Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22	
TOTAL	

General Certificate of Secondary Education
Higher Tier
November 2010

Mathematics (Specification A) 4306/1H

Paper 1 Non-calculator

H

Tuesday 9 November 2010 9.00 am to 11.00 am

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.

Time allowed
- 2 hours

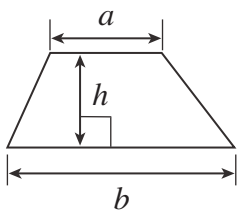
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.
- You must **not** use a calculator.

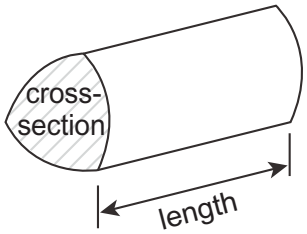
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$

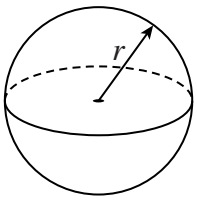


Volume of prism = area of cross-section × length



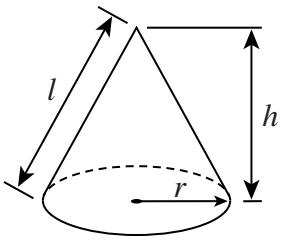
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

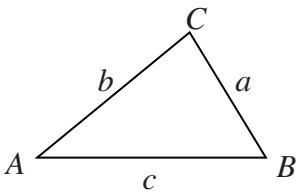
Curved surface area of cone = $\pi r l$



In any triangle ABC

Area of triangle = $\frac{1}{2}ab\sin C$

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Answer **all** questions in the spaces provided.

1 Use approximations to estimate the value of $\dfrac{52.3 \times 97.8}{19.4}$

You **must** show your working.

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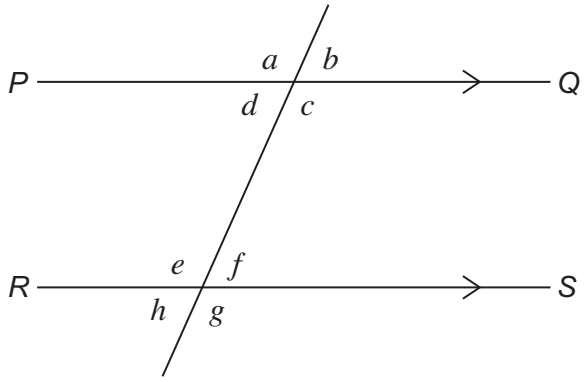
Answer ..... *(2 marks)*

2 On the diagram *PQ* is parallel to *RS*.



2 (a) Which angle is vertically opposite to angle a?

Answer ..... *(1 mark)*

2 (b) Which angle is alternate to angle f?

Answer ..... *(1 mark)*

2 (c) Which angle is corresponding to angle c?

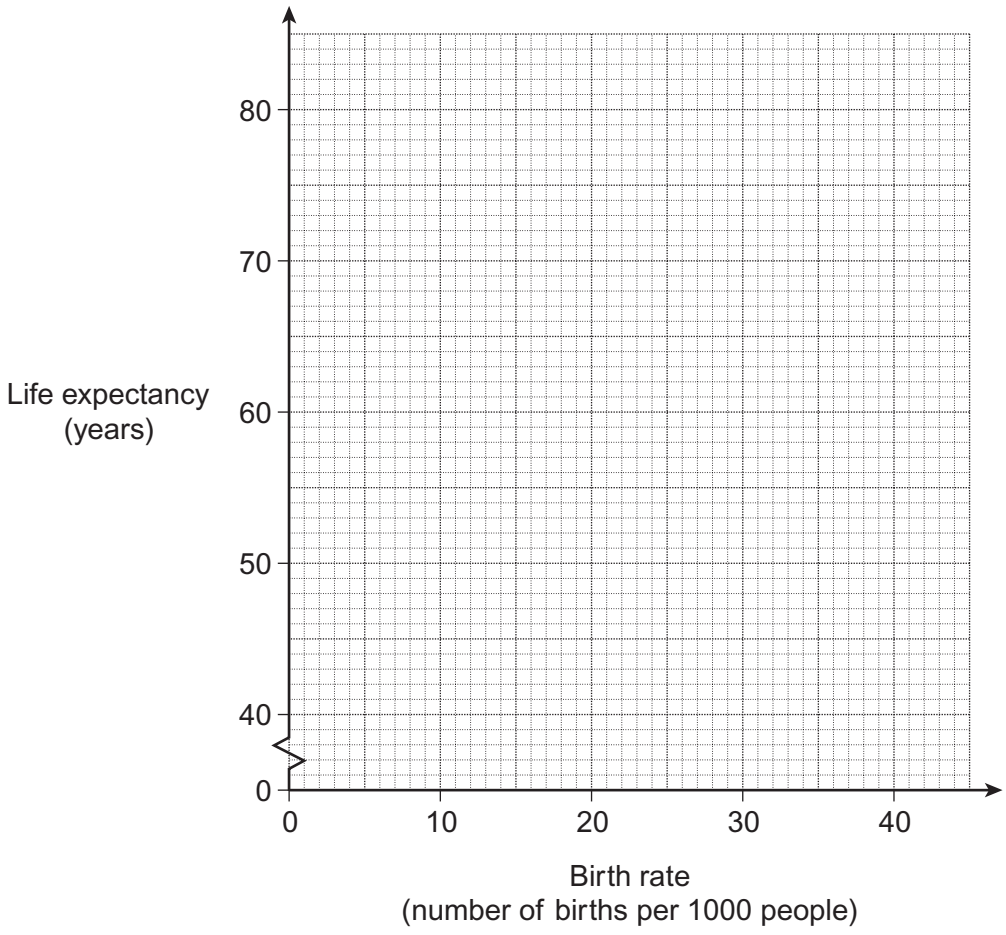
Answer ..... *(1 mark)*

5

3 The birth rate and the life expectancy for seven countries are shown in the table.

Country	Birth rate (number of births per 1000 people)	Life expectancy (years)
Chile	15	77
Egypt	22	72
Gambia	39	59
India	22	69
Japan	8	82
Nepal	30	64
United Kingdom	11	79

3 (a) Plot the data as a scatter graph on the grid below.



(2 marks)

3 (b) Describe the strength and type of correlation.

Answer Strength .....

Type of correlation .....

(2 marks)

3 (c) Draw a line of best fit on your scatter graph.

(1 mark)

3 (d) Use the line of best fit to estimate the life expectancy for Turkey whose birth rate is 16 births per 1000 people.

Answer ..... years *(1 mark)*

3 (e) Why might it **not** be reliable to use the line of best fit to estimate the life expectancy for Niger whose birth rate is 50 births per 1000 people?

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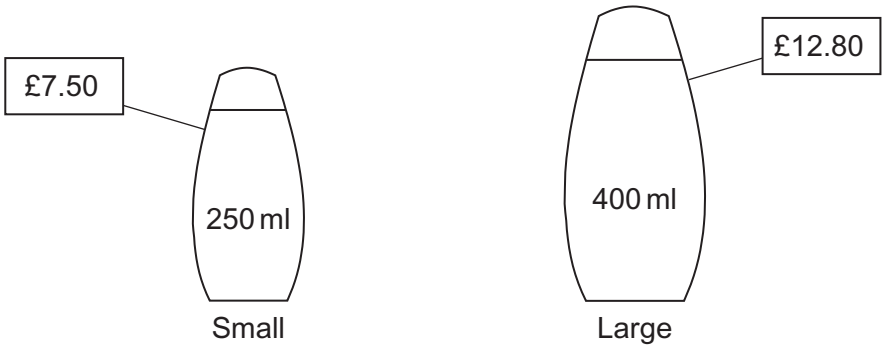
(1 mark)

Turn over for the next question

7

4 A chemist sells a brand of shampoo in two different sizes.



Which is the better value?
You **must** show your working.

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Answer ..... *(3 marks)*

5 Jenny works 8 hours each weekend.
She earns £4.50 per hour.
She saves one-third of her earnings.

She wants to buy an iPod costing £104.95

How many weeks will it take her to save enough to buy this iPod?

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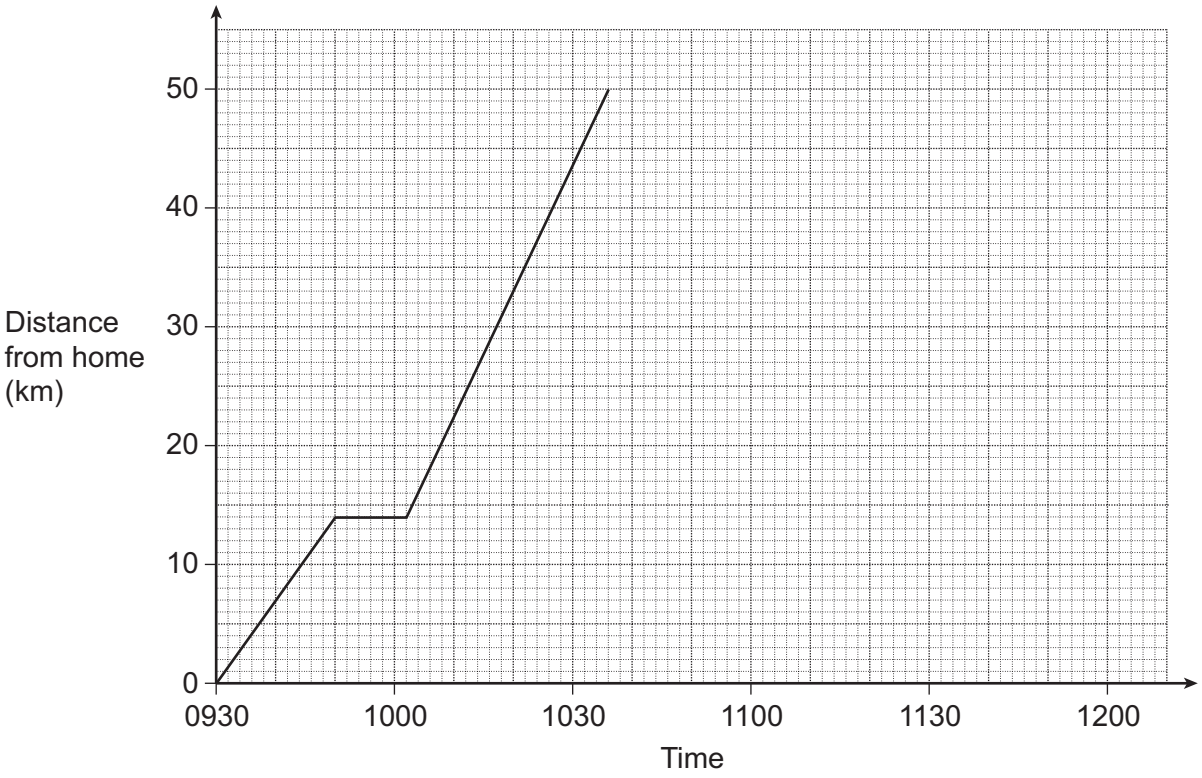
Answer ..... *(4 marks)*

6 Marcus leaves home at 0930 to drive to Leeds, 50 km away.
He stops at a petrol station on his way to Leeds.
The graph shows his journey to Leeds.



6 (a) How far has he gone before he stops at the petrol station?

Answer ..... km *(1 mark)*

6 (b) How many minutes is he at the petrol station?

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Answer ..... minutes *(1 mark)*

6 (c) Marcus stays in Leeds until 1110.
He leaves Leeds and arrives home at 1150, without stopping on the way.

6 (c) (i) Complete the graph.

(1 mark)

6 (c) (ii) Calculate his average speed for the return journey.
Give your answer in kilometres per hour.

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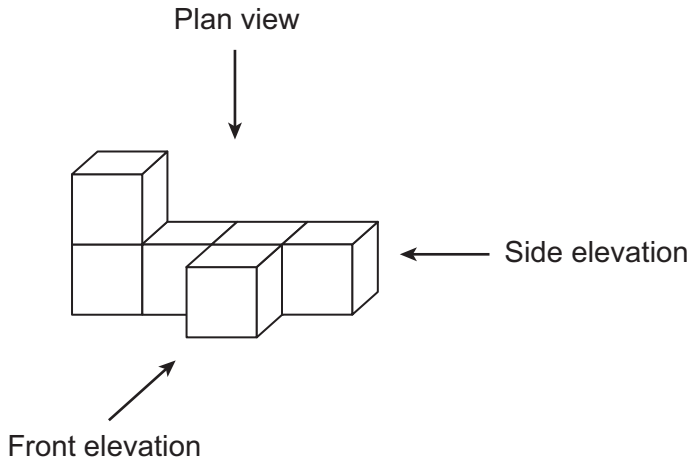
Answer ..... km/h *(2 marks)*

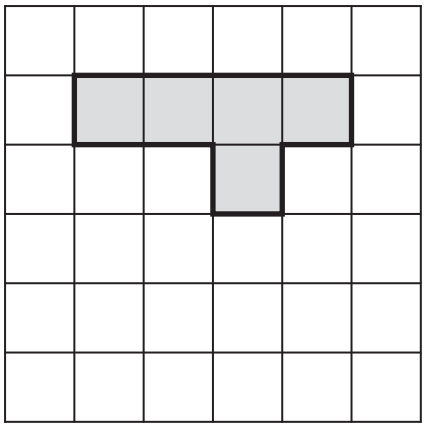
12

Turn over ▶

7 This solid is made from centimetre cubes.



The plan view of the solid is drawn on the grid.



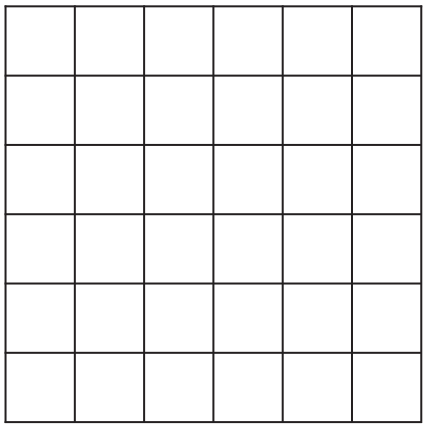
On the grids below,

7 (a) (i) draw the front elevation of the solid

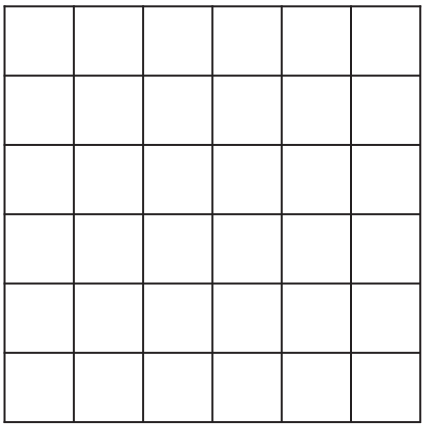
(1 mark)

7 (a) (ii) draw the side elevation of the solid.

(1 mark)



Front elevation.



Side elevation.

7 (b) What is the total surface area of the solid?
State the units of your answer.

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Answer ..... *(3 marks)*

8 (a) Solve $10(w - 1) = 15$

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Answer w = ... *(3 marks)*

8 (b) Solve $5t + 12 = 3(t + 5)$

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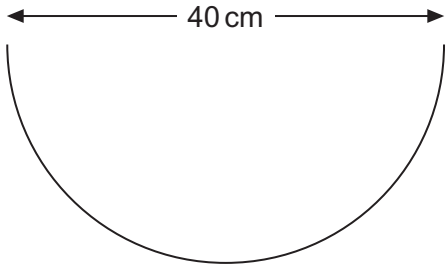
Answer t = ... *(3 marks)*

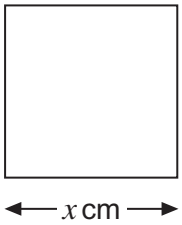
11

9 A wire is in the shape of a semi-circle of diameter 40 cm.



Not drawn accurately

The wire is bent into the shape of a square of side x cm.



Not drawn accurately

Work out the value of x.
Use $\pi = 3.14$ in your calculations.

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Answer ..... cm *(4 marks)*

10 Harry is going to buy a new car.
Here is some information about the running costs of the car.

Average amount of fuel used per **100** km	5 litres
Average cost of fuel per litre	£1.20
Road Tax and Insurance, per year	£450
Total servicing costs for **three** years	£500

Harry drives 30 000 kilometres a year, on average.
He plans to keep the car for three years.

What is Harry's expected total running costs for the three years?
You **must** show your working.

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Answer £ ..... *(5 marks)*

9

11 A bag contains only blue and yellow discs.

Lucy is doing an experiment to find out how many blue discs there are.
She takes out a disc, at random, and records its colour.
She then puts it back in the bag.
Lucy does this 200 times altogether.

The table shows the total number of blue discs and the relative frequency of blue after different numbers of trials.

Number of trials	Total number of blue discs	Relative frequency of blue
10	5	0.5
20	9	0.45
50		0.4
100	31	0.31
200	60	0.3

11 (a) What was the total number of blue discs after 50 trials?

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Answer ..... *(2 marks)*

11 (b) There are 40 discs in the bag.

Estimate the number of blue discs in the bag.
You **must** show your working.

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Answer ..... *(2 marks)*

12 (a) Make x the subject of $y = \frac{x}{w} - t$

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Answer ..... *(2 marks)*

12 (b) Solve the simultaneous equations $2y = x + 6$
$y = 2x - 3$

You **must** show your working.
Do **not** use trial and improvement.

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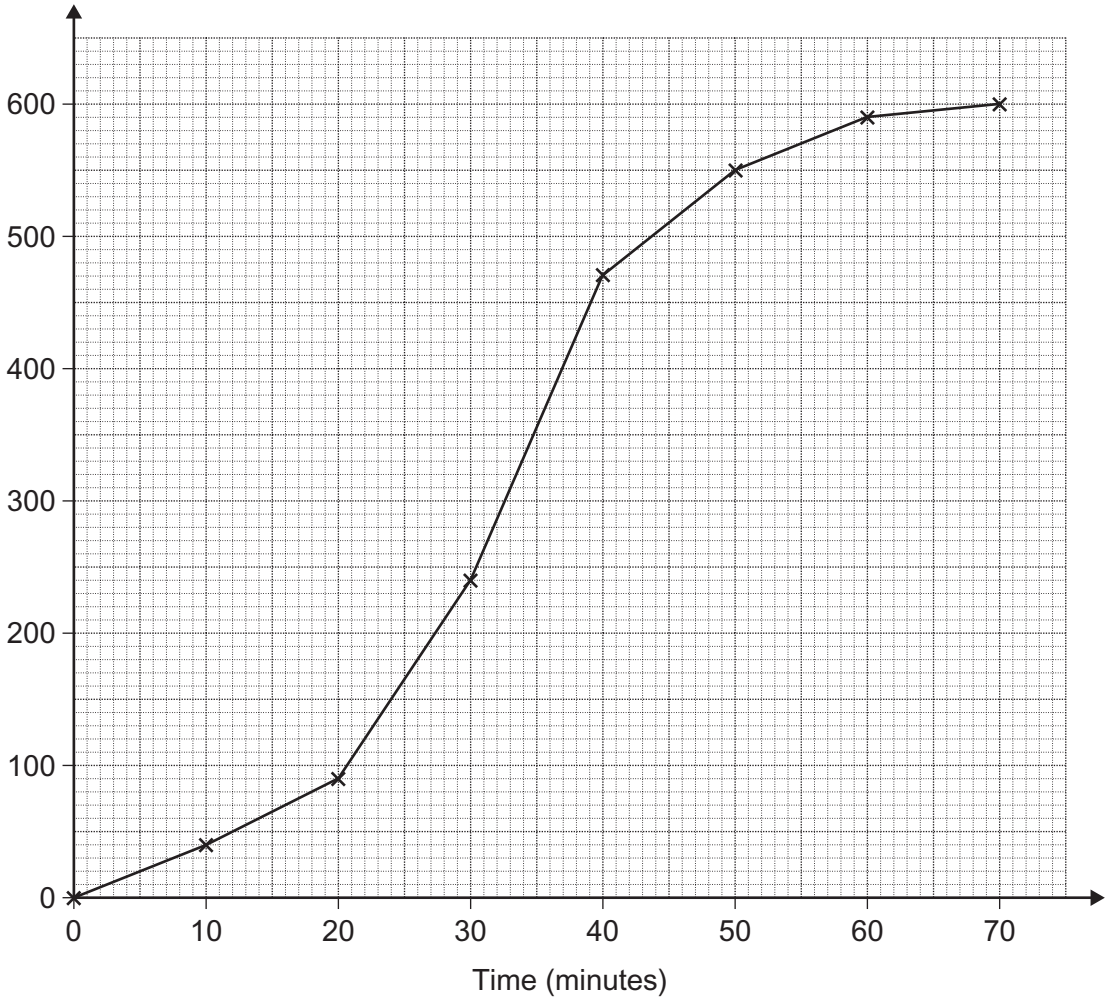
Answer x = ... y = ... *(3 marks)*

9

13 The cumulative frequency graph shows the journey times, to college, of 600 students.



13 (a) Write down the median time taken.

Answer ..... minutes *(1 mark)*

13 (b) Work out the inter-quartile range of these times.

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Answer ..... minutes *(2 marks)*

13 (c) What percentage of students took longer than 55 minutes to travel to college?

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Answer ..... % *(2 marks)*

14 (a) Simplify fully $5x^4y^2 \times 3x^3y^7$

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Answer ..... *(2 marks)*

14 (b) Solve $\frac{x}{2} + \frac{x}{3} = \frac{5}{4}$

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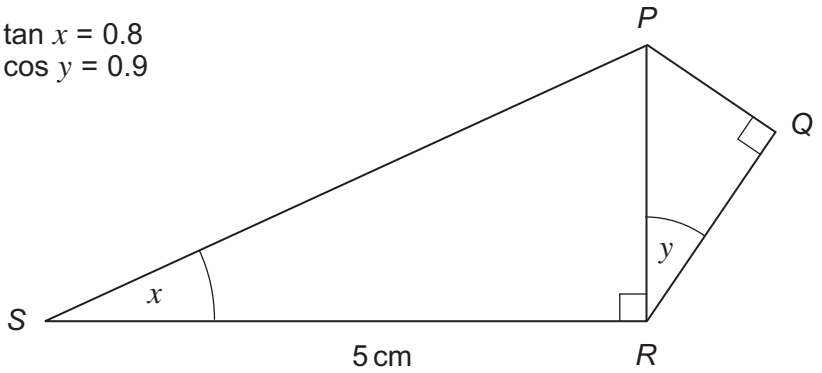
Answer x = ... *(3 marks)*

15 The diagram is made up of two right-angled triangles, *PQR* and *PRS*.
The length of *SR* is 5 cm.

tan x = 0.8
cos y = 0.9



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Work out the length of *QR*.

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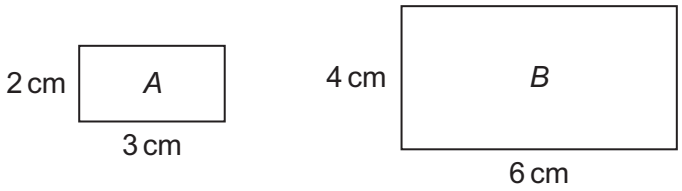
Answer ..... cm *(4 marks)*

14

Turn over ▶

16 (a) The diagram shows two similar rectangles, *A* and *B*.

Not drawn accurately



16 (a) (i) What is the scale factor of the perimeters of these rectangles?

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Answer ..... *(1 mark)*

16 (a) (ii) What is the area scale factor of these rectangles?

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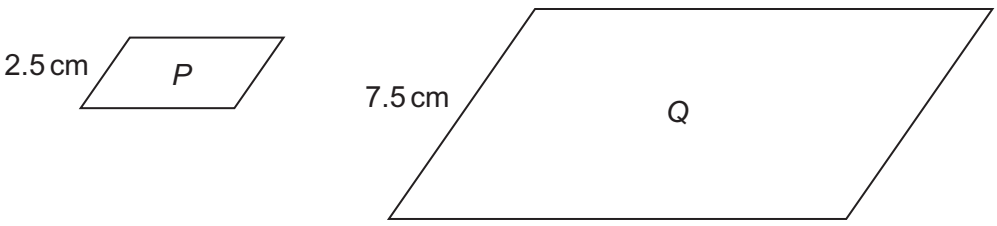
Answer ..... *(1 mark)*

16 (b) The diagram shows two similar parallelograms, *P* and *Q*.

Not drawn accurately



The lengths of the shorter sides are 2.5 cm and 7.5 cm, as shown.
The area of parallelogram *Q* is 54 cm^2.

What is the area of parallelogram *P*?

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Answer ..... cm^2 *(2 marks)*

17 (a) Show that $\frac{3}{11}$ can be written as the recurring decimal 0.2727 …

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(2 marks)

17 (b) Hence, or otherwise, express the recurring decimal 0.62727 … as a fraction.

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Answer ..... *(4 marks)*

18 Work out $\left(\frac{1}{2}\right)^{-4}$

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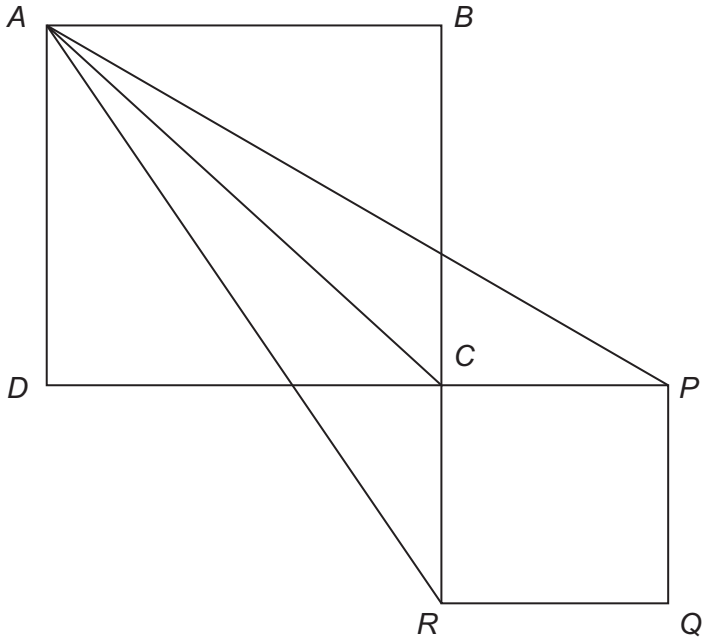
Answer ..... *(2 marks)*

12

19 In the diagram, *ABCD* and *CPQR* are squares.
BCR and *DCP* are straight lines.



Prove that triangles *ACP* and *ACR* are congruent.
You **must** show your working.
Give reasons for the statements you make.

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(4 marks)

20 Joanne is drawing graphs of the form $y = ax^2 + bx + c$ and solving equations of the form $ax^2 + bx + c = 0$

For one equation she uses the quadratic formula.
She correctly substitutes the values to get

$$x = \frac{5 \pm \sqrt{(25 - 48)}}{6}$$

20 (a) Work out the values of a, b and c.

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Answer a = ...

b = ...

c = ... *(3 marks)*

20 (b) (i) Explain why Joanne will **not** be able to find any solutions to the equation.

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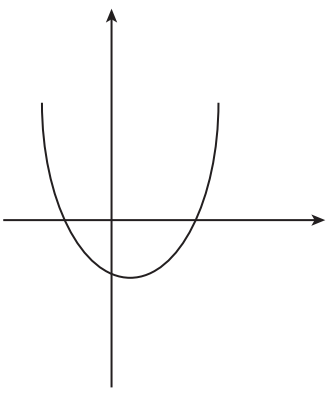
(1 mark)

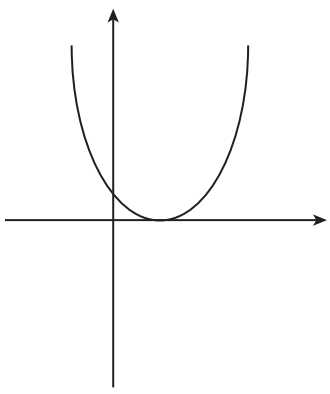
20 (b) (ii) Joanne draws a quadratic graph using the correct values of a, b and c.

Which of these graphs is the correct one?

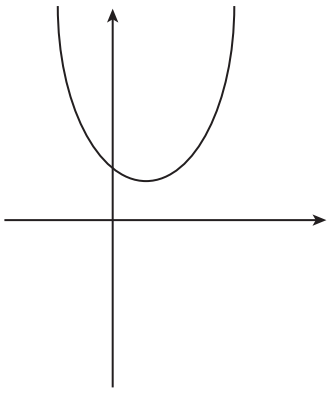
graph *P*



graph *Q*



graph *R*



Answer ..... *(1 mark)*

9

Turn over ▶

21 (a) Show clearly that $(\sqrt{2} + \sqrt{10})^2 = 12 + 4\sqrt{5}$

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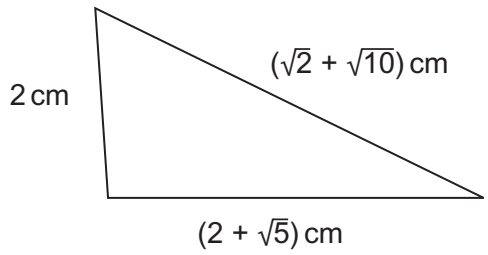
(2 marks)

21 (b) This triangle has sides of $(\sqrt{2} + \sqrt{10})$ cm, $(2 + \sqrt{5})$ cm and 2 cm.

Not drawn accurately



Is this triangle right-angled?
You **must** show your working.

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(3 marks)

22 (a) Show clearly that $(x - 3)^2$ can be written as $x^2 - 6x + 9$

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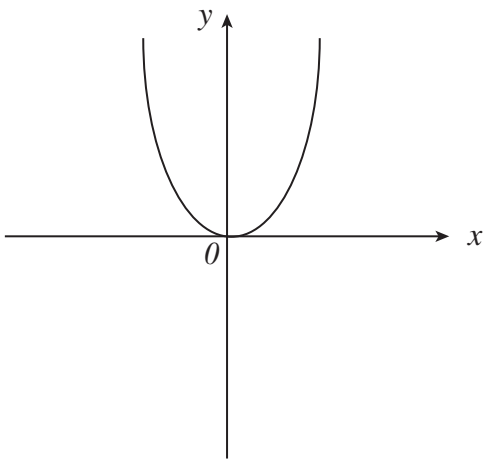
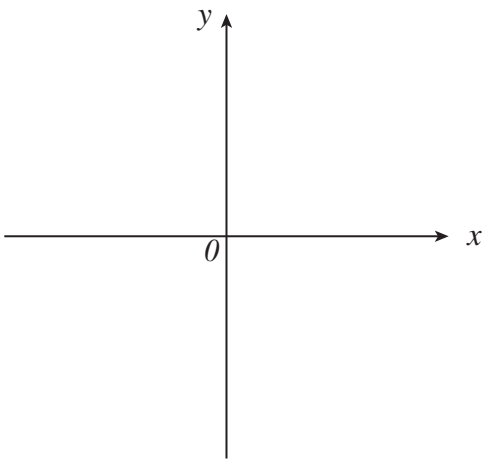
(1 mark)

22 (b) This sketch is of the graph $y = x^2$



22 (b) (i) On the axes below sketch the graph $y = (x - 3)^2$



(1 mark)

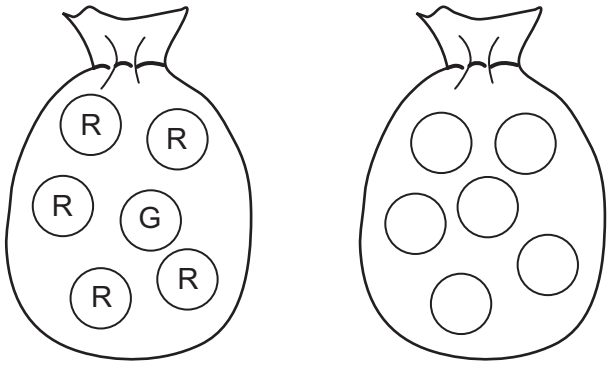
22 (b) (ii) The graph $y = x^2$ is transformed to the graph $y = x^2 - 6x + 9$ by a translation.

Use part (a) to write down the column vector of this translation.

Answer $\begin{pmatrix} \cdots\cdots \\ \cdots\cdots \end{pmatrix}$ *(1 mark)*

8

23 Bag A and Bag B contain only Red and Green counters.
Bag A has 5 Red counters and 1 Green counter.
Bag B also has 6 counters.



Bag A Bag B

John takes one counter, at random, from Bag A and puts it in Bag B.
He then takes one counter, at random, from Bag B and puts it in Bag A.

Bag A now contains only Red counters.
The probability of this happening is $\frac{2}{21}$

How many Green counters are in Bag B at the start?
You **must** show your working.

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Answer ..... *(4 marks)*

END OF QUESTIONS

4

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ANSWER IN THE SPACES PROVIDED

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