AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

Higher Tier Unit 3 Geometry and Algebra

Tuesday 14 June 2016 Morning Time allowed: 1 hour 30 minutes

Materials

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

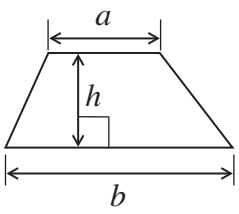
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.
- If your calculator does not have a π 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 your written communication is specifically assessed in Questions 1, 7, 9 and 19. 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.

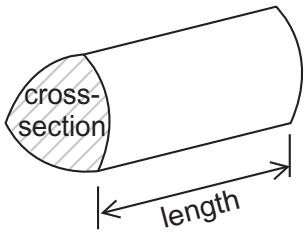
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

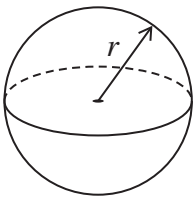


Volume of prism = area of cross-section × length



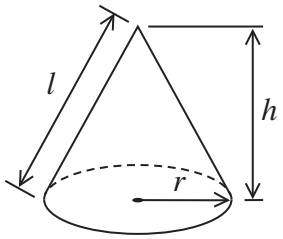
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

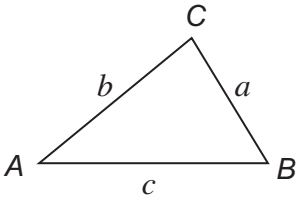
Curved surface area of cone = $\pi r l$



In any triangle *ABC*

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

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



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

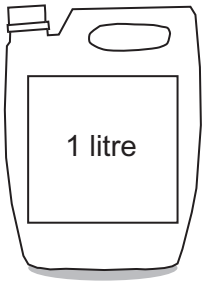
The Quadratic Equation

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

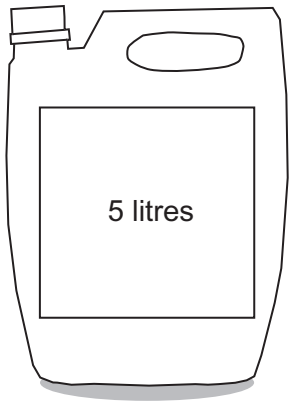
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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

***1** Oil is sold in two sizes.



£8.75



was £49.80

now 15% off

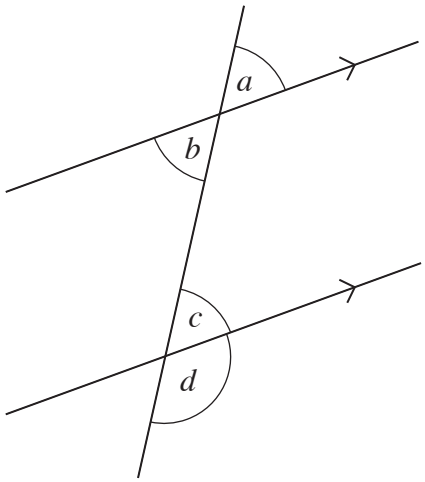
Which size is better value for money?
You **must** show your working.

[4 marks]

Answer _____

4

2



2 (a) Which angles are vertically opposite?
Circle your answer.

[1 mark]

a and *b* | *a* and *c* | *b* and *c* | *b* and *d* | *c* and *d*

2 (b) Which angles are alternate?
Circle your answer.

[1 mark]

a and *b* | *a* and *c* | *b* and *c* | *b* and *d* | *c* and *d*

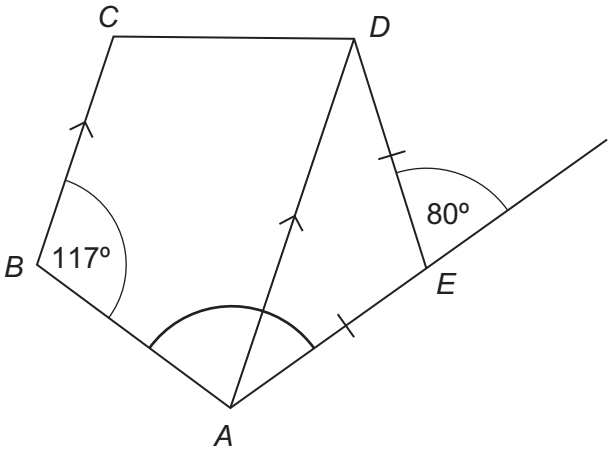
2 (c) Which angles are corresponding?
Circle your answer.

[1 mark]

a and *b* | *a* and *c* | *b* and *c* | *b* and *d* | *c* and *d*

3 *AD* is parallel to *BC*.

AE = *DE*



Not drawn accurately

Work out the size of angle *BAE*.

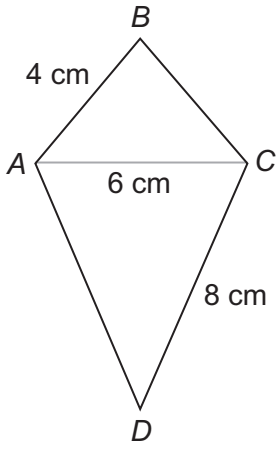
[3 marks]

Answer _____ degrees

Turn over for the next question

6

4 *ABCD* is a kite.



Not drawn accurately

Using a ruler and compasses, make an accurate construction of the kite.
AC has been drawn for you.

[3 marks]

5 Jack drives 95 miles.

He drives at an average speed of 38 mph
He starts his journey at 7 am

What time does he arrive?

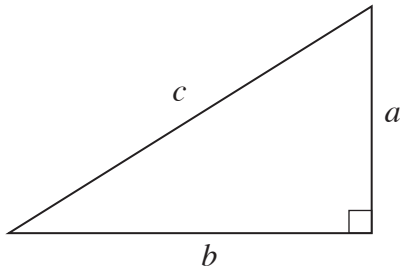
[3 marks]

Answer _____

Turn over for the next question

6

6 (a) The diagram shows a right-angled triangle.

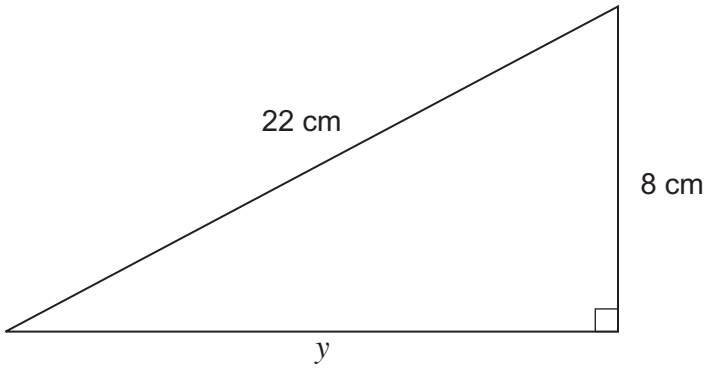


Circle the **two** correct formulae.

[2 marks]

$c = ab$ $\quad$ $c = a + b$ $\quad$ $c^2 = a^2 + b^2$ $\quad$ $c = \frac{1}{2}ab$ $\quad$ $c = \sqrt{a^2 + b^2}$

6 (b) Work out the length y.



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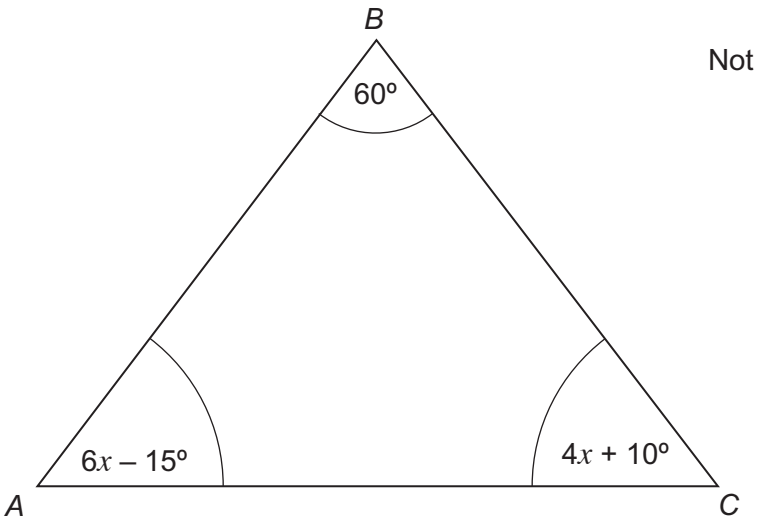
Give your answer to 1 decimal place.

[4 marks]

Answer _____ cm

***7** Show that *ABC* is an equilateral triangle.



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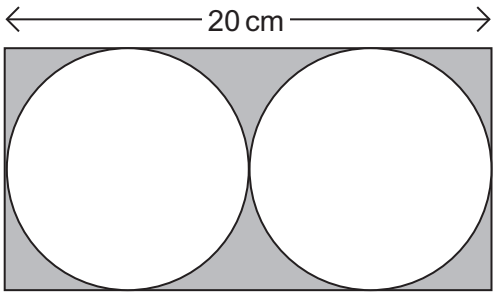
[5 marks]

11

Turn over ▶

8 Two identical circles fit inside a rectangle as shown.



Not drawn accurately

The length of the rectangle is 20 cm

Work out the area of the shaded section.

[6 marks]

Answer _____ cm^2

***9** Use trial and improvement to find a solution to $2^x - 30 = 0$
Give your answer to 1 decimal place.

[4 marks]

x	$2^x - 30$	**Comment**
4	– 14	Too small

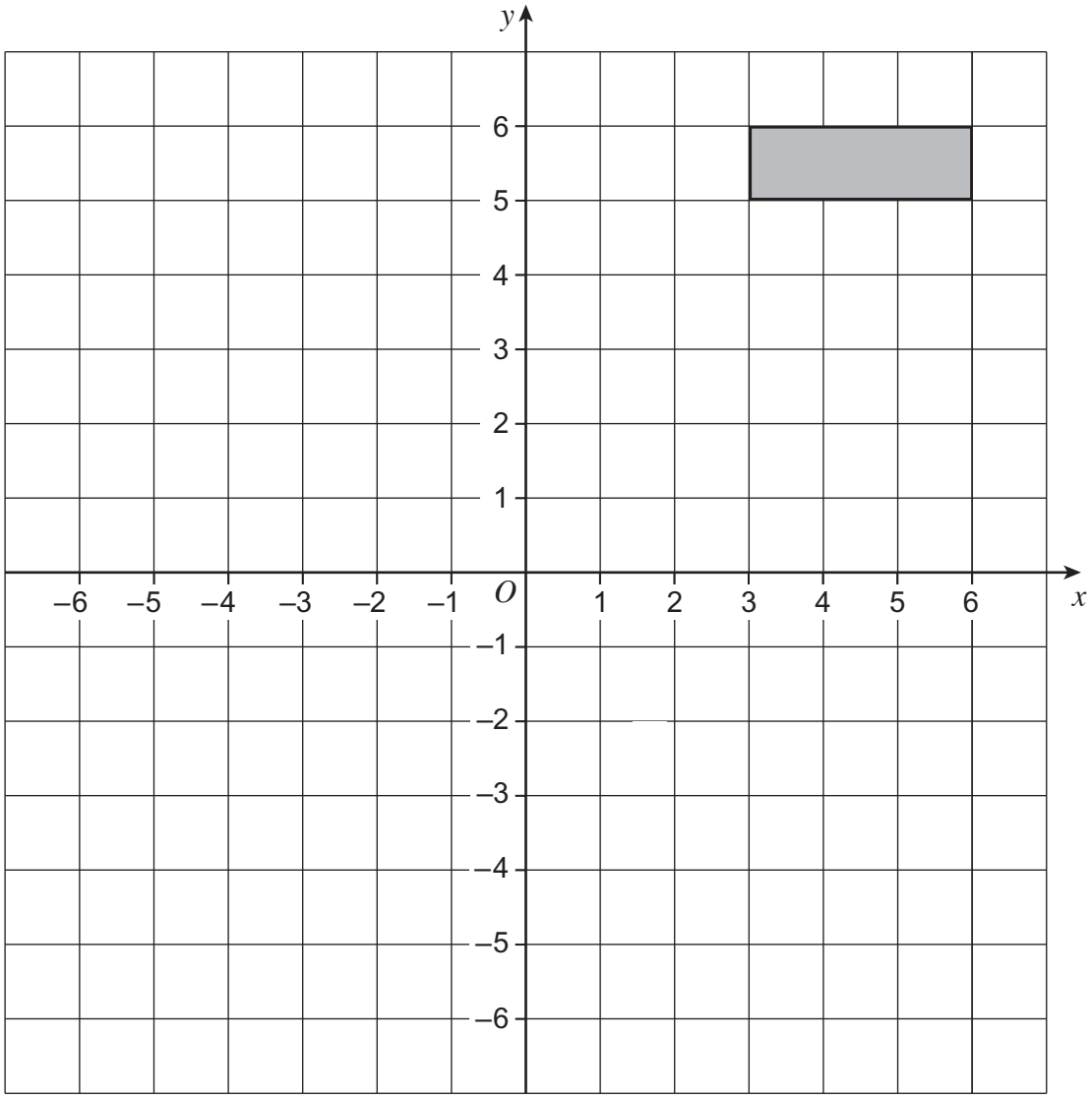
$x =$ _____

10

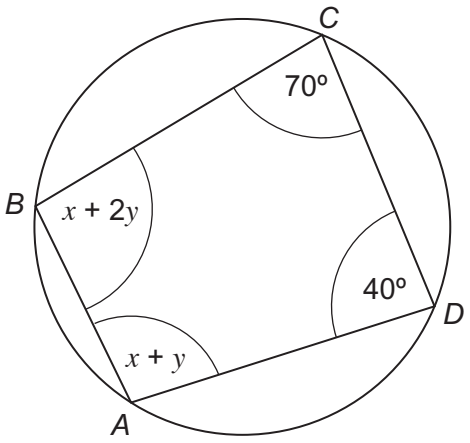
10 Enlarge the shape by scale factor –3

Use (3, 4) as the centre of enlargement.

[3 marks]



11 *ABCD* is a cyclic quadrilateral.



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Work out x and y.

[4 marks]

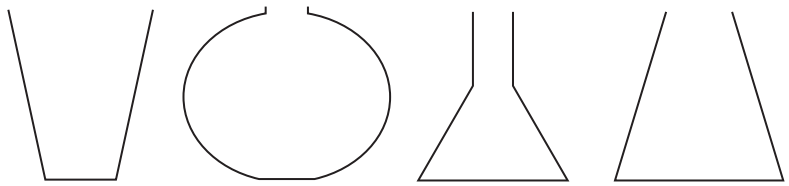
x = _____ degrees

y = _____ degrees

7

Turn over ▶

12 Four empty containers are shown.



A *B* *C* *D*

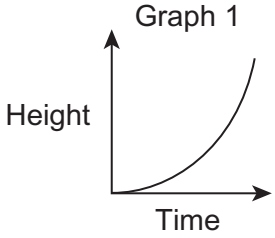
Each container is filled with water at a constant rate.

Opposite are six graphs showing the height of water against time.

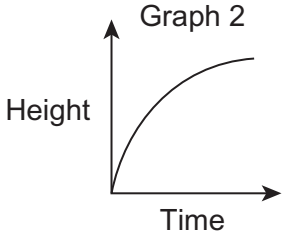
Write the letter of each container in the box next to its graph.
Leave the two remaining boxes blank.

[4 marks]

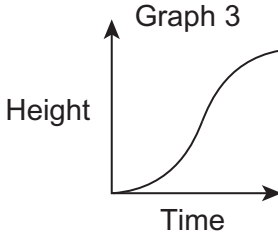
Graph 1



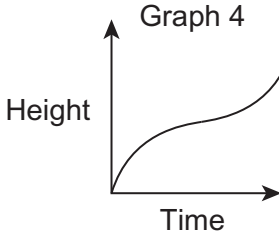
Graph 2



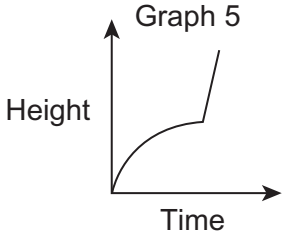
Graph 3



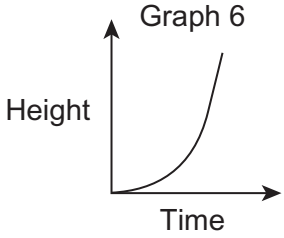
Graph 4



Graph 5



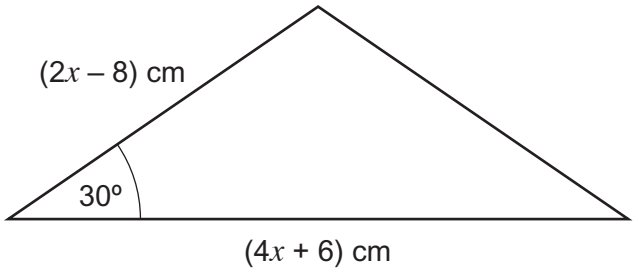
Graph 6



Turn over for the next question

4

13 The area of this triangle is 14 cm^2



Not drawn accurately

13 (a) Show that $2x^2 - 5x - 26 = 0$

[3 marks]

13 (b) Work out the value of x.
Give your answer to 2 significant figures.

[4 marks]

Answer _____

14 Boat *A* is 10 km north of a port.
Boat *B* is 5 km east of the same port.
Boat *A* sails in a straight line towards boat *B*.

Work out the bearing on which boat *A* sails.

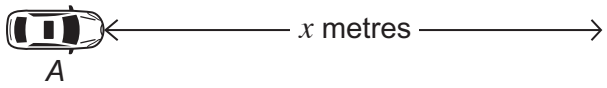
[4 marks]

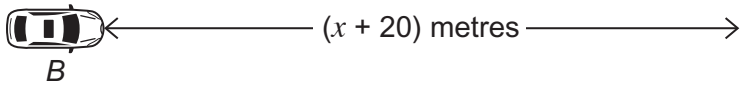
Answer _____ °

11

15 Car *A* travels x metres at a speed of 15 m/s

Car *B* travels $(x + 20)$ metres at a speed of 17 m/s





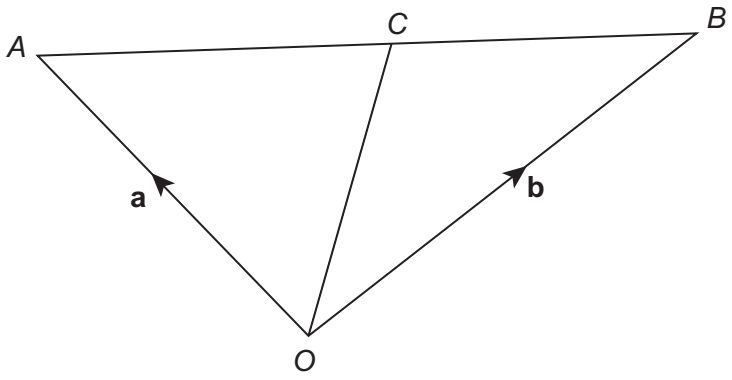
Both cars travel for the same time.

Set up an equation and work out x.

[4 marks]

$x =$ _____

16 C is the midpoint of the straight line AB.



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

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

16 (a) Work out $\overrightarrow{OC}$ in terms of **a** and **b**.
Simplify your answer.

[3 marks]

Answer _____

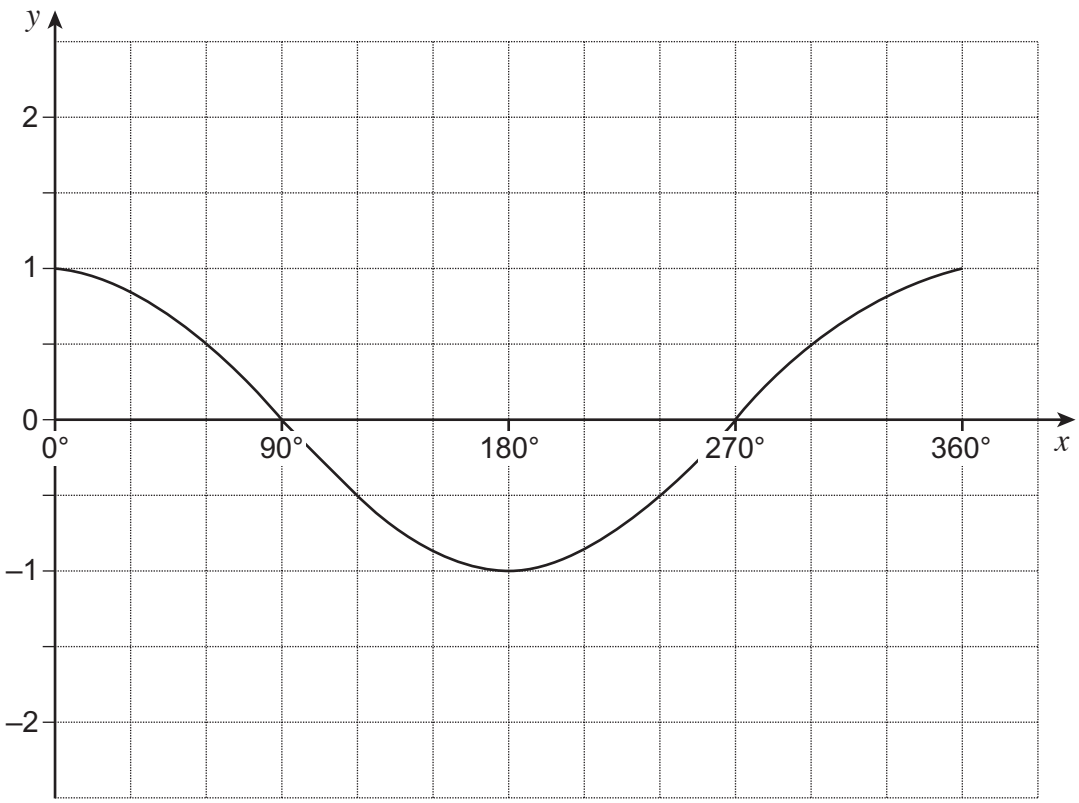
16 (b) Hence, write down an expression for $\overrightarrow{CO}$ in terms of **a** and **b**.
Simplify your answer.

[1 mark]

Answer _____

8

17 The graph $y = \cos x$ for $0° \leqslant x \leqslant 360°$ is shown.



17 (a) Write down the **two** solutions to the equation $\cos x = 0.5$ for $0° \leqslant x \leqslant 360°$

[1 mark]

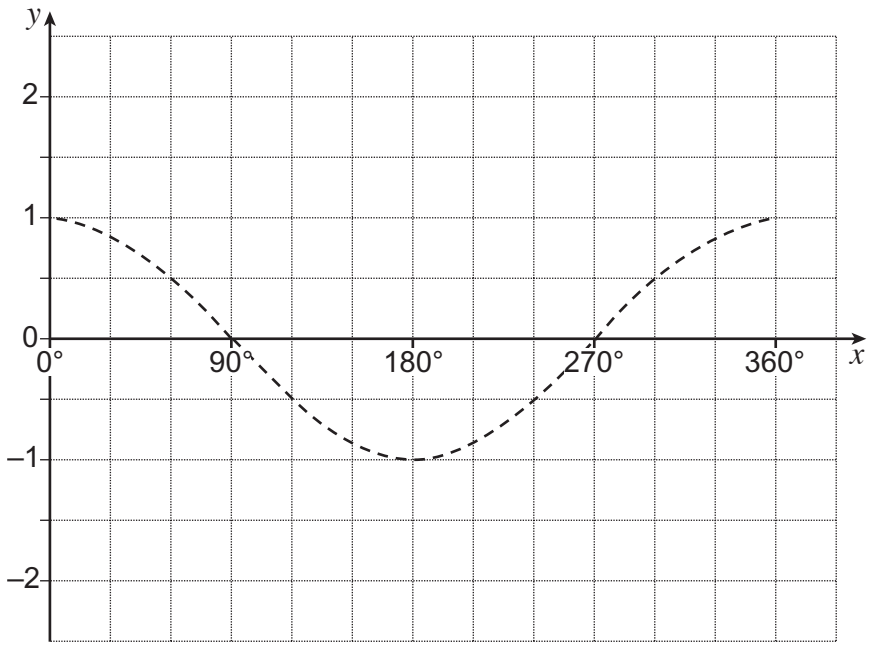
Answer _____ degrees

and _____ degrees

In parts (b) and (c) the graph of $y = \cos x$ is drawn to help you.

