4H(R)

Pearson Edexcel International GCSE

EDEXCEL IGCSE

MATHEMATICS A

SOLUTIONS

JANUARY 2014

4MA0/4HR

(a) Write $3 \times 3 \times 3 \times 3 \times 3$ as a single power of 3

3^5 (A1)

(1)

(b) Write $\dfrac{7^5 \times 7^9}{7^6}$ as a single power of 7

(M1) $\dfrac{7^{14}}{7^6} = 7^8$

7^8 (A1)

(2)

Here are Ryan's scores in nine French tests.

  4 6 4 7 8 a 6 7 7

The mean of Ryan's nine scores is 6

Work out the value of a.

TOTAL $= 9 \times 6$

$= 54$. (B1)

$4 + 6 + 4 + \ldots + 7 = 49$ (B1)

$a = 54 - 49$

$= 5$

$a = \underline{\hspace{1cm} 5 \hspace{1cm}}$ (A1)

ALTERNATE ANGLES

Diagram **NOT** accurately drawn

$28°$

$y°$

$36°$

$z°$

CORRESPONDING ANGLES
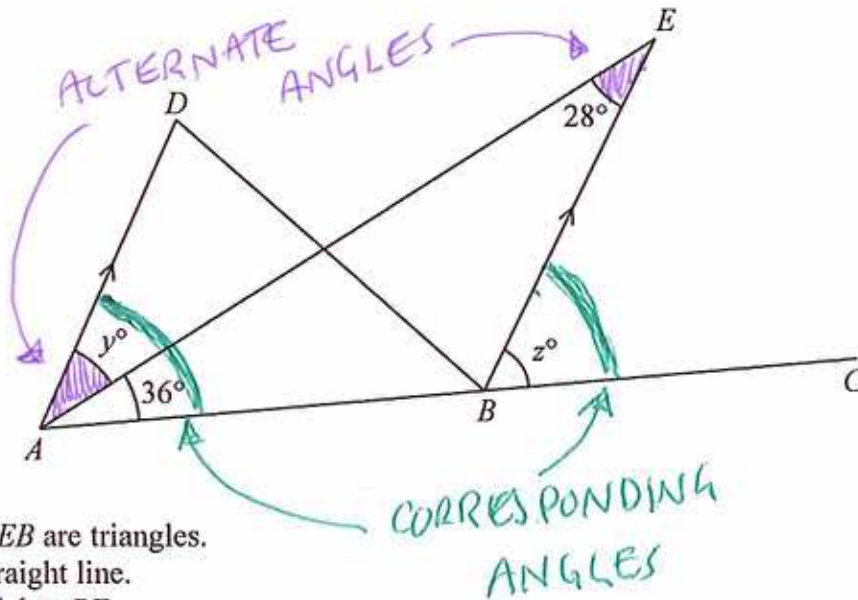
ADB and *AEB* are triangles.
ABC is a straight line.
AD is parallel to *BE*.

(a) Find the value of *y*.

Ⓐ①

$y = \underline{\quad 28° \quad}$
(1)

(b) Find the value of *z*.

$28 + 36$
ⓜ①

Ⓐ①

$z = \underline{\quad 64° \quad}$
(2)

(a) Show that $\dfrac{4}{5} + \dfrac{2}{3} = 1\dfrac{7}{15}$

$$\dfrac{4}{5} + \dfrac{2}{3} = \dfrac{12}{15} + \dfrac{10}{15} \quad \text{(B1)}$$

$$= \dfrac{22}{15} \text{(B1)} = 1\dfrac{7}{15}$$

(2)

(b) Show that $2\dfrac{1}{4} \div 3\dfrac{1}{2} = \dfrac{9}{14}$

$$= \dfrac{9}{4} \div \dfrac{7}{2} \quad \text{(B1)} \qquad = \dfrac{9}{14}$$

$$= \dfrac{9}{4} \times \dfrac{2}{7} \quad \text{(B1)}$$

$$= \dfrac{18}{28} \quad \text{(B1)}$$

(3)

Use ruler and compasses to construct the bisector of angle *ABC*.

You must show all of your construction lines.
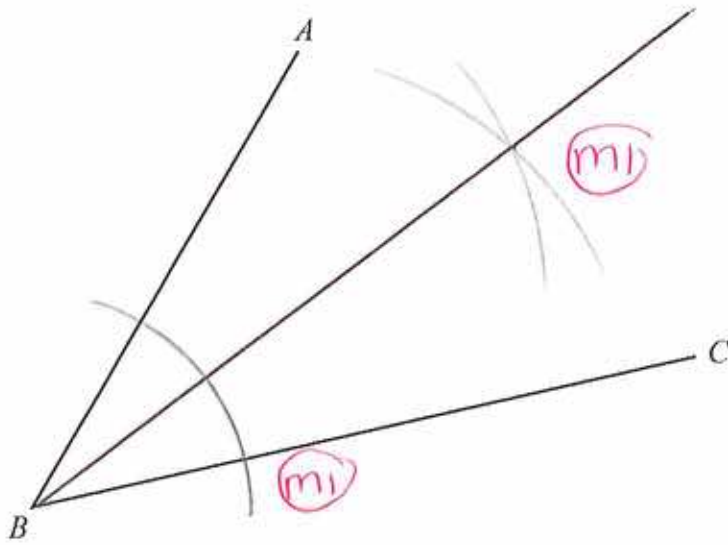
[MUST SHOW BISECTOR FOR TWO MARKS]

