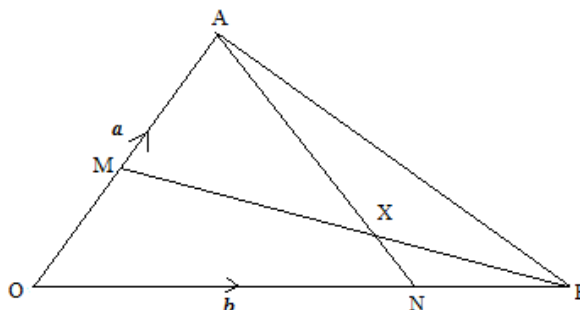


- a) i) Calculate the volume of the solid. (3marks)
- ii) The solid fits in a box in the shape of a cuboid 15 cm by 6cm by 6cm. Calculate the volume of the box not occupied by the solid correct to four significant figures. (2marks)
- b) i) Calculate the total surface area of the solid correct to four significant figures. (3marks)
- ii) The surface of the solid is to be painted. One millilitre of paint covers an area of  $8\text{cm}^2$ . The cost of paint is Ksh 900 per litre. Calculate the cost of the paint required. (2marks)

18. The table below shows the age groups and number of people who are HIV/ AIDS positive, in a certain sub county in Kenya.

Age group	10 – 19	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79
No. of people	12	15	16	25	18	10	4

- a) State the modal age group. (1mark)
- b) Calculate the mean age of the people who are HIV/AIDS Positive. (3marks)
- c) Calculate the median of the age group. (3marks)
- d) Draw on the grid provided a histogram to represent the above information. (3marks)
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 apart, 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 OAB is a triangle in which M divides OA in the ratio 2:3 and N divides OB in the ratio 4:1. AN and BM intersect at X.



- a) Given that  $OA = a$  and  $OB = b$  express in terms of  $a$  and  $b$ .
- i)  $AN$  (1 mark)
- ii)  $BM$  (1mark)
- iii)  $AB$  (1mark)

b) If  $\mathbf{AX} = s\mathbf{AN}$  and  $\mathbf{BX} = t\mathbf{BM}$  where  $s$  and  $t$  are constants.

- i) Write two expressions for  $\mathbf{OX}$  in terms of  $\mathbf{a}$ ,  $\mathbf{b}$ ,  $s$  and  $t$ . (2marks)
- ii) Find the value of  $s$  and  $t$ , and hence express  $\mathbf{OX}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ . (5marks)

22. A particle moving in a straight line is such that its distance from a fixed point O is given by

$$S = \frac{1}{3}t^3 - \frac{1}{2}t^2 = 10. \quad \text{Where } t \text{ is the time in seconds after the particle passes O.}$$

(a) Find :

- i) An expression for velocity. (1mark)
- ii) The time when the particle is at rest. (3marks)

(b) Calculate the velocity when  $t = 3$  seconds. (2marks)

(c)

- i) Find an expression for acceleration. (1mark)
- ii) Calculate the acceleration when  $t = 2$  seconds and  $t = 6$  seconds. (3 marks)

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

- (a) Triangle PQR in which  $PQ = 5\text{cm}$ ,  $\angle QPR = 30^\circ$  and  $\angle PQR = 105^\circ$ . (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 outside the triangle correct to 2 decimal places (2marks)

24. Members of a group decide to raise k£ 100 towards a charity. Five of them were unable to contribute. Each of the rest had therefore to pay k£ 1 more, in order to raise the same amount.

- a) If the original number of member was  $x$ , writes down :
  - i) An expression of how much each was originally to contribute. (1mark)
  - ii) Two distinct expressions of how much each contributed after the five pulled out. (2marks)

b) Calculate the value of  $x$ . (3marks)

c) Solve the equation  $\frac{y+3}{24} = \frac{1}{y-2}$  (3 marks)

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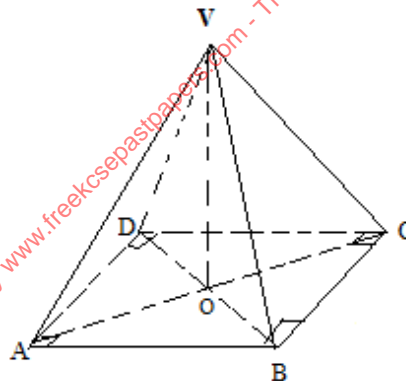
**BUURI EAST STANDARDS**  
**121/2**  
**MATHEMATICS**  
**JULY, 2019**  
**PAPER 2**

**SECTION I (50 MARKS):**

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

1. Given that  $8 \leq y \leq 12$  and  $1 \leq x \leq 6$ , find the maximum possible value of;  

$$\frac{y+x}{y-x}$$
 (3 marks)
2. Simplify  $\frac{4}{\sqrt{5}+\sqrt{2}} - \frac{3}{\sqrt{5}-\sqrt{2}}$  (3marks)
3. Make A the subject of the formula  $T = \frac{2m}{n} \sqrt{\frac{L-A}{3k}}$ . (3marks)
4. The fifth term of an arithmetic progression is 11 and the twenty fifth term is 51. Calculate the first term and the common difference of the progression. (3marks)
5. Solve for  $x$  in the equation.  $2\cos(3x + 60^\circ) = 3$  for  $0 \leq x \leq 180^\circ$ . (3marks)
6. The length of a rectangle is  $(x + 1)$  cm. its width is 3cm shorter than its length. Given that the area of the rectangle is 22cm, find its length using completing the square method. (3marks)
7. Given that  $\mathbf{p} = 2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$  and  $\mathbf{q} = 3\mathbf{i} - 4\mathbf{j} - 3\mathbf{k}$  find:
  - i)  $\mathbf{r} = 3\mathbf{p} + 2\mathbf{q}$  (2 marks)
  - ii)  $|\mathbf{r}|$  (2marks)
8. The figure below is a square based right pyramid with vertex V. Point O is the intersection of diagonals AC and BD.  $VA=VB=VC=VD=12\text{cm}$  and  $AB=BC=4\text{cm}$ .

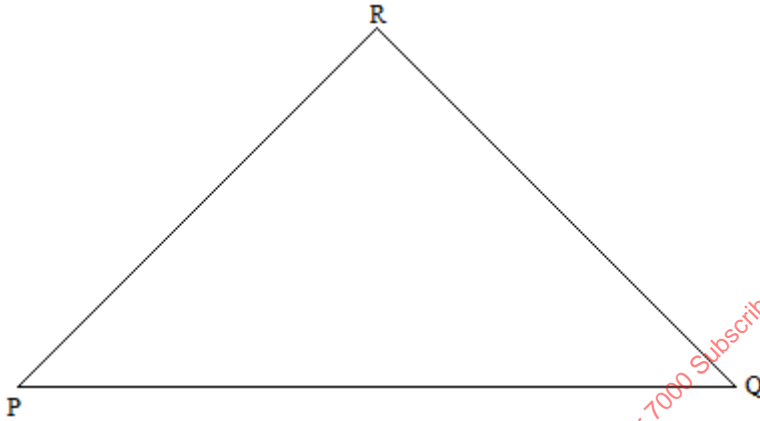


- (a) Name the projection of line VA on plane ABCD. (1mark)
- (b) Find the angle between line VB and the plane ABCD. (2 marks)
9. Find the value of  $x$  that satisfies the equation.  $\log(x + 5) = \log 4 - \log(x + 2)$ . (3marks)
10. The table below is part of tax table for monthly income for the year 2006.

Monthly taxable income (ksh)	Tax rate %
0 – 9680	10
9681 – 18800	15
18801 – 27920	20

In the year 2006, the tax on Jane’s monthly income was Ksh. 1, 916. Calculate Jane’s monthly income. (3marks)

11. Mr. Mwenda wishes to take students from his mixed secondary school for a tour. The total number of students to be taken should not exceed 60. Each girl must contribute ksh. 10,000 and each boy Ksh. 15,000 and the total money contributed should not exceed ksh. 120,000. If this trip is to be successful the number of boys should be greater than the number of girls. Write down all the inequalities to represent this information taking the number of girls and boys to be  $y$  and  $x$  respectively. (4marks)
12. Evaluate  $\int_{-3}^{-2} (x - 3)(x + 2)(x - 2)dx$ . (3 marks)
13. Below is a triangle PQR. Draw locus  $L_1$  of points equidistant from P and Q. Draw  $L_2$  locus of points equidistant from line PR and PQ to meet  $L_1$  at M. Measure PQ. (3marks)



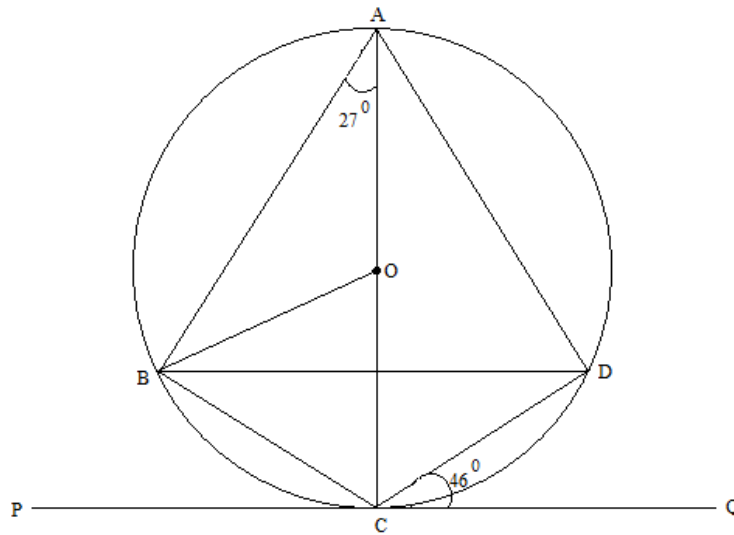
14. Find the centre and the radius of a circle whose equation is  $x^2 + y^2 + 6y - 8x - 2y = 0$ . (3marks)
15. a) Expand the Binomial expression  $(2 - \frac{1}{4}x)^5$  up to the term with  $x^3$ . (1mark)  
 b) Using the binomial expansion in(a) above estimate the value of  $(1.75)^5$ . (2marks)
16. Grade A sugar cost ksh.75 per kg and grade B sugar costs ksh. 50 per kg. The two grades are mixed in a ratio such that the blend costs ksh. 70 per kg. Find the ratio. (3marks)

**SECTION II(50 marks).**

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

17. A car hire company hire out cars such that there is a fixed charge and another part which varies with the distance covered. Taking  $C$  to stand for total cost,  $d$  for distance covered,  $k$  for fixed charge and  $t$  for charge per kilometer.
- a) Express  $C$  in terms of  $k$ ,  $t$  and  $d$ . (1mark)
- b) Given that the total cost is 7000 when the distance is 200km and the total cost is 11000 when distance is 400km.
- i) Find the values of  $k$  and  $t$ . (2marks)  
 ii) Find the equation connecting  $c,t,k$  and  $d$ . (1mark)
- (c) Find the cost of hiring a car to area a distance of 500km. (2marks)
- (d) Due to increase in fuel prices, the company increased the fixed charge by 20% and charge per kilometer by 10%:
- i) Find the cost of hiring the car for 500km. (2marks)  
 ii) Find the percentage increase of hiring the car for the 500km. (2marks)
18. ABC is a triangle with vertices  $A(-7,2)$ ,  $B(-2,1)$   $C(2,8)$ .  $A'B'C'$  is the image of ABC under a transformation  $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ .
- a) i) Find the co-ordinates of  $A'B'C'$  (2 marks)  
 ii) On the grid provided draw ABC and  $A'B'C'$ . (2marks)
- b) i) Find the coordinates of  $A''B''C''$  the image of the triangle  $A'B'C'D'$  under the transformation matrix.  $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ . (2marks)
- ii) On the same grid draw  $A''B''C''$ . (1 mark)
- c) i) Find the single matrix that maps  $A''B''C''$  onto ABC. (2 marks)

- ii) Describe the transformation fully. (1mark)
19. An airplane leaves town A( $40^{\circ}\text{N}, 155^{\circ}\text{W}$ ) and flies to town B( $40^{\circ}\text{N}, 25^{\circ}\text{E}$ ) using the shortest route and at a speed of 450 knot (Take  $\pi = 3.142$  and radius of the earth  $R=6370\text{km.}$ )
- (a)
- Calculate the distance between A and B covered by the airplane in nautical miles. (2marks)
  - Calculate the time taken by the aeroplane to fly from A to B. (2 marks)
- (b) From B the plane flies westwards along the latitude to a town C( $40^{\circ}\text{N}, 13^{\circ}\text{W}$ ). Calculate the distance BC in kilometres. (3marks)
- (c) From town C, The plane took off at 3:10 p.m towards townD( $10^{\circ}\text{N}, 13^{\circ}\text{W}$ ) at the same speed. At what time did the plane land at D? (3marks)
20. Purity bought a camera on hire purchase terms by paying a deposit of Ksh.7, 200 and cleared balance in 24 equal monthly installment each of ksh.1, 250.
- Find the hire purchase price of the camera. (3marks)
  - The hire purchase price of the camera is 24%higher than the cash price. Find the cash price of the camera. (2marks)
  - Eunice took a loan from a financial institution and bought the camera with cash. She repaid the end of the two years. Find the total interest paid by Eunice. (3marks)
  - A car is worth Ksh.800,000 when new. It depreciates by 20% every year. How much will it cost after five years. (2marks)
21. The table below shows marks obtained by 50 students in a maths quiz.
- |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 32 | 64 | 68 | 55 | 52 | 68 | 37 | 46 | 65 | 26 |
| 45 | 87 | 44 | 88 | 39 | 54 | 21 | 44 | 76 | 23 |
| 65 | 42 | 82 | 87 | 75 | 44 | 47 | 48 | 52 | 32 |
| 23 | 76 | 74 | 91 | 28 | 33 | 27 | 48 | 56 | 66 |
| 45 | 56 | 98 | 21 | 34 | 31 | 83 | 65 | 77 | 76 |
- Starting from 21 and using equal class intervals of 10 make a frequency distribution table. (2marks)
  - On the grid provided, draw the cumulative frequenting curve for the data. (4marks)
  - Using the graph in(b) above estimate :
    - The upper quartile. (1mark)
    - The lower quartile. (1mark)
    - Hence find the quartile deviation. (2marks)
22. In a carton there are 8 red pens, 5 blue pens and 2 green pens. Two pens are picked at random from the carton without replacement.
- Draw a probability three diagram to represent this information. (2marks)
  - Use the tree diagram to find the probability that:
    - The first pen picked is red. (1mark)
    - The first pen picked is blue or green. (2marks)
    - The two pens picked are blue. (2marks)
    - At least one of the pens picked is green. (3marks)
23. The diagram below shows a circle centre O. PQ is the tangent to the circle at C. Angle  $\text{DCQ}= 46^{\circ}$  and angle  $\text{BAC}=27^{\circ}$ .



Find giving reasons the size of each of the following angles.

- a) Angle OAD. (2 marks)
- b) Angle DBO. (2 marks)
- c) Angle ACD. (2 marks)
- d) Angle BDA. (2 marks)
- e) Reflex angle BOC. (2 marks)

24.

a) Complete the table below for the following function  $y = x^3 - 3x^2 - 5x + 7$  (2 marks)

x	-3	-2	-1	0	1	2	3	4	5
$y = x^3 - 3x^2 - 5x + 7$									

- b) On the grid provided draw the graph of  $y = x^3 - 3x^2 - 5x + 7$  for  $-3 \leq x \leq 5$ . (Use 2cm to represent 1 unit on the x-axis and 1 cm to represent 5 units on the y-axis). (3marks)
- c) Use the graph to solve the equation  $x^3 - 3x^2 - 5x + 7 = 0$  (2 marks)
- d) By drawing a suitable line, use the graph in (b) to solve the equation  $x^3 - 3x^2 - 10x + 17 = 0$ . (3 marks)

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**CEKENA**  
**121/1**  
**FORM FOUR**  
**MATHEMATICS PAPER 1**

**SECTION 1( 50 MARKS) COMPULSORY**

1. Evaluate without using a calculator (3 mks)

$$\frac{(2^{3/7} - 1^{5/6}) \div 5/6}{2/3 \text{ of } 2^{1/4} - 1^{1/7}}$$

2. Solve for X in: (3 mks)

$$\frac{6x - 4}{3} - \frac{2x - 1}{2} = \frac{6 - 5x}{6}$$

3. The ratio of goats to cows in a farm is 2:5 while the ratio of sheep to cows is 3:4. If there are 15 sheep, how many animals are there in the farm (2 mks)

4. Mr. Maina who deals in electronics sells a radio to a customer at Ksh. 1440 after giving him a discount of 10% but find that he still makes a 20% profit. Find the profit Mr. Maina would make if he does not give a discount (3 mks)

5. The sum of interior angles of a triangle is given by  $(10x - 2y)^0$  while that of a hexagon is given by  $(30x + 24y)^0$ . Calculate the values of x and y (3 mks)

6. Evaluate ;  $36^{x-1} + 6^{2x} - 222 = 0$  (3 mks)

7. The equation of a straight line is given by  $2y + 8x - 10 = 0$ . Another line  $L_2$  cuts  $L_1$  at right angles such that the point of intersection of the two lines is  $(-3, K)$

(a) Find the value of K (1 mk)

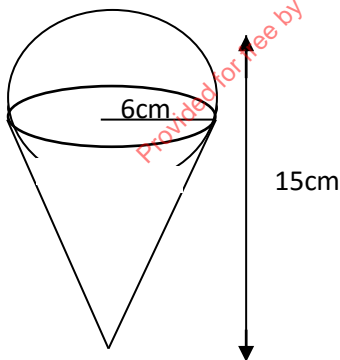
(b) Determine the equation of  $L_2$  in the form  $y = mx + c$  (2 mks)

8. Use Logarithms to evaluate (4 mks)

$$\sqrt[3]{\frac{7.96 \times \sin 54}{97.5}}$$

9. Given that  $\sin(3x - 50)^0 - \cos(x + 20)^0 = 0$  and x is an acute angle; find the value of x (2 mks)

10. The diagram below represents a solid made up of a hemisphere mounted on a cone. The common radius is 6cm and the height of the solid is 15cm.



Calculate the external surface area of the solid (4 mks)

11. Simplify completely (3 mks)

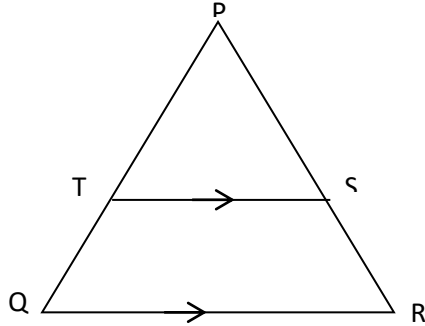
$$\frac{2x^2 - 98}{3x^2 - 16x - 35} \div \frac{x + 7}{3x + 5}$$

12. Solve the simultaneous inequalities given below and list all the integral values of  $x$  (3 mks)

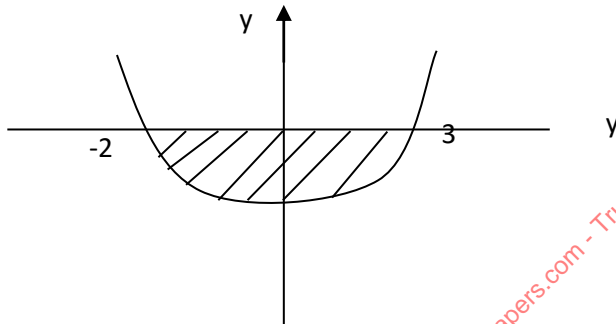
$$\frac{3-x}{2} \geq \frac{x+1}{3} \geq \frac{2x+1}{-3}$$

13. The gradient function of a curve is given by  $3x^2 + 2x - 3$ . If the curve passes through the point  $(-4, -6)$ , Find the equation of the curve (3 mks)

14. The figure below shows triangle PQR in which  $PR = 12\text{cm}$ , T is a point on PR such that  $TR = 4\text{cm}$ . Line ST is parallel to QR.

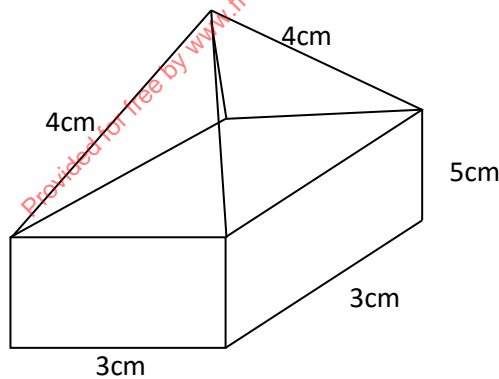


- If the area of triangle PQR is  $336\text{cm}^2$ , find the area of the quadrilateral QRTS (3 mks)
15. The diagram below is a sketch of the curve  $y = x^2 - x - 6$



- Using the mid-ordinate rule with five strips, Estimate the area of the shaded region (4 mks)

16. The figure below shows a square based pyramid on top of a cuboid \



- (a) Draw the net of the solid (2 mks)
- (b) Calculate the total surface area of the net. (2 mks)

**SECTION II (50 MARKS)**

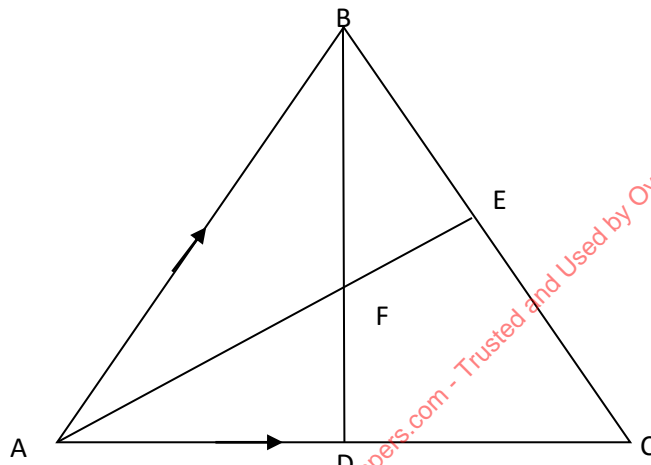
Attempt any 5 questions

17. Matrix  $M$  is given by  $\begin{pmatrix} 3 & 4 \\ 5 & 2 \end{pmatrix}$

- (a) Find the inverse of  $M$  (2 mks)



- (b) Two schools A and B purchased beans at Ksh.  $b$  per bag and maize at Ksh.  $m$  per bag. School A purchased 30 bags of beans and 40 bags of maize for sh. 72,000. School B purchased 50 bags of beans and 20 bags of maize for sh. 64,000
- (i) Form a matrix equation to represent the information above (1 mk)
- (ii) Use the inverse matrix of  $M$  to find the price of one bag of each item (4 mks)
- (c) The price of beans later went up by 5% and that of maize remained constant. School A 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. (3 mks)
18. Nairobi and Eldoret are 600km apart. At 9.20a.m. a lorry leaves Eldoret for Nairobi at a speed of 60km/hr. At 10.00a.m. a car leaves Eldoret for Nairobi at a speed of 120km/hr. After 20 minutes of travel, the car develops a mechanical problem which takes 20 minutes to repair. The car then proceeds with the journey at the same speed.
- (a) Calculate the time the lorry arrived in Nairobi (2 mks)
- (b) Find the time when the car overtakes the lorry (4 mks)
- (c) Find the distance from Nairobi at the overtaking point (2 mks)
- (d) Calculate how far the lorry was from Eldoret when the car reached Nairobi (2 mks)
19. 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  $AB = b$  and  $AC = c$