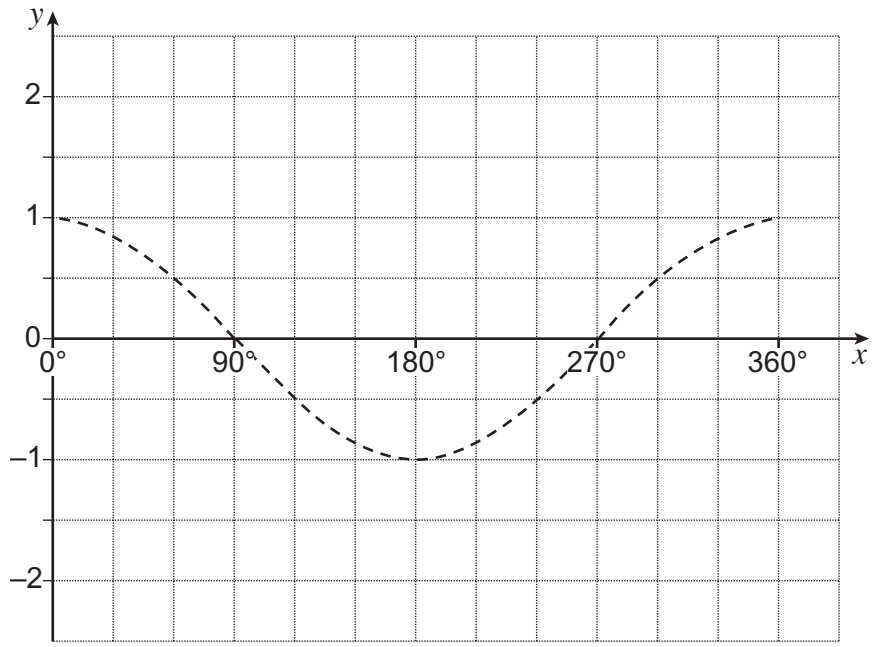
17 (b) On the grid below, draw the graph of $y = \frac{1}{2}\cos x$ for $0° \leqslant x \leqslant 360°$

[1 mark]



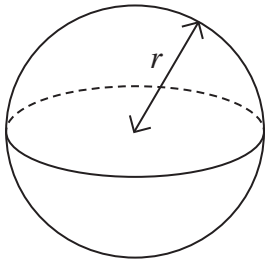
17 (c) On the grid below, draw the graph of $y = \cos 2x$ for $0° \leqslant x \leqslant 360°$

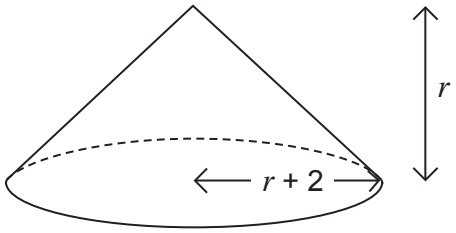
[1 mark]



3

18 The volume of the sphere is equal to the volume of the cone.





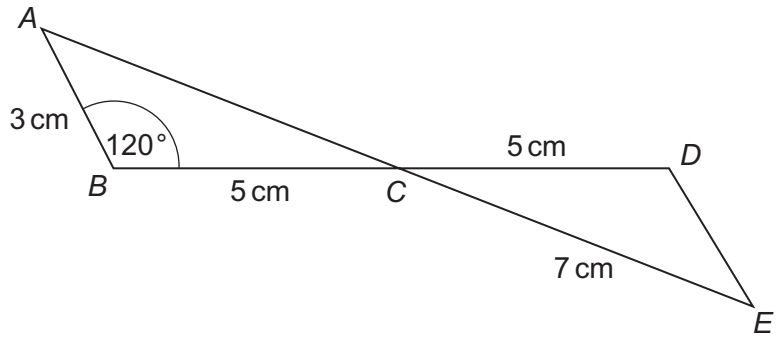
Work out the value of r.
Do **not** use trial and improvement.
You **must** show your working.

[5 marks]

Answer _____ units

***19** The straight lines *AE* and *BD* intersect at *C*.

Not drawn accurately



Prove that triangles *ABC* and *EDC* are congruent.

[5 marks]

END OF QUESTIONS

10

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED