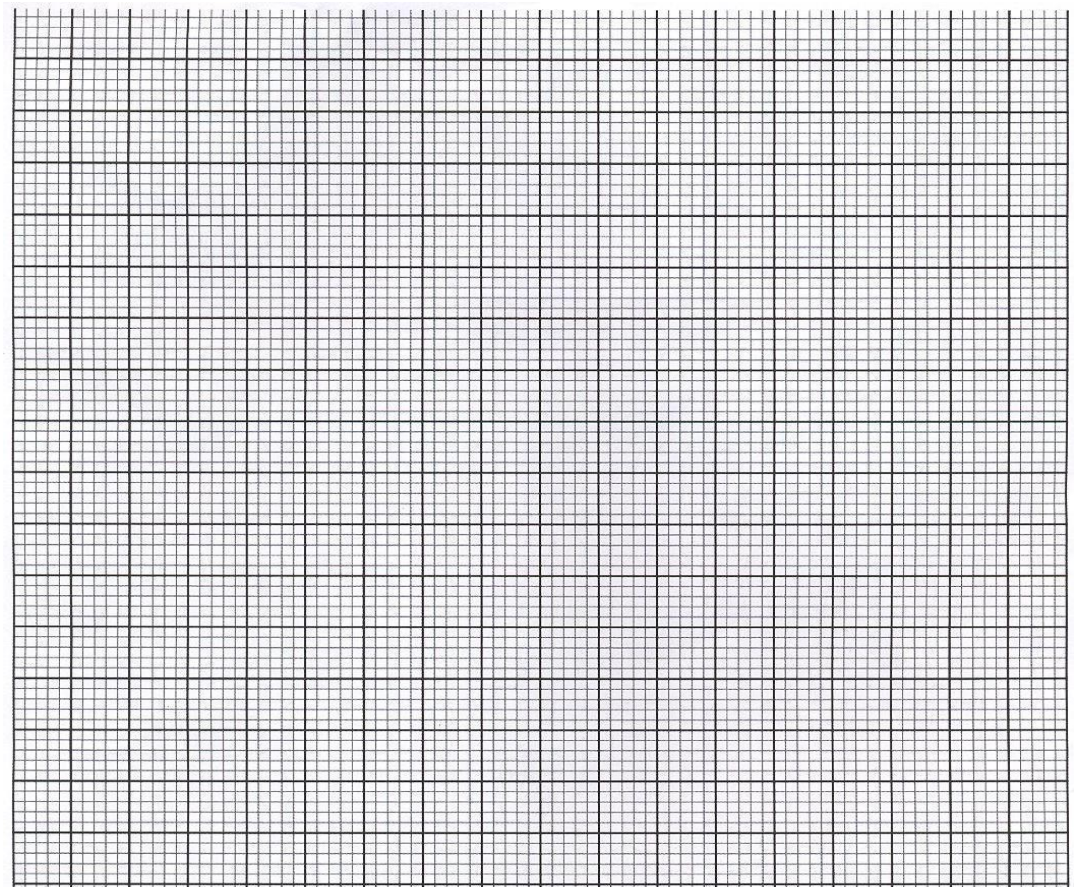
17. (a)Complete the table below for the function y=7 + 2x— $2x^2$ for the range —3≤ x ≤4.(2 marks)

X	-3	-2	-1	0	1	2	3	4
—$2x^2$		-8	-2	0		-8	-18	
2x	-6	-4		0		4	6	
7	7	7	7	7	7	7	7	7
Y		-5		7		3	-5	

(b) (i) On the grid provided draw the graph of y=7 + 2x— $2x^2$. (3 marks)

Take the scale:2 cm to represent 1 unit on x- axis

1 cm to represent 1 unit on y- axis



(ii) Use your graph to estimate the roots of $7 + 2x — 2x^2 = 0$. (1 mark)

(c) (i) By drawing a suitable line on the same axes in (b) above solve the equation

$9 + 5x — 2x^2 = 0$ (3marks)

(ii) State the co-ordinates of the turning point .(1 mark)

18. Paul is a sales executive earning sh 20,000 and a commission of 8% for the sales in excess of 100,000. In January 2014 he earned a total of 48000 in salaries and commissions.

(a) Determine the amount of sales he made in that month. (4 mks)

(b) If the total sales inn the month of February and march increased by 18% and then dropped by 25% respectively. Calculate.

(i) Paul`s commission in the month of February. (3 mks)

(b) If the total earnings in the month of march. (3 mks)

19. Two tasks are similar in shape. The capacity of the tanks are 1,000,000 litres and 512,00 litres respectively.

(a) Find the height of the smaller tank if the larger one is 300cm tall. (5 mks)

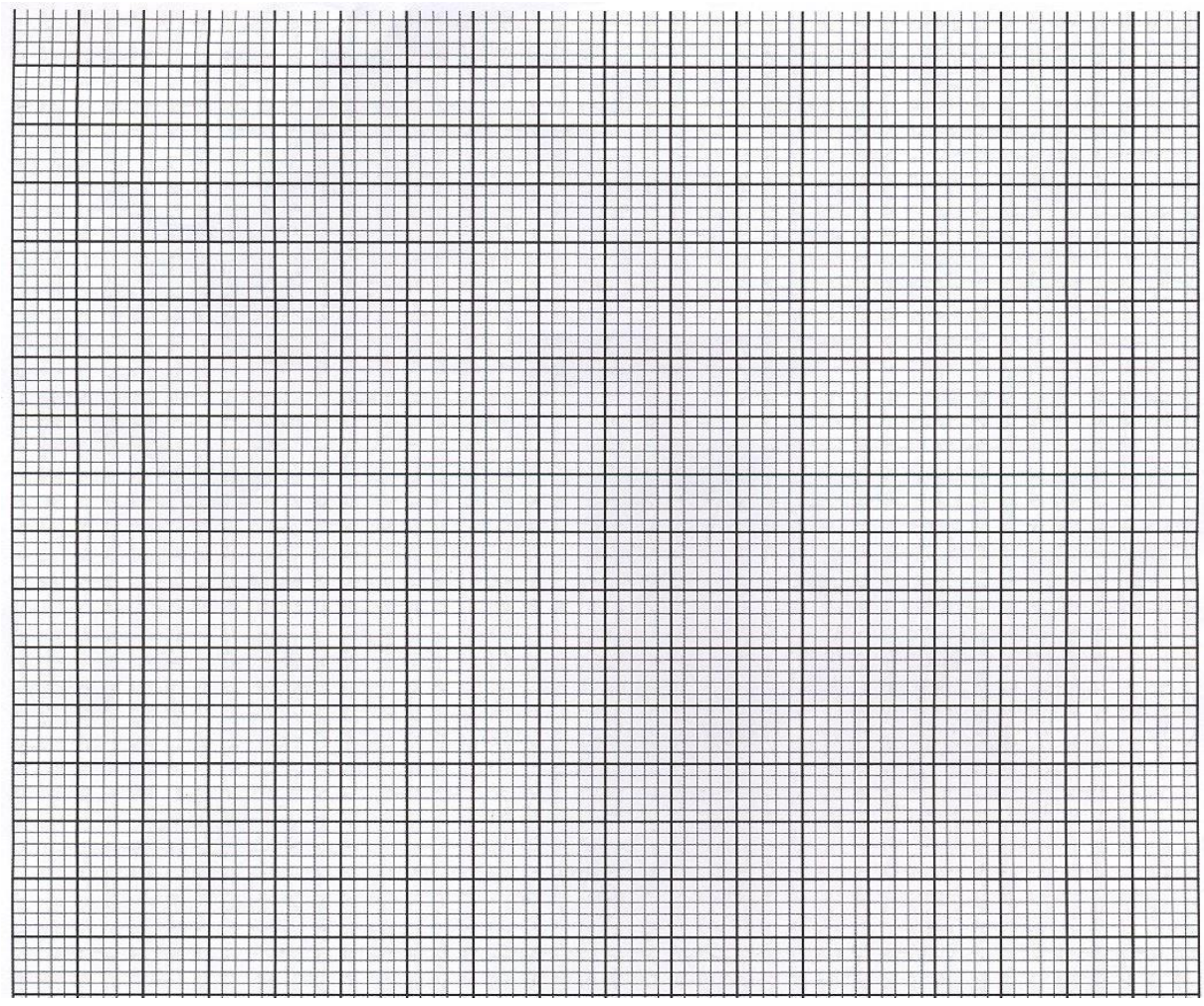
(b) Calculate the surface area of the tank if the smaller one has a surface area of $768cm^3$ (3 mks)

(c) Calculate the mass of the larger tank if the mass of the larger one is 800kg. (2 mks)

20. The vertices of a triangle ABC are A(2,5) B(4,3) and C(2,3). **P** represents half-turn about the origin.

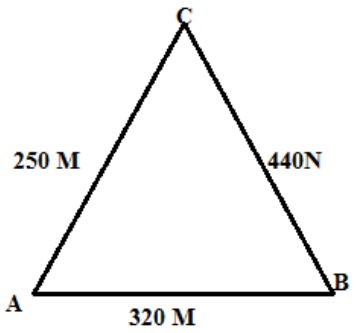
(a) Draw triangle ABC and $A^1B^1C^1$ under **P**. (4 mks)

(b) **T** represents a reflection in the line x = 0 and **K** represents a translation $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$. Find the coordinates of $A^{11}B^{11}$ and C^{11} under **T** and $A^{111}B^{111}C^{111}$ under **K.** Hence, draw triangle $A^{11}B^{11}C^{11}$. (4 mks)



(c) Find the area of the triangle $A^{11}B^{11}C^{11}$. (2 mks)

21. Ombati owns a farm that is triangular in shape as shown below.



(a) Calculate the size angle BAC. (2 mks)

(b) Find the area of the farm in hectares. (3 mks)

(c) Ombati wishes to irrigate his farm using a sprinkler machine in the farm such that it is equidistant from points A. B and C.

(i) The sprinkler rotates in a circular motion so that the maximum point reached by the water jets is the vertices A, B and C. Calculate the area outside the farm that will be irrigated. (5 mks)

22. Trasnsline bus left Nairobi at 8.00 am and travelled Kisii at an average speed of 80km/h. A car left Kisii at 3.30 am and travelled to Nairobi at an average speed of 120km/h. Given that the distance between Nairobi and Kisii is 400km, Calculate.

(a) The time the car arrived in arrived in Nairobi. (3 mks)

(b) The time the two vehicles met. (4 mks)

(c) The distance from Nairobi to the meeting point. (2 mks)

(d) The distance of the bus from Kisii when the car arrived in Nairobi. (2 mks)

23. Town B is 102km on the bearing of 122^0 from town A. Town C is 94 km on bearing of 062^0 from B. Town D is on a bearing of 073^0 from A and 336^0C.

(a) Using a scale of 1cm to represent 20km, draw a scale diagram to show the relative positions of town A, B, C and D. (4 mks)

(b) Using your diagram, determine.

(i) The bearing B from D. (1 mk)

(ii) The bearing of A from C. (1 mk)

(iii) The distance from town A to D. (1 mk)

(iv) The distance from town B and D. (1 mk)

24. A particle moves along a straight line such that its displacement S metres from a given point is $S = t^3 - 5t^2 + 3t + 4$ where t is time in seconds. Find

a) The displacement of the particle at t = 5 (2marks)

b) The velocity of the particle when t = 5 (3 marks

c) The values of t when the particle is momentarily at rest (3 marks)

d) Acceleration of the particle when t = 2 (2marks)

PAPER 2

1. Use a calculator to find V if $\frac{1}{V} = \frac{1}{23.9} - \frac{1}{38.45}$ (2mks)

2. Solve for X in **Log (7X – 3) + 2 Log 5 = 2 + Log (X+3)** (3mks)

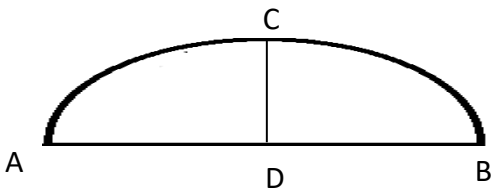
3. A quantity P is partly constant and partly varies as the square of Q. when Q = 2, P = 40 and when Q = 3, P = 65. Determine the equation connecting P and Q (3mks)

4. Expand $(1 - \frac{1}{2X})^6$ up to the fourth term; hence use your expansion to evaluate 0.996^6 correct to 4 decimal places. (4mks)

5. Simplify $\frac{\sqrt{5}+3}{\sqrt{5}-2}$. Give the answer in the form of $a + b\sqrt{c}$ where a, b and c are integers (3mks)

6. Given that **X-5**, **X-3** and **2X-3** are three consecutive terms of a geometric progression, find the possible values of X and the ratio **(2X+1):(X+2)** (4mks)

7. The figure below is a segment of a circle cut off by a chord AB. Line CD is a perpendicular bisector of chord AB.



If AB is 24cm and CD is 8cm, calculate the radius of the circle. (3mks)

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8. By completing the square, solve for x in the equation $\mathbf{2x^2 - 6 = x.}$ (3mks)

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

10. The base and height of a right-angled triangle are 4cm and 5cm respectively. Calculate the percentage error in its area. (3mks)

11. Given that $\mathbf{P} = \begin{pmatrix} \mathbf{5} & \mathbf{3} \\ \mathbf{6} & \mathbf{4} \end{pmatrix}$, find ;
    a. Its inverse (1mk)

    b. The value of x and y if $\mathbf{P}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (3mks)

12. The equation of a circle is given by $x^2 + y^2 + 6x - 10y - 30 = 0$. Determine the radius and center of the circle (3mks)

13. Find the value of X which satisfies the equation $5^{2x} - 6\times5^{x} + 5 = 0$ (3mks)

14. A scooter mixes oil and petrol in the ratio 5:19. If petrol costs Ksh. 130 per liter and oil costs Ksh. 250 per liter, find the cost of a liter of the mixture. (2mks)

15. Solve the pair of equations simultaneously (4mks)
    $2x - y = 3$

    $x^2 - xy = -4$

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16. The cash price of a water pump is Ksh. 38,000. Mr. Ahero opts to buy the pump on hire purchase terms by paying a deposit of Ksh. 6,500 and 24 equal monthly installments. Calculate the amount of each installment, if simple interest of 20% p.a is charged.
(3mks)

SECTION II (50 MARKS): Attempt any five questions in this section

17. The first term of an arithmetic sequence is equal to the first term of the geometric sequence. The second term of the arithmetic sequence is equal to the fourth term of the geometric sequence, while the tenth term of the arithmetic sequence is equal to the seventh term of the geometric sequence.

a. Given that a is the first term and d is the common difference of the arithmetic sequence while r is the common ratio of the geometric sequence, write down two equations connecting the arithmetic and geometric sequences. (2mks)

b. Find the value of **r** that satisfies the geometric sequence (4mks)

c. Given that the tenth term of the geometric sequence is 5120, find the values of **a** and **d**
(2mks)

d. Calculate the sum of the first 20 terms of the arithmetic sequence (2mks)

18. Three quantities R, S and T are such that R varies directly as S and inversely as the square of T.

a. Given that R = 480 when S = 150 and T = 5, write an equation connecting R, S and T
(3mks)

b. Find,
i. the value of R when S = 160 and T = 1.6 (3mks)

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ii. the percentage change in R if S increases by 5% and T decreases by 20%
(4mks)

19. The table below shows income tax rates

Monthly income in Kenya shillings (Ksh)	**Tax rate % in each shilling**
Up to 9680	10 %
From 9681to18800	15 %
From 18801 to 27920	20 %
From 27921 to 37040	25 %
From 37041 and above	30 %

In that year Okumu's salary amounted to K£ 45,000 p.a and he received allowances totaling Ksh. 300,000 p.a. He was entitled to:-

(i) Monthly personal relief of Ksh. 1,056
(ii) Monthly insurance relief at the rate of 15% of the premium paid
Okumu paid a monthly premium of Ksh. 2,500 towards his life insurance policy

Calculate

(a) His gross monthly income in Ksh (2mks)

(b) The monthly income tax he pays (5mks)

(c) His net monthly income, if his other monthly deductions were: - Ksh. 4,800 to HELB, Ksh. 5,000 to his co-operative and Ksh. 2,800 towards a bank loan repayment.
(3mks)

20. Square OABC with vertices O(0,0),A(2,0), B(2,2) and C(0,2) is mapped onto O'(0,0), A'(2,0), B'(5,2) and C'(3,2) by the matrix **T =** $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

a. Find T (3mks)

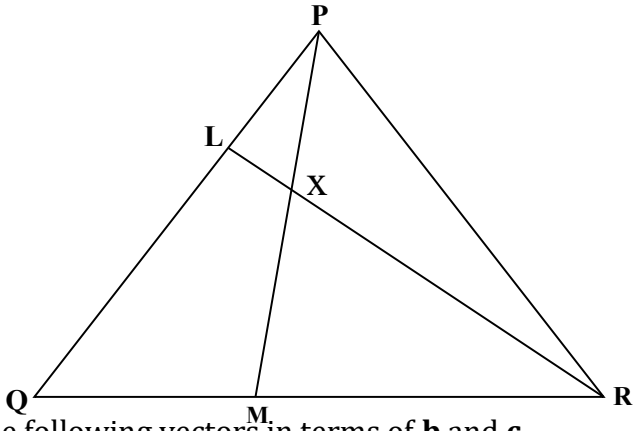
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b. Draw O'A'B'C' and reflect it on the line x + y = 0 to obtain O"A"B"C" (4mks)

(attach graph paper)

c. What single matrix P maps OABC to O"A"B"C" (3mks)

21. In the triangle PQR below L and M are points on PQ and QR respectively such that PL: LQ = 1:3 and QM: MR = 1:2, PM and RL intersect at X. Given that **PQ = b** and **PR=c**,



a. Express the following vectors in terms of **b** and **c**.

i. **QR** (1mk)

ii. **PM** (1mk)

iii. **RL** (1mk)

b. By taking **PX =** *h***PM** and **RX =** *k***RL** where ***h*** and ***k*** are constants find two expressions of PX in terms of *h, k,* b and c. Hence determine the values of the constants ***h*** and ***k***. (6mks)

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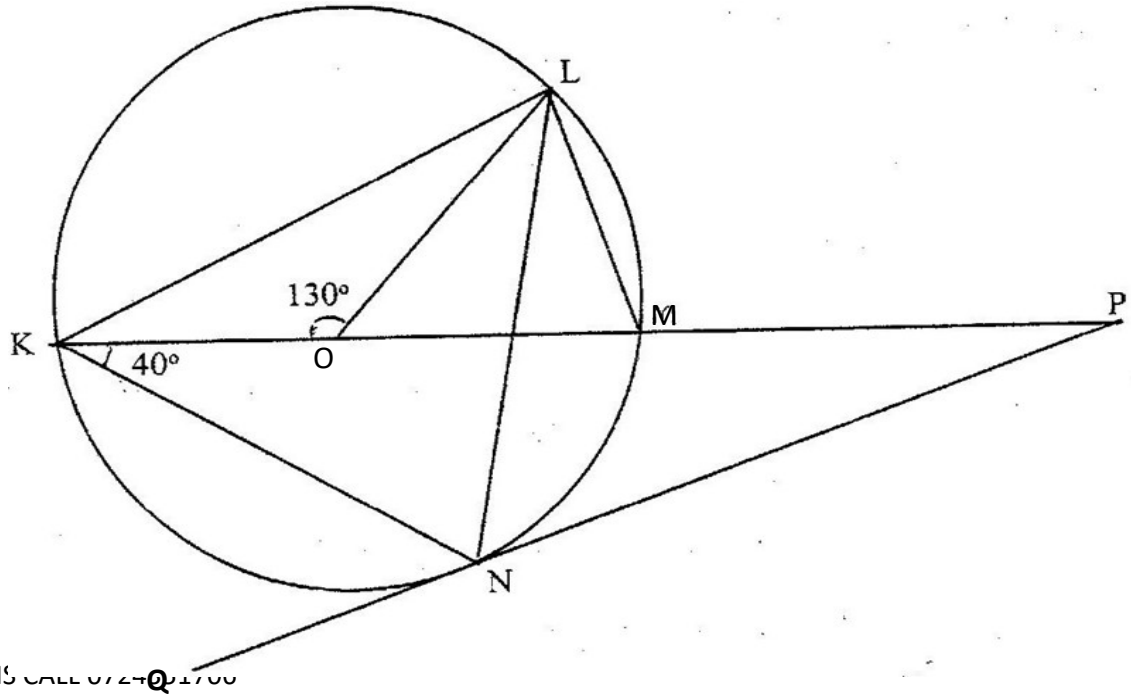
c. Determine the ratio **LX : XR** (1mk)

22. During a traffic crackdown, 1,000 motor cycles were sampled. 250 of these were found to lack necessary driving gear, 200 had no valid insurance and 300 lacked the driving license. Taking the sample to represent all motorcycles in the country;
    a. Represent the information in a tree diagram (3mks)

    b. Find the probability that, a motorcyclist at any given time
        i. Has no driving license (3mks)

        ii. Lacks a valid insurance but is in proper driving gear and has a valid driving license (2mks)
        iii. Has none of the offence (2mks)

23. In the figure below, K L M and N are points on the circumference of a circle centre O. The points K, O, M and P are on a straight line. PQ is a tangent to the circle at N. Angle KOL = 130^0 and angle MKN = 40^0



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Find the values of the following angles, stating the reasons in each case:

a. <MLN (2mks)

b. <OLN (2mks)

c. < LNP (2mks)

d. <MPQ (2mks)

e. <KNQ (2mks)

24. Complete the table below for y = Sin 2x and y = Sin(2x+30)^0 giving values to 2 d.p (1mk)

X^0	0^0	15^0	30^0	45^0	60^0	75^0	90^0	105^0	120^0	135^0	150^0	165^0	180^0
Sin 2x	0.00				0.87				-0.87				0.00
Sin $(2x+30)^0$	0.50				0.50				-1.00				0.50

a. Draw the graph of y = Sin 2x and y = Sin(2x+30)^0 on the same axis (4mks)

b. Use your graph to solve Sin(2x+30)^0 - Sin 2x = 0 (1mk)

c. Describe the transformation which maps the wave Sin 2x onto the wave Sin (2x +30) (2mks)

d. State the amplitude and period of y = a cos (bx +c) (2mks)

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SECTION I (50 marks)

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

1. All odd numbers from 1 to 10 are arranged in descending order to form a number.

(a)(i) Write the number (1 mark)

(ii) Write the total value of the second digit of the number formed in (a) (i) (1 mark)

(iii) Express the value of the number in (a) (ii) as a product of its prime factors in power form. (2 marks)

2. A shopkeeper bought a bag of sugar. He intends to repack the sugar in 40 g, 250 g and 750 g. Determine the least mass in grams of sugar that was in the bag. (3 marks)

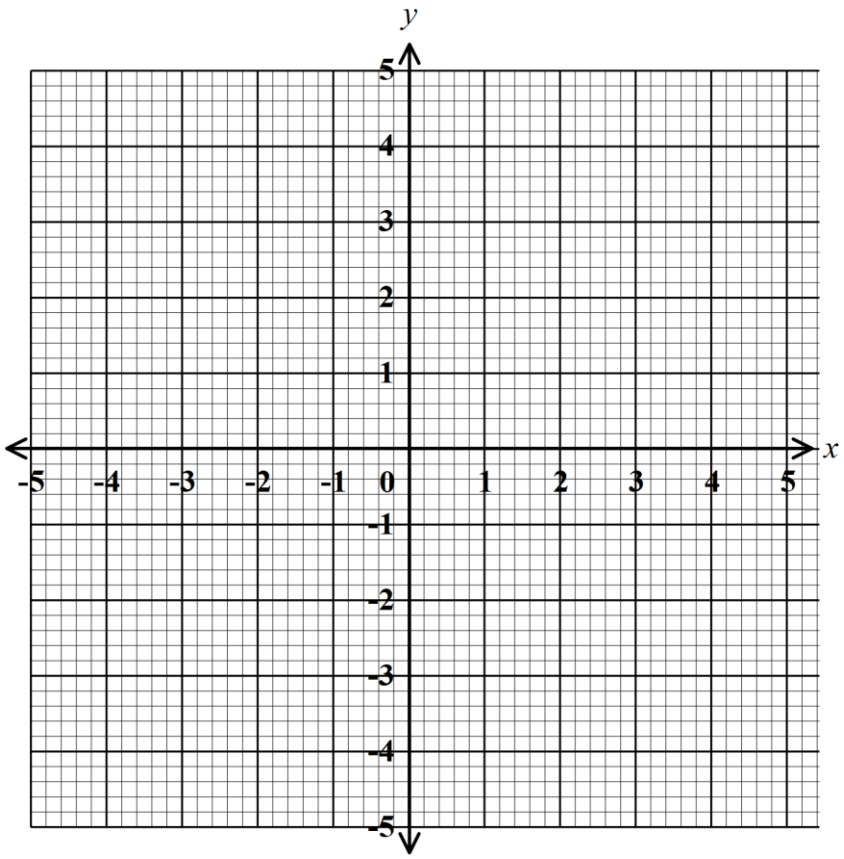
3. Given that $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$ without using tables or calculator find $\log 0.036$ correct to 4 significant figures. (3 marks)

4. Evaluate $\dfrac{\frac{1}{2}of\frac{3}{2}+1\frac{1}{2}\left(2\frac{1}{2}-\frac{2}{3}\right)}{\frac{3}{4}of2\frac{1}{2}\div\frac{1}{2}}$ (3 marks)

5. Using the grid provided below, solve the simultaneous equation (3 marks)

$3x-4y=10$

$5x+7y=3$



6. Given that a chord of length 10 cm subtends an angle of 1.2^{c} at the circumference of the circle. Calculate the radius of the circle. (3 marks)

7. When a shopkeeper sells articles at Ksh 24.05, he makes a 30% profit on the cost price. During a sale, he reduced the price of each article to Ksh 22.95. Calculate the percentage profit on an article sold at the sale price. (3 marks)

8. The size of one interior angle of an irregular polygon is 80^0. Each of the other interior angles is 128^0. Find the number of sides of the polygon. (3 marks)

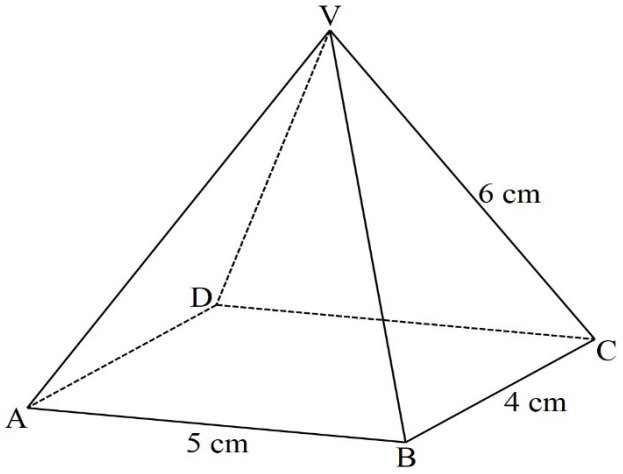
9. Simplify $81^{\frac{3}{4}} - \left(\frac{1}{5}\right)^{-1} - 27^0$ (2 marks)

10. Given the inequalities $x - 6 \leq -3x + 2 < -2x + 9$

(a)Solve the inequality (3 marks)

(b)Represent on a number line (1 mark)

11. The diagram below represents a right rectangular based pyramid of 5 cm by 4 cm. The slant edge of the pyramid is 6 cm. Draw and label the net of the pyramid. (3 marks)



12. Vectors $\mathbf{OA} = 4i + 3j$, $\mathbf{OB} = -2i - j$ and $\mathbf{OC} = -5i - 3j$. Show that points A, B and C are collinear.

(3 marks)

13. Find the period , amplitude and phase angle of the function $2y = 3\sin\left(\frac{1}{2}x - 60^0\right)$ (3 marks)

14. Simplify $\frac{20 - 11x - 3x^2}{16x - 12x^2}$ (3 marks)

15. Write the following ratios in ascending order $2:3$, $15:16$, $7:6$, $13:15$ (3 marks)

16. Under an enlargement, the image of the points $A(3,1)$ and $B(1,2)$ are $A'(3,7)$ and $B'(7,5)$.
Find the centre and scale factor of enlargement. (4 marks)

SECTION II (50 marks)

*Answer **only five** questions in this section in spaces provided*

17. A straight line passes through $P(-1,1)$ and $Q(3, 4)$.

(a)Find the length of line PQ (2 marks)

(b) Find the equation of the perpendicular bisector of line PQ, leaving the equation in the form $y = mx + c$ (4 marks)

(c) Determine the equation of line parallel to line PQ and passes through point $(2, 3)$, leaving your answer in double intercept form. Hence state the y intercept. (4 marks)

18. The marks scored by 30 students in test were recorded as follows

41	43	34	28	19	22
32	38	22	18	25	33
30	41	36	31	28	37
35	34	19	22	29	23
29	44	26	27	29	36

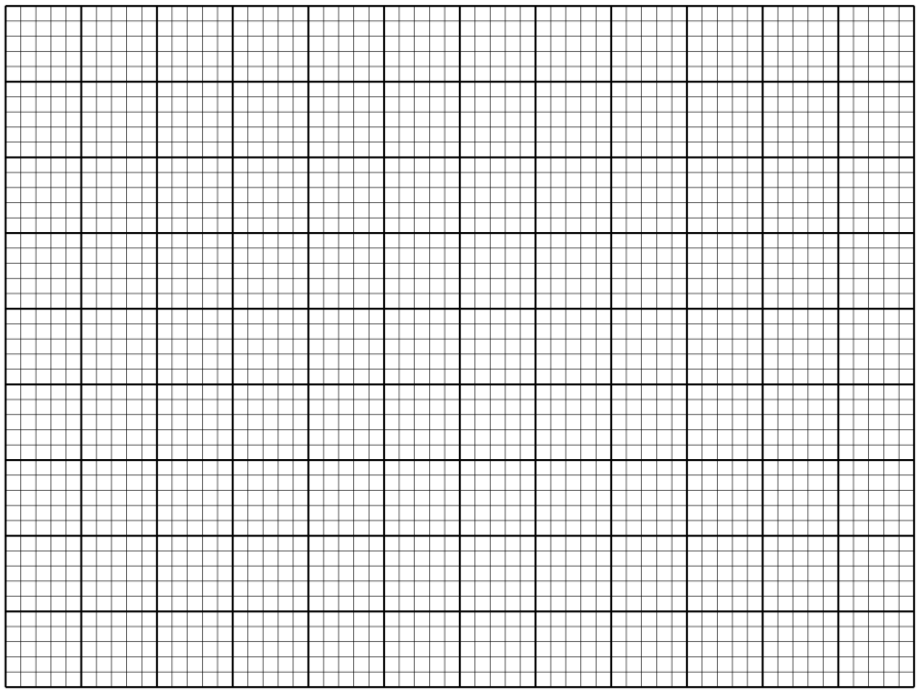
(a) Starting with the class $18-22$, make a frequency distribution table for the data. (2 marks)

(b) Using the frequency distribution in (a) above calculate :

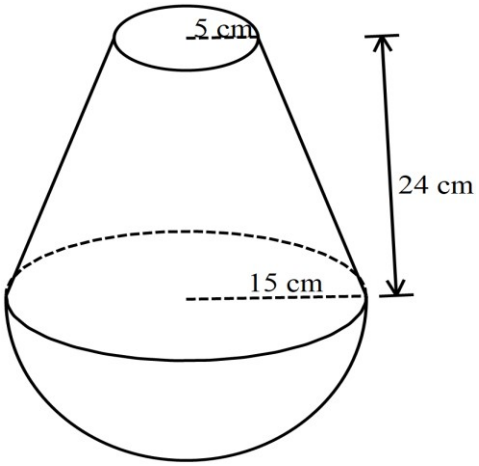
(i) the mean (2 marks)

(ii) the median (3 marks)

(c) Draw a frequency polygon to represent the data. (3 marks)



19. The solid below is made up of hemispherical part and a frustum of cone. The top and bottom radius of the frustum are 5 cm and 15 cm respectively. The vertical height of the frustum is 24 cm.



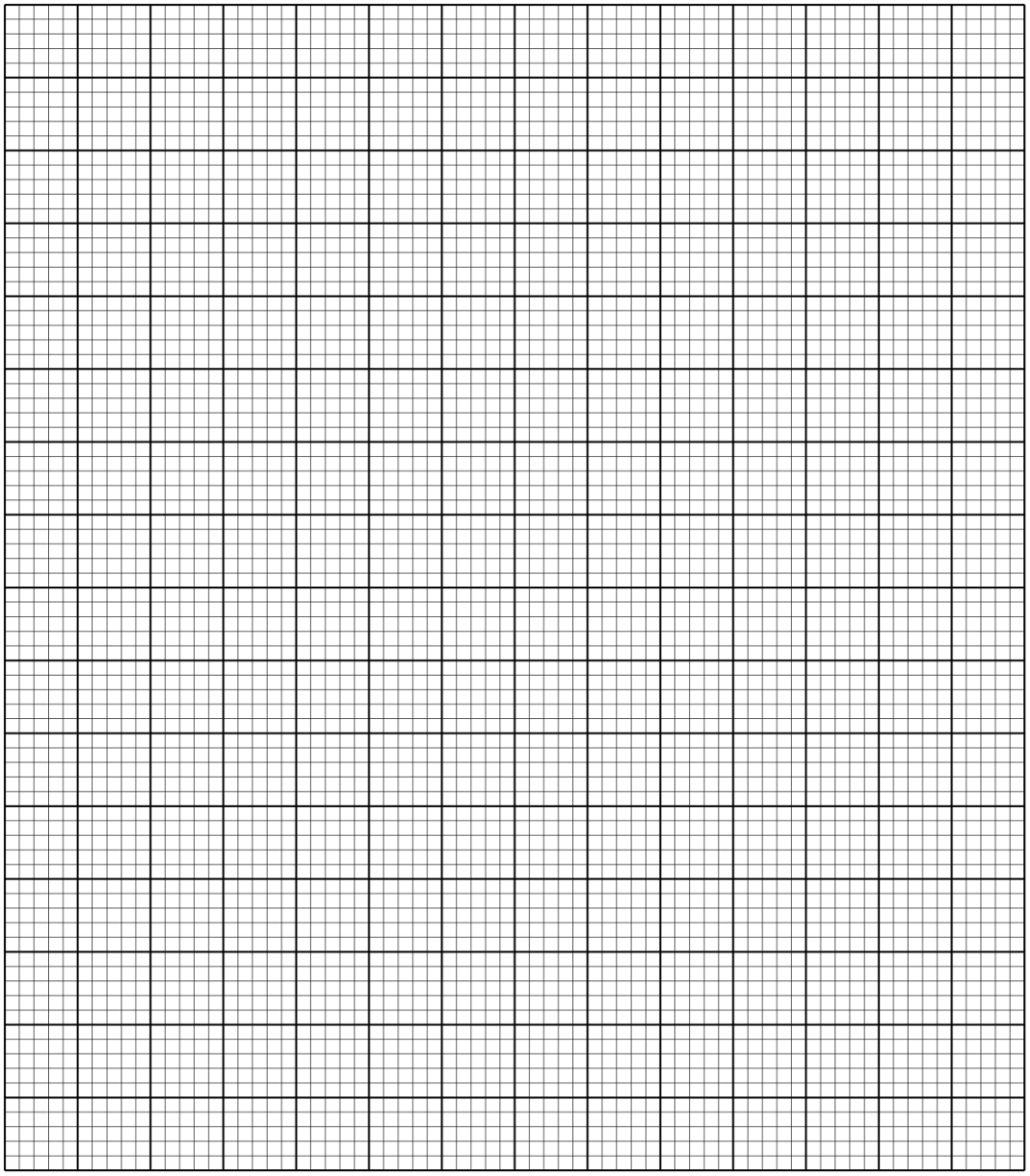
(a) Determine the vertical height of the cone from which the frustum was cut. (2 marks)

(b) Calculate

(i) The volume of the solid correct to 2 decimal places (3 marks)

(ii) The surface area of the solid correct to 2 decimal places (5 marks)

20. (a) (i) Draw the graph of the function $y = 2x^2 - 3x - 5$ for $-2 \leq x \leq 3$ (5 marks)

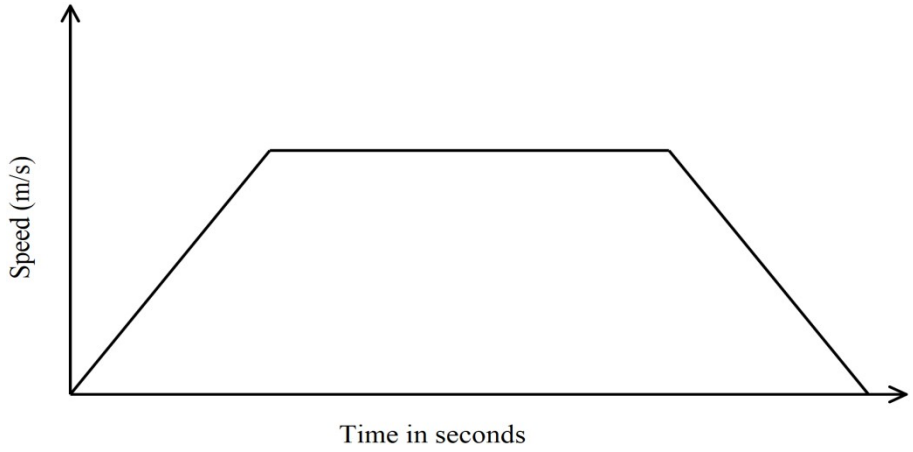


(ii) Use the graph to solve the equation $2x^2 - 3x - 5 = 0$ (1 mark)

(b) Use the graph to solve the simultaneous equation $y = 2x^2 - 3x - 5$ and $y = -2x - 2$ (3 marks)

(c) Write down the quadratic equation which the line $y = -2x - 2$ is solving. (1 marks)

21. The diagram below shows the speed time graph for a bus travelling between two stations, the bus starts from rest and accelerates uniformly for 75 seconds. It then travels at constant speed for 150 seconds and finally decelerates uniformly for 100 seconds.



(a) Given that the distance between the two stations is 5225 m. Calculate

(i) maximum speed in km/h attained by the bus. (3 marks)

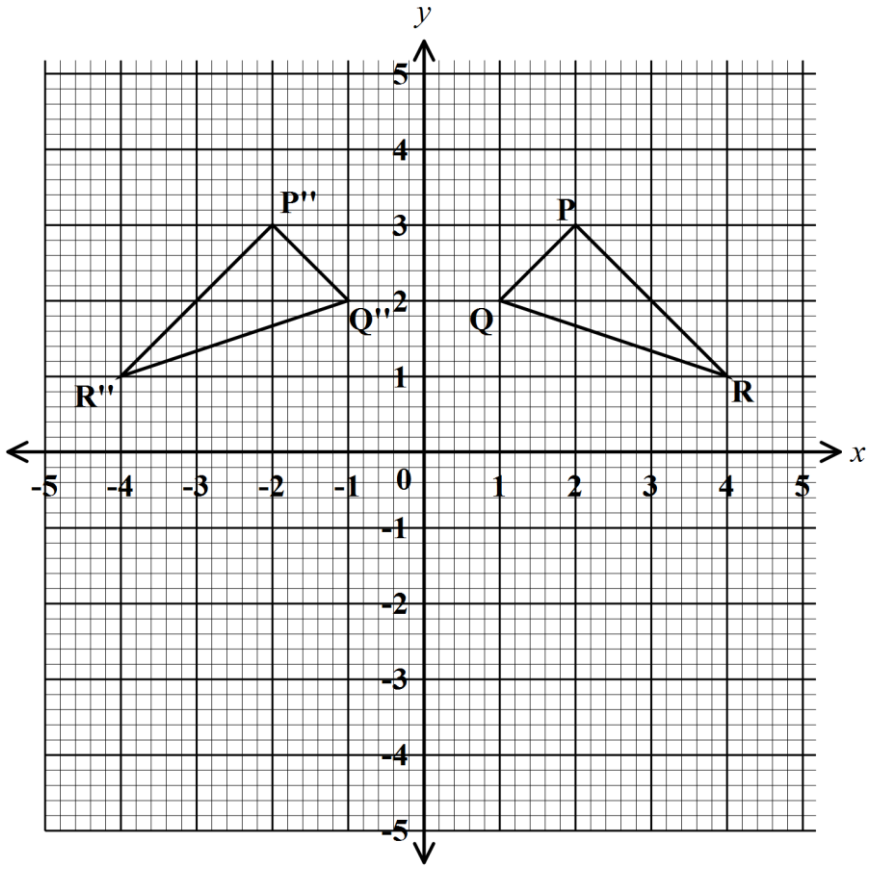
(ii) the acceleration of the bus (2 marks)

(c) A van left Nairobi at 8.30 a.m and travelled towards Mombasa at an average speed of 80 km/h. At 8.30 am a car left Nairobi and travelled along the same road at an average speed of 120 km/h.

(i) Calculate the distance covered by the car to catch up with the van. (4 marks)

(ii) Find the time of the day when the car caught up with van. (1 mark)

22. On the Cartesian plane below, triangle PQR has vertices P(2, 3), Q(1, 2) and R(4, 1) while triangle P''Q''R'' has vertices P''(-2, 3), Q''(-1, 2) and R''(-4, 1).



(a) Describe fully the transformation which maps triangle PQR onto triangle P''Q''R''. (1 mark)

(b) On the same plane, draw triangle P'Q'R', the image of triangle PQR under a reflection in the line $y = -x$ (2 marks)

(c) Describe fully a single transformation which maps triangle P'Q'R' onto triangle P''Q''R'' (2 marks)

(d) Draw triangle P'''Q'''R''' such that it can be mapped onto triangle PQR by a positive quarter turn about (0, 0) (3 marks)

(e) State a pair of triangles that is
i) oppositely congruent (1 mark)

ii) directly congruent (1 mark)

23. The equation of the curve is $y = x^3 - 2x^2 - 1$

(a) Determine

(i) the stationary points (4 marks)

(ii) the nature of the stationary points in (a) (i) above (2 marks)

(b) Determine

(i) the equation of the tangent to the curve at $x = 1$ (2 marks)

(ii) the equation of the normal to the curve at $x = 1$ (2 marks)

24. The boundaries of ranch AB, BC, CD and DA are straight lines such that B is 075^0 from A and a distance of 50 km. C is due east of B and a bearing of $N80^0E$ from A. D is due south of C and a distance of 70 km.

(a) Using a scale of **1 cm** to represent **10 km.** show the relative positions of ABCD. (3 marks)

(b) From the scale drawing, determine

(i) the distance in kilometres between B and C (2 marks)

(ii) the bearing of A from D (2 marks)

(iii) the shortest distance from A to border CD (1 mark)

(c) Calculate the area of the ranch in square kilometer. (2 marks)

PAPER 2
SECTION I

1. Use logarithms to 4 decimal places to evaluate (4 marks)

$$\sqrt[3]{\frac{23.56 \times 0.28^{2}}{4329}}$$

2. Make **s** the subject of the formula (3 marks)

$$d=p\left(\sqrt{\frac{s^2-w^2}{r^2+5^2}}\right)$$

3. Without using tables or calculator, evaluate and simplify (4 marks)

$$\frac{\sin 30^0 + \sin 45^0}{\cos 60^0 - 1}$$

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

5. Given that the values P=8.2 cm, A=4.1cm and B=7.0 cm were measured to 1dp. Find the percentage error in the evaluation of

(3 marks)

$$\frac{K}{A \times B}$$

6. Expand $(1 - \frac{1}{2}x)^{10}$ upto the 4th term in the ascending powers of x. Hence evaluate the value of $(0.95)^{10}$ to 3 decimal places. (3 marks)

7. Two types of coffee grade A and B retails at sh.240 and sh.300 respectively. Mohamed sell a mixture of both grades at shs.303 60, making a profit of 10%. Find the ratio in which he mixed the grades.

(3 marks)

8. 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 the $[x - y]$ is atleast 3.

(3 marks)

9. Two quantities x *and* y are such that y varies partly as the square of x and partly inversely as the square root of x. Given that when $x = 4, y = 40$ and when $x = 1, y = 18$. Find the value of y when $x = 0.25$. (4 marks)

10. In a triangle ABC, AB=7.2 cm, AC=6.8 cm and angle BAC=120^0.

Calculate;

(i) The length of BC to 3s.f (2 marks)

(ii) If a circle passes through the vertices A, B and C. Find the radius of the circle. (2 marks)

11. 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 that year Mr. Mogaka gets a total deduction of ksh5,000 he gets a personal tax relief of kshs.1056 and pays kshs.3944 for NHIF, WCPS and sacco loan repayment. Calculate

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

(ii) Monthly income/salary (3 marks)

12. 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. (3 marks)

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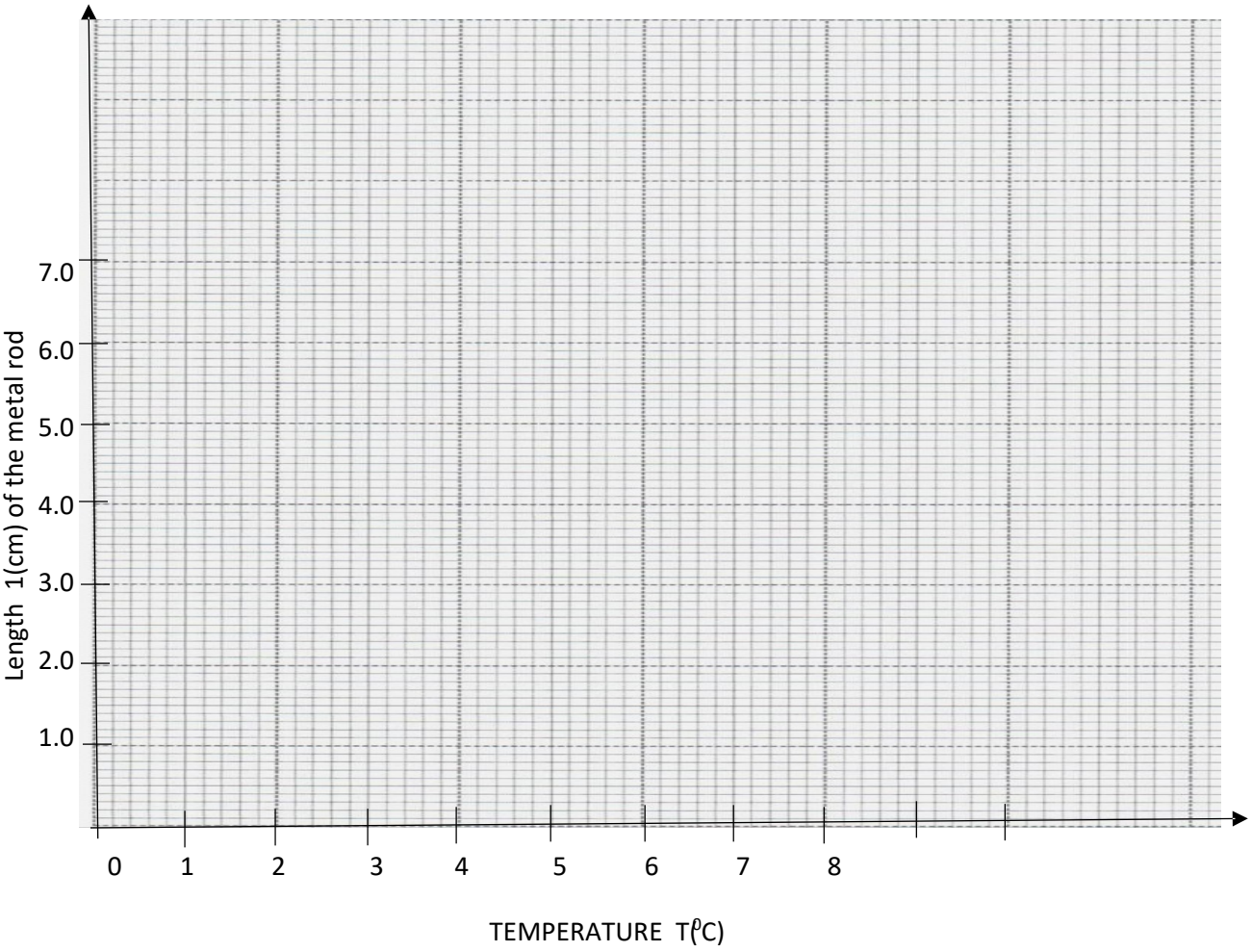
13. The 2nd, 10th and 42nd terms of an A.P forms the first three terms of a geometric progression, if the common differences of the AP=3. Find the sum of the first 10 terms of the G.p. (4 marks)

14. Raw data collected from experimental observation normally have errors. Below is a table of results obtained results from an experiment. The results show how length l(cm) of a metal rod various with increase in temperature T(^{0}c).

T(^{0}C)	0	1	2	3	4	5	6	7	8
L(cm)	4.0	4.3	4.7	4.9	5.0	5.5	5.9	6.0	6.4

Plot the values in the graph given below and draw the line of best fit.

(2 marks)



15. Evaluate the value of x in the following trigonometric equation.

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$\frac{1}{2}\ sin^2 2x = +0.25$ for$-180° \leq x \leq 180°$ (3 marks)

16. The points with co-ordinates A(13,3) and B(-3,-9) are the end of a diameter of a circle centre 0. Determine ;

(i) The coordinates of 0 (1 mark)

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

SECTION II

17. The following are the vertices of a triangle PQR P(1,1), Q(3, 1) and R(1,4)

i) Plot the triangle on the graph given (1 mark)

ii) Triangle PQR was reflected on the line $x = 0$ to give $P^1Q^1R^1$. Draw the triangle on the graph given.

iii) The triangle $P^1Q^1R^1$ was transformed by a matrix $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ to give $P^{11}Q^{11}R^{11}$. On the axes draw the triangle $P^{11}Q^{11}R^{11}$ on the grid. (2 marks)

iv) The triangle $P^{11}Q^{11}R^{11}$ was further transformed into a triangle $P^{111}Q^{111}$ and R^{111} using the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$. Draw the triangle and state its coordinates (3 marks)

v) Calculate the area of the triangle $P^{111}Q^{111}R^{111}$ drawn above. (2 marks)

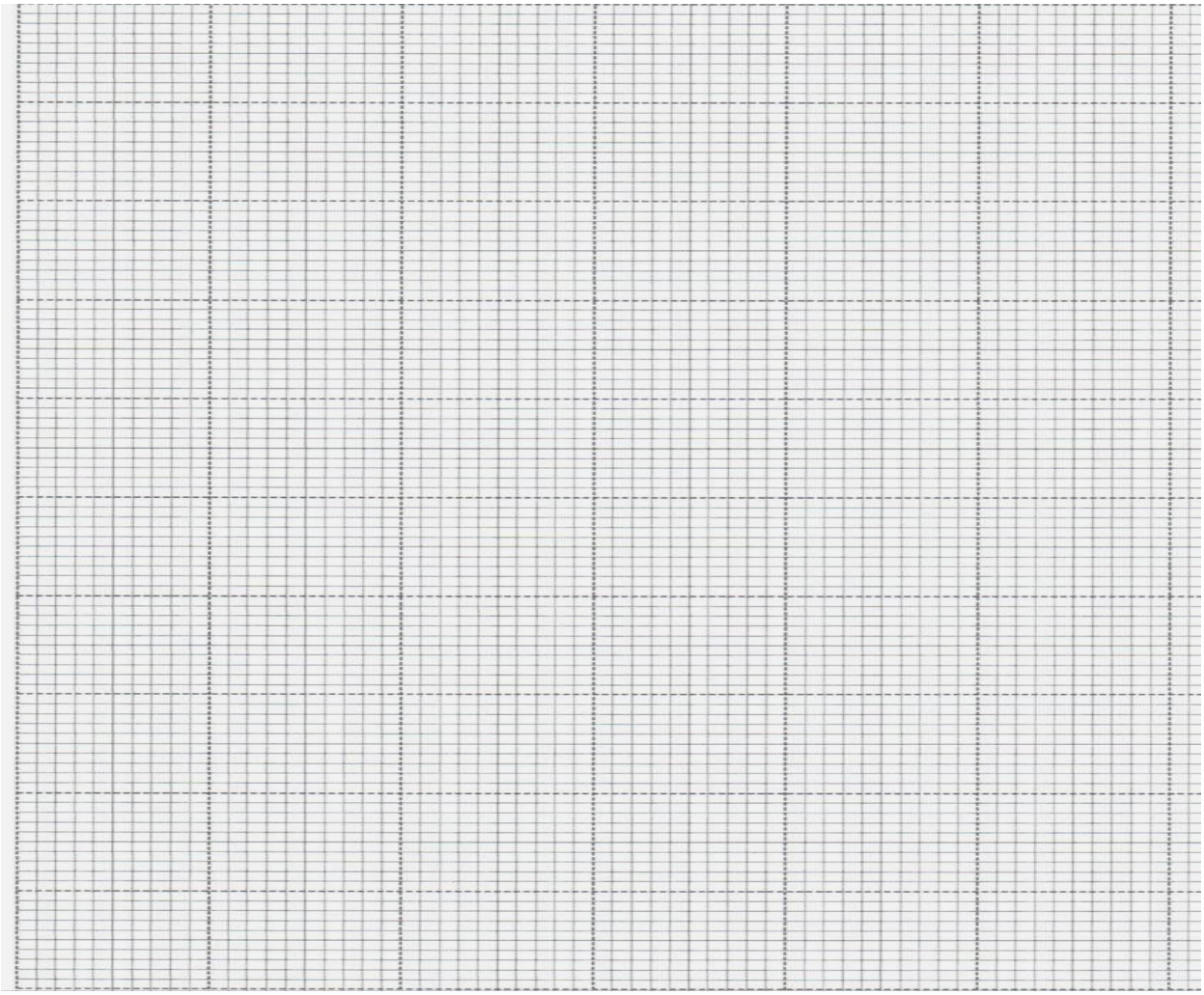
18. The table below shows the number of goals scored in handball

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matches during a tournament

Number of goals	0-10	10-20	20-30	30-40	40-50
Number of matches	2	14	24	12	8

(a) Draw a cumulative frequency curve in the space below. (3 marks)



i) Find the probability of scoring at least 20 goals using your graph.

(2 marks)

(b) Using an assumed mean of 25 calculate the standard deviation.

(3 marks)

(b) Calculate the 6th decile (2 marks)

19. Using a ruler and a pair of compasses only;

i) Construct a triangle ABC such that AB=6cm, BC=8cm and angle ABC=60^0. (2 marks)

ii) On the same side of BC as A construct the locus of **m** such that angle BMC=60^0. (2 marks)

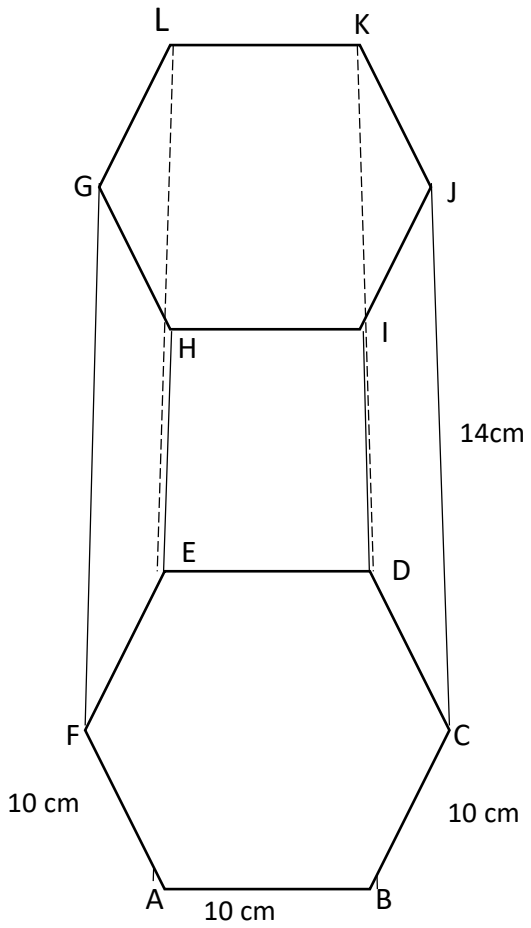
iii) Draw the locus of a point **Q** which is equidistant from B and C. (2 marks)

iv) Draw the locus of a point R such that RC=3cm. (1 mark)

v) Draw the locus of a point P such that the area of triangle BPC=$12cm^2$. (2 marks)

vi) Locate the region by shading such that; (2 marks)
Angle BMC ≥ 60^0, BQ ≥QC, RC<3 and area of BPC> $12cm^2$

20.



A B C D E F G H I J K L is a solid frustum which was cut two thirds way from the base of a regular hexagonal based pyramid of side 10cm. If the slant edge is 14cm. Calculate;

i) Perpendicular height of the pyramid (2 marks)

ii) Find the angle between the surface ABIH and ABCDEF (3 marks)

iii) Calculate the angle between HA and the base ABCDEF (2 marks)

iv) Calculate the angle between LK and BI (2 marks)

21. An Aeroplane moves from point A to D via B and C

(a) Give the position of B if the plane moves due north from A(30°s, 20^{0}W) to B covering a distance of 3600 nm. (2 marks)

(b) Calculate the distance from B to C along the parallel of latitude given that C lies on 50^{0}E. (2 marks)

(c) Calculate the shortest distance from C to D(30^{0}N, 130^{0} W) if the plane moves from C to D. (3 marks)

(d) Given that the plane left A at 0700h and stopped at B for 3 minutes and at C for 45 minutes. Calculate the day and time it will arrive at D. if the speed of the plane was 300knots (3 marks)

22. Complete the table below for the function $y = x^{2} - 3x - 4$ (1 mark)

X	-2	-1.5	-1.0	-0.5	0	0.5	1.0	1.5	2.0	2.5	3.0
y											

(a) Use the table and trapezoidal rule with 11 ordinate to estimate the area bounded by the curve $y = x^{2} - 3x - 4$, $x = -2$, $x = 3$ and $x - axis$ (2 marks)

(b) 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 $x - axis$ (2 marks)

(c) Calculate the exact area above (3 marks)

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

23. A particle moves in such a way that the velocity V at any given time is $v=10t - \frac{1}{2} t^{2} - \frac{15}{2}$ mls.

(a) Calculate the initial velocity (1 mark)

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(b) Calculate the velocity when the time t=3 (2 marks)

(c) Find the displacement during the 5th second (4 marks)

(d) Calculate the maximum velocity attained (3 marks)

24. The ministry of health made an order of both Astrazenica and Johnson and Johnson vaccines for a health centre. The total number of both vaccines should be more than 600 boxes. The number of boxes of Johnson and Johnson should be less than 500 boxes and more or equal to twice the number of Astrazenica. Letting x to represent the number of Johnson and Johnson boxes and y – to represent the number of boxes of Astrazenica.

(a) i) Form all the in equalities in x and y to represent the above information. (3 marks)

ii) Represent the inequalities on a graph (4 marks)

(b) If the cost of importing 1 box of Johnson and Johnson is sh1000 and astrazenica is shs.800. Find maximum cost of importing the vaccines.

(3 marks)

SECTION I (50 Marks)

Answer ALL Questions in this Section

1. Evaluate without using tables or calculator.

$$\sqrt{\frac{0.0625 \times 2.56}{0.25 \times 0.08 \times 0.5}}$$ **(3 Marks)**

2. Simplify $\frac{x+4}{x-4} - \frac{5x+20}{x^2-16}$. **(3 Marks)**

3. Evaluate without using log tables. **(3 Marks)**

$$\frac{\log_{10} 343 - \log_{10} 125}{\log_{10} {}^{7}/_{5}}$$

4. Solve the following inequalities and represent the solution on a single number line. **(3 Marks)**

$-2x + 3 < 5$

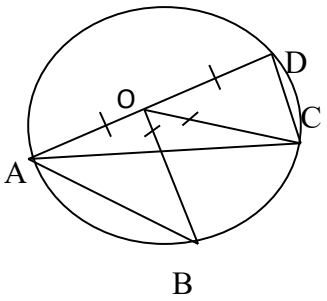
$4 - {}^{3}/_{2}x \geq -8$

5. The scale of a map is 1: 200. Calculate the actual area of a triangular field whose sides are 6cm, 8cm and 10cm on the map. **(4 Marks)**

6. 24 mean each working 10 hours a day take 4 days to complete a piece of work. How many more days will it take 15 men each working 8 hours a day to complete the same piece of work. **(3 Marks)**

7. Find the value of x in $(1/2)^x \times (1/8)^{1-x} = 32$. **(3 Marks)**

8. The figure below shows a circle ABCD, centre O. BO is perpendicular to the diameter AOD and ∠COD = 42°.



Calculate:

a) ∠CAD **(2 Marks)**

b) ∠BAC **(2 Marks)**

9. Given that $\sin x = {}^{2}/_{3}$, find without using tables.

$tan\ x$ **(2 Marks)**

10. A three digit number is such that twice the hundreds digit is more than the tens digit by 2. The units digit is thrice the hundreds digit. When the digits are reversed, the number is increased by 594. Find the number.

(4 Marks)

11. If $2m + 3n : 5m - n = 3 : 2$, calculate the ratio m : n. **(3 Marks)**

12. A dealer sells a car battery to a customer at a profit of 22%. The customer sells it to a friend for Sh.4800, at a profit of 8%. Find: -

a) How much it cost the dealer to buy the battery. **(2 Marks)**

b) How much it cost the dealer to buy the battery. **(2 Marks)**

13. Given vectors $\underset{\sim}{PQ} = \begin{pmatrix} 2 \\ 3 \\ 5 \end{pmatrix}$ and $\underset{\sim}{RS} = \begin{pmatrix} 6 \\ a-1 \\ 15 \end{pmatrix}$ are parallel, find the value of a, hence calculate $\left|\underset{\sim}{RS}\right|$.

(3 Marks)

14. Find the greatest common factor of x^3y^2 and $4xy^4$. Hence factorise completely the expression $x^3y^2 - 4xy^4$. **(3 Marks)**

15. Express 2.4545……. in the form $^p/_q$ where p and q are integers and $q \neq 0$. **(3 Marks)**

16. Given that $a = 2.5$ and $b = 6.15$, find the percentage error in $b - a$. **(3 Marks)**

SECTION II (50 Marks)

Answer any FIVE Questions in this Section.

17. Towns A and B are 580km apart. A matatu started from town A and travelled towards town B at an average speed of 90km/h at 7.30 a.m. One and a half hours later a car travelled from town B towards town A at an average speed of 120km/h.

a)

i) At what time did the two vehicles meet? **(2 Marks)**

ii) How far from B did the two vehicles meet? **(2 Marks)**

b) If the matatu took a total of 30 minutes to drop and pick travellers along the way, calculate the time it arrived at town B. **(2 Marks)**

c) A rally driver starts from B towards A at 10.00 a.m. at an average speed of 180km/h.

i) At what time did the rally driver overtake the car? **(2 Marks)**

ii) How far from A did the rally driver overtake the car? **(2 Marks)**

18. The figure below shows marks obtained by 60 students in a test.

Marks	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of pupils	2	2	3	8	23	13	6	2	1

a) Calculate the mean mark. **(3 Marks)**

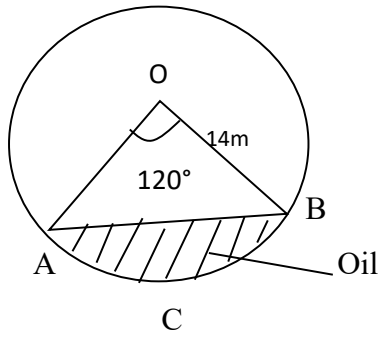
b) Calculate the median. **(3 Marks)**

c) State the modal class. **(1 Mark)**

d) Represent the information on a histogram. **(3 Marks)**

19. The figure shows the cross-section of a cylindrical tank containing some oil and lying horizontally. The tank is 4m long.

O is the centre of the circle, radius 14m. ∠AOB=120°.



Calculate:

i) The length of chord AB. **(2 Marks)**

ii) The area of segment ABC. **(3 Marks)**

iii) The volume of oil in the tank. **(2 Marks)**

iv) The area of the tank in contact with the oil. **(3 Marks)**

20. Given that $y = x^2 + 3x - 5$, complete the following table and use it to answer the questions that follow.

(2 marks)

X	-6	-5	-4	-3	-2	-1	0	1	2	3
Y										

a) Using a scale of 1cm to represent 1 unit on both axes plot the graph of $y = x^2 + 3x - 5$.

(3 Marks)

b) On the same grid draw the line $y = 2 - x$. **(3 Marks)**

c) Use your graph to estimate the roots of the equation. **(2 Marks)**

$$x^2 + 4x - 7 = 0$$

d) Give the least value of y for the curve $y = x^2 + 3x - 5$. **(1 Mark)**

e) Give the range of values of x for which $x^2 + 3x - 5$ is less than or equal to $2 - x$.

(1 Mark)

21. The vertices of a triangle are at $(3,1)$, $B\ (5,3)$ and $C\ (5,0)$. Under a rotation R, the images of A and B are $A'(0,0)$ and $B'(-2,2)$ respectively.

i) Draw the two triangles on the Cartesian plane. **(2 Marks)**

ii) Find the centre and angle of rotation **(2 marks)**

iii) State the coordinates of C' the image of C. **(1 mark)**

iv) Triangle $A'B'C'$ is reflected in the line $y = -2$ to get $A^2B^2C^2$. Draw triangle $A^2B^2C^2$. State the coordinates of $A^2B^2C^2$. **(2 marks)**

v) $\Delta A^3B^3C^3$ is the image of $\Delta A^2B^2C^2$ under an enlargement centre (0, -5) and scale factor = 2. Draw $\Delta A^3B^3C^3$ and state its coordinates. **(3 marks)**

22. Three straight lines L_1, L_2 and L_3 are such that;

L_1 cuts the y-axis at $y = 5$ and has a gradient of 2.

L_2 is perpendicular to L_1 at the point where L_1 cuts the x-axis.

L_3 is parallel to L_2 and passes through the point (1, 2).

a) Find the equations in the form $y = mx + c$ of

i) L_1 **(2 Marks)**

ii) L_2 **(2 Marks)**

iii) L_3 **(2 Marks)**

b) Determine the coordinates of the point at which L_3 is perpendicular to L_1. **(3 Marks)**

23. Use a ruler and a pair of compasses only to construct a triangle ABC with AB = 3.8 cm, BC = 4.2 cm and ∠ABC=75°. **(2 marks)**

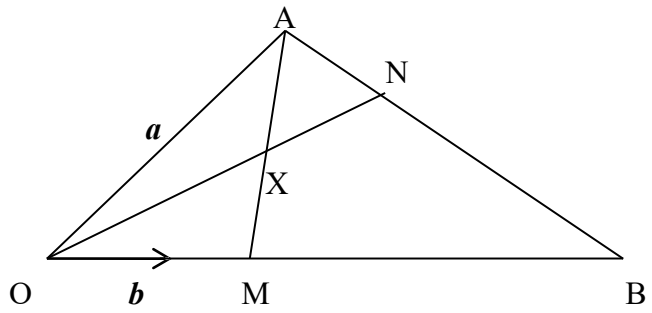
a) Measure AC. **(1 Mark)**

b) Drop a perpendicular from B to meet AC at N. Measure BN and AN. **(2 Marks)**

c) Calculate the area of ΔABN. **(2 Marks)**

d) Construct a perpendicular bisector of AB and BC to meet at O. Use OA as the radius to draw a circle. Find the area of the circle. **(3 Marks)**

24. In the figure below AN = ¼ AB and OM = $^2/_3$ OB. **OA = a** and **OB = b**. The lines AM and ON intersect at point X.



a) Express in terms of a and b.

i) ON

ii) AM

iii) AN

iv) AB

v) MB

PAPER 2

SECTION I (50 Marks)

Answer ALL Questions in this Section

1. Use logarithm tables to evaluate. **(4 Marks)**

$$\frac{32.95}{\sqrt{5.25 \times 0.069}}$$

2. A two digit number is such that the sum of its digits is 9. If the digits are reversed the new number formed exceeds the original number by 9. Find the number. **(3 Marks)**

3. The perimeter of a triangular field is 120m. Two of the sides are 21m and 40m. Calculate the largest angle of the field. **(3 Marks)**

4. Solve for x in the logarithmic equation.

$$\log_{10}(3x+4) - \log_{10}(3-x) = 1$$ **(3 Marks)**

5. Given that $\underset{\sim}{x} = 2\underset{\sim}{i} - 3\underset{\sim}{j} + \underset{\sim}{k}$, $\underset{\sim}{y} = 3\underset{\sim}{i} - 4 - \underset{\sim}{k}$, and $\underset{\sim}{z} = \underset{\sim}{j} + \underset{\sim}{k}$ and that $\underset{\sim}{OR} = 3\underset{\sim}{x} - \underset{\sim}{y} + \underset{\sim}{z}$.

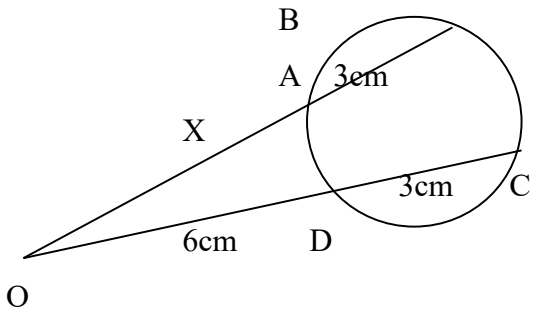
Find the magnitude of vector **OR** correct to 3 significant figures. **(3 Marks)**

6. Make x the subject of the equation.

$$3y = y + \frac{P}{q+\frac{1}{x}}$$ **(3 Marks)**

7. Two letters are selected from the word ECONOMICS, find the probability that the letters are a constant and a vowel in that order. **(2 Marks)**

8. In the circle below, $OA = xcm, AB = 3cm, OD = 6cm$ and $DC = 3cm$.



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

9. Simplify and leave your answer in surd form. **(3 Marks)**

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

10. Omolo bought a new car for Ksh.800, 000. After 5 years he sold it through a second hand car dealer. The dealer charged a commission of 4% for the sale of the car. If Omolo received Ksh.480, 000, calculate the annual rate of depreciation of the car. **(3 Marks)**

11. Expand $(1+3x)^6$ upto the fourth term, hence evaluate $(1.3)^6$ to 2 significant figures.

(4 Marks)

12. A trader has 3 grades of tea P, Q and R. Grade P costs Shs.140 per kg, grade Q costs Shs.160 per kg and grade R costs sh.256 per kg. The trader mixes grade P and grade Q in the ratio 5:3 to make a brand of tea which he sells at Shs.180 per kg. Calculate the percentage profit he makes. **(3 Marks)**

13. Each interior angle of a regular polygon of n sides exceeds each exterior angle of regular polygon of $3n$ sides by 8^0. Find the value of n. **(3 Marks)**

14. A quantity P is partly constant and partly varies as the square root of Q.

i) Using constants k and m, write down an equation connecting P and Q. **(1 Mark)**

ii) If Q = 25 when P = 20 and Q = 49, when Q = 30; find the values of k and m. **(2 Marks)**

15. Use matrix method to find the point of intersection of lines $5x - 1 = 7y$ and $2 - 5y = 4x$. **(3 Marks)**

16. The equation of a circle centre (a, b) is $2x^2 + 2y^2 - 12x - 20y + 60 = 0$. Find the value of a and b. **(3 Marks)**

SECTION II (50 Marks)

Answer any FIVE Questions in this Section.

17. A church has a sitting capacity of 468 people with the members sitting in rows which have 3 long benches and 2 short ones. The long bench takes 2 people more than the short bench. Let the number of people sitting on the short bench be x.

a) Form an expression in x for the number of rows of benches. **(2 Marks)**

b) A new pastor finds this arrangement crowded and decides that by having one more person on each long bench, he can take out some rows and still sit the same number of people. Find an expression in x for the new number of rows of benches. **(2 Marks)**

c) If one row of benches was taken out, find the original number of people per row. **(6 Marks)**

18. A form three class has 32 students. They are distributed between four houses as follows: -

House	**Boys**	**Girls**
Chania	6	2
Athi	3	3
Tana	4	6
Mara	5	3

Two students are selected at random from the class. Find the probability that both students will be: -

a) From Chania **(3 Marks)**

b) Girls **(2 Marks)**

c) Boys of Tana House **(2 Marks)**

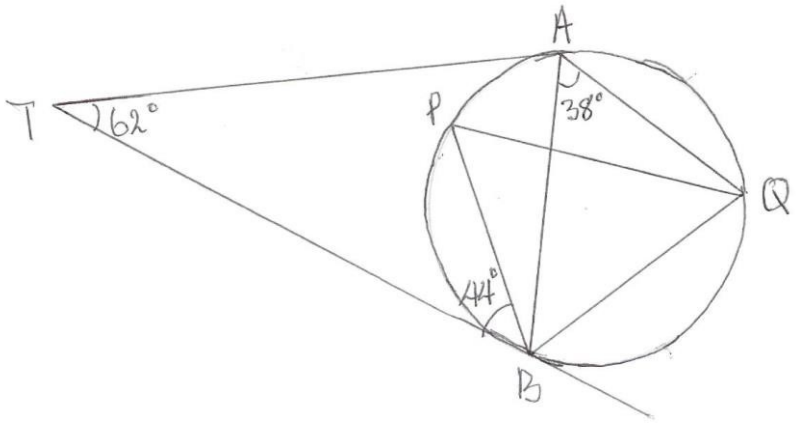
d) Either boys or from Mara House **(3 Marks)**

19. A tank is filled by tap A in 16 minutes. Tap B can empty the same tank in 24 minutes. Starting with an empty tank, both taps are turned on for 8 minutes and then tap B is turned off. Find: -

a) The time taken to fill the tank. **(6 Marks)**

b) The capacity of the tank if A delivered 18400 litres. **(4 Marks)**

20. In the diagram below TA and TB are tangents to the circle at A and B respectively. TBR is a straight line. The straight lines AB and QP intersect at K. ∠QAB=38°, ∠PBT=44° and ∠ATB=62°.



Calculate:

i) ∠PAB **(1 Mark)**

ii) ∠PBA **(2Marks)**

iii) ∠ABQ **(2 Marks)**

iv) ∠AKP **(3 Marks)**

v) If AK=KB=3cm and KQ=2cm, calculate the length QP. **(3 Marks)**

21. The data collected from an experiment involving two variables X and Y was recorded as shown 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 **(2 Marks)**

b) By drawing a suitable straight line graph, estimate the value of a and b. **(6 Marks)**

c) Write down the relationship connecting y and x **(2 Marks)**

22. The table below shows income tax rates for the year 2011.

Taxable Income (Sh. p.a.)	Tax Rate (%)
1 – 121 968	10
121 696 – 236 880	15
236 881 – 351 792	20
351 793 – 466 704	25
Above 466704	30

In the year 2011, Ole Sayeye's monthly earnings were as follows: -

Basic salary	Sh.42,800
House allowance	Sh.15,000
Medical allowance	Sh.2,880
Transport allowance	Sh.2,664
Hardship allowance	30% of Basic salary

Mr. Ole Sayeye was entitled to a monthly tax relief of Sh.1,162. Calulate: -

a) His annual taxable income. **(2 Marks)**

b) The monthly tax paid by Ole Sayeye. **(5 Marks)**

c) Ole Sayeye got a salary increment equal to 50% of the year 2011 allowances. Calculate the percentage increase in the tax paid. **(3 Marks)**

23. a) The first term of an arithmetic progression (AP) is 2. The sum of the first 8 terms of the AP is 156.

i) Find the common difference of the AP. **(2 Marks)**

ii) Given that the sum of the first n terms of the AP is 416, find n. **(4 Marks)**

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

The 1st term of the G.P. **(4 Marks)**

24. a) The weight of a metal rod varies jointly as the square of its length and inversely as the square root of its radius. Given that the length of the metal rod was increased by 5% and the radius decreased by 36%, what was the percentage change in weight. **(6 Marks)**

b) If the weight of the metal rod is 6N when the length is 12cm and radius 25cm, find the weight of the metal rod when the length is 15cm and radius 81cm. **(4 Marks)**

SERIES 34
PAPE 1

SECTION I (50 MKS) **Answer all the questions in this section in the spaces provided.**

1. Evaluate without using tables or a calculator the value of $\frac{1.33\times0.15}{0.19\times0.0017}$ **(3marks)**

2. When a certain number is divided by 48, 72 or 100 the remainder is 3 in each case. Find the number. **(3marks)**

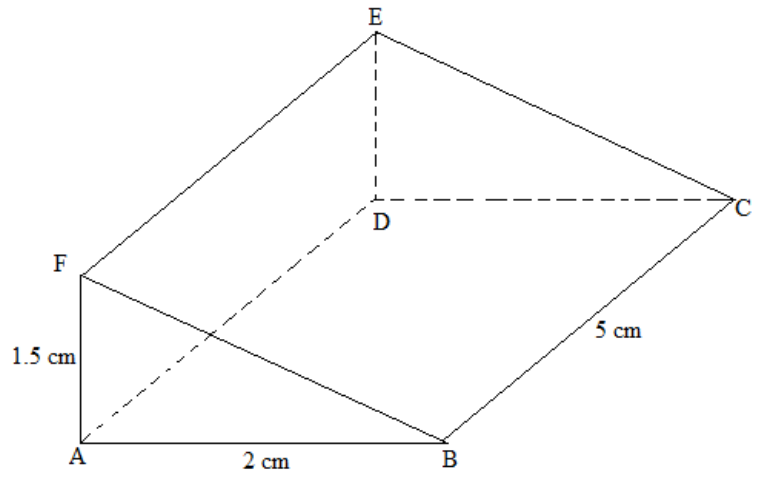
3. Using logarithm table evaluate $\sqrt[3]{\frac{849.6\times2.41}{3941}}$. **(4marks)**

4. A 890kg culvert is made of a hollow cylindrical material with outer radius of 76cm and an inner radius of 62cm. It crosses a road of width 3m. Determine the density of the material used in its construction in Kg/m^3 correct to one decimal place. **(3marks)**

5. Evaluate the value of x in $81^{x+1} + 3^{4x} = 246$. **(3marks)**

6. Simplify the equation $\frac{4x^2-9}{2x^2+5x+3}$. **(3marks)**

7. The diagram below represents a prism whose Cross-section is a right-angled triangle. Draw the net of the solid. **(3marks)**



8. During an annual general meeting at Elimu Mixed Day, goats and chicken were slaughtered. The number of heads for both chicken and goats were 45. The total number of legs were 100. Determine the exact number of goats and chicken slaughtered. **(3marks)**

9. In a mixed school there are 900 students, out of these 600 are girls.
   (a) Find the ratio of boys to girls. **(2marks)**

   (b) What is the percentage of boys in this school? **(1mark)**

10. Find the value of t in the equation $\frac{t-1}{3} - \frac{4+t}{4} = 0.$ **(3marks)**

11. The sum of interior angles of a polygon is 1980^0. Find the number of sides of the polygon and name the polygon. **(3marks)**

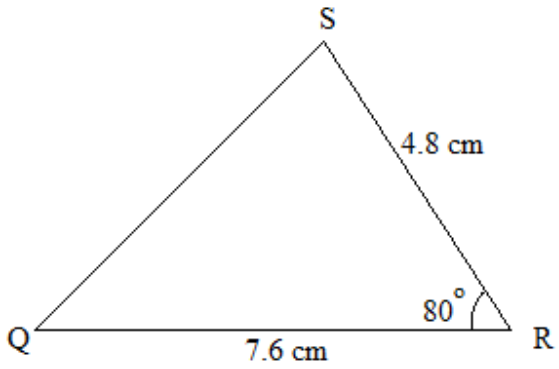
12. Solve the following inequalities and represent the solution on a single number line. **(3mks)**

3-2x<5

4-3x≥-8

13. Line K whose equation is $2y - 6 = 4x$ is perpendicular to another line Q. Find the equation of line Q if it passes through point. (-2, 7). **(3marks)**

14. The figure below is not drawn to scale.



Find correct to 1 decimal place;

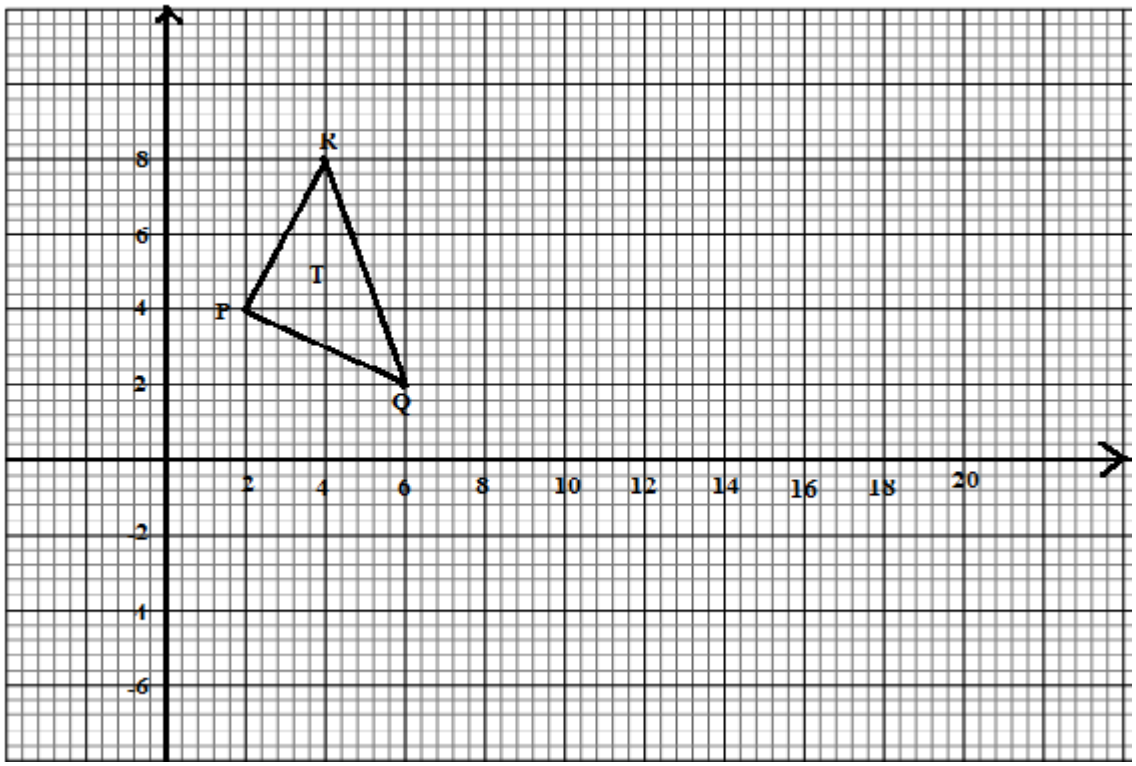
(a) Length PQ. **(2 marks)**

(b) Angle ABC **(2 marks)**

15. The marked price of a car ina dealers shop was Ksh.450 000. Kawira bought the car at 7% discount. The dealer still made a profit of 13%. Calculate the amount of money the dealer had paid for the car to the nearest shillings. **(3marks)**

16. The figure below shows triangle T with vertices P(2,4), Q(6,2) and R(4,8). It is mapped onto triangle $T^{/}$ with vertices $P^{/}(10,0)$, $Q^{/}(8,-4)$ and $R^{/}(14, -2)$ by a rotation.

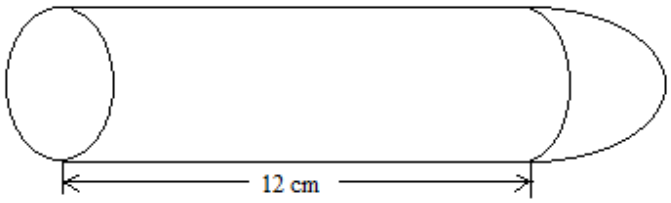
(a) Draw on the same axis $T^{/}$ the image of triangle T. **(1 mark)**



(b) Determine the center and angle of rotation. (2marks)

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

17. The diagram below shows a solid made of a hemisphere and a cylinder. The radius of both the cylinder and the hemisphere is 3cm. The length of the cylinder is 12cm.



a) i) Calculate the volume of the solid. **(3marks)**

ii) The solid fits in a box in the shape of a cuboid 15 cm by 6cmby 6cm. Calculate thevolume of the box not occupied by the solid correct to four significant figures. **(2marks)**

b) i) Calculate the total surface area of the solid correct to four significant figures. **(3marks)**

ii) The surface of the solid is to be painted. One millilitre of paint covers an area of $8cm^2$.The cost of paint is Ksh 900 per litre. Calculate the cost of the paint required. **(2marks)**

18. An expedition has 5 sections AB, BC, CD, DE and EA. B is 200m on a bearing of 050 ^{0} from A. C is 500m from B. The bearing of B from C is 300 ^{0}. D is 400m on a bearing 230 ^{0} from C. E is 250m on a bearing 025^0 from D.

(a) Sketch the route **(1 Mark)**

(b) Use the scale of 1cm to 50m to draw the accurate diagram representing the route. **(5 Marks)**

(c) Use your diagram to determine

(i) Distance in metres of A from E **(2 Marks)**

(ii) Bearing of E from A **(2 Marks)**

19. A trader bought 2 cows and 9 goats for a total of Ksh. 98,200. If she had bought 3 cows and 4 goats, she would have spent Ksh. 2, 200 less.

(a) Form two equations to represents the above information. **(2marks)**

(b) Use the matrix method to determine the cost of a cow and that of a goat. **(4marks)**

(c) The trader later sold the animals she had bought making a profit of 30% per cow and 40% per goats.

i) Calculate the total amount of money she received. **(2marks)**

ii) Determine corrects to 4 significant figures the percentage profit the trader made from the sale of animals. **(2marks)**

20. Two towns, Meru and Maua are 80km a part, Kimathi started cycling from Meru to Maua at 10:00 30a.m at an average speed of 40km/h. Mutuma started his journey from Maua to Meru at 10:30 a.m and travelled by car at an average speed of 60km/h.

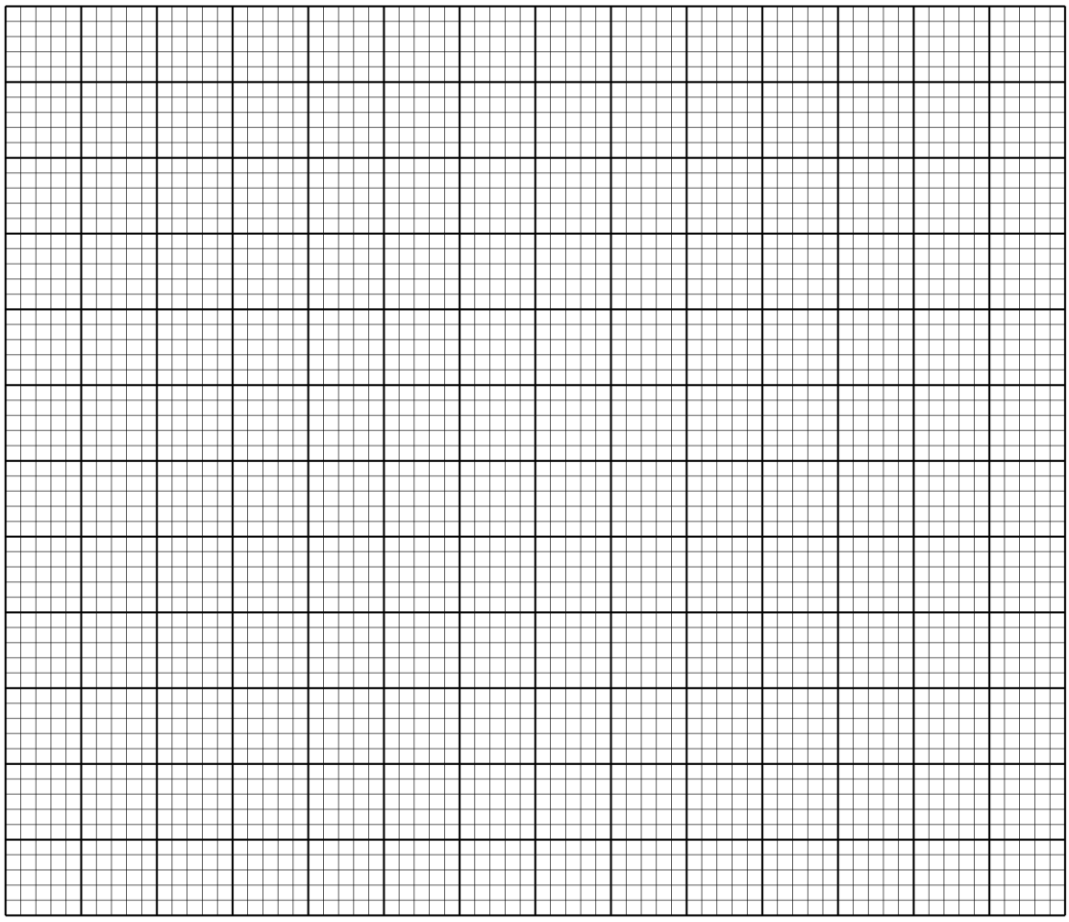
(a) Calculate:

i) The time taken by Kimathi and Mutuma to meet. **(3marks)**

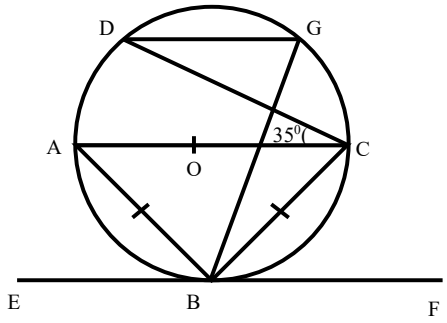
ii) The distance from Meru when Kimathi and Mutuma met. **(2marks)**

iii) The time of the day when the two met. **(2marks)**

(b) Murianki cycled from his home to a school 6km away in 20minutes. He stopped at the school for 5 minutes, before taking a motorbike to a town 40 km away. The motorbike travelled at 75km/h. On the grid provided, draw a distance time graph to represent Murianki's journey. **(3marks)**



21. In the figure below AOC is a diameter of the circle centre O; AB = BC and $\angle ACD = 35^0$. EBF is a tangent to the circle at B. G is a point on the minor arc CD.



Giving reason

(a) Calculate the size of

(i) $\angle BAD$ **(3 Marks)**

(ii) The obtuse $\angle BOD$ **(2 Marks)**

(iii) $\angle BGD$ **(2 Marks)**

(b) Show that $\angle ABE = \angle CBF$ **(3 Marks)**

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

(b). The length of a floor of a rectangular hall is 9m more than its width. The area of the floor is $36m^2$.

(i). Calculate the perimeter of the floor. **(4 marks)**

(ii). A rectangular carpet is placed on the floor of the hall leaving an area of $28m^2$. If the length of the carpet is twice its width, determine the width of the carpet. **(2 marks)**

23. Using a pair of compass and ruler only construct.

(a) Triangle PQR in which PQ =5cm$\angle$QPR = 30^0 and $\angle$PQR=105^0. **(3marks)**

(b) A circle that passes through the vertices of the triangle PQR. Measure its radius. **(3marks)**

(c) The height of triangles PQR with PQ as the base. Measure the height. **(2marks)**

(d) Determine the area of the circle that has outsides the triangle correct to 2 decimal places. **(2marks)**

24. (a). The equation of a line L_1 is $7y - 5x - 20 = 0 \cdot$ Find the x-intercept of the equation **(1mark)**

b). Another line L_2 is perpendicular to L_1 and passes through (-5, 3). Find the equation of L_2. **(3marks)**

c). L_3 passes through (0,-3) and parallel to the line L_4 whose equation is $3y - 8x = 3$ find the equation of L_3. **(3marks)**

d). Calculate the coordinates of point of intersection between the lines L_1 and L_3. **(3marks)**

PAPER 2 SECTION I (50 MKS)

SECTION I (50 MARKS)Answer ALL questions in this section.

1. Make y the subject of the formula : $v = \frac{A\sqrt{x^2 + y^2}}{y}$ (3 marks)

2. Solve for x in the equation: $Log_8(6-2x) - Log_8(x-2) = {}^{-1}/_{3}$ (3 marks)

3. Three quantities *P*, *Q* and *R* are such that *P* varies directly as the cube of *Q* and inversely as the square root of $\boldsymbol{R}$. Find the percentage change in *P* if *Q* decreases by 10% and *R* decreases to 36%.

(3 marks)

4. A circle with its Centre at O (-2, 0) passes through a point (1, 4). Write down the equation of the circle in the form $x^2 + y^2 + ax + by + c = 0$ (3 marks)

5. Express: $\frac{COS\ 30^0}{\tan 45^0+\sqrt{3}}$ in surd form and simplify by rationalizing the denominator

(3 marks)

6. In a transformation, an object with area 9cm² is mapped onto an image whose area is 54cm². Given that the matrix of transformation is $\begin{pmatrix} x & x-1 \\ 2 & 4 \end{pmatrix}$ Find the value of X

(3 marks)

7 a) Find the binomial expansion of $(1+\frac{1}{2x})^7$ up to the 4th term with increasing powers of x. (2 marks)

b) Hence estimate the value of $(1.05)^7$ correct to 4 decimal places. **(2 marks)**

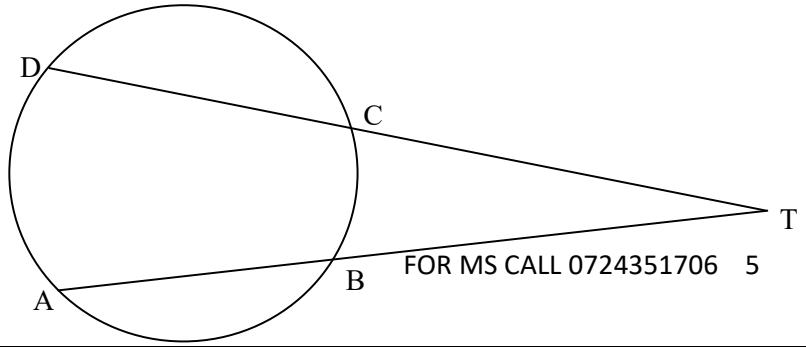
8. A computer with a marked price of Kshs. 40000 can also be bought on hire purchase terms. Kibet bough the computer on hire purchase by making a deposit of Ksh 10000 and cleared the balance with equal 12 monthly installments of KShs. 3500 each. Determine the monthly interest rate of hire purchase to 2 significant figures. **(3 marks)**

9. A dealer blends Kericho tea that costs sh 300 per 100g packet with Ketepa that costs ksh 160 per 200g packet. In what ratio must the dealer mix the two so that by selling a 100g packet of the blend for ksh 250, a profit of 25% is made? (4 marks)
10. Solve for x in the equation: $Sin\ 2\theta = -0.5$ for $0^0 \leq \theta \leq 360^0$ (3 marks)

11. Use completing of the square method to solve: $2x^2 - 6x + 4 = 0$ (3 marks)

12. A carpenter wishes to cut a 1m long piece of wood into 3 equal parts. He approximates the length of each piece to 0.33m. Calculate the percentage error due to this approximation (3 marks)

13. Calculate length DT in the figure below given AT and DT are secants that intersect at T and AB = 5 cm, BT = 4 cm and DC = 9 cm. (3 marks)



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14. An arc of a circle of diameter 7 cm subtends an angle of 1.2 radians to the Centre of the circle. What is the length of the arc? (2 marks)

15. Given matrix $A = \begin{pmatrix} x - 2x & x - 4 \\ x & 2 \end{pmatrix}$. Find the possible values of x if A is a singular matrix.

(3 marks)

16. Working together two taps A and B can fill a tank in 2 hours. By itself tap A can fill the tank in 6 hrs. Tap A and B are opened at the same time and after running for 1 hour, an outlet taps which can drain the full tank by itself in 12 hours is opened and Tap A is closed. Find the total time taken to fill the tank. (4 marks)

SECTION II – 50 MARKS Answer only FIVE questions from this section.

17. In a form 4 class there are 24 girls and 30 boys. The probability that a girl participates in games is 0.4 whereas that of a boy is 0.6.

a) A student is picked at random from the class. Find the probability that the student picked:

i) Is a boy and will participate in games (2 marks)

ii) Will not participate in games (2 marks)

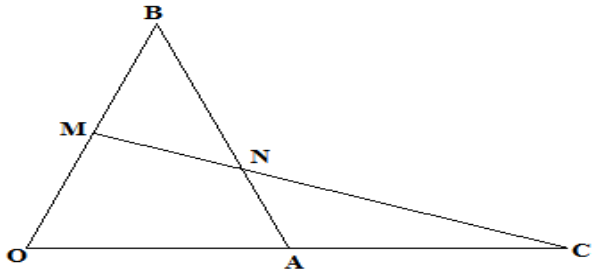
b) Two similar bags A and B are such that, bag A contains 3 blue balls and 7 red balls while bag B contains 4 green balls and 8 blue balls. The balls are similar in shape and size. A ball is drawn from bag A and bag B. Determine the probability that:

i) One of the balls drawn is green. (2 marks)

ii) The balls drawn are of the same colour. (2 marks)

iii) None of the balls drawn is red (2 marks)

18. In the triangle OAB below, $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$ and $3\mathbf{OA} = 2\mathbf{OC}$. M divided **OB** in the ratio 1:1 .



a) Express in terms of **a** and **b** only, the vectors

i) **BA** (1 mark)

ii) **OC** (1 mark)

iii) **MC** (1 mark)

b) Given further that **MN** = h**MC** and BN = k**BA**,

i) Express vector **MN** in two different ways in terms of **a**, **b**, h and k (2 marks)

ii) Find the value of h and k. (4 marks)

c) State the ratio **MN:MC** (1 mark)

19. A group of people planned to contribute equally towards buying a plot valued at Ksh. 270,000. After the contribution, 2 members joined of the group. As a result, a refund of Ksh 1500 was made to the members who had already contributed.

a) Let the original number of people be x, express in terms of x:

i) The original contribution (1 mark)

ii) The new contribution (1 mark)

b) Find how much each member contributed finally (5 marks)

c) Calculate the percentage decrease in the contribution per person caused by the members who joined. (3 marks)

20. The table shows income tax rates for a certain year.

Monthly taxable pay K£	Rate of tax in Ksh. Per K£
1- 434	2
435 - 866	3
867- 1298	4
1299 - 1730	5
Over 1730	6

A company employee earns a monthly basic salary and is also given taxable allowances amounting to Ksh 10480. If the employees' tax on the 5th band is Ksh 3420,

a) Calculate the employee's monthly taxable income tax in K£. (2 marks)

b) The employee is entitled to a personal tax relief of Ksh. 1056 per month. Determine the net tax. (4 marks)

c) In a certain month, the employee received a 25% increment in his basic salary. Calculate his net monthly pay. (4 marks)

21.(a) In a geometrical progression the sum of the second and third terms is 12 and the sum of the third and fourth terms is -36. Find the first term and the common ratio. **(4 marks)**

(b) In an arithmetic progression the 12th term is 25 and the 7th term is three times the second term, find;

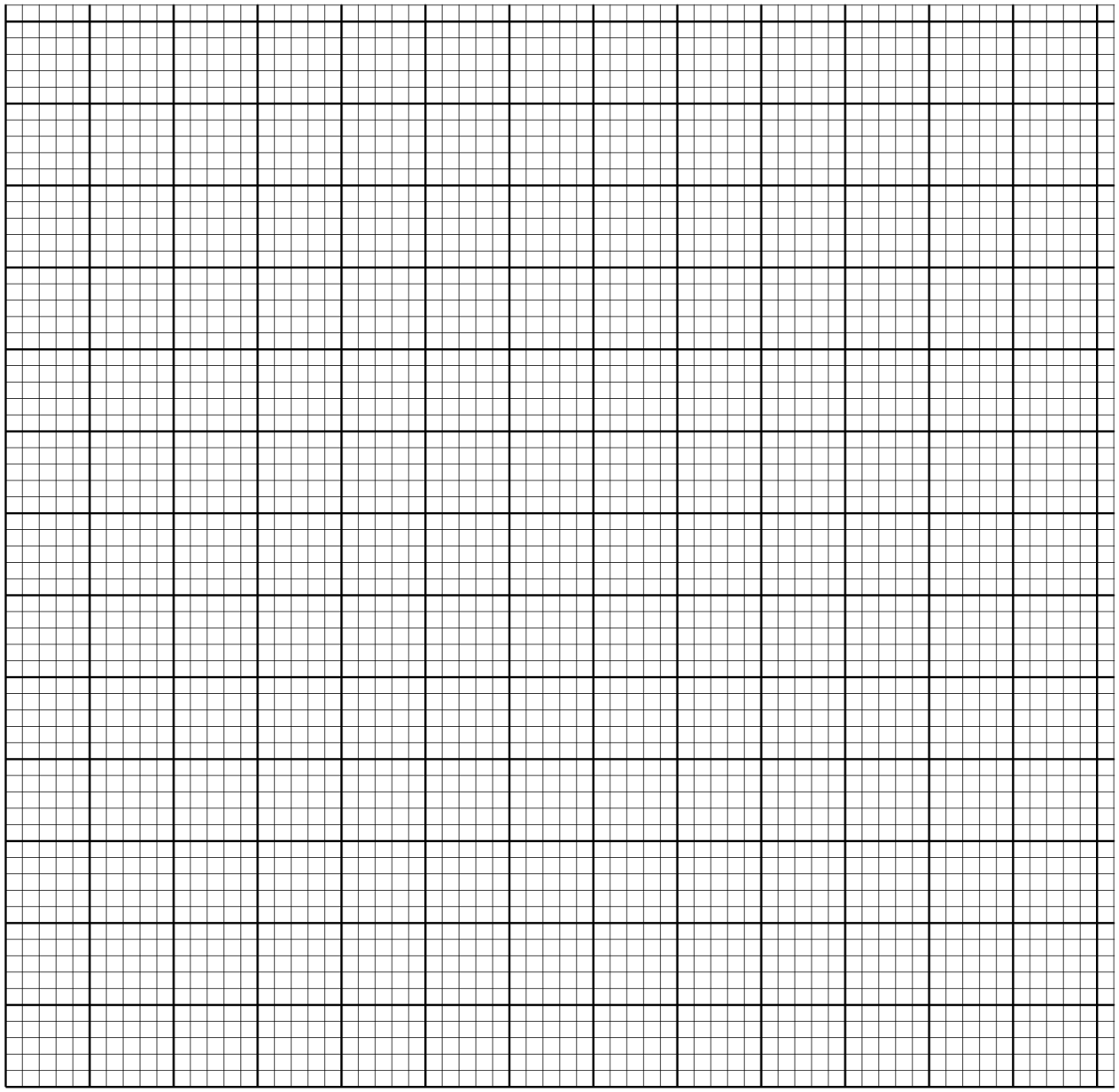
i) The first term and the common difference **(4 marks)**

iii) The sum of the first 10 terms of the arithmetic progression. (2 marks)

22 a). The table below shows the frequency distribution of marks scored by students in a test.

Marks	1-10	11-20	21-30	31-40	41-50
Frequency	2	4	8	4	2

On the grid provided, draw a cumulative frequency curve for the data. *(3 marks)*



b).

Use your graph to determine;

(i). The pass mark if only 6 students passed the exam. *(2 marks)*

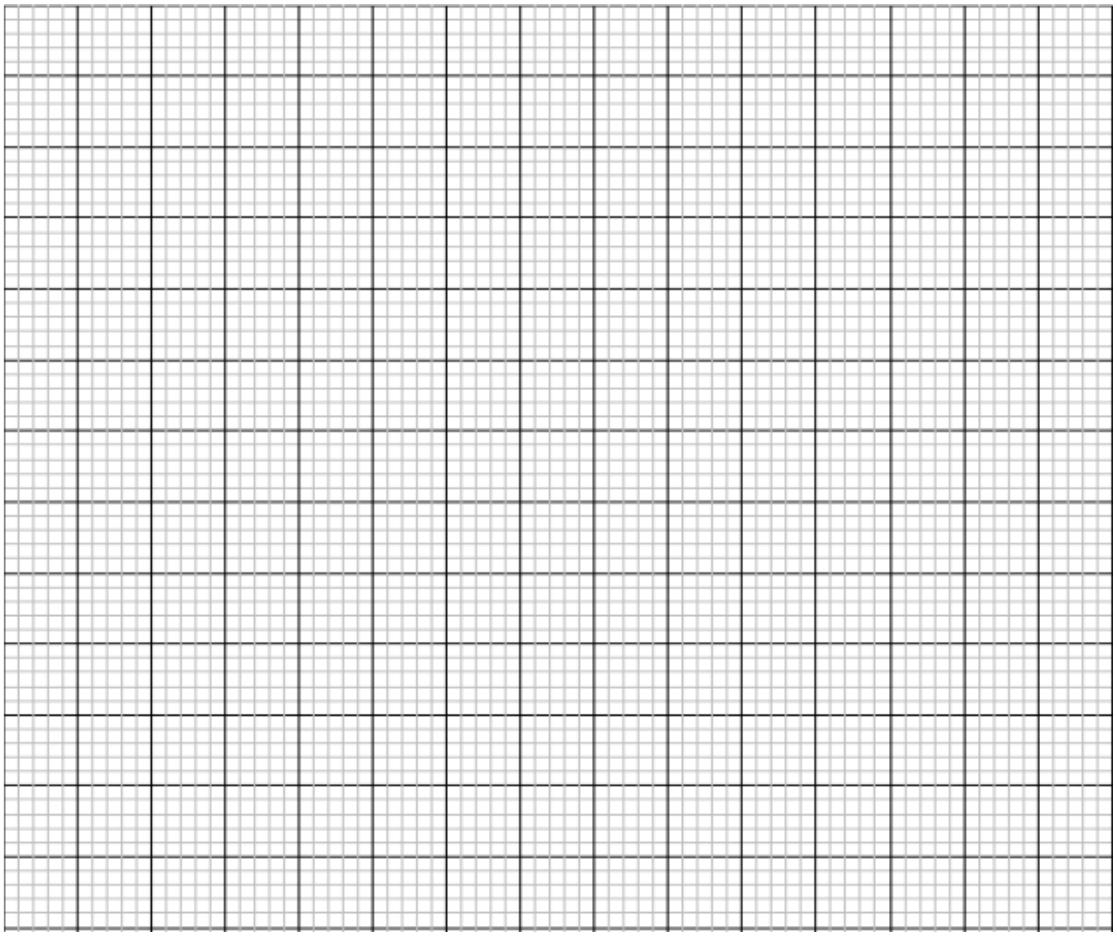
(ii). The upper quartile mark *(1 mark)*

c). Find the percentage change if the upper quartile in b(ii) above was found by calculation. (3 marks)

23 a) Complete the table below for $y = -2 \sin x$ and $y = 3 \cos x$. (2 marks)

x	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°	360°
-2 Sin x	0.00		-1.73			-1.00	0.00			2.00	1.73		
3 Cos x	3.00		1.50			-2.60	-3.00			0.00	1.50		

b,) Draw the graph $y = -2\,Sin\,x$ and $y = 3\,cos\,x$ using 1 cm to represent 30° horizontal axis and 2 cm to represent 1 unit on the vertical axis. **(5 marks)**



c) Use the graph to solve:

i) 3 Cos x + 2sin x = 0 **(1 mark)**

ii) 1 - 2sin x = 2 (2 marks)

24. A triangle ABC with vertices at A (1,-1) ,B (3,-1) and C (1, 3) is mapped onto triangle $A^1B^1C^1$ by a transformation whose matrix is $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$.Triangle $A^1B^1C^1$ is then mapped onto $A^{11}B^{11}C^{11}$ with vertices at A^{11} (2, 2), B^{11} (6, 2) and C^{11} (2,-6) by a second transformation.

(i) Find the coordinates of $A^1B^1C^1$ ***(3 marks)***

(ii) Find the matrix which maps $A^1B^1C^1$ onto $A^{11}B^{11}C^{11}$. ***(3 marks)***

(iii) Determine the ratio of the area of triangle $A^1B^1C^1$ to triangle $A^{11}B^{11}C^{11}$. ***(1 mark)***

(iv) Find the transformation matrix which maps $A^{11}B^{11}C^{11}$ onto **ABC** ***(3 marks)***