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	
22–23	
TOTAL	

General Certificate of Secondary Education
Higher Tier
November 2012

Mathematics (Linear) 43651H

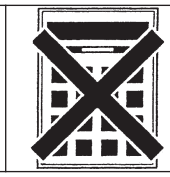
Paper 1

Thursday 8 November 2012 1.30 pm to 3.00 pm

H

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.



Time allowed
- 1 hour 30 minutes

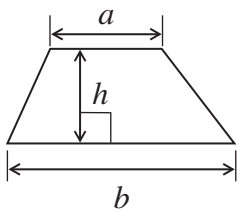
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- The quality of your written communication is specifically assessed in Questions 8 and 11. These questions are indicated with an asterisk (*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

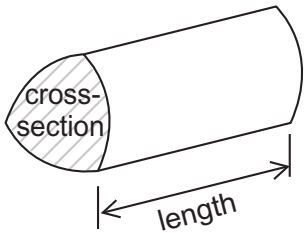
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

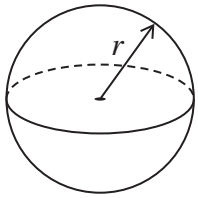


Volume of prism = area of cross-section × length



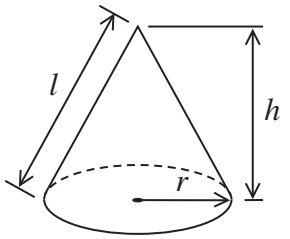
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

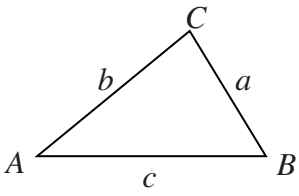
Curved surface area of cone = $\pi r l$



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

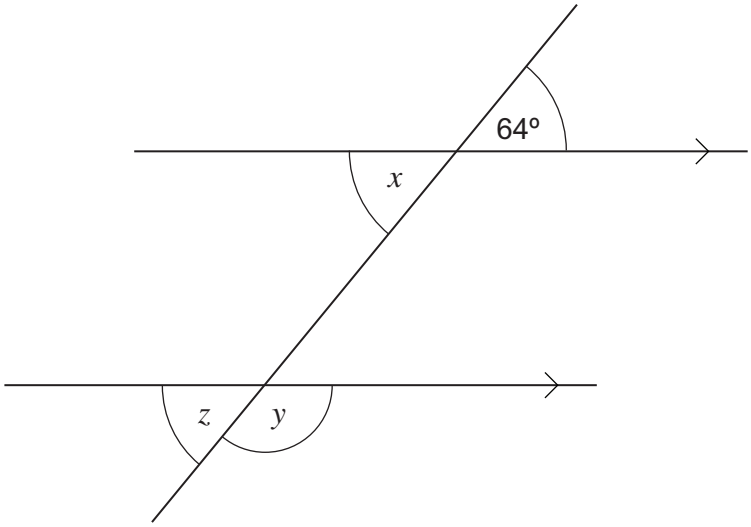
The Quadratic Equation

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



Not drawn accurately

1 (a) Write down the size of angle x.

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

1 (b) Work out the size of angle y.

.....

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

1 (c) Choose the correct word from the list to complete the sentence.

opposite **alternate** **corresponding** **interior**

Angle x and angle z are ..... angles.

