Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Higher Tier
June 2014

Mathematics

43603H

Unit 3

H

Friday 13 June 2014   9.00 am to 10.30 am

For this paper you must have:
- a calculator
- mathematical instruments.

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 π button, take the value of π 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.

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a+b)h$
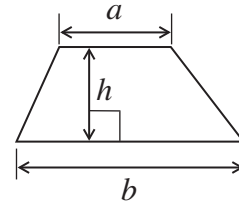
Volume of prism = area of cross-section × length
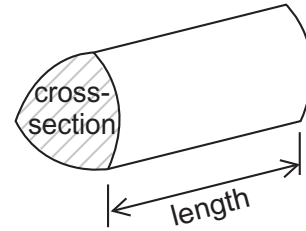
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$
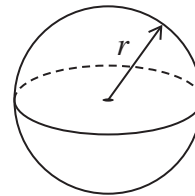
Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$
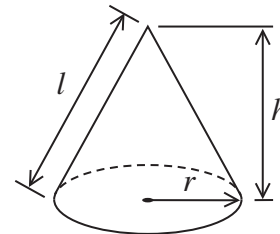
In any triangle ABC

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

Sine rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$
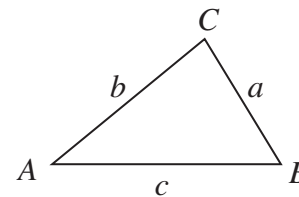
The Quadratic Equation

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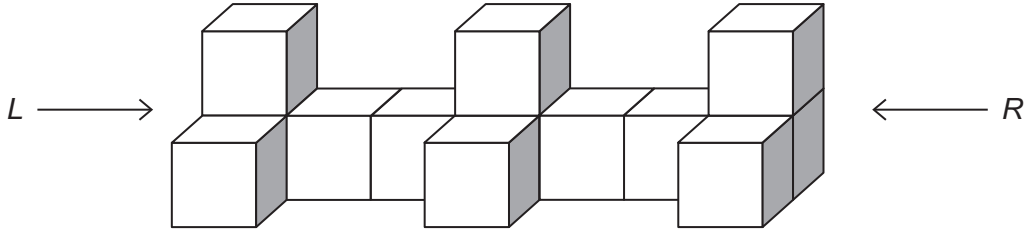
On the grids, draw the side elevations from *L* and *R* and the plan view.

[3 marks]

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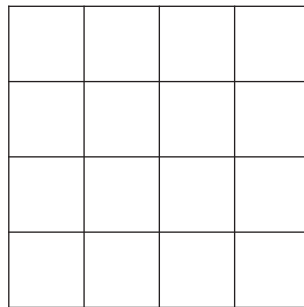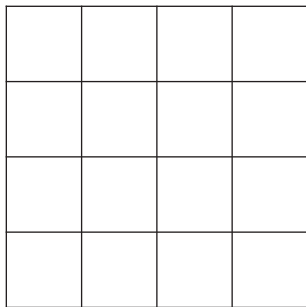
Plan view
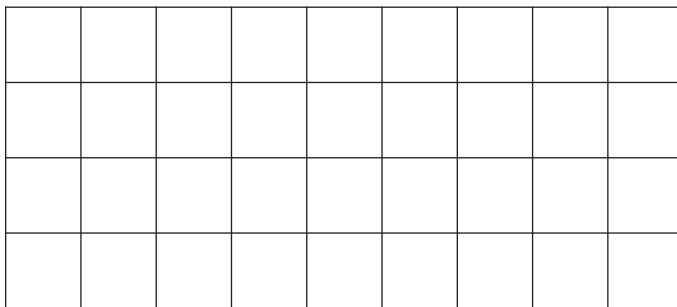
2 The diagram shows a full-size drawing of a drinking glass.
The glass is a cylinder with radius 3 cm and height 14 cm.

