

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
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TOTAL	



General Certificate of Secondary Education
Higher Tier
June 2013

Mathematics (Linear)

43651H

Paper 1

Tuesday 11 June 2013 9.00 am to 10.30 am

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 14 and 16. 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.



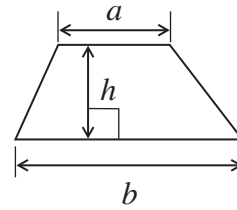
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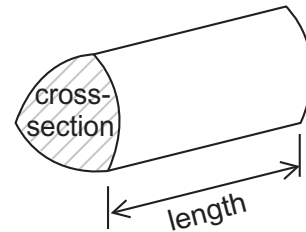
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Formulae Sheet: Higher Tier

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

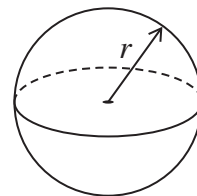


Volume of prism = area of cross-section $\times$ length



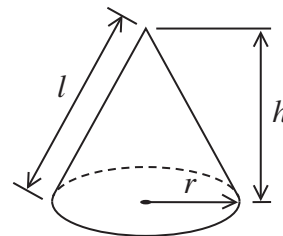
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

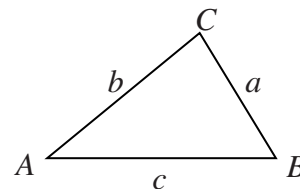


In any triangle ABC

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

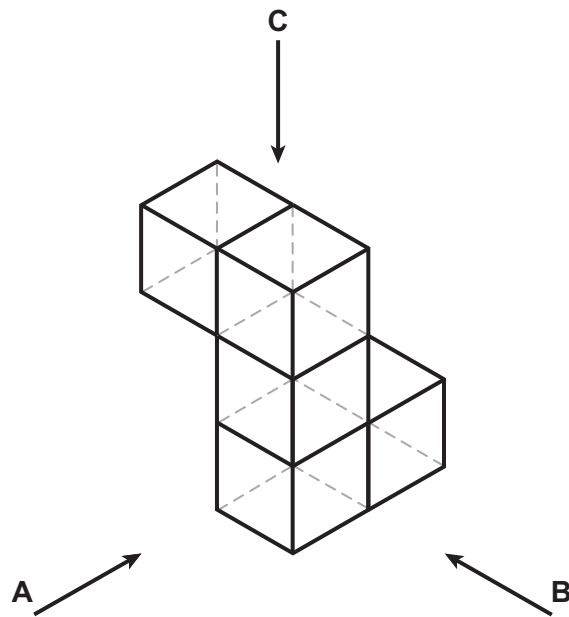
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



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

- 1** This shape is made from **five** cubes.



Draw what the shape looks like when seen from A, B and C.

From A

From B

From C

(3 marks)

3

Turn over ►



- 2 Work out an approximate value of $\frac{41 \times 198}{77}$

.....

.....

.....

Answer (2 marks)

- 3 Which of the following expressions will give the median value when $n = 10$?

$$\frac{1}{n}$$

$$n - 1$$

$$n + 1$$

$$n^2$$

$$\sqrt{n}$$

You **must** show your working.

.....

.....

.....

Answer (3 marks)



- 4** p is an even number.
 q is an odd number.

Tick the correct box for each part.

- 4 (a)** Is pq an odd number, an even number or could it be either?

☐

odd

☐

even

☐

could be either

(1 mark)

- 4 (b)** Is $3(p + q)$ an odd number, an even number or could it be either?

☐

odd

☐

even

☐

could be either

(1 mark)

- 4 (c)** Is $p \div q$ an integer, not an integer or could it be either?

☐

integer

☐

not an integer

☐

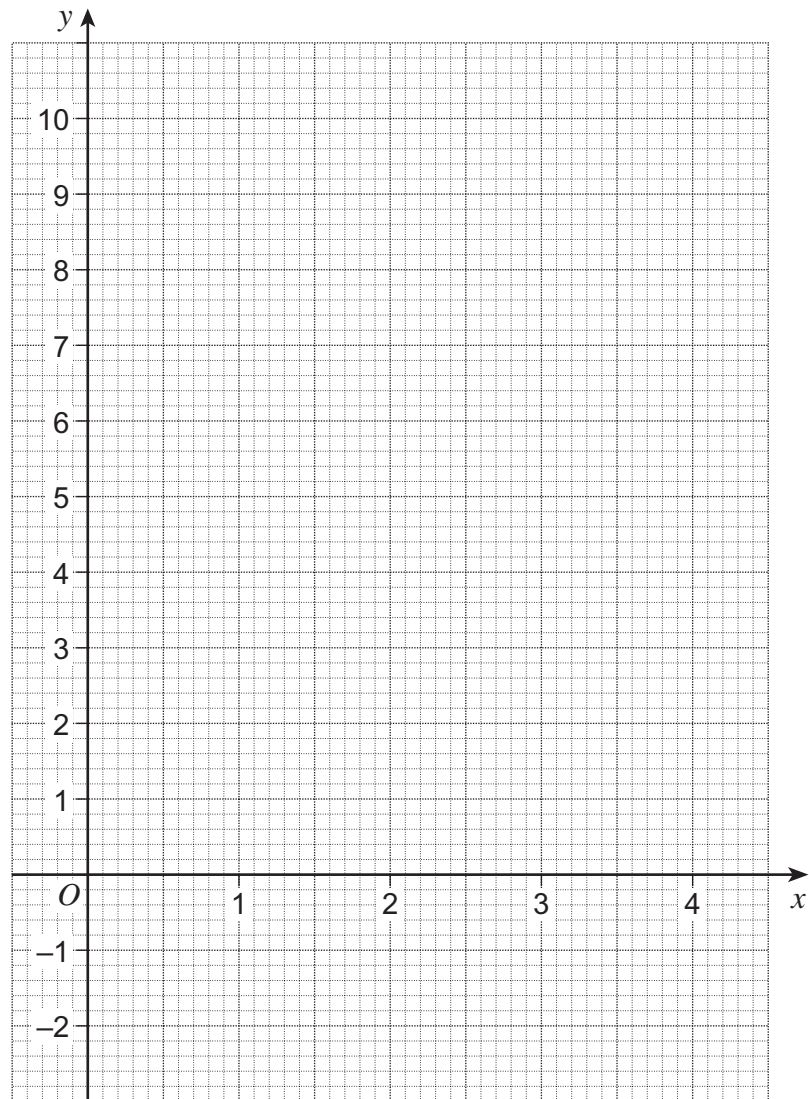
could be either

(1 mark)

Turn over for the next question



5 (a) Draw the graph of $y = 2x - 1$ for values of x from 0 to 4.



(3 marks)

5 (b) Solve $2x - 1 = 2$

.....

.....

$x =$ (1 mark)

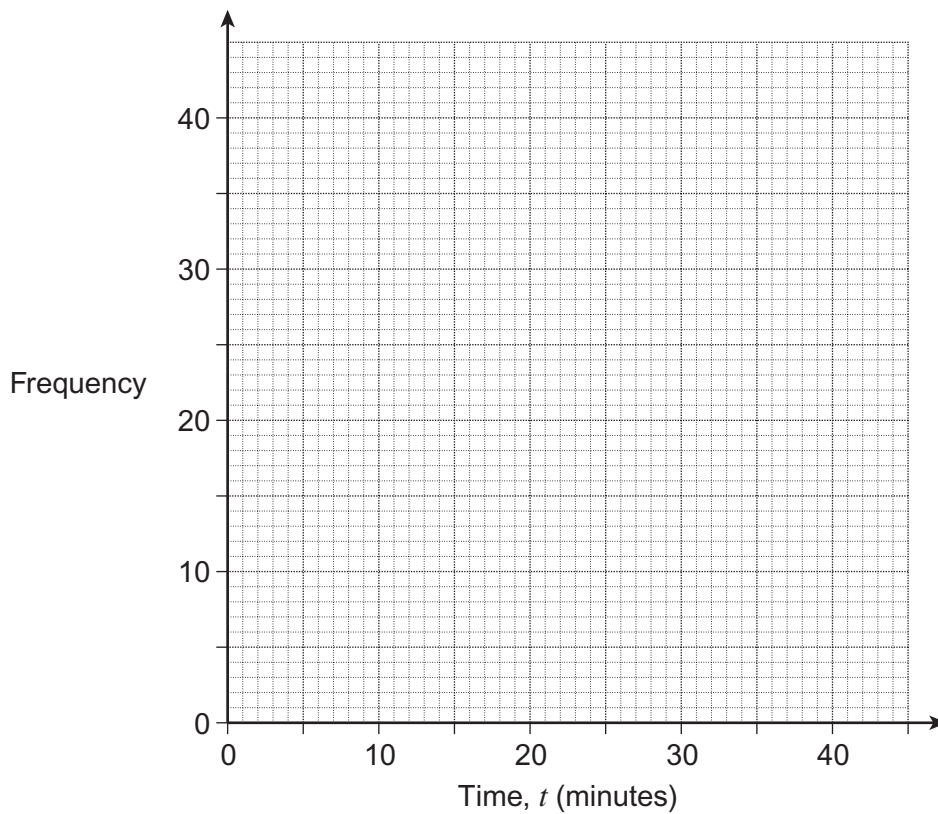
Turn over for the next question



- 6** The times taken by 100 students to travel to school are shown.

Time, t (minutes)	Frequency
$0 < t \leq 10$	36
$10 < t \leq 20$	34
$20 < t \leq 30$	18
$30 < t \leq 40$	12

- 6 (a)** Draw a frequency diagram for the data.



(2 marks)

- 6 (b)** The school has 600 students.

Estimate how many students take more than 20 minutes to travel to school.

.....

Answer

(2 marks)



- 7 The total number of people living in a street is 30.
The table shows the number of people living in each house.

Number of people living in each house	Number of houses
2	4
3	3
4	a
5	1

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

.....

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.....

$a =$ (3 marks)



8 (a) Factorise $3x - 15$

Answer (1 mark)

8 (b) Multiply out $5(y + 4t - 2)$

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Answer (2 marks)

8 (c) Solve $3(w + 2) = 2w - 1$

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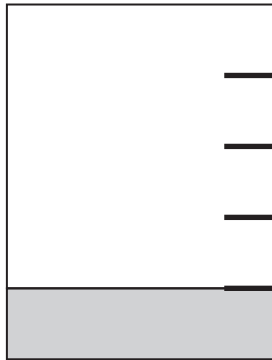
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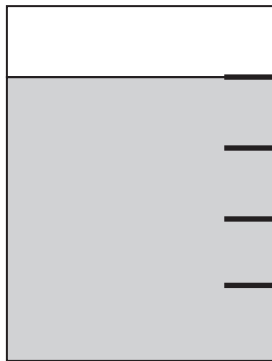
$w =$ (3 marks)



- 9 When a jug is $\frac{1}{5}$ full of water it weighs 250 grams.



When the same jug is $\frac{4}{5}$ full of water it weighs 550 grams.



How much does the jug weigh when it is empty?

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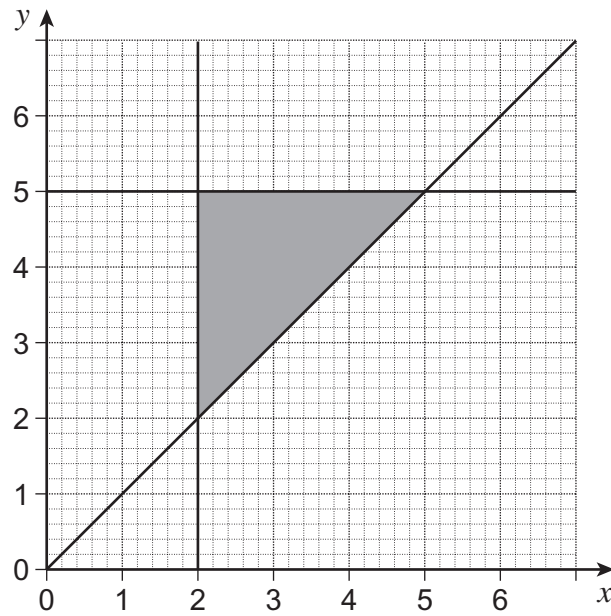
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Answer grams (4 marks)



10

Work out the three inequalities that describe the shaded region.



Answer

.....

.....

(3 marks)



11

A triangle, square and pentagon have a **total** area of 48 cm^2 .
The areas of the shapes are in the ratio of their number of sides.

Work out the area of the **pentagon**.

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Answer cm^2 (3 marks)

12

Rearrange $2(a + c) = 5(a - b)$ to make c the subject.

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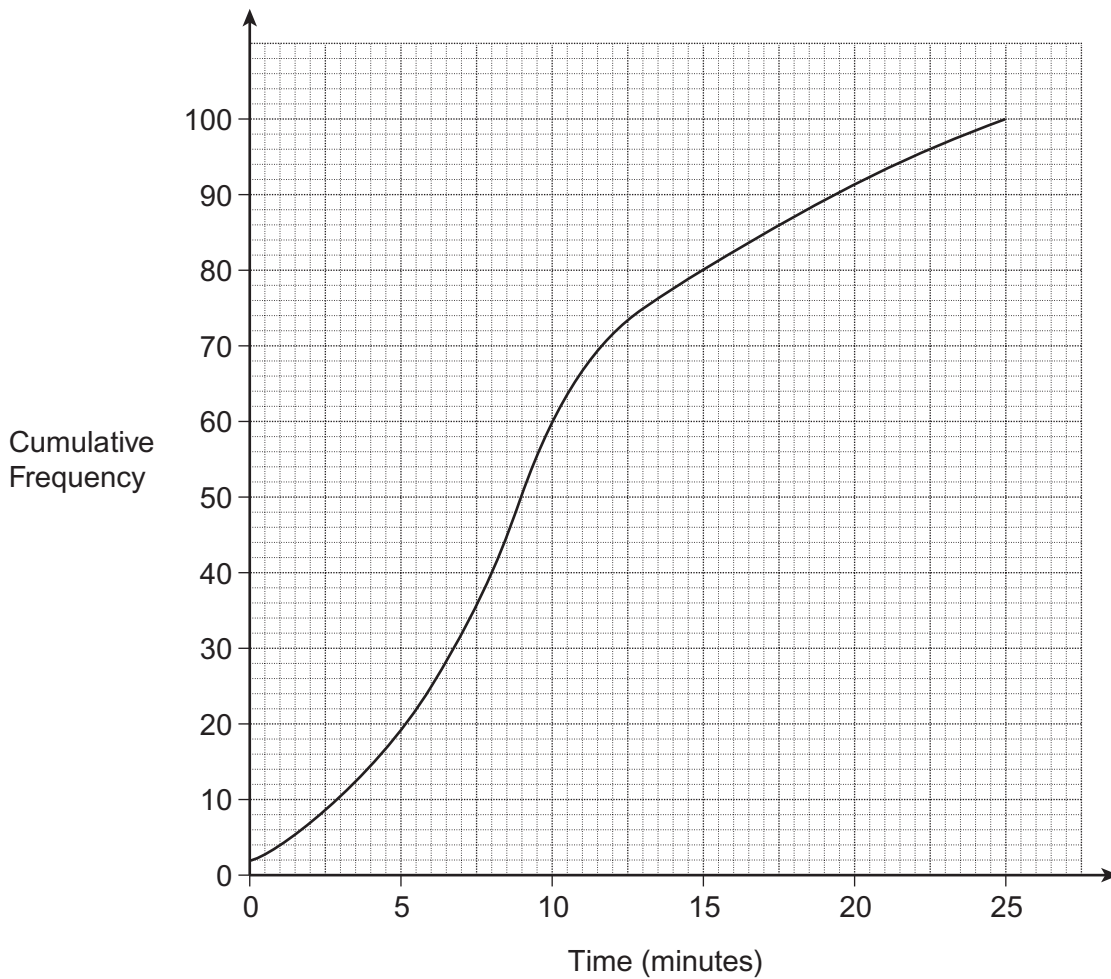
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Answer (3 marks)



- 13** The times that 100 customers spent queuing in a post office were recorded. The cumulative frequency diagram shows the results.



- 13 (a)** How many customers queued for more than 15 minutes?

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Answer (1 mark)

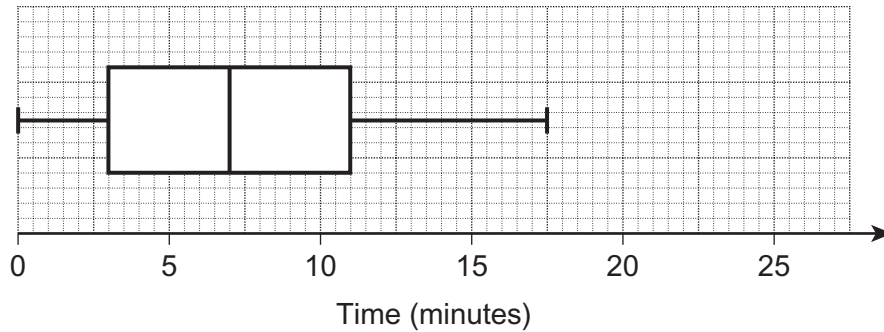
- 13 (b)** Work out the median queuing time.

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Answer minutes (1 mark)



- 13 (c)** A new serving window was opened in the post office.
The times that 100 customers spent queuing were then recorded.
The box plot shows the results.



Work out the inter-quartile range of these times.

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Answer minutes (2 marks)

- 13 (d)** Compare the queuing times before and after the new serving window was opened.
Give **two** comparisons.

Comparison 1

.....

.....

Comparison 2

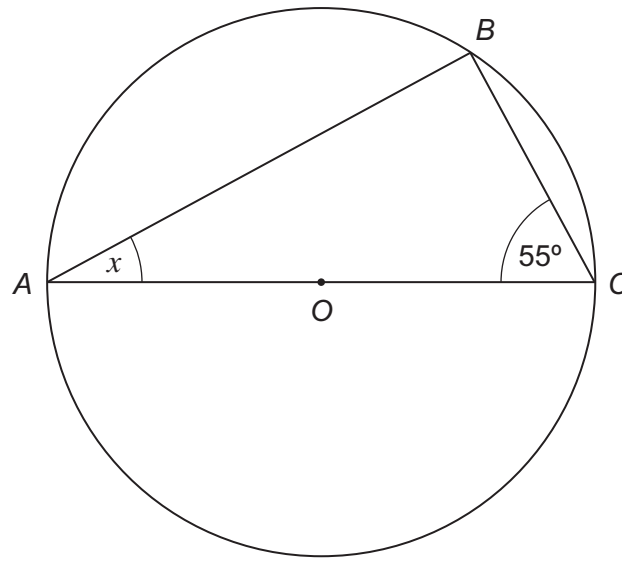
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(2 marks)



- 14 (a)** A , B and C are points on the circumference of a circle with centre O .



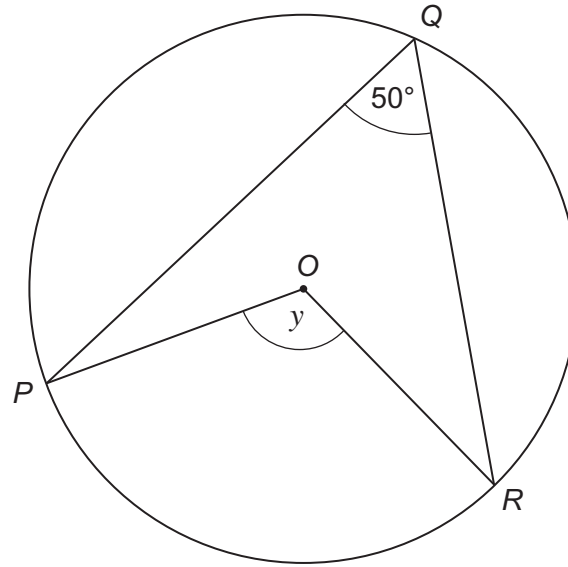
Not drawn
accurately

Work out the size of angle x .

Answer degrees (1 mark)



- *14 (b)** P , Q and R are points on the circumference of a circle with centre O .



Not drawn
accurately

Work out the size of angle y .
Give a reason for your answer.

Answer degrees

Reason

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(2 marks)

Turn over for the next question



15 (a) Expand and simplify $(3x + 2)(2x + 5)$

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Answer (2 marks)

15 (b) Simplify fully $(3x^2y^4)^2$

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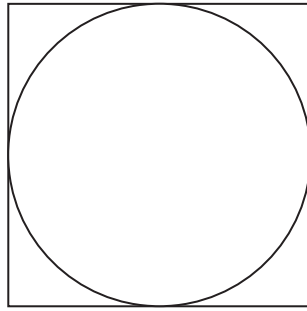
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Answer (2 marks)



***16**

A circle is drawn inside a square as shown.



Show that the area of the circle is more than 75% of the area of the square.

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*(4 marks)***Turn over for the next question**

17 n is an integer.

Show that $\frac{n(n-1)}{2} + \frac{n(n+1)}{2}$ is a square number.

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(3 marks)

18 The graph of $y = x^2 + 2x - 3$ is drawn on the opposite page.

Draw an appropriate **straight** line on the graph to work out the approximate solutions of

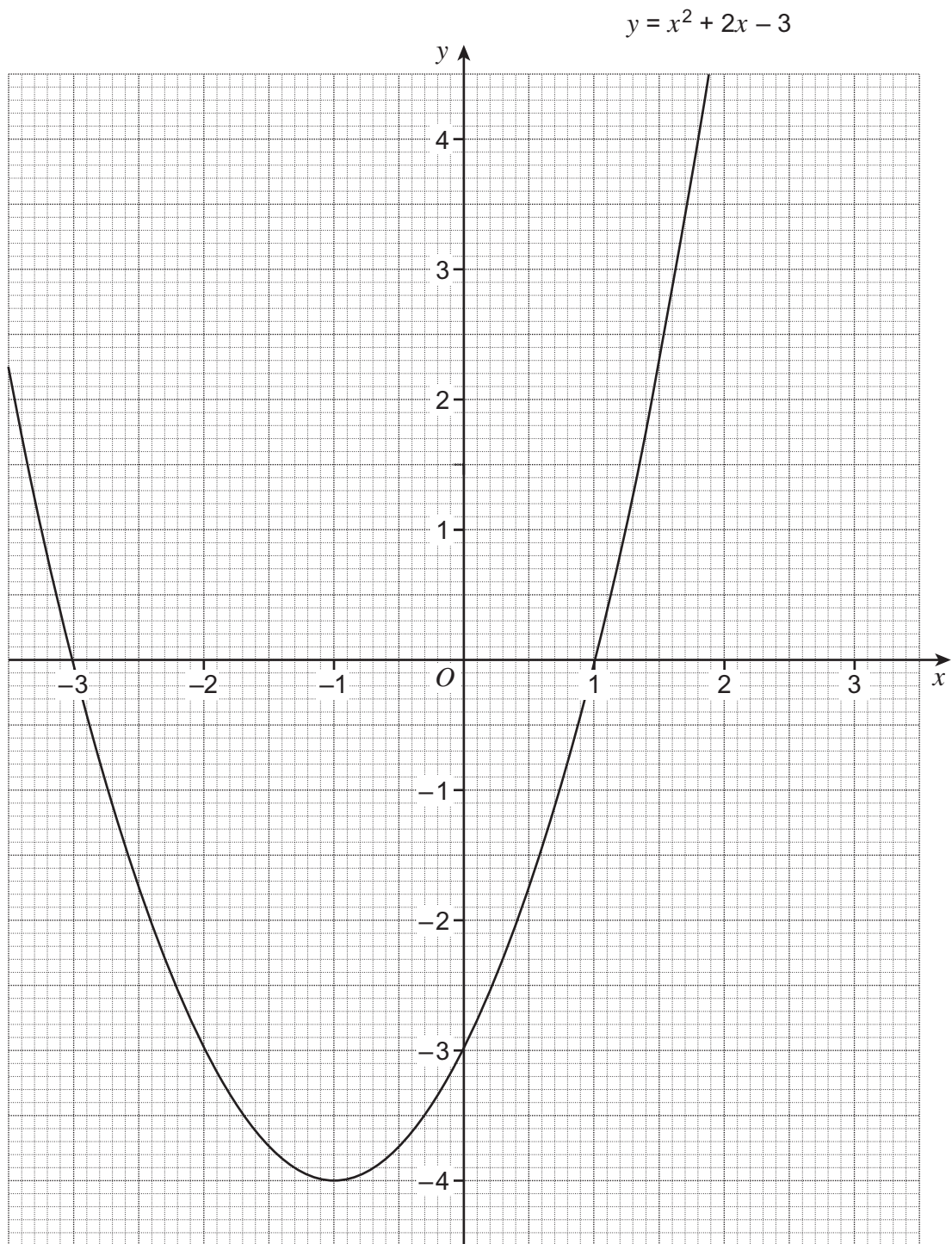
$$x^2 + x - 3 = 0$$

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Answer (3 marks)





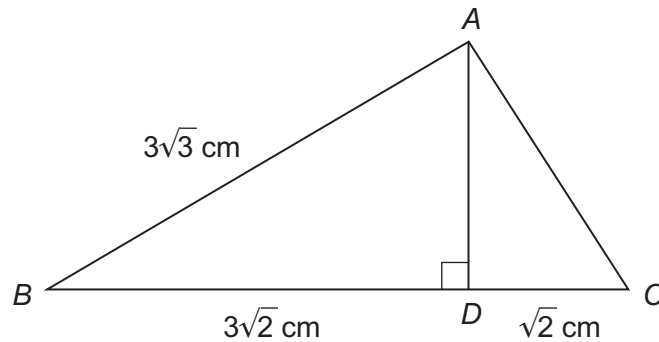
- 19 (a) Show clearly that $(3\sqrt{3})^2 = 27$

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(1 mark)

- 19 (b) ABC is a triangle.
 AD is perpendicular to BC .
 $AB = 3\sqrt{3}$ cm, $BD = 3\sqrt{2}$ cm, $DC = \sqrt{2}$ cm



Not drawn
accurately

Work out the area of triangle ABC .
 Give your answer in the form $a\sqrt{2}$ where a is an integer.

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Answer cm² (5 marks)

END OF QUESTIONS



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