

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# 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  $\pi$  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.
- 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

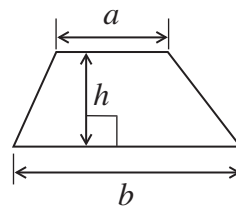
- In all calculations, show clearly how you work out your answer.



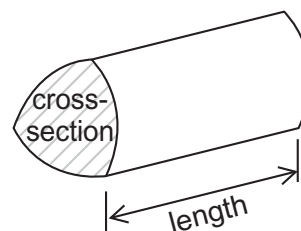
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### Formulae Sheet: Higher Tier

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

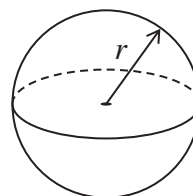


**Volume of prism** = area of cross-section  $\times$  length



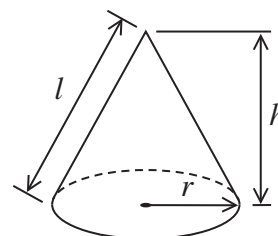
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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



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

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

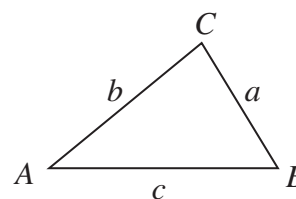


**In any triangle ABC**

**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** 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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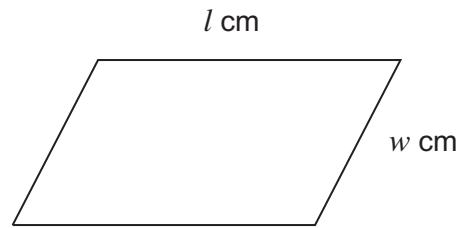
Answer \_\_\_\_\_

5

**Turn over** ►



2 (a)



The perimeter of the parallelogram is  $P \text{ cm}$

Circle the correct formula.

[1 mark]

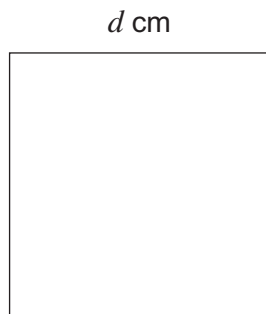
$P = l + w$

$P = lw$

$P = 2(l + w)$

$P = 2lw$

2 (b)



The area of the square is  $A \text{ cm}^2$

Circle the correct formula.

[1 mark]

$A = 2d$

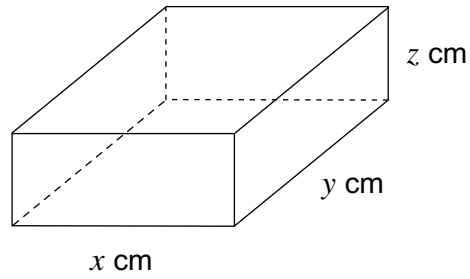
$A = 4d$

$A = \sqrt{d}$

$A = d^2$



2 (c)



The surface area of the cuboid is  $S \text{ cm}^2$

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  $150 \text{ cm}^2$ 

Work out the volume of the cube.

[4 marks]

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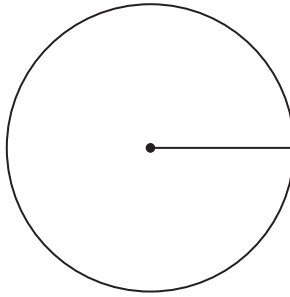
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Answer \_\_\_\_\_  $\text{cm}^3$



**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]**

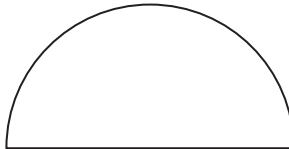
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Answer \_\_\_\_\_ cm<sup>2</sup>

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

Not drawn accurately



Work out the perimeter of the semicircle.

**[3 marks]**

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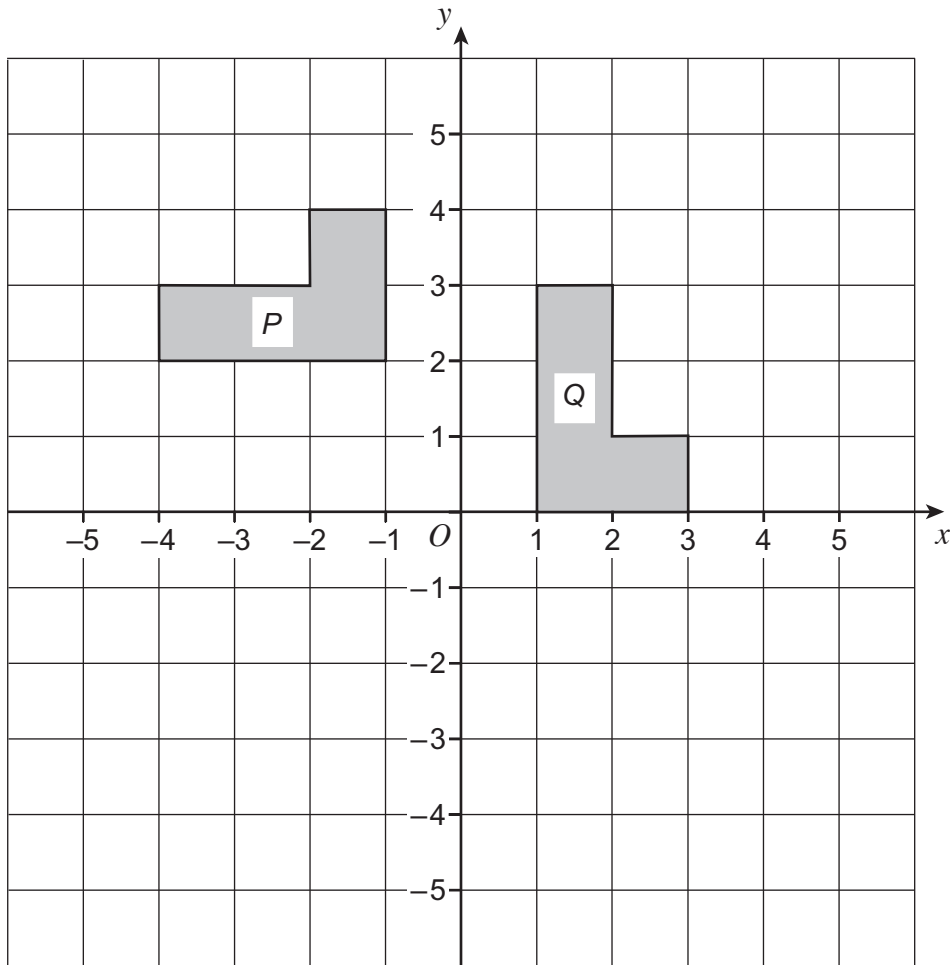
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Answer \_\_\_\_\_ cm



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

[3 marks]




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

[2 marks]







**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 \_\_\_\_\_

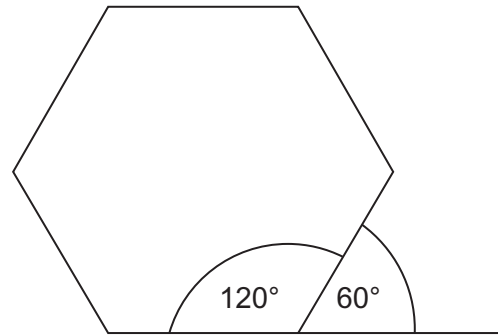
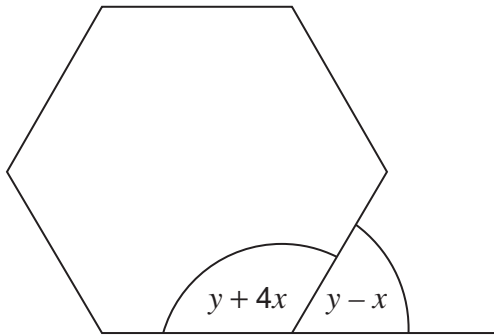
**Turn over for the next question**

