AQA

GCSE MATHEMATICS

H

Higher Tier   Unit 3   Geometry and Algebra

Tuesday 8 November 2016   Morning   Time allowed: 1 hour 30 minutes

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

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- 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. Cross through any work that you do not want to be marked.
- 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.
- Quality of written communication is specifically assessed in Questions 1 and 5. 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.
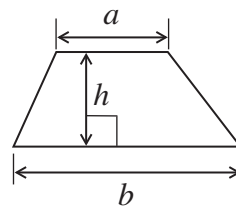
Advice
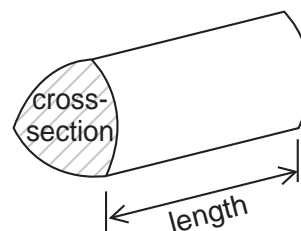- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier
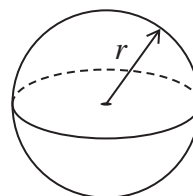
Area of trapezium = $\frac{1}{2}(a+b)h$

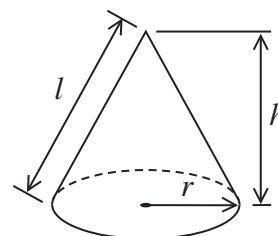**Volume of prism** = area of cross-section × length

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

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

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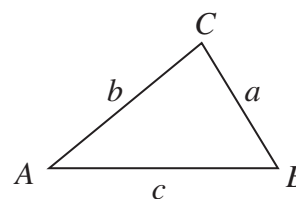
Curved surface area of cone = $\pi r l$

In any triangle ABC

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

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

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 The same type of shirt is sold in two shops.

Shop A

£19.90

Buy one
get second for half price

Shop B

£18

Get a 15% discount
when you buy two

Which shop is cheaper for buying **two** of these shirts?
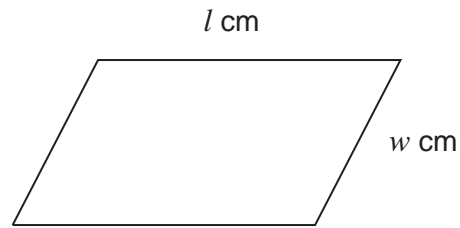You **must** show your working.

[5 marks]

_____

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_____

Answer _____

Turn over ▶

2 (a)

l cm

w cm

The perimeter of the parallelogram is P cm

Circle the correct formula.

[1 mark]
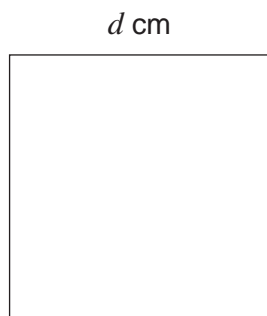
$P = l + w$ $P = lw$ $P = 2(l + w)$ $P = 2lw$

2 (b)

d cm

The area of the square is A cm^2

Circle the correct formula.

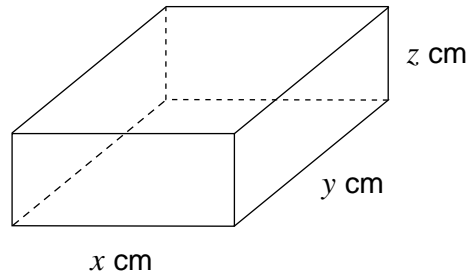**[1 mark]**

$A = 2d$ $A = 4d$ $A = \sqrt{d}$ $A = d^2$

2 (c)

The surface area of the cuboid is S cm^2

Circle the correct formula.

[1 mark]

$S = xyz$ $S = (xyz)^2$ $S = 6xyz$ $S = 2(xy + xz + yz)$

2 (d) The surface area of a **cube** is 150 cm^2
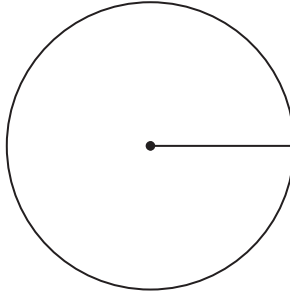
Work out the volume of the cube.

[4 marks]

_____

_____

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_____

_____

Answer _____ cm^3

7

Turn over ▶

3 (a) The radius of this circle is 2.5 cm
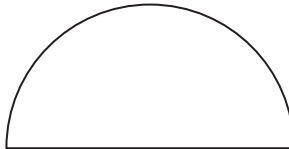
Not drawn accurately

Work out the area.
Give your answer to 1 significant figure.

[3 marks]

_____

_____

Answer _____ cm^2

3 (b) The diameter of this semicircle is 16 cm

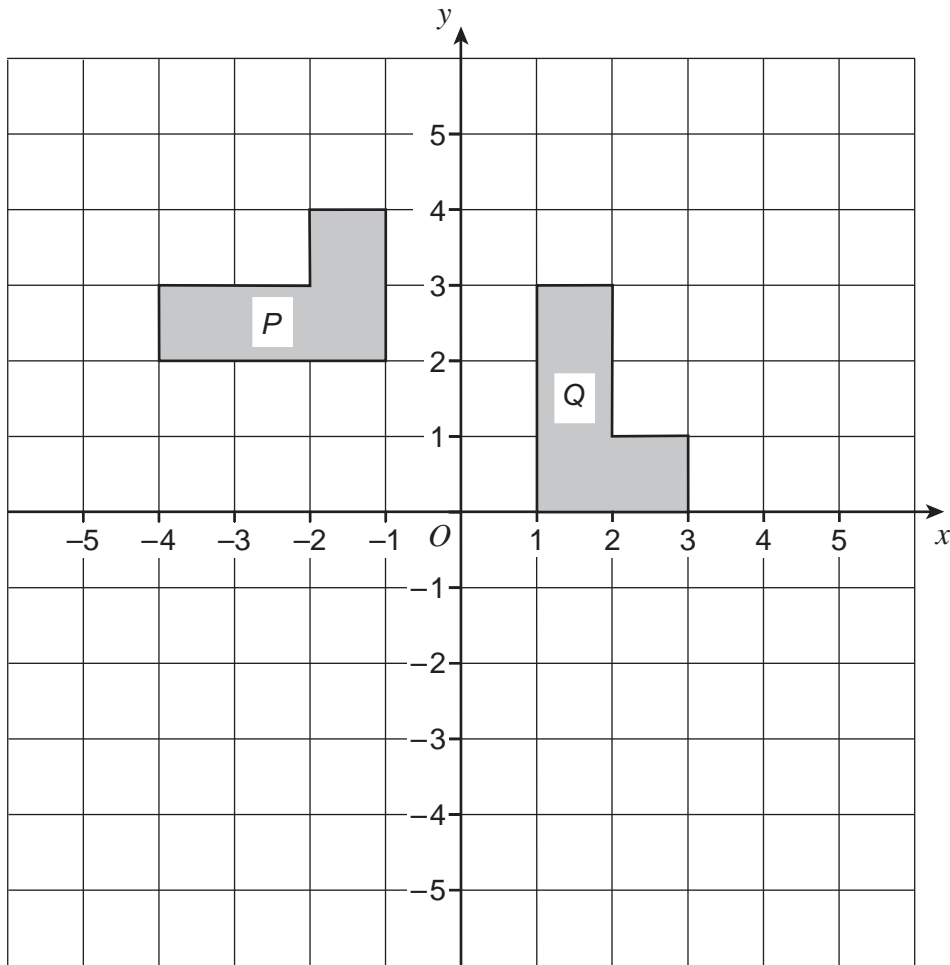Not drawn accurately

Work out the perimeter of the semicircle.

[3 marks]

_____

_____

_____

_____

_____

Answer _____ cm

4 (a) Describe fully the **single** transformation that maps shape *P* to shape *Q*.

[3 marks]

_____

_____

_____

4 (b) On the grid, translate shape *Q* by vector $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$

[2 marks]

11

*5 Use trial and improvement to find a positive solution to $x^3 - 10x = 6$
Give your answer to 1 decimal place.

[4 marks]

x	$x^3 - 10x$	Comment
4	24	Too big

$x =$ _____

6 Ali is going to drive 210 miles.

He has 27 **litres** of petrol in his car.
His car travels 36 miles for each **gallon** of petrol.

Does he have enough petrol for the journey?
You **must** show your working.

[4 marks]

_____
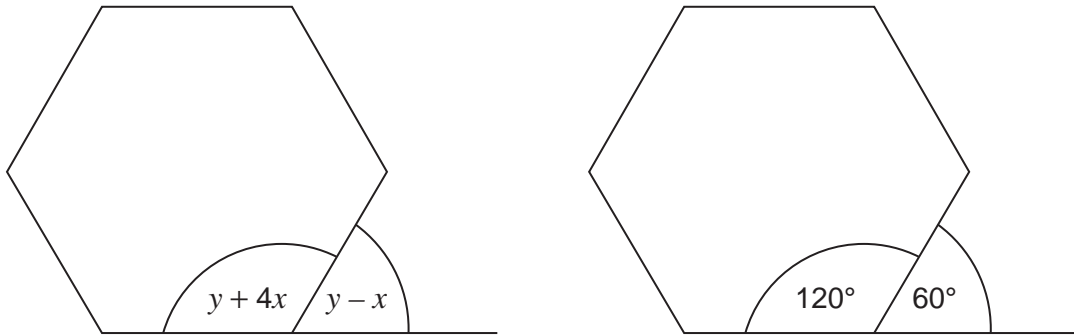
_____

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Answer _____

Turn over for the next question

8

Turn over ▶

7 The diagram shows two regular hexagons with the base lines extended.
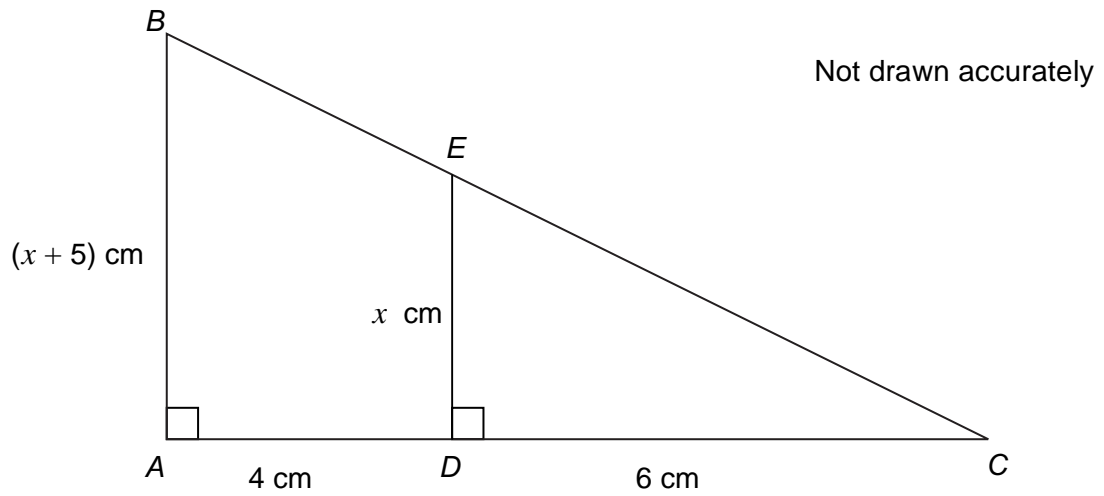

Work out the values of x and y.

[5 marks]

_____

_____

_____

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_____

$x =$ _____ degrees

$y =$ _____ degrees

8 *ABC* and *DEC* are similar triangles.

Not drawn accurately

$(x + 5)$ cm

x cm

B

E

A

D

C

4 cm

6 cm

Work out the value of x.

[4 marks]

_____

_____

_____

_____

_____

_____

Answer _____ cm

9 *ABCD* is a square.
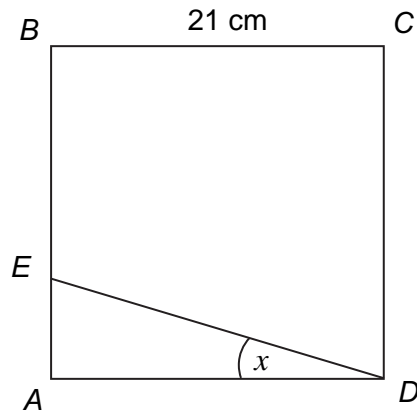
Not drawn accurately

$AE = \dfrac{2}{5} EB$

Work out the size of angle x.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

Answer _____ degrees

10 (a)

Not drawn accurately

5 cm

3 cm

x

4 cm
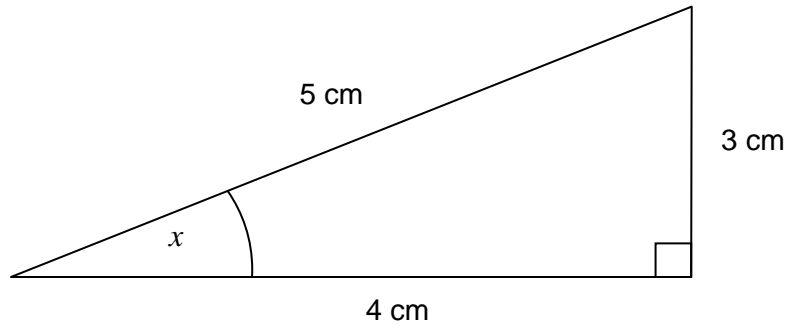
Circle the value of sin x.

[1 mark]

$\dfrac{3}{5}$ $\dfrac{3}{4}$ $\dfrac{4}{5}$ $\dfrac{4}{3}$ $\dfrac{5}{3}$

10 (b)

Not drawn accurately

6 cm

y

3 cm
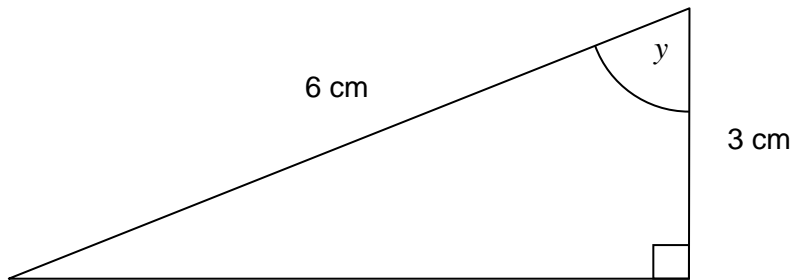
Circle the size of angle y.

[1 mark]

30°   36°   45°   50°   60°

6

Turn over ▶

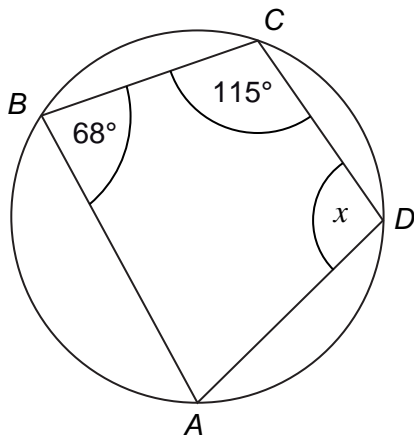**11 (a)**   *E, F* and *G* are points on a circle, centre *O*.
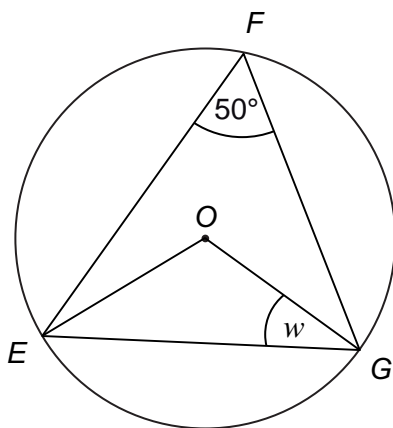
Not drawn accurately

Work out the size of angle w.

[2 marks]

_____

Answer _____ degrees

11 (b)   *A*, *B*, *C* and *D* are points on the circumference of the circle.

Not drawn accurately

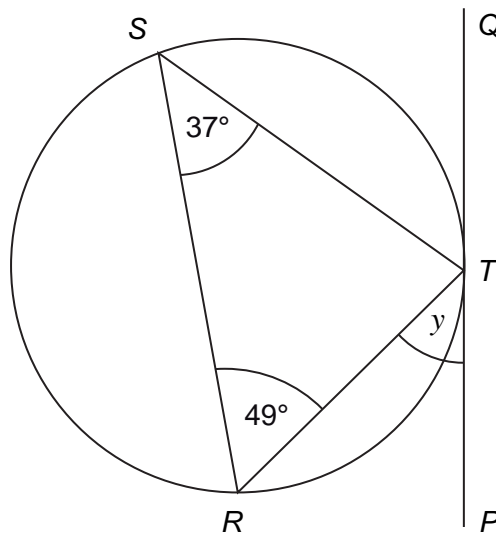Work out the size of angle x.
Give a reason for your answer.

[2 marks]

Answer _____ degrees

Reason_____

_____

11 (c)   *PTQ* is a tangent to the circle.
R, S and *T* are points on the circle.

Not drawn accurately

Write down the size of angle *y*.
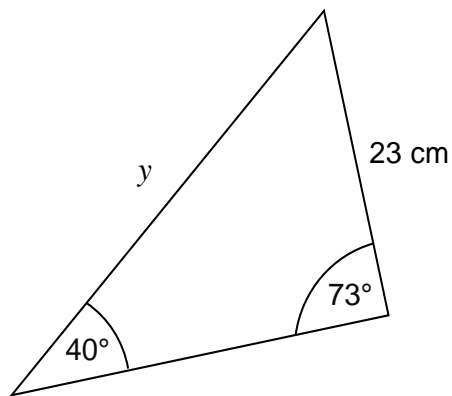Give a reason for your answer.

[2 marks]

Answer _____ degrees
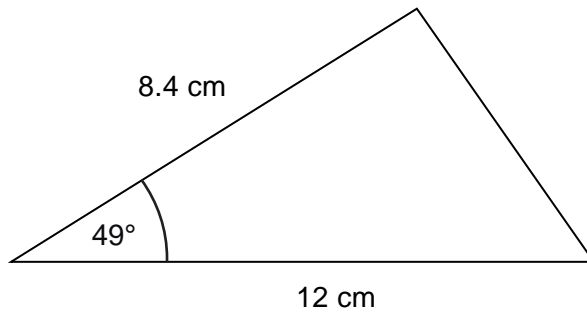
Reason _____

_____

Turn over for the next question

6

Turn over ▶

12 Work out length y.

Not drawn accurately

[3 marks]

_____

_____

_____

_____

_____

_____

Answer _____ cm

13 Work out the area of the triangle.

8.4 cm

49°

12 cm

Not drawn accurately

[2 marks]

_____

_____

_____

Answer _____ cm^2

14 Solve $2x^2 + 3x - 6 = 0$

Give your answers to 2 decimal places.

[3 marks]

_____

_____

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Answer _____ and _____

8

Turn over ▶

15 The area of this rectangle is 28 cm^2

Not drawn accurately

$(x + 2)$ cm

$(6x - 1)$ cm
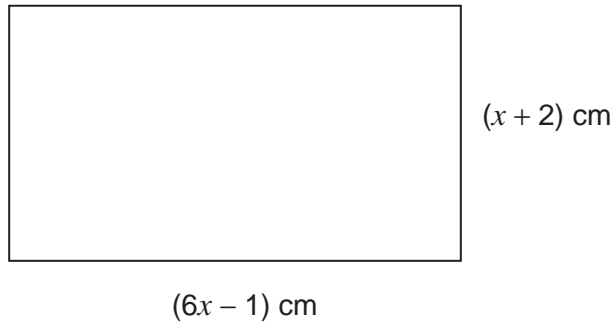
Work out the perimeter of the rectangle.

[7 marks]

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Answer _____ cm

16 Work out the size of angle x.

32 cm

40 cm

Not drawn accurately

55 cm

[3 marks]

_____

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Answer _____ degrees

Turn over for the next question
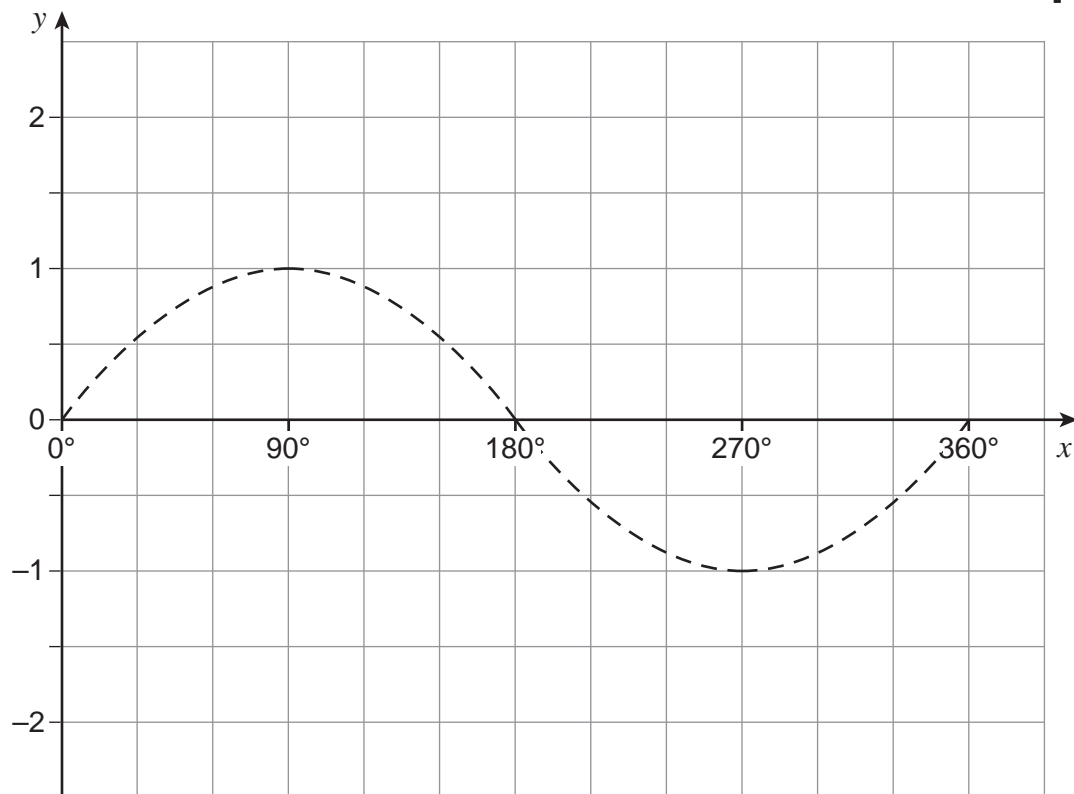
10

Turn over ▶

17   The graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$ is shown.
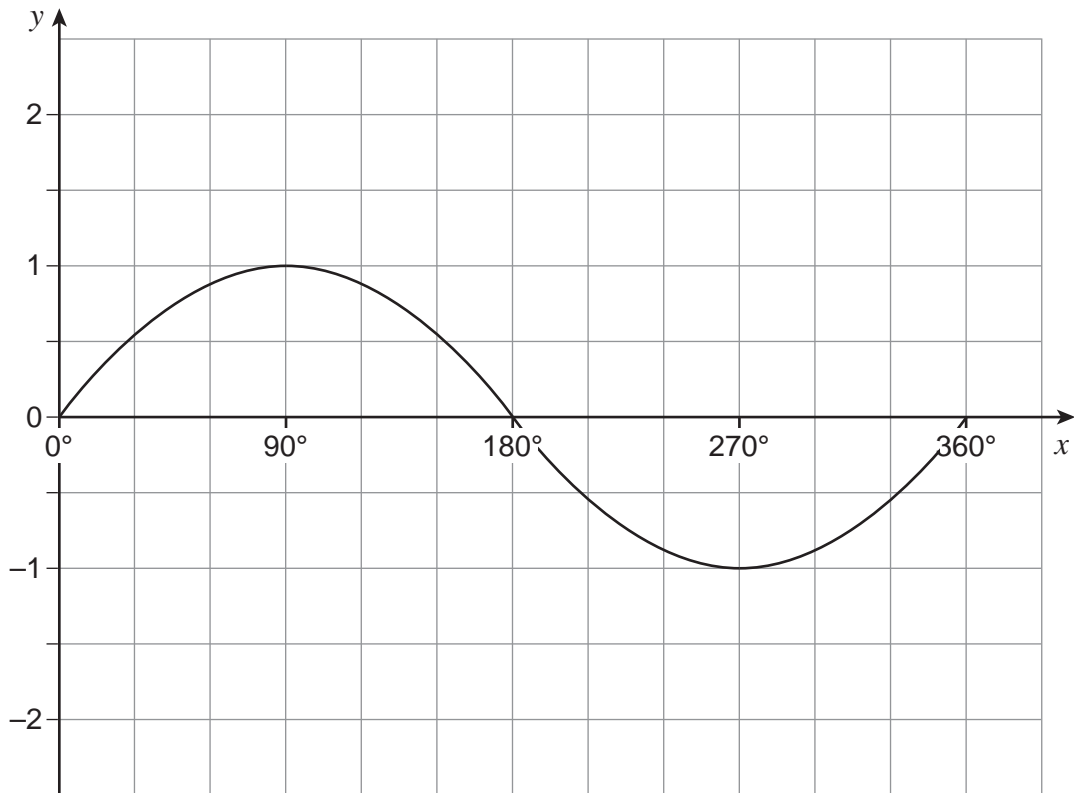
17 (a)   On the grid below, draw the graph of $y = 1 + \sin x$ for $0° \leqslant x \leqslant 360°$

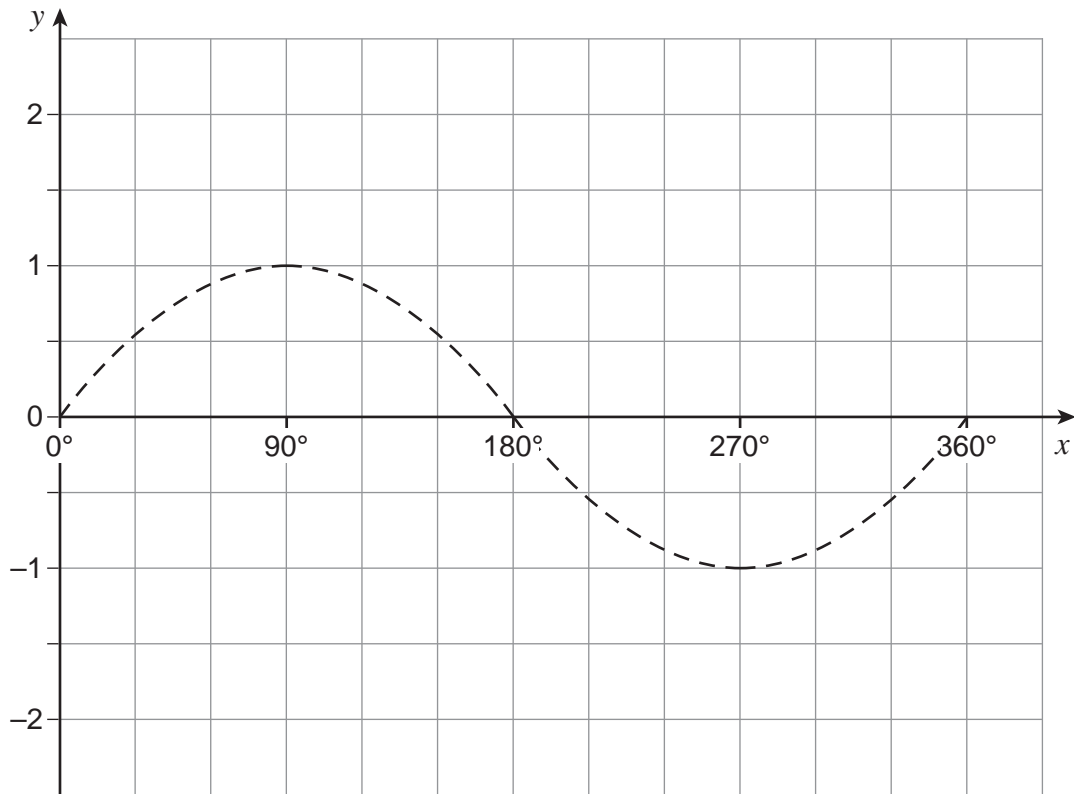The graph of $y = \sin x$ is shown to help you.

[1 mark]

17 (b) On the grid below, draw the graph of $y = \sin(x + 90°)$ for $0° \leqslant x \leqslant 360°$

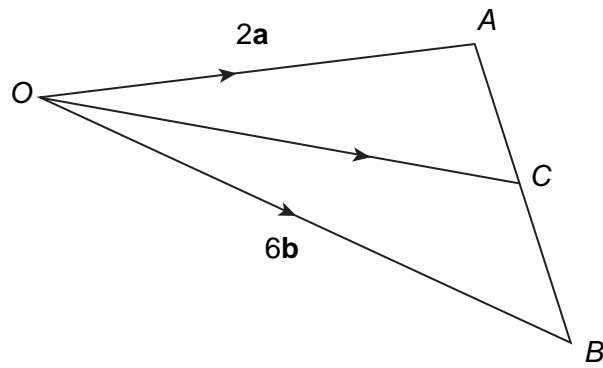The graph of $y = \sin x$ is shown to help you.

[1 mark]

Turn over for the next question

Turn over ▶

2

18 *C* is the midpoint of *AB*.

$\overrightarrow{OA}$ = 2**a**

$\overrightarrow{OB}$ = 6**b**

Work out $\overrightarrow{OC}$ in terms of **a** and **b**.
Simplify your answer as far as possible.

[4 marks]

_____

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_____

Answer _____

19 A hemisphere and a cone each have radius 9 cm
They are joined together to make a toy.
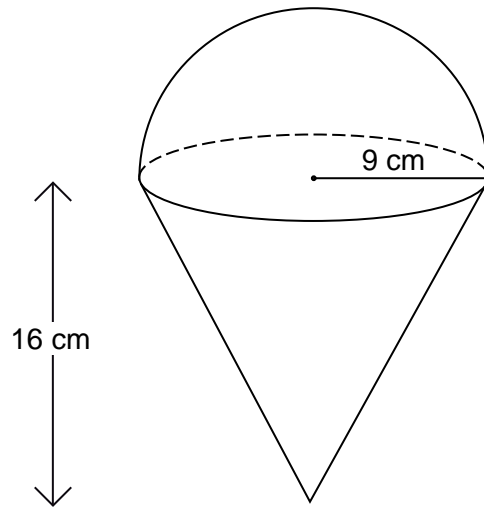
Work out the total volume of the toy.

[4 marks]

_____

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_____

Answer _____ cm^3

END OF QUESTIONS

8

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED