Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
TOTAL	

General Certificate of Secondary Education
Higher Tier
June 2012

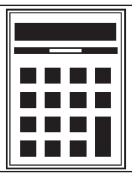
Mathematics 43603H

Unit 3

Wednesday 13 June 2012 9.00 am to 10.30 am

H

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



Time allowed
- 1 hour 30 minutes

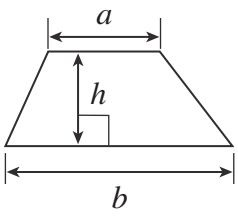
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this 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 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.

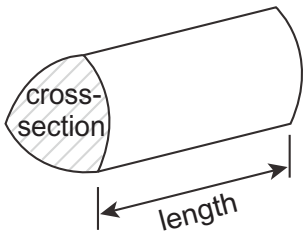
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

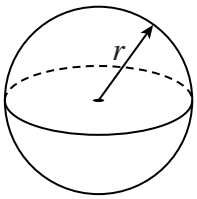


Volume of prism = area of cross-section × length



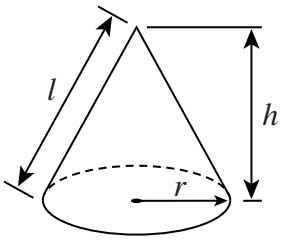
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

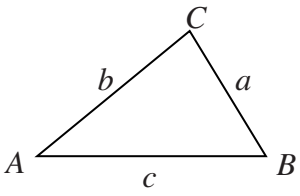
Curved surface area of cone = $\pi r l$



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

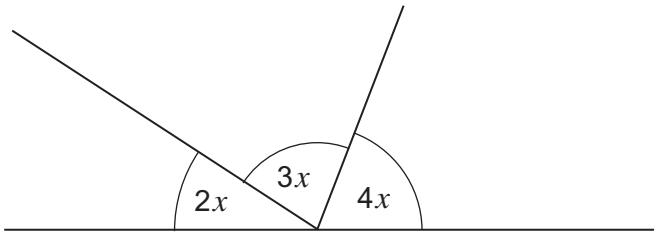
The Quadratic Equation

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



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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

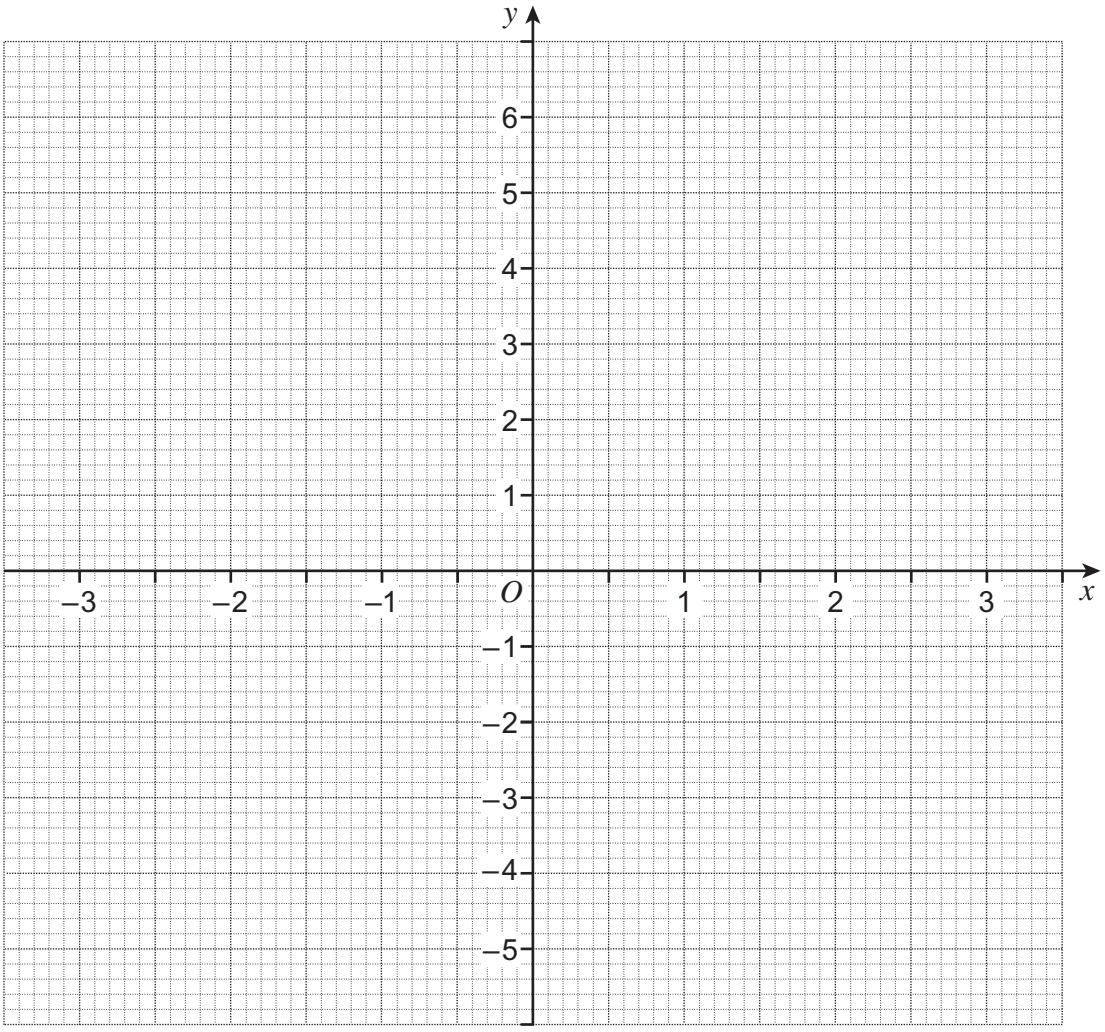
4

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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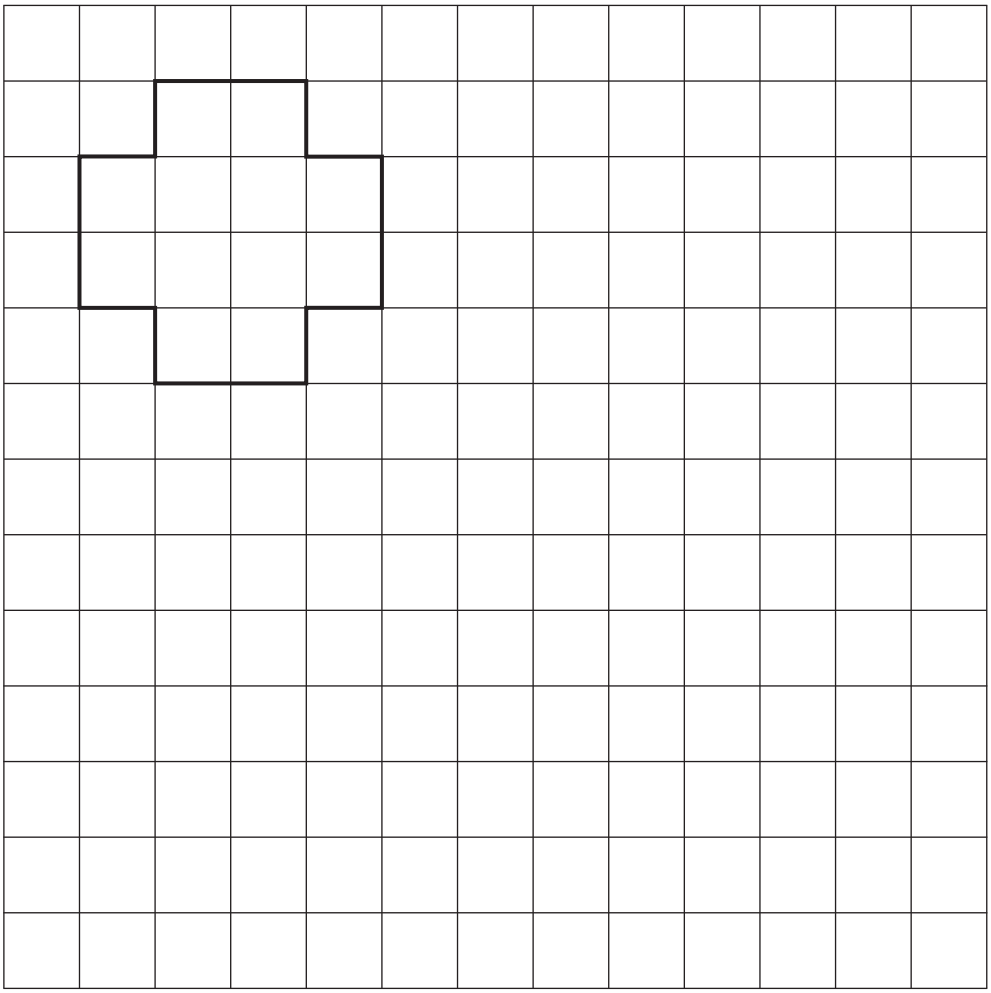
Answer ..... *(3 marks)*

