

Cover page

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1. Solve the equation $6 + x - 2x^2 = 0$

(5 marks)

$$(6+x)(-3x-2x^2)=0 \quad M1$$

$$2(3+2x)-x(3+2x)=0 \quad M1$$

$$(2-x)(3+2x)=0 \quad M1$$

$$x = 2 \text{ or } -\frac{3}{2}$$

A1

A1

2. Given that $A = \begin{pmatrix} 3 & -1 \\ 1 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 3 \\ 6 & 1 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$,
find $5(A - BC)$

(5 marks)

$$5 \left[\begin{pmatrix} 3 & -1 \\ 1 & 0 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ 6 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right] \quad M1$$

$$5 \left[\begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix} - \begin{pmatrix} 1 & 3 \\ 6 & 1 \end{pmatrix} \right] \quad M1$$

$$5 \begin{pmatrix} 1 & -4 \\ -5 & -1 \end{pmatrix} \quad M1$$

$$\begin{pmatrix} 5 & -20 \\ -25 & -5 \end{pmatrix} \quad M1 \quad A1$$

3. Solve for y in the equation: $(2^y)^2 - 9(2^y) = -8$

(5 marks)

$$\text{let } 2^y = x$$

$$x^2 - 9x + 8 = 0 \quad \text{M1}$$

$$(x-1)(x-8) = 0$$

$$x = 1 \text{ or } 8 \quad \text{M1}$$

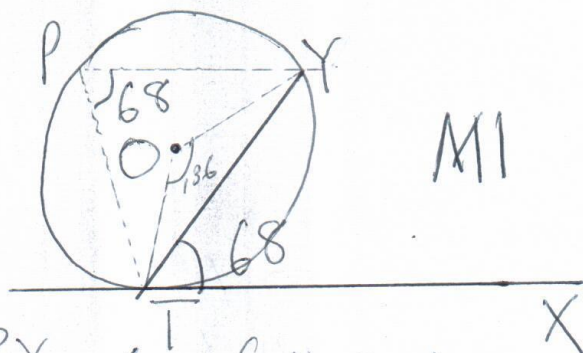
$$\therefore 2^y = 1 \text{ or } 2^y = 8$$

$$2^y = 2^0 \text{ or } 2^y = 2^3 \quad \text{M1}$$

$$\therefore y = 0 \text{ or } 3$$

4. A circle centre O has a tangent XT at T . TY is a chord such that angle YTX is acute. If angle $YTX = 68^\circ$, calculate the value of angle OYT

(5 marks)



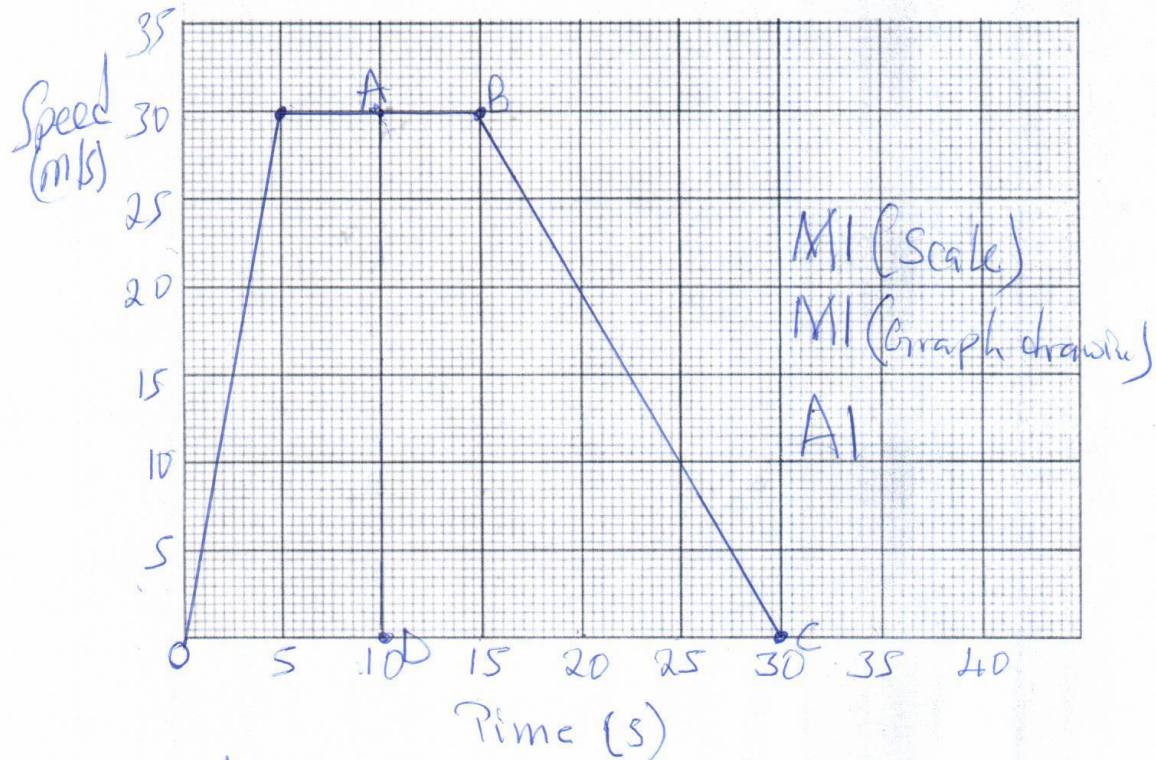
$$\angle TPY = 68^\circ, \text{ (alt seg)} \quad \text{M1}$$

$$\angle TOY = 2\angle TPY = 2 \times 68 = 136^\circ \quad \text{M1}$$

$$\angle OYT = \frac{180 - 136}{2} \quad \text{(Base angle of Iso } \Delta \text{) M1}$$

$$\angle OYT = 22^\circ \quad \text{A1}$$

5. A car starts from rest and attains a maximum speed of 30 m/s in 5 seconds. It is kept at that speed for the next 10 seconds before it decelerates to 0 m/s in the next 15 seconds. Using a scale of 2 cm to represent 5 seconds on the horizontal axis and 2 cm to represent 5 m/s on the vertical axis, draw a speed time graph, and use it to find the distance that it covers in the last 20 seconds. (6 marks)



$$\begin{aligned}
 \text{Distance} &= \text{Area of ABCD} \\
 &= \frac{1}{2}(5+20) \times 30 \text{ MI} \\
 &= 375 \text{ m MI AI}
 \end{aligned}$$

6. Figure 1 shows a tangent NT to a circle MNOQ at N. NT is parallel to MO.

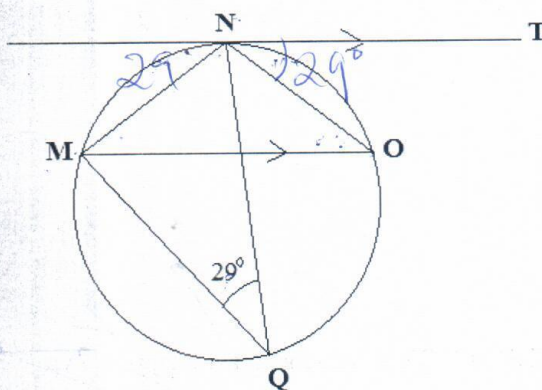


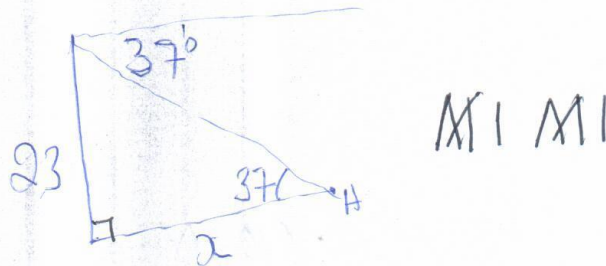
Figure 1

Given that angle MQN is 29° , calculate the value of angle MNO

(5 marks)

$$\begin{aligned}
 \angle MNQ &= 29^\circ \text{ (alt seg)} & M1 \\
 \angle MQN &= 29^\circ \text{ (Same seg)} & M1 \\
 \angle ONT &= 29^\circ \text{ (alt angles)} & M1 \\
 \angle MNO &= 180 - 29 - 29 \text{ (adj } \angle\text{s)} & M1 \\
 \angle MNO &= 122^\circ & A1
 \end{aligned}$$

8. The angle of depression of a hut from the top of a pole is 37° . If the pole is 23 m tall, how far is the hut from the foot of the pole? (5 marks)



$$\tan 37 = \frac{23}{x} \quad \text{MI}$$

$$x = \frac{23}{\tan 37} \quad \text{MI}$$

$$x = 30.522 \quad \text{AI}$$

9. Given the position vectors $P = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$ and $Q = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$, find $\vec{PQ}$ (4 marks)

$$\vec{PQ} = \begin{pmatrix} 2 \\ 6 \end{pmatrix} - \begin{pmatrix} 6 \\ -2 \end{pmatrix} \quad \text{MI MI}$$

$$= \begin{pmatrix} 2 - 6 \\ 6 - (-2) \end{pmatrix} \quad \text{MI}$$

$$= \begin{pmatrix} -4 \\ 8 \end{pmatrix} \quad \text{AI}$$

10. Figure 2 shows a straight line graph $y = x + 10$ crossing the x and y axes at P and Q respectively.

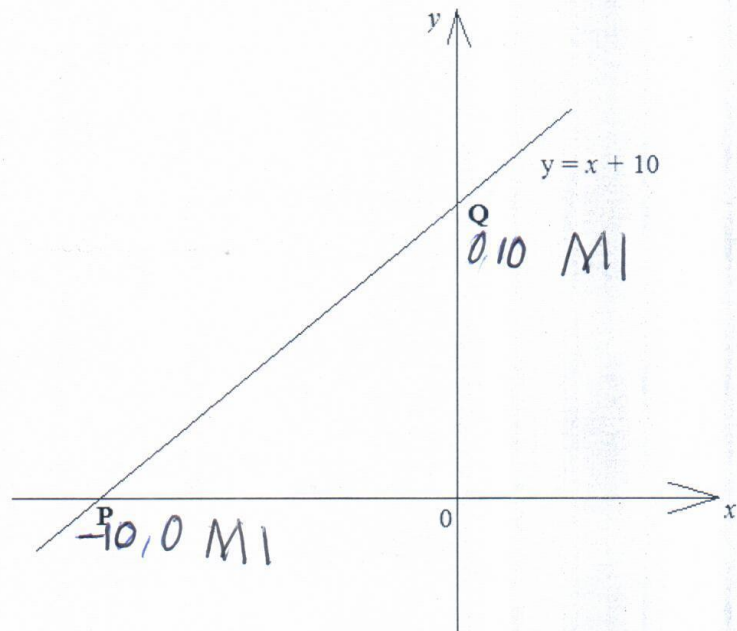


Figure 2

Find the coordinates of the mid-point of PQ

(6 marks)

$$\frac{-10+0}{2}, \frac{0+10}{2} \text{ M1}$$

$$\frac{-10}{2}, \frac{10}{2} \text{ M1}$$

$$(-5, 5) \text{ M1 A1}$$

11. Simplify $\frac{7}{3\sqrt{18}} + \frac{15\sqrt{6}}{3\sqrt{6}}$ leaving your answer with a rational denominator

(5 marks)

$$\frac{7+45\sqrt{6}}{3\sqrt{18}} \times \frac{\sqrt{18}}{\sqrt{18}} \quad M1 \quad M1$$

$$\frac{7\sqrt{18} + 45\sqrt{108}}{3 \times 18} \quad M1$$

$$\frac{\sqrt{18}(7+45\sqrt{6})}{3 \times 18} \quad M1$$

$$\frac{\overset{54}{\cancel{54}} \sqrt{2}(7+45\sqrt{6})}{\overset{54}{\cancel{54}} 18} \Rightarrow \frac{\sqrt{2}(7+45\sqrt{6})}{18} \quad A1$$

12. P varies directly as x^3 and inversely as y. when $x = 2$ and $y = 4$, $p = 3$.
Find the value of x when $p = 12$ and $y = 4$. (5 marks)

$$p \propto \frac{x^3}{y}$$

$$p = \frac{kx^3}{y} \quad M1$$

$$3 = \frac{2^3 k}{4} \quad M1$$

$$8k = 12$$

$$k = 1.5 / 1\frac{1}{2} / 3\frac{1}{2} \quad M1$$

$$12 = \frac{1.5x^3}{4}$$

$$1.5x^3 = 48$$

$$x^3 = \frac{48}{1.5} \quad M1$$

$$x^3 = 32$$

$$x = \sqrt[3]{32} \quad A1$$

13. In a survey at Tsanja Secondary, the number of people in each car passing a school was recorded as shown below

Number of people	1	2	3	4	5
Number of cars	14	16	14	21	16

What is the probability that a car picked at random has more than 3 passengers.

