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| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

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| For Examiner's Use | |
| Examiner's Initials | |
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| TOTAL | |



General Certificate of Secondary Education
Higher Tier
June 2012

Mathematics

43603H

Unit 3

Wednesday 13 June 2012 9.00 am to 10.30 am

H

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|---|--|
| <p>For this paper you must have:</p> <ul style="list-style-type: none"> • 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 1 and 10. 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 booklet.

Advice

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



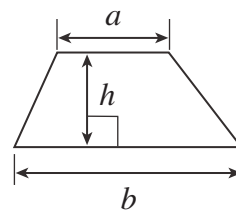
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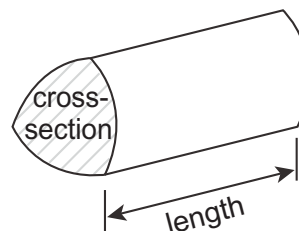
43603H

Formulae Sheet: Higher Tier

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

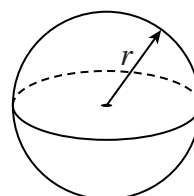


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



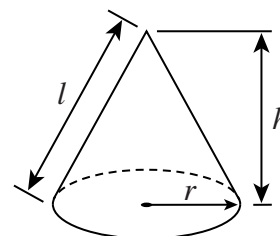
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

$$\text{Curved surface area of cone} = \pi r l$$

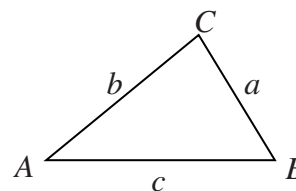


In any triangle ABC

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

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

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$



The Quadratic Equation

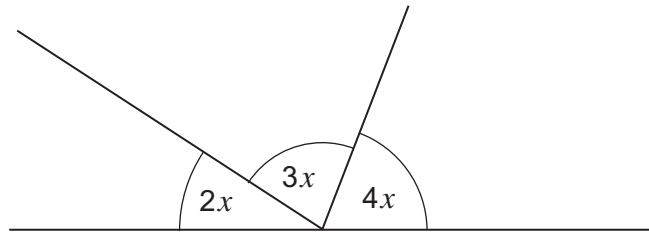
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



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

- *1 The diagram shows three angles on a straight line.



Not drawn
accurately

Set up and solve an equation in x to help you work out the size of the smallest angle.

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Answer degrees (4 marks)

Turn over for the next question

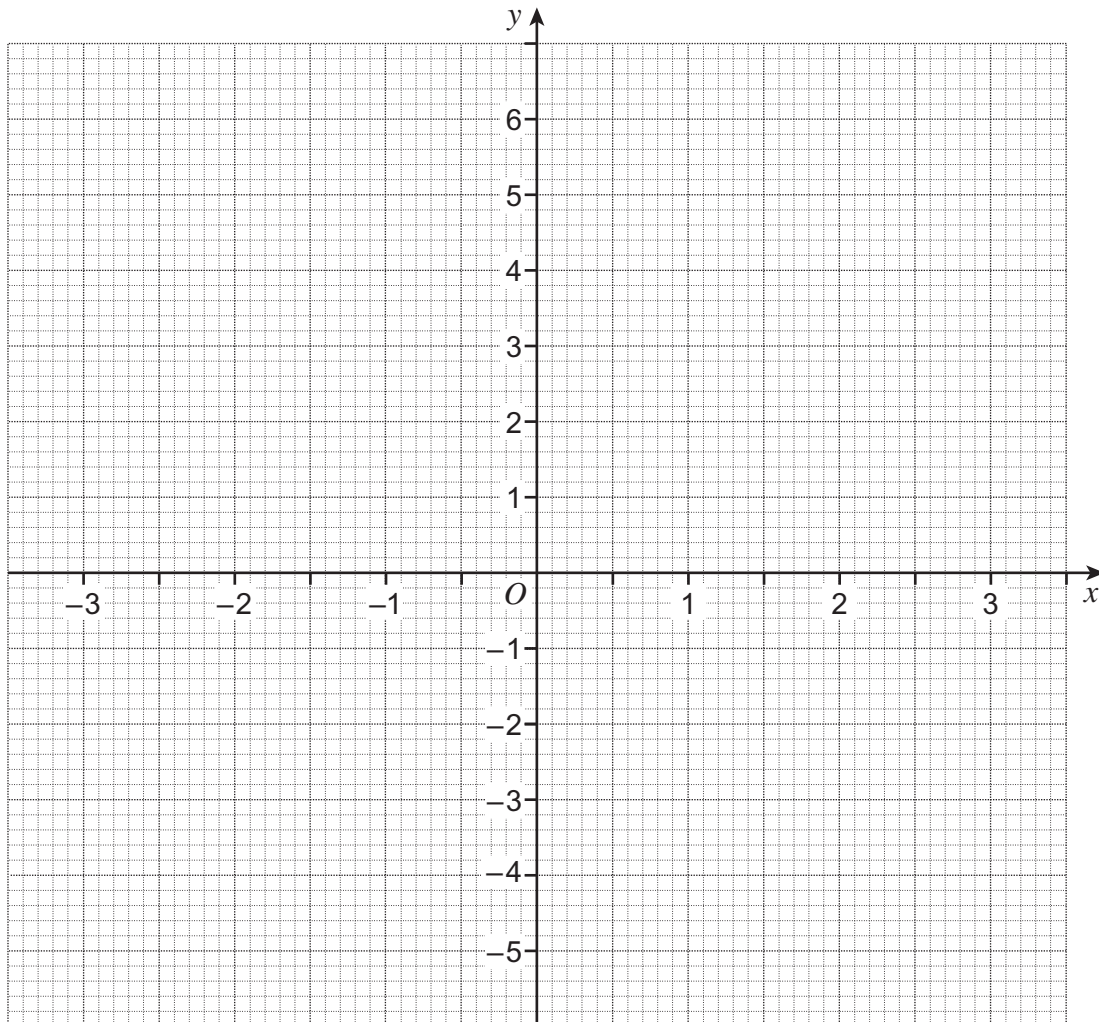


2 (a) Complete the table of values for $y = x^2 - 4$

| | | | | | | | |
|-----|----|----|----|---|---|---|---|
| x | -3 | -2 | -1 | 0 | 1 | 2 | 3 |
| y | 5 | 0 | -3 | | | 0 | |

(2 marks)

2 (b) Draw the graph of $y = x^2 - 4$ for values of x from -3 to 3 .



(3 marks)



2 (c) Draw the graph of $y = 2$ on the grid opposite for values of x from -3 to 3 .
(1 mark)

2 (d) Write down the x -coordinates of the points of intersection of the two graphs.

Answer and (2 marks)

3 A base for a shed has a volume of 3.8 cubic metres.
55% of the base is concrete.
The rest is steel.

A lorry delivers ready-mixed concrete in loads of 6 cubic metres.

How many of these bases can be built with 5 loads of concrete?

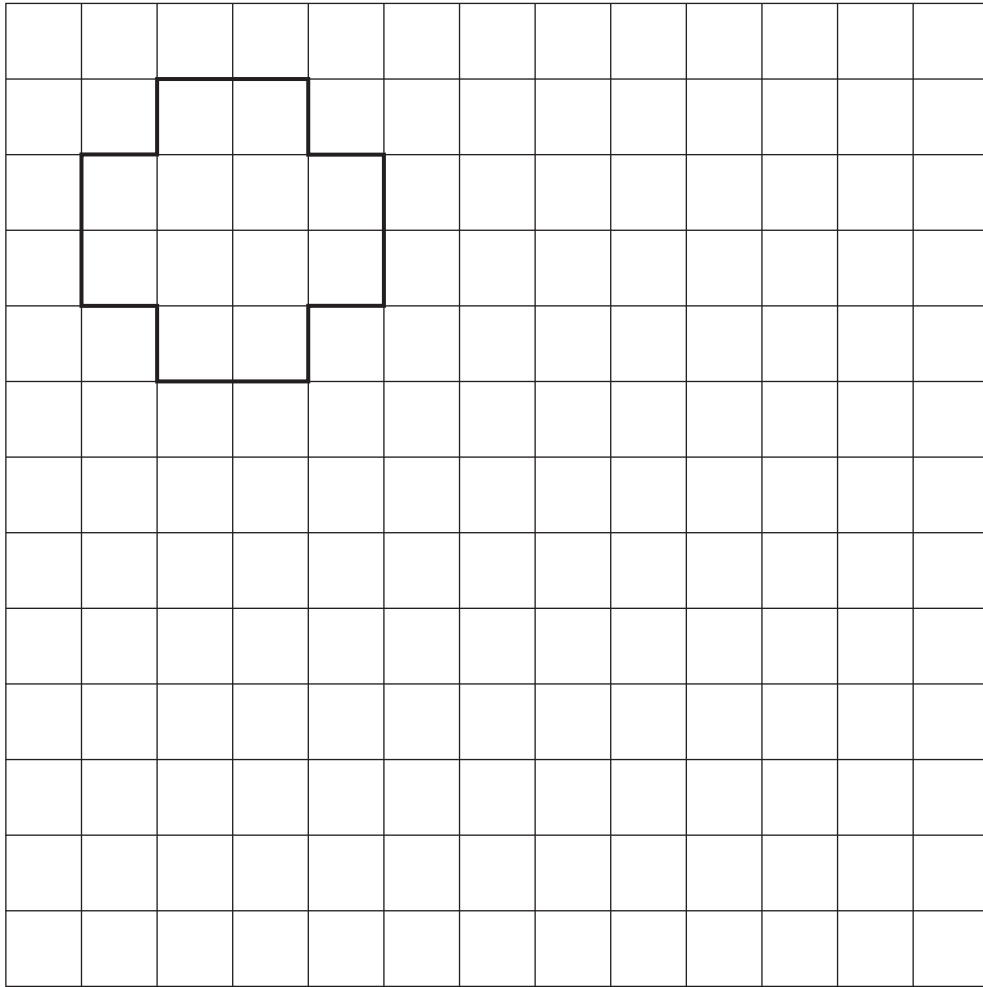
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Answer (3 marks)

Turn over for the next question



4 The diagram shows a shape on a centimetre grid.



Work out the area of the shape after an enlargement of scale factor 2.
State the units of your answer.

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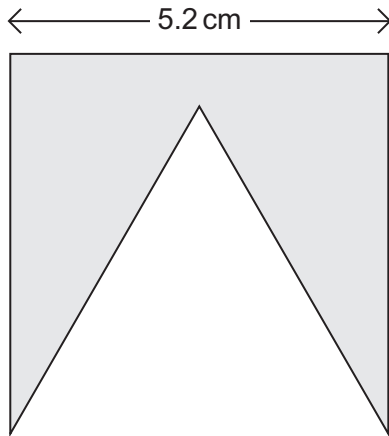
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Answer (3 marks)

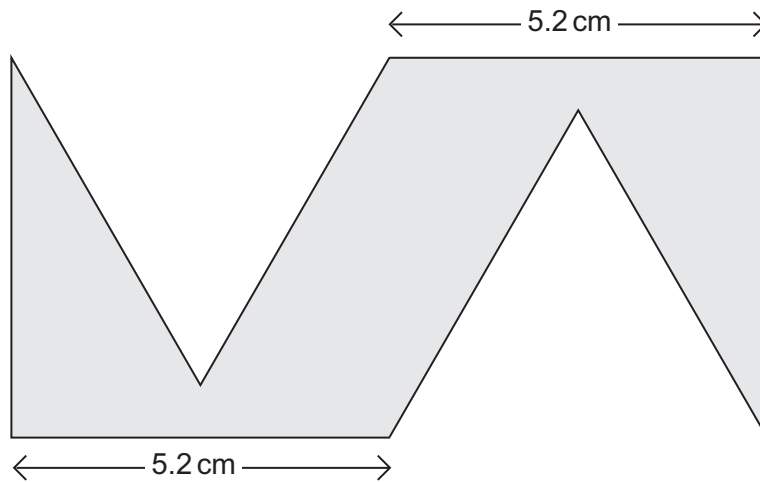


5 This shape is made by cutting out an equilateral triangle from a square.



Not drawn
accurately

Two of these shapes are then put together to make a new shape as shown below.



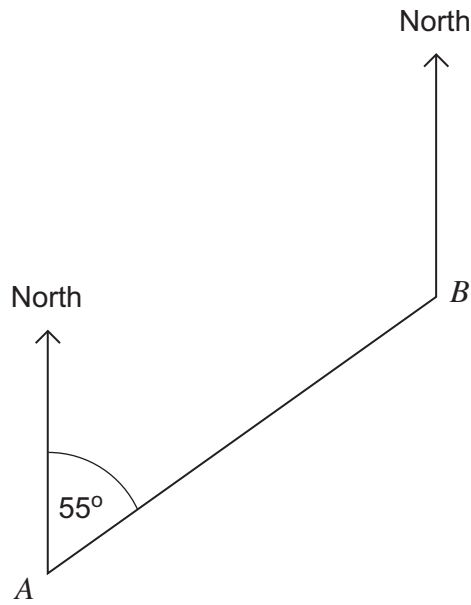
Work out the perimeter of this new shape.

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Answer cm (3 marks)



6 A and B are two towns.



Here is a formula for working out the bearing of A from B.

$$T = F + 180^\circ$$

where T is the bearing of A from B
and F is the bearing of B from A

6 (a) Use the diagram and the formula to work out the bearing of A from B.

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Answer ° (2 marks)

6 (b) Give a reason why the formula can only be used for $0^\circ < F \leq 180^\circ$

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(1 mark)



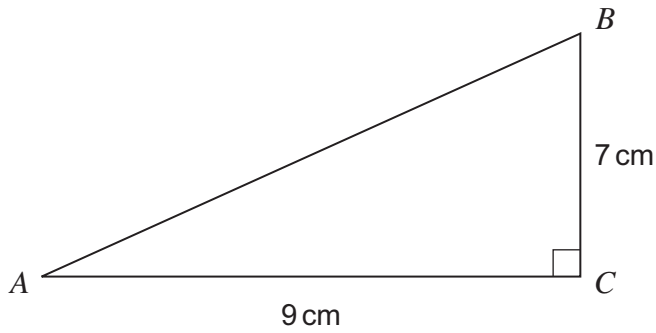
6 (c) The bearing of C from D is 342° .

Work out the bearing of D from C .

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Answer $^\circ$ (2 marks)

7 Work out length AB as a decimal.



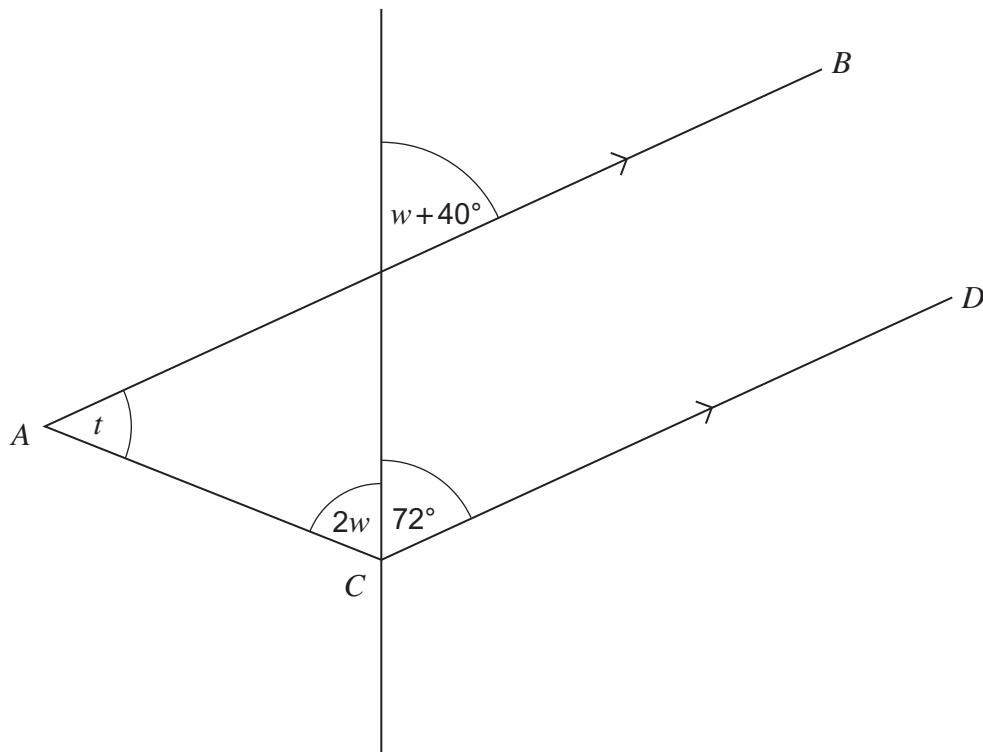
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Answer cm (3 marks)



8 *AB* is parallel to *CD*.



Not drawn accurately

Work out the value of *t*.

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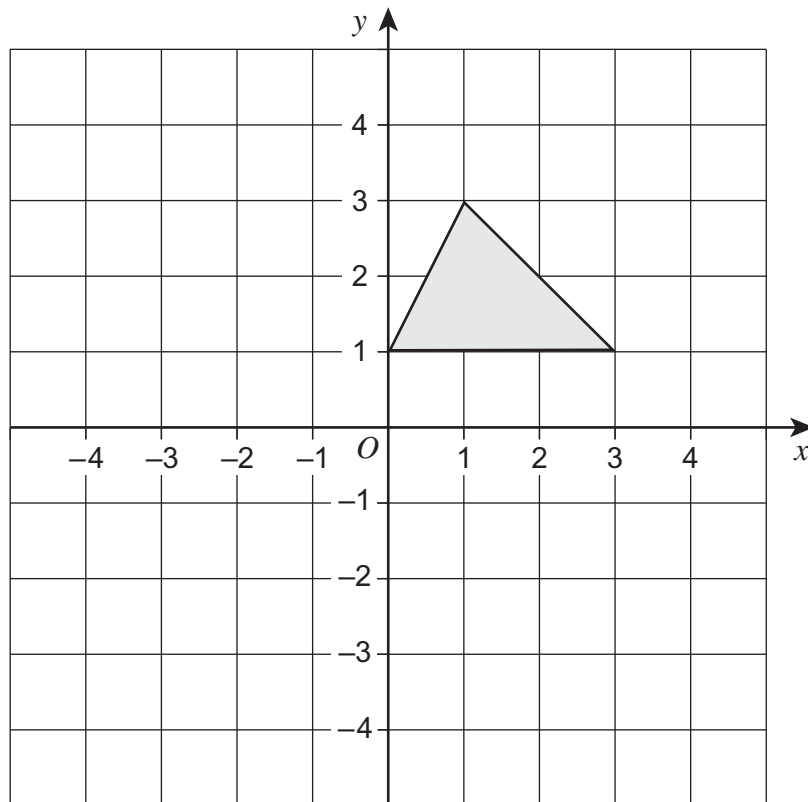
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Answer degrees (5 marks)



- 9 Rotate the triangle through 90° clockwise about $(0, 1)$.



(2 marks)

Turn over for the next question

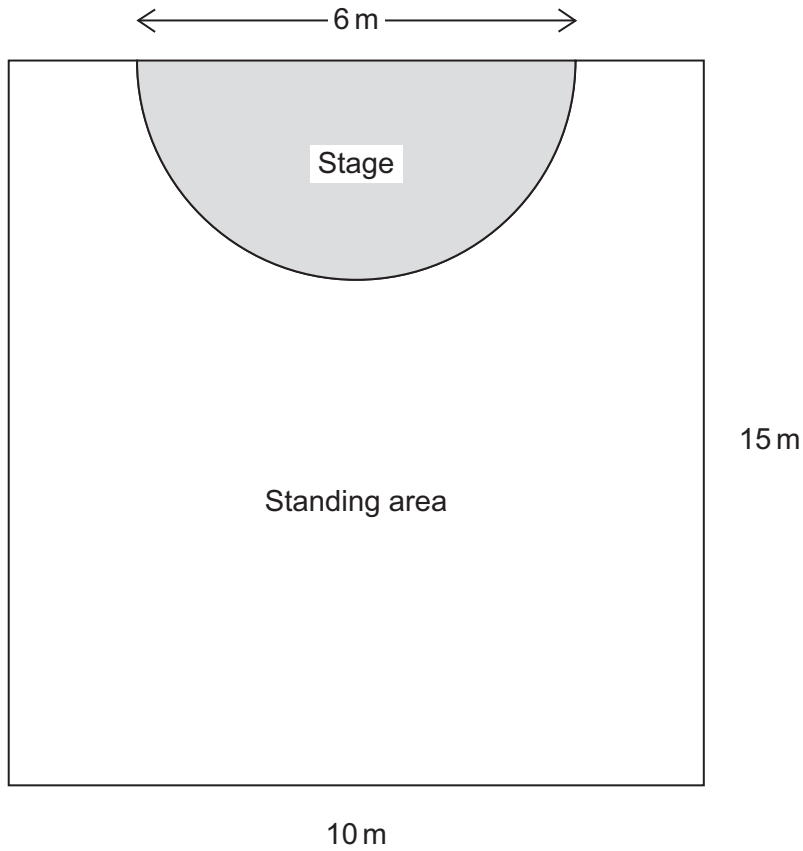
Turn over ►



*10

A hall has length 15 metres and width 10 metres.
The stage is a semicircle with diameter 6 metres.

Not drawn accurately



The maximum number of people allowed in the standing area at a concert is calculated using this formula.

$$\text{Maximum number} = \text{Standing area in m}^2 \div 0.3$$

Work out the maximum number of people allowed in the standing area at the concert.

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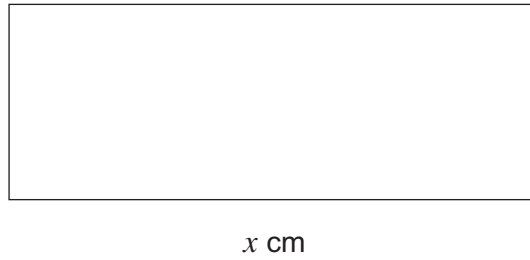
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Answer (5 marks)



11 A rectangle has length x cm and width y cm.



Not drawn
accurately

You are given that $x : y = 5 : 2$

11 (a) Write down an equation connecting x and y .

Answer (1 mark)

11 (b) Write down an expression for the perimeter of the rectangle in terms of x and y .

Answer (1 mark)

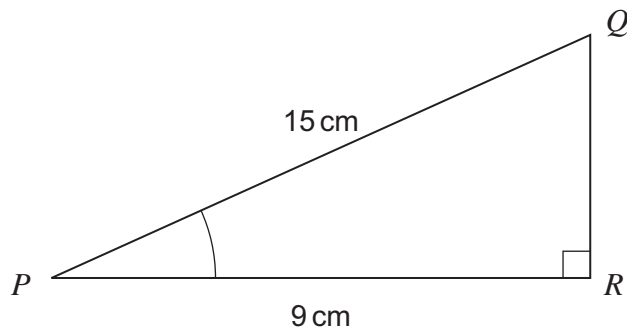
11 (c) Work out an expression for the perimeter in terms of x .
Give your answer as simply as possible.

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Answer (2 marks)



12

Work out the size of angle P .Not drawn
accurately

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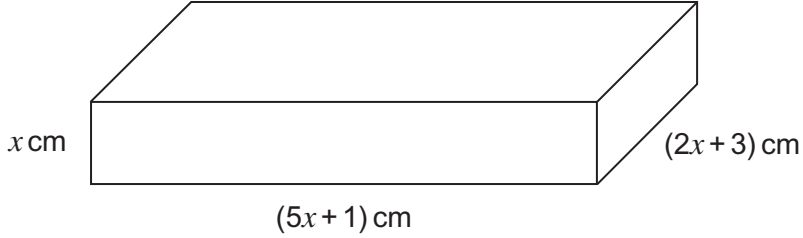
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Answer degrees (3 marks)



- 13 The diagram shows a cuboid.
The length is $(5x + 1)$ cm.
The width is $(2x + 3)$ cm.
The height is x cm.



The length is 7 cm longer than the width.

Work out the volume of the cuboid.