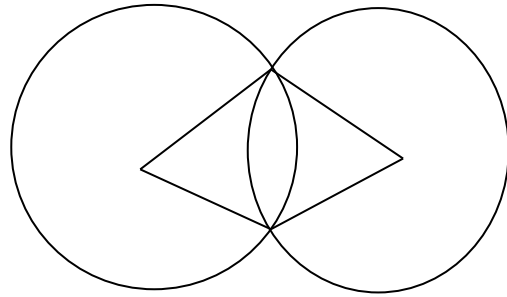
- (a) Express vectors
- (i)  $AE$
- (ii)  $BD$  in terms of  $b$  and  $c$  only (3 mks)
- (b) By expressing vectors  $BF$  in two ways, find the ratio  $BF:FD$  given that  $BF = hBD$  and  $AF = tAE$  where  $h$  &  $t$  are constant (5 mks)
- (c) Hence find vector  $BF$  in terms of  $b$  and  $c$  only (2 mks)
20. A group of people planned to contribute equally toward water project which needed Ksh. 2,000,000 to complete. However, 40 members of the group withdraw 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 (5 mks)
- (b) Forty five percent of the value of the project was funded by the constituency development fund(CDF), Calculate the amount of the contribution that would be made by each of the remaining members (3 mks)
- (c) Members contribution were in terms of labour provided and money contributed. If the rate of the value of labour to the money contribution was 6:9, Calculate the total amount of money contributed by the members (2 mks)

21. The table shows the marks obtained by 40 candidates in an examination

Marks	5 – 14	15 – 29	30 – 34	35 – 44	45 – 49
Frequency	2	12	7	15	x

- (a) Find the value of  $x$  (1 mk)
- (b) Calculate the mean mark (2 mks)
- (c) On the grid provided below draw a histogram to represent the data (4 mks)
- (d) Drawing a straight line on the graph above determine the median mark (3 mks)

22. The figure below shows two intersecting circles radii 8cm and 6cm respectively. The common chord AB = 9cm and P and Q are the centres as shown.



- (a) Calculate the size of angle:-
- (i)  $\angle APB$  (1mk)
  - (ii)  $\angle AQB$  (1 mk)
- (b) Calculate the area of :-
- (i) Minor segment of the circle P (2 mks)
  - (ii) Minor segment of the circle centre Q (2 mks)
  - (iii) The quadrilateral APBQ (2 mks)
  - (iv) The shaded region (2 mks)
23. Town B is 180km on a bearing  $050^0$  from town A. Another town C is on a bearing of  $110^0$  from town A and on a bearing of  $150^0$  from town B. A fourth town D is 240 km on a bearing of  $320^0$  from A. Using scale drawing, such that 1cm rep 30km,
- (a) Show the relative position of the towns (4 mks)
  - (b) Using the diagram, find
    - (i) Distance AC (2 mks)
    - (ii) Distance CD (2 mks)
    - (iii) Compass bearing of C from D (2 mks)
24. The displacement of a particle S metres, t seconds after passing a fixed point O is given by  $S = 3 + 2t - 5t^2$  Calculate :-
- (a) The displacement of the particle 2 seconds later (2 mks)
  - (b) The time taken for the particle to return to O (3 mks)
  - (c) The maximum displacement of the particle (3 mks)
  - (d) The initial velocity of the particle (2 mks)

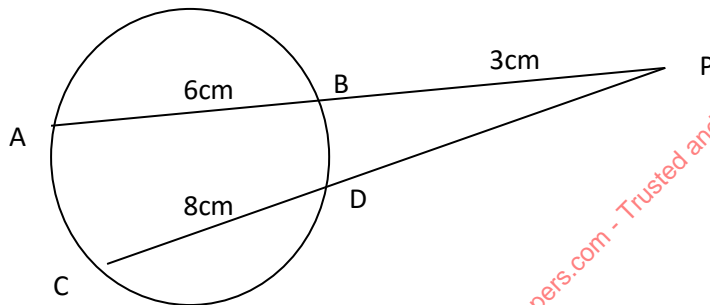
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**CEKENA I**  
**121/2**  
**FORM FOUR**  
**MATHEMATICS PAPER 2**  
**JULY 2019**

**SECTION 1 ( 50 MARKS) COMPULSORY**

- Mwangi truncated  $\frac{7}{9}$  to 3 decimal places. Calculate the percentage error resulting from the truncating (3 mks)
- Given that  $A = 5i + 4j + k$  and  $B = 8i - 5j - 5k$  and P divides AB externally in the ratio 5:2. Find the:-  
 (a) Position vector of P (2 mks)  
 (b) The magnitude of OP (1 mk)
- Express as a surd and simplify (3 mks)  

$$\frac{1 + \cos 30}{1 - \sin 60}$$
- Solve for x (3 mks)  
 $\log_{27} (x + 5) - \log_{27} (x - 3) = \frac{2}{3}$
- (a) Find the expansion of  $(1 - \frac{x}{3})^7$  in ascending powers of x up to the term in  $x^3$  (2 mks)  
 (b) Use the expansion above to find,  $(0.99)^7$  to four significant figures. (2 mks)
- Find the length of DP in the figure below



- Use complete square method to solve for x (4 mks)  
 $8x^2 + 6x - 9 = 0$
- Make T the subject of the formula (3 mks)

$$\frac{F\sqrt{T}}{d} = \sqrt{\frac{a^2 - k}{T}}$$

- Point P( $X^0N, 30^0E$ ) and Q( $X^0N, 50^0E$ ) are 1935 km apart. Taking  $R = 6370km$  and  $\pi = \frac{22}{7}$ , Find the value of x (3 mks)
- Three variables P,Q and R are such that P varies directly as the cube of Q and inversely as the square root of R. If Q is increased by 20% and R is decreased by 10%, Find the percentage change in P (3 mks)
- PQ is a diameter of a circle is such that the co-ordinates of P and Q are (-6, -2) and (4, -2) respectively. 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 constants. (3 mks)
- The third term and the sixth term of a geometric series are  $3^{1/3}$  and  $11^{1/4}$  respectively. Calculate the  
 (a) Common ratio (2 mks)  
 (b) First term (1 mk)
- Solve for x in the equation (3 mks)  
 $6\sin^2 x - \cos x - 5 = 0$   
 for  $0^0 \leq x \leq 360$
- Find the equation of the normal to the curve  $y = 3x^2 - 8x + 5$  at the point where  $x = 2$  (4 mks)
- Machine A can complete some work in 8 hours while machine B can complete the same work in 10 hours. The two machines were set to do the work at the same time. After 3 hours, machine B broke down. Determine the time taken by machine A to complete the remaining piece of work (3 mks)

16. T is a transformation represented by the matrix  $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$  Under T, a square whose area is  $10\text{cm}^2$  is mapped onto a square of area  $110\text{cm}^2$ . Find the possible values of x (3 mks)

**SECTION II ( 50 MARKS)**

Attempt any **FIVE** questions

17. A transformation represented by the matrix  $\begin{pmatrix} 2 & 1 \\ 1 & -2 \end{pmatrix}$  maps the point

A (0 , 0), B (2 , 0) C (2 , 3) D (0 , 3) of the quadrilateral ABCD onto  $A^1B^1C^1D^1$

- (a) Draw the quadrilateral ABCD and its image  $A^1B^1C^1D^1$  (2 mks)  
 (b) Hence determine the area of  $A^1B^1C^1D^1$  (2 mks)

- (c) A transformation represented by the matrix  $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$  maps  $A^1B^1C^1D^1$  onto  $A^{11}B^{11}C^{11}D^{11}$ .

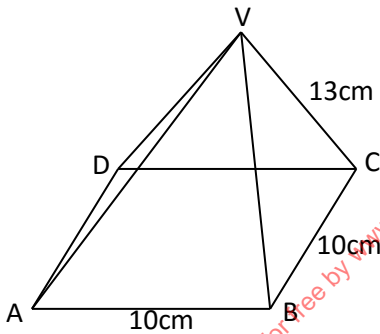
Draw the image  $A^{11}B^{11}C^{11}D^{11}$  (2 mks)

- (d) Determine a single matrix which maps  $A^{11}B^{11}C^{11}D^{11}$  back to ABCD. (2 mks)

- (e) Draw an image  $A^{111}B^{111}C^{111}D^{111}$  of ABCD under shear transformation of factor 2 and X – axis as the invariant line (2 mks)

18. The figure below shows a square based pyramid VABCD. Point V is vertically above middle of the base ABCD.

AB = 10cm and VC = 13cm



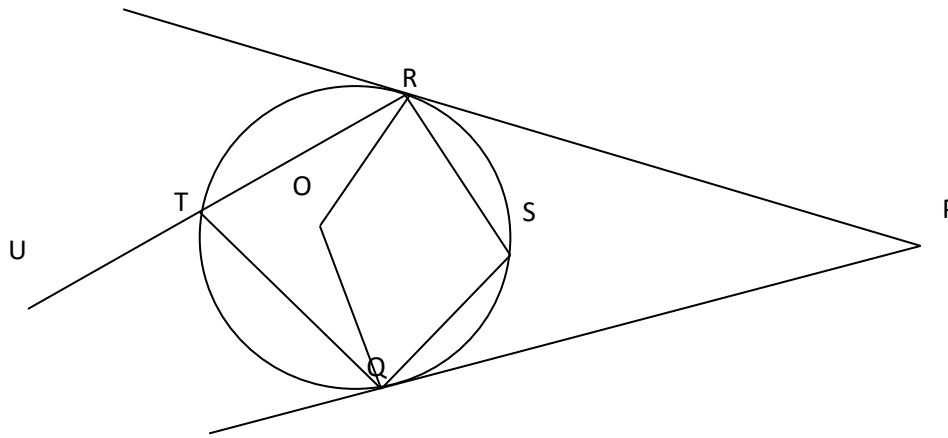
Find:-

- (a) The length of diagonal AC (2 mks)  
 (b) The height of the pyramid (2 mks)  
 (c) The acute angle between VB and the base ABCD (2 mks)  
 (d) The acute angle between BVA and ABCD (2 mks)  
 (e) The acute angle between AVB and DVC (2 mks)

19. 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  $\frac{4}{15}$  otherwise its only  $\frac{1}{13}$ . When he is bitten by the dog, the probability that he will get treatment is  $\frac{4}{5}$  and if he does not get treatment the probability that he will get rabies is  $\frac{5}{7}$ .

- (a) Draw a tree diagram to show the events (3 mks)  
 (b) Using the tree diagram in (a) above, determine the probability that  
 i) Karanja will not be bitten by a rabid dog (2 mks)  
 ii) He will get rabies (2 mks)  
 iii) He will not get rabies if he does not get treatment (3 mks)

20.



In the figure below, O is the centre of the circle. PQ and PR are tangent to the circle at P and R respectively. Angle PQS =  $43^\circ$  and angle PRS =  $36^\circ$ , RTU is a straight line.

Find , giving reasons the angles

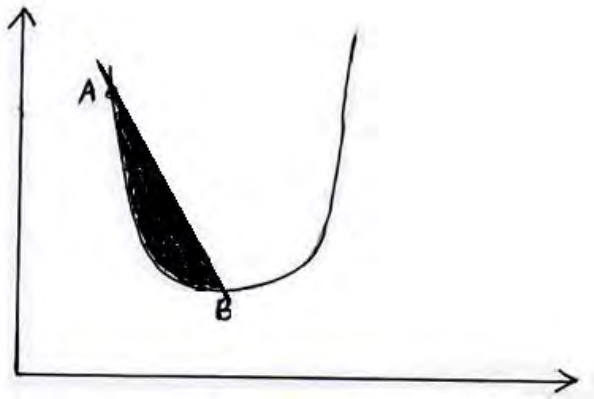
- (i) QRS (2 mks)
  - (ii) RTQ (2 mks)
  - (iii) RPQ (2 mks)
  - (iv) Reflex angle QOR (2 mks)
  - (v) TRO given that TR = TQ (2 mks)
21. (a) Without using a protractor, construct a quadrilateral ABCD such that AB = 5cm, AC = 7cm, AD = 6m, angle BAC =  $30^\circ$  and DAB =  $120^\circ$  (4 mks)
- (b) Construct the locus of a point P on the same side as D such that angle APC =  $90^\circ$  (2 mks)
- (c) Construct a locus T on the same side as D such that the area of triangle ATC =  $7\text{cm}^2$  and angle ATC  $\geq 90^\circ$  (3 mks)
- (d) Measure  $T_1 T_2$  (1 mk)
22. The table below shows income tax rates

Monthly taxable Pay in Ksh.	Rate of tax Ksh. Per %
1 - 8700	10%
8701 - 17200	15%
17201 - 26140	20%
26141 - 34800	25%
Over 34800	30%

Mr. Kiprono is employed and housed by a company. For which he pays a normal rent of Sh. 2000. He earns a basic salary of Ksh. 32,000 pm. He is also given taxable allowances amounting to ksh. 8480.

- (a) Calculate his taxable income in K£ (3 mks)
- (b) Determine his total income tax in Ksh. (4 mks)
- (c) If he pays a monthly water bill of Ksh. 350, electricity bill of Ksh. 400 and is a member of a co-operative and pays Ksh. 2500 pm. Determine his net monthly income. (3 mks)

23. The figure below shows parts of a curve whose gradient function is given by  $3x - 6$



Given that the curve passes through the points  $A(1, 6)$  and has a minimum turning point at B

- (a) Determine:-
- (i) The equation of the curve (3 mks)
  - (ii) The coordinates of B (3 mks)
- (b) The shaded region is bounded by the curve and the straight line passing through A and B, Calculate the area of the shaded region. (4 mks)
24. A shopkeeper sells two types of chewing gum. Big G and Orbit. Each big G costs sh. 3 and each orbit costs sh. 4. The shopkeeper has put aside sh. 300 for the purchase of gums. He needs at least twice as many Big G as Orbit and there must be at least 50 Big G and at least 20 orbit. Let  $x$  represent the number of Big G and  $y$  the number of orbit the shopkeeper purchases.
- (a) Write down all the inequalities representing the information (3 mks)
  - (b) Represents the inequalities in (a) graphically (4 mks)
  - (c) The shopkeeper makes a profit of sh. 1.00 on each big G and sh. 1.50 on each orbit.
    - (i) Find the number of gums of each type that would give him maximum profit (2 mks)
    - (ii) Hence find the maximum profit (1 mk)

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**MERU SOUTH**  
**121/1**  
**MATHEMATICS**  
**PAPER 1**

**SECTION I (50 Marks)**

Answer all questions in the spaces provided in this section.

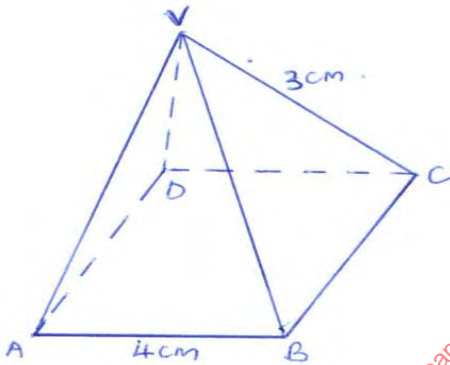
1. Evaluate without using a calculator; (3 marks)

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

2. Solve for  $x$  in the equation  $125^{-x} \times 5^{2(x-2)} = 25^{(x+2)}$  (3 marks)

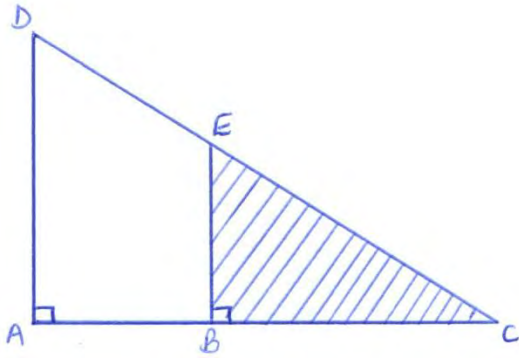
3. A cylindrical tank of diameter 1.4 m and height 1.2 m is two – thirds full of water. The tank is filled using a cylindrical bucket of diameter 35 cm and diameter 20 cm. Find the number of buckets required to fill the tank. (3 marks)

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  $ABC = 30^\circ$  and angle  $ACB = 45^\circ$ . (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,  $\angle DAB = \angle EBC = 90^\circ$ . (3 marks)



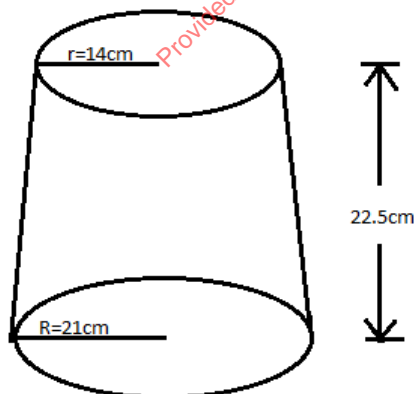
11. Write the expression below in surd form and rationalize the denominator. (3 marks)  

$$\frac{1 - \cos 60^\circ}{1 + \tan 30^\circ}$$
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  $3 \text{ g/cm}^3$ . (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)

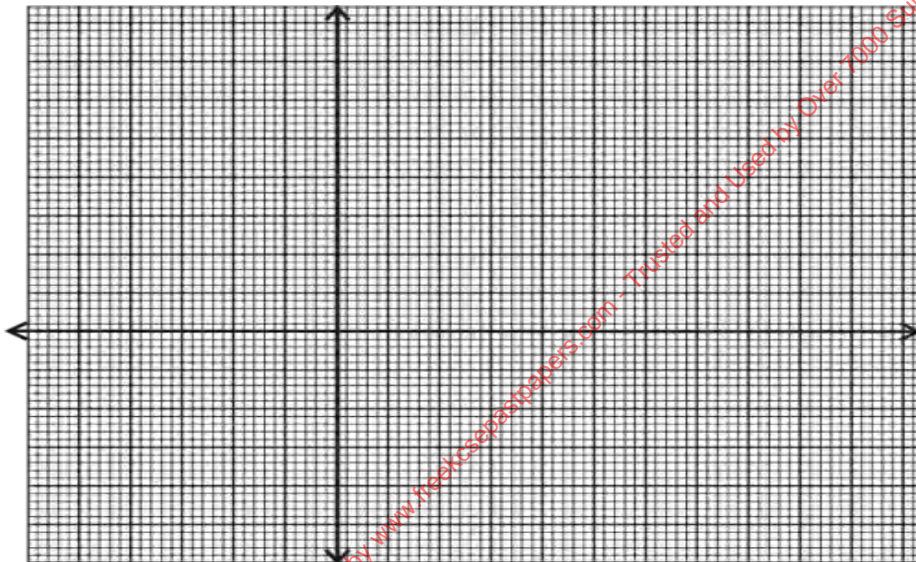


18. A line  $L_1$  passes through the points  $(-2, 3)$  and  $(-1, 6)$  and is perpendicular to  $L_2$  at  $(-1, 6)$ .
- Find the equation of  $L_1$ . (2 marks)
  - Find the equation of  $L_2$  in the form  $ax + by - c = 0$  where  $a, b$  and  $c$  are constants. (2 marks)
  - Given that another 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)
  - Find the point of intersection of  $L_2$  and  $L_3$ . (3 marks)

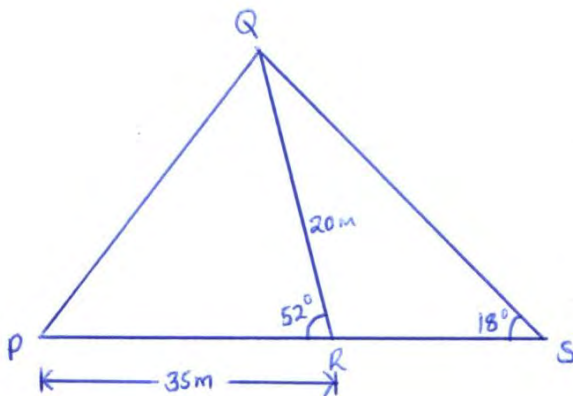
19. (a) Complete the table below for the function  $y = 3x^2 - 2x + 5$  (2 marks)

$x$	-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

- 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)
  - Use calculus to calculate the actual area in part b above. (3 marks)
  - 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  $D(6, -1)$ .



- On the same grid, draw:
    - $A'B'C'D'$  the image of  $ABCD$ , under an enlargement scale factor 3 centre  $(9, -4)$ . (3 marks)
    - $A''B''C''D''$  the image of  $A'B'C'D'$  under a reflection in the line  $x = 0$ . (2 marks)
    - $A'''B'''C'''D'''$  the image of  $A''B''C''D''$  under a rotation of  $+90^\circ$  about  $(0,0)$ . (2 marks)
  - 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,

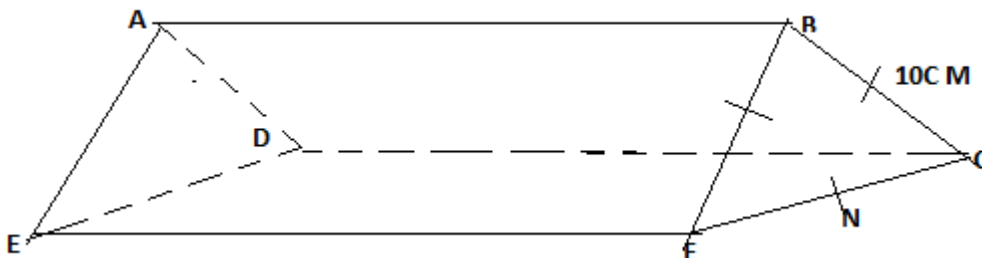
- The length of boundary  $PQ$ . (3 marks)

- 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)

**MERU SOUTH**  
**121/2**  
**MATHEMATICS PAPER 2**

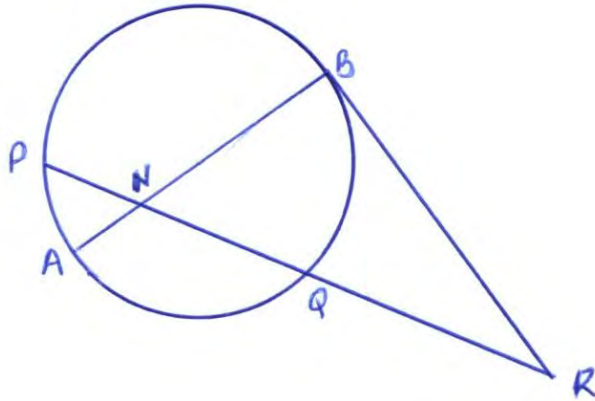
**SECTION I (50 Marks)**  
**Answer all the questions in the spaces provided in this section.**

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 10cm. 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 6 days. Mogutu working alone takes 5 days 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 ( $^{\circ}\text{C}$ )	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  $75^{\circ}\text{C}$ . (1 mark)
10. State the amplitude and the phase angle of the curve  $4y = \cos(5x - 40^{\circ})$  (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  $15^{\circ}\text{N}$  and their longitudes differ by  $25^{\circ}$ . 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.

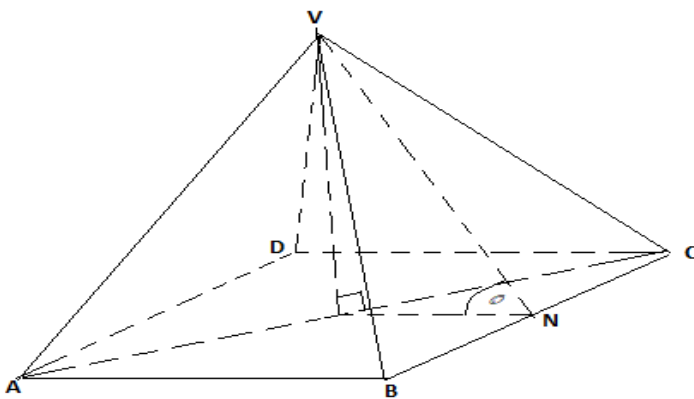
Mass kg	40-49	50-59	60-69	70-79	80-89	90-99	100-109
No of people	9	27	70	50	26	12	6

- a) Draw a cumulative frequency curve for the data above. (4 marks)
- b) Use your graph to estimate
- The median mass. (1 mark)
  - The number of people whose mass lies between 70.5 kg and 75.5 kg (1 mark)
- c) From your graph find
- The lower quartile (1 mark)
  - the upper quartile (1 mark)
  - the interquartile range (2 marks)
20. Without using a protractor, construct line  $XY = 8\text{cm}$
- Construct the locus of all points R such that  $\angle XRY = 60^\circ$  (4 marks)
  - Construct the locus of all points P such that the area of triangle XPY is  $16\text{ cm}^2$ . (3 marks)
  - 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  $y = 3 \cos(x + 45^\circ)$ ;

a) Complete the table below

$x^\circ$	0	20	40	60	80	100	120	140	160	180
$2 \sin 2x^\circ$	0.00		1.97		1.68	-0.68	-1.73		-1.28	0.00
$3 \cos(x + 45^\circ)$	2.12	1.27		-0.78		-2.46			-2.72	-2.12

- Use the data to draw the graphs of  $y = 2 \sin 2x^\circ$  and  $y = 3 \cos(x + 45^\circ)$  for  $0^\circ \leq x \leq 180^\circ$  on the same axes. (3 marks)
  - State the amplitude and period of each curve. (2 marks)
  - Use the graph to solve the equation  $2 \sin 2x - 2 \cos(x + 45^\circ) = 0$  for  $0^\circ \leq x \leq 180^\circ$ . (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)

THE SALVATION ARMY KENYA WEST TERRITORIAL EVALUATION TESTS (SAKWETET)

121/1

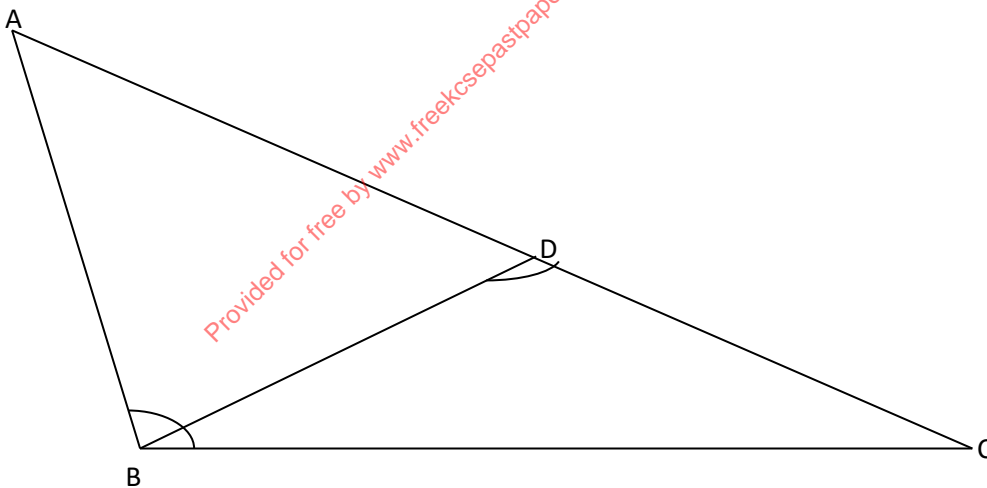
MATHEMATICS

PAPER 1

**SECTION 1 (50 MARKS)**

**ANSWER ALL QUESTIONS IN THE SPACES PROVIDED.**

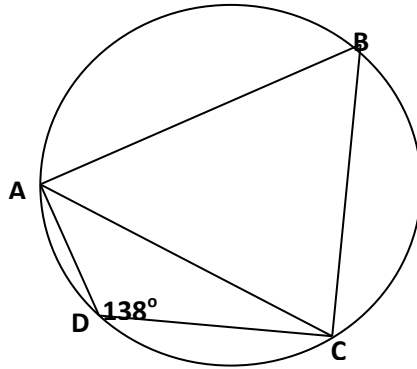
1. Evaluate without using a calculator  $\frac{\left(2\frac{3}{7} - 1\frac{5}{6}\right) \div \frac{5}{6}}{\frac{2}{3} \text{ of } 2\frac{1}{4} - 1\frac{1}{7}}$  (3mks)
2. Calculate the standard deviation for the data below (3mks)  
5,8,13,12,7,10,8,15,3,14
3. A straight line  $L_1$  is perpendicular to another line  $L_2$  whose equation is  $3y+4x=12$ . If the two lines meet at point P which lines on the x-axis, find:
  - (i) The co-ordinate of point P (1mk)
  - (ii) The equation of line  $L_1$  in the form  $y=mx+c$  (3mks)
4. Mr. Otieno who deals in electronics sells a radio to a customer at Kshs. 1,440 after giving him a discount of 10% but finds that he still makes a 20% profit. Find the profit Mr. Otieno would make if he does not give a discount. (3mks)
5. 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  $5\text{g/cm}^3$ , find the radius of the cylinder. Take  $\pi = \frac{22}{7}$  (3mks)
6. Simplify completely by factorization  $\frac{20 - 45x^2}{6x^2 - x - 2}$  (3mks)
7. The figure below shows a triangle ABC not drawn to scale, D is a point on line AC. Given that  $BC=14\text{cm}$ ,  $DC=7\text{cm}$  and  $\angle ABC = \angle BDC$ . Find the length of AD. (3mks)



8. Solve the simultaneous inequalities given below and list all the integral values of x (3mks)  

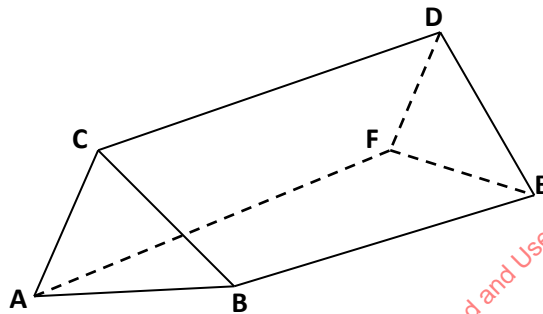
$$\frac{3-x}{2} \geq \frac{x+1}{3} \geq \frac{2x+1}{-3}$$

9. In the circle drawn to scale below A,B,C and D are points on its circumference, Chord BC=AC and angle ADC=138°



Giving reasons calculate the angle ACB (3mks)

10. The figure below shows a triangular prism ABCDEF. AF=CD=BE=18cm, The ends ABC and EDF are equilateral triangles of side 8cm. calculate the angle plane ABD makes with the lie CD (3mks)



11. Patricia a student at Simwa mixed Secondary bought 5 pens and 3 exercise books from Solving supermarket at Kshs. 135, at the same time Jane her class mate also bought 4 pens and 5 exercise books and spent Ksh. 25 more than Patricia. Find the cost of each pen and exercise book (4mks)
12. Evaluate using mathematical tables only expressing your answer to 4 significant figures (3mks)

$$\frac{4}{0.2356} + (0.9873)^3$$

13. A Kenyan bank buys and sells foreign currencies as shown below,

	Buying(Ksh.)	Selling (Ksh)
1 Euro	84.15	84.26
100 Japanese yen	65.37	65.45

A Japanese travelling from France arrives in Kenya with 5000 Euros.He converts all the 5000 Euros to Kenya shillings at the bank.While in Kenya he spends a total of Ksh289850 and then converts the remaining Kenya shillings to Japanese yen at the bank.Calculate the amount in Japanese yen that he receives. (4mrks)

14. Given that  $\sin(3x-35)^\circ - \cos(x+20)^\circ = 0$  and x is an acute angle, find its value (2 mks)
15. A train of length 80m crosses a bridge 20 m long in 5 seconds. Calculate the average speed of the train in km/h (3mks)
16. The principal of a 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 which can be used to fit exactly without breaking (3mks)

### SECTION B (50 MARKS)

Answer ONLY FIVE questions in this section in the spaces provided

17. Four towns W, A, N and G are such that W 15km from A on a bearing of 158°, N is to the west of A and 20km away while G is to the South of N and on a bearing of 240° from W.
- (a) Using a scale of 1:400,000 draw a scale diagram showing the relative positions of the four schools. (5mks)
- (b) Using your diagram determine the distance and bearing of G from A (2mks)
- (c) A mast is to be erected so that its equidistant from A and N and 20km from G on the same diagram show

the position of the mast and find its distance from **W**

(3mks)

18. The table shows the marks obtained by 40 candidates in an examination

Marks	5-14	15-29	30-34	35-44	45-49
Frequency	2	12	7	15	x

(a) Find the value of x (2mks)

(b) On the grid provided below draw a histogram to represent the data (5mks)

(c) By drawing a straight line on the graph above determine the median mark (3mks)

19. A matatu left Kakamega for Kisumu town 51km away at an average speed of 48km/h at 7.00am. At 7.30am a Bodaboda left Kisumu for Kakamega travelling along the same route at an average speed of 60km/h

(a) The time when Bodaboda meet the matatu (3mks)

(b) How far from Kisumu did the Bodaboda meet the matatu (3mks)

(c) After meeting the Bodaboda the matatu stopped for fifteen minutes before resuming the journey. At what speed should it travel then to reach Kisumu at the same time when the Bodaboda reached Kakamega. (4mks)

20. A certain number of form four students agreed to contribute equally to buy a gift worth sh. 1200 for their class prefect's birthday. Five students pulled out and so the others agreed to contribute an extra sh. 10. Their contribution enabled them to buy a gift worth sh. 200 more than they originally expected.

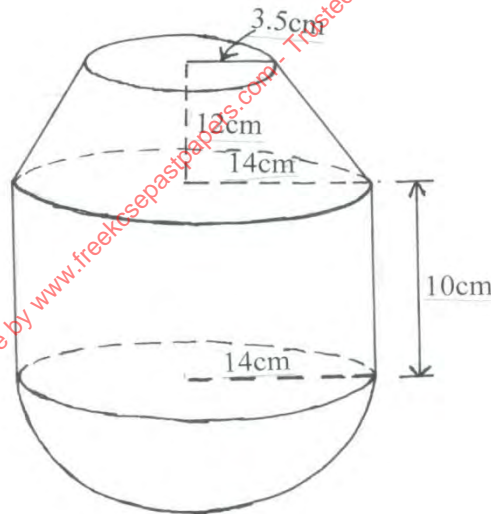
(a) If the original number of students was X, write an expression of how much each was originally going to contribute. (1 mark)

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

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

(d) Find how much each contributed. (2 marks)

21.



A right frustum of base radius 14cm, top radius 3.5cm and height 12cm is stuck onto a cylinder of base radius 14cm and height 10cm and further attached to a hemisphere to form a closed solid as shown above.

(Use  $\pi = \frac{22}{7}$ )

Find

(a) The full height of the solid. (1 mark)

(b) The volume of the solid. (4 marks)

(c) The total surface area of the solid. (5 marks)

22. The displacement of a particle S metres, t seconds after passing a fixed point O is given by

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

Calculate:

(a) The displacement of the particle 2 seconds later (2mks)

(b) The time taken for the particle to return to O (2mks)

(c) The maximum displacement of the particle (3mks)

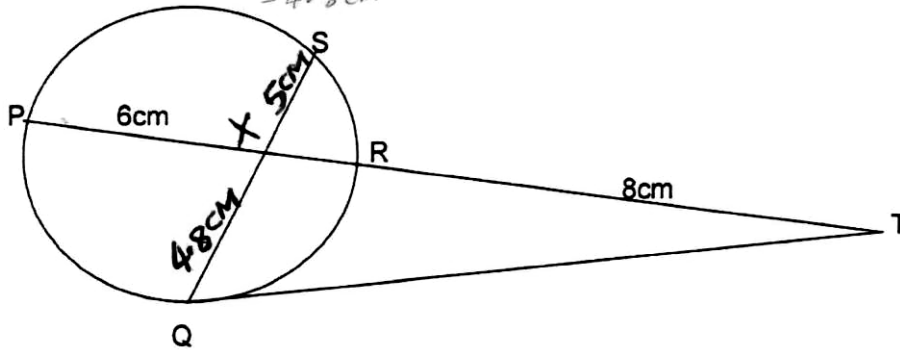
(d) The initial velocity of the particle (2mks)



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$$\frac{3}{2\sqrt{7}-4\sqrt{3}} - \frac{3}{2\sqrt{7}+4\sqrt{3}}$$

6. The position vectors of A and B are given as  $\mathbf{a} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$  and  $\mathbf{b} = -2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$  respectively. Find to 2 decimal places, the length of the vector  $\overrightarrow{AB}$ . (3 marks)
7. In the figure below QT is a tangent to a circle at Q. PXRT and QXS are straight lines. PX = 6cm, RT = 8cm, QX = 4.8cm and XS = 5cm.



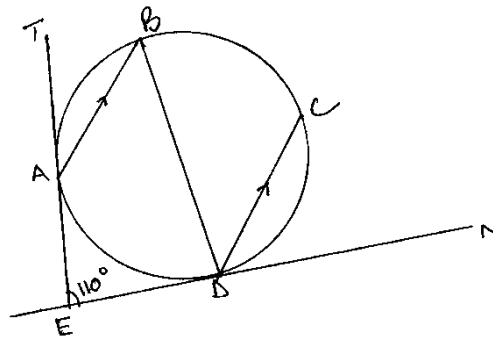
Find the length of:

- (a) XR (2mks)  
 (b) QT (2mks)
8. Find the centre and the radius of a circle whose equation is  $x^2 - 6x + y^2 - 10y + 30 = 0$  (3 marks)
9. (a.) Expand  $(3 + \frac{2}{x})^5$  up-to the term  $x^4$ . (2marks)  
 (b) Hence estimate the value of  $(3.5)^5$  to 4sf. (2marks)
10. Juma, Ali and Chege are three masons and together complete building a stone wall together in 12 Hours Juma and Ali working together complete the work in 18 hours while Juma and Chege working together complete the work in 24 hours. Find how long each would take to complete the building of the stone wall while alone. (4 marks)
11. 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) {3 marks}
12. The table below shows the distribution of marks scored in a test by form 2 students.

Marks	No. of students
30 - 34	2
35 - 39	5
40 - 44	13
45 - 49	12
50 - 54	8

Find the mean mark. (3 marks)

13. A computer whose marked price is sh. 40,000 is sold at sh. 56,000 on hire purchase terms. Mary bought the computer on hire purchase terms. She paid a deposit of 25% of the hire purchase and cleared the balance by equal monthly installments of sh. 2,625. Calculate the rate of interest charged per month if compound interest was applied. (3 marks)
14. TAE and EDN are tangents to a circle at A and D respectively. Line AB and DC are parallel chords, BD is another chord of the circle. Angle TAB is  $46^\circ$ . Find angle CDN giving reasons. (3 marks)



15. Find the equation of the normal to the curve  $y = (x^2 + 1)(x - 2)$  at  $x = 0.5$  {3 marks}
16. The co-ordinates of a point A and B are  $(8 -12 8)$  and  $(-4 28 -4)$  respectively. A point Q divides AB in the ratio 9:-5. Find the co-ordinates of Q. {3 marks}

**SECTION II (50 MARKS)**

**Answer FIVE questions in this section**

17. (i) complete the table below, giving the values correct to 2 decimal places (2marks)

$x^\circ$	$0^\circ$	$15^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$75^\circ$	$90^\circ$	$105^\circ$	$120^\circ$	$135^\circ$	$150^\circ$	$165^\circ$	$180^\circ$
$\cos 2x^\circ$	1.00	0.87		0.00	-0.5		-1.00		-0.5	0.00	0.50	0.87	1.00
$\sin (x^\circ + 30^\circ)$	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  $y = \cos 2x^\circ$  and  $y = \sin(x^\circ + 30^\circ)$  for  $0^\circ \leq x \leq 180^\circ$ . (4marks)
- (iii) Find the period of the curve  $y = \cos 2x^\circ$  (1 mark)
- (iv) Using the graph, estimate the solutions to the equations;
- (a)  $\sin(x^\circ + 30^\circ) = \cos 2x^\circ$  (1 mark)
- (b)  $\cos 2x^\circ = 0.5$  (1 mark)
18. A trader bought 8 cows and 12 goats for a total of Ksh.294,000. If he had bought 1 more cows and 3 more goats he would have spend Ksh.337, 500.
- (a) Form two equations to represent the above information. (2 marks)
- (b) Use matrix method to determine the cost of a cow and that of a goat. (4 marks)
- (a) The trader sold the animals he had bought making a profit of 40% per cow and 45% per goat.
- (i) Calculate the total amount of money he received. (2 marks)
- (ii) Determine his profit in Kenya shillings. (2 marks)

19. Income tax is charged on annual income at the rate shown below

Taxable income (K£)	Rate (shs per K£)
1 – 1500	2
1501 – 3000	3
3001 – 4500	5
4501 - 6000	7
6001 – 7500	9
Over 7500	10

A civil servant earns a monthly basic salary of Ksh.8570. He is housed by the government and as a result, his taxable income is 15% more than his salary. He is entitled to a tax relief of Ksh. 150 per month.

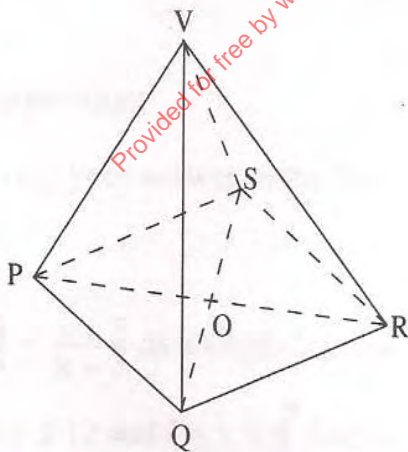
- a) How much tax does he pay in a year? (6mks)

b) From his salary, the following deductions are also made every month.

WCPS	2% basic salary
NHIF	Ksh 20

Calculate the civil servants net salary per month. (4mks)

20. A plane takes off from airport P at  $(0^\circ, 40^\circ\text{W})$  and flies 1800 nautical miles due East to Q then 1800 nautical miles due South to R and finally 1800 nautical miles due West before landing at S.
- (a) Find to the nearest degree the latitudes and longitudes of Q, R and S. (4mks)  
 (b) the total flight time is 16 hours, find the average speed in knots for the whole journey. (4mks)  
 (c) Find the time taken to fly from R to S (2mks)
21. A certain number of people agreed to contribute equally to buy books worth Sh. 1200 for a school library. Five people pulled out, so the others agreed to contribute an extra sh. 10 each. Their contribution enabled them to buy books worth sh. 200 more than they originally expected.
- a) If the original number of people  $x$ , write an expression of how much each was originally to contribute. {1 mark}  
 b) Write down two expressions of how much each contributed after the people pulled out. {2 marks}  
 c) Calculate how many people made the contribution? {5 marks}  
 d) State how much each contributed. {2 marks}
22. A farmer has at least 50 acres of land on which he plans to plant potatoes and cabbages. Each acre of potatoes requires 6 men and each acre of cabbages requires 2 men. The farmer has 240 men available and he must plant at least 10 acres of potatoes. The profit on potatoes is Ksh. 1000 per acre and on cabbages is Ksh. 1200 per acre. If he plants  $x$  acres of potatoes and  $y$  acres of cabbages:
- 23.
- (a) Write down 3 inequalities in  $x$  and  $y$  to describe the information. (2 marks)  
 (b) Represent these inequalities graphically. (use a scale of 1:10 for both axes) (4 marks)  
 (c) Use your graph to determine the number of acres for each vegetable which will give maximum profit. (4 marks)
24. 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)  
 (ii) acceleration of the particle at  $t = 4$  (2 marks)  
 (c) Calculate the percentage error arising from the estimated area in (a) above. (2mks)
25. The figure below represents a right pyramid on a square base PQRS of side 12 cm. O is the centre of the base and  $VO = 14$  cm.



Calculate;

- (a) The length of VP to 1 decimal place (3 marks)  
 (b) The angle which VP makes with the base PQRS (2 marks)  
 (c) The surface area of the pyramid to 1 decimal place (3 marks)  
 (d) The volume of the pyramid (2 marks)

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**FORM FOUR**  
**MATHEMATICS PAPER 1**  
**SECTION 1 ( 50 MARKS) COMPULSORY**

- Mary arranged all prime numbers less than ten in descending order to get a number. Kyalo also arranged all perfect square less than ten in ascending order to get a number. Find the total value of the second digit in the difference between the numbers (3 mks)
- Simplify the expression (3 mks)

$$\frac{y^4 - x^4}{y^3 - yx^2}$$

- Solve for x in the equation (3 mks)

$$2^{(2x-1)} \times \left[ \frac{1}{8} \right]^{(1-x)} = 4^{(3x+1)}$$

- The marked price of a modern camera is Ksh. 24,000. A trader sold it to a customer at a 10% discount. If the trader still made a profit of 20% on the cost price, what was its cost price (3 mks)
- A two digit number is such that the sum of the digit is 12. If the digits are interchanged the value of the new number formed is fifteen more than twice the value of the original number. Find the original number? (4 mks)
- Using reciprocal and squareroot tables only. Evaluate. (3 mks)

$$9.452^2 + \frac{1}{63.37}$$

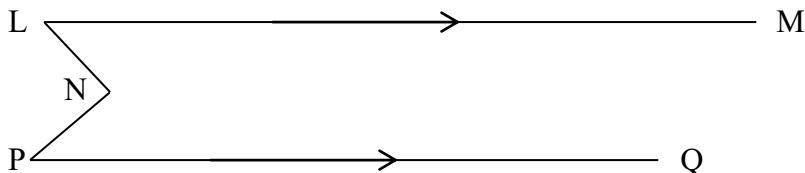
- Two similar container hold 2000cm<sup>3</sup> and 6.75 litres respectively. If the smaller container has a diameter of 15.50cm. What is the radius of the larger container correct to 1 decimal place. (3 mks)
- Given that OA = i + 3j - 4k and OB = 3i - j - k. Find /AB/ (3 mks)
- Three schools A, B, and C are such that B is 12km due south of A and C is 15km from A. C is on a bearing of N30°W from B. Calculate the bearing of C from A. (3 mks)
- Solve the inequality

$$3 - 2x < x \leq \frac{2x + 5}{3}$$

State the integral values which satisfy these inequalities (3 mks)

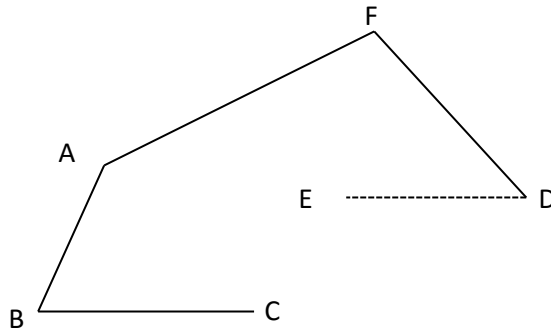
- The gradient of a line L through A(2x, 4) and B(-1, x) is 1/7. Find the equation of line perpendicular to L through B. (3 mks)

- On the figure below LM is parallel to PQ. Angle MLN = 30° and Angle NPQ = 70°. Find the value of X° (3 mks)



13. Complete the sketch below for the prism, ABCDEF

(3 mks)



14. A Jua Kali artisan has 63000g of metal of density  $7\text{g/cm}^3$ . He intends to use it to make a rectangular pipe with external dimensions 120mm by 150mm and internal dimensions of 100mm by 120mm. Calculate the length of the pipe in metres

(3 mks)

15. Jane and Mary started a business whereby contributed Ksh. 25000 and 20000 respectively. At the end of the year a profit of Ksh. 8100 was realized. From the profit funds for development dividends and reserves were set aside in the ration 4:5:6 respectively. If the dividends were shared in the ration of their contribution, determine:

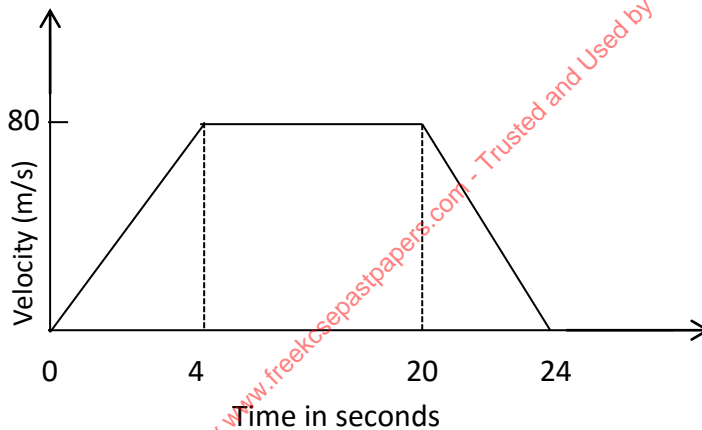
(a) The amount set aside for development

(2 mks)

(b) The dividends Mary received

(2 mks)

16. The figure below is a velocity timegraph for car



(a) Find total distance traveled by the car

(2 mks)

(b) Calculate the deceleration of the car.

(1 mk)

**SECTION II (50 MARKS)**

Answer any five questions in this section

17. Five members of 'SILK', a self supporting enterprise Jane, Jephoge, Esther, Mama Charo and Chepkoech were given a certain amount of money to share amongst themselves. Jane got  $\frac{3}{8}$  of the total amount while Jephoge got  $\frac{2}{5}$  of the remainder. The remaining amount was shared equally among Esther, Mama Charo and Chepkoech each of which received Ksh. 6,000;

(a) How much was shared among the five business women?

(3 mks)

(b) How much did Jephoge get?

(2 mks)

(c) Jane, Jephoge and Chepkoech invested their money and earned a profit of Ksh. 12,000. A third of the profit was left to maintain the business and the rest was shared according to their investments. Find how much each got.

(5 mks)

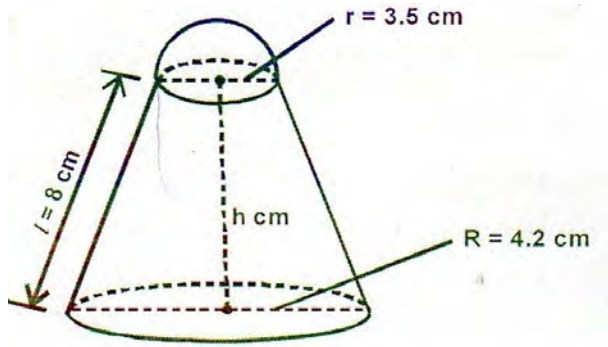
18. (a) On the grid provided draw the square whose vertices are A(6, -2), B(7, -2), C(7, -1) and D(6, -1) (1 mk)

(b) On the same grid draw

(i)  $A^1B^1C^1D^1$  the image of ABCD, under an enlargement scale factor 3, centre (9, -4) (3 mks)

- (ii)  $A^{11}B^{11}C^{11}D^{11}$ , the image  $A^1B^1C^1D^1$  under a reflection in the line  $x = 0$  (2 mks)
- (iii)  $A^{111}B^{111}C^{111}D^{111}$ , the image of  $A^{11}B^{11}C^{11}D^{11}$  under a rotation of  $+90^\circ$  about the origin (2 mks)
- (c) Describe a single transformation that maps  $A^1B^1C^1D^1$  onto  $A^{111}B^{111}C^{111}D^{111}$ . (2 mks)

19. The figure below shows a solid made up of a conical frustum and a hemispherical top. The dimensions are as indicated.

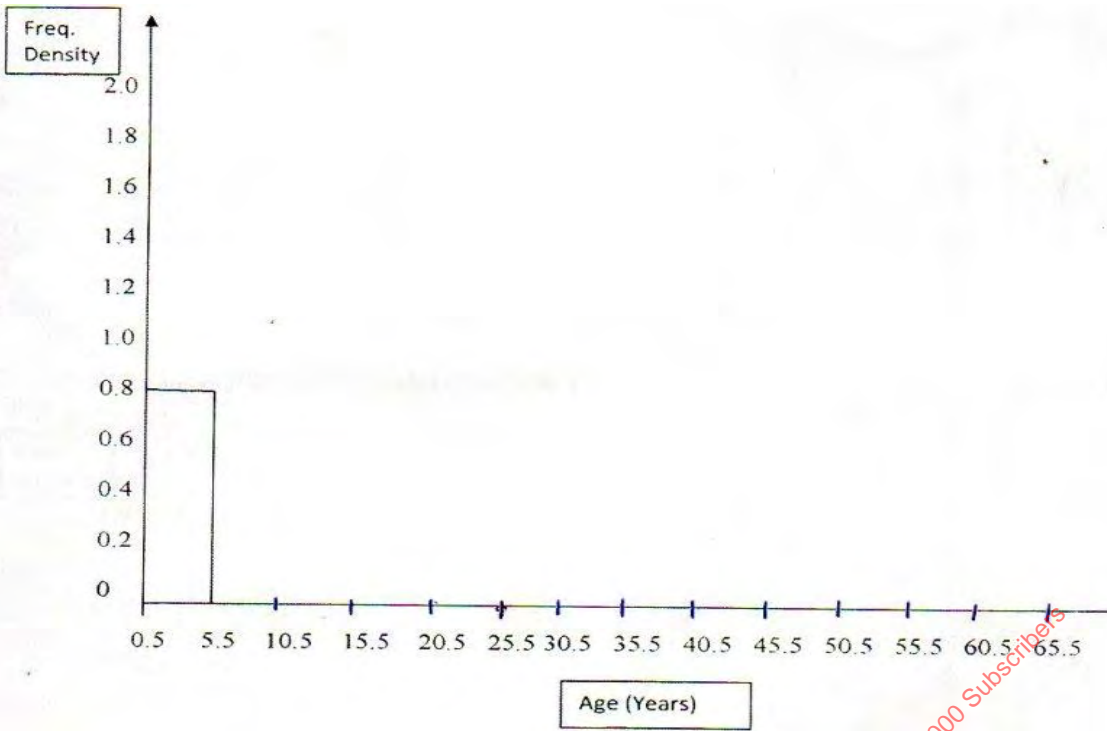


The top radius  $r = 3.5\text{cm}$ , bottom radius  $R = 4.2\text{cm}$ , slant height  $l = 8\text{cm}$  and the height of the frustum part is  $h\text{cm}$ .

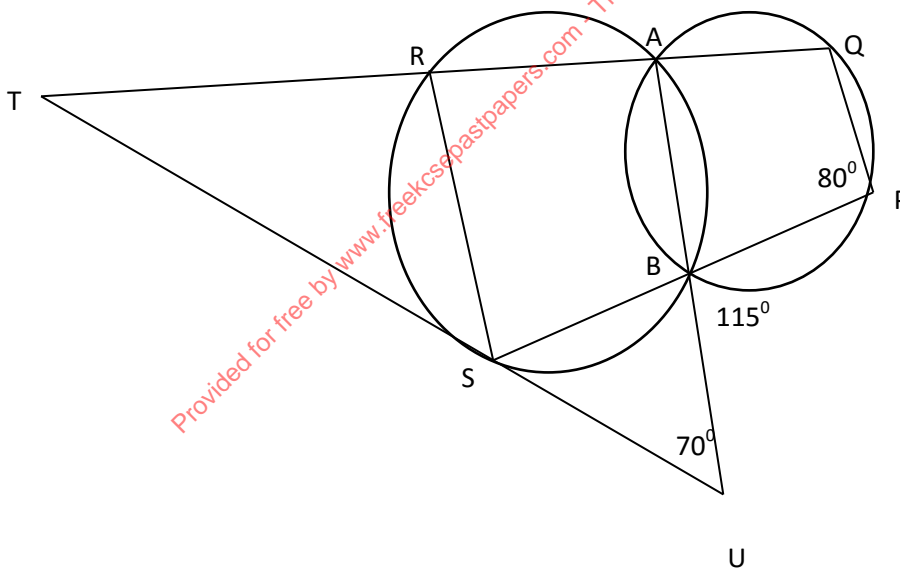
- (a) Find the surface area of the solid (Take  $\pi = \frac{22}{7}$ ) (5 mks)
  - (b) If a similar solid has a total surface area of  $81.51\text{cm}^2$ , determine the radius of its base, to the nearest whole number (1 mk)
  - (c) (i) Find the height  $h$  of the frustum. (1 mk)
  - (ii) Hence determine the volume of the solid (3 mks)
20. Two towns A and B are 80km apart. Juma started cycling from town A to town B at 10.00am at an average speed of 40km/h. Mutuku started his journey from town B to town A at 10.30am and traveled by car at an average speed of 60km/h
- Calculate:
- (i) The distance from town A when Juma and Mutuku met (5 mks)
  - (ii) The time of the day when the two met (2 mks)
  - (b) Kamau started cycling from town A to town B at 10.20am. He met Mutuku at the same time as Juma did. Determine Kamau's average speed (3 mks)
21. The following data shows the sample of age distribution of the people who reside in a certain village in years, in Nandi County

Age group	Frequency
1 .....5	4
6 .....10	8
11 .....20	8
21 .....30	6
31 .....50	40
51 .....55	3
56 .....65	3

- (a) Complete the histogram of the given data below (6 mks)



- (b) Calculate the mean age of the given sample in the village (4 mks)
22. the figure below shows two circles ABPQ and ABSR intersecting at A and B. PBS, QART and ABU are straight lines. The line UST is a tangent to the circle ABSR at S. Angle BPQ =  $80^\circ$ , angle PBU =  $115^\circ$  and angle BUS =  $70^\circ$



Find the values of the following angles, stating your reasons in each case.

- (a)  $\angle BAR$  (2 mks)
  - (b)  $\angle STR$  (2 mks)
  - (c)  $\angle BSU$  (2 mks)
  - (d)  $\angle BRS$  (2 mks)
  - (e)  $\angle SBU$  (2 mks)
23. Using a pair of compasses and ruler only,
- (a) Construct triangle XYZ such that  $XY = 8\text{cm}$ ,  $YZ = 6\text{cm}$  and angle  $XYZ = 30^\circ$  (3 mks)
  - (b) Measure the length of XZ (1 mk)
  - (c) Draw a circle that touches the vertices X, Y and Z. (2 mks)
  - (d) Measure the radius of the circle (1 mk)
  - (e) Calculate the area of the circle outside the triangle to 2 d.p. (3 mks)



24. The function  $y = \frac{1}{3}x^3 + x^2 - 3x + 2$  represents a curve.
- Find the gradient function of the curve (1 mk)
  - Find the turning points of the curve and distinguish between them. (6 mks)
  - Hence sketch the curve  $y = \frac{1}{3}x^3 + x^2 - 3x + 2$  (3 mks)

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**FORM FOUR**

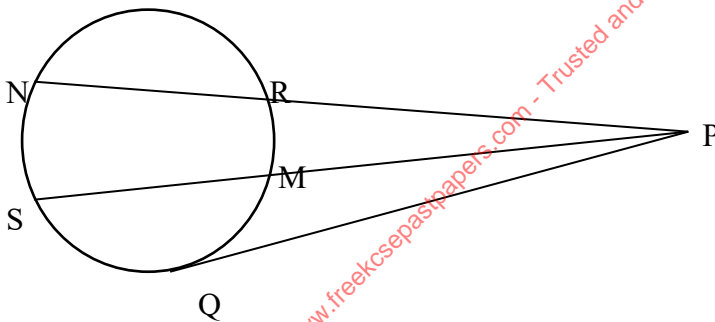
**MATHEMATICS PAPER 2**

**SECTION 1 (50 MARKS) COMPULSORY**

- The side of a triangle measures 5cm, 7.1cm and 6.20cm respectively. Find the percentage error in calculating the perimeter (3 mks)
- The sum of the fifth and sixth term of an AP is 30. If the third is 15, find the first term (3 mks)
- Solve for x in the following equation (3 mks)  
 $\sin(\frac{1}{2}x - 10^\circ) = \cos 2x$
- Make H the subject of the formula (3 mks)

$$F = \sqrt{\frac{H - 2WL}{3H}}$$

- In the figure below, RN and MS are chords of a circles that meet at an external point P. PQ is a tangent to the circle at Q. Given that PR = 2cm, PN = 12cm and PM = 3cm. Find the length of :



- PS (2 mks)
  - PQ (1 mk)
- By rationalizing the denominator, simplify.  
 $\frac{\sqrt{3}}{3\sqrt{3} + 2\sqrt{5}}$  leaving the answer in the form  $a + b\sqrt{c}$  (3 mks)
  - Find the radius and the centre of a circle whose equation is (3 mks)  
 $3x^2 + 3y^2 + 18y - 12x - 9 = 0$
  - The interior angle of a regular polygon is three times the exterior angle. Determine the number of sides in the polygon (3 mks)
  - A coffee trader buys two grades of coffee at sh. 80 and sh. 100 per packet. Find the ratio at which she should mix them so that by selling the mixture at sh. 120, a profit of 25% is realized (3 mks)
  - Given that  $a = 2i + 4j$  and  $b = 2i - j$ . Find  $2a - 3b$  (3 mks)
  - From the data 16, 5, 7, 13, 2, 9, 3, 20, 13, 6, 5 Find;
    - The range (1 mk)
    - Quartile deviation (2 mks)
  - Draw line  $AB = 5\text{cm}$ . On one side AB construct the locus of all points P such that angle  $APB = 60^\circ$ . (Using a ruler and compass only (3 mks)
  - Two similar cans have different heights 8cm and the other one 10cm. If the surface area of the larger can is  $480\text{cm}^2$ . Find the surface area of the smaller can. (3 mks)

14. A bag contain 5 blue balls and 3 red balls. A ball is picked at random and replaced. A second ball is then picked. Find the probability that
- (a) Both ball are red (1 mk)
  - (b) The two balls are of different colours (2 mks)
15. A commercial plot is valued at sh. 500,000. The plot depreciates at rate of 10% per six months for a period of 2 years. It then appreciates at a rate of 4% per quarter yearly for three years. Find the value of the plot after 5 years to nearest shillings (4 mks)
16. Three quantities P, Q and R are such that P varies jointly with Q and the square of R. If P = 900 when Q = 20 and R = 3, Find
- (i) An equation connecting P,Q and R (2 mks)
  - (ii) The value of R when Q = 10 and P = 800 (2 mks)

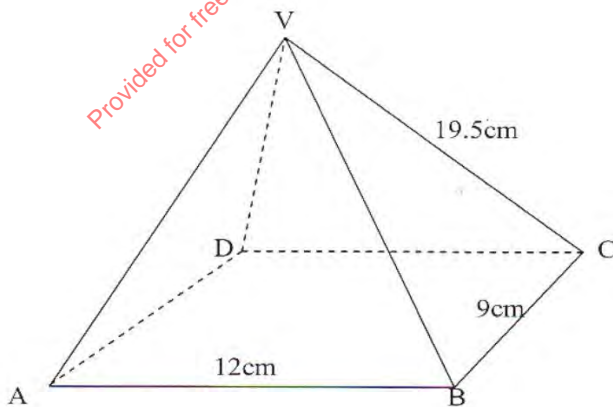
**SECTION II**

17. A rural factory manufacturer broilers food made from sunflower seed, millet and maize in the ratio 5:3:1. Sunflower seeds are imported in to the country from Philippines at a cost of US \$ 204.50 for 30kg or from Germany at £ 96.4 for 20kgs. The exchange rate is 1 US \$ = £ 0.718. Bags are filled with the food at the rate of 420 grammes per second.
- (a) How much is the quantity of sunflower seed in 15kg of the food (2 mks)
  - (b) Determines the cheapest source of this sunflower seed, clearly stating the difference in cost in terms of US\$. (3 mks)
  - (c) Determine the number of bags of the food packed in 4 hours given a bag is 15kg. (2 mks)
  - (d) A trader buys the food from the factory and sell each bat at Ksh. 1377, thereby making a profit of 12.5%. Determine his buying price. (3 mks)

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

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

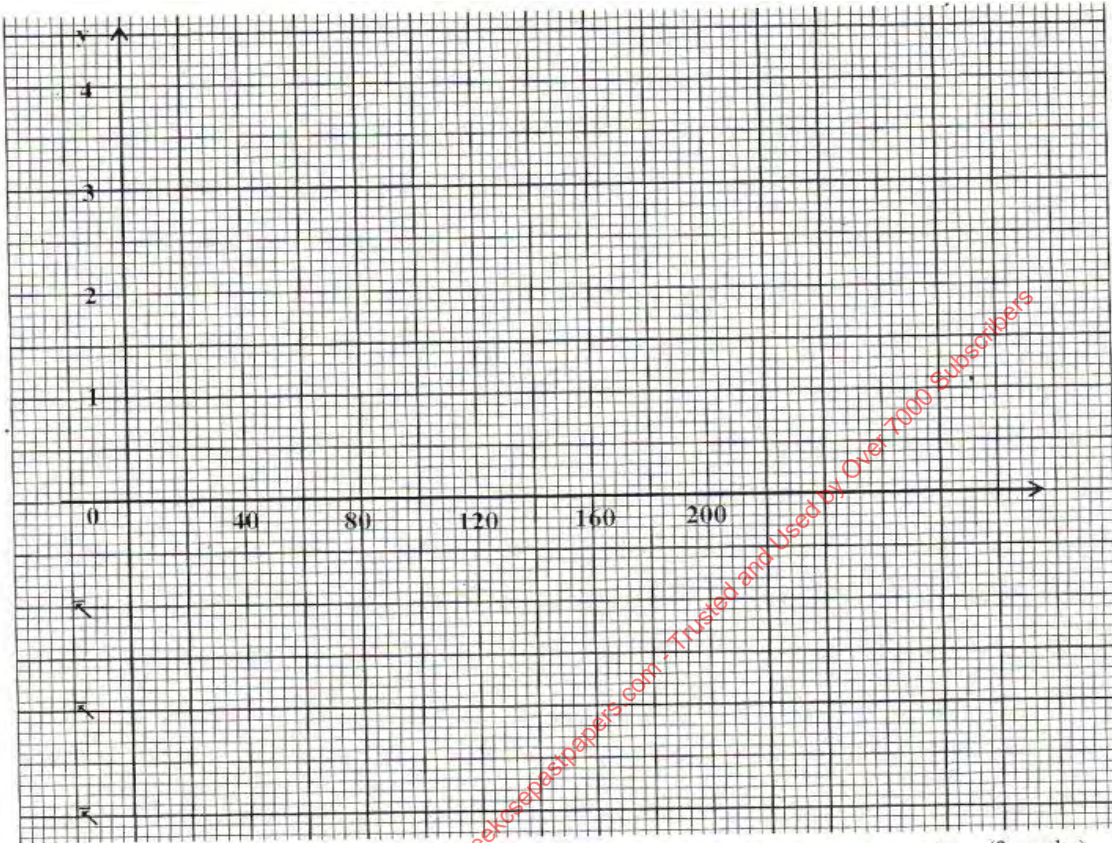
- (a) State the modal class (1 mk)
  - Calculate the median to 4 d.p (3 mks)
  - (b) Using an assumed mean of 5.2, find;
    - (i) Mean to 4 d.p (3 mks)
    - (ii) Standard deviation 4 d.p (3 mks)
19. The figure below is a right pyramid with a rectangular base ABCD of length 12cm and width 9cm. The slanting edge is 19.5cm long.



- (a) Determine the height of the pyramid (2 mks)
  - (b) Find the angle, the line AV makes with base ABCD (3 mks)
  - (c) Calculate the angle between planes VAD and VBC (3 mks)
  - (d) Calculate the volume of the pyramid. (2 mks)
20. Given that  $y = 2 \sin 2x$  and  $y = 3 \cos (x + 45^\circ)$
- (a) Complete the table below: (2 mks)

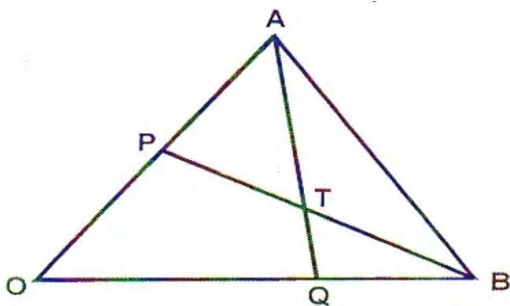
x	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
2 sin 2x	0		1.97		0.68	-0.68	-1.73		-1.28	0.00
3 cos (x + 45°)	2.12	1.27		-0.78		-2.46			-2.72	-2.12

- (b) Use the data to draw the graph of  $y = 2 \sin 2x$  and  $y = 3 \cos (x + 45^\circ)$  for  $0^\circ \leq x \leq 180^\circ$  on the same axis on the grid provided below. (5 mks)



- (c) State the amplitude and period of each curve (2 mks)  
 (d) Use the graph to solve the equation  $2 \sin 2x - 3 \cos (x + 45^\circ) = 0$  for  $0^\circ \leq x \leq 180^\circ$  (1 mk)

21. In the triangle below P and Q are points on OA and OB respectively such that  $OP:PA = 3:2$  and  $OQ:QB = 1:2$ . AQ and PQ intersect at T. Given that  $OA = a$  and  $OB = b$ .



- (a) Express AQ and PQ in terms of a and b (2 mks)  
 (b) Taking  $BT = kBP$  and  $AT = hAQ$  where h and k are real numbers.  
 (i) Find two expressions for OT in terms of a and b (2 mks)  
 (ii) Use the expression in b(i) above to find the values of h and k. (4 mks)  
 (c) Give the ratio BT:TP (2 mks)

22. A plane flying at 2000 knots left an airport A ( $30^{\circ}\text{S}$ ,  $31^{\circ}\text{E}$ ) and flew due north to an airport B ( $30^{\circ}\text{N}$ ,  $31^{\circ}\text{E}$ )
- (a) Calculate the distance covered by the plane in nautical miles (3 mks)
- (b) After a 15 minutes stop over at B, the plane flew west to the airport C ( $30^{\circ}\text{N}$ ,  $13^{\circ}\text{E}$ ) at the same speed. Calculate the total time to complete the journey from airport A to airport C through B (4 mks)
- (c) If the plane left airport at 0800 hours. Find the time the plane touched down at C. (3 mks)
23. The table below shows how income tax was charged in a certain year.

(Kenya pounds)	(Ksh. Per Kenya pound)
1 – 3630	2
3631 – 7260	3
7261 – 10890	4
10891 – 14520	5
14521 – 18150	6
18151 – 21780	7
21781 and above	7.5

During the year Mwadime earned a basic salary of Ksh. 25,200 and a house allowance of Ksh. 12,600 per month. He was entitled to a personal tax relief of Ksh. 1,162 per month.

- (a) Calculate:
- (i) Mwadime's taxable income in Kenya pounds per annum (2 mks)
- (ii) The net tax he pays per month (6 mks)
- (b) Apart from income tax he also contributes monthly NHIF Ksh. 1600, WCPS Ksh. 1000. Calculate his net monthly pay (2 mks)
24. The initial velocity of a particle was 1 m/s and its acceleration is given by  $2 - t$  m/s<sup>2</sup> every second after the start.
- (a) (i) Determine the equation representing its velocity. (3 mks)
- (ii) Find the velocity of the particle during the third second. (3 mks)
- (b) (i) find the equation representing its distance  $t$  seconds after the start (3 mks)
- (ii) What was the distance covered by the particle during the first three seconds (1 mk)

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