Mansi left her home at 09 00 to walk to the shops.
She stopped at the newspaper shop and then carried on to the fish shop.
Here is the distance-time graph for Mansi's journey from her home to the fish shop.
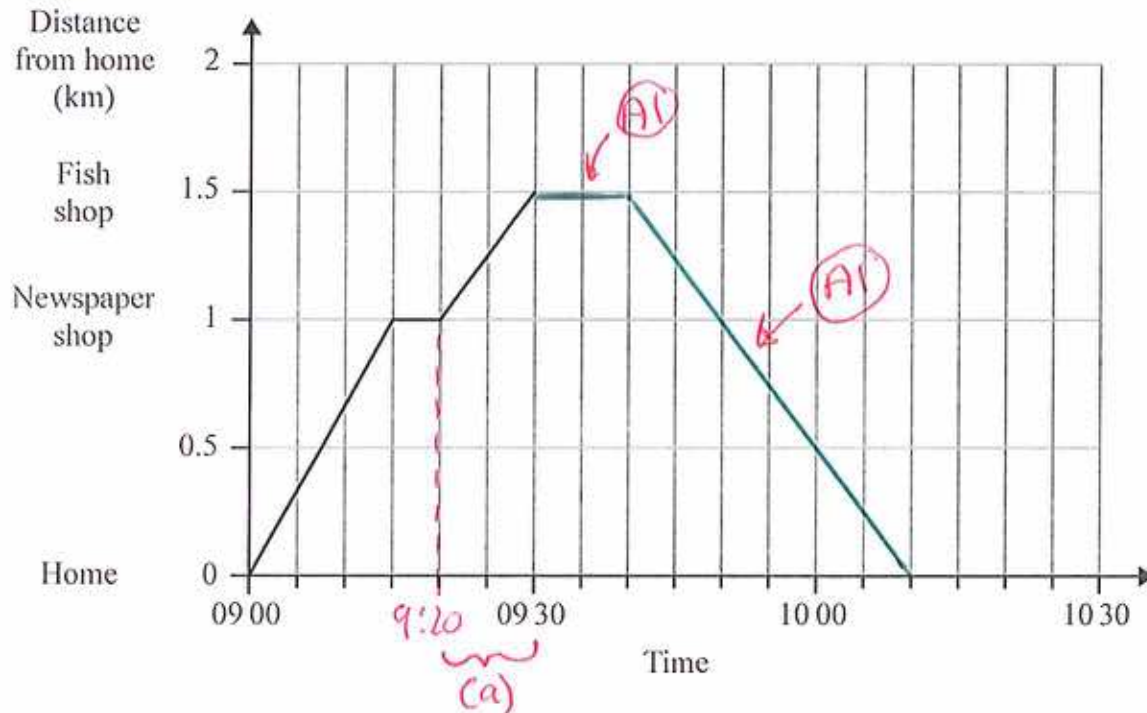
(a) How many minutes did it take Mansi to walk from the newspaper shop to the fish shop?

........10........ minutes

(1)

(b) Work out the average speed, in kilometres per hour, for Mansi's journey from her home to the newspaper shop.

$$v = \frac{d}{t}$$

$(d = 1km, \quad t = 15 \, min$
$= 0.25 \, HOURS)$

$$= \frac{1}{0.25} = \underline{\underline{4}}$$

........4........ km/h

(2)

Mansi stopped for 10 minutes in the fish shop.
She then walked home at a constant speed of 3 km/h.

(c) Show this information on the graph.

TRAVELS 1·5 km
IN ½ HOUR!

(2)
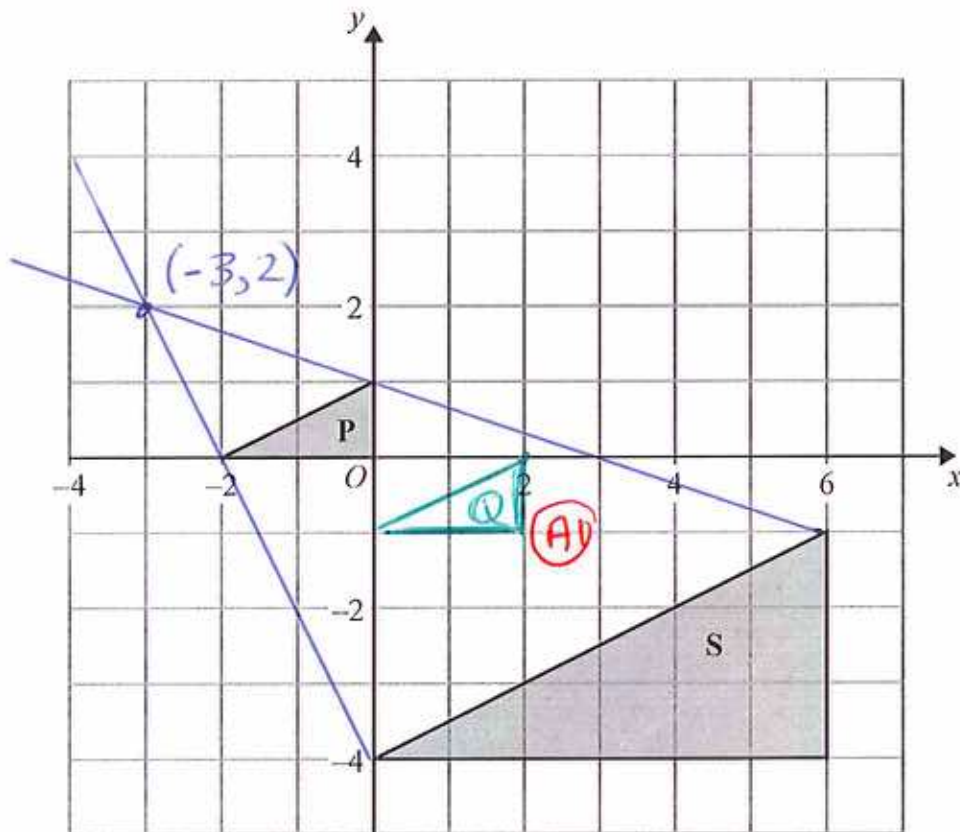
(a) On the grid, translate triangle **P** by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$

Label the new triangle **Q**.

(1)

(b) Describe fully the single transformation that maps triangle **P** onto triangle **S**.

ENLARGEMENT, SCALE FACTOR 3

CENTRE (-3, 2)

(3)

(a) Complete the table of values for $2x + y = 4$ $\Rightarrow y = -2x + 4$

x	-1	2	4
y	6	0	-4	(A2)

(2)

(b) On the grid, draw the graph of $2x + y = 4$ for values of x from -1 to 4

(2)

Ⓡ

Ⓐ

(A2)

$y = -2x + 4$

Ⓐ1
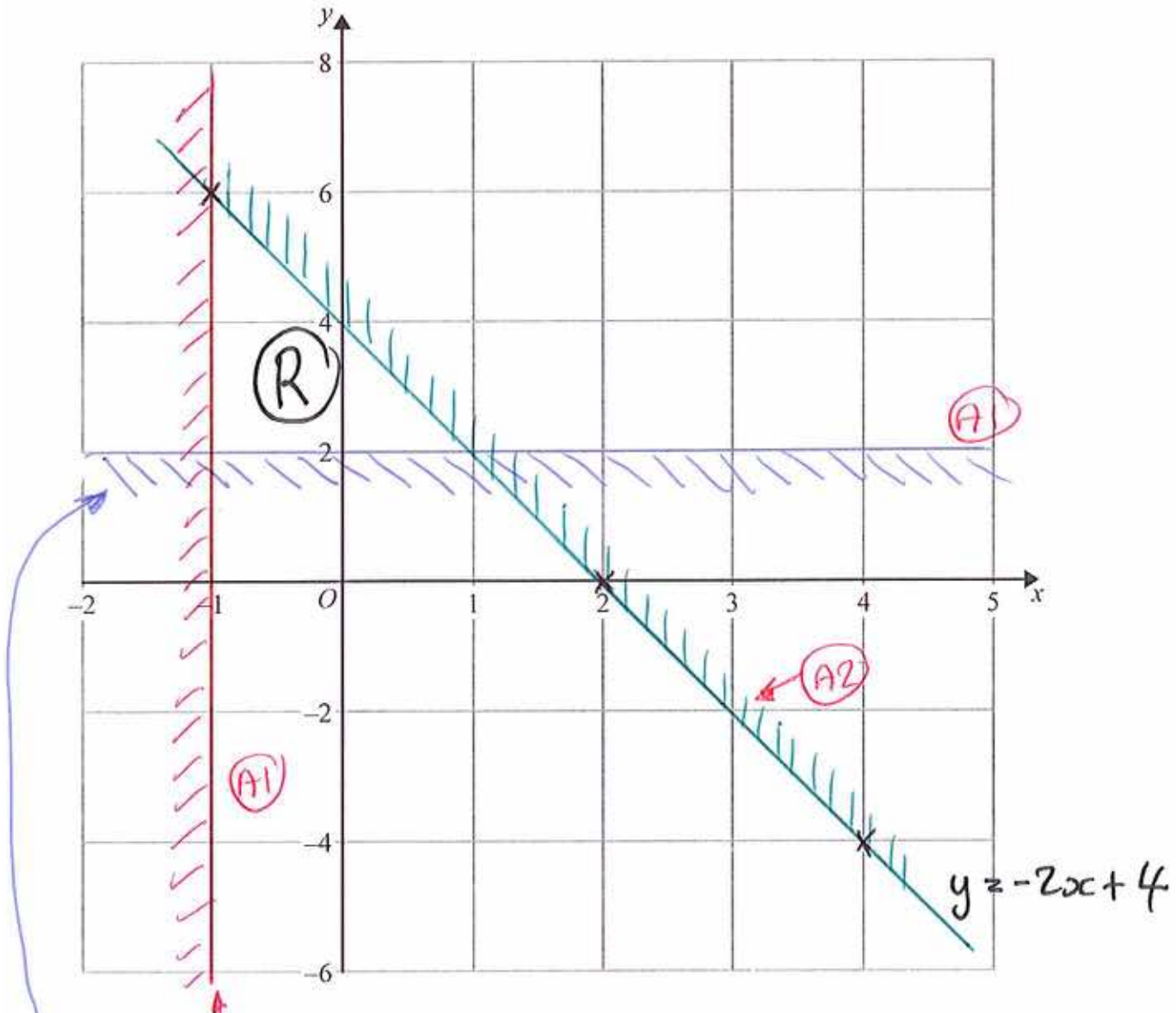
(c) Show, by shading on the grid, the region which satisfies **all three** of the inequalities

$x \geqslant -1,$ $y \geqslant 2$ and $2x + y \leqslant 4$

Label the region **R**.

(2)

On a map, 4 centimetres represents a real distance of 1 kilometre.

(a) On the map, the distance between two points is 14 cm.
Work out the real distance between these two points.
Give your answer in kilometres.

$$M : R$$

$$4cm : 1 \ km$$

$$1cm : 0.25 \ km$$

$$14 \times 0.25 = 3.5 \quad \text{(M1)}$$

(A1)

...........3·5........... km

(2)

(b) Work out the scale of the map in the form $1:n$

$$1 \ cm : 0.25 \ km$$

$$= 1 cm : 250 \ m \quad \text{(M1)}$$

$$= 1cm : 25 \ 000 \ cm$$

(A1)

1: ....25 000....

(2)

North

Diagram **NOT**
accurately drawn

NORTH

228°

118° (PART b)

Y

48°

180°

•S

B
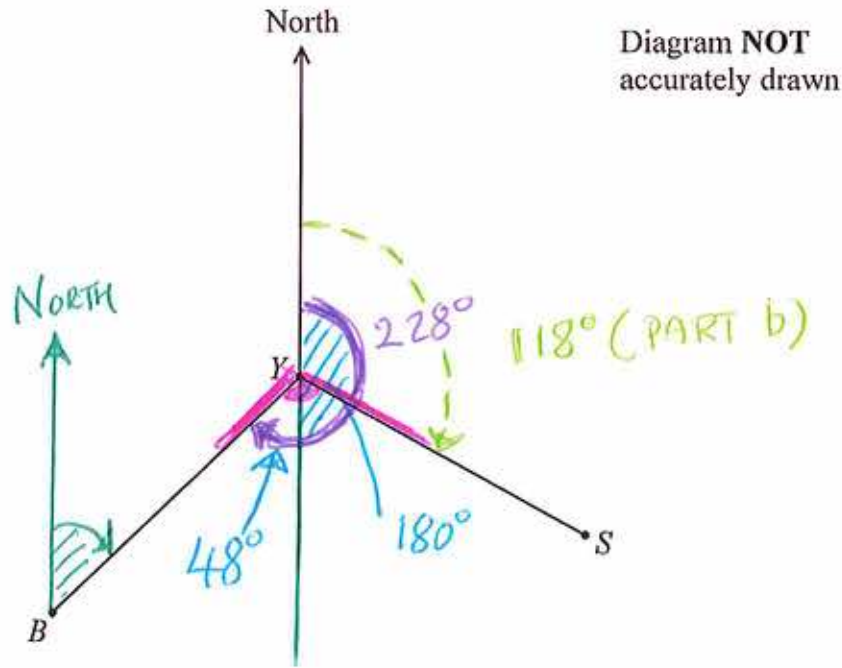
The diagram shows the positions of a yacht Y, a ship S and a beacon B.
The bearing of B from Y is 228°

(a) Find the bearing of Y from B.

$$228 - 180 \quad \text{(M1)}$$

(A1)

48 °
....
(2)

The bearing of S from Y is 118°

(b) Find the size of the angle BYS.

$$228 - 118$$

(M1)

(A1)

110 °
....
(1)

The table shows the population of each of three countries in 2012.

Country	Population
India	1.21×10^9
Turkey	7.48×10^7
Singapore	5.2×10^6

(a) Find the total population of India, Turkey and Singapore in 2012.
Give your answer in standard form.

(A2)

1.29×10^9

(2)

[(A1) IF ANSWER IS CORRECT
BUT NOT IN STANDARD FORM]

Population density is calculated by the formula

Population density = Population ÷ Land area

The land area of India is 3.29×10^6 km²

(b) Calculate the population density of India in 2012.
Give your answer correct to 3 significant figures.

(m1) $\dfrac{1.21 \times 10^9}{3.29 \times 10^6}$ = $367.78\ldots$

(A1)

368 people/km²

(2)

Loma grows tomatoes in her garden.
The table shows information about the weights, in grams, of some of her tomatoes.

MID-VALUE	Weight of tomato (w grams)	Number of tomatoes	$x \times f$
5	$0 < w \leqslant 10$	2	10
15	$10 < w \leqslant 20$	8	120
25 (m)	$20 < w \leqslant 30$	16	400 (m)
35	$30 < w \leqslant 40$	10	350
45	$40 < w \leqslant 50$	4	180
			1060

(a) Work out an estimate for the total weight of these tomatoes.

.........1060......... grams (A)

(3)

Loma also grows potatoes.
The incomplete histogram shows information about the weights, in grams, of some of her potatoes.
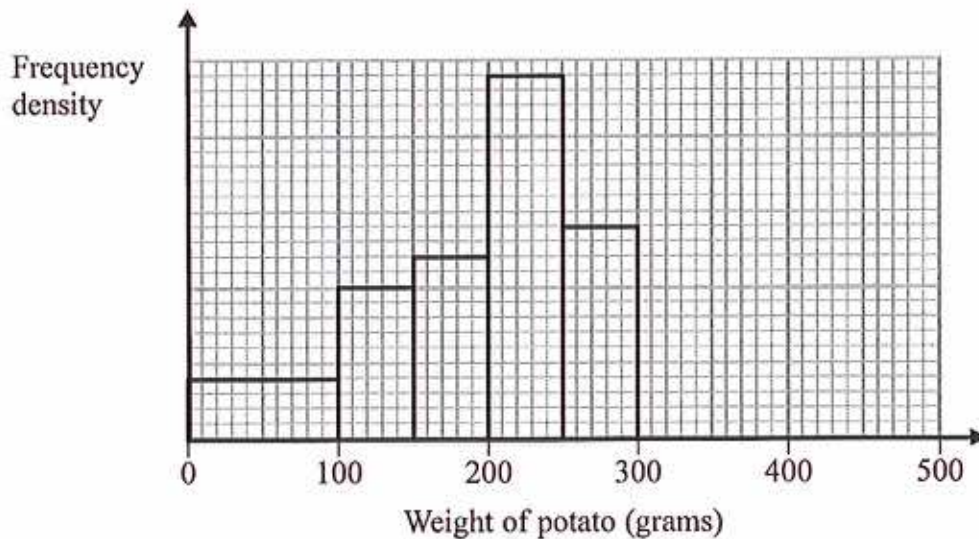
(a) The straight line L passes through the points (0, 12) and (10, 4).
Find an equation for L.

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

$$= \frac{4 - 12}{10 - 0}$$

$$= -0.8$$

$$y = -0.8x + 12$$

(3)

(b) Find an equation of the straight line which is parallel to L and passes through the point (5, -11).

$$y - y_1 = m(x - x_1)$$

$$y - (-11) = -0.8(x - 5)$$

$$y + 11 = -0.8x + 4$$

$$y = -0.8x - 7$$

Diagram **NOT** accurately drawn
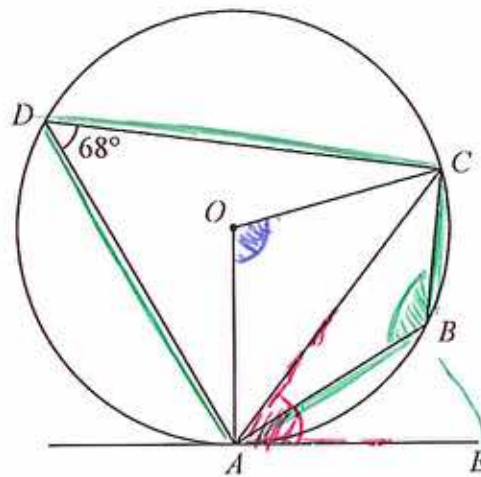
A, *B*, *C* and *D* are points on a circle, centre *O*.
AE is a tangent to the circle.
Angle *ADC* = 68°

(a) (i) Find the size of angle *ABC*.

180 − 68

(A1)

112 °

(ii) Give a reason for your answer.

(A1)

OPPOSITE ANGLES IN A CYCLIC QUADRALATERAL ADD TO 180°

(2)

(b) (i) Find the size of angle *AOC*.

2 × 68

136 (A1)

(ii) Give a reason for your answer.

ANGLE AT THE CENTRE IS TWICE ANGLE AT THE (A1) CIRCUMFERENCE

(2)

(c) Find the size of angle *CAE*.

(ANGLE BETWEEN A TANGENT AND CHORD) IS EQUAL TO THE ANGLE IN THE ALTERNATE SEGMENT)

68° (A1)

For the curve with equation $y = 4x^3 - 2x + 5$

(i) find $\dfrac{dy}{dx}$

(A1)   (A1)

$$12x^2 - 2$$

(ii) find the coordinates of the two points on the curve where the gradient of the curve is 1

$$12x^2 - 2 = 1 \quad \text{(M1)}$$
$$12x^2 = 3$$
$$x^2 = \frac{3}{12}$$
$$x = \pm\sqrt{\frac{3}{12}}$$

$\dfrac{dy}{dx}$

$x = 0.5$ (A1) $x = -0.5$ (A1)

$\Rightarrow y = 4 \times 0.5^3 - 2 \times 0.5 + 5$ $y = 4 \times (-0.5)^3 - 2 \times (-0.5) + 5$

$= 4.5$ $= 5.5$

$(0.5, 4.5)$ $(-0.5, 5.5)$

(A1) [BOTH]

A particle moves from rest.
The speed of the particle is v m/s when it has moved a distance of x metres.

v is proportional to $\sqrt{x}$

When $v = 8$, $x = 25$

(a) Express v in terms of x.

$$V = k \times \sqrt{x}$$

$$8 = k \times \sqrt{25} \quad \text{(M1)}$$

$$k = \frac{8}{\sqrt{25}}$$

$$= 1.6 \quad \text{(B1)}$$

$$\text{(A1)} \quad V = 1.6\sqrt{x}$$

$$\text{.......................}$$
(3)

(b) Find the speed of the object when it has moved a distance of 56.25 metres.

$$V = 1.6\sqrt{x} \quad (x = 56.25)$$

$$\Rightarrow V = 1.6\sqrt{56.25} \quad \text{(M1)}$$

$$= \underline{12} \text{ m/s} \quad \text{(A1)}$$

Hugo competes in the high jump at a school athletics competition.
He has up to 3 attempts to clear the bar at each height.
When he clears the bar, he does not have another attempt at that height.

When the bar is set at a height of 1.60 metres, the probability that Hugo will clear the bar
on any attempt is 0.4
The probability tree diagram shows the possible outcomes of Hugo's attempts at
1.60 metres.

First attempt　　　　　　Second attempt　　　　　Third attempt
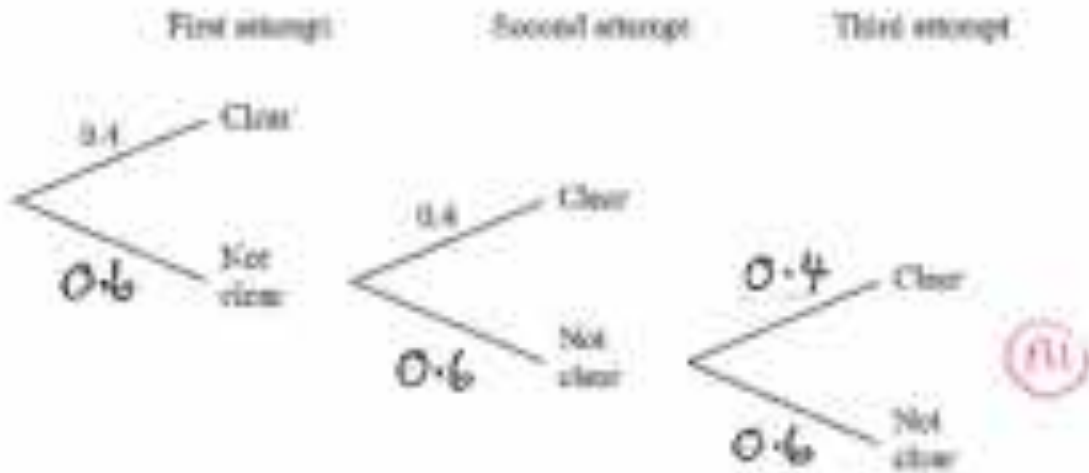
(a) Complete the probability tree diagram to show the four missing probabilities.
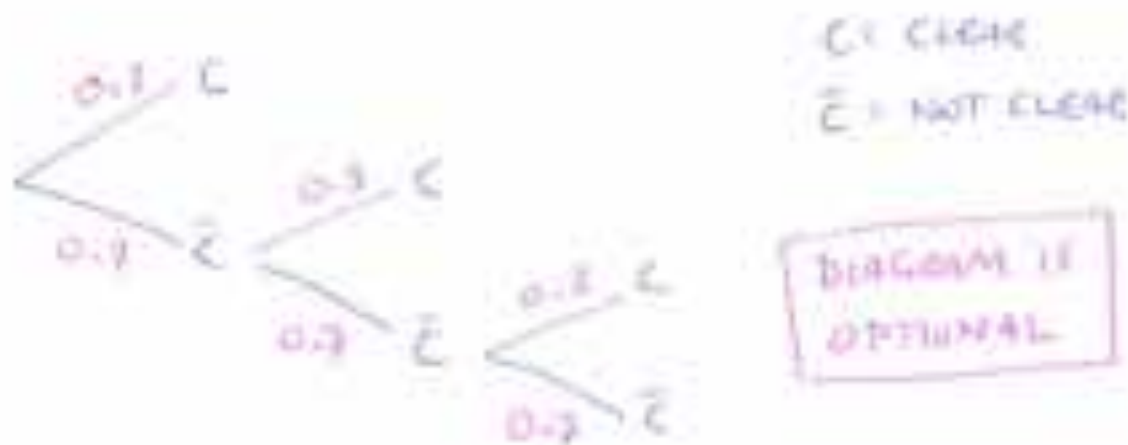
(2)

(b) Work out the probability that Hugo does not clear the bar on his first two attempts
and then does clear the bar on his third attempt at 1.60 metres.

$$P(N,N,C) = 0.6 \times 0.6 \times 0.4$$

$$= 0.144$$

Hugo clears the bar at 1.60 metres and the height is raised to 1.65 metres.
He has up to three attempts to clear the bar at 1.65 metres.

When the bar is set at a height of 1.65 metres, the probability that Hugo will clear the bar
on any attempt is 0.3

(c) Find the probability that Hugo clears the bar at 1.65 metres.

C = CLEAR
C̄ = NOT CLEAR

DIAGRAM IS OPTIONAL

PROBABILITY OF SUCCESS:

$$P(c) = \underline{0.3}$$

$$P(\bar{c}c) = 0.7 \times 0.3 = \underline{0.21} \leftarrow \text{(M1) [EITHER]}$$

$$P(\bar{c},\bar{c},c) = 0.7 \times 0.7 \times 0.3 = \underline{0.147}$$

(M1)
[THREE POSSIBILITIES]

$$\text{TOTAL} = 0.3 + 0.21 + 0.147$$
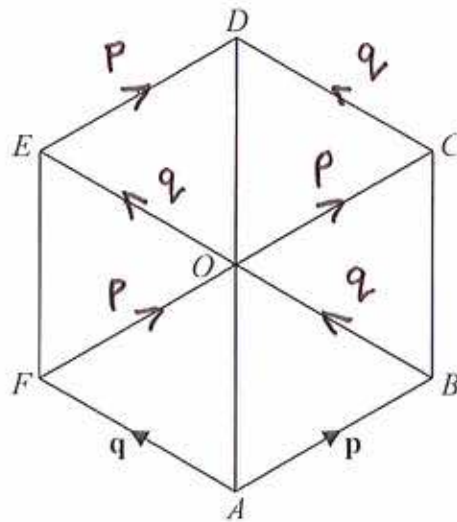
$$= \underline{0.657} \text{ (A1)}$$

Diagram **NOT**
accurately drawn

ABCDEF is a regular hexagon, centre *O*.

$\vec{AB}$ = p and $\vec{AF}$ = q

(a) Express in terms of **p** and **q**

(i) $\vec{AO}$ = $\vec{AF}$ + $\vec{FO}$

$= q + P$

$\underline{\underline{p + q}}$

(ii) $\vec{AD}$ = $2\vec{AO}$

$= 2(p + q)$

$2(p + q)$

(iii) $\vec{AC}$ = $\vec{AO}$ + $\vec{OC}$

$= (q + p) + P$

$= 2p + q$

$\underline{\underline{2p + q}}$
(3)

(b) Given that **p** = $\begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$ centimetres,

find the length of a side of the hexagon.

$p^2 = 1^2 + (\sqrt{3})^2$

$= 1 + 3$

$= 4$

$\Rightarrow p = \sqrt{4}$

$= \underline{\underline{2}}$
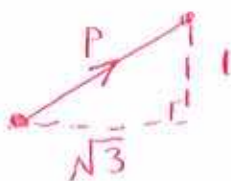
$\underline{2}$ cm
(2)

Diagram **NOT** accurately drawn

x m

0.18 m

x m
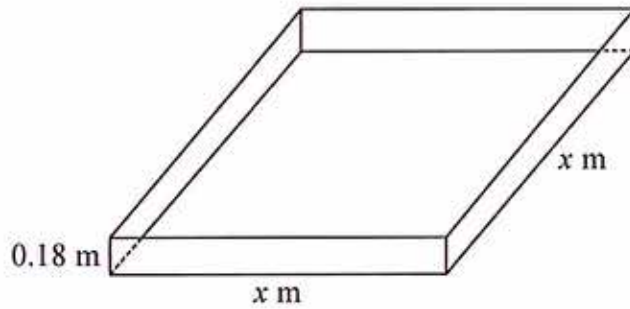
Trena wants to build a sandpit in the shape of a cuboid.
The volume of sand in the sandpit will be 1.0 m³, correct to 1 decimal place. $\rightarrow$ 1.0 ± 0.05
The depth of sand in the sandpit will be 0.18 metres, correct to 2 decimal places.
The sandpit will have a square base with sides of length x metres.

Find the upper bound for x 0.18 ± 0.005
Give your answer correct to 3 significant figures.

$$x^2 \times (0.18 \pm 0.005) = 1.0 \pm 0.05$$

$$\Rightarrow \quad x^2 = \frac{1.0 \pm 0.05}{0.18 \pm 0.005}$$

(m1) [FOR UPPER BOUND]

$$= \frac{1.0 + 0.05}{0.18 - 0.005}$$

(m1) [FOR LOWER BOUND]

$$= 6$$

$$x = \sqrt{6} \quad (m1)$$

$$= 2.44948\ldots$$

$$= \underline{\underline{2.45}} \text{ m} \quad (A1)$$

Express $\dfrac{4}{x-1} - \dfrac{3}{x+1}$ as a single fraction.

Give your answer as simply as possible.

CROSS MULTIPLY

$$\frac{4}{x-1} - \frac{3}{x+1} = \frac{4(x+1) - 3(x-1)}{(x-1)(x+1)} \quad \text{(M1)} \; [\text{COMMON DENOMINATOR}]$$

$$= \frac{4x+4-3x+3}{(x-1)(x+1)} \quad \text{(M1)} \; [\text{EXPAND NUMERATOR}]$$
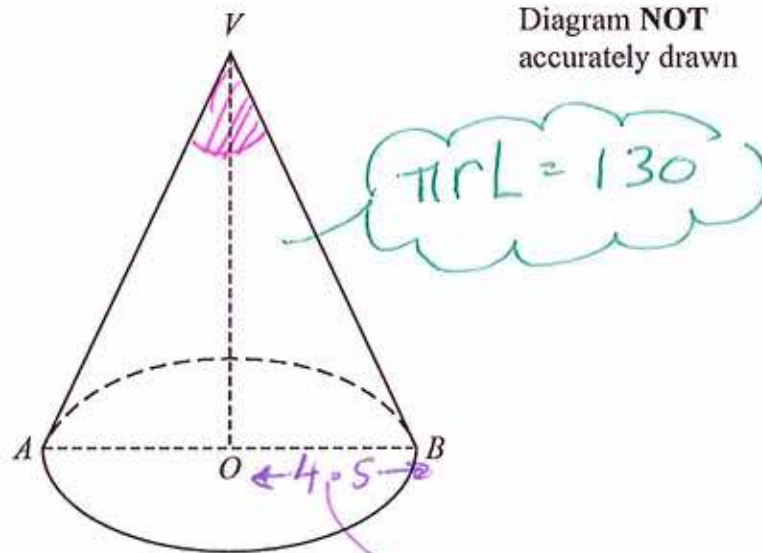
$$= \frac{x+7}{(x-1)(x+1)} \quad \text{(M1)}$$

NOTE

DENOMINATOR IS FACTORISED
SO I HAVE LEFT IT ALONE.

HOWEVER, ON THIS OCCASION,
YOU MAY SPOT THAT ITS "THE
DIFFERENCE OF TWO SQUARES"
SO MAY LIKE TO WRITE IT
AS SUCH

$$\longrightarrow \frac{x+7}{x^2-1}$$

[NOT NECESSARY THOUGH!]

V

Diagram **NOT**
accurately drawn

$\pi r L = 130$

A --------- O ←4·5→ B

The diagram shows a solid cone.
The base of the cone is a horizontal circle, centre O, with radius 4.5 cm.
AB is a diameter of the base and OV is the vertical height of the cone.
The curved surface area of the cone is 130 cm²

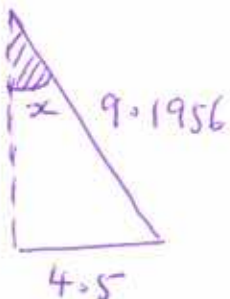Calculate the size of the angle AVB.

Give your answer correct to 1 decimal place.

1ST

$$\pi r L = 130 \Rightarrow L = \frac{130}{\pi r}$$

$$= \frac{130}{\pi \times 4 \cdot 5} = 9 \cdot 1956 \ldots$$ **B1**

2ND

x \ 9·1956

4·5

$$SIN \, x = \frac{4 \cdot 5}{9 \cdot 1956}$$

$$\Rightarrow x = SIN^{-1} \left(\frac{4 \cdot 5}{9 \cdot 1957} \right)$$ **M1**

$$= 29 \cdot 298 \ldots$$

$$\therefore AVB = 2 \times 29 \cdot 298 \ldots = 58 \cdot 6°$$ **A1**

M1

Solve the simultaneous equations

$$x^2 + y^2 = 26 \quad \text{——} \quad ①$$
$$y = 3 - 2x \quad \text{——} \quad ②$$

Show clear algebraic working.

$$x^2 + (3-2x)^2 = 26 \quad \text{(M1)}$$

$$x^2 + (3-2x)(3-2x) = 26$$

$$x^2 + 9 - 6x - 6x + 4x^2 = 26 \quad \text{(M1)}$$

$$5x^2 - 12x + 9 = 26$$

$$5x^2 - 12x - 17 = 0 \quad \text{(B1)}$$

$$(5x - 17)(x + 1) = 0 \quad \text{(M1)}$$

$$5x - 17 = 0 \qquad\qquad x + 1 = 0$$
$$5x = 17 \qquad\qquad x = -1$$
$$x = \frac{17}{5} \qquad\qquad \text{(A1) [BOTH]}$$

___

SUBSTITUTE INTO EQ. ②

$$y = 3 - 2 \times \frac{17}{5} \qquad\qquad x = 3 - 2 \times (-1)$$

$$= 3 - \frac{34}{5} \qquad\qquad\qquad = 3 + 2$$

$$= -\frac{19}{5} \qquad\qquad\qquad = 5$$

$$\qquad\qquad\qquad\qquad\qquad\qquad \text{(A1) [BOTH]}$$