

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
2-3	
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14-15	
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22	
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

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>mathematical instruments.</li> </ul> <p>You must <b>not</b> use a calculator.</p>	
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### 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

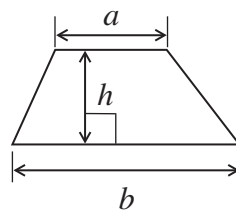
- In all calculations, show clearly how you work out your answer.



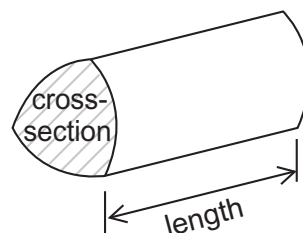
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## Formulae Sheet: Higher Tier

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

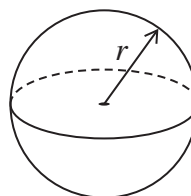


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



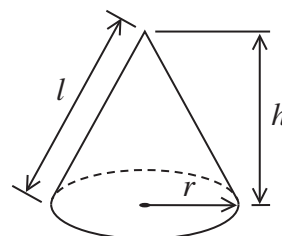
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$

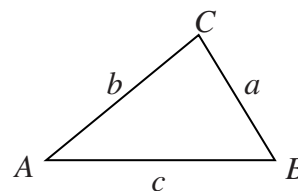


In any triangle  $ABC$

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$



### The Quadratic Equation

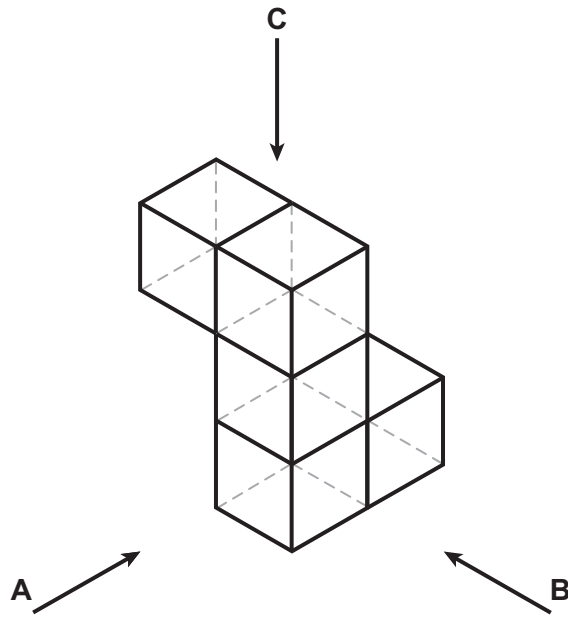
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



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
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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

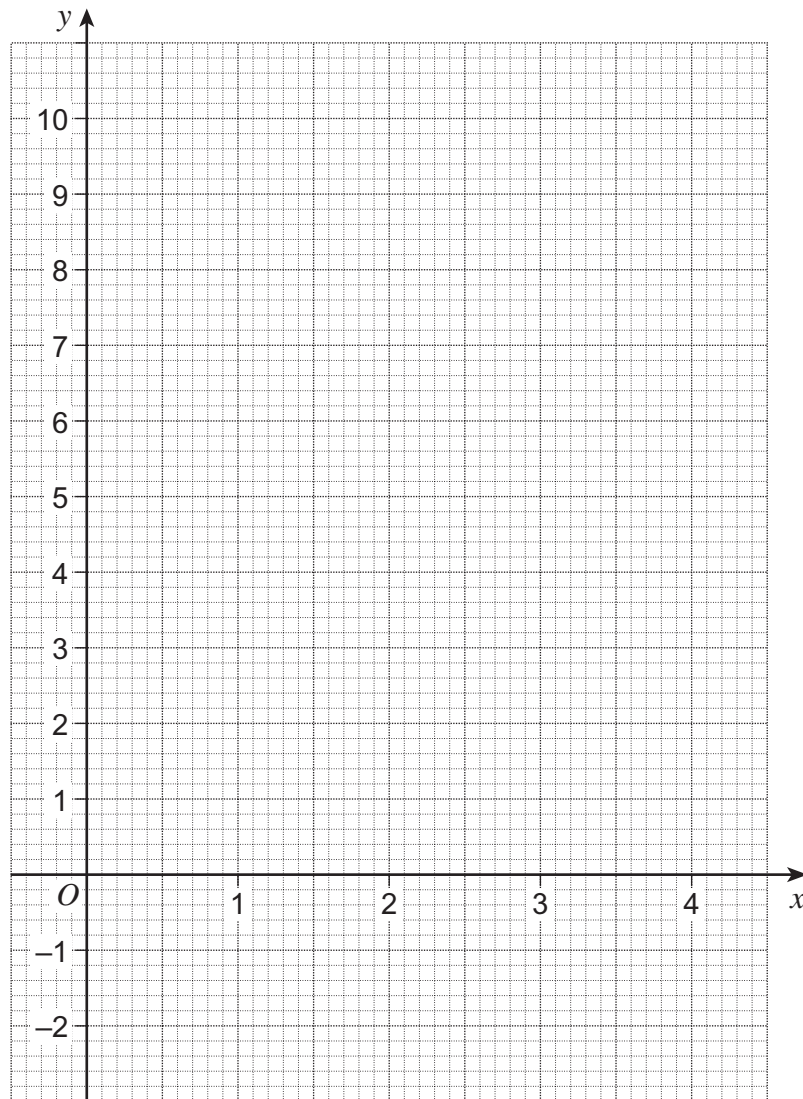
could be either

(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  $2x - 1 = 2$

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.....

$x =$  ..... (1 mark)

**Turn over for the next question**

4
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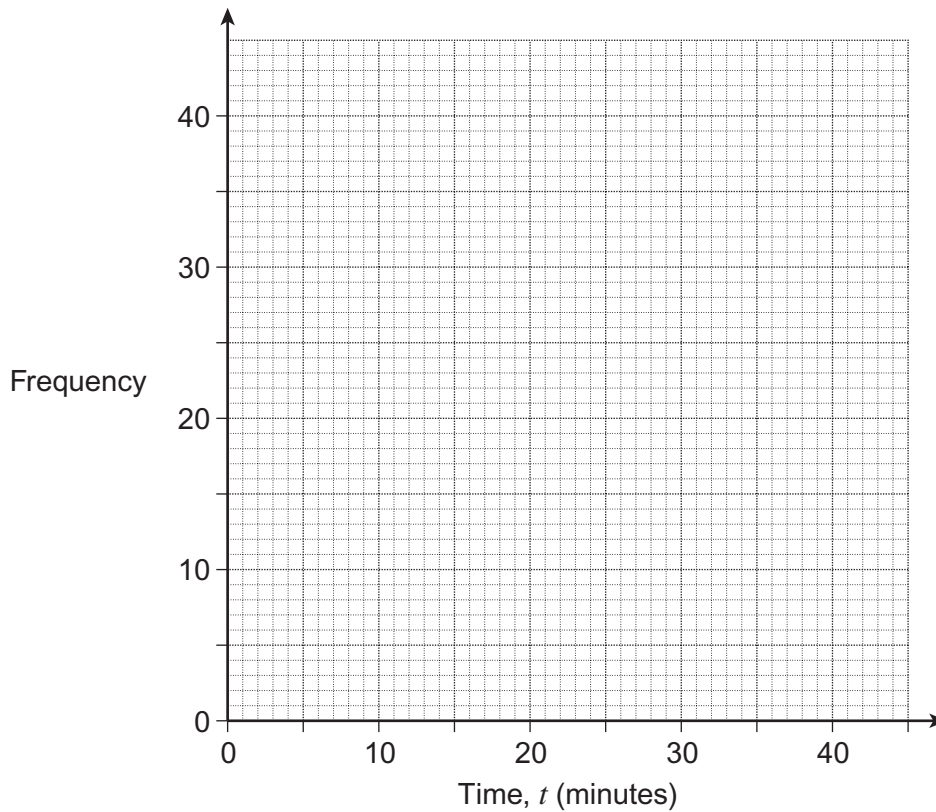
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**6** The times taken by 100 students to travel to school are shown.

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.

.....

.....

.....

$a =$  ..... (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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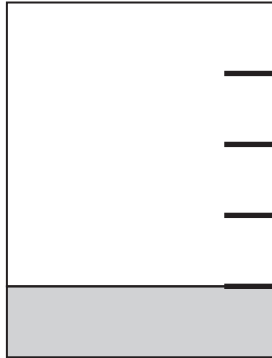
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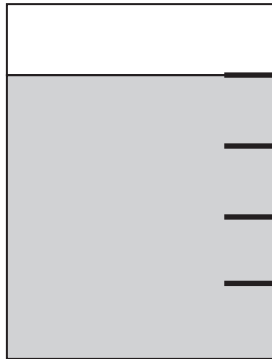
$w =$  ..... (3 marks)



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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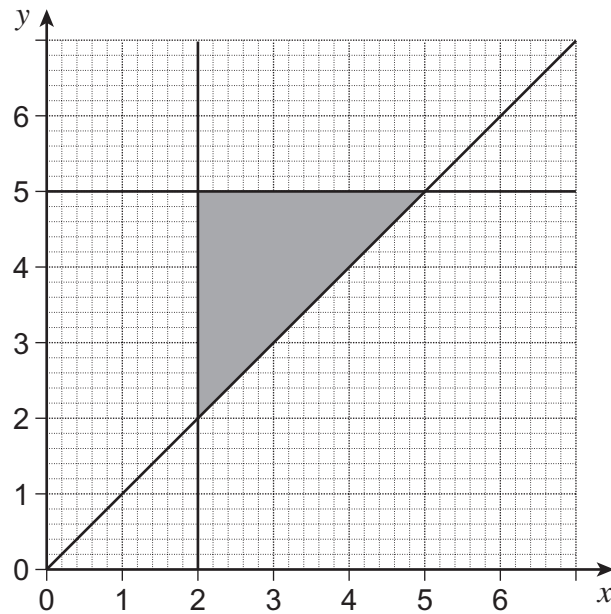
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Answer ..... grams (4 marks)



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



Answer .....

.....

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(3 marks)



**11** A triangle, square and pentagon have a **total** area of  $48 \text{ cm}^2$ .  
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 .....  $\text{cm}^2$  (3 marks)

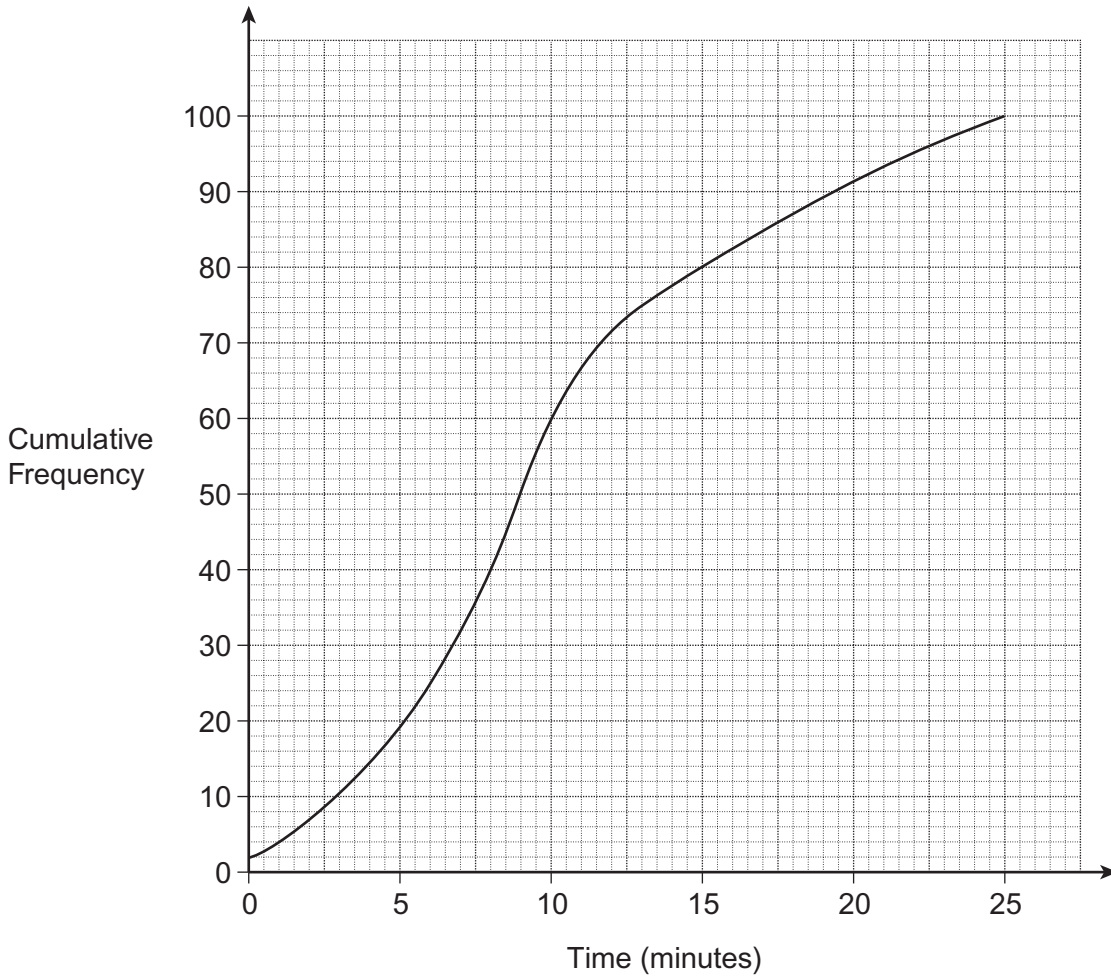
**12** Rearrange  $2(a + c) = 5(a - b)$  to make  $c$  the subject.

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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)

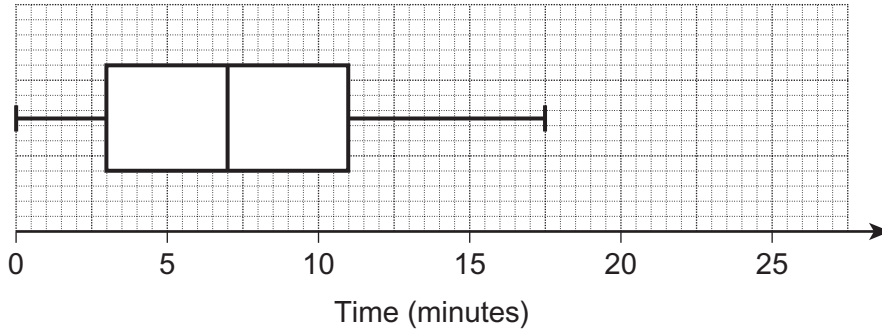
**13 (b)** Work out the median queuing time.

.....

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.

.....

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 .....

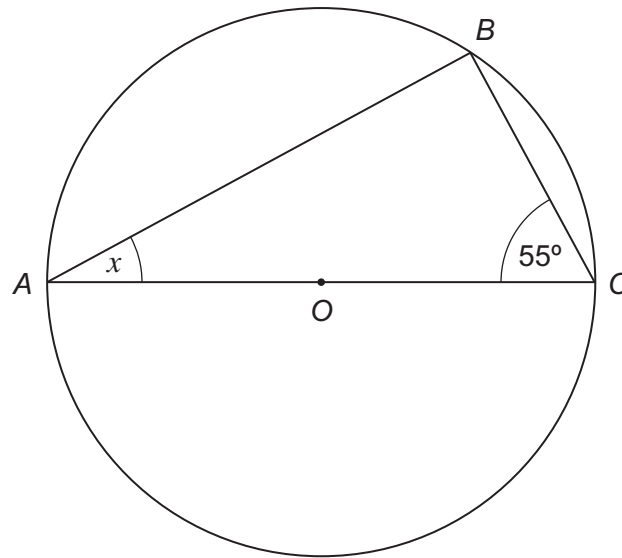
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(2 marks)



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



Not drawn  
accurately

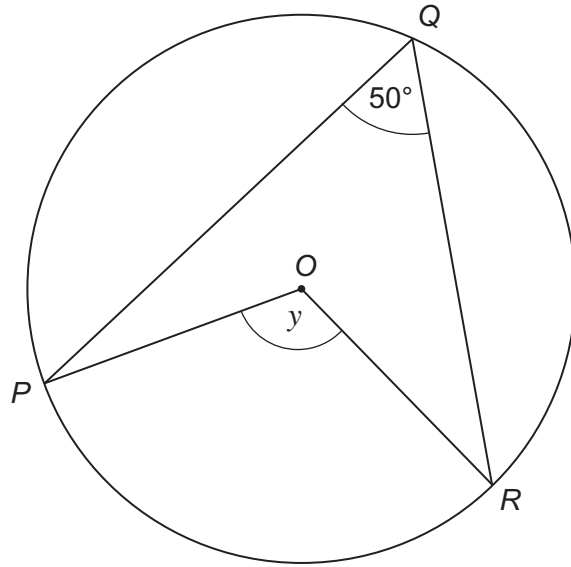
Work out the size of angle  $x$ .

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 .....

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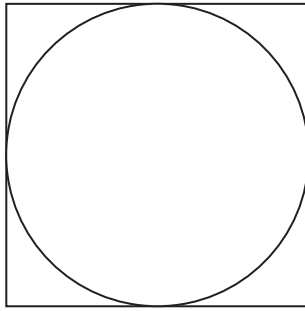
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Answer ..... (2 marks)



**\*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

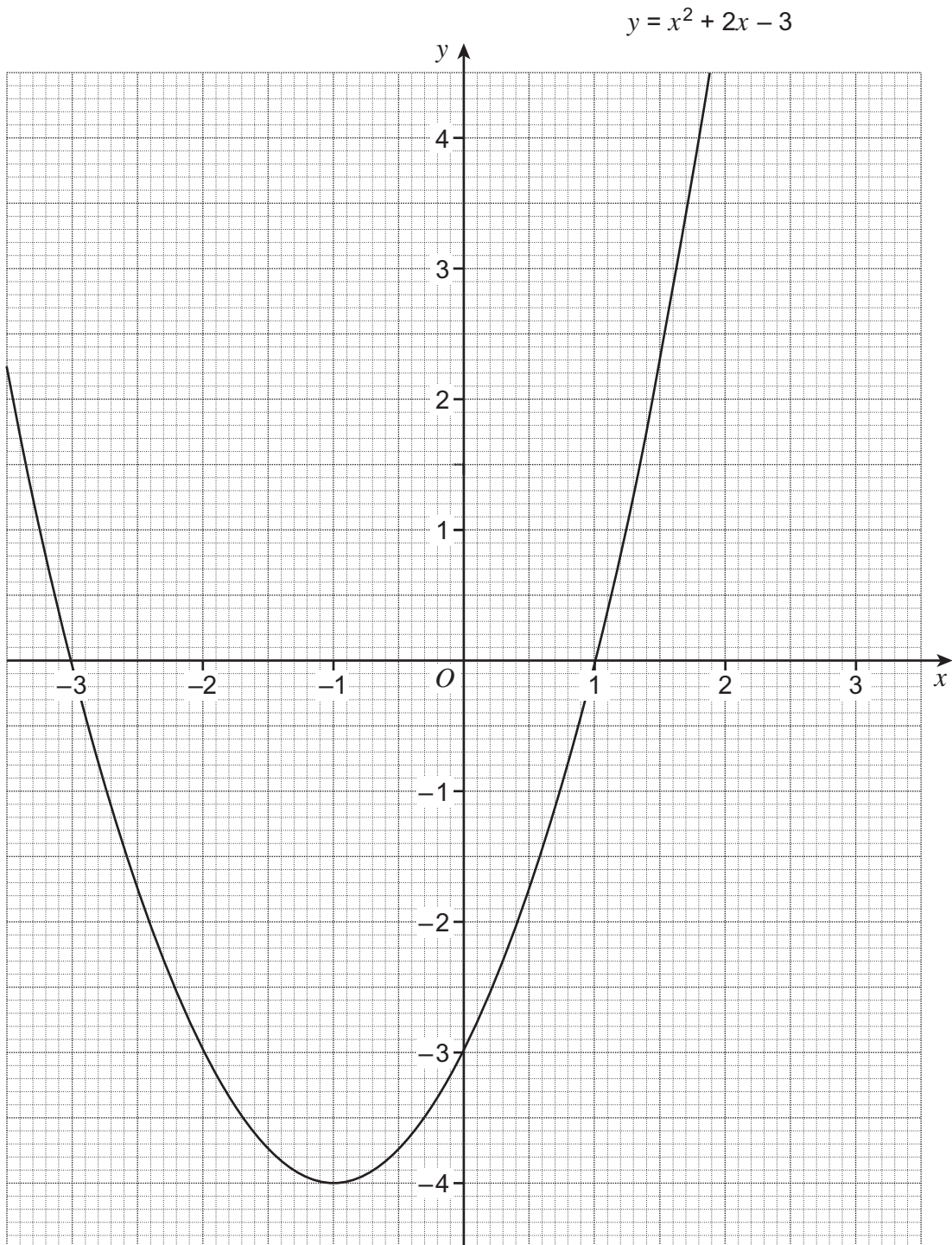
$$x^2 + x - 3 = 0$$

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Answer ..... (3 marks)



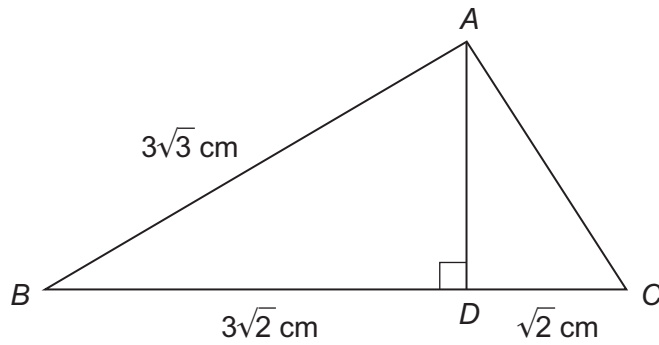


19 (a) Show clearly that  $(3\sqrt{3})^2 = 27$

.....  
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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 ..... cm<sup>2</sup> (5 marks)

END OF QUESTIONS



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