Turn over for the next question

11

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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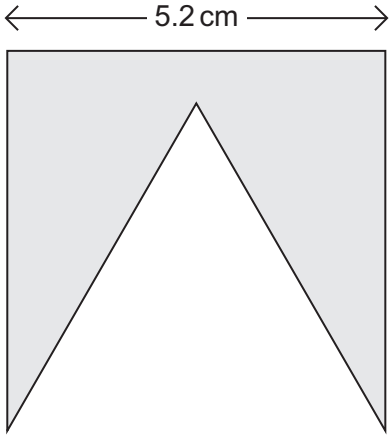
Answer ..... *(3 marks)*

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



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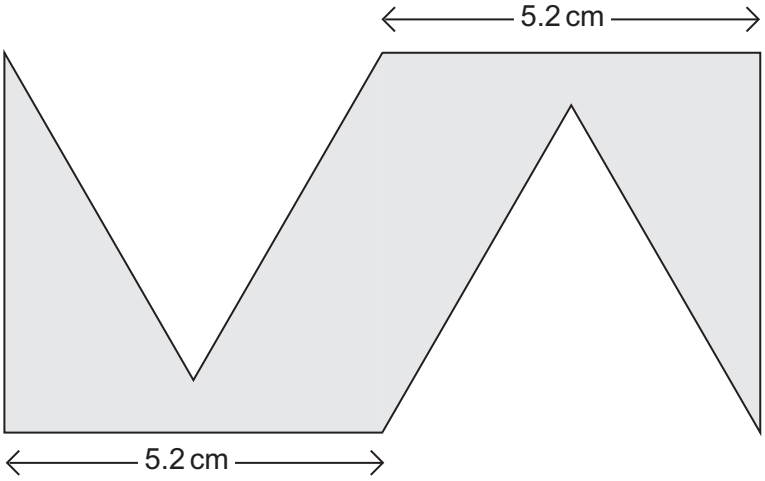
Two of these shapes are then put together to make a new shape as shown below.



Work out the perimeter of this new shape.

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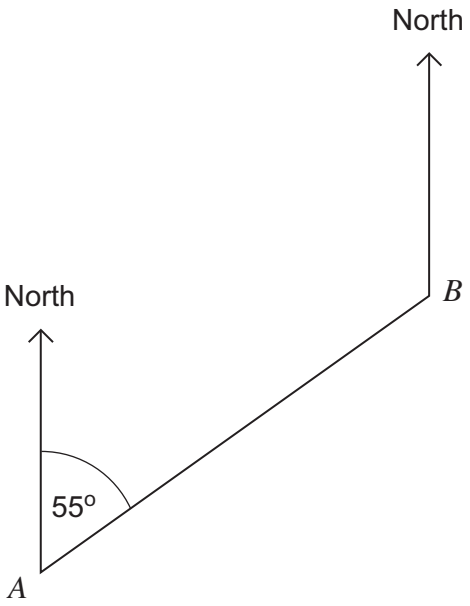
Answer ..... cm *(3 marks)*

6

6 A and B are two towns.



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

$$T = F + 180°$$

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 $0° < F \leqslant 180°$

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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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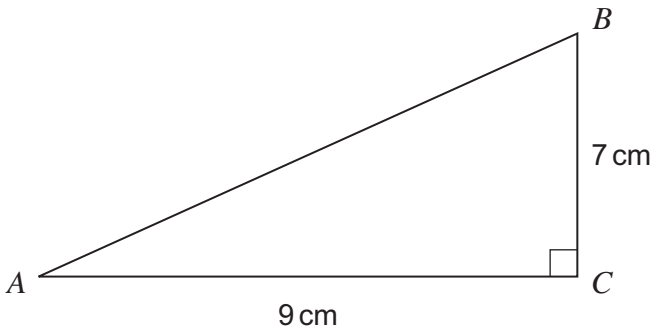
Answer ..... ° *(2 marks)*

7 Work out length AB as a decimal.



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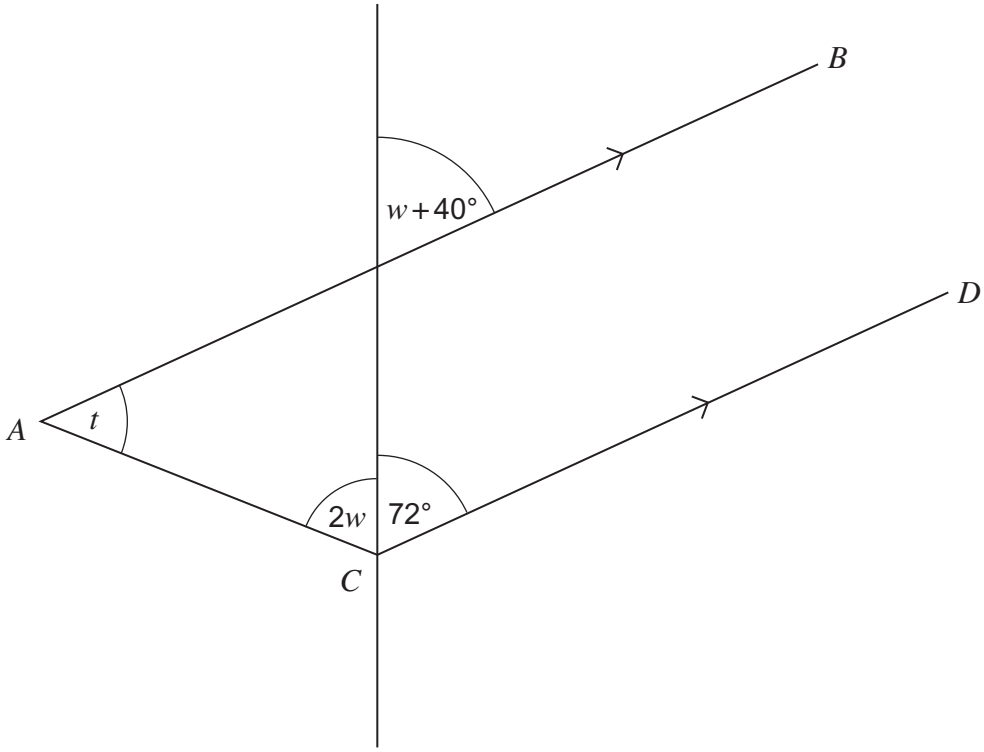
Answer ..... cm *(3 marks)*

8

8 AB is parallel to CD.



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Work out the value of t.

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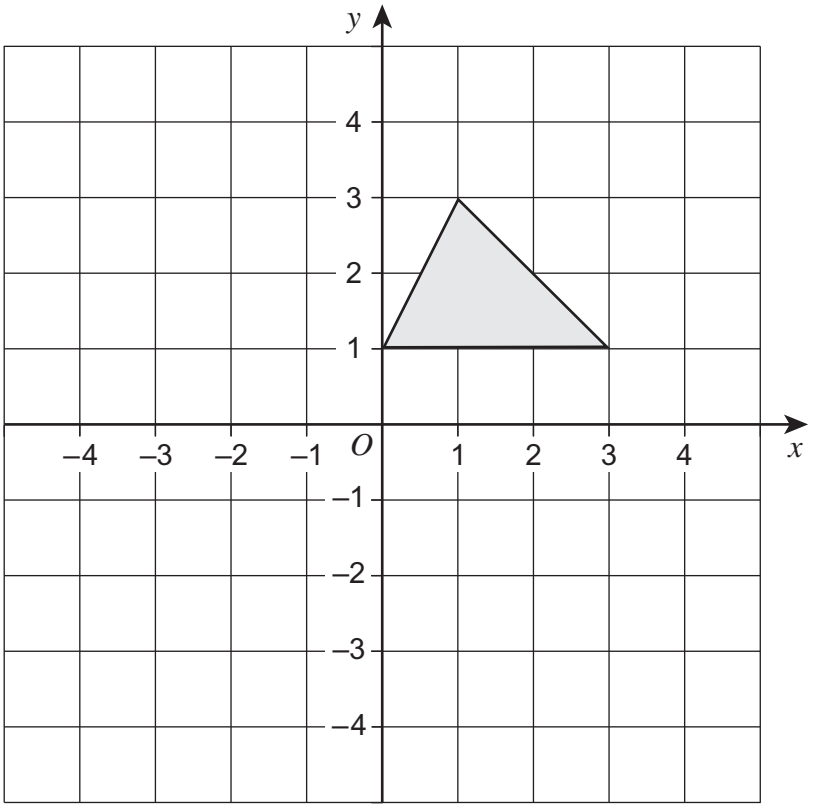
Answer ..... degrees *(5 marks)*

9 Rotate the triangle through 90º clockwise about (0, 1).



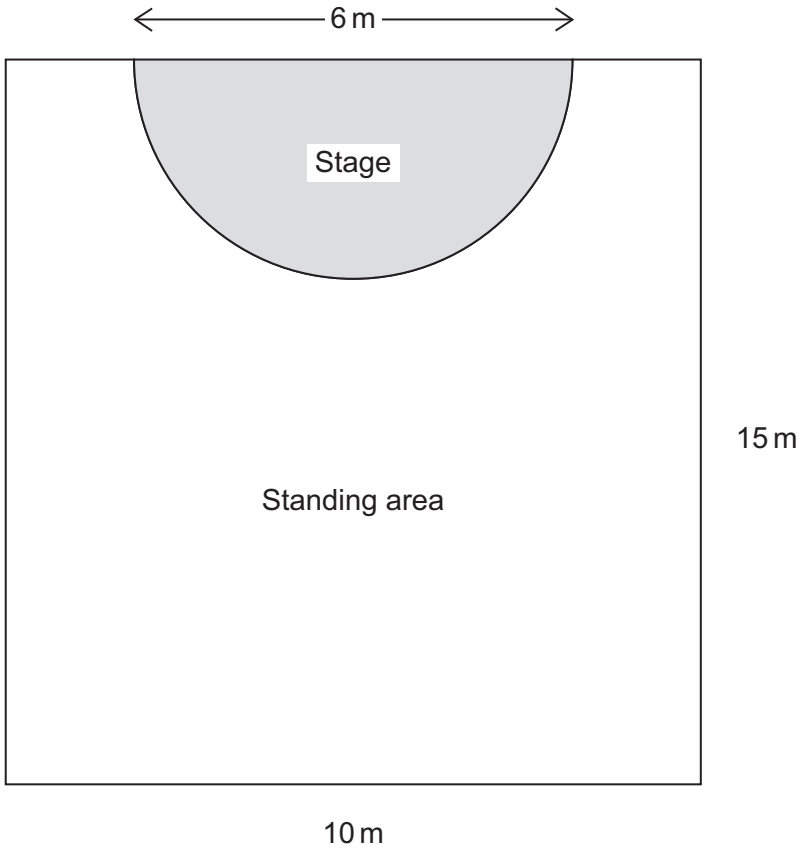
(2 marks)

Turn over for the next question

7

***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.

Maximum number = Standing area in m^2 ÷ 0.3

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

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Answer ..... *(5 marks)*

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

y cm

Not drawn accurately

x cm

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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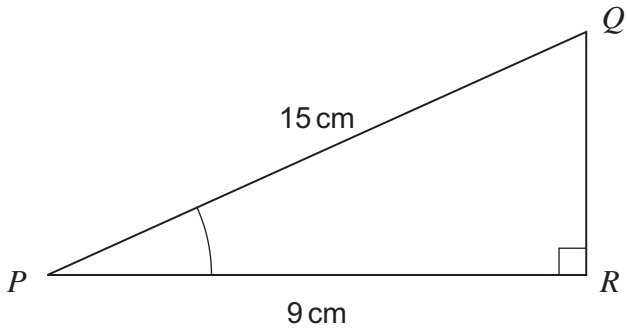
Answer ..... *(2 marks)*

9

Turn over ▶

12 Work out the size of angle P.



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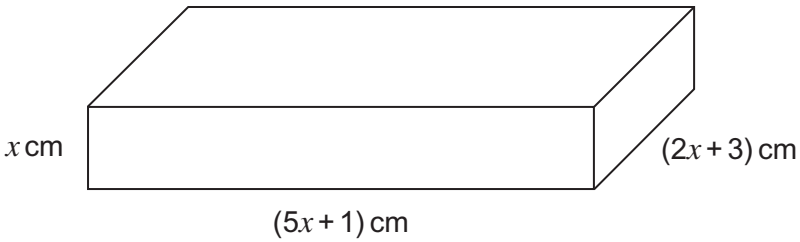
Answer ..... degrees *(3 marks)*

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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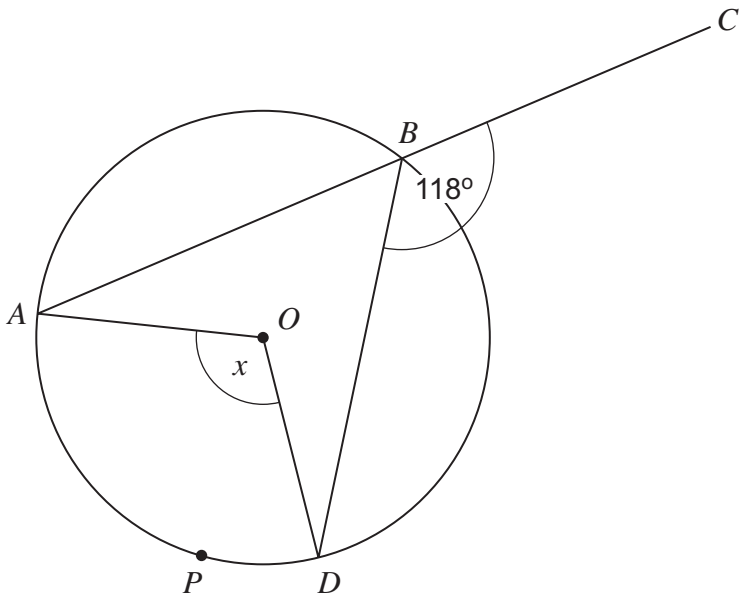
Answer ..... cm^3 *(5 marks)*

8

14 O is the centre of the circle.
ABC is a straight line.
Angle CBD = 118°



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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°

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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

7

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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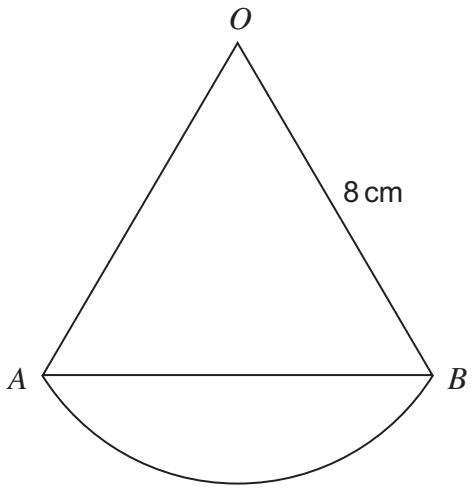
Answer ..... *(3 marks)*

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



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Work out the length of arc AB.

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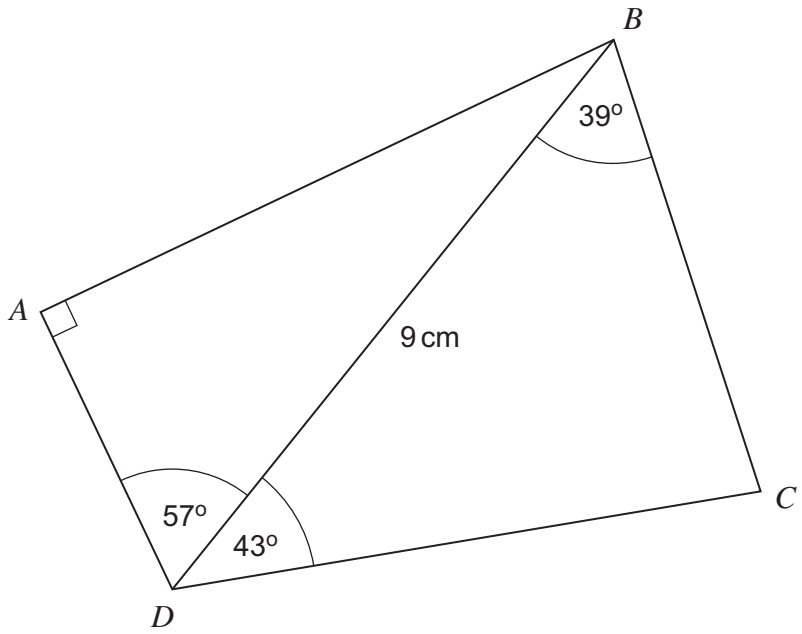
Answer ..... cm *(3 marks)*

Turn over for the next question

10

18 Work out the area of $ABCD$.



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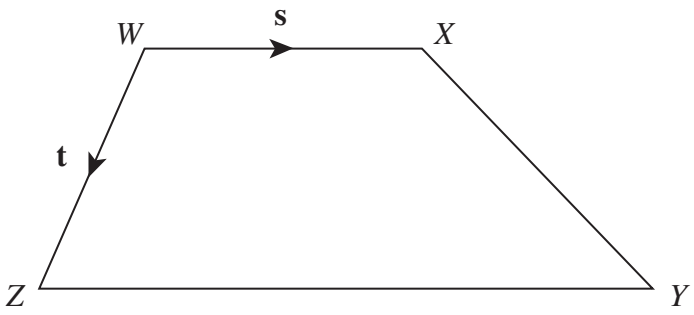
Answer ..... cm^2 *(7 marks)*

19 $WXYZ$ is a trapezium.

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

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

$ZY : WX = 3 : 2$



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

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Answer ..... *(1 mark)*

19 (b) Work out vector $\overrightarrow{XY}$ 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

10

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