

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.

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

Answer(b)(iii) min [2]

2

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

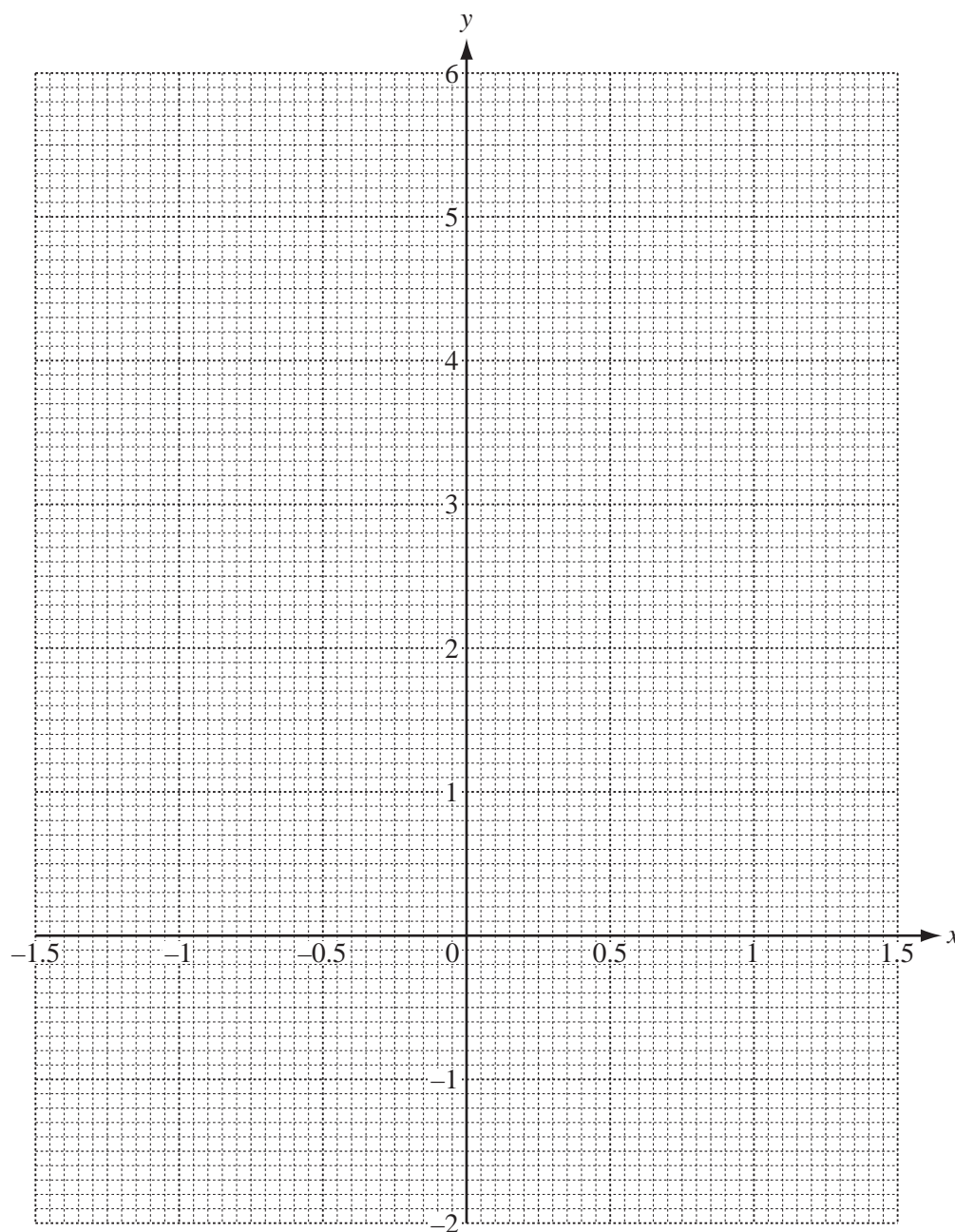
(a) Complete the tables of values for $f(x)$ and $g(x)$.

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]

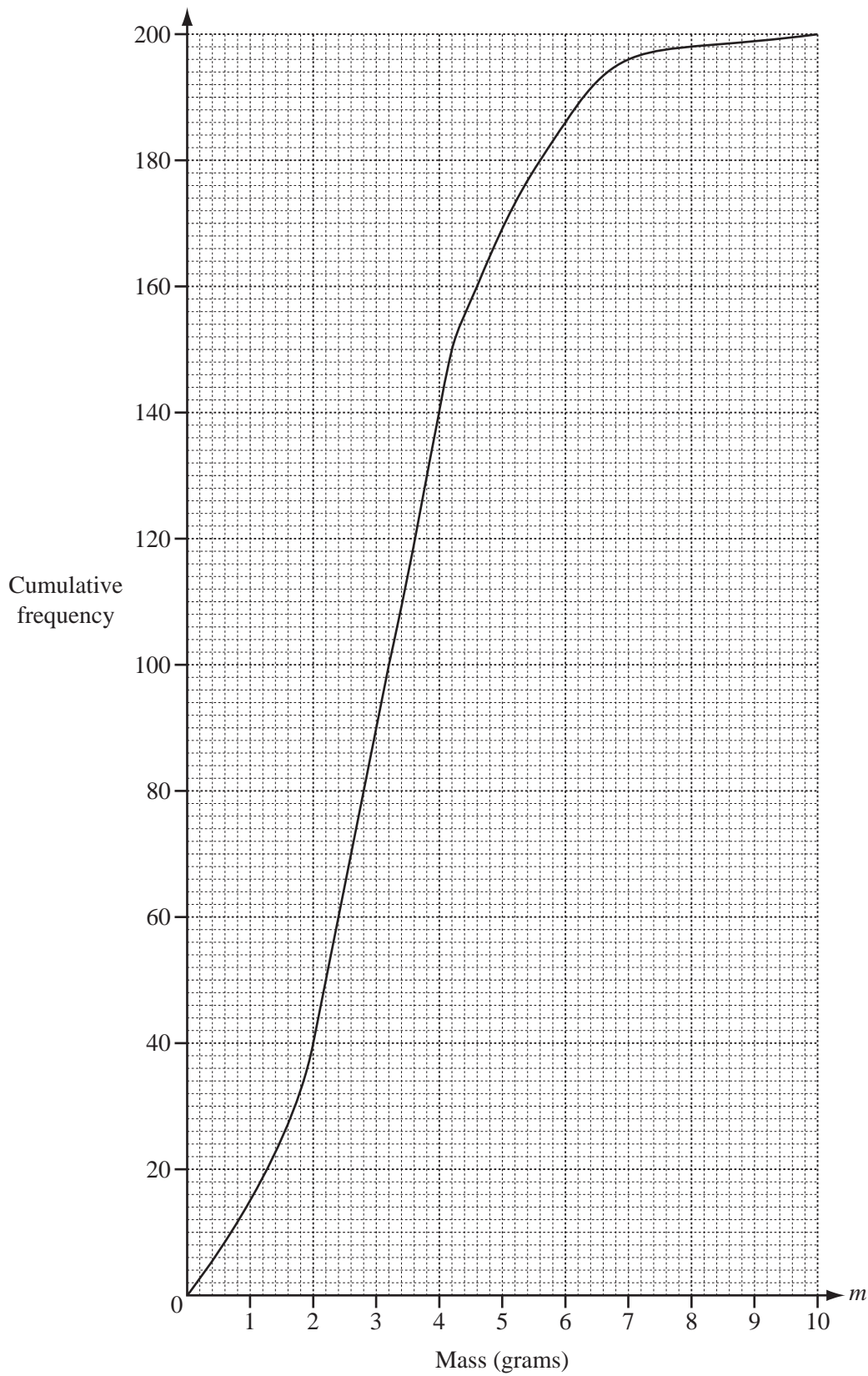
(iii) $f(x) = g(x)$.

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

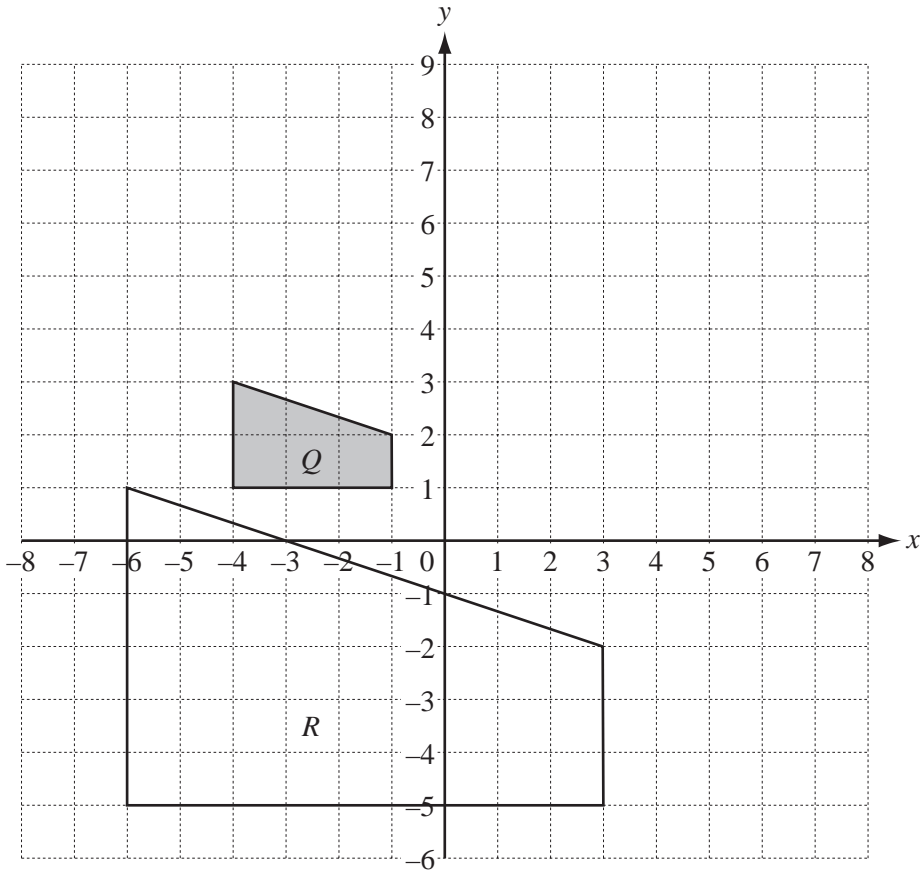
[2]

(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 2×2 matrix that represents a stretch of factor 3, x -axis invariant.

Answer(b)(iv) $\left(\begin{array}{cc} & \\ & \end{array} \right)$ [2]

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

Answer(c) [2]

5

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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.

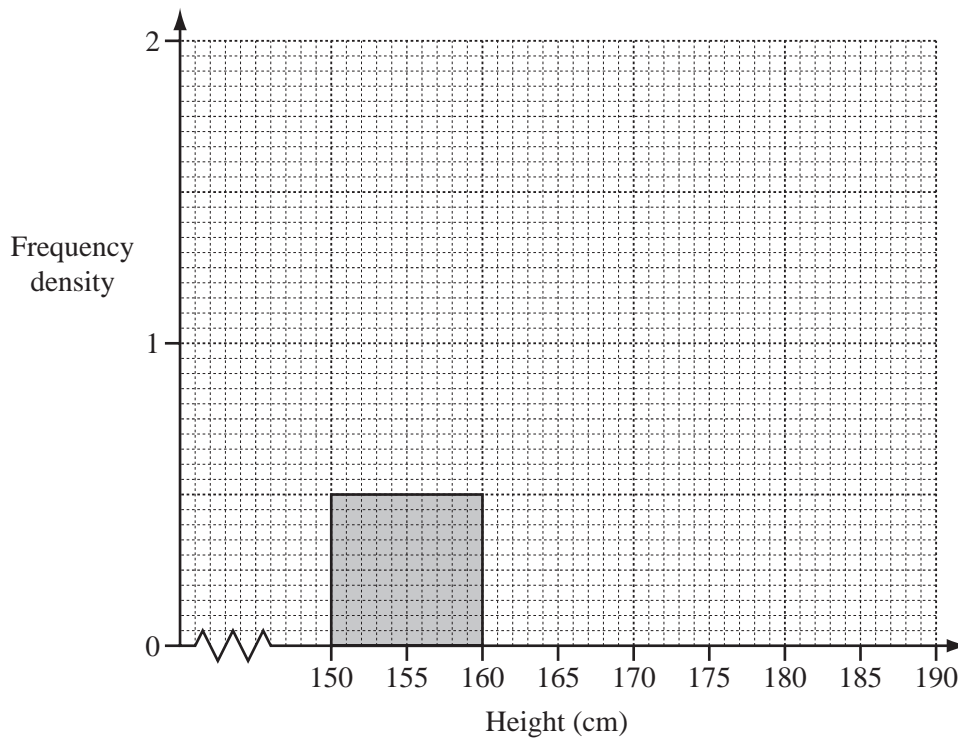
- (a) Using mid-interval values, calculate an estimate of the mean height of the students.
Show your working.

Answer(a) cm [3]

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

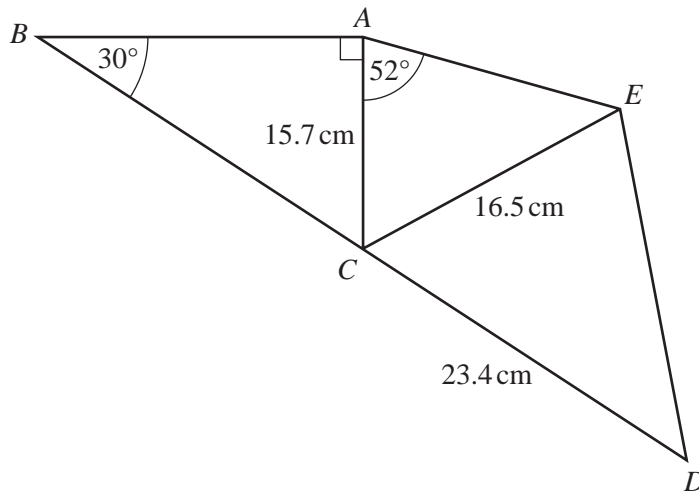
Answer(b) [1]

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



[4]

6

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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° , correct to 2 decimal places.

Answer(b)

[3]

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

Answer(c)(i)

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[2]

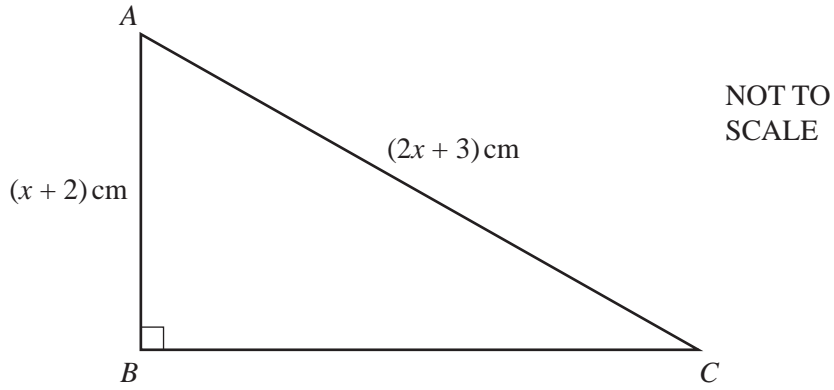
- (ii) Calculate DE .

Answer(c)(ii) DE = cm [4]

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

Answer(d) cm² [4]

7 (a)



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

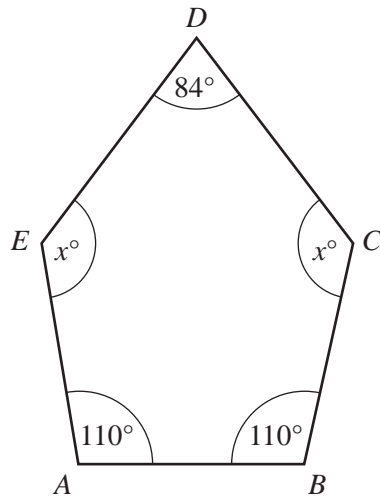
(a) they are both white,

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

(b) one is white and one is red.

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

8 (a)



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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 .

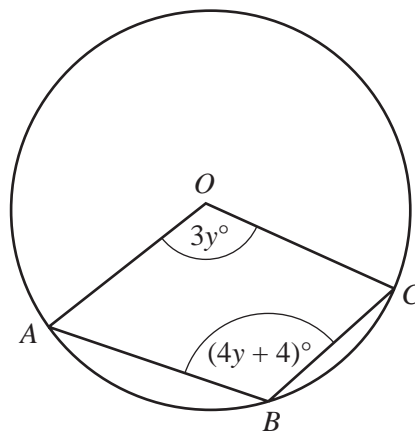
Answer(a)(ii) Angle $CBD = \dots\dots\dots$ [1]

(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 $ABC = (4y + 4)^\circ$.

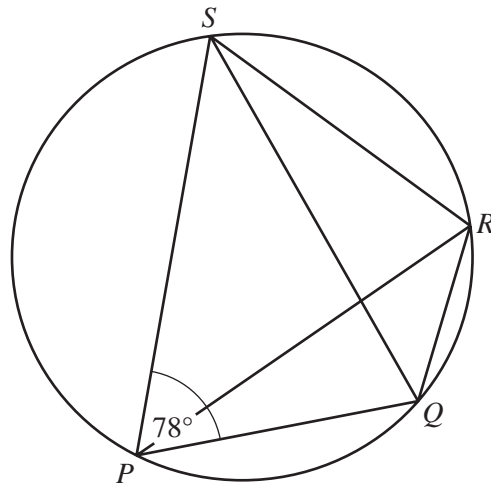
Find the value of y .



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

(c)



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

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

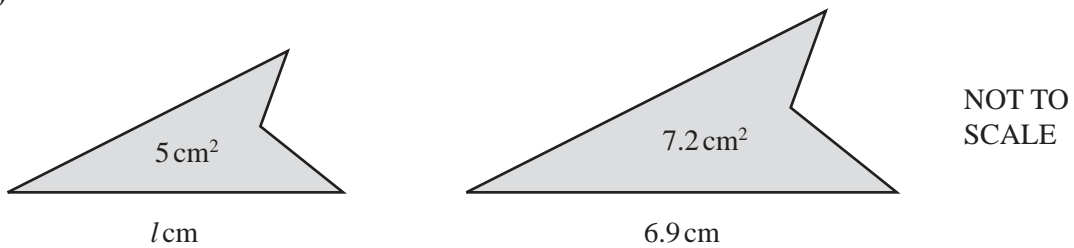
Answer(c)(i) [1]

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

Calculate angle PQS .

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

(d)



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

Calculate the value of l .

Answer(d) $l =$ [3]

9

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

$g(x) = 2x + 7$

$h(x) = 2^x$

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- (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 $h(x) = 0.25$.

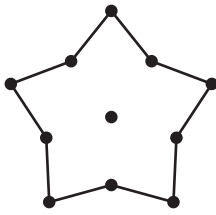
Answer(d) $x = \dots\dots\dots$ [1]

(e) Find $hhh(3)$.

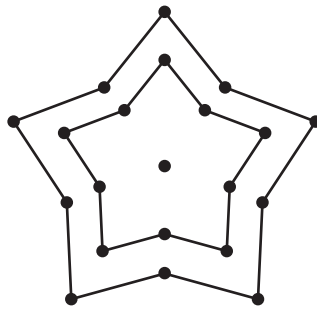
Give your answer in standard form, correct to 4 significant figures.

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

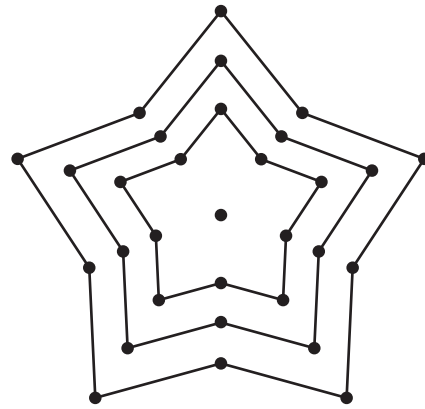
10



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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