Rim

14 cm

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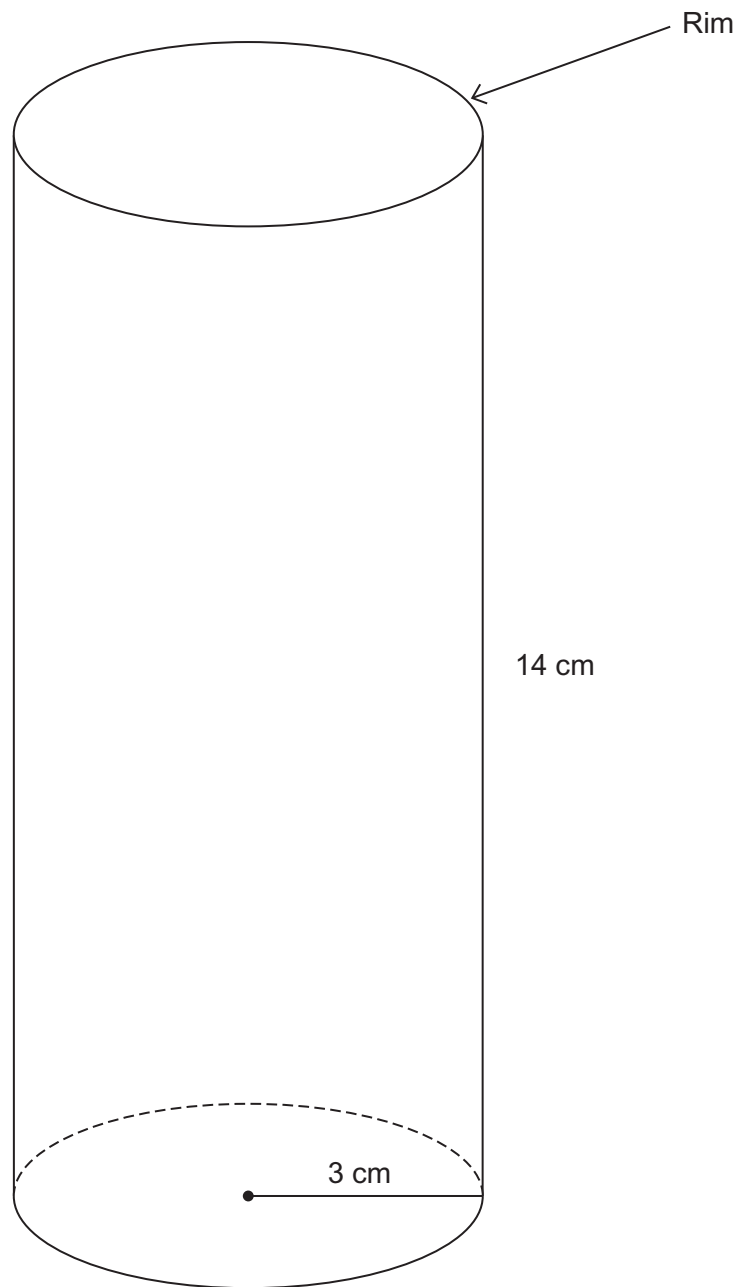
A man claims that the circumference of the rim is greater than the height of the glass.

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.
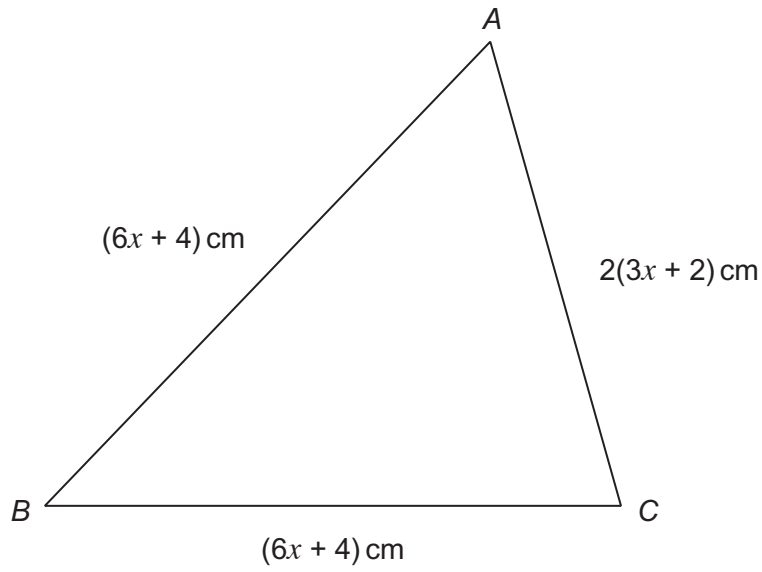
Not drawn accurately

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

[2 marks]

Answer ....

Reason ....

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4
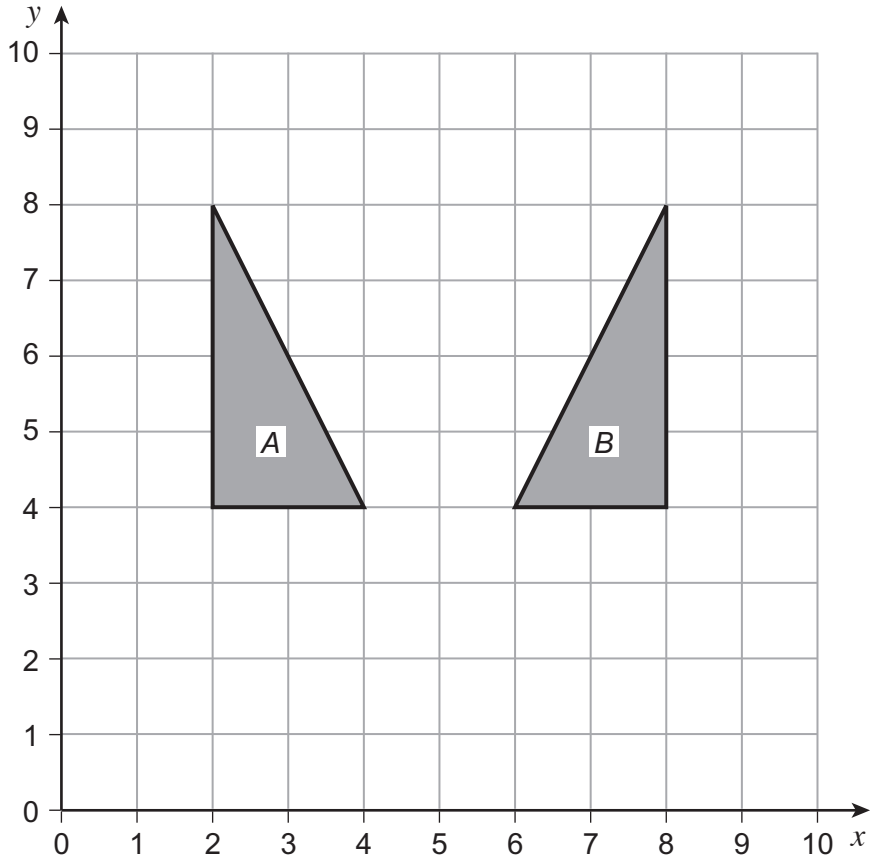
Describe fully the **single** transformation that maps shape *A* to shape *B*.

[2 marks]

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Turn over for the next question

4

Turn over ▶

5

Not drawn accurately
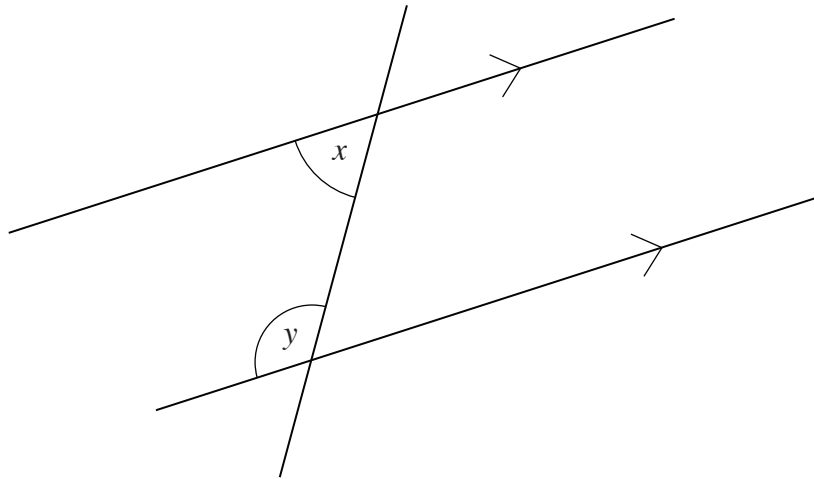
5 (a) Use the diagram to write an equation connecting x and y.

[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 = ... degrees, y = ... degrees

*6 This water tank is a cuboid.

3 m

1.5 m

8 m
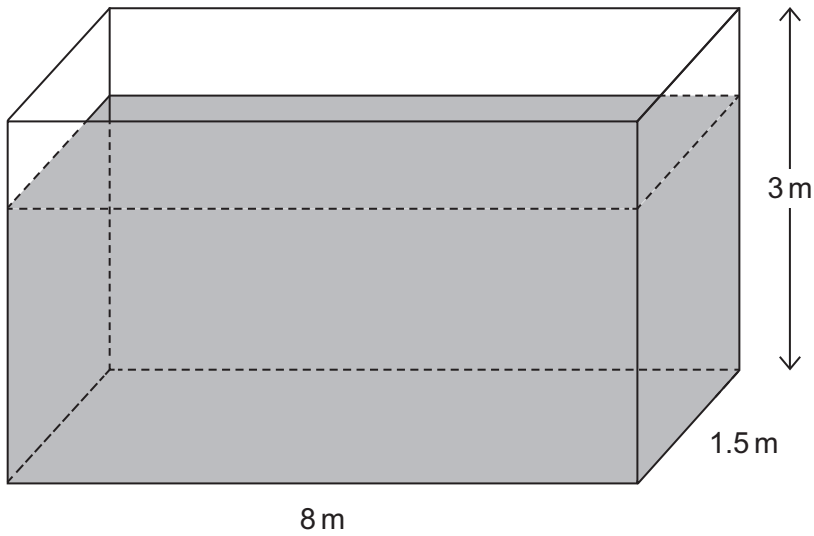
You are given that 1 cubic metre holds 1000 litres.

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

5 cm

9 cm
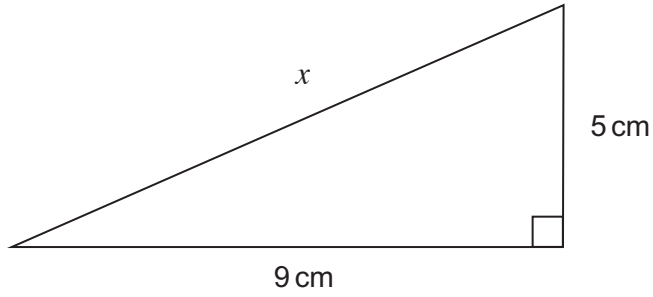
Not drawn accurately

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

3 cm

3 cm

10 cm
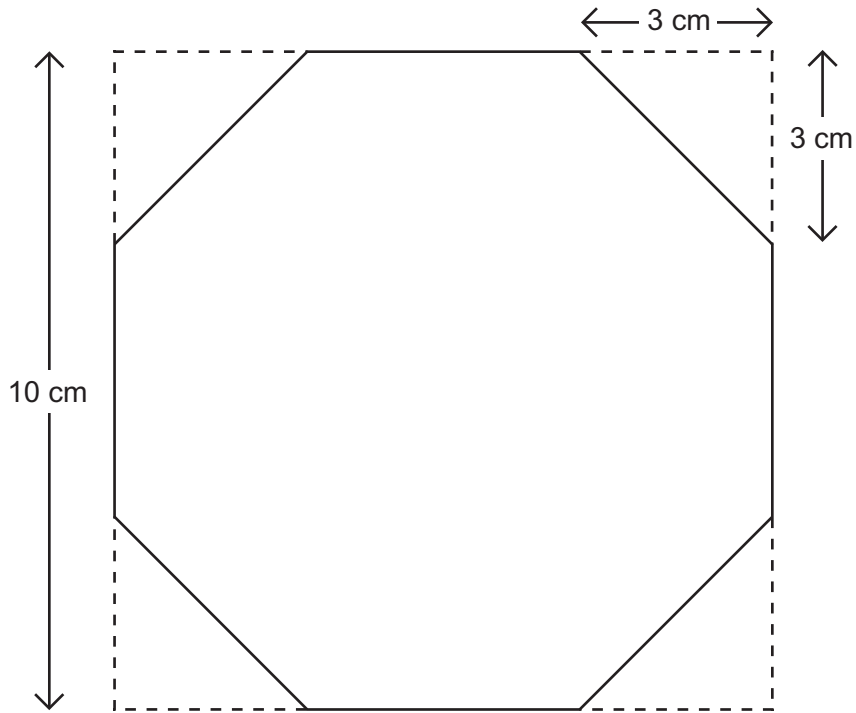
9 (a) Show that the area of the octagon is 82 cm^2.

[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

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

Turn over ▶

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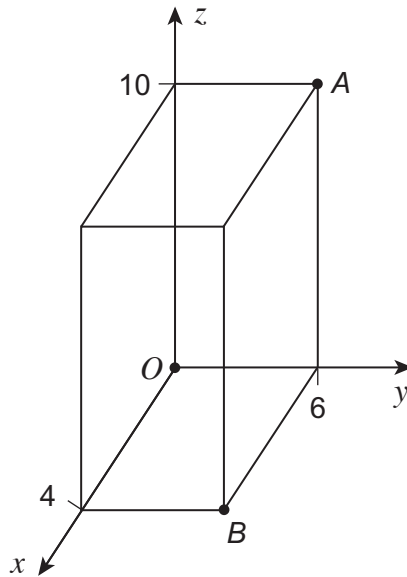
12 (a) Write down the coordinates of vertex *A*.

[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 cm²

$4(3x - 2)$ cm

Not drawn accurately

$8x - y$ cm
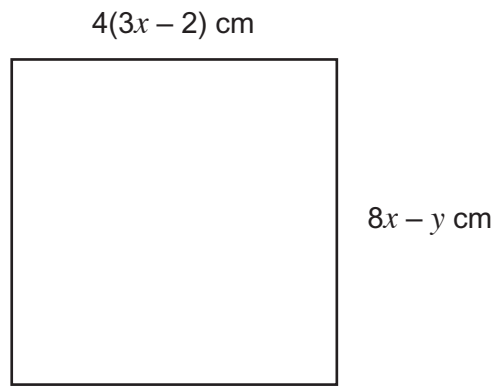
Work out the values of x and y.

[6 marks]

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$x =$ ....

$y =$ ....

14

Not drawn accurately

x

4 cm

10 cm
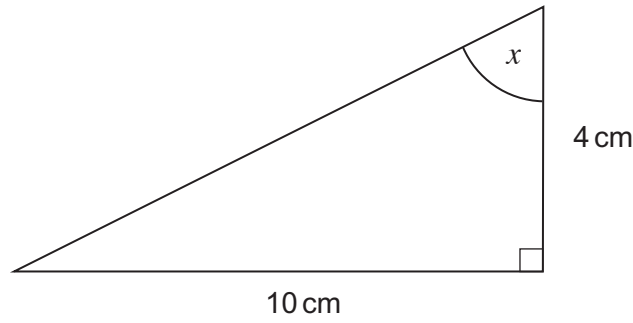
Work out the size of angle x.

[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*.
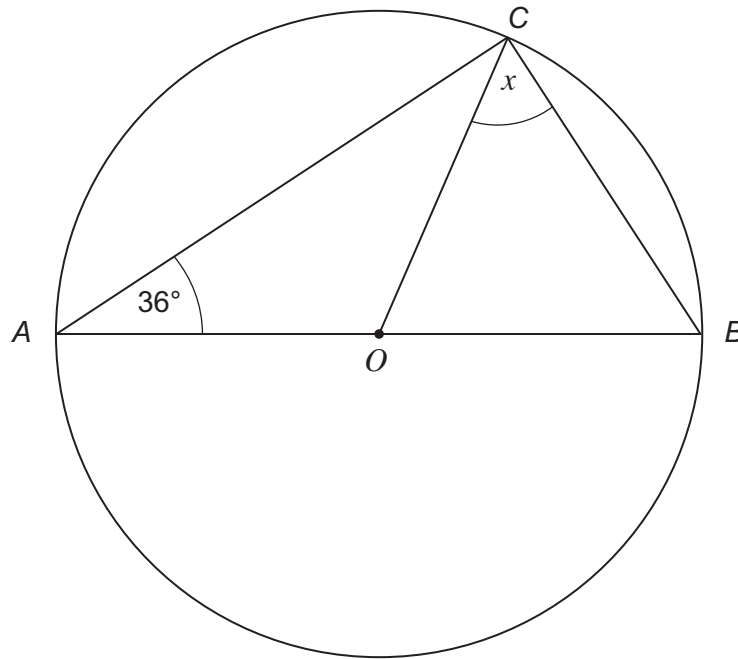
Not drawn
accurately

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*.
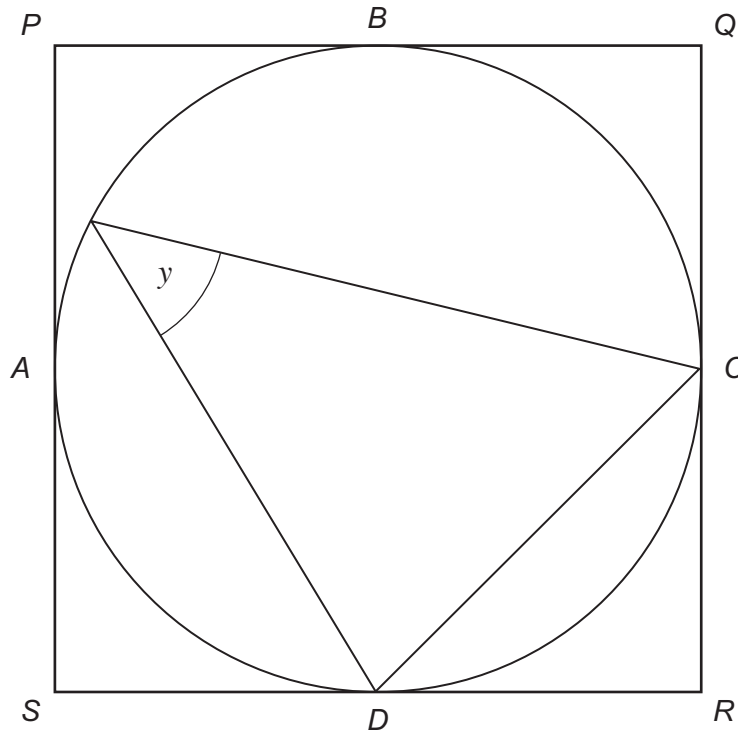
Not drawn
accurately

Give reasons to show why *y* = 45º

[3 marks]

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Turn over ▶

2 1

16 (a)

Not drawn
accurately
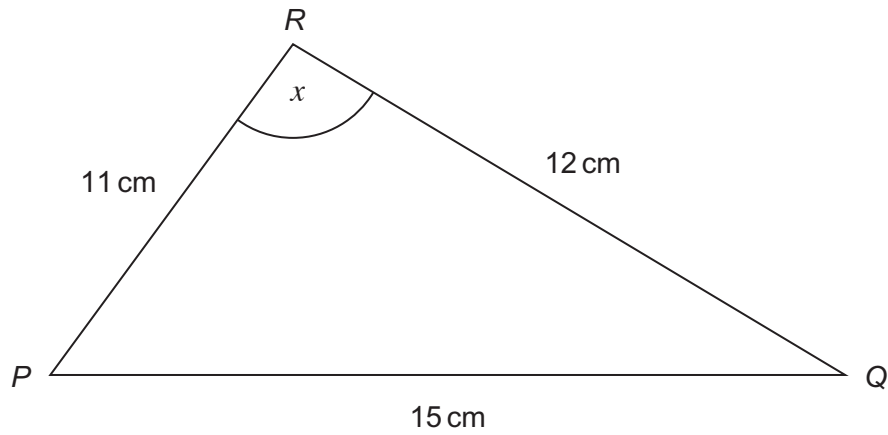
Use the cosine rule to work out the size of angle x.

[3 marks]

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Answer .... degrees

16 (b)

B

Not drawn accurately

8 cm

35°

74°

A

C
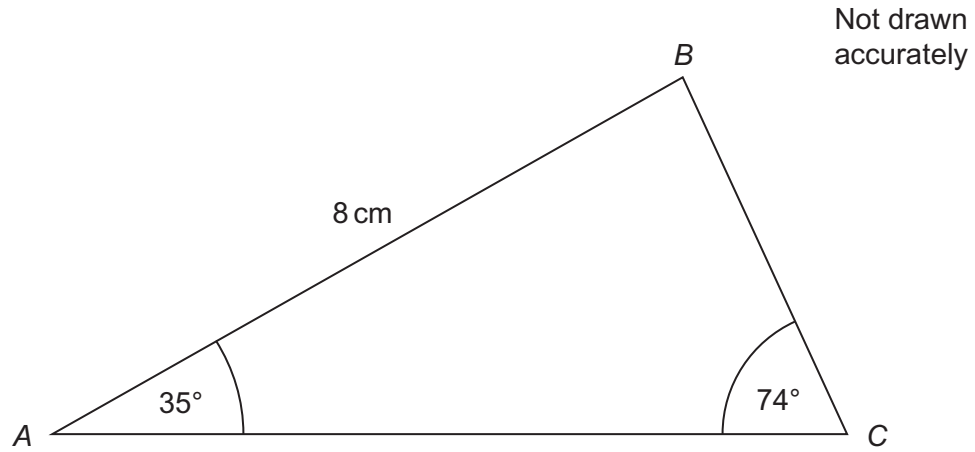
Use the sine rule to work out the length *BC*.

[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

8 cm

Work out the total area of the shape.

[4 marks]

....
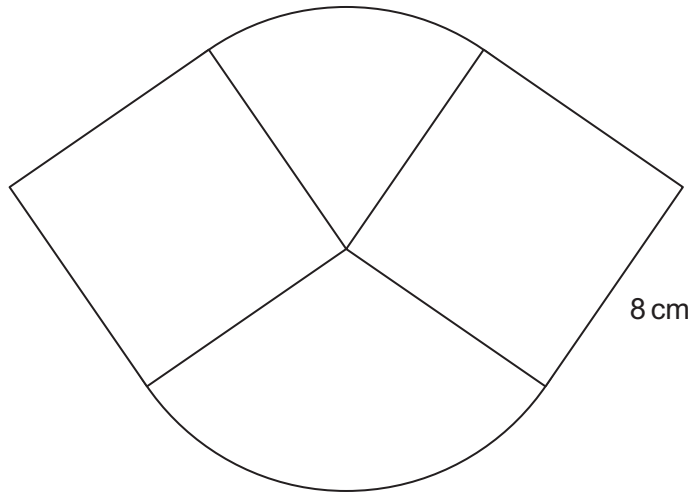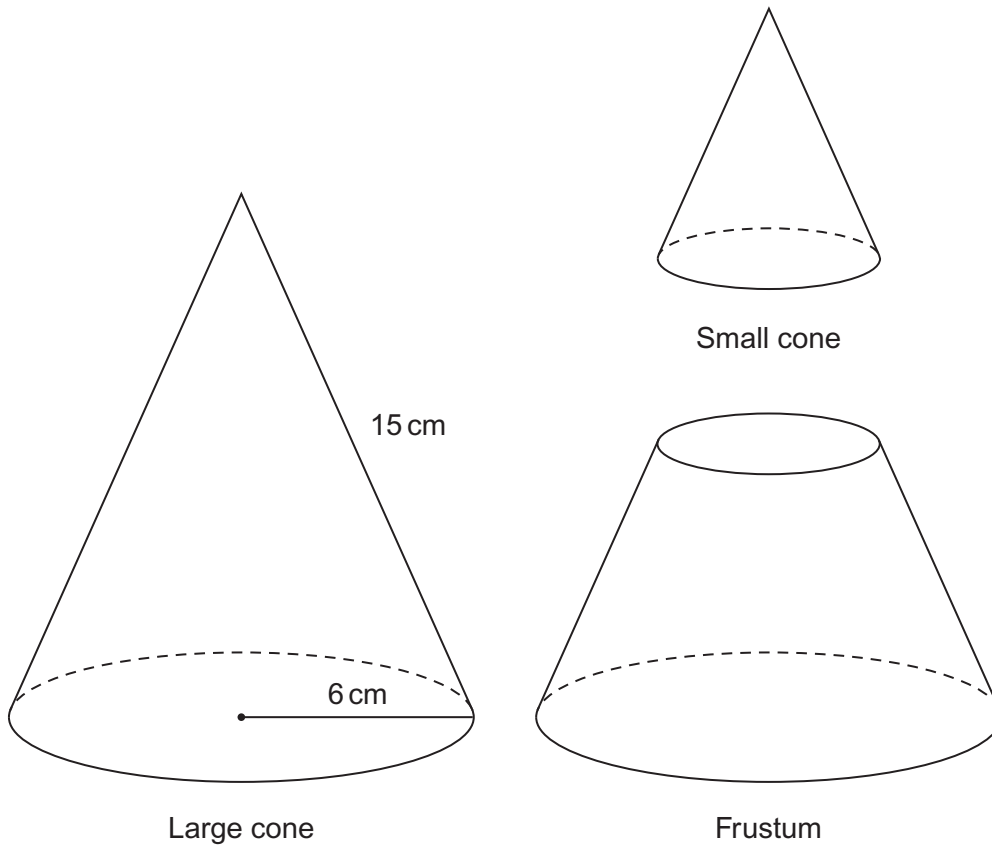
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Answer .... cm^2

7

Turn over ▶

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

Small cone

15 cm

6 cm

Large cone

Frustum

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.
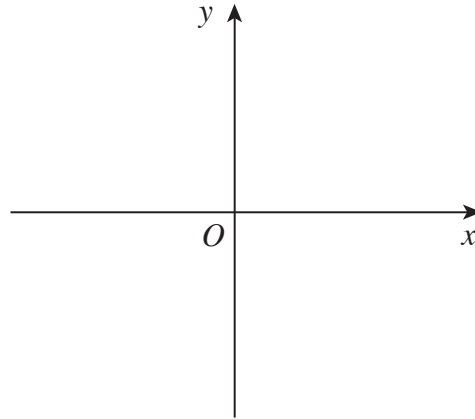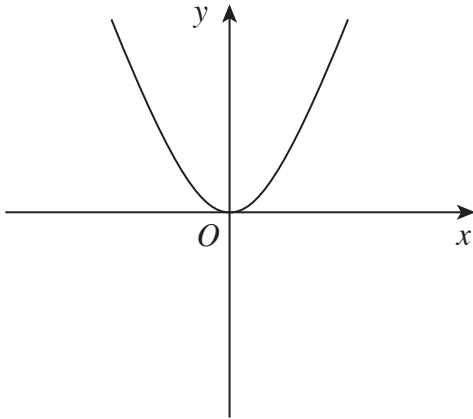
[4 marks]

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Answer .... cm^2

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

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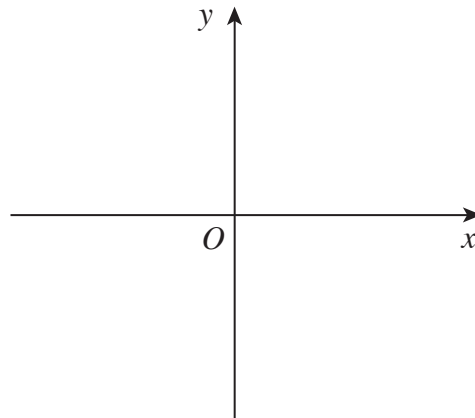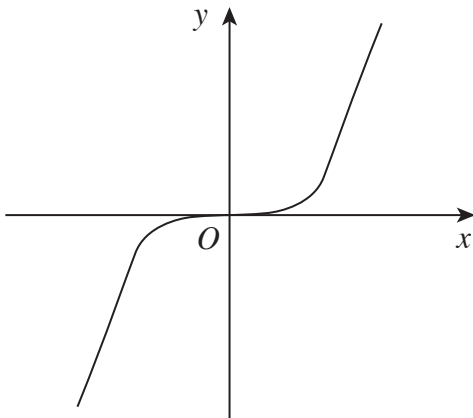
[2 marks]

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

8

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED