UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1191404320

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2013**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator; Geometrical instruments; Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

This document consists of **19** printed pages and **1** blank page.

IB13 06_0580_41/3RP

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

For Examiner's Use

1 **(a)** One day, Maria took 27 minutes to walk 1.8 km to school.
She left home at 07 48.

(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]

For Examiner's Use

(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]

For Examiner's Use

2

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

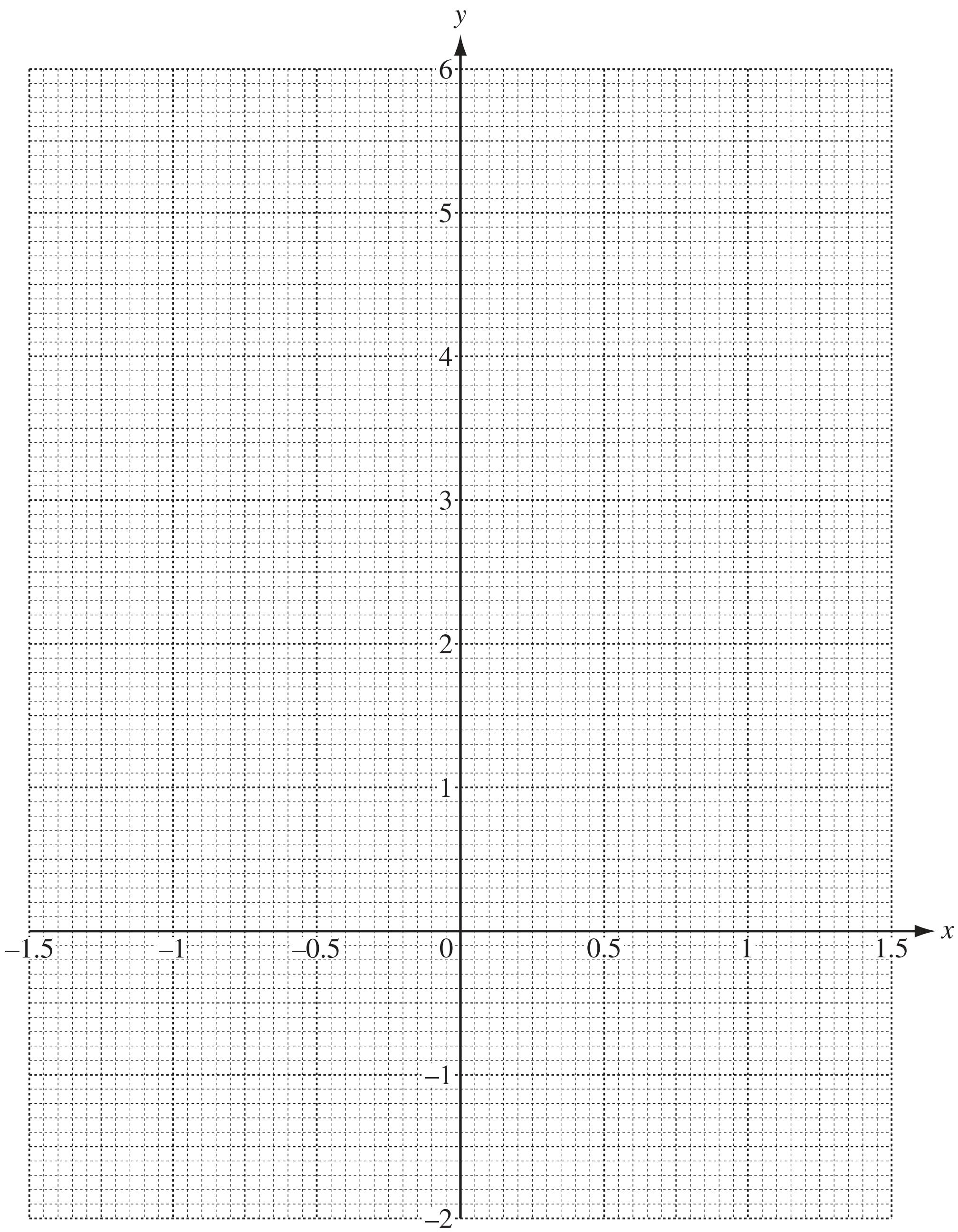
(a) Complete the tables of values for f(x) and g(x).

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 $-1.5 \leqslant x \leqslant 1.5$.



[6]

For Examiner's Use

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

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

Answer(c)(i) $x =$ .... [1]

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

Answer(c)(ii) $x =$ .... [1]

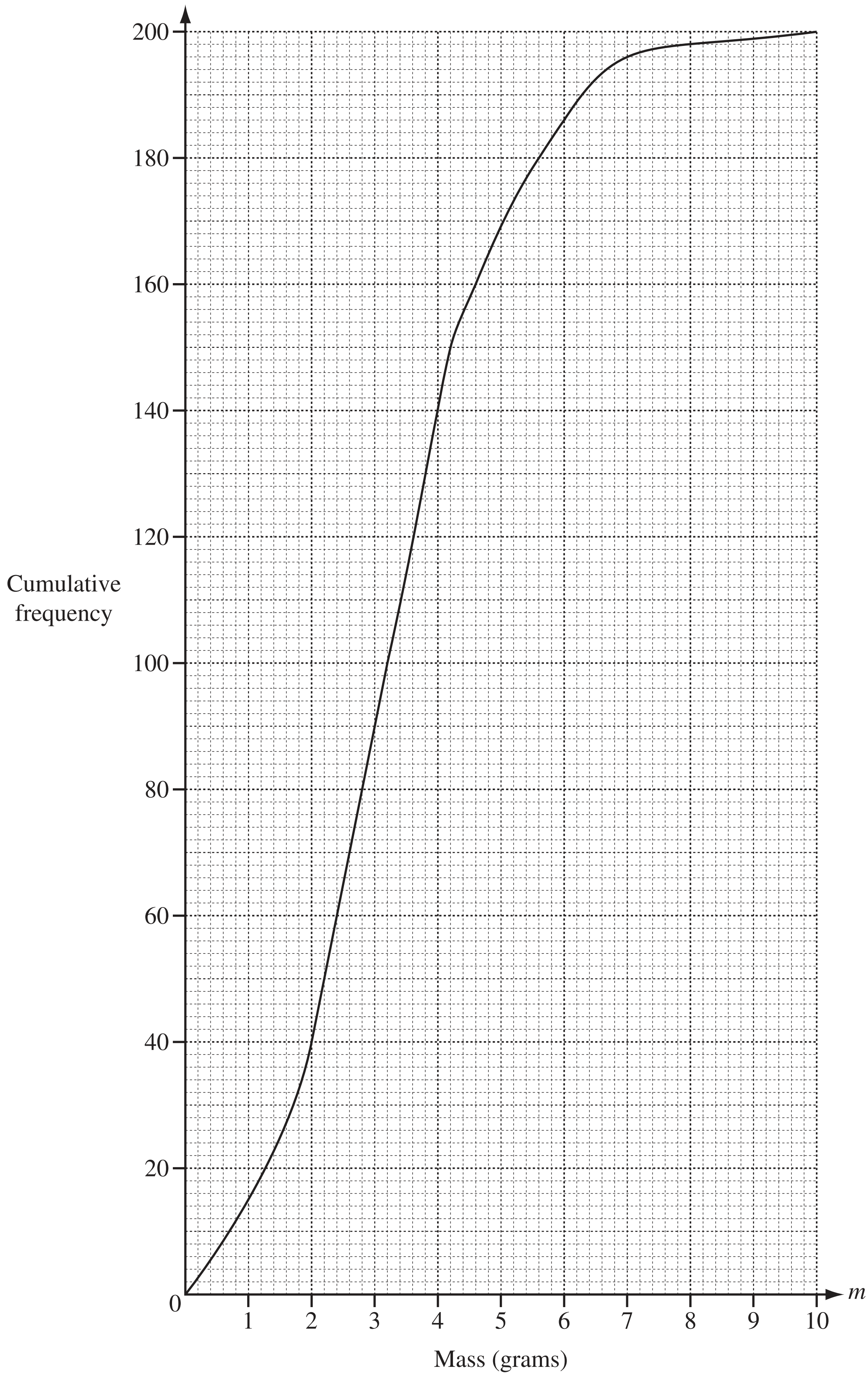
(iii) $f(x) = g(x)$.

Answer(c)(iii) $x =$ .... [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) .... [3]

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



For Examiner's Use

For Examiner's Use

(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)	$0 < m \leqslant 2$	$2 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 8$	$8 < m \leqslant 10$
Frequency	40				2

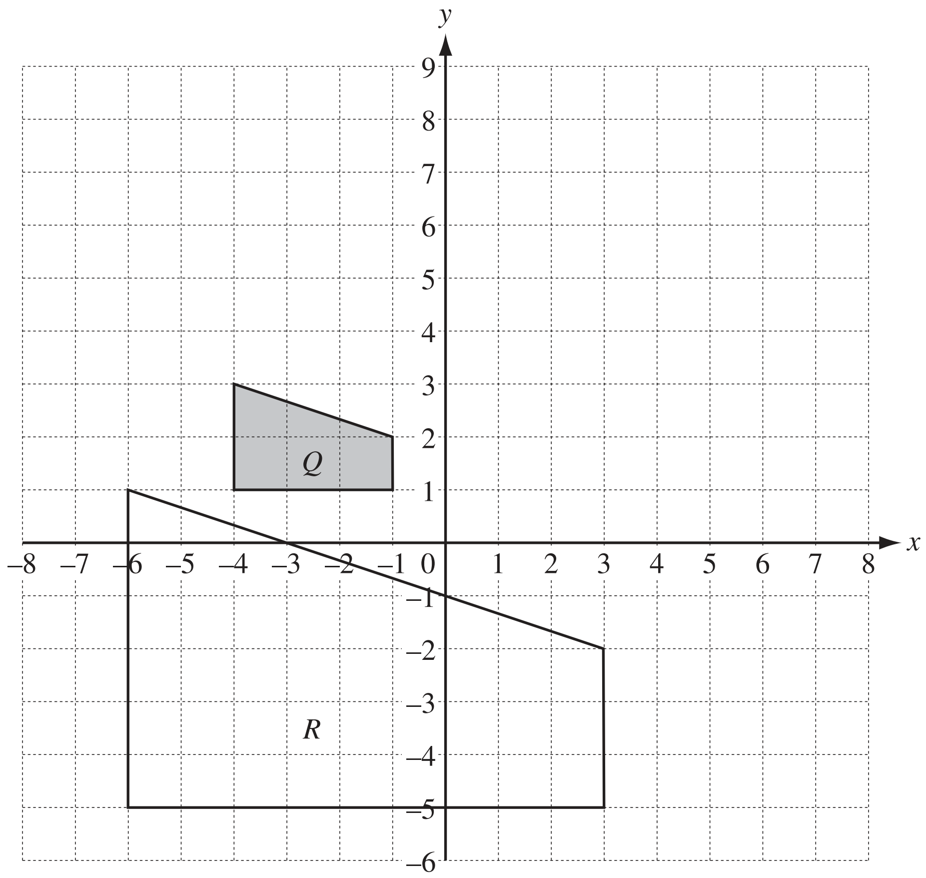
[2]

(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]

4



(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) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [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)	$150 < h \leqslant 160$	$160 < h \leqslant 165$	$165 < h \leqslant 180$	$180 < h \leqslant 190$
Frequency	5	9	18	10

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

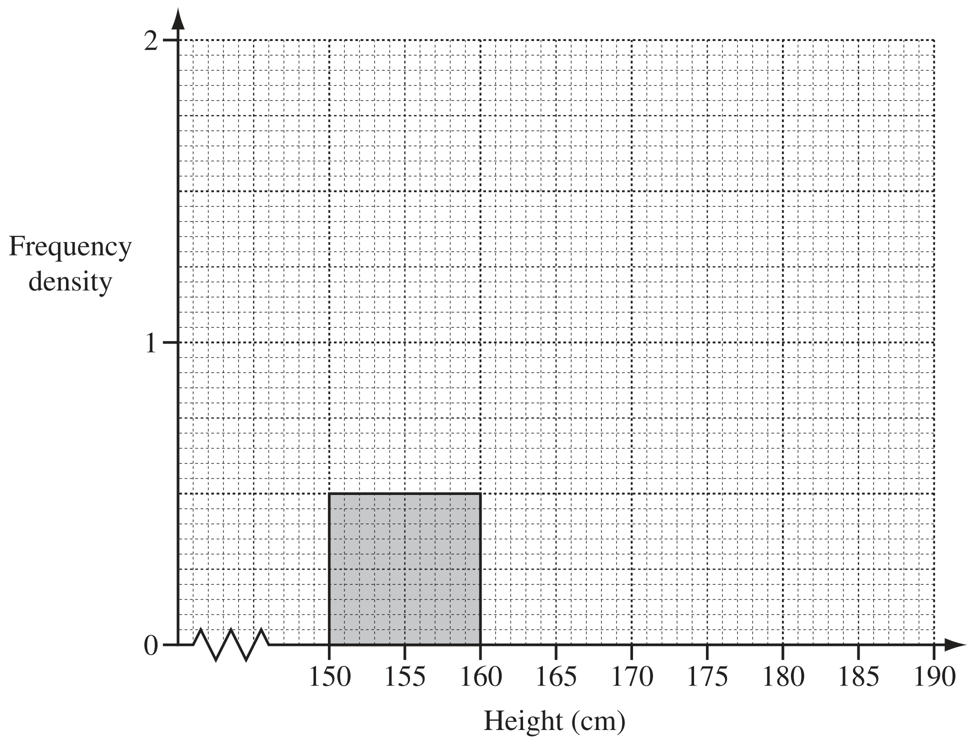
(a) Using mid-interval values, calculate an estimate of the mean height of the students.
Show your working.

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

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

Answer(b) .... [1]

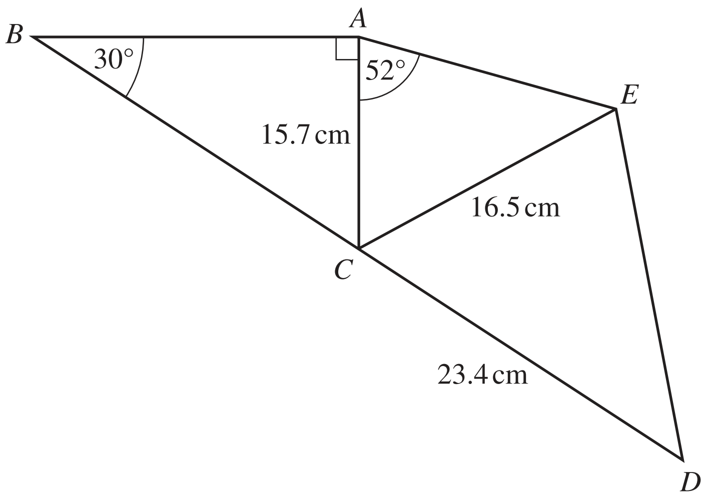
(c) Complete the histogram to show the information in the table.
One column has already been drawn for you.



[4]

For Examiner's Use

6



NOT TO SCALE

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

(a) Calculate *BC*.

Answer(a) BC = ... 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]

For Examiner's Use

(c) **(i)** Show that angle *ECD* = 40.6°, correct to 1 decimal place.

Answer(c)(i)

[2]

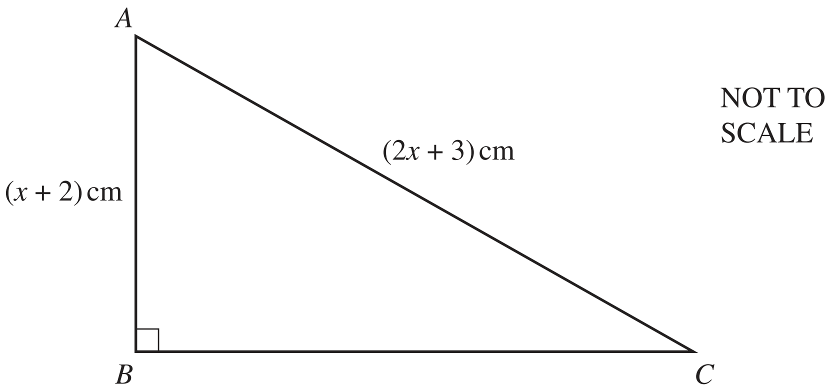
(ii) Calculate *DE*.

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

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

Answer(d) .... cm^2 [4]

7 (a)



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

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

Find the length of BC.

Answer(a) BC = ... 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 .... g

Red .... g [5]

For Examiner's Use

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

Find the probability that

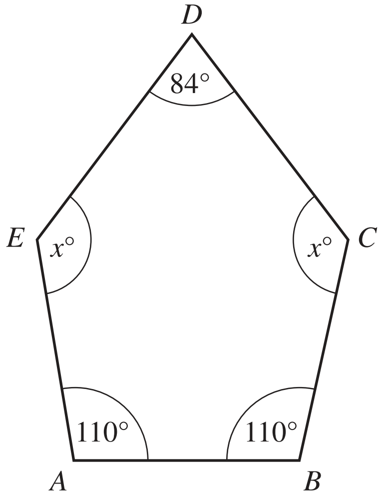
(a) they are both white,

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* = angle *ABC* = 110° and angle *CDE* = 84°.
Angle *BCD* = angle *DEA* = x°.

(i) Calculate the value of x.

Answer(a)(i) x = ... [2]

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

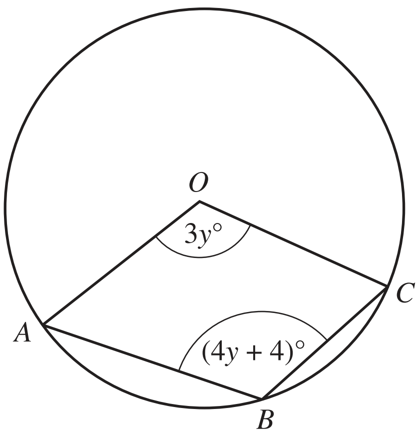
Answer(a)(ii) Angle *CBD* = ... [1]

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

Answer(a)(iii) Angle *ADB* = ... [1]

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

Find the value of y.



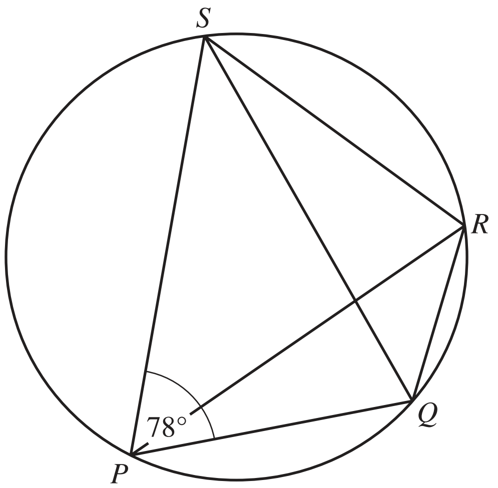
NOT TO SCALE

Answer(b) y = ... [4]

For Examiner's Use

For Examiner's Use

(c)



In the cyclic quadrilateral *PQRS*, angle *SPQ* = 78°.

(i) Write down the geometrical reason why angle *QRS* = 102°.

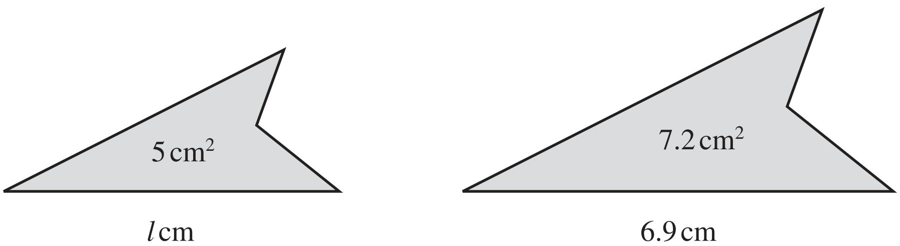
Answer(c)(i) .... [1]

(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 $5\,\text{cm}^2$ and $7.2\,\text{cm}^2$.
The lengths of the bases are l cm and 6.9 cm.

Calculate the value of l.

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

For Examiner's Use

9 $\quad f(x) = x^2 + x - 3 \qquad g(x) = 2x + 7 \qquad h(x) = 2^x$

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

Answer(a) $x =$ .... or $x =$ .... [4]

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

Find the values of p, q and r.

Answer(b) $p =$ ....

$q =$ ....

$r =$ .... [3]

For Examiner's Use

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

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

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

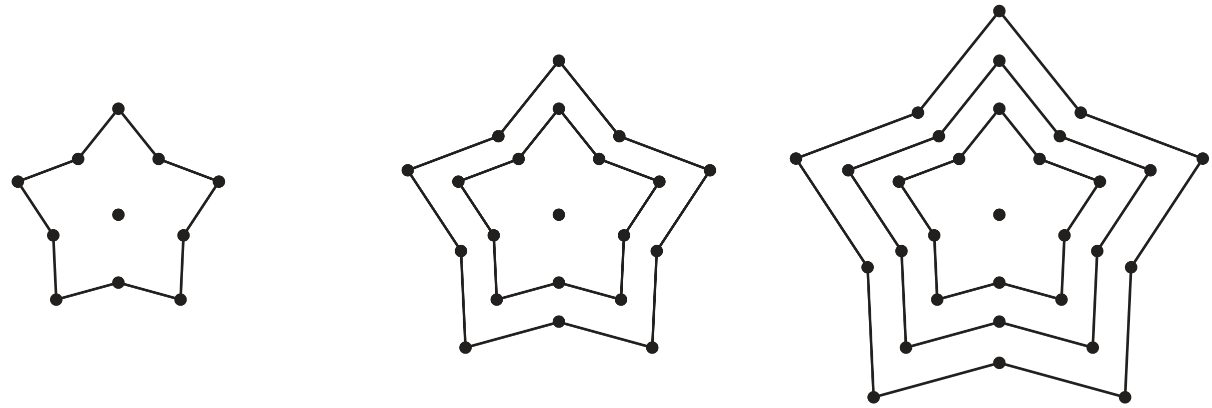
Answer(d) $x =$ .... [1]

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

Answer(e) .... [4]

[Turn over

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]

For Examiner's Use

(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]

BLANK PAGE