8
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**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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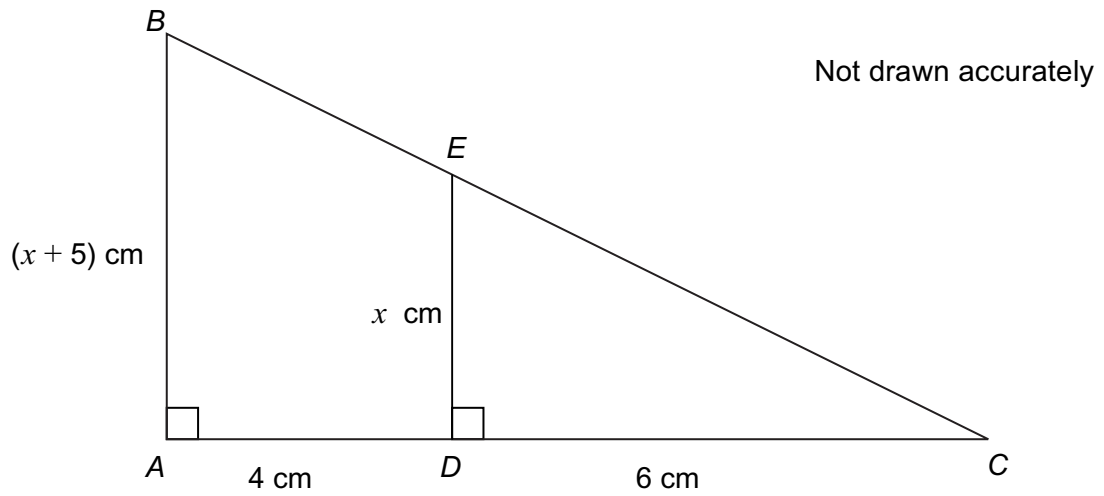
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$x =$  \_\_\_\_\_ degrees

$y =$  \_\_\_\_\_ degrees



- 8  $ABC$  and  $DEC$  are similar triangles.



Work out the value of  $x$ .

[4 marks]

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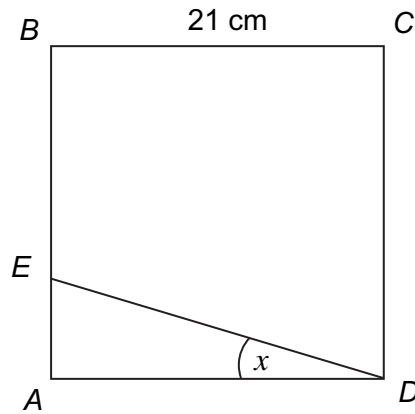


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Answer \_\_\_\_\_ cm



9  $ABCD$  is a square.



Not drawn accurately

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

Work out the size of angle  $x$ .

[4 marks]

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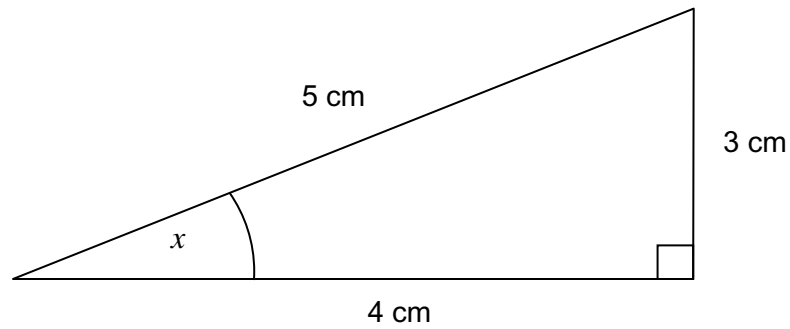
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Answer \_\_\_\_\_ degrees



10 (a)

Not drawn accurately

Circle the value of  $\sin x$ .

[1 mark]

$\frac{3}{5}$

$\frac{3}{4}$

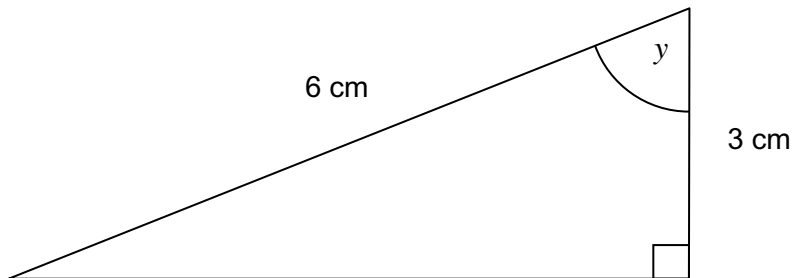
$\frac{4}{5}$

$\frac{4}{3}$

$\frac{5}{3}$

10 (b)

Not drawn accurately

Circle the size of angle  $y$ .

[1 mark]

$30^\circ$

$36^\circ$

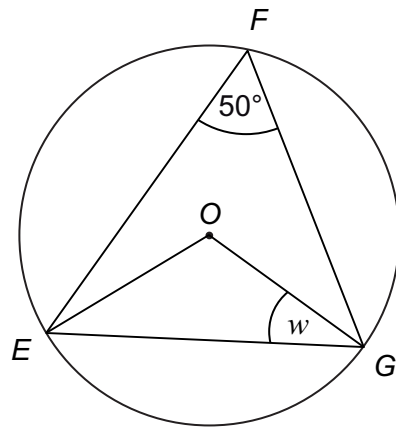
$45^\circ$

$50^\circ$

$60^\circ$



11 (a)  $E, F$  and  $G$  are points on a circle, centre  $O$ .



Not drawn accurately

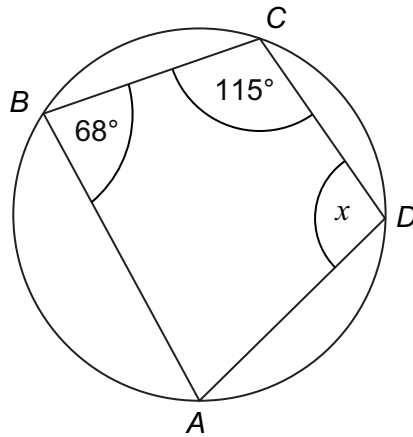
Work out the size of angle  $w$ .

[2 marks]

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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

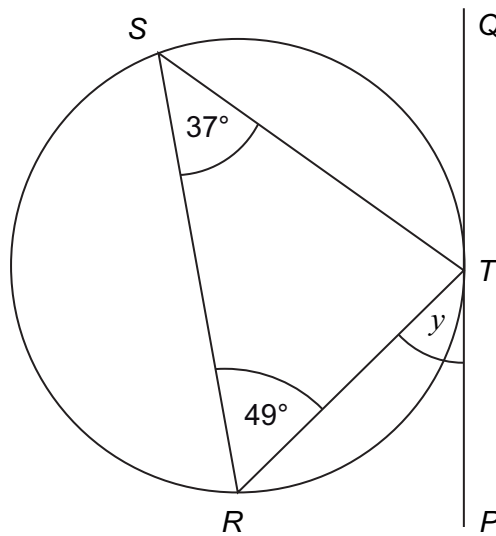
Reason \_\_\_\_\_

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- 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

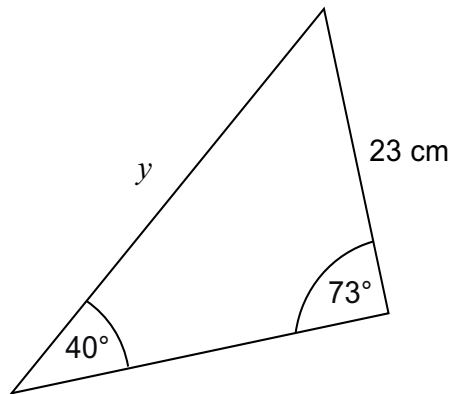
Reason \_\_\_\_\_

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Turn over for the next question



12

Work out length  $y$ .Not drawn  
accurately**[3 marks]**

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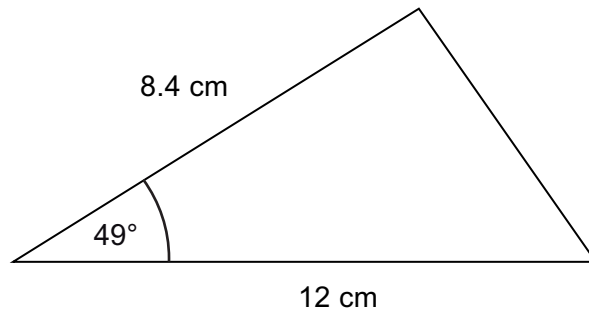
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Answer \_\_\_\_\_ cm





- 13 Work out the area of the triangle.



Not drawn accurately

[2 marks]

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Answer \_\_\_\_\_ cm<sup>2</sup>

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

Give your answers to 2 decimal places.

[3 marks]

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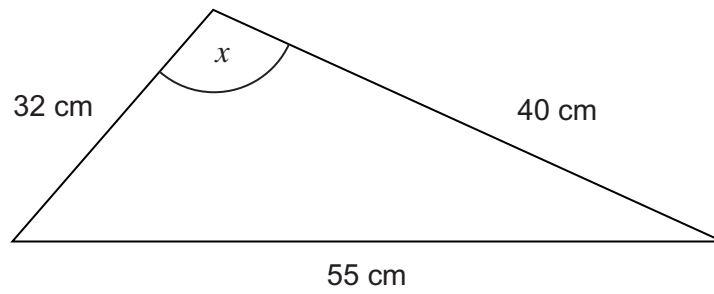
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Answer \_\_\_\_\_ and \_\_\_\_\_





16

Work out the size of angle  $x$ .Not drawn  
accurately**[3 marks]**

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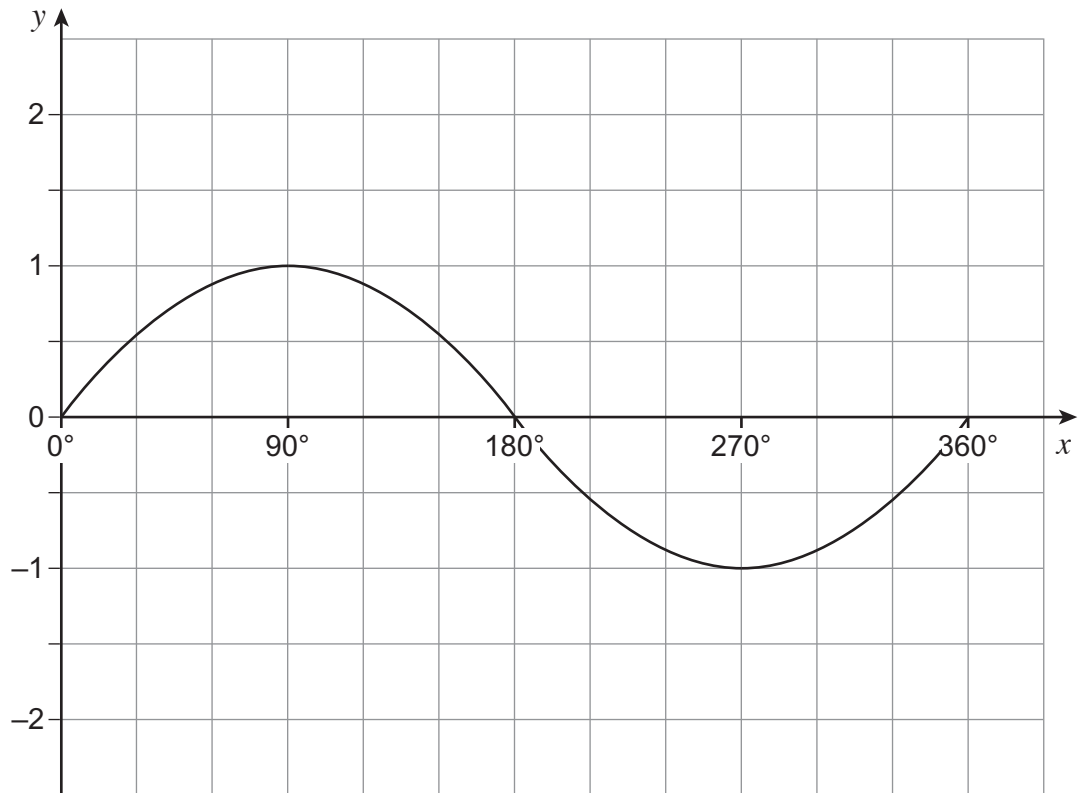
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Answer \_\_\_\_\_ degrees

**Turn over for the next question**

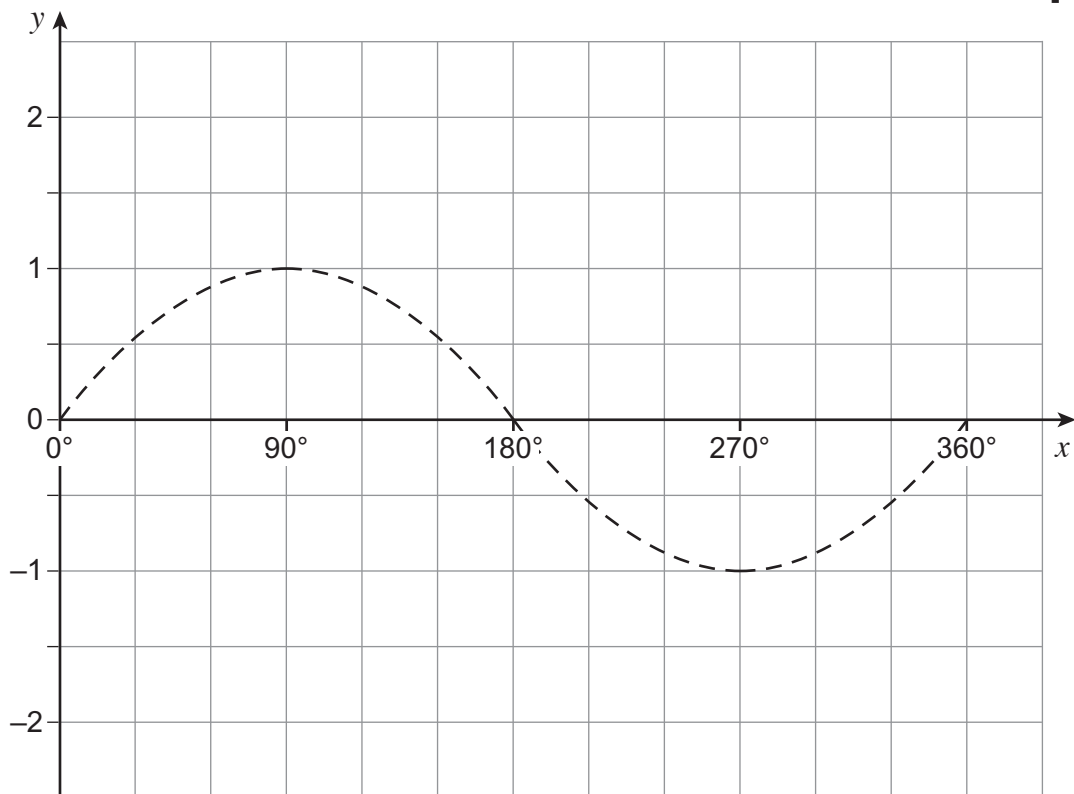
- 17 The graph of  $y = \sin x$  for  $0^\circ \leq x \leq 360^\circ$  is shown.



- 17 (a) On the grid below, draw the graph of  $y = 1 + \sin x$  for  $0^\circ \leq x \leq 360^\circ$

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

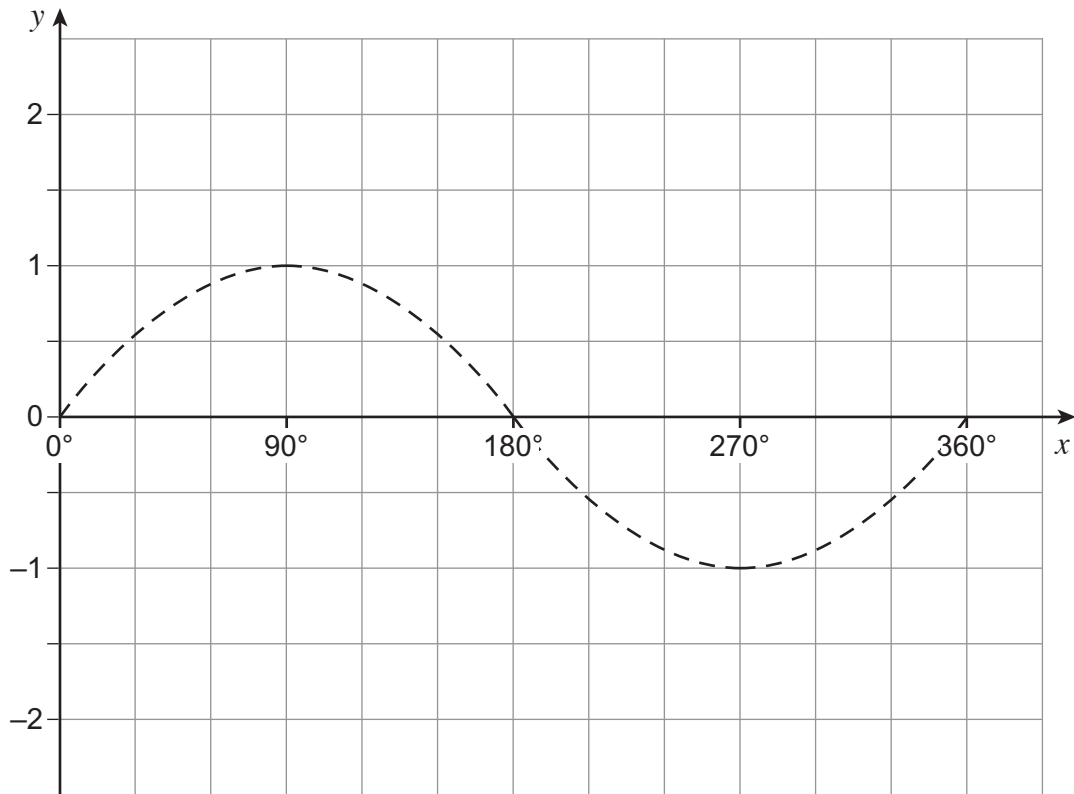
[1 mark]



**17 (b)** On the grid below, draw the graph of  $y = \sin(x + 90^\circ)$  for  $0^\circ \leq x \leq 360^\circ$

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

[1 mark]

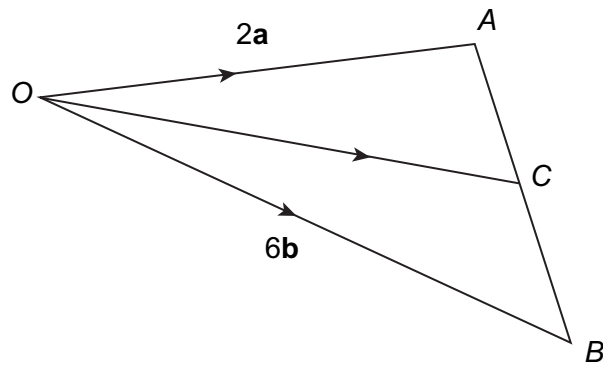


Turn over for the next question



18

C is the midpoint of AB.



$$\vec{OA} = 2\mathbf{a}$$

$$\vec{OB} = 6\mathbf{b}$$

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

**[4 marks]**


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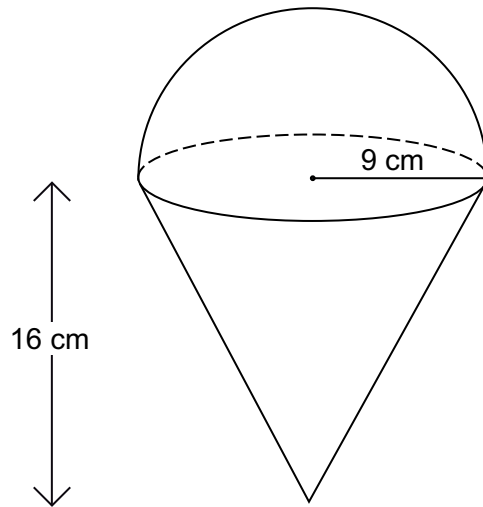


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Answer \_\_\_\_\_



- 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 \_\_\_\_\_  $\text{cm}^3$

**END OF QUESTIONS**



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

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ANSWER IN THE SPACES PROVIDED**

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