

Section A (62 marks)
Answer all the questions in this section.

1 (a) Evaluate $\frac{5.48 \times \sqrt[3]{98}}{(0.15)^2}$.

(i) Write down your answer correct to 2 significant figures.

$$1122.897$$

Answer 1100 [1]

(ii) Write down your answer as a whole number.

Answer 1123 [1]

(b) The population of Asia is approximately 4 758 460 732.

(i) Write the value correct to the nearest million.

Answer 4758 millions [1]

(ii) The land area of Asia is estimated to be 4.46×10^7 square kilometres.
Calculate the number of people per square kilometre in Asia.

$$\frac{4758460732}{4.46 \times 10^7} = 106.6919$$

Answer 107 A1 [2]

2 (a) Simplify $8(y^{\frac{3}{2}}z)^2 \div \sqrt{4y^3}$.

$$\frac{8y^{\frac{3}{2}}z^3}{2y^{\frac{3}{2}}} = 4z^3$$

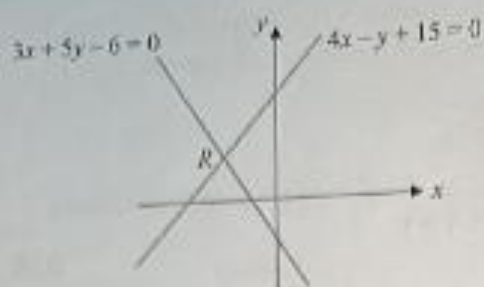
Answer 4z³ A1 [2]

(b) Given $3^m \times 3^4 = 9$, find m .

$$\begin{aligned} 3^{m+4} &= 3^2 & \text{M1} & \text{or } 3^m = \frac{1}{9} \\ m+4 &= 2 & & 3^m = 3^{-2} \\ m &= -2 \end{aligned}$$

Answer $m =$ -2 A1 [2]

3



Two lines intersect at point R . Find the coordinates of point R .

$$3x + 5y = 6 \quad \text{--- (1)}$$

$$4x - y = -15 \quad \text{--- (2) MI}$$

$$20x - 5y = -75 \quad \text{--- (3)}$$

$$\text{(1) + (3): } 23x = -69$$

$$x = -3 \quad \text{MI}$$

$$y = 3$$

Answer $R = (-3, 3)$ AI [3]

- 4 A reservoir has an area of 1250 m^2 . It is represented on the map by an area of 50 cm^2 . Find the scale of the map in the form of $1 : n$.

$$50 \text{ cm}^2 : 1250 \text{ m}^2 \quad \left[\begin{array}{l} 1 \text{ m} = 100 \text{ cm} \\ 1 \text{ m} = 100 \text{ cm} \end{array} \right] \times$$

$$50 \text{ cm}^2 : (250 \times 100 \times 100 \text{ cm}^2) \quad \text{or } 50 \text{ cm}^2 : 1250 \text{ m}^2$$

$$1 \text{ cm}^2 : 25,000 \text{ cm}^2 \quad \text{MI}$$

$$1 \text{ cm} : 500 \text{ cm}$$

$$1 \text{ cm}^2 : 25 \text{ m}^2$$

$$1 \text{ cm} : 5 \text{ m}$$

$$1 \text{ cm} : 500 \text{ cm}$$

AI
Answer $1 : 500$ [2]

- 5 The number of hours spent on online activities by students in a particular week are recorded. The results are shown in the table below:

Number of hours	$0 < x \leq 2$	$2 < x \leq 4$	$4 < x \leq 6$	$6 < x \leq 8$	$8 < x \leq 10$
Frequency	p	9	10	25	16

- (a) The modal online hours spent by students in a week is $6 < x \leq 8$. Find the largest possible value of p .

Answer $p = \dots\dots\dots 24 \dots\dots\dots$ [1]

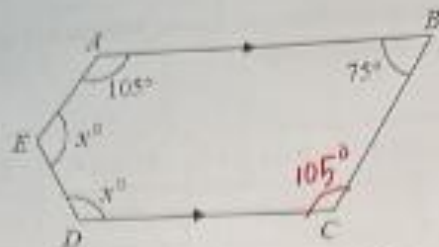
- (b) The estimated mean online hours spent by students in a week is 6.25. Find the value of p .

$$\frac{p+27+50+175+144}{p+60} = 6.25 \quad \text{M2}$$

$$\frac{396+p}{60+p} = 6.25 \quad p = 4$$

Answer $p = \dots\dots\dots 4 \dots\dots\dots$ [3]

6 (a)



$ABCDE$ is a pentagon. AB is parallel to DC ; angle $ABC = 75^\circ$ and angle $BAE = 105^\circ$. Find the value of angle x , stating all reasons clearly.

$$\begin{aligned}\angle BCD &= 180^\circ - 75^\circ \\ &= 105^\circ \text{ (interior angles)}\end{aligned}$$

M1

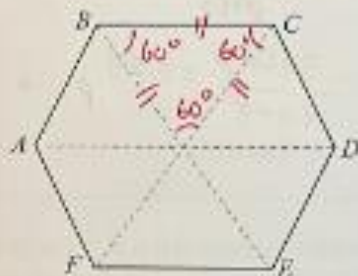
$$\begin{aligned}\text{Sum of interior angles} &= (5-2)180^\circ \\ &= 540^\circ\end{aligned}$$

$$\begin{aligned}2x + 105^\circ + 75^\circ + 105^\circ &= 540^\circ \\ x &= 127.5^\circ\end{aligned}$$

M1

Answer $x = 127.5$ A1 [3]

(b)

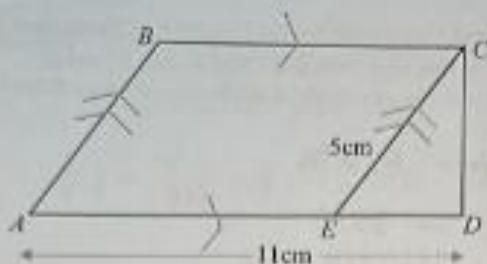


$ABCDEF$ is a regular hexagon. The length of each side is 10cm. Calculate the area of the hexagon.

$$\begin{aligned}&6 \left[\frac{1}{2} \times 10 \times 10 \times \sin 60^\circ \right] \\ &= 259.807 \\ &\approx 260 \text{ cm}^2\end{aligned}$$

M2

Answer 260 A1 cm^2 [3]



$ABCE$ is a parallelogram. AED is a straight line.

Given that $EC = 5\text{ cm}$, $AD = 11\text{ cm}$ and perimeter of parallelogram = 26 cm .

- (a) Show that $AE = 8\text{ cm}$.

Answer

$$\begin{aligned} 5 + 5 + BC + AE &= 26 \\ BC + AE &= 16 \\ AE &= \frac{16}{2} \\ &= 8\text{ cm} \end{aligned}$$

[1]

- (b) If $CD = 4\text{ cm}$, explain how you know that angle CDE is a right angle. Show any calculations you make.

$$\begin{aligned} ED &= 11 - 8 \\ &= 3\text{ cm} \end{aligned} \quad \begin{aligned} CE^2 &= 5^2 \\ &= 25 \end{aligned} \quad \begin{aligned} CD^2 + ED^2 &= 4^2 + 3^2 \\ &= 25 \end{aligned} \quad \text{M1}$$

Answer ... By converse of pythagoras theorem, $CE^2 = CD^2 + ED^2$ and angle CDE is a right angle. M1

[2]

- (c) Find angle CED .

$$\begin{aligned} \sin \hat{CED} &= \frac{4}{5} \quad \text{M1} \\ \angle CED &= 53.1^\circ \end{aligned}$$

Answer 53.1° A1 [2]

8

- (a) Alan, Benny and Charles ran for the President of the student council. Alan won 42%, Ben won 38% and Charles won 52 votes. Find the total number of votes cast.

$$\begin{aligned} 20\% &= 52 \text{ votes} \\ 100\% &= 52 \times 5 \\ &= 260 \text{ votes} \end{aligned}$$

M1

Answer 260 A1 votes [2]

- (b) The usual price of a calculator is \$38. It was sold at a promotion price of \$32. Find the percentage decrease.

$$\frac{6}{38} \times 100\%$$

M1

Answer 15.8 A1 % [2]

- (a) The total participants registered for a marathon run was 224. The ratio of male runners to female runners was 3:4. On the actual day of the marathon run, a few more female runners who did not register joined in and the ratio of male runners to female runners became 8:11. Find the total number of female runners for the marathon run on the actual day.

$$\begin{aligned} M : F \\ &= 3 : 4 \\ &= 96 : 128 \end{aligned}$$

M1

$$\begin{aligned} \text{Actual day, } M : F \\ &= 8 : 11 \\ \times 12 \quad & \left(\begin{array}{l} 8 \times 12 = 96 \\ 11 \times 12 = 132 \end{array} \right) \times 12 \\ &= 96 : 132 \end{aligned}$$

K

Answer 132 A1 [2]

- 9 (a) Benny travelled $\frac{2}{5}$ of his journey by train, $\frac{1}{4}$ by bus, $\frac{1}{3}$ by car and the remaining 3km on foot. Find the total length of the journey.

$$\frac{2}{5}x + \frac{1}{4}x + \frac{1}{3}x + 3 = x \quad M1$$

$$x = 180$$

Answer 180 km [2]

- (b) A train travelled 240km at speed x km/h.
When the engine was replaced by an improved model, the speed of the train increased by 20 km/h and the travel time was reduced by an hour.
Form an equation and show that it reduces to $x^2 + 20x - 4800 = 0$.
Hence, find the value of x .

Longer Time
shorter speed

$$\frac{240}{x} - \frac{240}{x+20} = 1 \quad M1$$

$$\frac{240(x+20) - 240x}{x(x+20)} = 1 \quad M1$$

$$4800 = x^2 + 20x$$

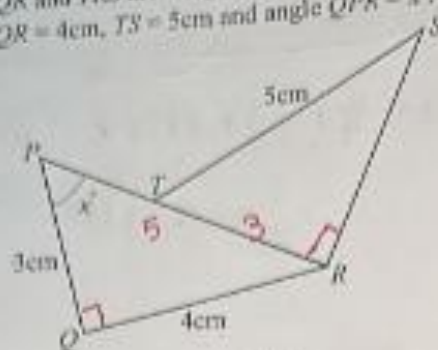
$$x^2 + 20x - 4800 = 0 \quad \# \text{ shown}$$

$$x = \frac{-20 \pm \sqrt{20^2 - 4(1)(-4800)}}{2} \quad M1$$

$$= 60 \text{ or } -80 \text{ (N.A.)}$$

Answer $x =$ 60 km/h [4]

- 10 (a) Triangles PQR and TRS are congruent.
 $PQ = 3\text{cm}$, $QR = 4\text{cm}$, $TS = 5\text{cm}$ and angle $QPR = x^\circ$.



- (i) Express angle TSR in terms of x° .

accept $180^\circ - 90^\circ - x^\circ$

$90 - x^\circ$

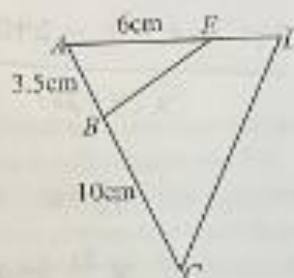
Answer [1]

- (ii) Find the length of PT .

2

Answer cm [1]

- (b) The two triangles in the diagram are similar.
 $AE = 6\text{cm}$, $AB = 3.5\text{cm}$ and $BC = 10\text{cm}$.



- (i) Write down the pair of similar triangles.

Answer Triangle ADC is similar to triangle ABE [1]

- (ii) Find the length of DE .

$\frac{3.5}{AD} = \frac{6}{13.5}$

or

scale factor = $\frac{13.5}{6}$
 $= 2.25$

$AD = 7.875$

$DE = 7.875 - 6$
 $= 1.875$

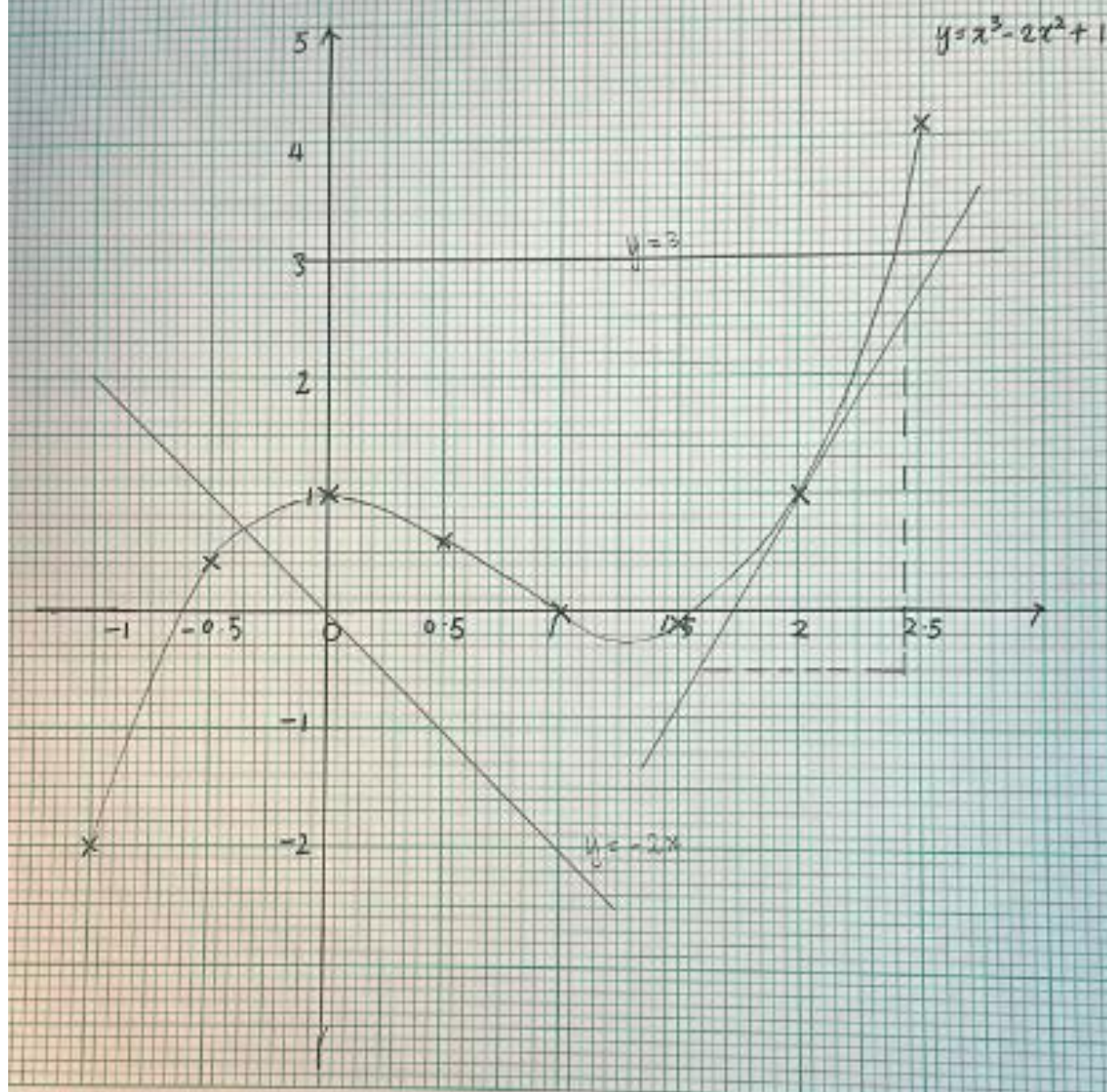
$AD = 3.5 \times 2.25$

Answer cm [2]

Question No.

When $x = -0.5$, $y = 0.375 / 0.4$

M1 - correct points plotted
M1 - smooth curve



- (c) Use your graph to find the solutions to the equation $x^3 - 2x^2 + 1 = 3$.

curve $y=3$
 Actually 2.35/2.36 is the closer answer.
 would you be looking at $2.3 \leq x \leq 2.4$
 instead?

Answer $x = \dots\dots\dots 2.4$ [1]

accept 2.3 - 2.4

- (d) Draw a straight line $y = -2x$.
 Write down the coordinates of the intersection point.

x	0	1	2
y	0	-2	-4

Draw $y = -2x$ M1

Answer $\dots\dots\dots (-0.35, 0.7)$ A1 [2]
 $\pm 0.05 \quad \pm 0.1$

- (e) By drawing a tangent, find the gradient of the curve $y = x^3 - 2x^2 + 1$ when $x = 2$.

$$\text{gradient} = \frac{3}{0.85} \quad \text{Draw tangent M1}$$

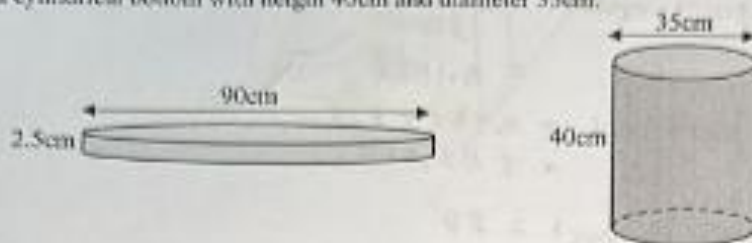
$$= 3.5$$

Answer $\dots\dots\dots 3.5$ A1 [2]
 accept 2.5 - 4.5

- 12 The wooden table in a café is as seen in diagram.



It consists of two solid parts: a circular table top with thickness 2.5cm and diameter 90cm and a cylindrical bottom with height 40cm and diameter 35cm.



The table shows the cost required to paint the wooden tables in the café.

Paint type	Area Coverage (cm ² per litre)	Cost (\$ per litre)	Labour Cost (\$ per table)
Primer Single Coat	5000	12	4
Double Coat Paint	3000	28	8

- (a) Show that the total surface area of a wooden table to be painted is approximately 16900cm².

Answer

$$\text{table top, circle} = \pi(45^2)$$

$$= 6361.725$$

$$\boxed{\pi r^2} \quad [3]$$

M1

$$\text{curve area} = 2\pi(45)(2.5)$$

$$= 706.858$$

$$\boxed{2\pi rh}$$

$$\text{bottom, circle} = \pi(17.5^2)$$

$$= 962.112$$

M1

$$\text{curve area} = 2\pi(17.5)(40)$$

$$= 4398.229$$

$$\text{table top, circular area below} = 6361.725 - 962.112$$

$$= 5399.612$$

M1

$$\text{total surface area} = 6361.725 + 706.858 + 4398.229 + 5399.612$$

$$= 16866.424 \approx 16900$$

13

shown

- (b) Benny has set aside a budget of \$3000 for the paint job. Assuming primer single coat paint is used for the cylindrical bottom and double coat paint is used for the circular top, what is the maximum number of tables that can be painted in the cafe?

table top, double coat paint

$$\text{surface area} = 6361.725 + 706.858 + 5399.612$$

$$= 12468.195$$

$$\text{paint required} = \frac{12468.195}{3000}$$

$$= 4.156 \text{ L}$$

$$\text{paint cost} = 4.156 \times \$28$$

$$= \$116.368$$

$$\text{labour cost} = \$8$$

bottom, primer single coat paint

$$\text{paint required} = \frac{4398.229}{5000}$$

$$= 0.87964 \text{ L}$$

$$\text{paint cost} = 0.87964 \times \$12$$

$$= \$10.555$$

$$\text{labour cost} = \$4$$

$$\text{Total cost per table} = \$116.368 + \$8 + \$10.555 + \$4$$

$$= \$138.923$$

$$\$3000 \div \$138.923 = 21.594 \dots$$

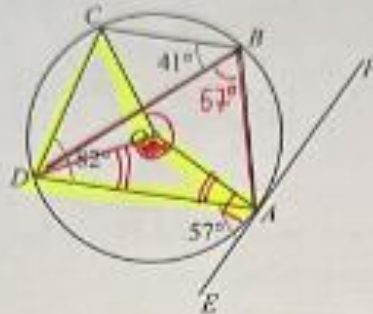
Answer The maximum number of tables that can be painted with \$3000 is 21. A1

[4]

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

- 13 (a) A, B, C and D are points on the circumference of a circle with centre O .
 EF is a tangent to the circle at A .
 Angle $EAD = 57^\circ$, angle $CDA = 82^\circ$ and angle $DBC = 41^\circ$.



Find

- (i) obtuse angle AOC ,

$$2 \times 82^\circ \quad (\text{angle at centre} = 2 \angle \text{at circumference})$$

Answer 164 $^\circ$ [1]

- (ii) angle ABD ,

$$180^\circ - 82^\circ - 41^\circ \quad (\text{angles in opposite segment})$$

Answer 57 $^\circ$ [1]

- (iii) angle ODA .

$$\begin{aligned} \angle AOD &= 2 \times 57^\circ \\ &= 114^\circ \end{aligned}$$

$$\begin{aligned} \angle ODA &= \frac{180^\circ - 114^\circ}{2} \\ &= 33^\circ \end{aligned}$$

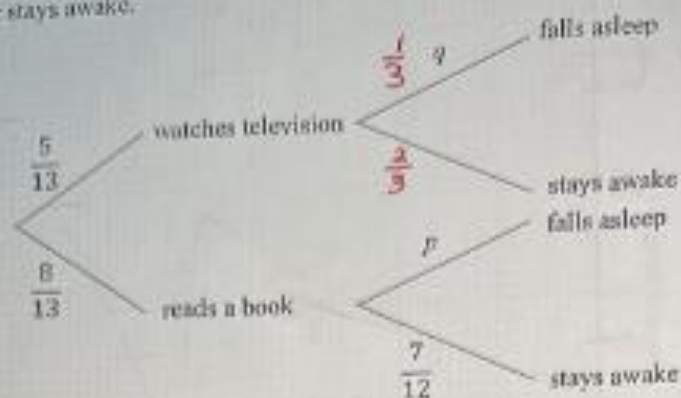
Alternatively

$$\begin{aligned} \angle OAD &= 90^\circ - 57^\circ \\ &= 33^\circ \end{aligned}$$

$$\angle OAD = \angle ODA = 33^\circ \quad (\text{isos } \Delta)$$

Answer 33 AI $^\circ$ [2]

- (b) Benny watches television or reads a book for an hour every night. He either falls asleep or stays awake.



- (i) Find the value of p .

$$1 - \frac{7}{12}$$

Answer $p = \frac{5}{12}$ [1]

- (ii) Given that the probability of Benny falling asleep when watching television is $\frac{5}{39}$, find the value of q .

$$\frac{5}{13} \times q = \frac{5}{39}$$

Answer $q = \frac{1}{3}$ [1]

- (iii) Find the probability that Benny stays awake on a particular night.

watch TV, stays awake or reads a book, stays awake

$$\frac{5}{13} \times \left(1 - \frac{1}{3}\right) + \frac{8}{13} \times \frac{7}{12} \quad \text{M1}$$

$$= \frac{8}{13}$$

Answer $\frac{8}{13}$ [2]

