

Centre Number						Candidate Number				
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Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
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20	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
November 2013

# Mathematics

43603H

## Unit 3

Monday 11 November 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>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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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.
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  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 4, 7 and 9. 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.



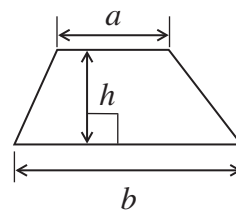
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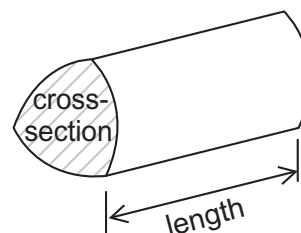
43603H

## Formulae Sheet: Higher Tier

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

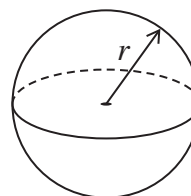


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



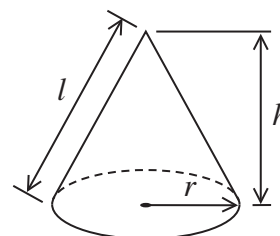
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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

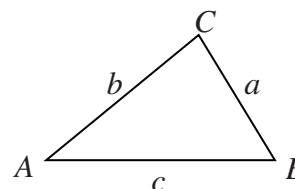


In any triangle  $ABC$

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

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

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



### The Quadratic Equation

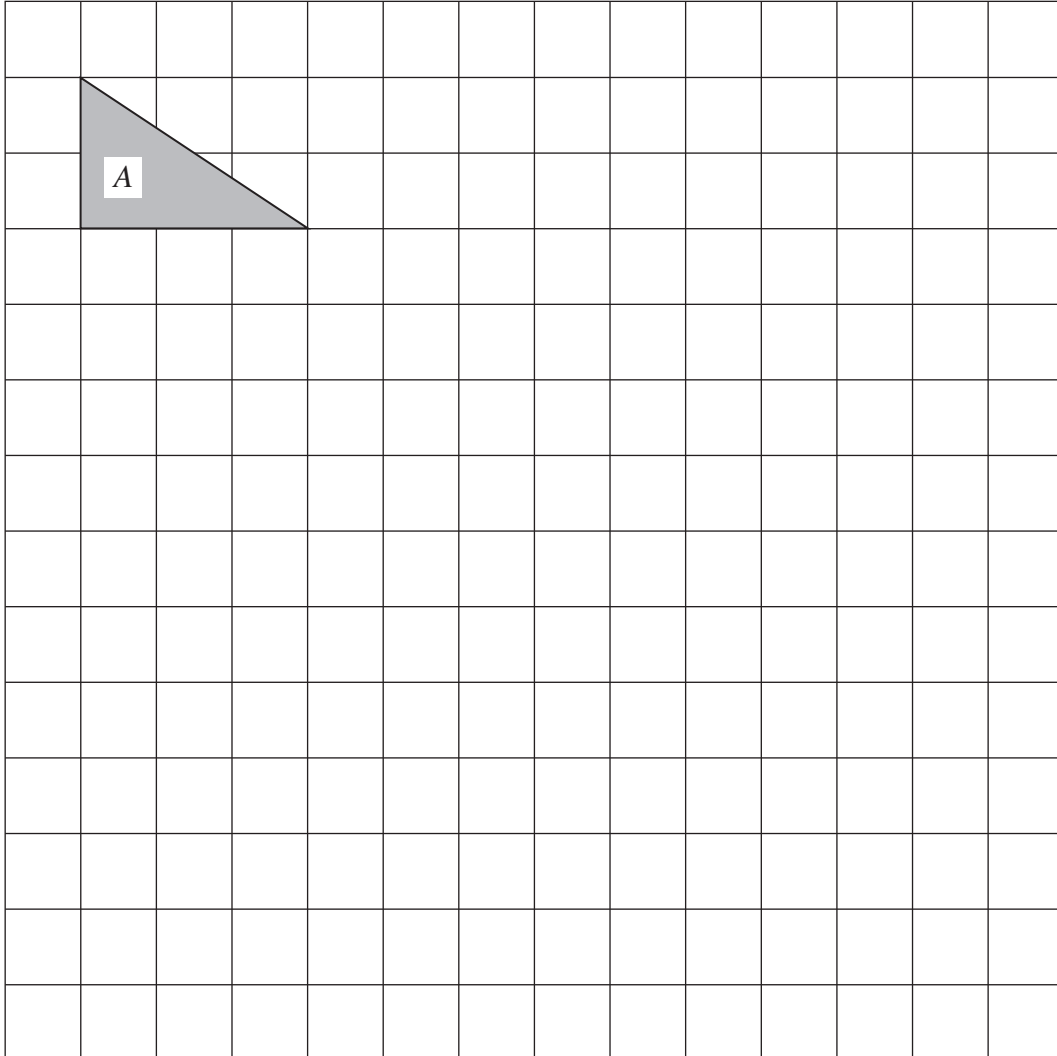
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



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

1 Shape *A* on the centimetre grid is enlarged by scale factor 3.



Work out the area of the enlargement.

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Answer ..... cm<sup>2</sup> (3 marks)

3
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Turn over ►

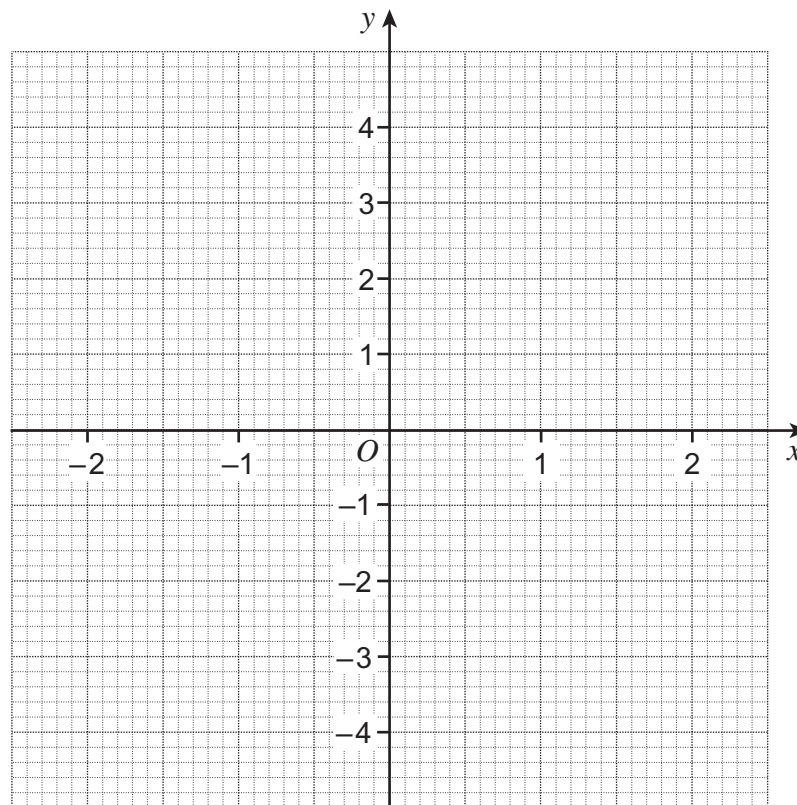


**2 (a)** Complete the table of values for  $y = x^2$

$x$	-2	-1	0	1	2
$y$	4			1	

(2 marks)

**2 (b)** On the grid, draw the graph of  $y = x^2$  for values of  $x$  from -2 to 2.



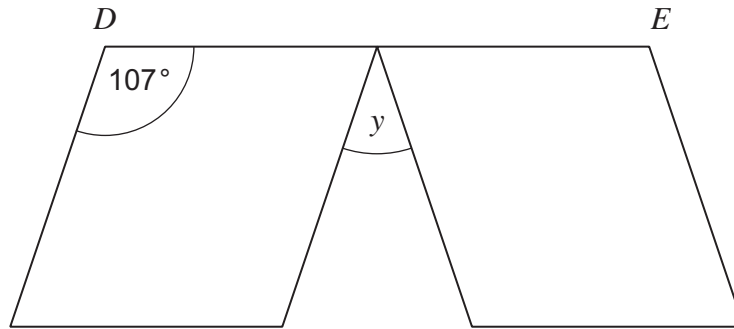
(2 marks)

**2 (c)** On the same grid, draw the graph of  $y = x^2 - 3$  for values of  $x$  from -2 to 2.

(2 marks)



3 A rhombus is reflected as shown.  
*DE* is a straight line.



Not drawn  
accurately

Work out the size of angle *y*.  
Show your working, which may be on the diagram.

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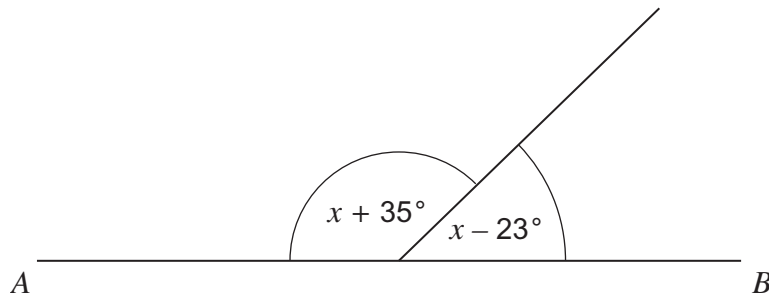
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Answer ..... degrees (3 marks)

Turn over for the next question



**\*4** $AB$  is a straight line.Not drawn  
accurately

Set up and solve an equation to work out the size of the obtuse angle.

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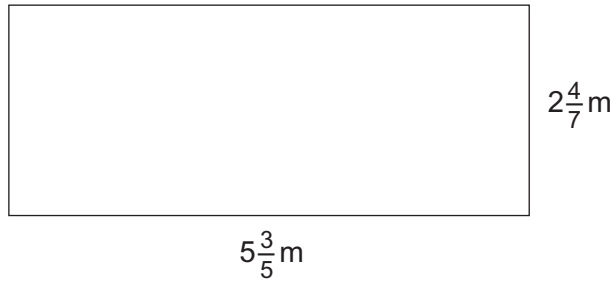
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Answer ..... degrees (4 marks)



5 Use a calculator to work out the perimeter of the rectangle.



Not drawn accurately

Give your answer as a mixed fraction.

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Answer ..... m (2 marks)

6 The scale on a map is 1 : 500 000

Two towns are 8 cm apart on the map.

Work out the actual distance between the towns.  
Give your answer in kilometres.

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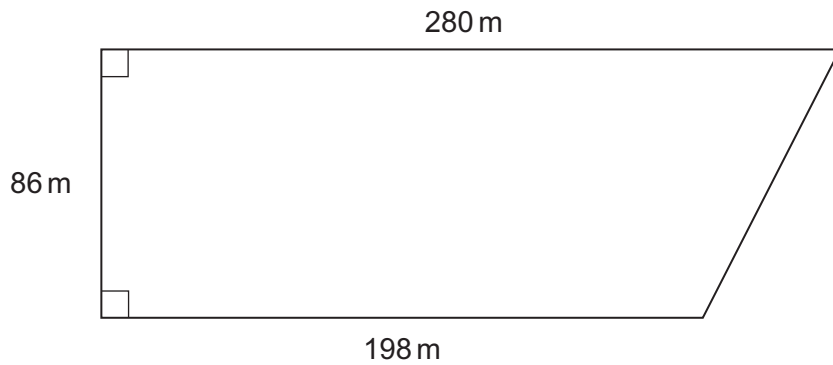
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Answer ..... km (3 marks)



7 The diagram shows a field.

Not drawn accurately



7 (a) Work out the area of the field.

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Answer ..... m<sup>2</sup> (2 marks)

\*7 (b) 1 acre = 4047 square metres

A farmer keeps cows in the field.  
He is allowed 7 cows per acre.

Work out the maximum number of cows he is allowed to put in the field.

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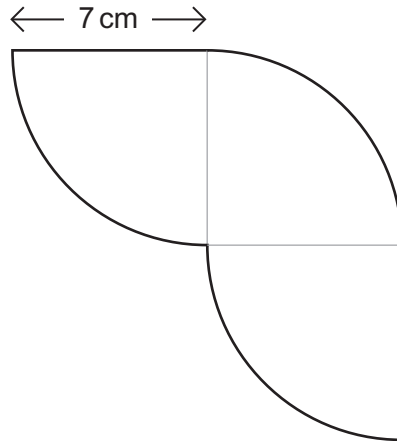
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Answer ..... (4 marks)





8 This shape is made from identical quarter circles.



Not drawn  
accurately

Work out the perimeter of the shape.

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Answer ..... cm (4 marks)

Turn over for the next question



\*9 Use trial and improvement to find a solution to the equation

$$x^3 + x = 25$$

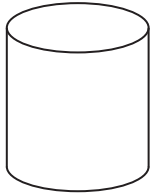
The first step is shown in the table.  
Give your solution to 1 decimal place.

$x$	$x^3 + x$	Comment
2	10	Too small

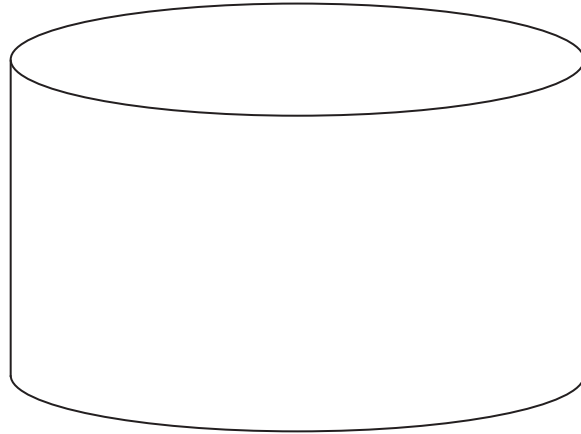
$x = \dots\dots\dots$  (4 marks)



10 The diagram shows two cylinders.



radius 4 cm
height 9 cm



radius 10 cm
height 36 cm

How many times bigger is the volume of the large cylinder than the small cylinder?  
You **must** show your working.

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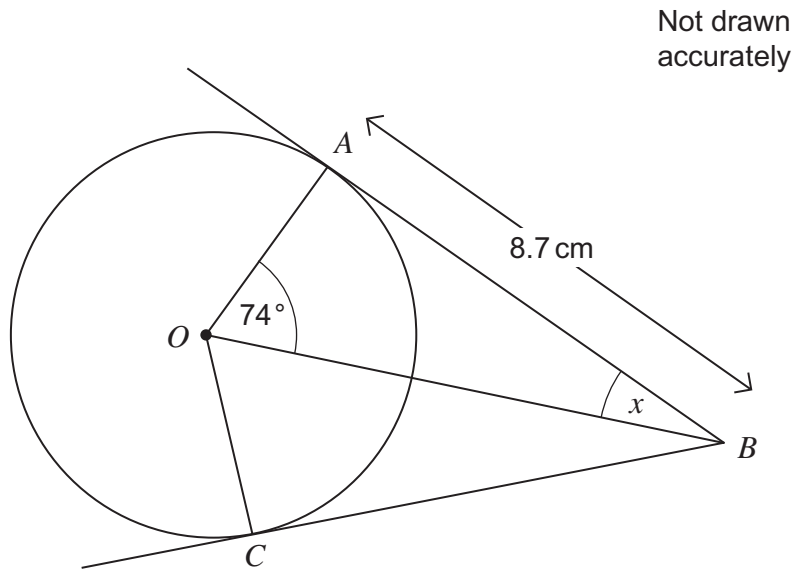
Answer ..... (4 marks)

8
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Turn over ►



**11** The diagram shows a circle centre  $O$ .  
 $A$  and  $C$  are points on the circumference.  
 $AB$  and  $CB$  are tangents.



**11 (a)** Work out the size of angle  $x$ .

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

**11 (b)** Write down the length of  $BC$ .  
Give a reason for your answer.

Answer ..... cm

Reason .....  
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 (1 mark)



**11 (c)** Work out the radius of the circle.

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Answer ..... cm (3 marks)

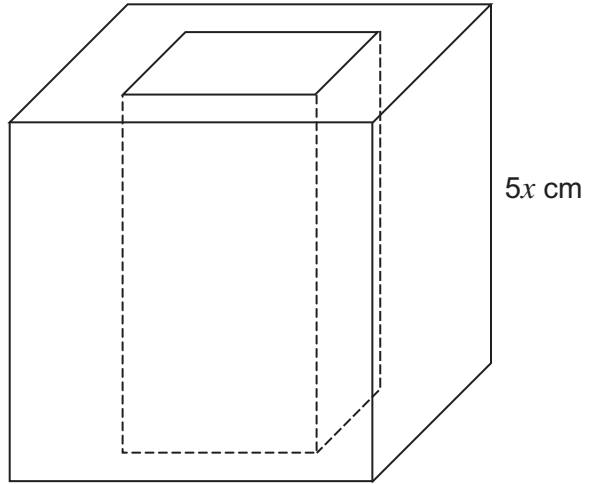
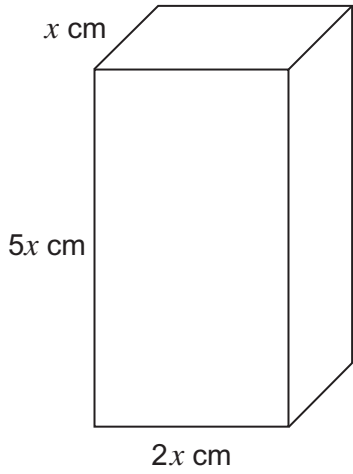
**Turn over for the next question**

6

**Turn over ►**



**12** The cuboid has been cut out of the wooden cube as shown.



**12 (a)** Show clearly why the volume of wood remaining, in cubic centimetres, is  $115x^3$ .

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(3 marks)

**12 (b)** You are given that  $x = 3.5$   
Work out the volume of wood remaining.

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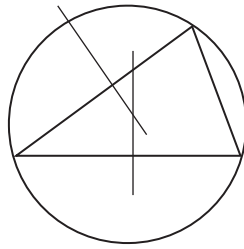
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Answer .....  $\text{cm}^3$  (2 marks)



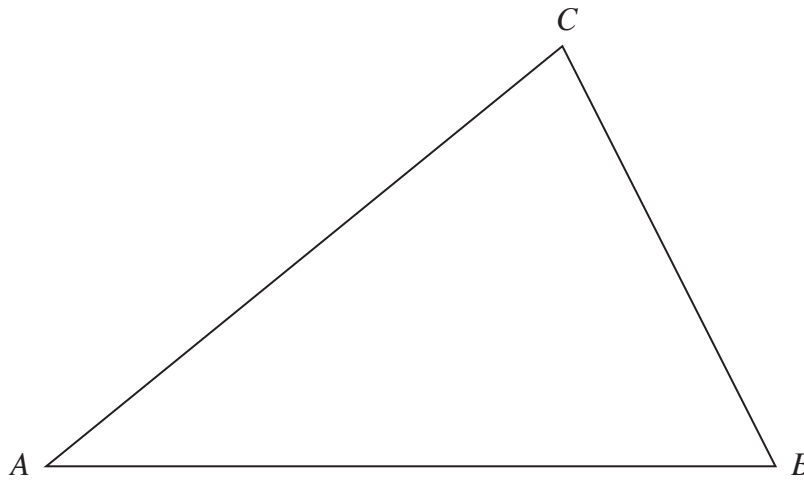
13

Use these steps to construct a circle passing through the vertices of the triangle  $ABC$ .



- Construct the perpendicular bisector of  $AB$ .
- Construct the perpendicular bisector of  $AC$ .
- Use the point of intersection of the bisectors as the centre of the circle.
- Draw the circle through  $A$ ,  $B$  and  $C$ .

Show your construction arcs clearly.



(4 marks)

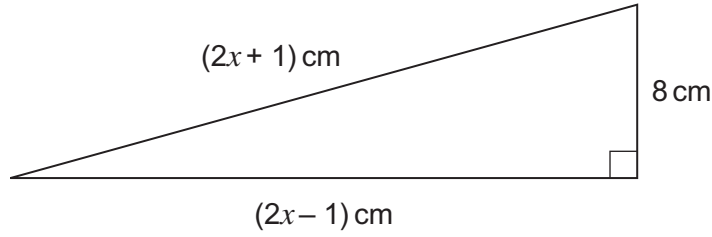
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Turn over ►



14 Work out the value of  $x$ .

Not drawn  
accurately



You **must** show your working.

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$x =$  ..... (5 marks)





**15**  $y$  is **inversely** proportional to  $x$ .

When  $y = 5$ ,  $x = 9$

**15 (a)** Work out an equation connecting  $y$  and  $x$ .

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Answer ..... (3 marks)

**15 (b)** Work out the value of  $y$  when  $x = 15$

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Answer ..... (2 marks)

**Turn over for the next question**



16 Three items were bought at a car boot sale.

Item A  
Mass = 9.5 grams  
Volume = 2 cm<sup>3</sup>

Item B  
Mass = 57 grams  
Volume = 3 cm<sup>3</sup>

Item C  
Mass = 76 grams  
Volume = 4 cm<sup>3</sup>

The density of gold is **approximately** 19 grams per cm<sup>3</sup>.

Which item or items **cannot** be gold?  
You **must** show your working.

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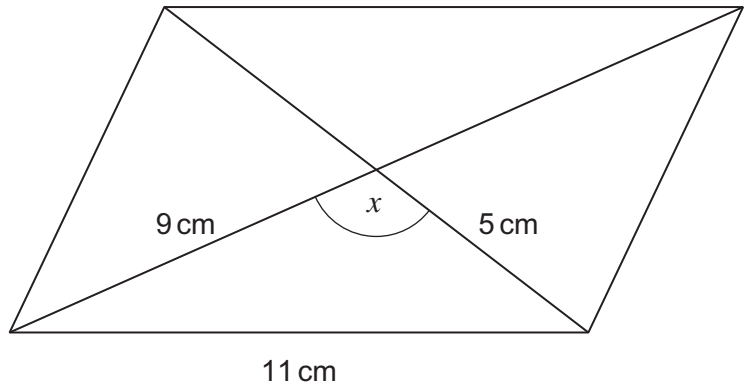
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Answer ..... (4 marks)



17 The diagram shows a parallelogram.



Not drawn  
accurately

17 (a) Work out the size of angle  $x$ .

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Answer ..... degrees (3 marks)

17 (b) Work out the area of the parallelogram.

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Answer ..... cm<sup>2</sup> (3 marks)

Turn over for the next question

Turn over ►



18

A car and a lorry complete the same 240 mile journey without stopping.

The average speed of the car is  $x$  mph.

The average speed of the lorry is 12 mph slower than the car.

The lorry takes 1 hour longer than the car.

Use an algebraic method to work out the average speed of the car.

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Answer ..... mph (6 marks)

**END OF QUESTIONS**

6

