MARANDA HIGH SCHOOL

FORM 4 PREMOCK EXAMINATIONS-2024

121/1 **MATHEMATICS** **Paper 1**

Alt. A

March 2024 – 2½ hours

Name: Marking Guide ..... **Adm No:** ..... **Stream:** .....

Date: .....**Signature:** .....

Instructions to candidates

(a) Write your name, admission number and stream in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
*(c) This paper consists of **two** sections: **Section I** and **Section II.***
*(d) Answer **all** the questions in **Section I** and all **any five** questions from **Section II.***
*(e) **Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.***
(f) Marks may be given for correct working even if the answer is wrong.
*(g) **Non-programmable** silent electronic calculators **and** KNEC Mathematical tables may be used, except where stated otherwise.*
*(h) **This paper consists of 16 printed pages.***
*(i) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
*(j) Candidates should answer the questions in **English***

For Examiner's Use Only

Section I

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

Section II

17	18	19	20	21	22	23	24	Total

Grand Total

SECTION 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)

$$\frac{y(9a^2-16b^2y^2)}{y(4by-3a)} \quad \surd M_1$$

$$=\frac{(3a-4by)(3a+4by)}{(4by-3a)}$$

$$=-(3a+4by) \quad \surd M_1$$

$$=-3a-4by \quad \surd A_1$$

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)

New Mass $= 41+3$ $\surd M_1$

$= 44$

Total Mass $= 44 \times 45$ $\surd M_1$

$= 1980$ kg $\surd A_1$

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)

$2y = 3x + 8$

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

$m_{MN} = \frac{3}{2}$ $\surd B_1$

$\frac{-1-2k}{k+1} = \frac{3}{2}$ $\surd M_1$

$-2-4k = 3k+3$

$k = -\frac{5}{7}$

$M\left(-\frac{5}{7}, 1\right)$

$N\left(-1, 1\frac{3}{7}\right)$ } $\surd A_1$

7. Use matrix method to solve (4 marks)

$5x + 3y = -26$

$3x - 4y = -33$

$\begin{pmatrix} 5 & 3 \\ 3 & -4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -26 \\ -33 \end{pmatrix}$ $\surd M_1$

$-\frac{1}{29}\begin{pmatrix} -4 & -3 \\ -3 & 5 \end{pmatrix}\begin{pmatrix} 5 & 3 \\ 3 & -4 \end{pmatrix} =$

$-\frac{1}{29}\begin{pmatrix} -4 & -3 \\ -3 & 5 \end{pmatrix}\begin{pmatrix} -26 \\ -33 \end{pmatrix}$ $\surd M_1$

$\begin{pmatrix} x \\ y \end{pmatrix} = -\frac{1}{29}\begin{pmatrix} 203 \\ -87 \end{pmatrix}$

$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -7 \\ 3 \end{pmatrix}$ $\surd M_1$

$x = -7$ & $y = 3$ $\surd A_1$

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)

$2x + x = 90^\circ$ $\surd M_1$

$x = 30^\circ$ $\surd A_1$

$\sin 30^\circ = \frac{7}{l}$ or $\cos 60 = \frac{7}{l}$ $\surd M_1$

$l = 14\text{m}$ $\surd A_1$

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)

$A.S.F = \frac{630}{280}$

$= \frac{9}{4}$ $\surd B_1$

$M.S.F = \frac{27}{8}$

$\frac{27}{8} = \frac{M_b}{720}$ $\surd M_1$

$M_b = \frac{720 \times 27}{8}$

$= 2430\text{g}$ $\surd A_1$

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)

$$\begin{pmatrix}-3\\4\end{pmatrix}+\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}2\\2\end{pmatrix}$$

$$\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}5\\-6\end{pmatrix}\quad \sqrt{B_1}$$

$$\begin{pmatrix}x_1\\y_1\end{pmatrix}+\begin{pmatrix}5\\-6\end{pmatrix}=\begin{pmatrix}0\\1\end{pmatrix}$$

$$\begin{pmatrix}x_1\\y_1\end{pmatrix}=\begin{pmatrix}-5\\5\end{pmatrix}$$

$B(-5, 5)\ \sqrt{B_1}$

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)

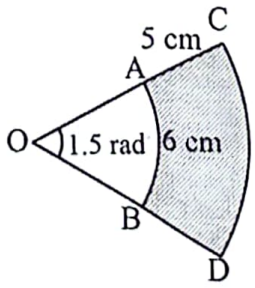
$2x+45^\circ+x=180^\circ\quad \sqrt{M_1}$

$x=45^\circ$

N^o of sides $=\frac{360^\circ}{45^\circ}\quad \sqrt{M_1}$

$=8$ sides $\sqrt{A_1}$

6. In the figure below, AB and CD are arcs of the sectors OAB and OCD respectively. $\angle AOB = 1.5^c$, AB = 6 cm and AC = 5 cm.



Calculate the area of the shaded region. (3 marks)

$\frac{1.5}{2\pi}\times 2\pi(OA)=6\ \sqrt{M_1}$

$OA=4$ cm

Area $=\frac{1.5}{2\pi}\times\pi\left(9^2-4^2\right)\sqrt{M_1}$

$=48.75\ cm^2\ \sqrt{A_1}$

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)

$x = \frac{4}{3}$ or $\frac{1}{2}$

$\left(x - \frac{4}{3}\right)\left(x - \frac{1}{2}\right) = 0$ $\surd M_1$

$x^2 - \frac{1}{2}x - \frac{4}{3}x + \frac{4}{6} = 0$ $\surd M_1$

$x^2 - \frac{11}{6}x + \frac{4}{6} = 0$

$6x^2 - 11x + 4 = 0$ $\surd A_1$

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	2	3	6	11	18	27	38	51

$\surd B_1$ $\surd B_1$

$A = 2(2 + 6 + 18 + 38)$ $\surd M_1$

$= 128$ $\surd A_1$

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)

Area of the cross-section of the pipe $= 18 \times 10 - 15 \times 8$

$= 60$

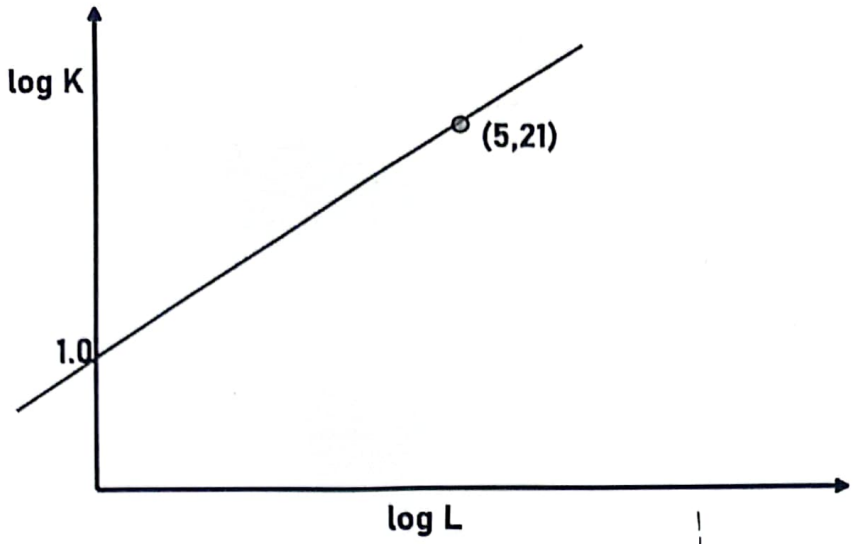
Volume of the pipe $= 60 \times 150$ $\surd M_1$

$= 9000\ cm^2$

Mass $= \frac{9000 \times 14}{1000}$ $\surd M_1$

$= 126\ kg$ $\surd A_1$

13. The graph below shows a plot of log K against log L.



Express K in terms of L. (3 marks

$m = \frac{21-1}{5-0}$ $\surd m_1$

$= 4$

$\log K = 4 \log L + 1$

$\Rightarrow \log K = \log L^4 + \log 10$ $\surd$

$\log K = \log (10L^4)$

$K = 10L^4$ $\surd A_1$

14. The distance between two stations Kakira and Luambaga is 200 km. A truck left Kakira for Luambaga at a 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

Distance covered by truck as at 9:18 am $\surd m_1$

$\frac{48}{60} \times 60 = 48$ km

$\surd m_1$

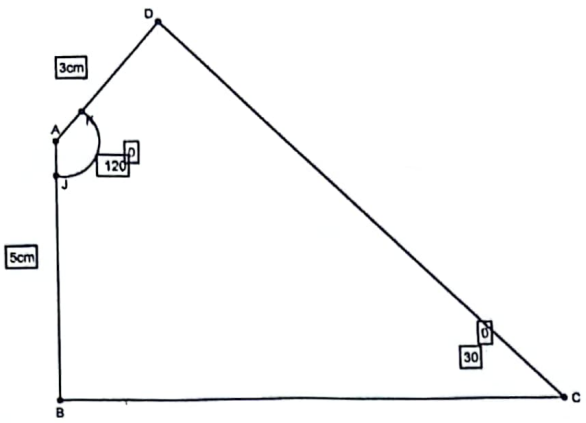
$\frac{192}{60} \times 60 = 192$ km

Remaining distance

$= 200 - 192$

$= 8$ km $\surd A_1$

15. The figure below shows quadrilateral ABCD in which $< DAB = 120°, < DCB = 30°$ and $< ABC = 90°$ and also lengths AB=5cm and AD=3cm.



$\sin 30° = \frac{8}{3+DC}$ $\surd M_1$

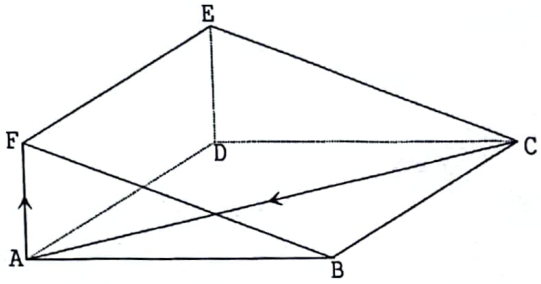
$3 + DC = \frac{8}{\sin 30°}$

$DC = 16 - 3$ $\surd M_1$

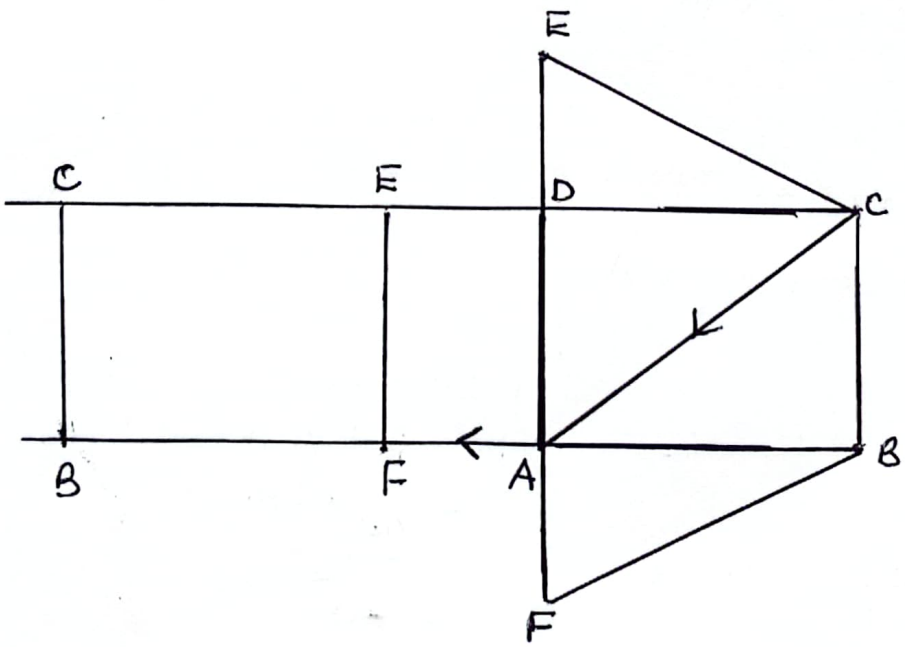
$= 13.0$ $\surd A_1$

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)



$\surd B_1$ Correct sketch

$\surd B_1$ Correct labelling

$\surd B_1$ correct path drawn

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)

Fraction shared by the boys
$= \frac{5}{6} \times \frac{1}{3}$ $\checkmark M_1$
$= \frac{5}{18}$
Fraction of the remaining pencils $= 1 - \frac{2}{3} - \frac{5}{18}$ $\checkmark M_1$
$= \frac{1}{18}$
If $\frac{1}{18} = 8$ pencils
$\therefore \frac{18}{18} = \frac{18}{18} \times \frac{18}{1} \times 8$ $\checkmark M_1$
$= 144$ pencils $\checkmark A_1$

(b) amount of money the teacher spent in purchasing the pencils given that he was charged Ksh. 25 per every six pencils. (3 marks)

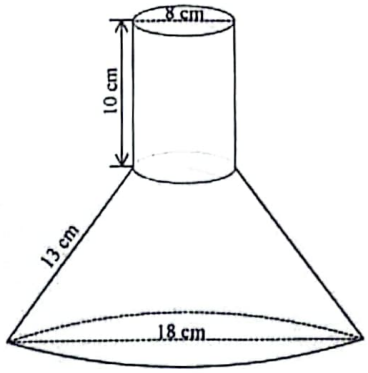
Number of bunches of pencils
$= \frac{144}{6}$ $\checkmark M_1$
$= 24$
Total cost $= 24 \times 25$ $\checkmark M_1$
$= 600/=$ $\checkmark A_1$

(c) number of learners in the class if each girl got three pencils and each boy two. (3 marks)

No of girls in the class
$= \frac{2}{3} \times 144$
$\frac{3}{}$ $\checkmark M_1$
$= 32$

No of boys in the class
$= \frac{5}{18} \times 144$ $\checkmark M_1$
$\frac{2}{}$
$= 20$
Total Number of learners
$= 32 + 20$
$= 52$ $\checkmark A_1$

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)

$\frac{18}{8} = \frac{x+10}{x}$

$x = 12.5$ $\surd B_1$

$L = \sqrt{22.5^2 + 9^2}$

$= 24.23$

$l = \sqrt{10^2 + 4^2}$ } $\surd B_1$

$= 10.77$

Area of the curved surface of the frustum $= \pi(9 \times 24.23 - 4 \times 10.77)$ $\surd M_1$

$= 174.99\pi$

Surface area of the curved part of the cylinder $= \pi \times 8 \times 10$ $\surd M_1$

$= 80\pi$

Surface area of the bottom $= 9^2\pi$ $\surd M_1$

$= 81\pi$

Total surface $= 80\pi + 81\pi + 174.99\pi$

$= 335.99\pi$ $\surd A_1$ (4 marks)

b) volume of solid

Volume of the frustum

$= \frac{1}{3}\pi(9^2 \times 22.5) - \frac{1}{3}\pi(4^2 \times 10)$ $\surd M_1$

$= 554.17\pi$

Volume of cylinder $= \pi \times 4^2 \times 10$ $\surd M_1$

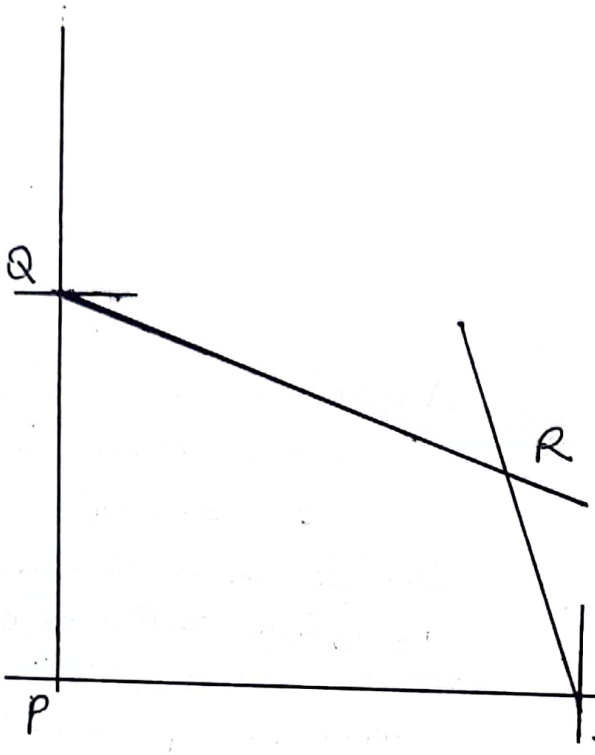
$= 160\pi$

Total Volume $= 554.17\pi + 160\pi$ $\surd M_1$

$= 714.17\pi$ $\surd A_1$

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)



$B_1\surd$ Correct scale used

$\surd B_1$ correct location of Q from P

$\surd B_1$ Correct location of S from P

$\surd B_1$ Correct bearing of R from Q

$\surd B_1$ correct location of R

b) Using the scale drawing, determine

i) Compass bearing of R from P. (1 mark)

N65°E $\surd B_1$

ii) The distance between R and S. (1 mark)

$180^0 \pm 6m$ $\surd B_1$

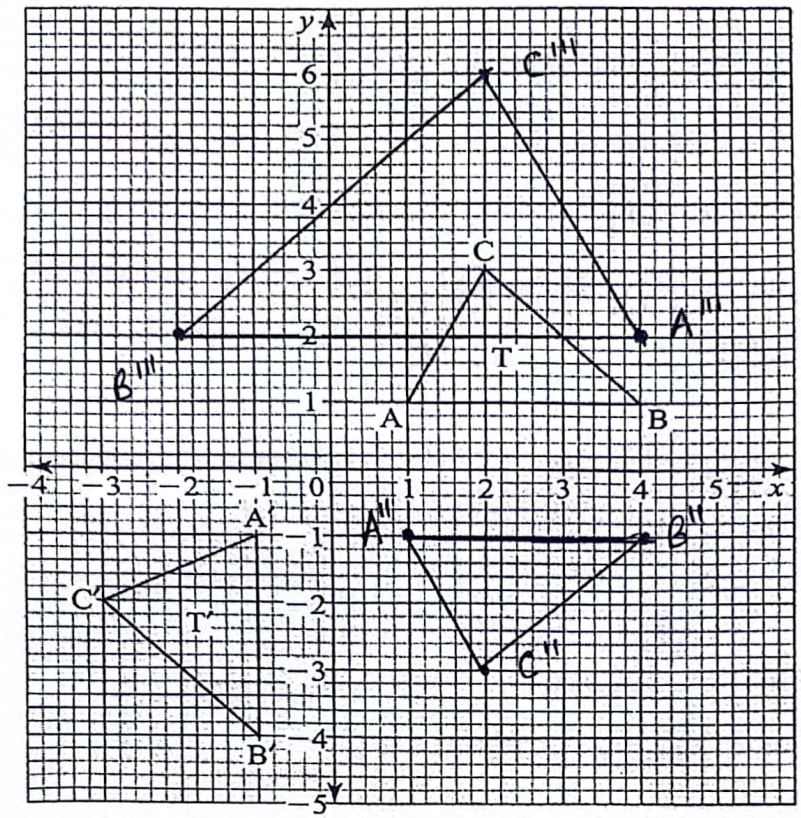
iii) The area of the region enclosed by the four pegs. (3 marks)

$A = \frac{1}{2} \times 180 \times 420 \sin 70^0 + \frac{1}{2} \times 390 \times 300 \sin 70^0$ $\surd M_1$

$= 35520.38 + 54972.02$ $\surd M_1$

$= 90492.4 m^2$ $\surd A_1$

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)

$y = -x$ $\surd B_1$

b) i)T' is mapped onto T'' by positive quarter turn about (0,0). Draw T''and state its coordinates. (2 marks)

B_1 $\surd$ Diagram $A''(1,-1)$, $B''(4,-1)$ and $C''(-2,3)$ $\surd B_1$

ii) Describe a single transformation that maps T onto T'' (2 marks)

Reflection $\surd B_1$ on the line $y=0$ $\surd B_1$

c) T'' is mapped onto T''' by an enlargement, centre (2, 0), scale factor -2 . Draw T'''. (2 marks)

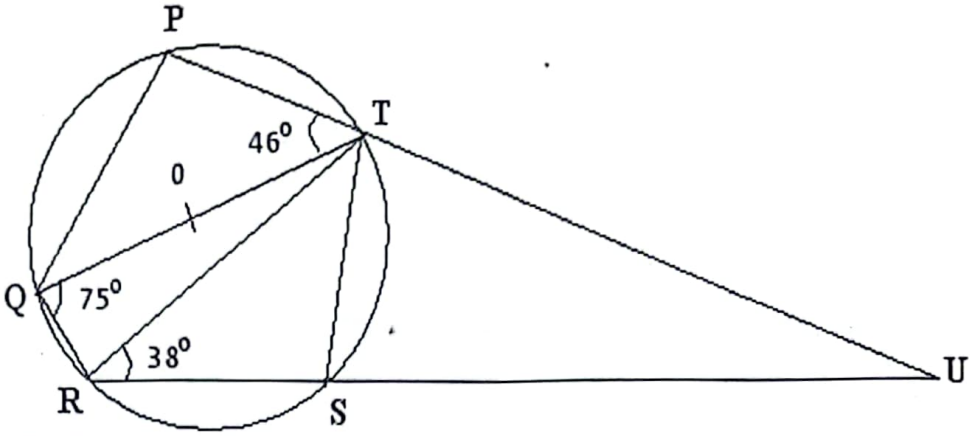
$\surd B_1$ First point correctly enlarged $\surd B_1$ the remaining two vertices enlarged correctly and T''' $\surd$ completed

d) Given that the area of T''' is 12cm^2, calculate the area of T. (3 marks)

A.S.F $= \left(\frac{3}{1}\right)^2$ $\surd M_1$ Area of T $= \frac{12 \times 1}{4}$ $\surd M_1$

$= 3\ cm^2$ $\surd A_1$

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)

105° $\surd B_1$

Angles on a straight line add up to 180° $\surd B_1$

b) Angle SUT (2 marks)

23° $\surd B_1$

Sum of the interior angles of a triangle is 180° $\surd B_1$

c) Angle PST (2 marks)

44° $\surd B_1$

Angles subtended by the same chord PT are equal $\surd B_1$

d) Obtuse angle ROT (2 marks)

150° $\surd B_1$ The reflex angle is always twice the angle $\surd B_1$

e) Angle SQT (2 marks)

38° $\surd B_1$

Sum of interior angles of a triangle is 180° $\surd B_1$

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)

$\frac{dy}{dx} = 6x^2 - 18x + p$ $\surd M_1$

$6(4)^2 - 18(4) + p = 36$ $\surd M_1$

$p = 12$ $\surd A_1$

b) The equation of the tangent to the curve at $x = 0.5$. (4 marks)

$y = 2(0.5)^3 - 9(0.5)^2 + 12(0.5) - 1$ $\surd M_1$

$= 3$

The point is $(0.5, 3)$

$m = 6(0.5)^2 - 18(0.5) + 12$ $\surd M_1$

$= 4.5$

$\frac{y-3}{x-0.5} = 4.5$ $\surd M_1$

$y = 4.5x + 0.75$ $\surd A_1$

c) Find the coordinates of the turning points of the curve (3 marks)

$6x^2 - 18x + 12 = 0$ $\surd M_1$

$x = \frac{18 \pm 6}{12}$ $\surd M_1$

$x = 1$ or 2

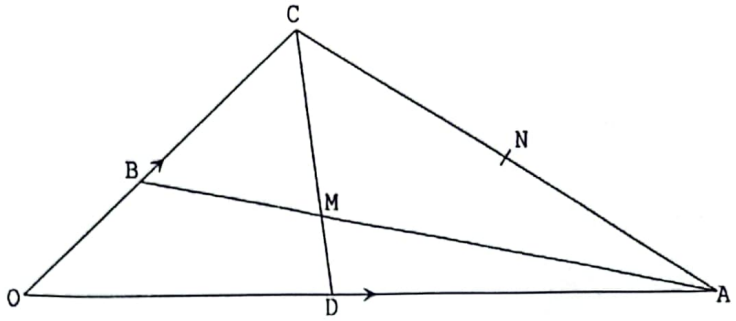
when $x = 1$ then $y = 4$

when $x = 2$ then $y = 3$

The turning points are

$(1, 4)$ and $(2, 3)$ $\surd A_1$

23. In the figure below $\vec{OB} = \underset{\sim}{b}; OC = 3\vec{OB}$ and $OA = \underset{\sim}{a}$



a) Given that $\overrightarrow{OD} = \frac{1}{3}\overrightarrow{OA}$ and $\overrightarrow{AN} = \frac{1}{2}\overrightarrow{AC}$, $\overrightarrow{CD}$ and $\overrightarrow{AB}$ meet at M. Determine in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

i) $\vec{AB} = -\underset{\sim}{a} + \underset{\sim}{b}$ (1 mark)

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

$\vec{CM} = k(-3\underset{\sim}{b} + \frac{1}{3}\underset{\sim}{a})$ ✓B_1

$\vec{AM} = h(-\underset{\sim}{a} + \underset{\sim}{b})$

$\vec{CM} = \vec{CA} + \vec{AM}$

$= -3\underset{\sim}{b} + \underset{\sim}{a} + h(-\underset{\sim}{a} + \underset{\sim}{b})$

$= (1-h)\underset{\sim}{a} + (-3+h)\underset{\sim}{b}$ ✓B_1

$-3k = -3 + h$

$\frac{1}{3}k = 1 - h$ ✓m_1

$\Rightarrow \frac{8}{3}k = 2$ ✓m_1

$k = \frac{3}{4}$

$-3 \times \frac{3}{4} = -3 + h$

$h = \frac{3}{4}$ ✓A_1

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

$\vec{OM} = 3\underset{\sim}{b} + \frac{3}{4}(-3\underset{\sim}{b} + \frac{1}{3}\underset{\sim}{a})$

$= \frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}$ ✓B_1

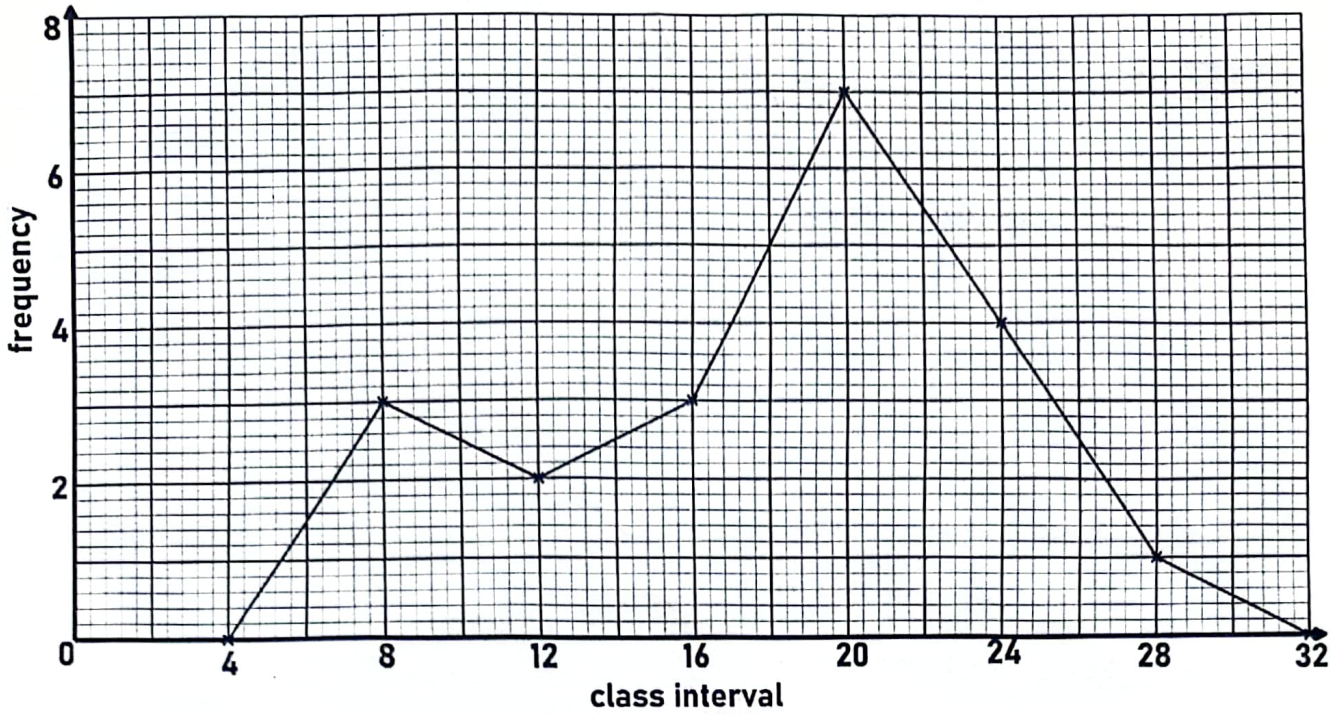
$\vec{MN} = -\frac{3}{4}(-3\underset{\sim}{b} + \frac{1}{3}\underset{\sim}{a} + \frac{1}{2}(-3\underset{\sim}{b} + \underset{\sim}{a}))$

$= \frac{1}{4}\underset{\sim}{a} + \frac{3}{4}\underset{\sim}{b}$ ✓B_1

$\vec{MN} = \vec{OM}$ hence $\vec{OM} \parallel \vec{MN}$

Since $\vec{OM}$ is parallel to $\vec{MN}$ and they share a common point M then points O, M and N are collinear ✓B_1

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)
6-10	8	3
10-14	12	2
14-18	16	3
18-22	20	7
22-26	24	4
26-30	28	1
		$\Sigma f = 20$

$\sqrt{B_1}$ Class sizes correct

$\sqrt{B_1}$ Midpoints correct

$\sqrt{B_1}$ Frequencies correct

b) Use the data to estimate to one decimal place the:

i) mean of the data (3 marks)

Σfx = 24 + 24 + 48 + 140 + 96 + 28 $\sqrt{M_1}$

= 360

$\bar{x} = \frac{360}{20}$ $\sqrt{M_1}$

= ~~17.9~~ 18.0 years $\sqrt{A_1}$

ii) median age. (2 marks)

$$\text{Median} = 18 + \left(\frac{\frac{20}{2} - 8}{7}\right)4 \quad \surd M_1$$

$$= 22\tfrac{4}{7} \text{ years} \quad \surd A_1$$

$$= 19.1 \text{ years}$$

iii) percentage of this family members who are atleast 25 years of age. (2 marks)

Total area under the histogram

$= 4(3 + 2 + 3 + 7 + 4 + 1)$

$= 80$ square units

Area of those 25 years and above

$= 1 \times 4 + 4 \times 1$

$= 8$

$\% = \frac{8}{80} \times 100\% \quad \surd M_1$

$= 10\% \quad 10.0\% \quad \surd A_1$

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