

4H(R)

Pearson Edexcel
International GCSE

EDEXCEL

IGCSE

MATHEMATICS A

SOLUTIONS

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4MA0/4HR

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The methods used in these solutions, where relevant, are methods which have been successfully used with students. The method shown for a particular question is not always the only method and We do not claim that the method we have used is necessarily the most efficient or ‘best’ method. We will, from time to time, update a solution to show a different method if We feel that it is a good idea to do so.

Sometimes a method used in these solutions might be unfamiliar to You. If You are able to use a different method to obtain the correct answer then We would usually recommend that You keep using your existing method and not change to the method that We have used here. However, the choice of method is always up to You and We believe that it is often useful if You know more than one method to solve a particular type of problem.

Within these solutions We have indicated where marks **might** be awarded for each question. We have used B marks, M marks and A marks in a similar, but **not identical**, way that the exam board uses these marks within their mark schemes. We have done this for simplicity and convenience. We have sometimes interchanged B marks, M marks and A marks and We have sometimes awarded the marks in different ways to the exam board.

B1 - This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of ‘follow through’).

M1 - This is a method mark. We have indicated where method marks might be awarded for the method that is shown. If You use a different method, then the same number of method marks would be awarded but We are not able to indicate for what the marks would be awarded for Your particular method. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board’s web site

A1 - These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown Your method) and all of the accuracy marks.

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

$$\frac{3^5 \text{ (A1)}}{\text{(1)}}$$

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

$$\text{(M1)} \quad \frac{7^{14}}{7^6} = 7^8$$

$$\frac{7^8 \text{ (A1)}}{\text{(2)}}$$

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 .

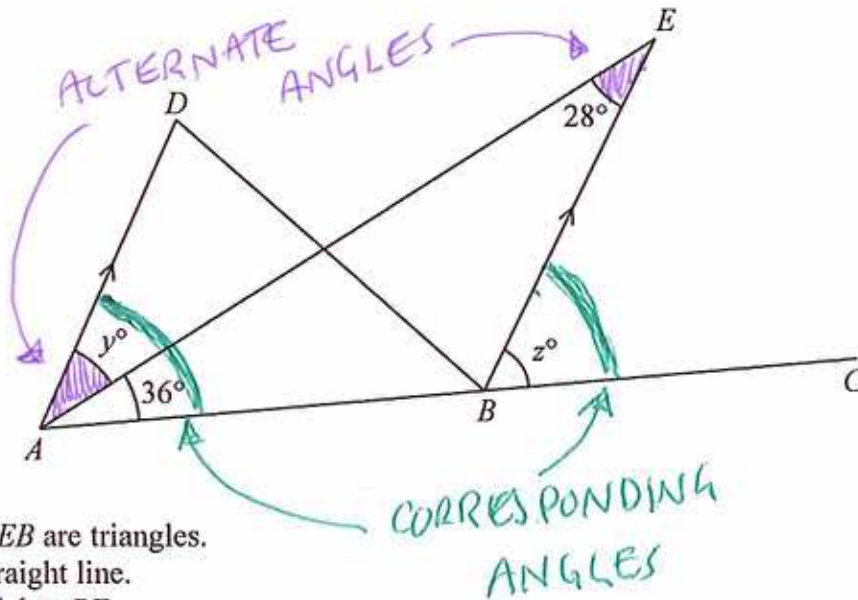
$$\begin{aligned} \text{TOTAL} &= 9 \times 6 \\ &= \underline{54}. \quad (B1) \end{aligned}$$

$$4 + 6 + 4 + \dots + 7 = 49 \quad (B1)$$

$$a = 54 - 49$$

$$= \underline{\underline{5}}$$

$$a = \underline{\quad 5 \quad} \quad (A1)$$



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

(a) Find the value of y .



$$y = \frac{28^\circ}{(1)}$$

(b) Find the value of z .

$$28 + 36$$

(ms)

$$z = \frac{64^\circ}{(2)}$$

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

$$\begin{aligned}\frac{4}{5} + \frac{2}{3} &= \frac{12}{15} + \frac{10}{15} \quad (B1) \\ &= \frac{22}{15} \quad (B1) = 1\frac{7}{15}\end{aligned}$$

(2)

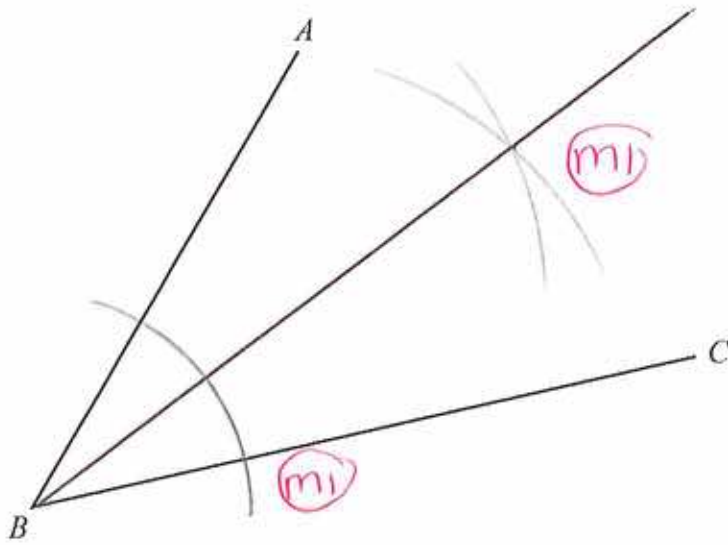
(b) Show that $2\frac{1}{4} \div 3\frac{1}{2} = \frac{9}{14}$

$$\begin{aligned}&= \frac{9}{4} \div \frac{7}{2} \quad (B1) \\ &= \frac{9}{4} \times \frac{2}{7} \quad (B1) \\ &= \frac{18}{28} \quad (B1) \quad \rightarrow \quad = \frac{9}{14}\end{aligned}$$

(3)

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

You must show all of your construction lines.

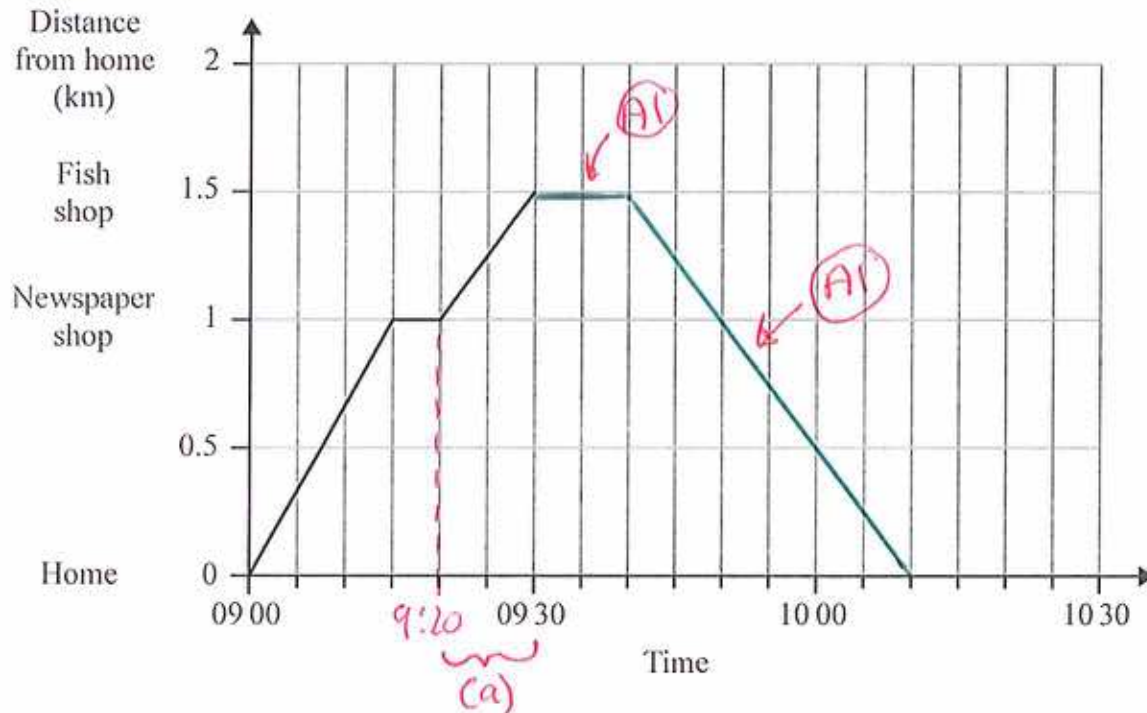


[MUST
SHOW
BISECTOR
FOR
TWO MARKS]

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.

$$v = \frac{d}{t} \quad (d = 1 \text{ km}, t = 15 \text{ min} = \underline{\underline{0.25 \text{ HOURS}}})$$

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

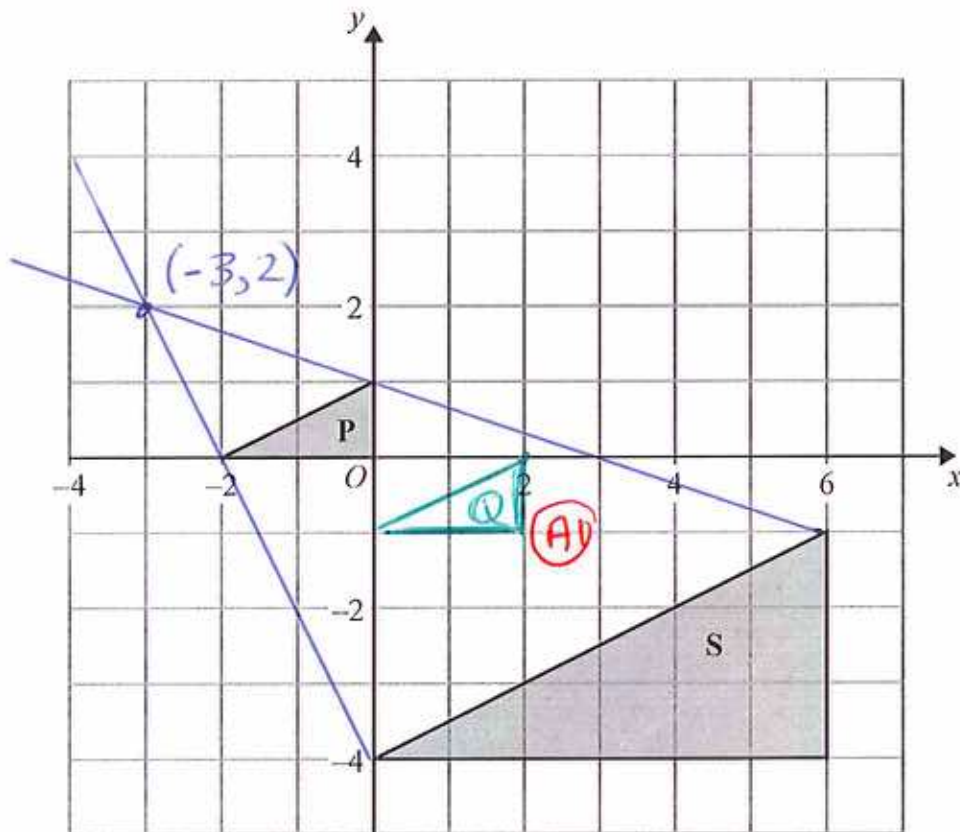
4 km/h
(2)

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 $\frac{1}{2}$ 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.

(AV) ENLARGEMENT, SCALE FACTOR 3 (AV)
CENTRE $(-3, 2)$

(3)

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

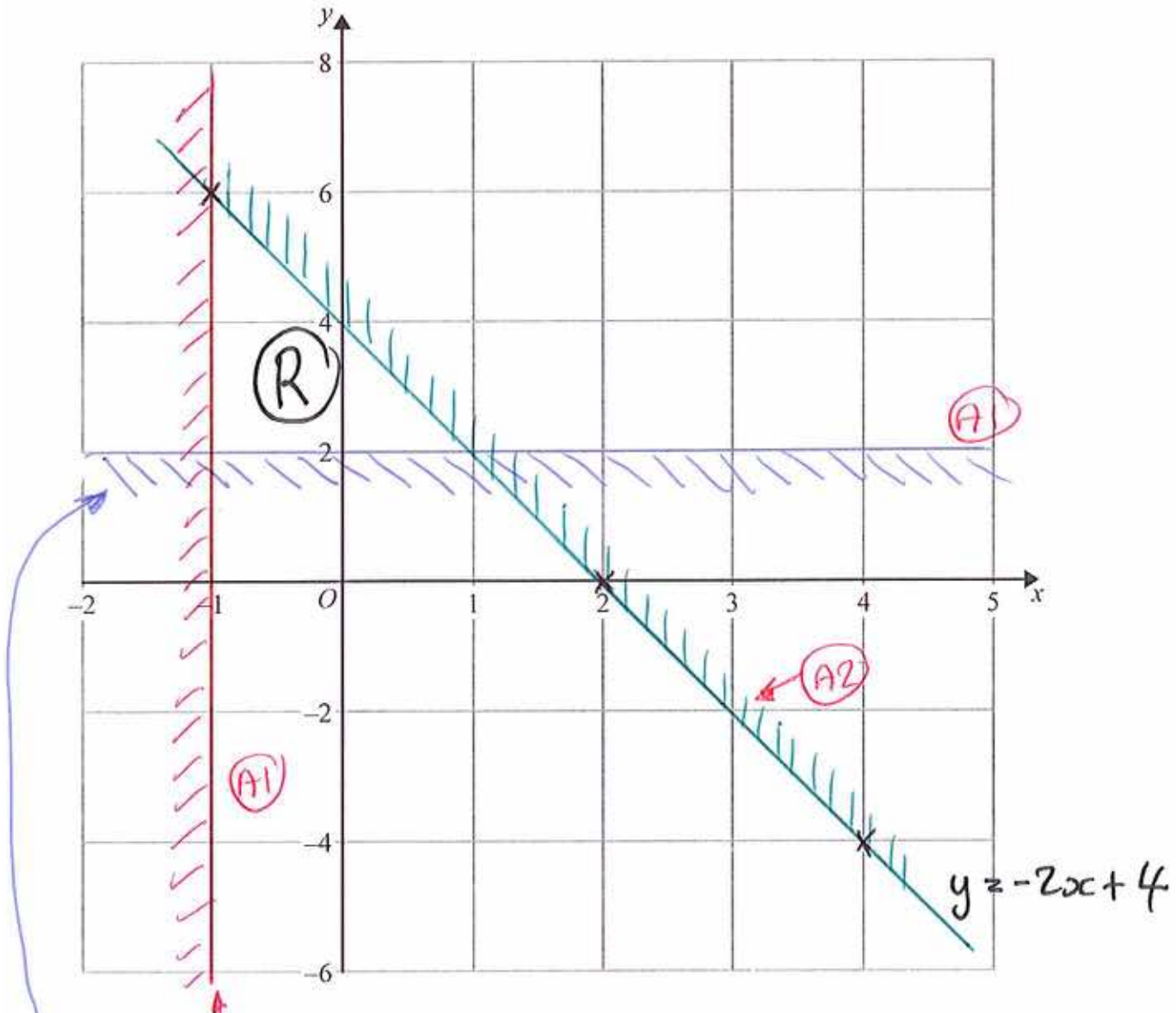
x	-1	2	4
y	6	0	-4

(A2)

(2)

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

(2)



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

$x \geq -1$, $y \geq 2$ and $2x + y \leq 4$

Label the region R.

(2)

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

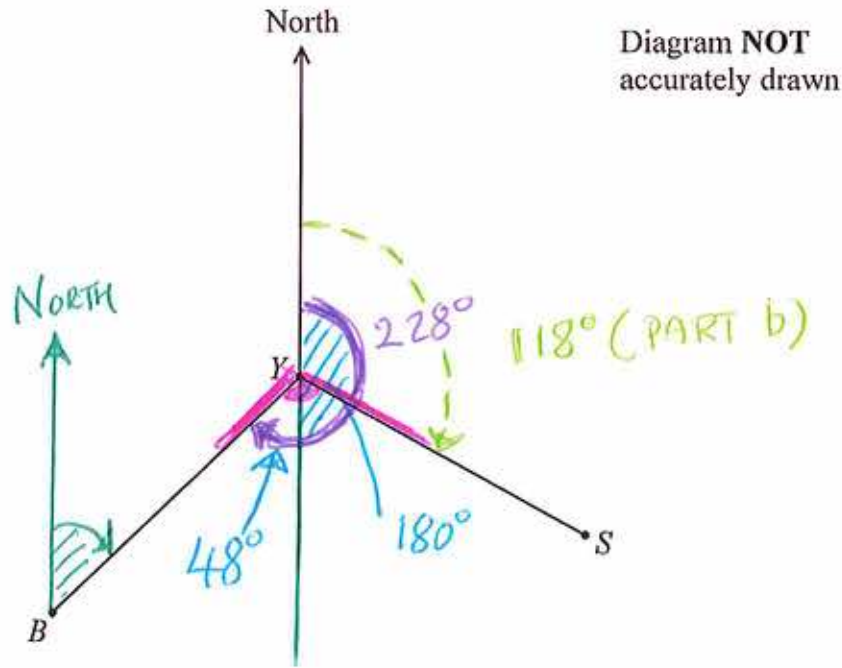
- (a) On the map, the distance between two points is 14 cm.
Work out the real distance between these two points.
Give your answer in kilometres.

$$\begin{array}{l}
 m : R \\
 4 \text{ cm} : 1 \text{ km} \\
 1 \text{ cm} : 0.25 \text{ km}
 \end{array}
 \rightarrow
 \begin{array}{l}
 14 \times 0.25 = \underline{\underline{3.5}} \\
 \text{(m)}
 \end{array}$$

$$\begin{array}{r}
 \text{(A1)} \\
 \underline{\underline{3.5}} \text{ km} \\
 (2)
 \end{array}$$

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

$$\begin{array}{l}
 1 \text{ cm} : 0.25 \text{ km} \\
 = 1 \text{ cm} : 250 \text{ m} \text{ (m)} \\
 = 1 \text{ cm} : 25000 \text{ cm} \rightarrow 1 : \underline{\underline{25000}} \\
 \text{(2)}
 \end{array}$$



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 .

$$228 - 180 \text{ (ml)}$$

$$\begin{array}{r} \text{(A1)} \\ 48^\circ \\ \hline (2) \end{array}$$

The bearing of S from Y is 118°

(b) Find the size of the angle BYS .

$$228 - 118 \text{ (ml)}$$

$$\begin{array}{r} \text{(A1)} \\ 110^\circ \\ \hline (1) \end{array}$$

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.

$$\frac{1.29 \times 10^9}{(2)} \quad \text{(A2)}$$

[A1] IF ANSWER IS CORRECT

Population density is calculated by the formula

BUT NOT IN STANDARD FORM]

$$\text{Population density} = \text{Population} \div \text{Land area}$$

The land area of India is $3.29 \times 10^6 \text{ km}^2$

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

$$\text{(M)} \quad \left| \frac{1.21 \times 10^9}{3.29 \times 10^6} = 367.78\dots \right.$$

$$\frac{368}{(2)} \text{ people/km}^2 \quad \text{(A1)}$$

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	$w \times f$
5	$0 < w \leq 10$	2	10
15	$10 < w \leq 20$	8	120
25 (M)	$20 < w \leq 30$	16	400
35	$30 < w \leq 40$	10	350
45	$40 < w \leq 50$	4	180
			1060

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

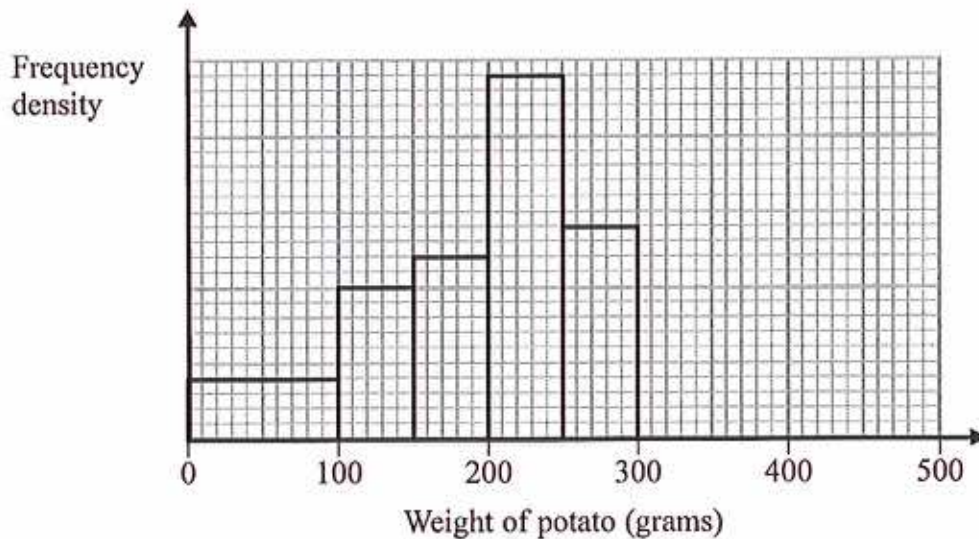


1060 grams (A)

 (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 .

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

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

$$= \underline{-0.8}$$

$y = \underline{-0.8x + 12}$

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

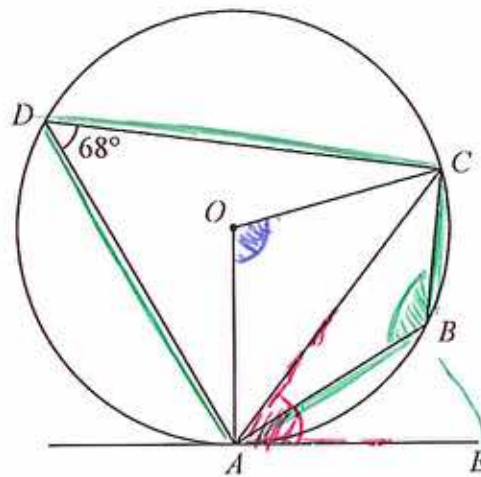
$$y - y_1 = m(x - x_1)$$

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

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

$$y = \underline{-0.8x - 7}$$

Diagram NOT
accurately drawn



A, B, C and D are points on a circle, centre O .
 AE is a tangent to the circle.
Angle $ADC = 68^\circ$

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

$$180 - 68$$

$$\underline{112}^\circ$$

(ii) Give a reason for your answer.

OPPOSITE ANGLES IN A CYCLIC QUADRILATERAL
ADD TO 180° (2)

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

$$2 \times 68$$

$$\underline{136}$$

(ii) Give a reason for your answer.

ANGLE AT THE CENTRE IS TWICE ANGLE AT THE
CIRCUMFERENCE (2)

(c) Find the size of angle CAE .

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

$$\underline{68}^\circ$$

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

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

$$\textcircled{A1} \quad \textcircled{A1}$$

$$\underline{12x^2 - 2}$$

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

$$12x^2 - 2 = 1 \quad \textcircled{M1}$$

$$12x^2 = 3$$

$$x^2 = \frac{3}{12}$$

$$x = \pm \sqrt{\frac{3}{12}}$$

$$x = \underline{0.5} \quad \textcircled{A1}$$

$$x = \underline{-0.5} \quad \textcircled{A1}$$

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

$$= \underline{4.5}$$

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

$$= \underline{5.5}$$

$$\underline{(0.5, 4.5)}$$

$$\underline{(-0.5, 5.5)}$$

$\textcircled{A1}$ [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 .

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

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

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

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

$$\rightarrow v = 1.6\sqrt{x} \quad (A1)$$

(3)

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

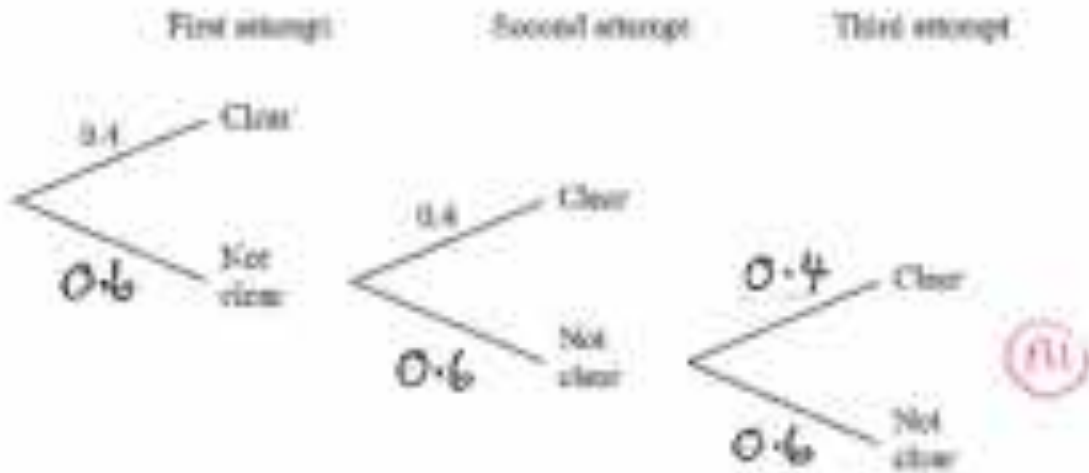
$$v = 1.6\sqrt{x} \quad (x = 56.25)$$

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

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

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.



(a) Complete the probability tree diagram to show the final missing probabilities.

(1)

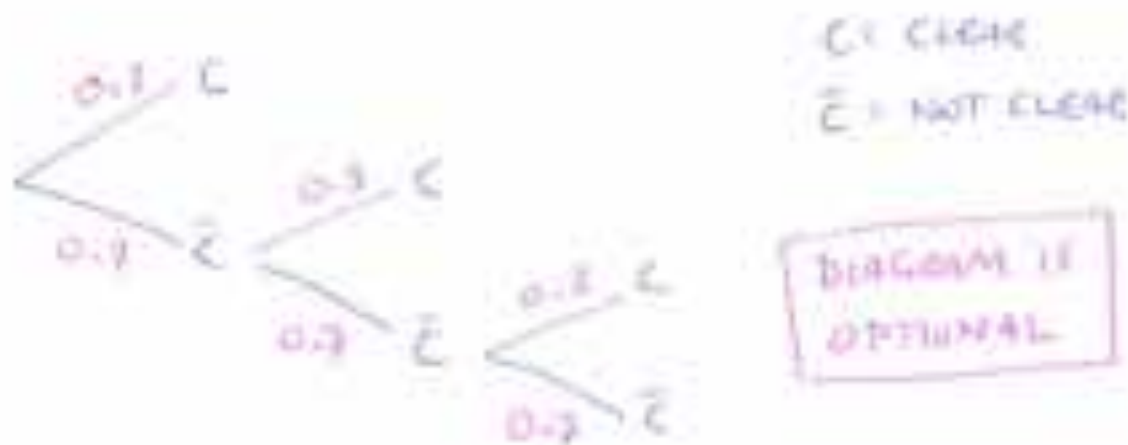
(b) Work out the probability that Hugo does not clear the bar on his first two attempts and then does clear the bar on his third attempt at 1.60 metres.

$$\begin{aligned}
 P(N, N, C) &= 0.6 \times 0.6 \times 0.4 \quad (M1) \\
 &= 0.144 \quad (A1)
 \end{aligned}$$

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.

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



PROBABILITY OF SUCCESS:

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

$$P(\bar{E}C) = 0.7 \times 0.3 = \underline{0.21} \quad \text{--- (iii) [either]}$$

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

(iii)
↑
[three possibilities]

$$\text{TOTAL} = 0.3 + 0.21 + 0.147$$

$$= \underline{\underline{0.657}} \quad \text{(iv)}$$

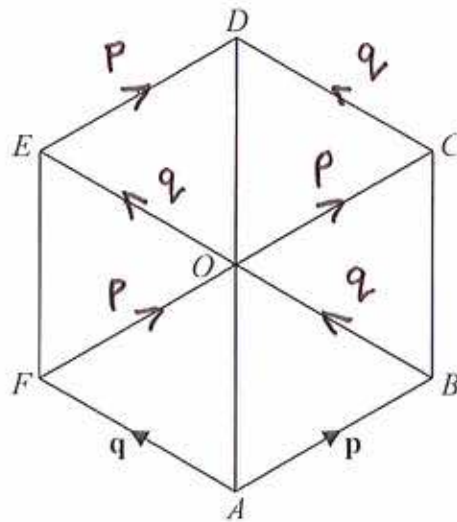


Diagram NOT accurately drawn

ABCDEF is a regular hexagon, centre O.

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

(a) Express in terms of p and q

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

p + q

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

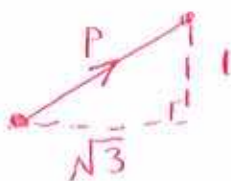
2(p + q)

(iii) $\vec{AC} = \vec{AO} + \vec{OC}$
 $= (q + p) + p$
 $= 2p + q$

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

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

find the length of a side of the hexagon.



$$\begin{aligned}
 p^2 &= 1^2 + (\sqrt{3})^2 \\
 &= 1 + 3 \\
 &= 4 \\
 \Rightarrow p &= \sqrt{4} \\
 &= \underline{\underline{2}}
 \end{aligned}$$

2 cm
 (2)

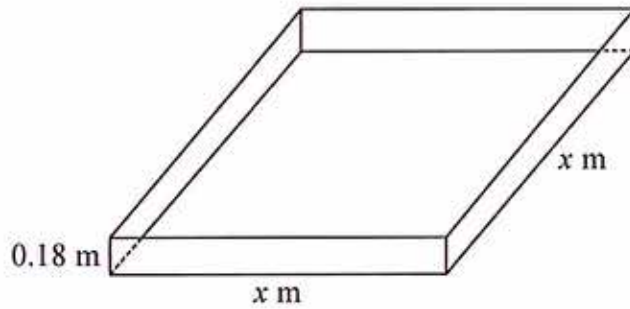


Diagram NOT
accurately drawn

Trena wants to build a sandpit in the shape of a cuboid.

The volume of sand in the sandpit will be 1.0 m^3 , correct to 1 decimal place.

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 $x \text{ metres}$.

Find the upper bound for x

Give your answer correct to 3 significant figures.

$$1.0 \pm 0.05$$

$$0.18 \pm 0.005$$

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

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

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

(M1) [FOR UPPER
BOUND]

$$= 6$$

(M1) [FOR LOWER
BOUND]

$$x = \sqrt{6} \quad (\text{M1})$$

$$= 2.44948\dots$$

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

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

Give your answer as simply as possible.

CROSS MULTIPLY

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

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

$$= \frac{x + 7}{(x-1)(x+1)} \quad (M1)$$

→

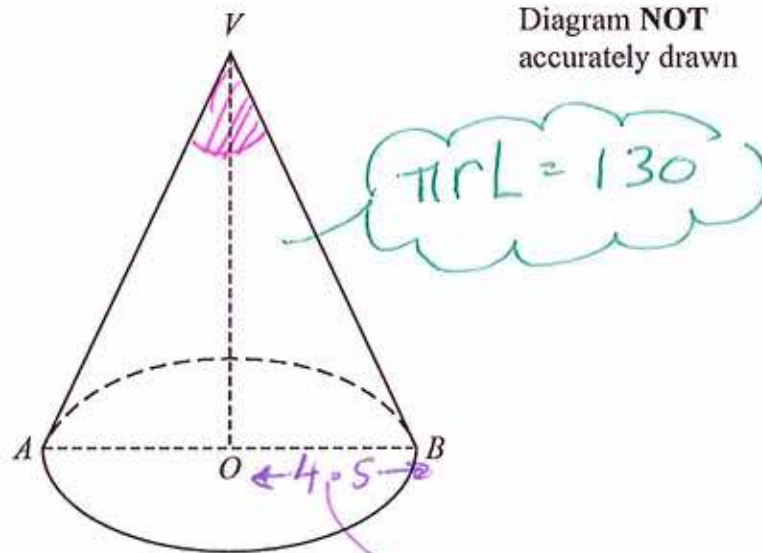
NOTE

DENOMINATOR IS FACTORISED
SO I HAVE LEFT IT ALIVE.

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

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

[NOT NECESSARY THOUGH!]




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 . 

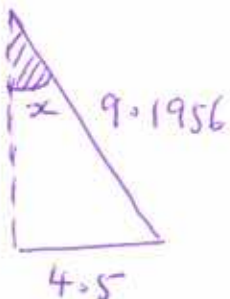
Give your answer correct to 1 decimal place.

1ST

$$\begin{aligned} \pi r L &= 130 \Rightarrow L = \frac{130}{\pi r} \\ &= \frac{130}{\pi \times 4.5} = \underline{\underline{9.1956\dots}} \end{aligned}$$

(B1)

2ND



$$\begin{aligned} \sin x &= \frac{4.5}{9.1956} \\ \Rightarrow x &= \sin^{-1}\left(\frac{4.5}{9.1956}\right) \text{ (m1)} \\ &= 29.298\dots \end{aligned}$$

$$\therefore \angle AVB = \underline{\underline{2 \times 29.298\dots}} = \underline{\underline{58.6^\circ}}$$

(m1) (A1)

Solve the simultaneous equations

$$x^2 + y^2 = 26 \quad \text{--- (1)}$$

$$y = 3 - 2x \quad \text{--- (2)}$$

Show clear algebraic working.

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

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

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

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

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

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

$$\begin{aligned} 5x - 17 &= 0 \\ 5x &= 17 \\ x &= \frac{17}{5} \end{aligned}$$

$$\begin{aligned} x + 1 &= 0 \\ x &= \underline{\underline{-1}} \end{aligned}$$

(A1) [BOTH]

SUBSTITUTE INTO Eq. (2)

$$y = 3 - 2 \times \frac{17}{5}$$

$$= 3 - \frac{34}{5}$$

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

$$x = 3 - 2 \times (-1)$$

$$= 3 + 2$$

$$= \underline{\underline{5}}$$

(A1) [BOTH]