$$\text{Total Cars passed} = 14 + 16 + 14 + 21 + 16 = 81 \quad (4 \text{ marks}) \quad M1$$

$$\text{Cars with more than 3 passengers} = 21 + 16 = 37 \quad M1$$

$$P(\text{more than 3}) = \frac{37}{81} \text{ or } 0.457 \quad (\text{mark})$$

M1 A1

14. The sum of terms of an arithmetic progression is $5n^2 - 11n$. Find the tenth term of the sequence.

$$a = S_1 = 5(1)^2 - 11(1)$$

$$S_1 = 5 - 11 \quad M1$$

$$S_1 = -6$$

$$a + d = S_2 = 5(2)^2 - 11(2)$$

$$= 20 - 22$$

$$= -2 \quad M1$$

$$-6 + d = -2 \quad (5 \text{ marks})$$

$$d = -2 + 6$$

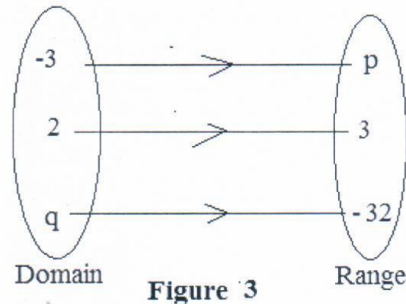
$$d = 4 \quad M1$$

$$T_{10} = a + 9d$$

$$= -6 + 9(4) \quad M1$$

$$T_{10} = 30 \quad A1$$

15. Figure 3 shows an arrow diagram for the function $f(x) = x^3 - 5$



Calculate the values of p and q

(6 marks)

$$\begin{aligned}
 p &= (-3)^3 - 5 \quad M1 \\
 &= -27 - 5 \quad M1 \\
 &= -32 \quad A1 \\
 q^3 - 5 &= -32 \quad M1 \\
 q^3 &= -27
 \end{aligned}
 \quad \Bigg/ \quad
 \begin{aligned}
 q &= \sqrt[3]{-27} \quad M1 \\
 q &= -3 \quad A1
 \end{aligned}$$

16. The volumes of two cubes are 24 cm^3 and 81 cm^3 . If the base area of the bigger cube is 36 cm^2 , Find the base area of the smaller cube.

(5 marks)

$$\begin{aligned}
 V \cdot F &= \frac{24}{81} \quad \frac{8}{27} \quad M1 \\
 S \cdot F &= \frac{2}{3} \quad M1 \\
 A \cdot F &= (S \cdot F)^2 = \left(\frac{2}{3}\right)^2 = \frac{4}{9} \quad M1 \\
 \frac{4}{9} &= \frac{x}{36} \Rightarrow x = \frac{4 \times 36}{9} \quad M1 \\
 x &= 16 \text{ cm}^2 \quad A1
 \end{aligned}$$

17. Figure 4 shows a pyramid placed on top of a square based cuboid.

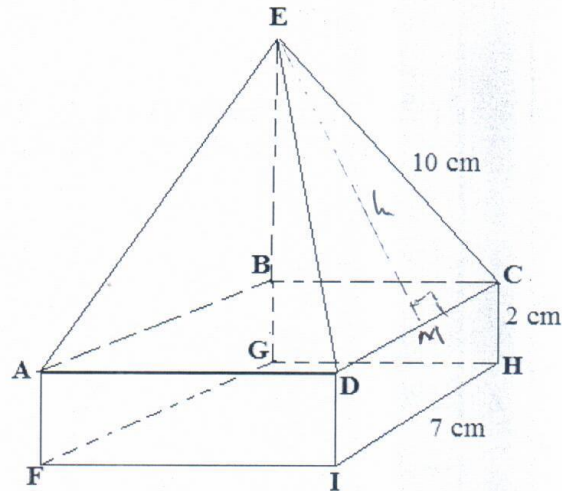


Figure 4

Given that $CE = 10$ cm, $IH = 7$ cm and $CH = 2$ cm, calculate the total surface area of the shape to 2 decimal places. (6 marks)

$$EM = h^2 = 10^2 - 3.5^2 \quad M1$$

$$h^2 = 100 - 12.25$$

$$h = 87.75$$

$$h = \sqrt{87.75} \quad M1$$

$$\Delta \text{r areas} = \frac{1}{2} \times 7 \times \sqrt{87.75} \times 4^2 \quad M1$$

$$14\sqrt{87.75} + 7 \times 2 \times 4 + 7 \times 7 \quad M1$$

$$14\sqrt{87.75} + 14 \times 4 + 49$$

$$14\sqrt{87.75} + 56 + 49$$

$$= 236.14496 \quad M1$$

$$= 236.14 (2.d.p) \quad A1$$

18. Given that $3p^3 + xp^2 + yp - 6$ and $((3p^2 + p - 6)(p + 1))$ are identical polynomials, find the values of x and y (5 marks)

$$3p^3 + xp^2 + yp - 6 \equiv 3p^3 + p^2 - 6p + 3p^2 + p - 6 \quad M1$$

$$3p^3 + xp^2 + yp - 6 \equiv 3p^3 + 4p^2 - 5p - 6 \quad M1$$

$$\frac{xp^2}{p^2} = \frac{4p^2}{p^2} \quad M1$$

$$x = 4 \quad A1$$

$$\frac{yp}{p} = \frac{-5p}{p}$$

$$y = -5 \quad A1$$

19. Make y subject of the formula $p = x \left(\frac{r}{y}\right)^3$ (4 marks)

$$\frac{x \left(\frac{r}{y}\right)^3}{x} = \frac{p}{x} \quad M1$$

$$\sqrt[3]{\left(\frac{r}{y}\right)^3} = \sqrt[3]{\frac{p}{x}} \quad M1$$

$$\frac{r}{y} = \sqrt[3]{\frac{p}{x}} \quad M1$$

$$y = \frac{r}{\sqrt[3]{\frac{p}{x}}} \quad A1$$

20. Using a scale of 2 cm to represent 2 units on both axes, show the region **W** represented by the following system of inequalities by shading the **unwanted** region on the graph paper on below:

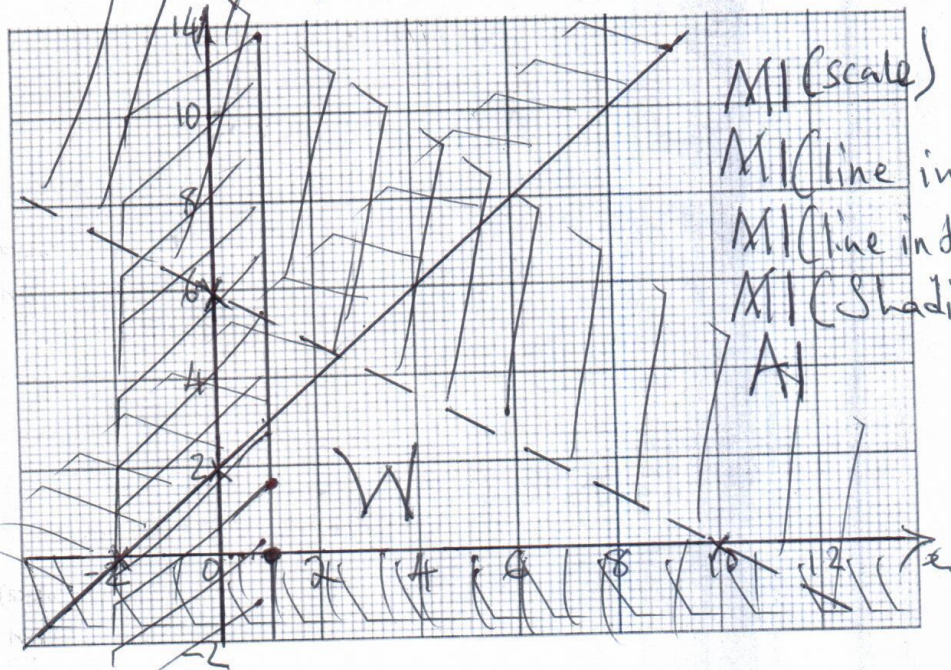
$$y - x \leq 2, \Rightarrow y = x + 2$$

$$y \geq 0, \Rightarrow y = 0$$

$$x \geq 1, \Rightarrow x = 1$$

$$5y + 3x < 30 \Rightarrow 5y = -3x + 30$$

(5 marks)



END OF QUESTION PAPER.

NB: This paper has 14 printed pages.