Version 1.0

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
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12 – 13	
14 – 15	
16 – 17	
18	
TOTAL	

General Certificate of Secondary Education
Higher Tier

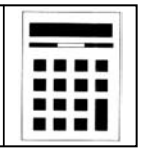
Mathematics 43603H

Unit 3 Higher Tier

Specimen Paper 2012 Specification

H

For this paper you must have:
- a calculator
- mathematical instruments.



Time allowed
- 1 hour 30 minutes

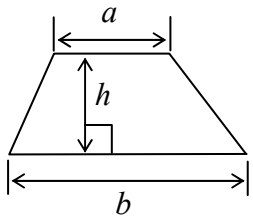
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- The quality of your written communication is specifically assessed in questions 10 and 16.
  These questions are indicated with an asterisk (*).
- You may ask for more answer paper, graph paper and tracing paper.
  These must be tagged securely to this answer booklet.

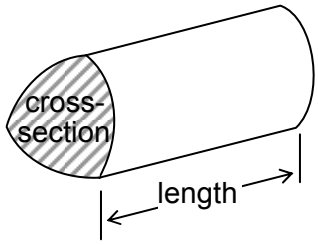
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

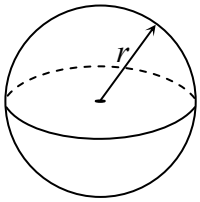


Volume of prism = area of cross-section × length



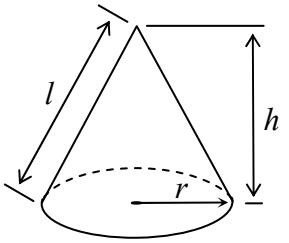
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

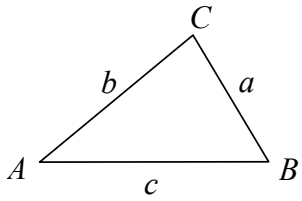


In any triangle ABC

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



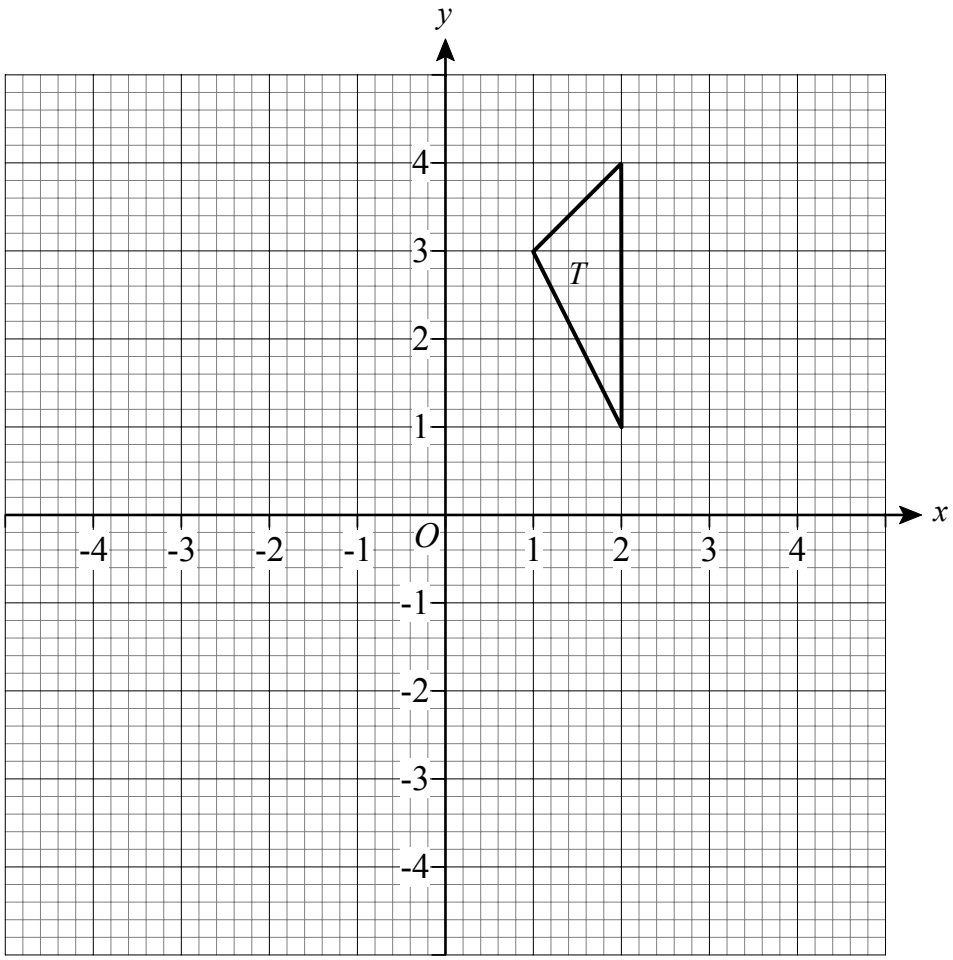
The Quadratic Equation

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 Triangle T is drawn on the grid.



1 (a) Draw the image of T after a rotation of 90° anticlockwise about O.

(3 marks)

1 (b) The triangle T is reflected to form a new triangle S.
The coordinates of S are (–4, 4), (–3, 3), and (–4, 1).

Work out the equation of the mirror line.

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

5

2 The speed limit through some roadworks is 50 mph.

Cameras recorded the time taken for a car to travel 600 m through the roadworks as 27 seconds.

10 mph is approximately 4.47 m/s

Was the car speeding through the roadworks?

You **must** show your working.

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(4 marks)

3 Is the statement below always true, sometimes true or never true?

Tick the correct box.

The circumference of a circle of diameter 10 cm is greater than the perimeter of triangle with a base 10 cm.

☐ Always true ☐ Sometimes true ☐ Never true

Explain your answer

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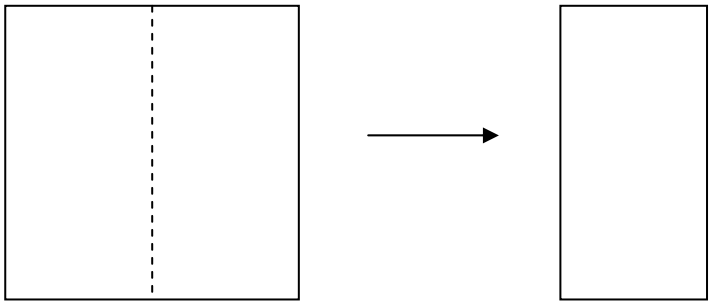
(2 marks)

Do not write outside the box

4 You have a square piece of paper which is folded in half to form a rectangle as shown.



The perimeter of the rectangle is 39 centimetres.

What is the area of the square you started with?

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Answer ..... cm^2 *(4 marks)*

5 At a wedding reception there are 103 people at 12 tables.
There are eight or nine people at each table.

How many tables are there with eight people?

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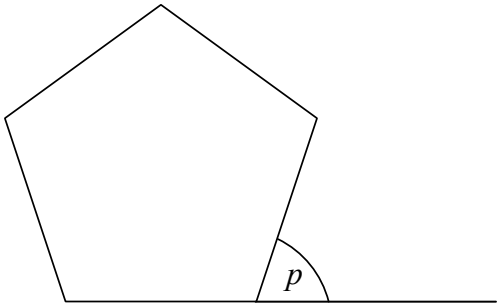
Answer ..... *(4 marks)*

14

6 (a) Explain why the exterior angle of a regular pentagon, marked p on the diagram, is 72°.



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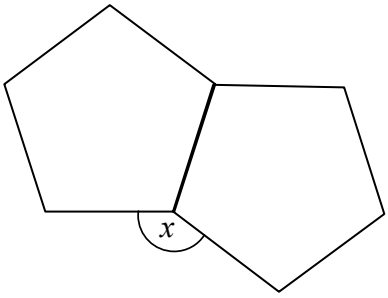
(1 mark)

6 (b) Two identical regular pentagons are joined as shown.



Not drawn accurately

Work out the size of angle x.

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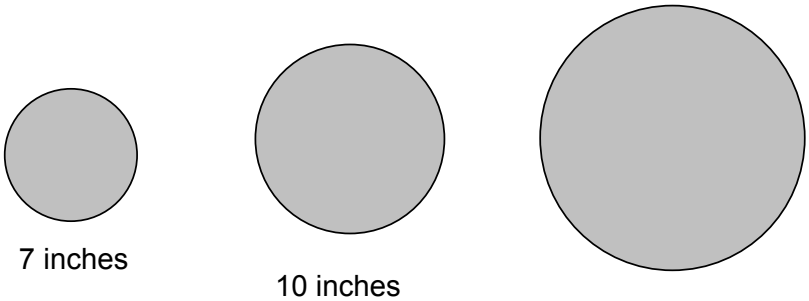
Answer ..... degrees *(2 marks)*

Do not write outside the box

7 A restaurant serves garlic bread.

All the garlic breads are circular and the same thickness.
They can be made with different diameters as shown.



7 inches

10 inches

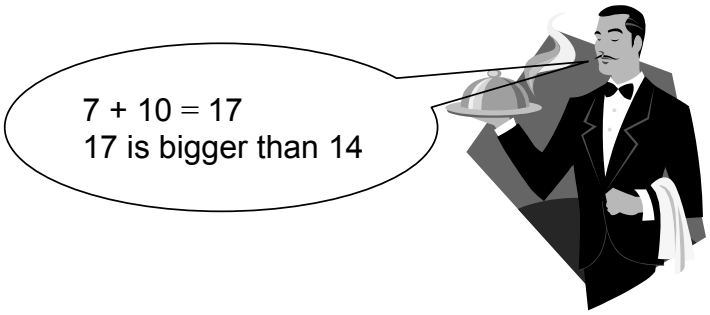
14 inches

Robert is going to order a 14-inch garlic bread.

The restaurant has a special offer.

Special Offer

Get one 7-inch garlic bread **and** one 10-inch garlic bread for the same price as a 14-inch garlic bread.



Robert says that if he has the special offer he will get less garlic bread.

Is Robert correct?

You **must** show your working.

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(4 marks)

7

Turn over ▶

8 (a) Factorise $x^2 + 10x$

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

8 (b) Factorise $y^2 - 36$

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

8 (c) Solve the equation $5w + 6 = 9 - w$

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

8 (d) Solve the equation $\frac{2x+3}{4} + \frac{x-5}{3} = \frac{3}{2}$

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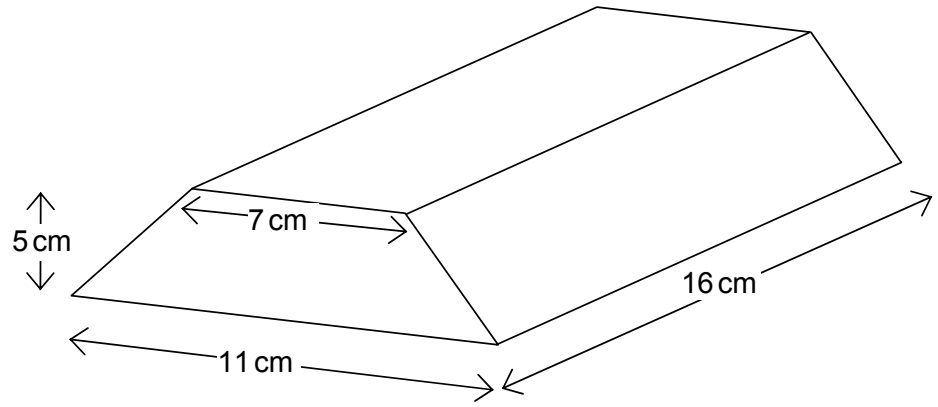
Answer $x =$ ..... *(4 marks)*

9 A gold bar has a trapezium cross-sectional area.

The dimensions are shown in the diagram.

Not drawn accurately



9 (a) Calculate the cross-sectional area of the gold bar.

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

9 (b) Gold has a density of 19.3 grams per cm^3.

Work out the mass of the gold bar.

Give your answer in kilograms.

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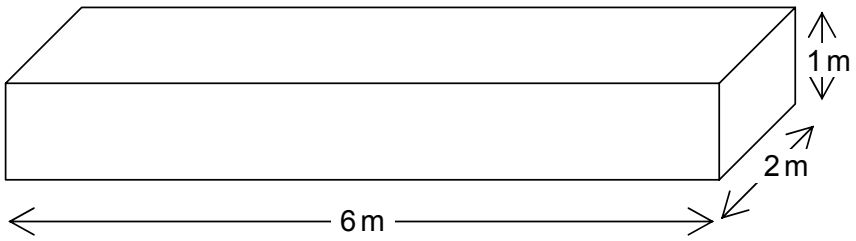
Answer ..... kg *(4 marks)*

15

✶**10** The shape of a flower bed is a cuboid as shown.

Not drawn accurately



$1\,m^3$ of soil weighs 1.25 tonnes

A gardener wants to fill the flower bed with soil as cheaply as possible.

The table shows the costs for Company A and Company B.

Company A	£49.50 per tonne	Delivery £30
Company B	10 tonnes for £430 then £67.50 per extra tonne	Delivery free

Which company should she use and how much will it cost?

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Answer Company .....

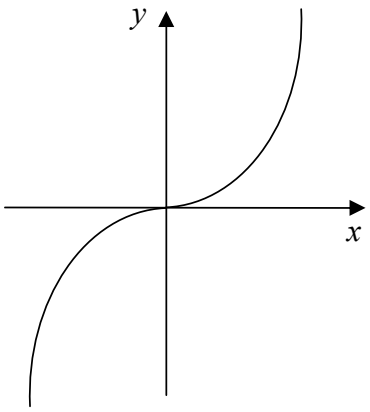
£ ..... *(6 marks)*

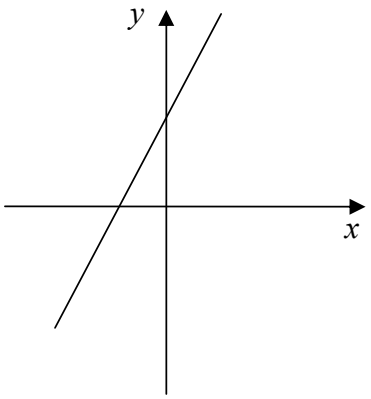
11 Here are four equations of graphs.

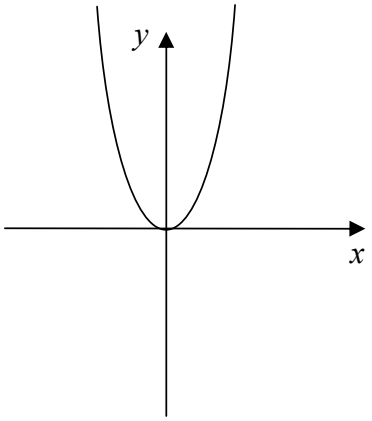
A $y = 3x + 2$ B $2x + 3y = 6$ C $y = 3x^2$ D $y = x^3$

11 (a) Here are three sketch graphs.

Match each graph to its equation.



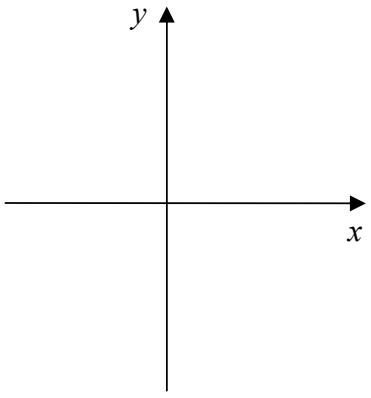




Equation ..... Equation ..... Equation .....

(3 marks)

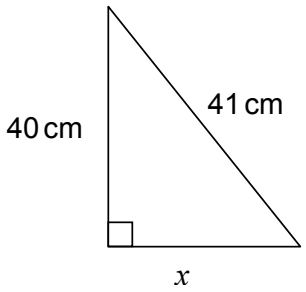
11 (b) On the axes below, sketch the graph of the other equation.



(1 mark)

10

12 (a) The right-angled triangle has sides shown.



Not drawn accurately

Show that $x = 9$ cm

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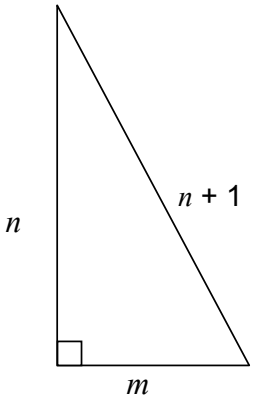
(2 marks)

12 (b) This right-angled triangle has sides n, m and $n + 1$.

m are n are integers.



Prove that m must be an odd number.

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(5 marks)

13 Katy is using the quadratic formula to solve a quadratic equation.

After correctly substituting the values, she writes

$$x = \frac{7 \pm \sqrt{49 - 72}}{4}$$

13 (a) What is the quadratic equation Katy is trying to solve?

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

13 (b) Explain why Katy will **not** be able to find any solutions to the equation.

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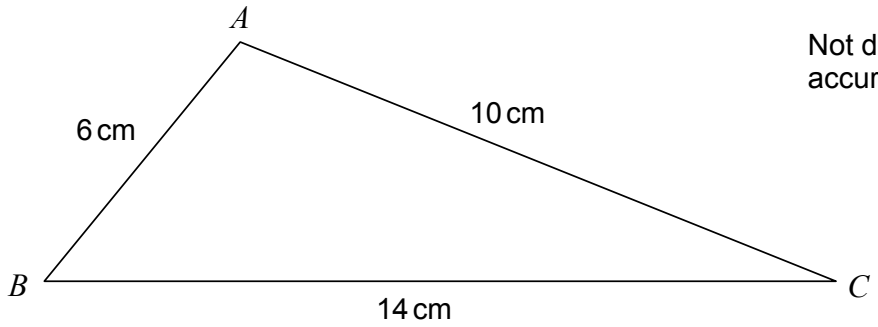
(1 mark)

11

14 Triangle ABC has AB = 6 cm, AC = 10 cm, BC = 14 cm



Calculate the largest angle in the triangle.

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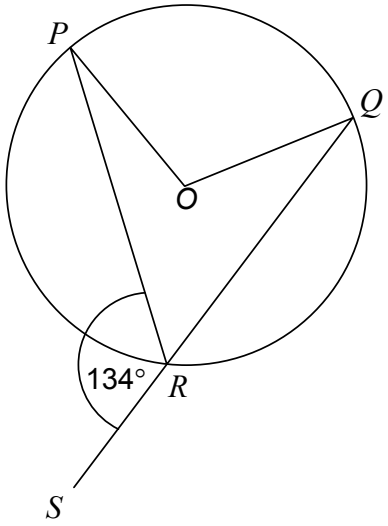
Answer ..... degrees *(3 marks)*

15 O is the centre of the circle.

Angle $PRS = 134°$

Not drawn accurately



Work out the size of the reflex angle *POQ*.

You **must** show your working.

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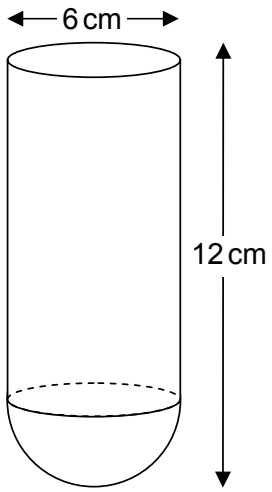
Answer ..... degrees *(3 marks)*

Turn over for the next question

6

✳**16 (a)** A test tube is formed from a cylinder and a hemisphere as shown.



Work out the total volume of the test tube.

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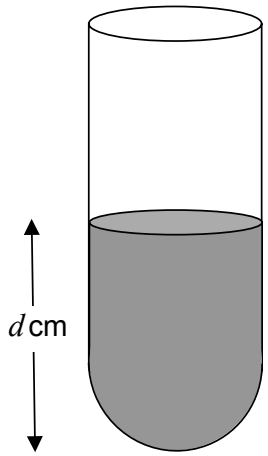
Answer ..... cm^3 *(4 marks)*

✶**16 (b)** The test tube is filled with water to a depth of d cm, as shown in the next diagram.



The water occupies exactly half the full capacity of the test tube.

Work out the value of d.

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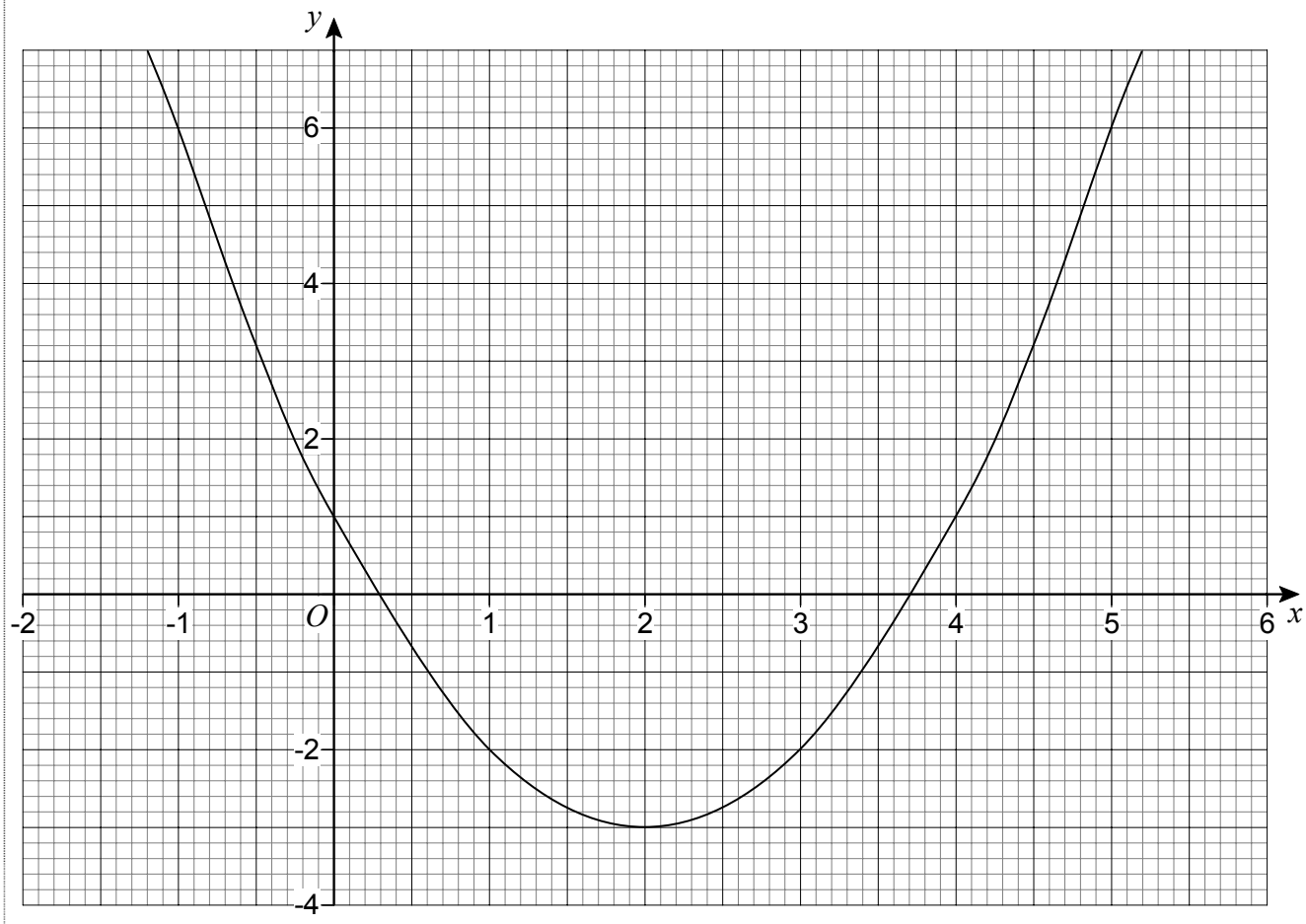
Answer ..... cm *(4 marks)*

Turn over for the next question

8

17 This is the graph of $y = x^2 - 4x + 1$



By drawing an appropriate linear graph, solve the equation $x^2 - 5x + 3 = 0$

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

END OF QUESTIONS

4

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