

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
June 2014

# Mathematics

# 43603H

## Unit 3

Friday 13 June 2014 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 6, 15 and 18. 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 book.

### Advice

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

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
24 – 25	
26 – 27	
<b>TOTAL</b>	



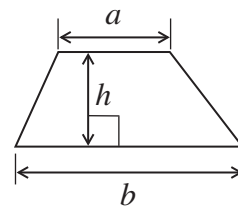
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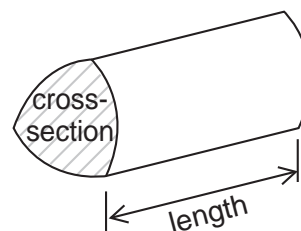
# 43603H

### Formulae Sheet: Higher Tier

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

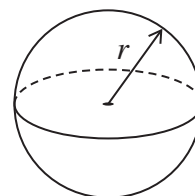


**Volume of prism** = area of cross-section  $\times$  length



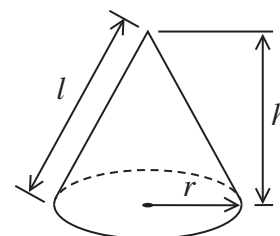
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

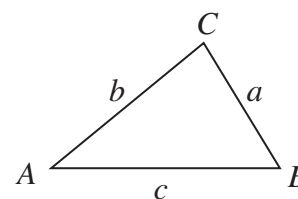


**In any triangle ABC**

**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

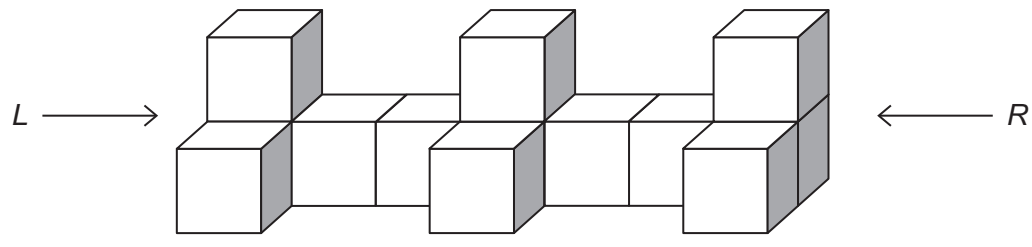
The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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



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

1 This solid shape is made from identical cubes.

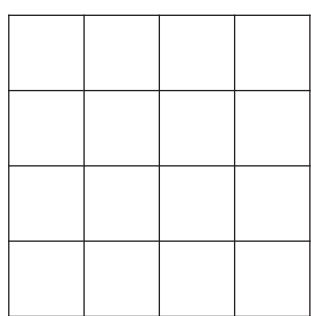
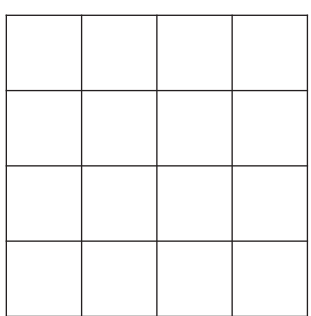


On the grids, draw the side elevations from *L* and *R* and the plan view.

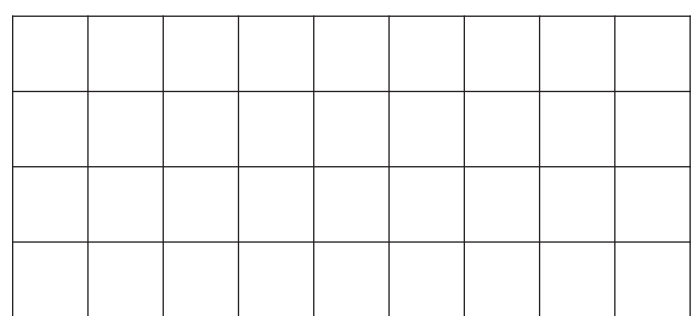
[3 marks]

*L*

*R*



Plan view

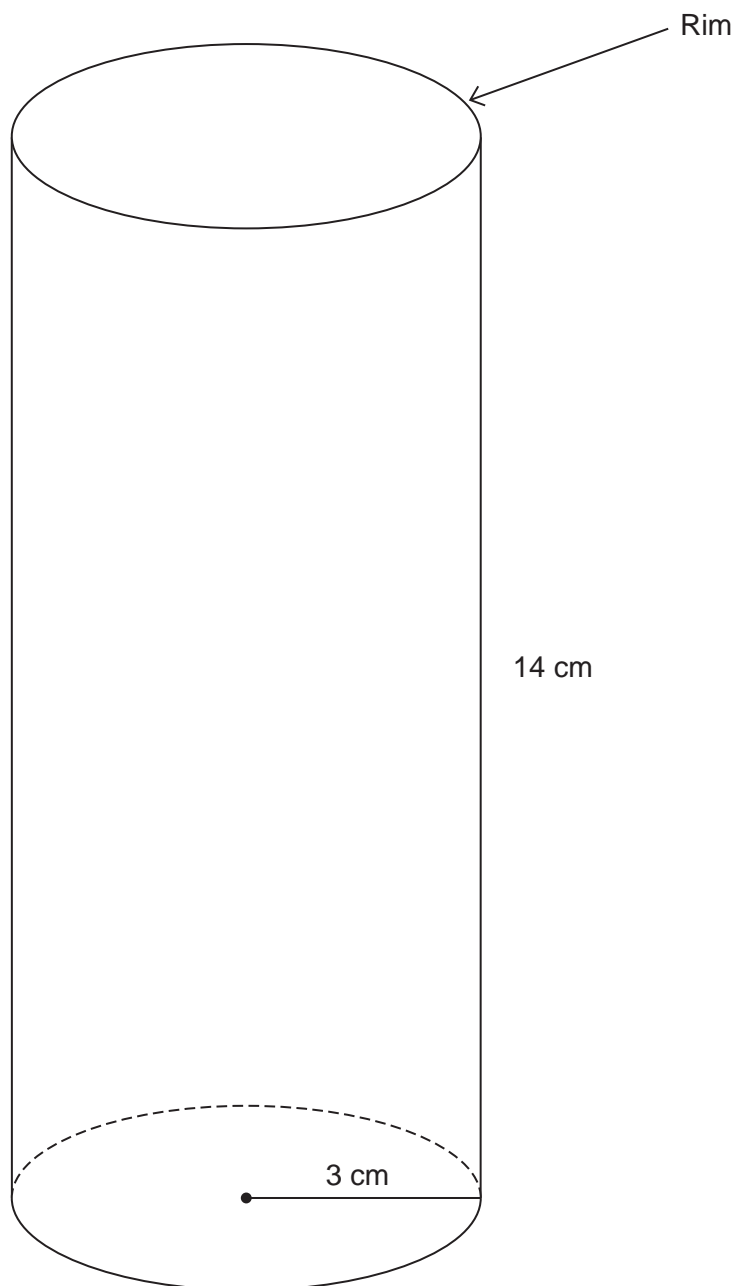


3

Turn over ►



- 2 The diagram shows a full-size drawing of a drinking glass.  
The glass is a cylinder with radius 3 cm and height 14 cm.



A man claims that the circumference of the rim is greater than the height of the glass.

Is he correct?

You **must** show your working.

**[2 marks]**

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Answer .....

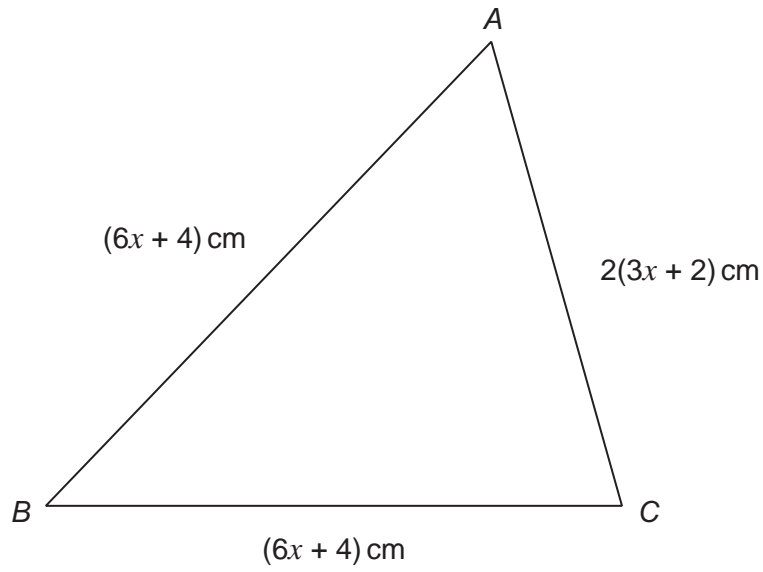
**Turn over for the next question**

2

**Turn over** ►



3 The diagram shows a triangle.



Not drawn  
accurately

What type of triangle is it?  
Give a reason for your answer.

[2 marks]

Answer .....

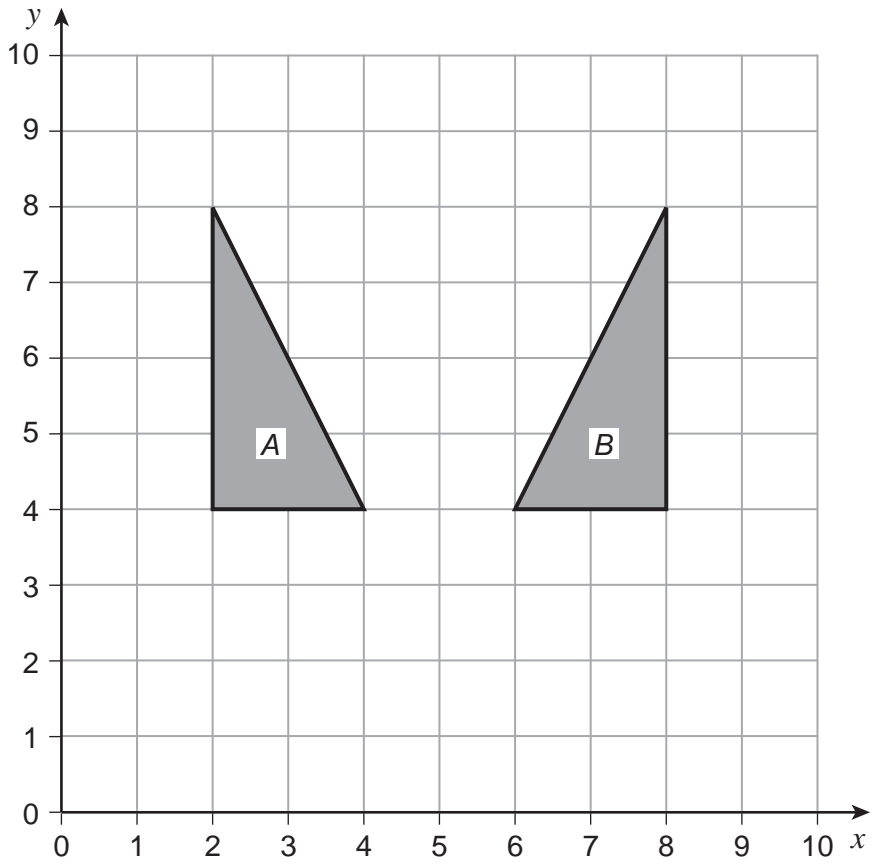
Reason .....

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4



Describe fully the **single** transformation that maps shape A to shape B.

[2 marks]

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Turn over for the next question

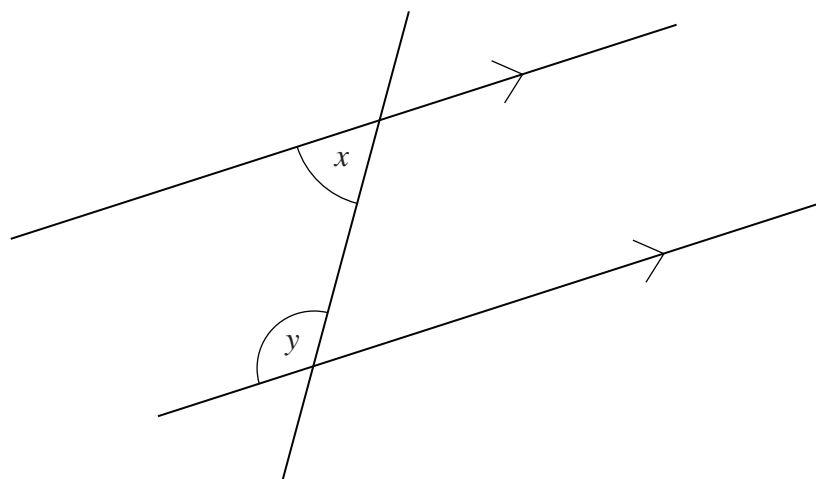
4

Turn over ►



5

Not drawn accurately



5 (a) Use the diagram to write an equation connecting  $x$  and  $y$ .

[1 mark]

Answer .....

5 (b) The ratio  $x : y = 2 : 3$

Use this information to write another equation connecting  $x$  and  $y$ .

[1 mark]

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Answer .....

5 (c) Work out the size of angles  $x$  and  $y$ .

[3 marks]

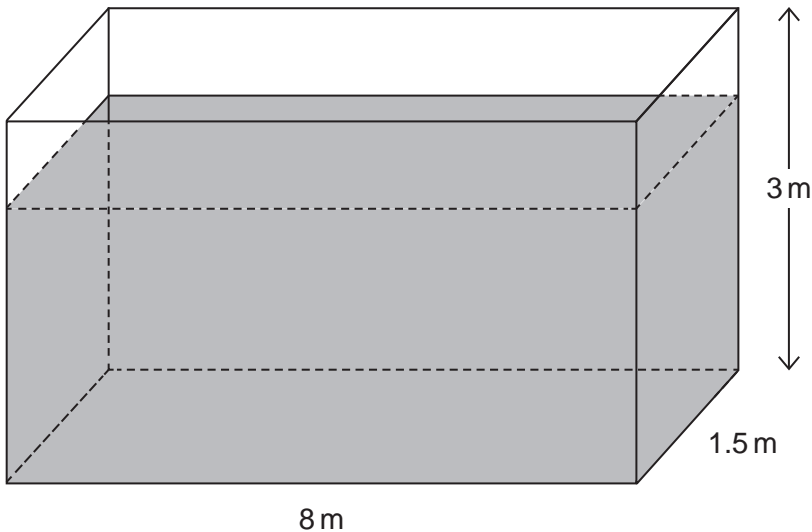
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$x = \dots\dots\dots$  degrees,  $y = \dots\dots\dots$  degrees





\*6 This water tank is a cuboid.



You are given that 1 cubic metre holds 1000 litres.

The tank is five-sixths full of water.  
Water is leaking from the tank at a rate of 20 litres per minute.

How long will it take the tank to empty?  
Give your answer in hours.

[5 marks]

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Answer ..... hours

10

Turn over ►



7 The diagram shows a map of Poland.



Choose one of the following three-figure bearings to complete each sentence correctly.

045°

090°

035°

180°

225°

270°

315°

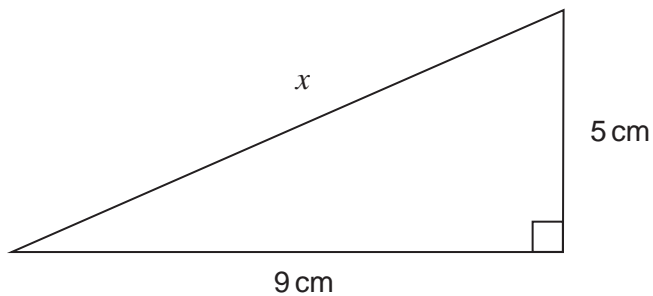
360°

7 (a) The bearing of Krakow from Gdansk is ..... [1 mark]

7 (b) The bearing of Gdansk from Poznan is ..... [1 mark]



8



Not drawn  
accurately

Work out the length  $x$   
Give your answer to 1 decimal place.

[4 marks]

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Answer ..... cm

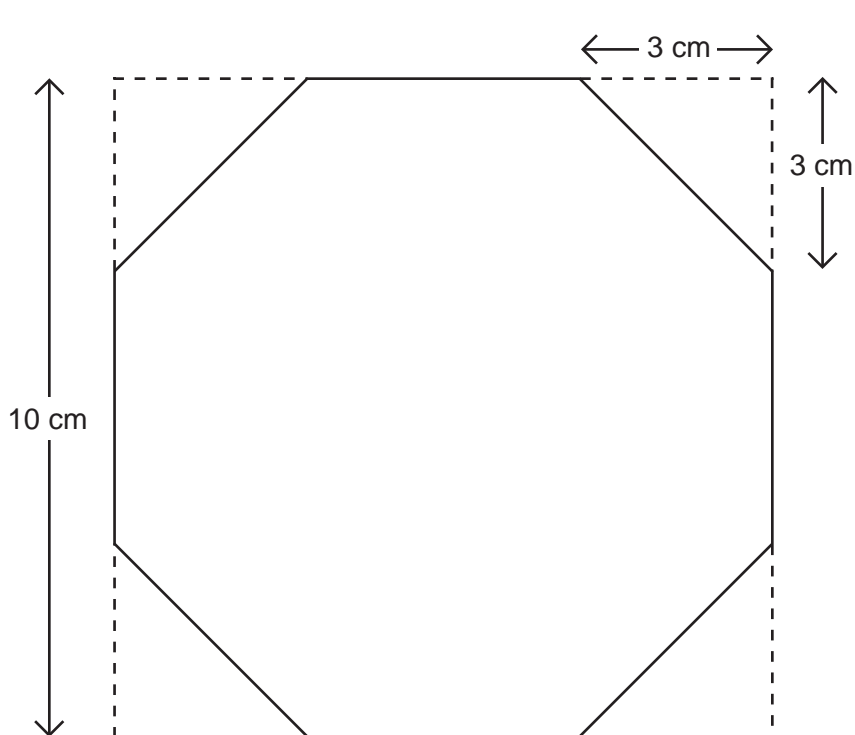
Turn over for the next question

6

Turn over ►



9 An octagon is made by cutting four identical triangles from a square sheet of gold as shown.



Not drawn accurately

9 (a) Show that the area of the octagon is  $82 \text{ cm}^2$ .

[4 marks]

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**9 (b)** The original square sheet of gold has a value of £750

The octagon shape is made into a piece of jewellery.  
This increases the value of the gold in the octagon shape by 90%

Work out the new value of the gold in the octagon shape.

**[4 marks]**

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Answer £ .....

**Turn over for the next question**

8

**Turn over ►**



10

You will need a ruler and compasses for this question.

Draw accurately the locus of a point which is always 5 cm from the line.

[3 marks]



**11** Circle the correct words to complete each sentence.

**11 (a)**  $x^2 + 3x = 16$  is **[1 mark]**

an expression      an equation      a formula      an identity

**11 (b)**  $V = \pi r^2 h$  is **[1 mark]**

an expression      an equation      a formula      an identity

**11 (c)**  $(x + 3)^2 \equiv x^2 + 6x + 9$  is **[1 mark]**

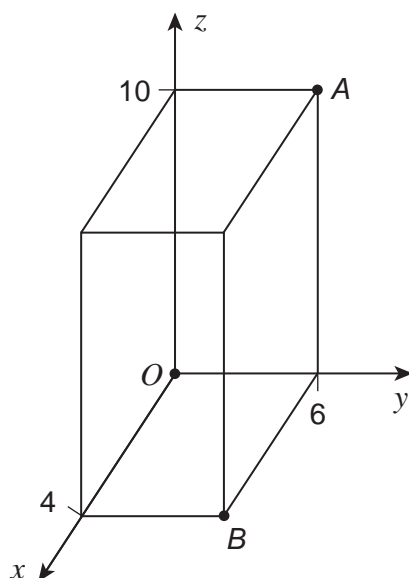
an expression      an equation      a formula      an identity

**11 (d)**  $2x + 3y$  is **[1 mark]**

an expression      an equation      a formula      an identity



- 12** The coordinates of four of the vertices of a cuboid are  $(0, 0, 0)$ ,  $(4, 0, 0)$ ,  $(0, 6, 0)$  and  $(0, 0, 10)$ .



- 12 (a)** Write down the coordinates of vertex  $A$ .

[1 mark]

Answer ( ..... , ..... , ..... )

- 12 (b)** Write down the coordinates of vertex  $B$ .

[1 mark]

Answer ( ..... , ..... , ..... )





12 (c) Work out the total surface area of the cuboid.

[3 marks]

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Answer ..... square units

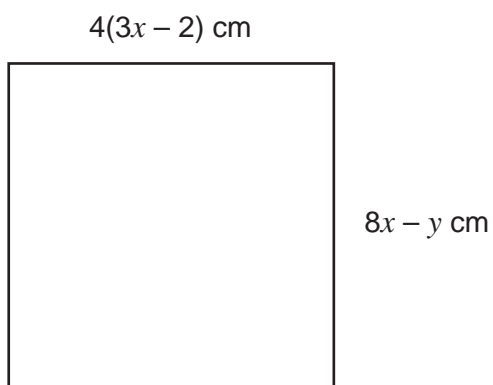
Turn over for the next question

5

Turn over ►



13 The diagram shows a square with area  $100 \text{ cm}^2$



Not drawn  
accurately

Work out the values of  $x$  and  $y$ .

[6 marks]

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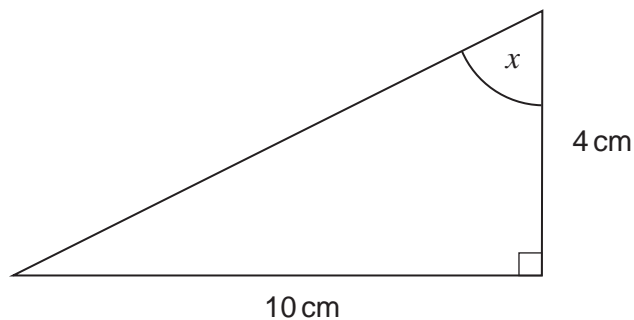
$x =$  .....

$y =$  .....



14

Not drawn  
accurately



Work out the size of angle  $x$ .

[3 marks]

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Answer ..... degrees

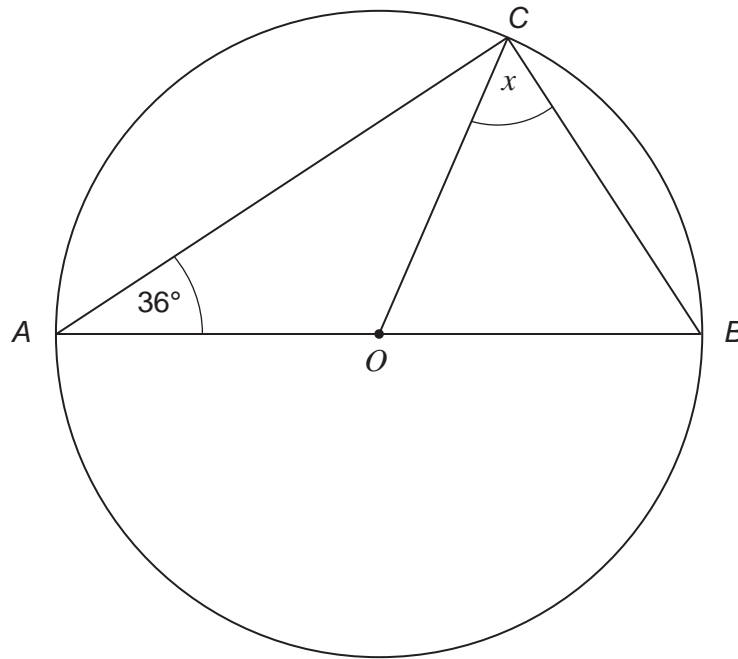
Turn over for the next question

9

Turn over ►



15 (a) The diagram shows a circle, centre  $O$ , with diameter  $AB$ .



Not drawn  
accurately

Work out the size of angle  $x$   
You **must** show your working, which may be on the diagram.

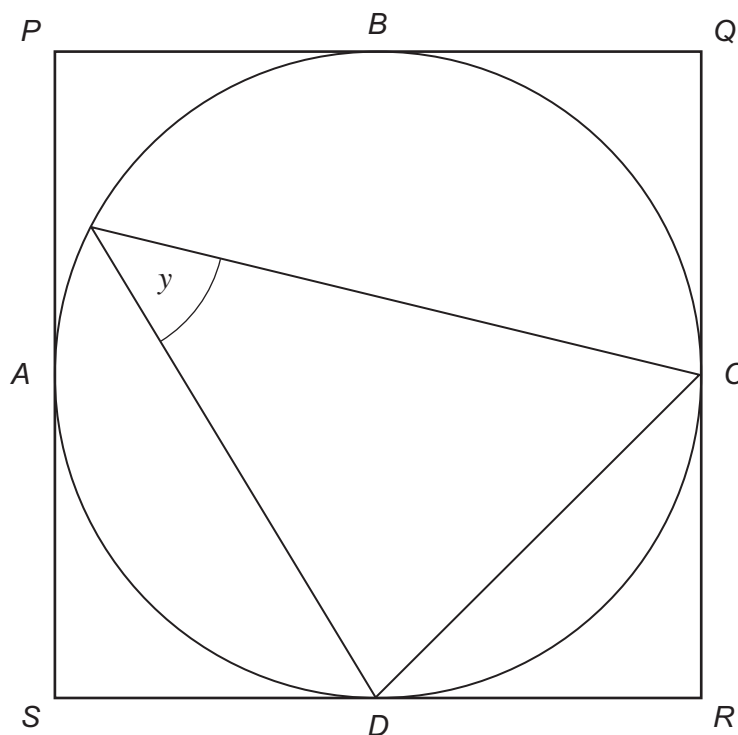
[2 marks]

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Answer ..... degrees



\*15 (b) The diagram shows a circle touching a square at  $A, B, C$  and  $D$ .



Not drawn accurately

Give reasons to show why  $y = 45^\circ$

[3 marks]

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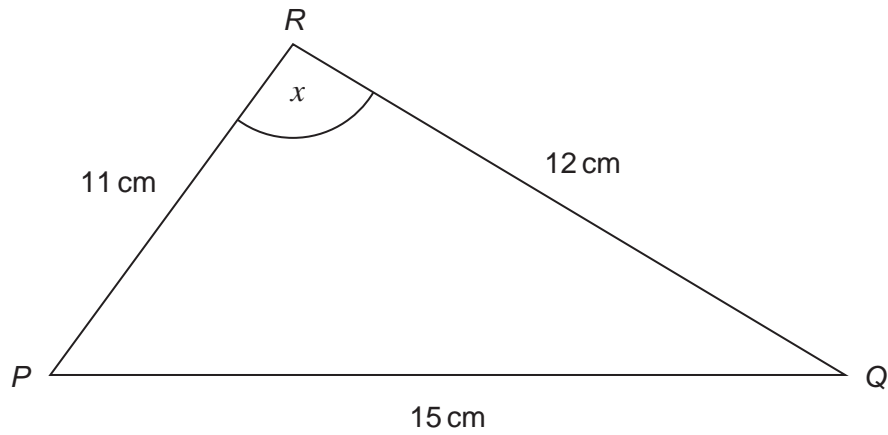
5
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Turn over ►



16 (a)

Not drawn  
accurately



Use the cosine rule to work out the size of angle  $x$ .

[3 marks]

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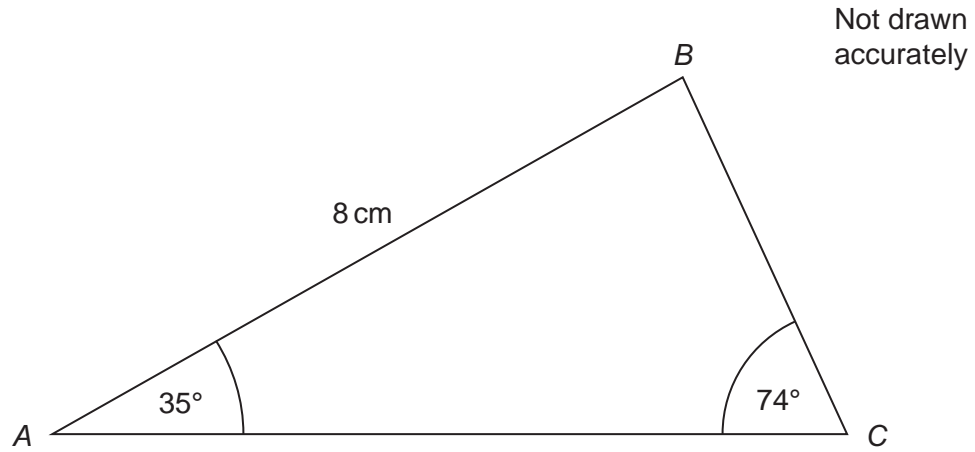
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Answer ..... degrees



16 (b)



Use the sine rule to work out the length  $BC$ .

[3 marks]

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Answer ..... cm

6

Turn over ►



17 Solve the quadratic equation  $3x^2 - 12x - 5 = 0$

Give your answers to 2 decimal places.

**[3 marks]**

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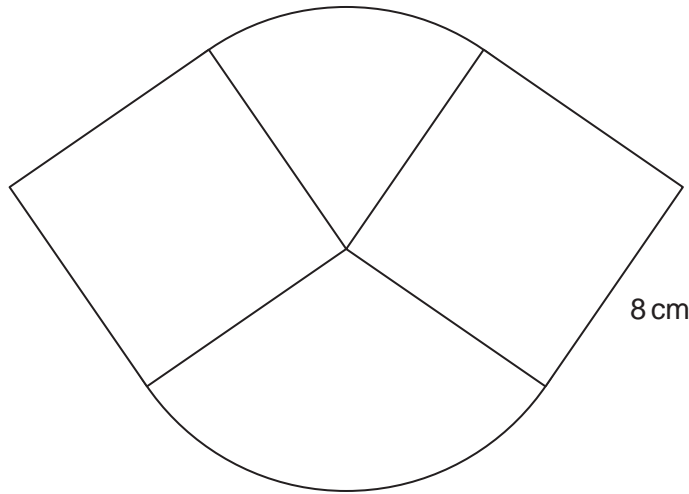
Answer .....





**\*18**

This shape is made from two sectors and two squares of side 8 cm.  
The radius of each sector is also 8 cm.



Not drawn  
accurately

Work out the total area of the shape.

**[4 marks]**

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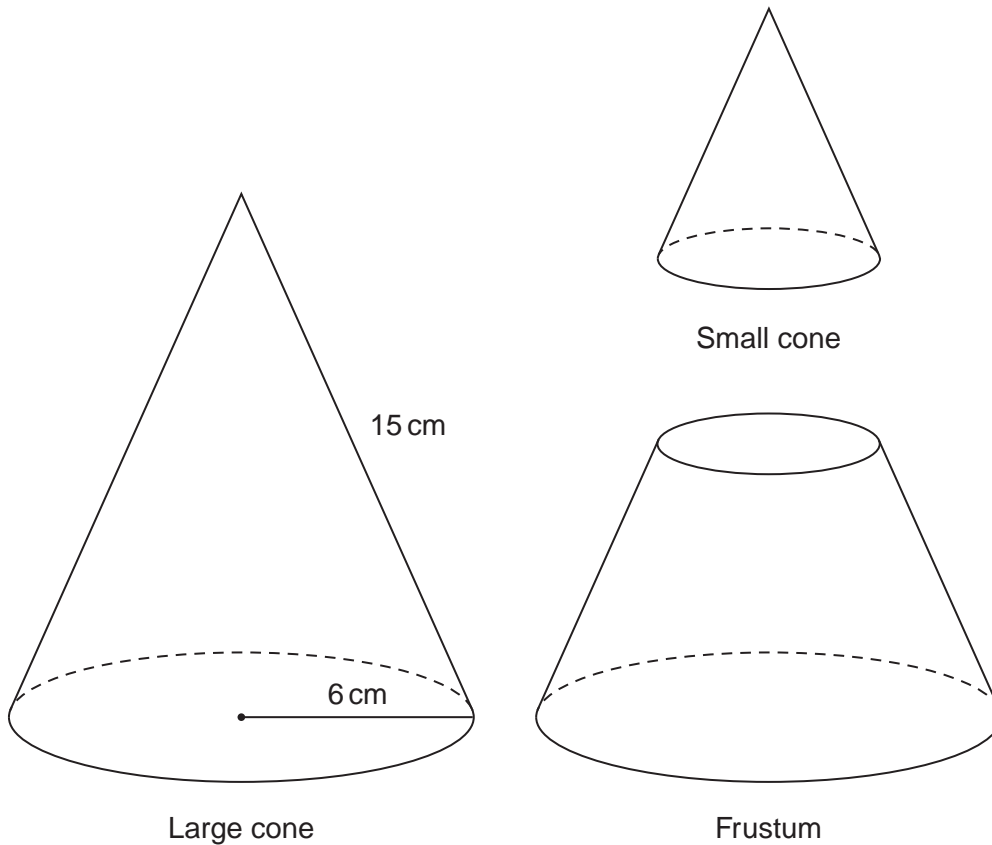
Answer ..... cm<sup>2</sup>

7

Turn over ►



19 A frustum is made by cutting a small cone from the top of a large cone as shown.



The slant height of the large cone is 15 cm.  
The radius of the base of the large cone is 6 cm.

The height of the small cone is half the height of the large cone.

Work out the **curved** surface area of the frustum.

**[4 marks]**

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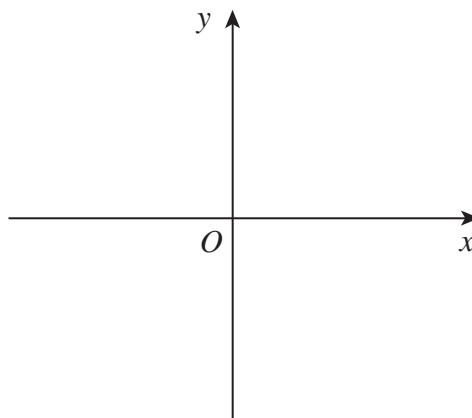
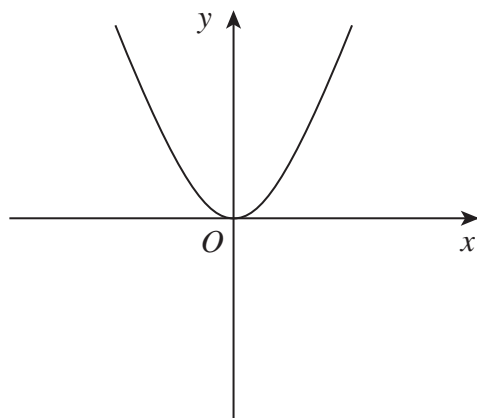
Answer ..... cm<sup>2</sup>



**20 (a)** The diagram shows a sketch of the graph  $y = x^2$

On the blank grid sketch a graph of  $y = -x^2 + 2$

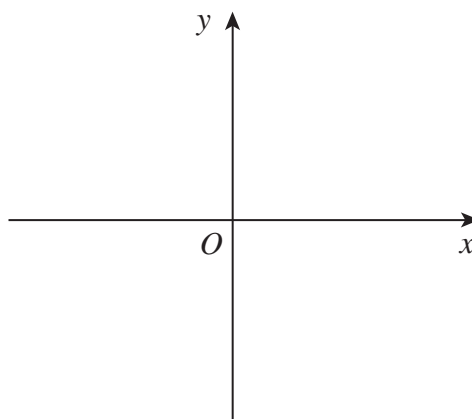
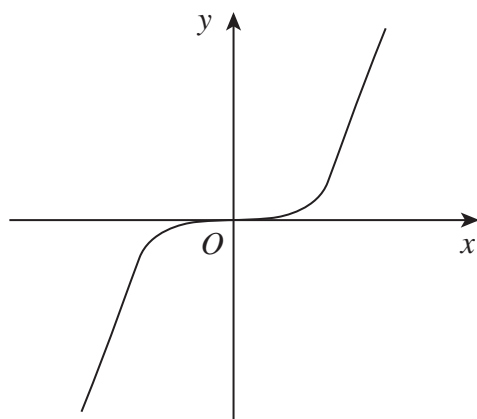
**[2 marks]**



**20 (b)** This diagram shows a sketch of the graph  $y = x^3$

On the blank grid sketch a graph of  $y = x^3$  after a translation by the vector  $\begin{pmatrix} -5 \\ 5 \end{pmatrix}$

**[2 marks]**



**END OF QUESTIONS**



**There are no questions printed on this page**

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