



1 (a) One day, Maria took 27 minutes to walk 1.8 km to school. She left home at 0748.

(i) Write down the time Maria arrived at school.

Answer(a)(i) ..... [1]

(ii) Show that Maria's average walking speed was 4 km/h.

Answer(a)(ii)

[2]

(b) Another day, Maria cycled the 1.8 km to school at an average speed of 15 km/h.

(i) Calculate the percentage **increase** that 15 km/h is on Maria's walking speed of 4 km/h.

Answer(b)(i) ..... % [3]

(ii) Calculate the percentage **decrease** that Maria's cycling time is on her walking time of 27 minutes.

Answer(b)(ii) ..... % [3]

(iii) After school, Maria cycled to her friend's home.  
This took 9 minutes, which was 36% of the time Maria takes to walk to her friend's home.

Calculate the time Maria takes to walk to her friend's home.

Answer(b)(iii) ..... min [2]

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2

$$f(x) = 3 - x - x^2 \qquad g(x) = 3^x$$

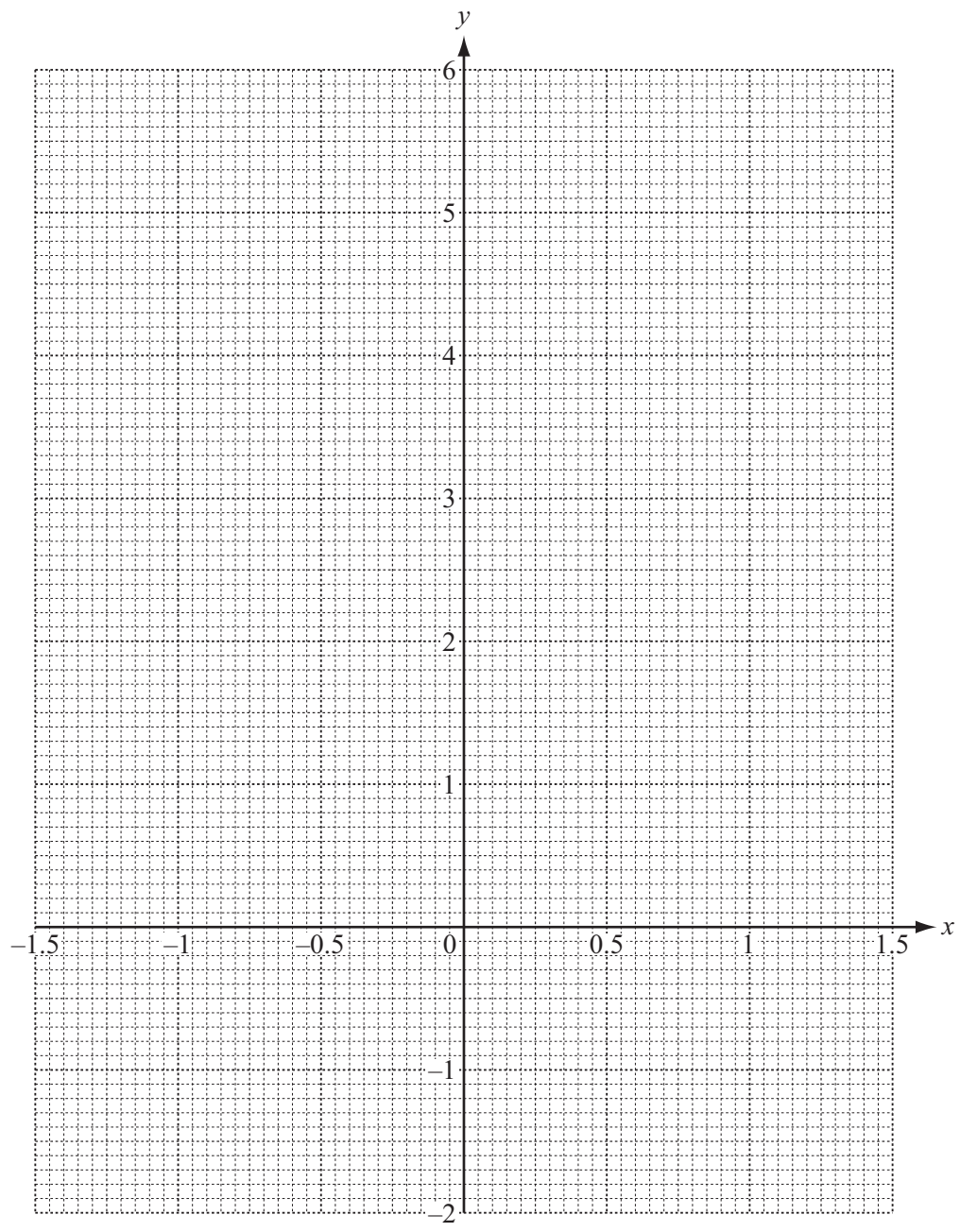
(a) Complete the tables of values for  $f(x)$  and  $g(x)$ .

$x$	-1.5	-1	-0.5	0	0.5	1	1.5
$f(x)$	2.25	3	3.25		2.25	1	-0.75

$x$	-1.5	-1	-0.5	0	0.5	1	1.5
$g(x)$	0.19		0.58		1.73	3	5.20

[3]

(b) On the grid, draw the graphs of  $y = f(x)$  and  $y = g(x)$  for  $-1.5 \leq x \leq 1.5$ .



[6]

(c) For  $-1.5 \leq x \leq 1.5$ , use your graphs to solve

(i)  $f(x) = 0$ ,

Answer(c)(i)  $x = \dots\dots\dots$  [1]

(ii)  $g(x) = 4$ ,

Answer(c)(ii)  $x = \dots\dots\dots$  [1]

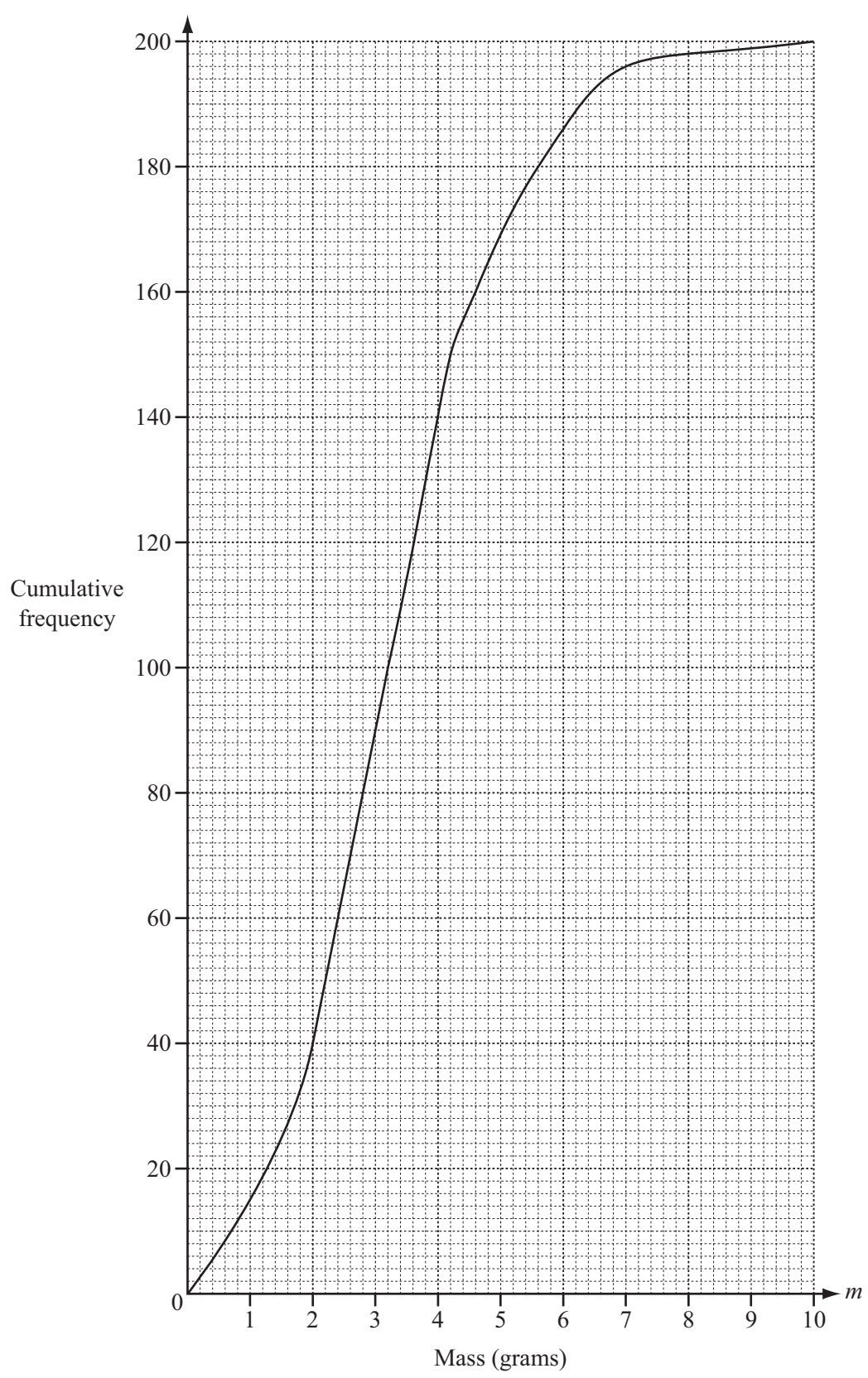
(iii)  $f(x) = g(x)$ .

Answer(c)(iii)  $x = \dots\dots\dots$  [1]

(d) By drawing a suitable tangent, find an estimate of the gradient of the graph of  $y = f(x)$  when  $x = 0.5$ .

Answer(d)  $\dots\dots\dots$  [3]

- 3 200 students estimate the mass ( $m$  grams) of a coin.  
The cumulative frequency diagram shows the results.



(a) Find

(i) the median,

Answer(a)(i) ..... g [1]

(ii) the upper quartile,

Answer(a)(ii) ..... g [1]

(iii) the 80th percentile,

Answer(a)(iii) ..... g [1]

(iv) the number of students whose estimate is 7 g or less.

Answer(a)(iv) ..... [1]

(b) (i) Use the cumulative frequency diagram to complete the frequency table.

Mass ( $m$ grams)	$0 < m \leq 2$	$2 < m \leq 4$	$4 < m \leq 6$	$6 < m \leq 8$	$8 < m \leq 10$
Frequency	40				2

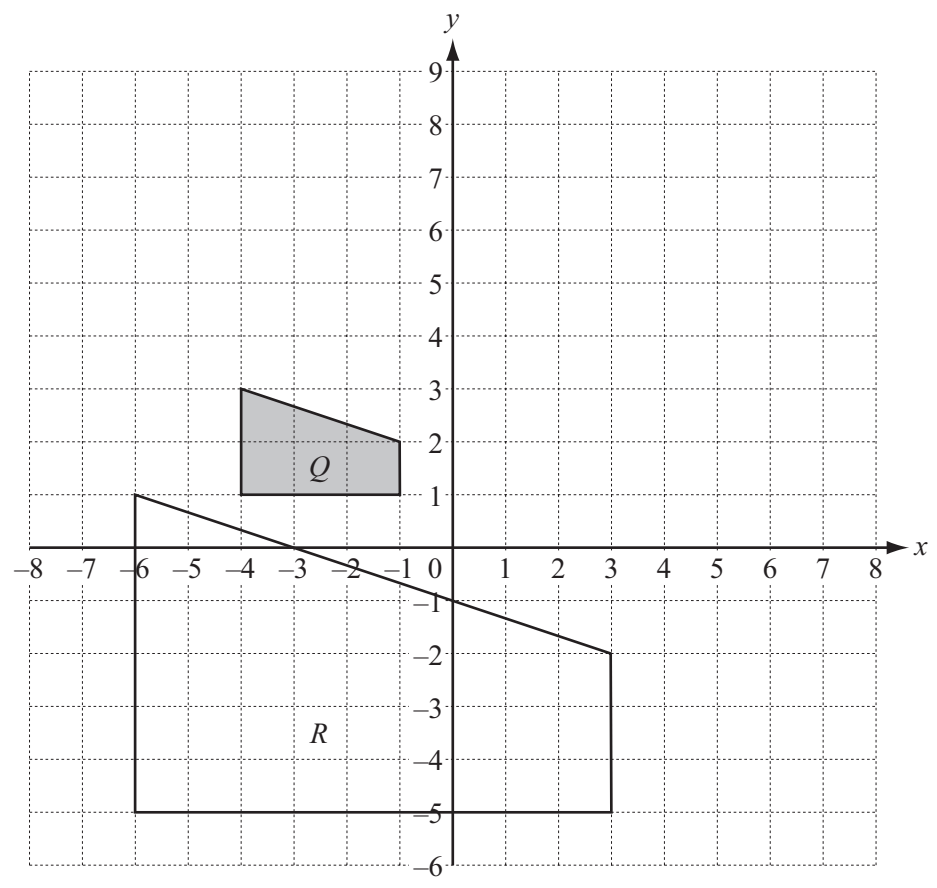
[2]

(ii) A student is chosen at random.

The probability that the student estimates that the mass is greater than  $M$  grams is 0.3.

Find the value of  $M$ .

Answer(b)(ii)  $M =$  ..... [2]



(a) Describe fully the **single** transformation that maps shape *Q* onto shape *R*.

Answer(a) ..... [3]

(b) (i) Draw the image when shape *Q* is translated by the vector  $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$ . [2]

(ii) Draw the image when shape *Q* is reflected in the line  $x = 2$ . [2]

(iii) Draw the image when shape *Q* is stretched, factor 3,  $x$ -axis invariant. [2]

(iv) Find the  $2 \times 2$  matrix that represents a stretch of factor 3,  $x$ -axis invariant.

Answer(b)(iv)  $\begin{pmatrix} & \\ & \end{pmatrix}$  [2]

(c) Describe fully the **single** transformation represented by the matrix  $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ .

Answer(c) ..... [2]



5

Height ( $h$ cm)	$150 < h \leq 160$	$160 < h \leq 165$	$165 < h \leq 180$	$180 < h \leq 190$
Frequency	5	9	18	10

The table shows information about the heights of a group of 42 students.

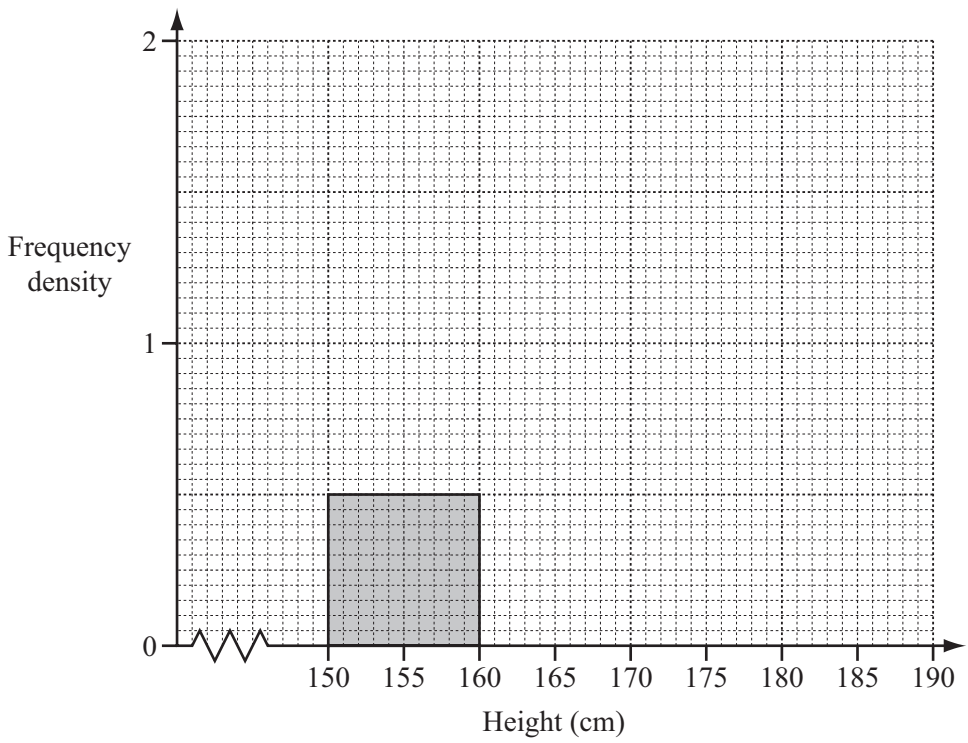
- (a) Using mid-interval values, calculate an estimate of the mean height of the students. Show your working.

Answer(a) ..... cm [3]

- (b) Write down the interval which contains the lower quartile.

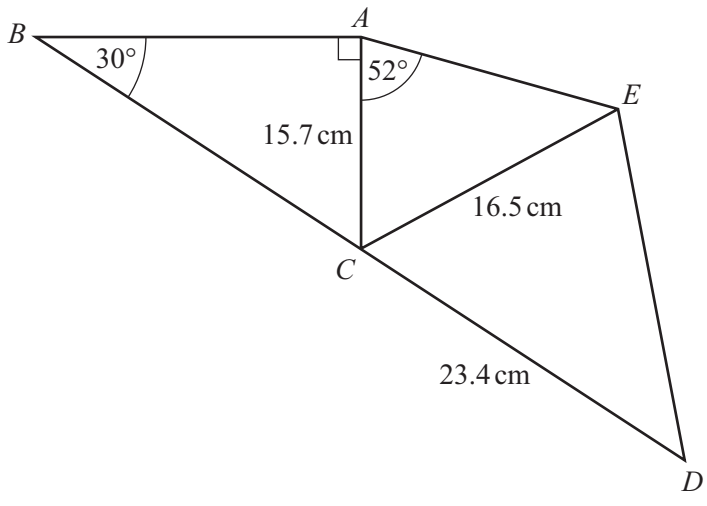
Answer(b) ..... [1]

- (c) Complete the histogram to show the information in the table. One column has already been drawn for you.



[4]

6



NOT TO SCALE

In the diagram,  $BCD$  is a straight line and  $ABDE$  is a quadrilateral.  
Angle  $BAC = 90^\circ$ , angle  $ABC = 30^\circ$  and angle  $CAE = 52^\circ$ .  
 $AC = 15.7$  cm,  $CE = 16.5$  cm and  $CD = 23.4$  cm.

(a) Calculate  $BC$ .

Answer(a)  $BC = \dots\dots\dots$  cm [3]

(b) Use the sine rule to calculate angle  $AEC$ .  
Show that it rounds to  $48.57^\circ$ , correct to 2 decimal places.

Answer(b)

[3]

11

(c) (i) Show that angle  $ECD = 40.6^\circ$ , correct to 1 decimal place.

*Answer(c)(i)*

[2]

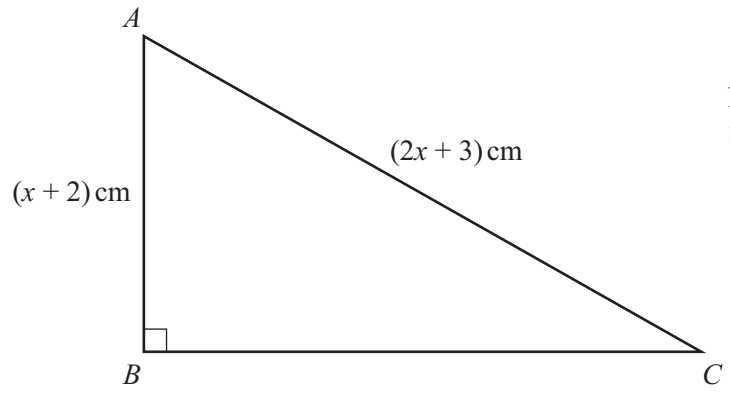
(ii) Calculate  $DE$ .

*Answer(c)(ii)*  $DE = \dots\dots\dots$  cm [4]

(d) Calculate the area of the quadrilateral  $ABDE$ .

*Answer(d)*  $\dots\dots\dots$  cm<sup>2</sup> [4]

7 (a)



NOT TO SCALE

In triangle  $ABC$ ,  $AB = (x + 2)$  cm and  $AC = (2x + 3)$  cm.

$$\sin ACB = \frac{9}{16}$$

Find the length of  $BC$ .

Answer(a)  $BC = \dots\dots\dots$  cm [6]

(b) A bag contains 7 white beads and 5 red beads.

(i) The mass of a red bead is 2.5 grams more than the mass of a white bead.  
The total mass of all the 12 beads is 114.5 grams.

Find the mass of a white bead and the mass of a red bead.

Answer(b)(i) White  $\dots\dots\dots$  g

Red  $\dots\dots\dots$  g [5]

(ii) Two beads are taken out of the bag at random, without replacement.

Find the probability that

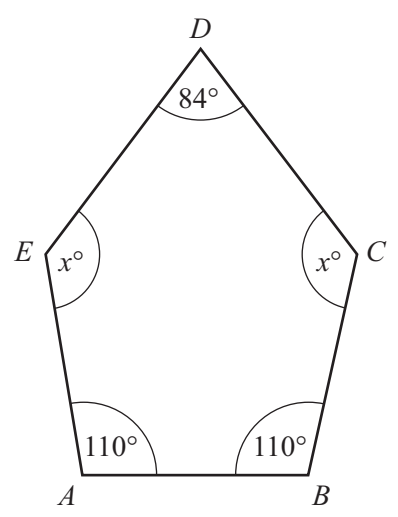
(a) they are both white,

Answer(b)(ii)(a) ..... [2]

(b) one is white and one is red.

Answer(b)(ii)(b) ..... [3]

8 (a)



NOT TO SCALE

In the pentagon  $ABCDE$ , angle  $EAB = \text{angle } ABC = 110^\circ$  and angle  $CDE = 84^\circ$ .  
 Angle  $BCD = \text{angle } DEA = x^\circ$ .

(i) Calculate the value of  $x$ .

Answer(a)(i)  $x = \dots\dots\dots$  [2]

(ii)  $BC = CD$ .  
 Calculate angle  $CBD$ .

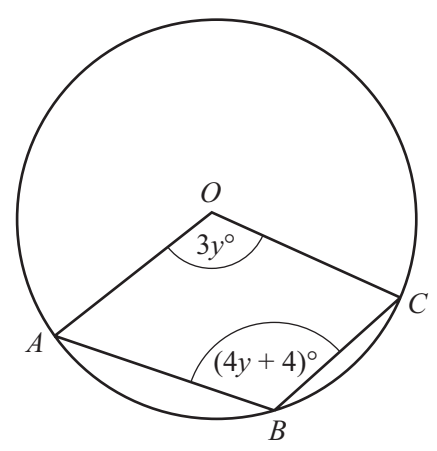
Answer(a)(ii) Angle  $CBD = \dots\dots\dots$  [1]

(iii) This pentagon also has one line of symmetry.  
 Calculate angle  $ADB$ .

Answer(a)(iii) Angle  $ADB = \dots\dots\dots$  [1]

(b)  $A, B$  and  $C$  lie on a circle centre  $O$ .  
 Angle  $AOC = 3y^\circ$  and angle  $ABC = (4y + 4)^\circ$ .

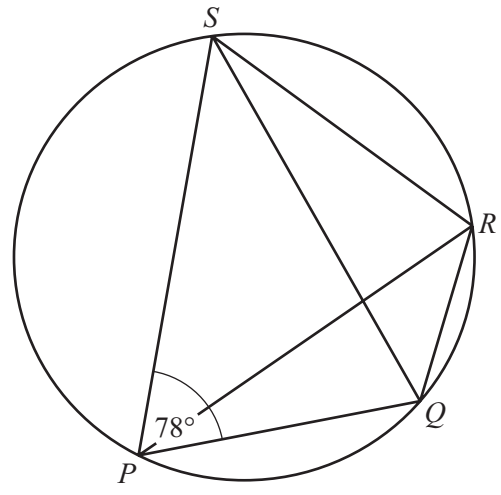
Find the value of  $y$ .



NOT TO SCALE

Answer(b)  $y = \dots\dots\dots$  [4]

(c)



NOT TO SCALE

In the cyclic quadrilateral  $PQRS$ , angle  $SPQ = 78^\circ$ .

(i) Write down the geometrical reason why angle  $QRS = 102^\circ$ .

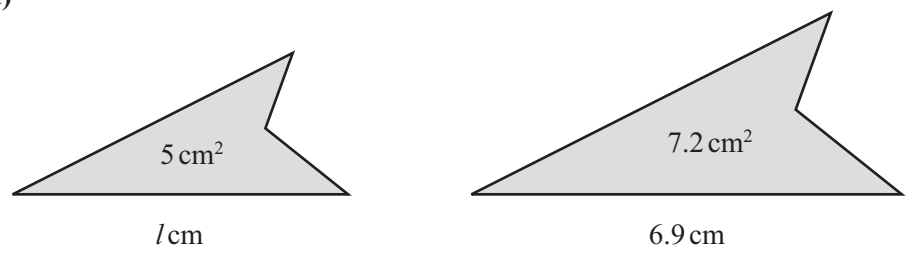
Answer(c)(i) ..... [1]

(ii) Angle  $PRQ$  : Angle  $PRS = 1 : 2$ .

Calculate angle  $PQS$ .

Answer(c)(ii) Angle  $PQS =$  ..... [3]

(d)



NOT TO SCALE

The diagram shows two similar figures.  
The areas of the figures are  $5 \text{ cm}^2$  and  $7.2 \text{ cm}^2$ .  
The lengths of the bases are  $l \text{ cm}$  and  $6.9 \text{ cm}$ .

Calculate the value of  $l$ .

Answer(d)  $l =$  ..... [3]

9

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

$$g(x) = 2x + 7$$

$$h(x) = 2^x$$

- (a) Solve the equation  $f(x) = 0$ .  
Show all your working and give your answers correct to 2 decimal places.

Answer(a)  $x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]

(b)  $fg(x) = px^2 + qx + r$

Find the values of  $p$ ,  $q$  and  $r$ .

Answer(b)  $p = \dots\dots\dots$

$q = \dots\dots\dots$

$r = \dots\dots\dots$  [3]



(c) Find  $g^{-1}(x)$ .

Answer(c)  $g^{-1}(x) = \dots\dots\dots$  [2]

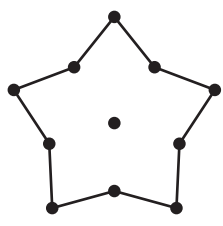
(d) Find  $x$  when  $h(x) = 0.25$ .

Answer(d)  $x = \dots\dots\dots$  [1]

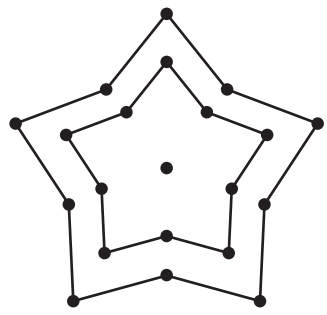
(e) Find  $hhh(3)$ .  
Give your answer in standard form, correct to 4 significant figures.

Answer(e)  $\dots\dots\dots$  [4]

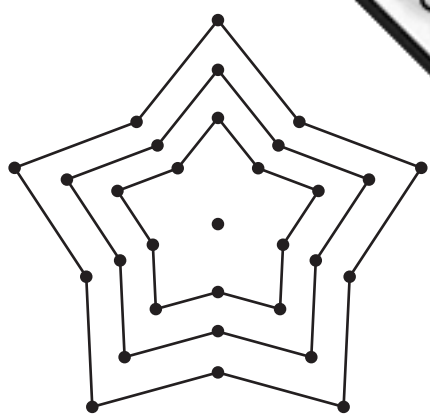
10



Star 1



Star 2



Star 3

The diagrams show a sequence of stars made of lines and dots.

(a) Complete the table for Star 5, Star 7 and Star  $n$ .

	Star 1	Star 2	Star 3	Star 4	Star 5		Star 7		Star $n$
Number of lines	10	20	30	40					
Number of dots	11	21	31	41					

[4]

(b) The sums of the number of dots in two consecutive stars are shown in the table.

Star 1 and Star 2	Star 2 and Star 3	Star 3 and Star 4
32	52	72

Find the sum of the number of dots in

(i) Star 10 and Star 11,

Answer(b)(i) ..... [1]

(ii) Star  $n$  and Star  $(n + 1)$ ,

Answer(b)(ii) ..... [1]

(iii) Star  $(n + 7)$  and Star  $(n + 8)$ .

Answer(b)(iii) ..... [1]

(c) The **total number of dots** in the first  $n$  stars is given by the expression  $5n^2 + 6n$ .

(i) Show that this expression is correct when  $n = 3$ .

*Answer(c)(i)*

[2]

(ii) Find the total number of dots in the first 10 stars.

*Answer(c)(ii)* ..... [1]

(d) The total number of dots in the first  $n$  stars is  $5n^2 + 6n$ .  
The number of dots in the  $(n + 1)$ th star is  $10(n + 1) + 1$ .

Add these two expressions to show that the total number of dots in the first  $(n + 1)$  stars is

$$5(n + 1)^2 + 6(n + 1).$$

You must show each step of your working.

*Answer(d)*

[4]

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