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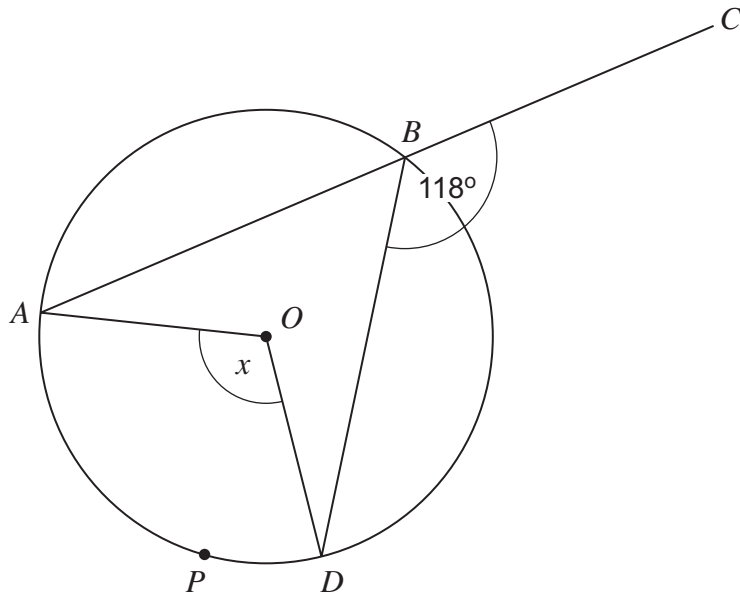
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Answer cm^3 (5 marks)



- 14** O is the centre of the circle.
 ABC is a straight line.
 Angle $CBD = 118^\circ$



Not drawn
accurately

- 14 (a)** Work out the value of x .

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Answer degrees (3 marks)

- 14 (b)** P is a point on the minor arc AD .

Explain why angle $APD = 118^\circ$

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(1 mark)



15 Solve the equation $3x^2 + 4x - 10 = 0$

Give your answers to 2 significant figures.

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Answer (3 marks)

Turn over for the next question



16 M is directly proportional to r^3
When $r = 5$, $M = 200$

16 (a) Work out the value of M when $r = 8$

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Answer (4 marks)

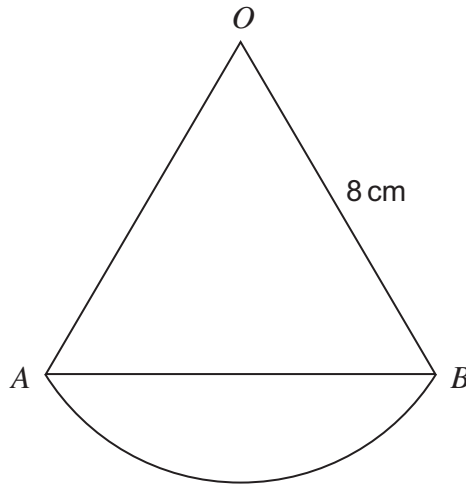
16 (b) Work out the value of r when $M = 3125$

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Answer (3 marks)



- 17 The diagram shows an arc AB of a circle, centre O .
Triangle OAB is equilateral.



Not drawn
accurately

Work out the length of arc AB .

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Answer cm (3 marks)

Turn over for the next question

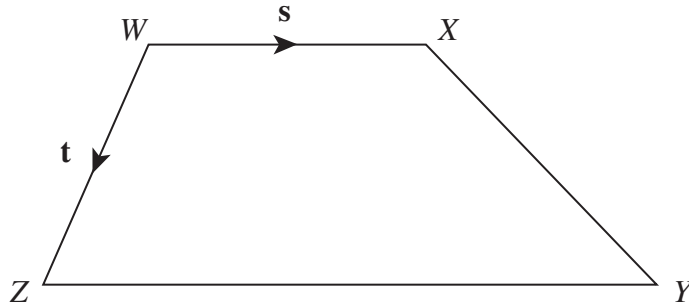


19 $WXYZ$ is a trapezium.

$$\vec{WX} = \mathbf{s}$$

$$\vec{WZ} = \mathbf{t}$$

$$ZY : WX = 3 : 2$$



19 (a) Write vector \vec{ZY} in terms of \mathbf{s}

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Answer (1 mark)

19 (b) Work out vector \vec{XY} in terms of \mathbf{s} and \mathbf{t}
Give your answer in its simplest form.

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Answer (2 marks)

END OF QUESTIONS



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