Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
2–3	
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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

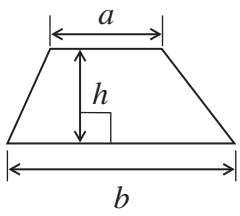
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

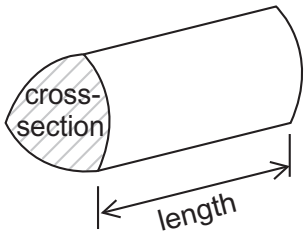
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

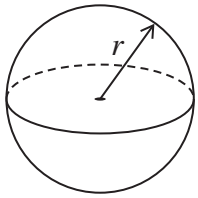


Volume of prism = area of cross-section × length



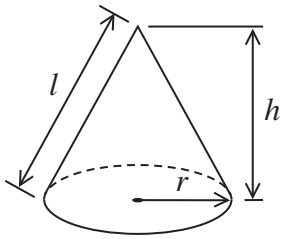
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

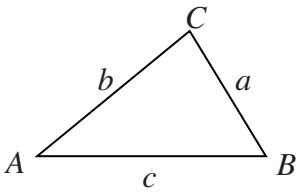
Curved surface area of cone = $\pi r l$



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

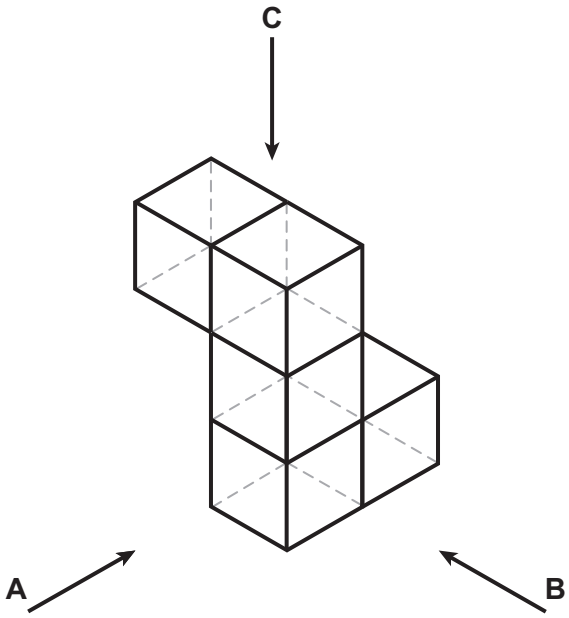
The Quadratic Equation

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 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 $\dfrac{41 \times 198}{77}$

.....

.....

.....

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

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

$\dfrac{1}{n}$ $\quad n - 1$ $\quad n + 1$ $\quad n^2$ $\quad \sqrt{n}$

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?

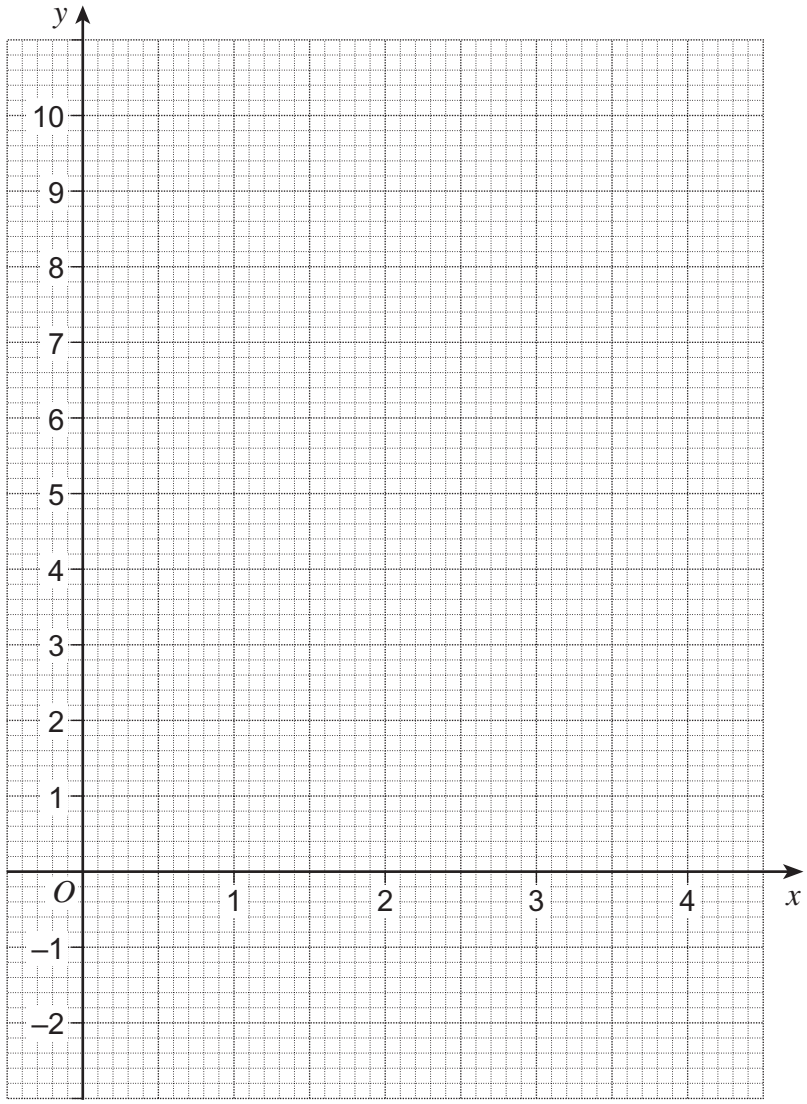
☐ integer ☐ not an integer ☐ could be either

(1 mark)

Turn over for the next question

8

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)*

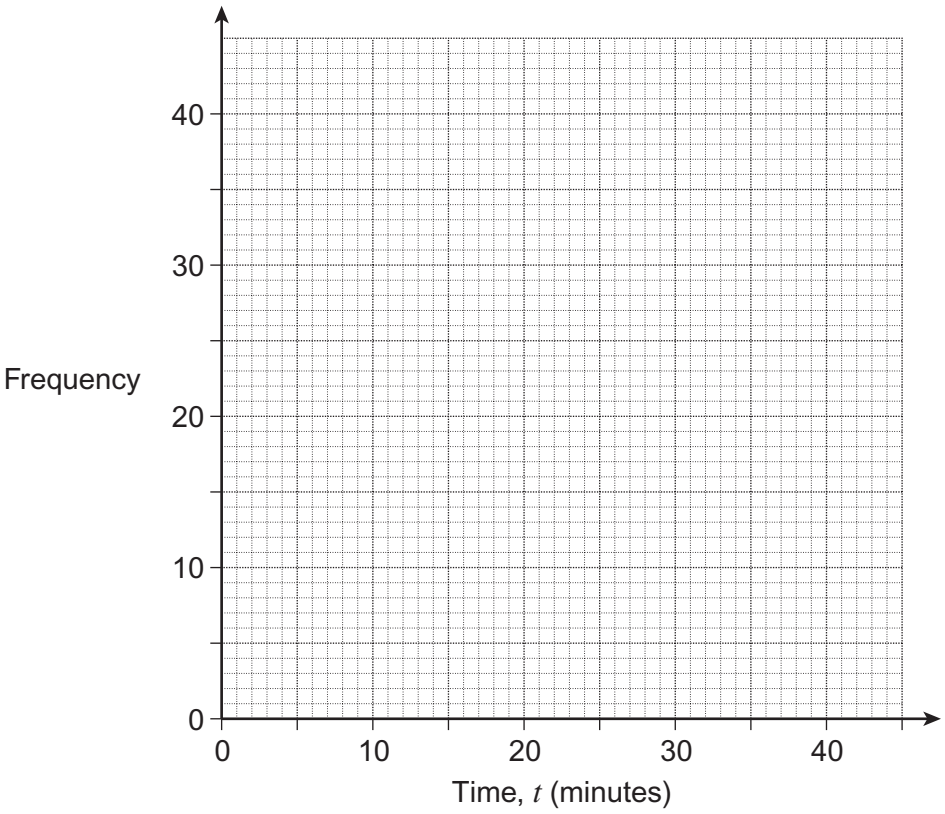
Turn over for the next question

4

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

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

7

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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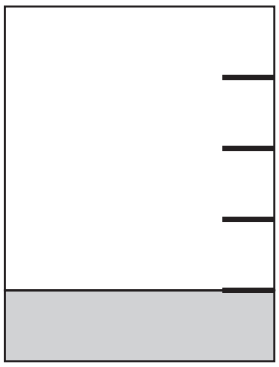
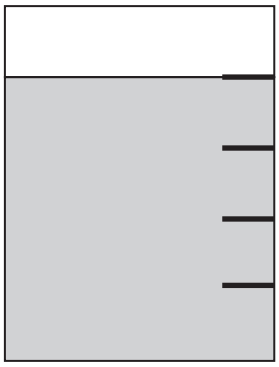
w = ... *(3 marks)*

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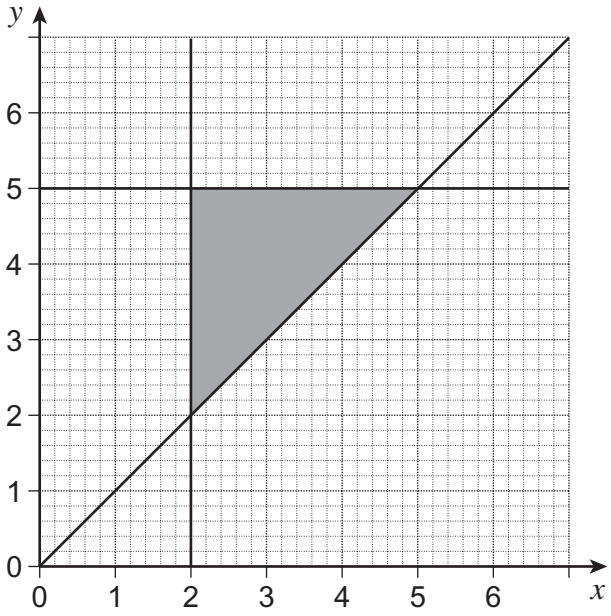
Answer ..... grams *(4 marks)*

10

10 Work out the three inequalities that describe the shaded region.



Answer .....

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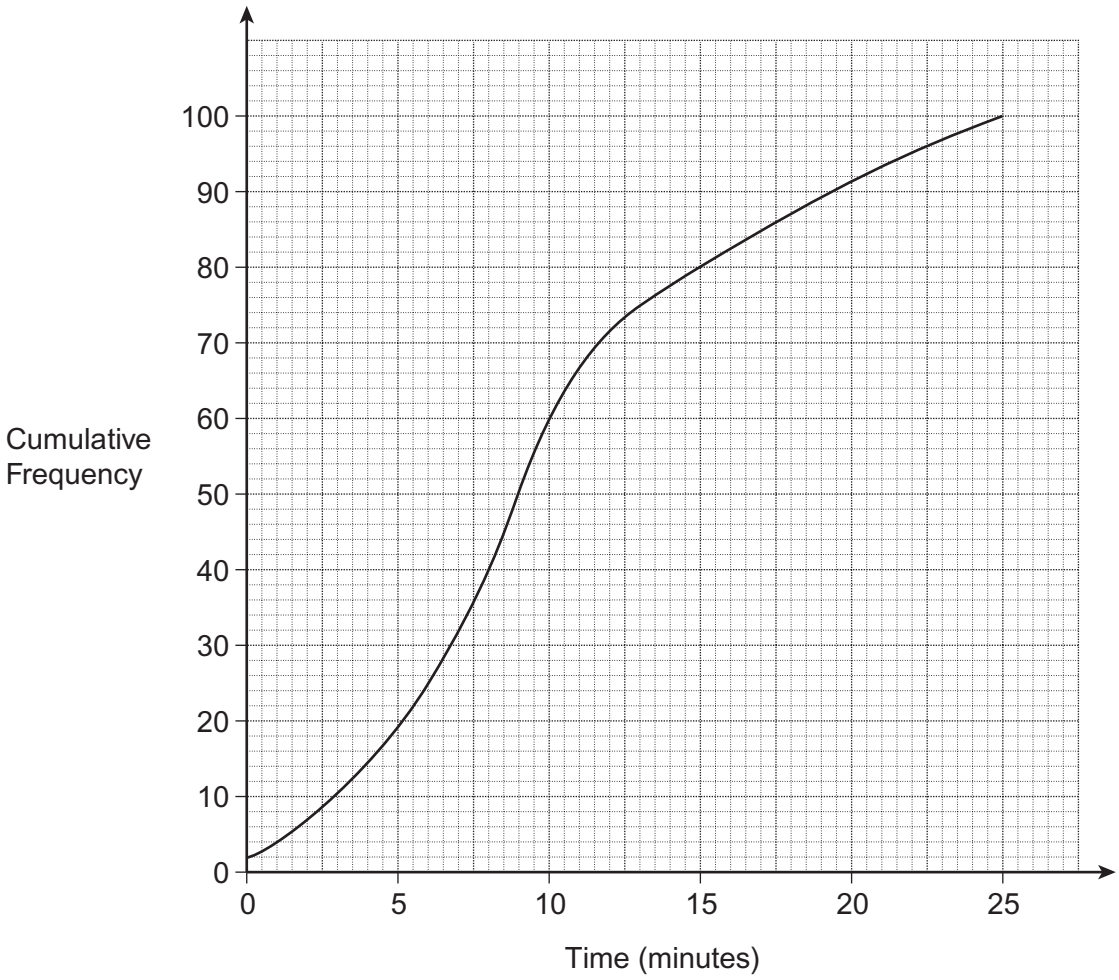
Answer ..... *(3 marks)*

9

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?

.....

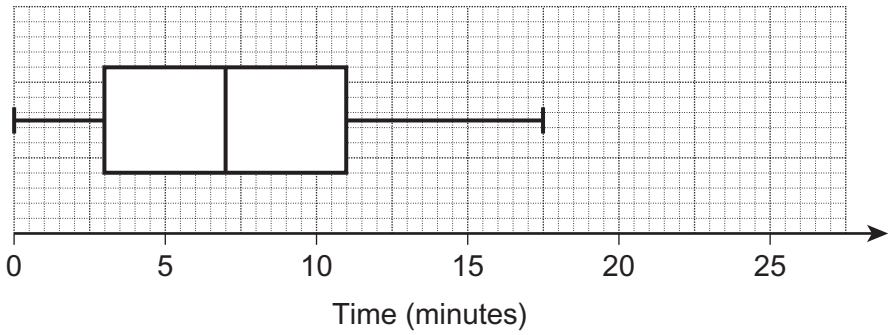
Answer ..... *(1 mark)*

13 (b) Work out the median queuing time.

.....

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 .....

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Comparison 2 .....

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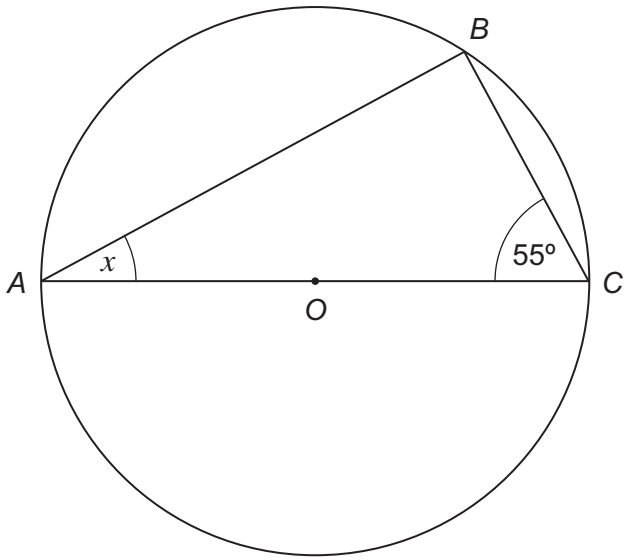
(2 marks)

6

Turn over ▶

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

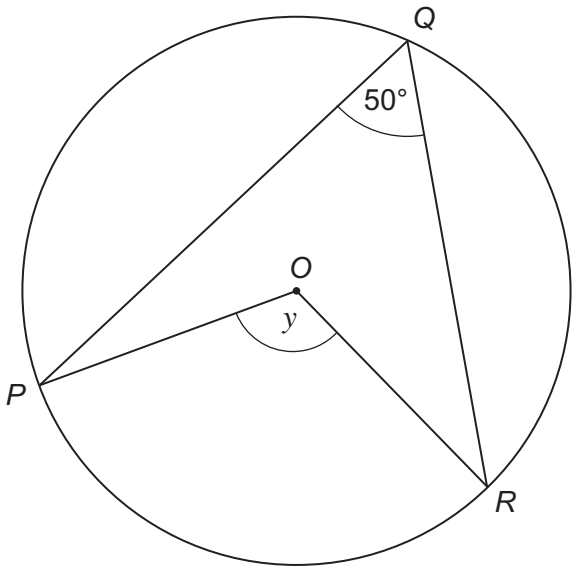


Not drawn accurately

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

3

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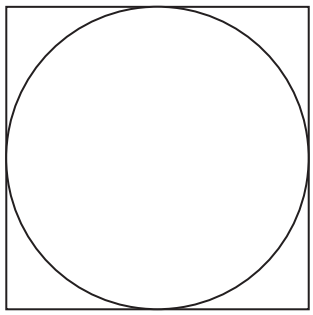
Answer ..... *(2 marks)*

***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

8

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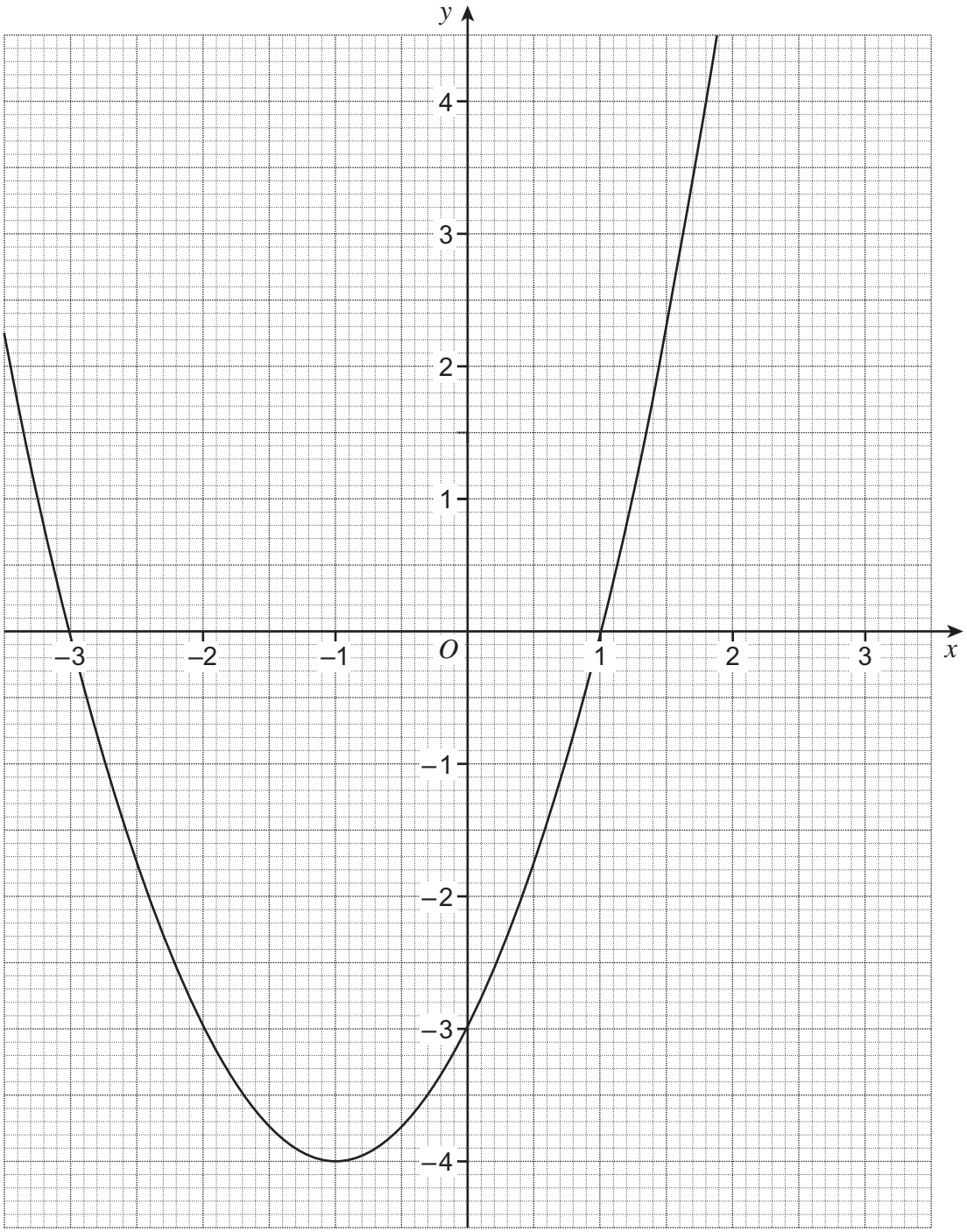
Answer ..... *(3 marks)*

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



6

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

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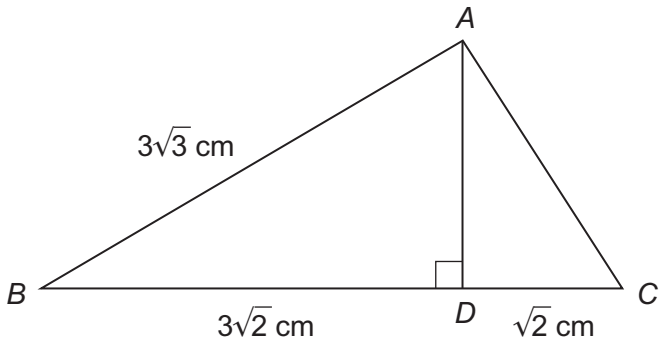
(1 mark)

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 ..... cm^2 *(5 marks)*

END OF QUESTIONS

6

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