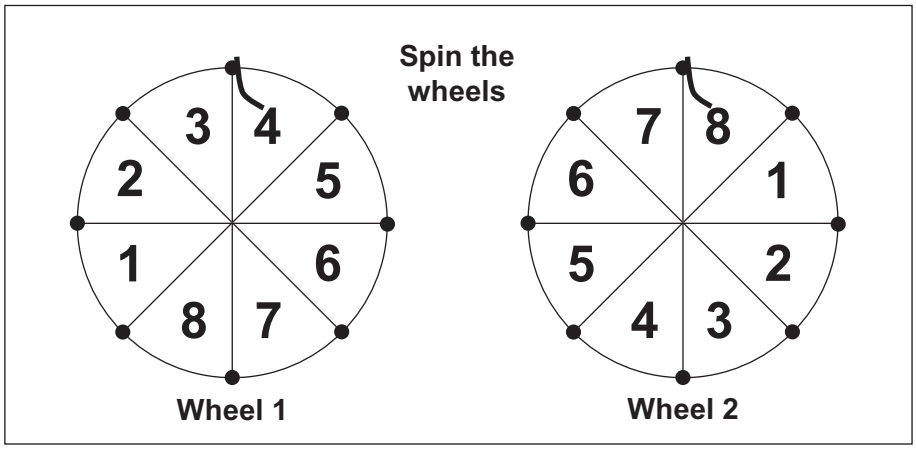
(1 mark)

3

Turn over ▶

2 In a game, players spin two wheels.
The wheels are fair.

The numbers are added to get a score.
The wheels show a score of 4 + 8 = 12



You may use the grid below to help you answer the questions on the next page.

Wheel 2

Wheel 1 +	1	2	3	4	5	6	7	8
1								
2								
3								
4								12
5								
6								
7								
8								

2 (a) What is the most likely score?

.....

.....

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

2 (b)

Score
2, 3, 15 or 16
to win a prize

Work out the probability of winning a prize.

.....

.....

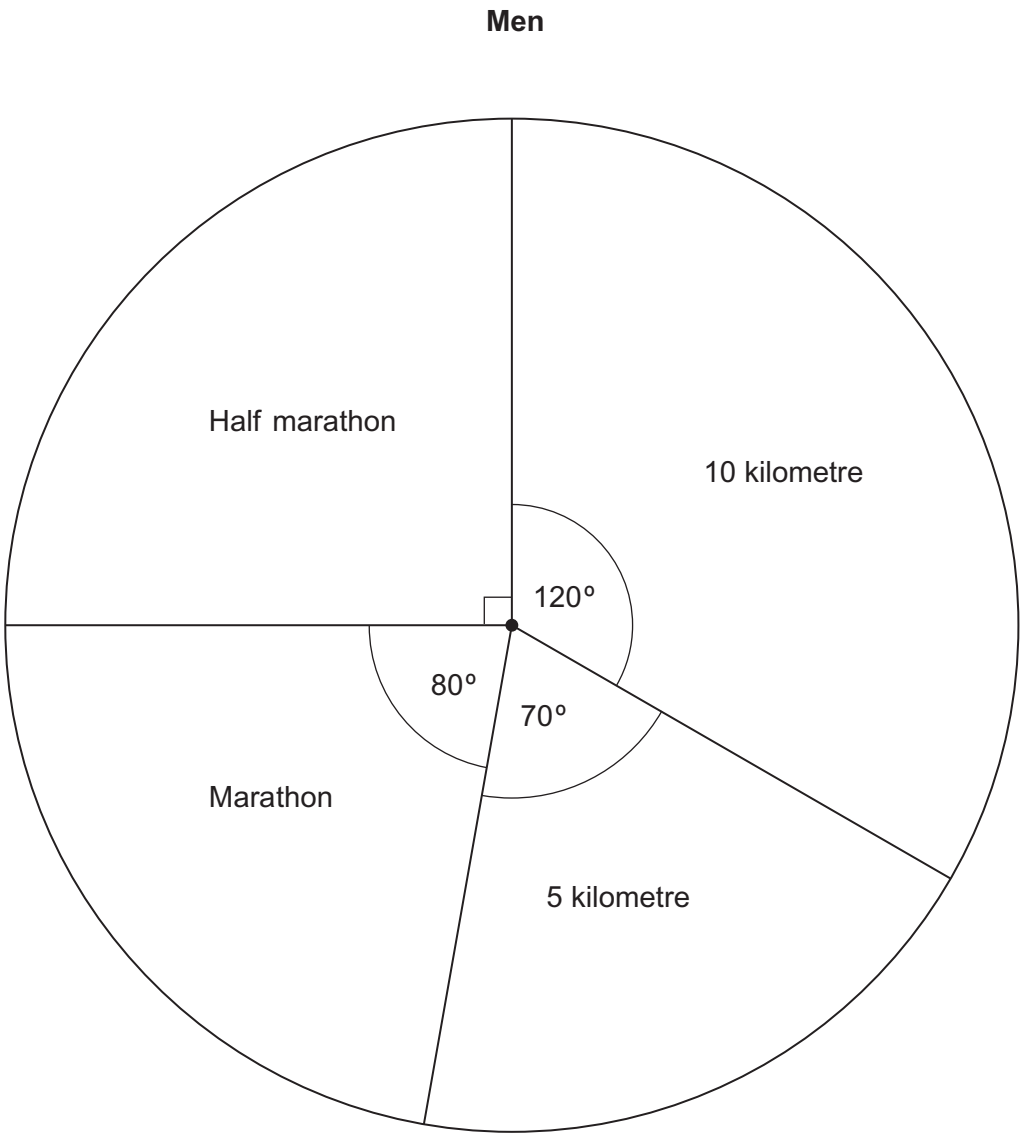
Answer ..... *(3 marks)*

Turn over for the next question

5

3 There are 36 men in a running club.

The pie chart shows information about their favourite races.



There are 20 women in the running club.

Here is information about their favourite races.

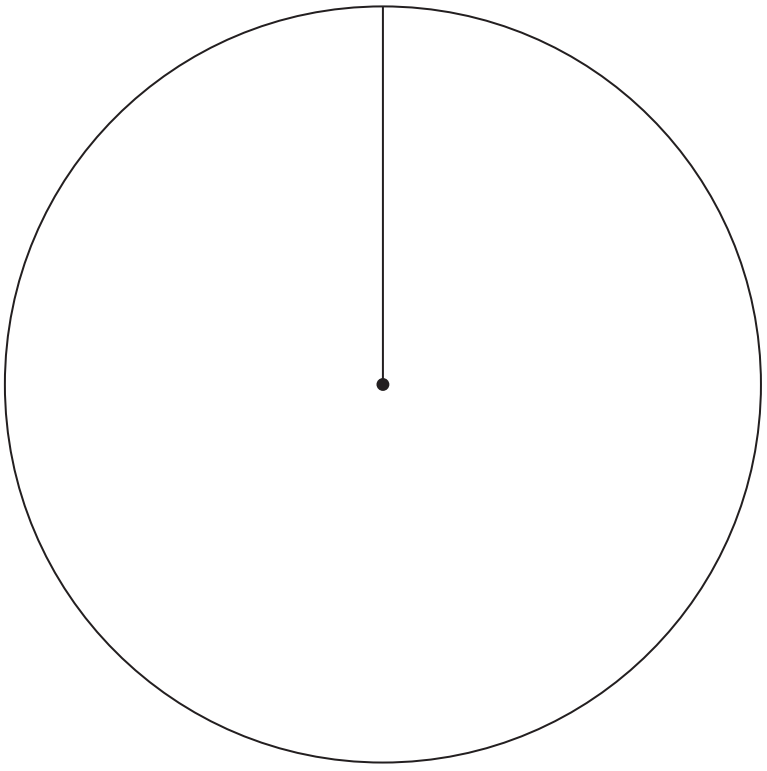
The same **proportion** of women prefer the half marathon as men.

The same **number** of women prefer 5 km races as men.

Equal numbers of women prefer 10 km races and the marathon.

Use this information to draw a fully labelled pie chart to show the favourite races of the women.

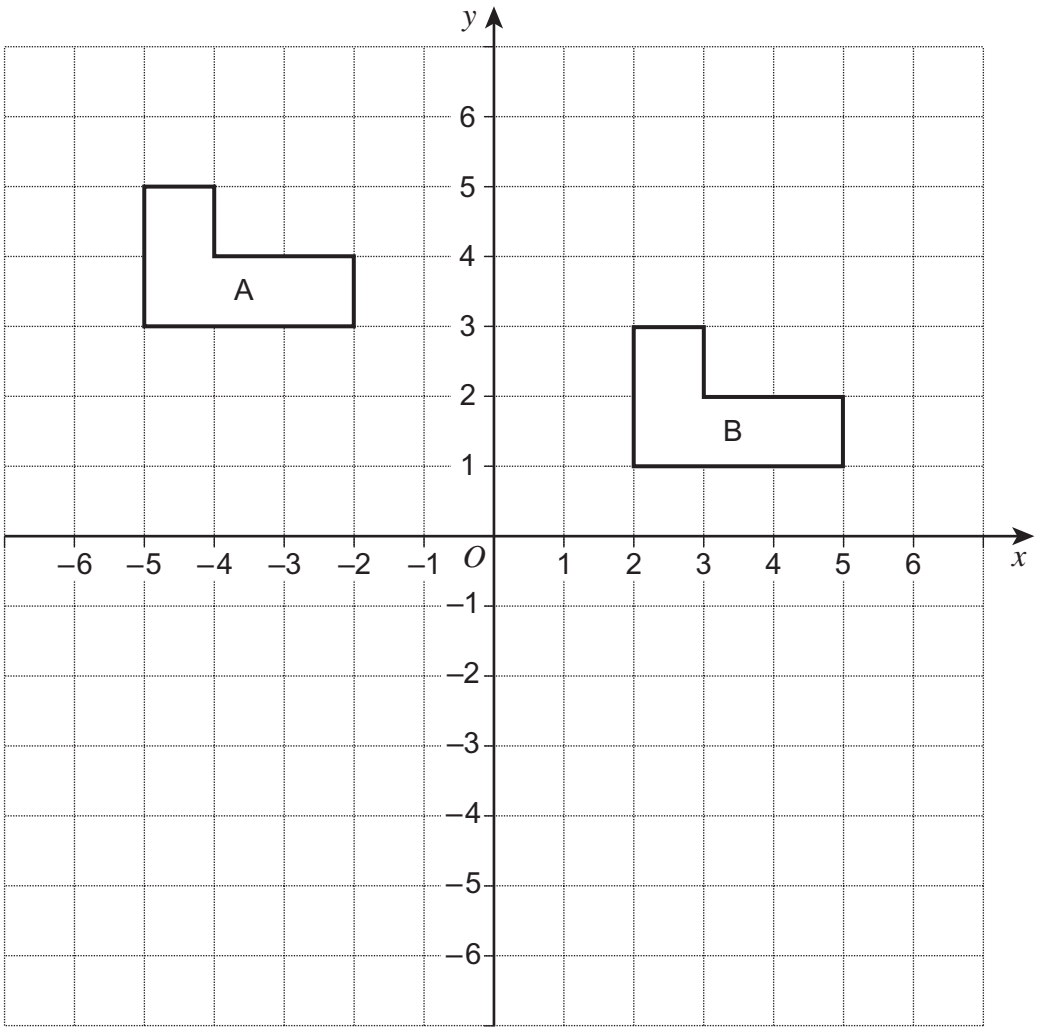
Women



(4 marks)

4

4



4 (a) Describe fully the **single** transformation that maps shape A to shape B.

.....

.....

(2 marks)

4 (b) Draw the reflection of shape B in the line $y = -1$

(2 marks)

5 Solve $9x - 3 = 4x + 17$

.....

.....

.....

.....

x = ... *(3 marks)*

6 (a) Factorise $7x - 21$

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

6 (b) Multiply out $4(y + 9)$

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

7 Expand and simplify $5(x - 3) - 2(x - 1)$

.....

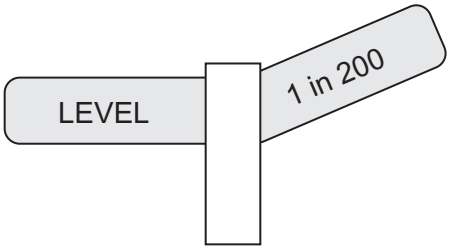
.....

.....

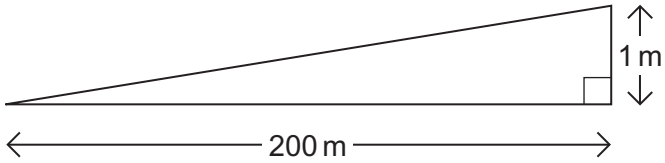
Answer ..... *(3 marks)*

12

8 The steepness of a railway track is shown by signs like this.

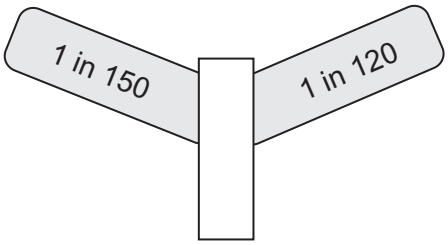


On the left of the sign the track is level.
On the right of the sign the track rises 1 metre for every 200 metres travelled horizontally.



Not drawn accurately

***8 (a)**



Which side of this sign shows the steeper track?
Show clearly how you decide.

You may use a diagram to explain your answer.

.....

.....

.....

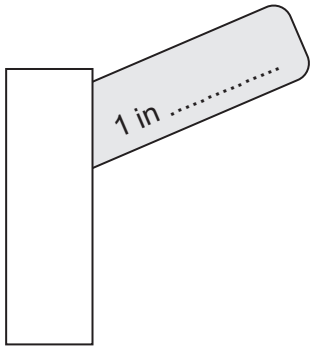
(2 marks)

8 (b) The steepness can also be measured as a percentage.

For example 1 in 200 would be $\frac{1}{200} \times 100 = 0.5\%$

The steepest railway line in Britain has a percentage of 2.5%.

Fill in this sign to show a steepness of 2.5%.

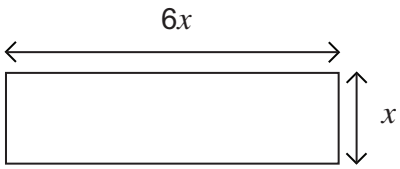


(2 marks)

Turn over for the next question

4

9 The length of this rectangular tile is 6 times the width.



Not drawn accurately

Two tiles are put together to make this shape.

Not drawn accurately

The perimeter of the new shape is 24 cm.

Work out the width of **one** tile.

.....

.....

.....

.....

.....

.....

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

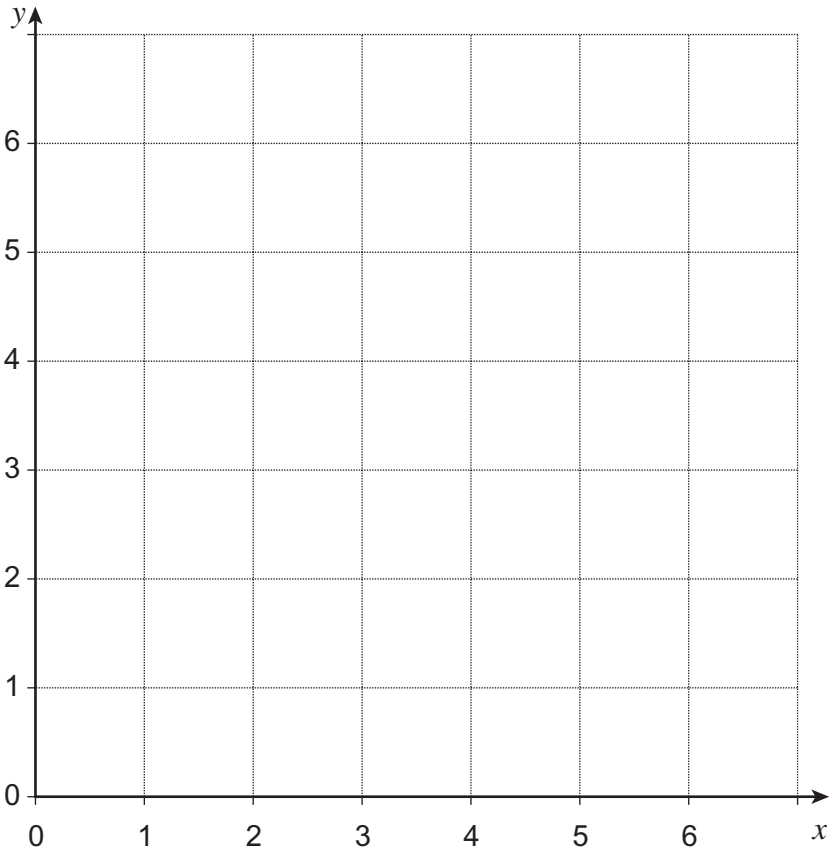
10 On the grid draw lines to show the region satisfied by the three inequalities.

$$x \leqslant 4$$

$$y \leqslant x$$

$$x + y \geqslant 4$$

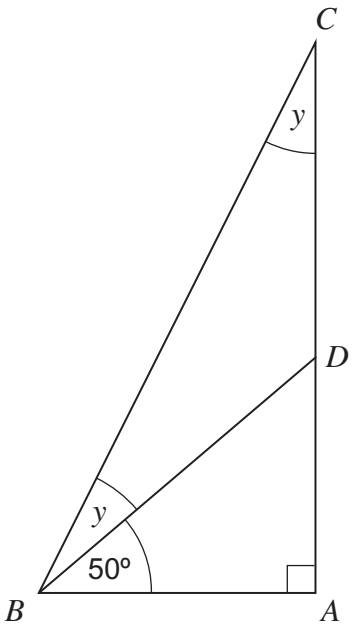
Label the region clearly with the letter R.



(3 marks)

6

11 (a) ABC is a right-angled triangle.



Not drawn accurately

Work out the size of angle y.

.....

.....

.....

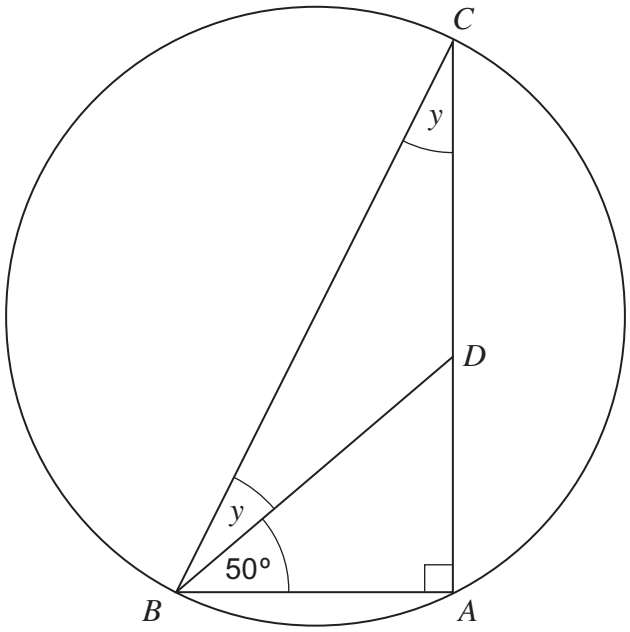
.....

.....

.....

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

***11 (b)** A circle is drawn around ABC.



Not drawn accurately

Give a reason why BC is a diameter of the circle.

.....

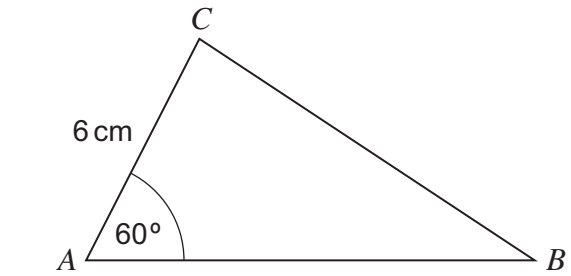
.....

(1 mark)

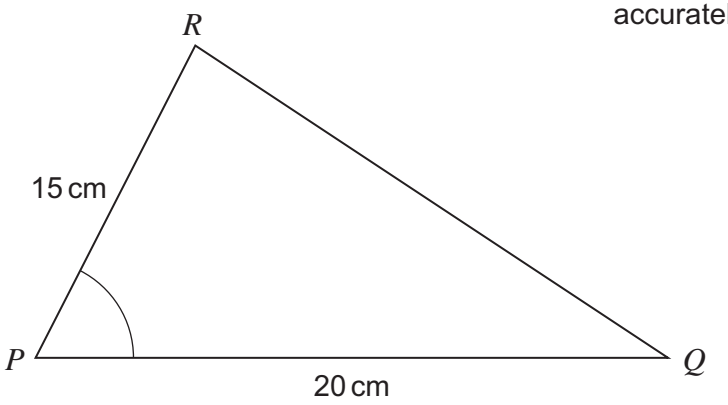
Turn over for the next question

4

12 PQR is an enlargement of ABC.



Not drawn accurately



12 (a) Work out the scale factor of the enlargement.

.....

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

12 (b) Write down the size of angle P.

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

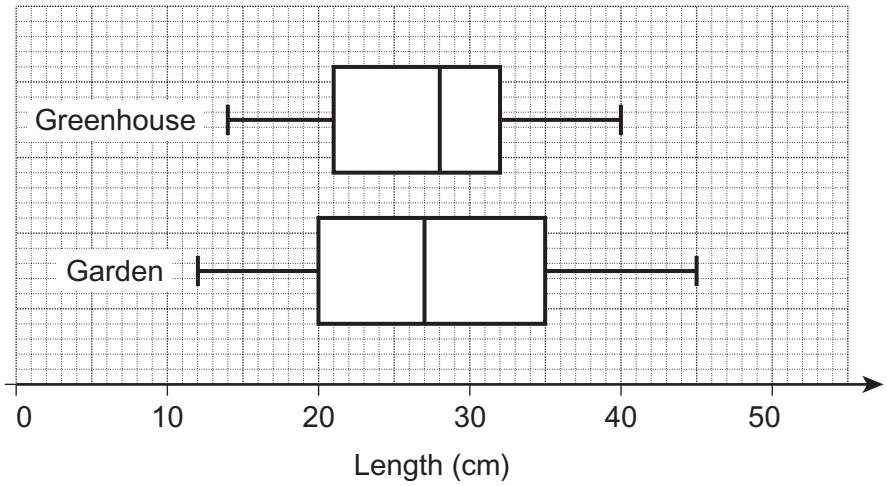
12 (c) Work out the length AB.

.....

.....

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

13 Cucumbers are grown in a greenhouse or in a garden.
The box plots show data about their lengths, in centimetres.



13 (a) Write down the median length of the cucumbers grown in the garden.

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

13 (b) Give **two** comparisons between the lengths of cucumbers grown in the greenhouse and cucumbers grown in the garden.

Comparison 1 .....

.....

.....

Comparison 2 .....

.....

.....

(3 marks)

8

Turn over ▶

14 (a) Factorise $x^2 - 9$

.....

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

14 (b) Hence, simplify fully $\dfrac{x^2 - 9}{2x^2 - 5x - 3}$

.....

.....

.....

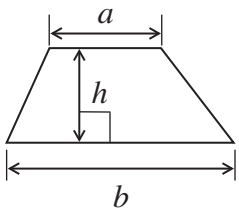
.....

.....

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

15 The area of a trapezium is given by the formula

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



15 (a) For a trapezium, a = 5 cm, b = 8 cm and h = 6 cm

All measurements are given to the nearest centimetre.

Work out the minimum possible area.

.....

.....

.....

.....

Answer ..... cm^2 *(3 marks)*

15 (b) Rearrange $A = \frac{1}{2}(a + b)h$ to make h the subject.

.....

.....

.....

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

9

16 The manager of a company wants to survey his employees.

He decides to sample 20% of them, stratified by the type of job they do.

This table shows the number of employees.

Office staff	Drivers	Mechanics	**Total**
12	24	4	40

Fill in the table below to show how many of each group he should survey.

Office staff	Drivers	Mechanics

(3 marks)

17 Write $\sqrt{12} + \sqrt{75}$ in the form $a\sqrt{3}$ where a is an integer.

.....

.....

.....

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

18 Write these numbers in order of size starting with the smallest.

You **must** show your working.

$27^{\frac{2}{3}}$ $64^{\frac{1}{3}}$ $4^{\frac{3}{2}}$

.....

.....

.....

.....

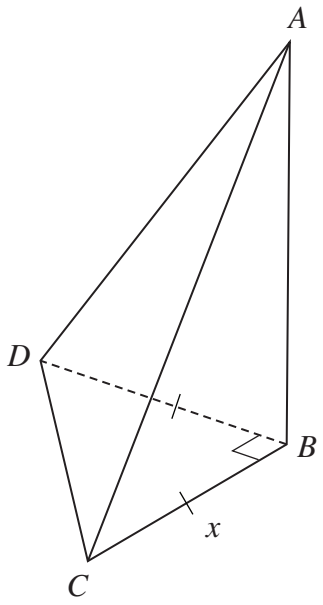
Answer ..... , ... , ... *(3 marks)*

8

19 $ABCD$ is a triangular based pyramid.
The base BCD is a right-angled triangle.

A is directly above B.
$BC = BD$
$AB = 2 \times BC$
The volume of the pyramid is $72\,\text{cm}^3$.

The formula for the volume of a pyramid is $\frac{1}{3} \times \text{base area} \times \text{height}$.



Calculate the length of BC, labelled x in the diagram.

.....

.....

.....

.....

.....

.....

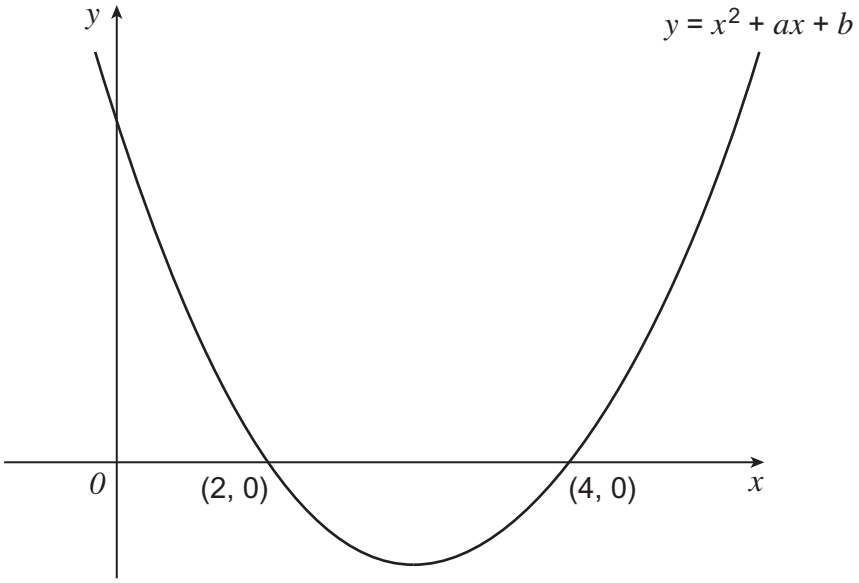
.....

.....

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

20 The diagram shows a sketch of the graph of $y = x^2 + ax + b$

The graph crosses the x-axis at (2, 0) and (4, 0).



Work out the value of b.
You **must** show your working.

.....

.....

.....

.....

.....

.....

b = ... *(4 marks)*

END OF QUESTIONS

7

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED