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	
22 – 23	
TOTAL	

General Certificate of Secondary Education
Higher Tier
November 2012

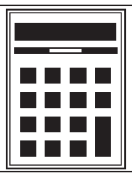
Mathematics 43603H

Unit 3

Monday 12 November 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

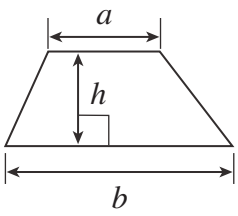
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this 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 3 and 16. 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.

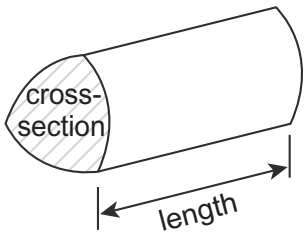
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

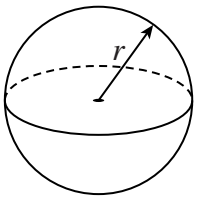


Volume of prism = area of cross-section × length



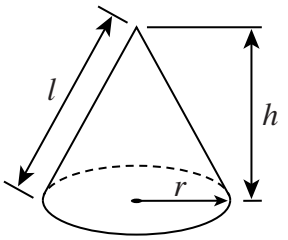
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

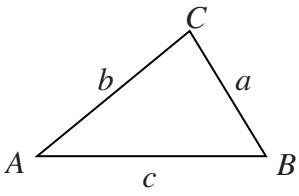
Curved surface area of cone = $\pi r l$



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

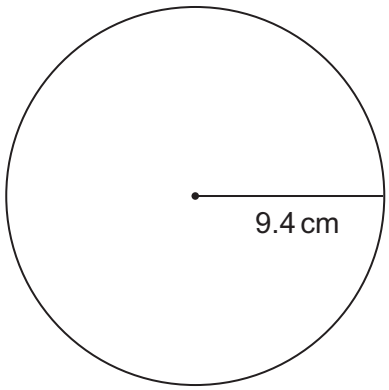
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

Do not write outside the box

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

1 A circle has radius 9.4 cm.



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1 (a) Work out the circumference of the circle.

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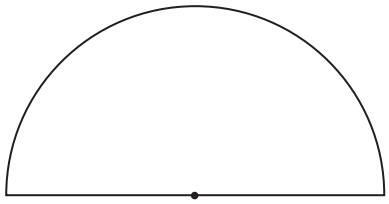
Answer ..... cm *(2 marks)*

1 (b) A semicircle has radius 9.4 cm.



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Use your answer to part (a) to work out the perimeter of the semicircle.

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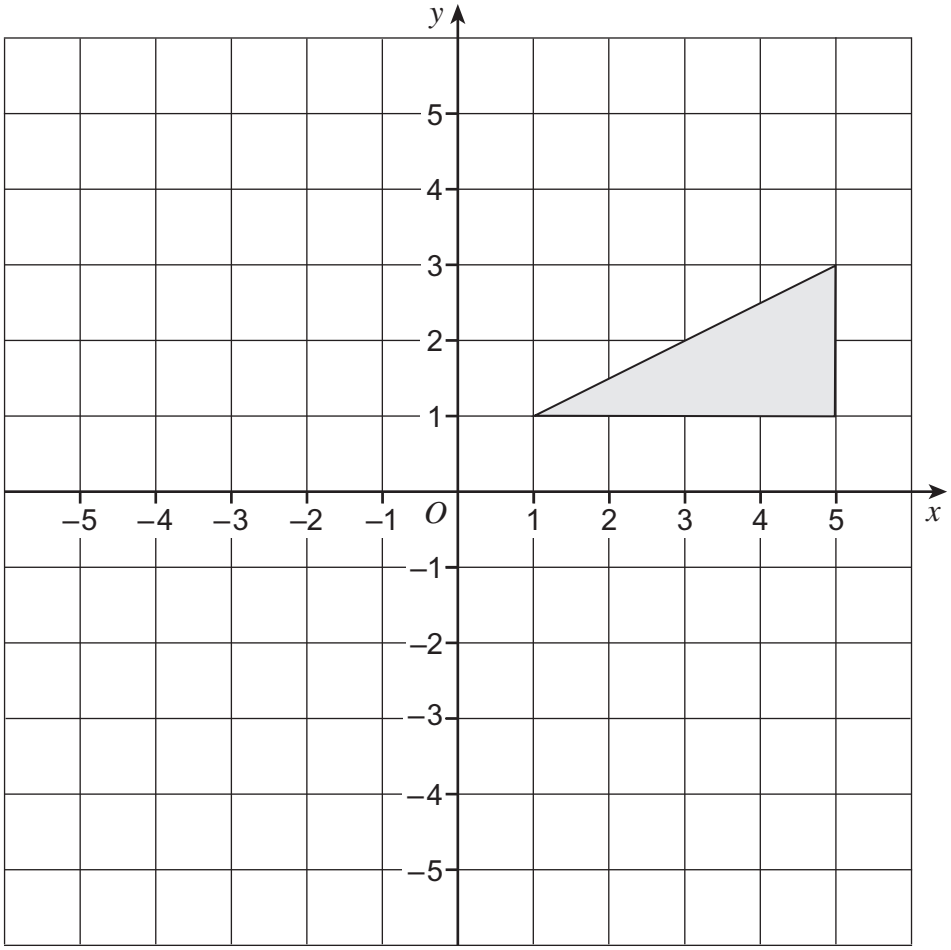
Answer ..... cm *(2 marks)*

4

Turn over ▶

Do not write outside the box

2 (a) Reflect the triangle in the line $x = 1$



(2 marks)

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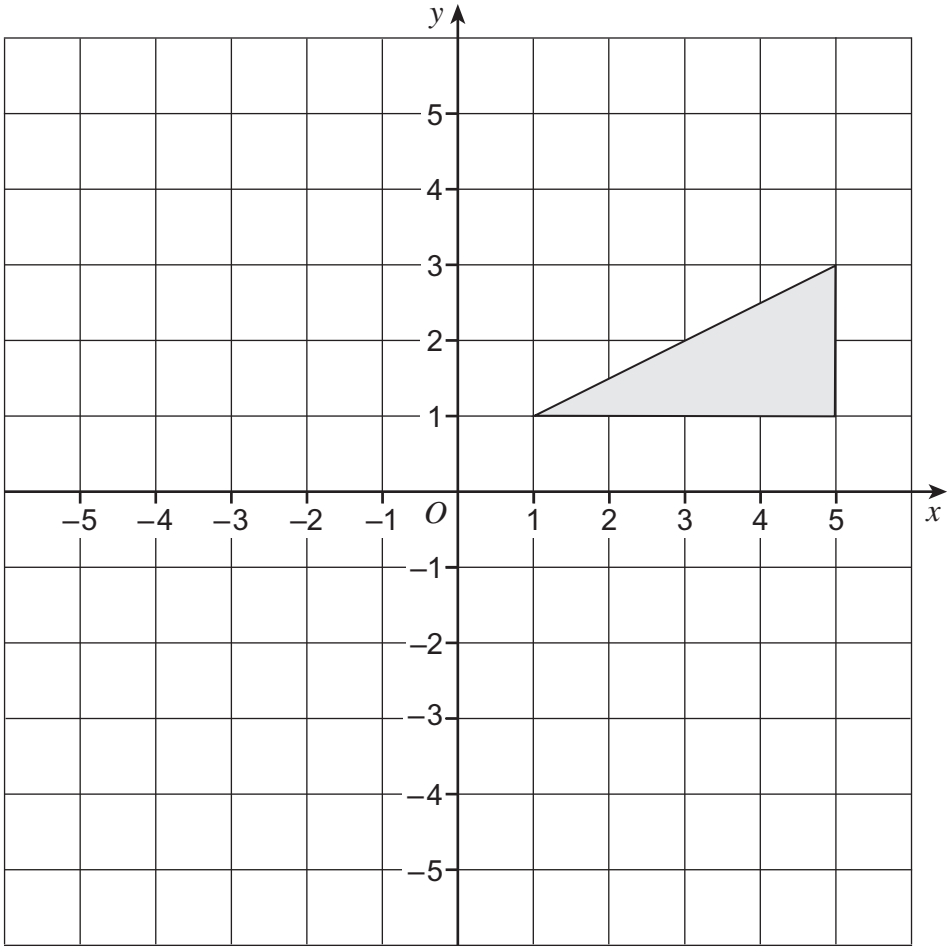
2 (b) Rotate the triangle through 180º about the origin.



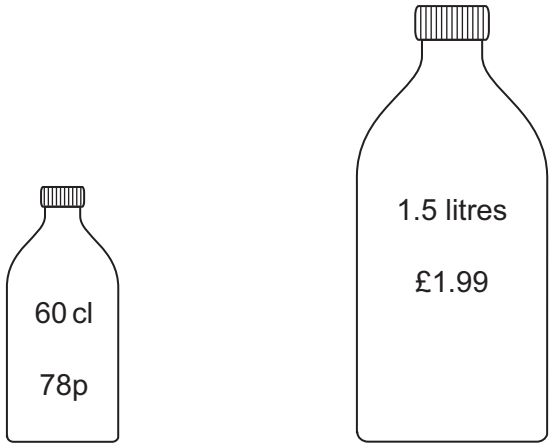
(2 marks)

Turn over for the next question

4

Do not write outside the box

***3** The diagram shows two bottles of the same drink.



Small Large

You are given that 1 litre = 100 cl

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

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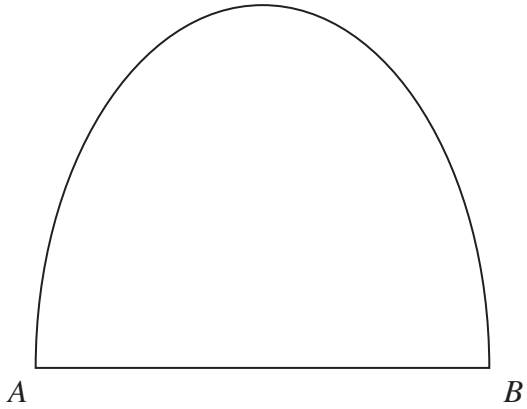
Answer ..... *(4 marks)*

Do not write outside the box

4 Here is a scale drawing of a play area.



Scale 1 : 800

A straight wall is to be built from A to B.
250 bricks are needed for each metre of wall.

Work out the total number of bricks needed to build the wall.

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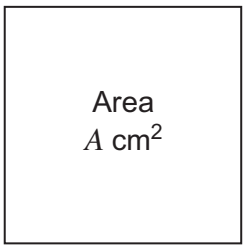
Answer ..... *(4 marks)*

8

Turn over ▶

Do not write outside the box

5 (a) The diagram shows a square piece of card.



Write down a formula connecting A and w.

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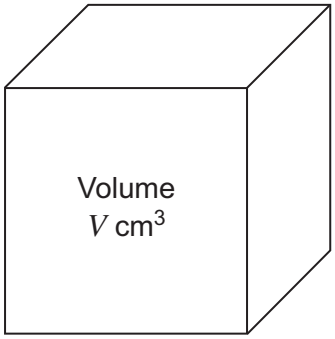
Answer ..... *(1 mark)*

5 (b) This diagram shows a cube.



Write down a formula connecting V and w.

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

Do not write outside the box

5 (c) The area of one face of a cube is 20 cm^2.

Work out the volume of the cube.

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

Turn over for the next question

5

Do not write outside the box

6 (a) Three angles are in the ratio 2 : 3 : 7
The smallest angle is 60º.

Show that these three angles will fit together at a point with no gaps.

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(3 marks)

6 (b) Two angles form a straight line.
One of the angles is $(x + 30)$ degrees.

Write down an expression for the size of the other angle.
Give your answer in its simplest form.

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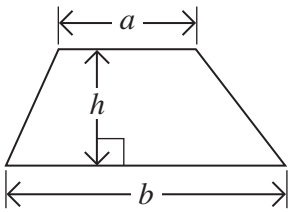
Answer ..... degrees *(2 marks)*

Do not write outside the box

7 In the trapezium, a = 6.5 m, b = 8.3 m and h = 3.2 m



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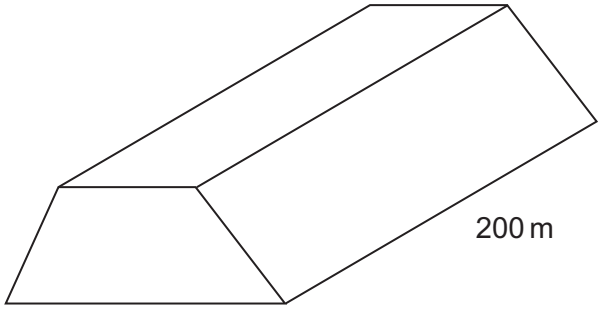
The trapezium is the cross-section of a tunnel.
The tunnel is 200 metres long.



Work out the volume of the tunnel.

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Answer ..... m^3 *(4 marks)*

9

Turn over ▶

Do not write outside the box

8 Solve the equation $x^2 - 5 = 0$
Give your answers to 1 decimal place.

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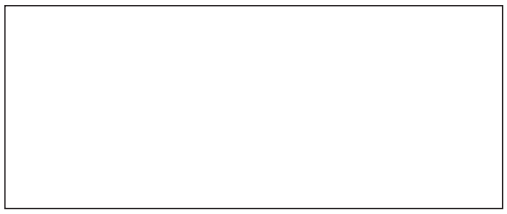
Answer ..... and ..... *(2 marks)*

9 The diagram shows a rectangle.



$(x - 5)$ cm

$(x + 4)$ cm

The area of the rectangle is 90 cm^2.

Set up and solve a quadratic equation to work out the value of x.

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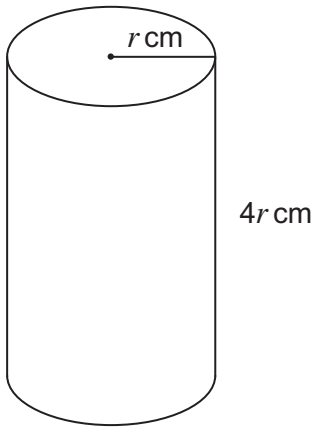
x = ... cm *(5 marks)*

Do not write outside the box

10 The diagram shows a cylinder of radius r cm and height $4r$ cm.



10 (a) Work out a formula for the volume, V of the cylinder in terms of π and r.
Simplify your answer.

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

10 (b) Work out the volume of the cylinder when $r = 8$

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Answer ..... cm^3 *(2 marks)*

11

Do not write outside the box

11 This is a formula for the time to cook a turkey.

$T = 15 + 20m$

This is a formula for the time to cook a goose.

$T = 40 + 15m$

m is the mass in kilograms.
T is the time in minutes.

A turkey and a goose have the same mass and take the same time to cook.

Work out this time.

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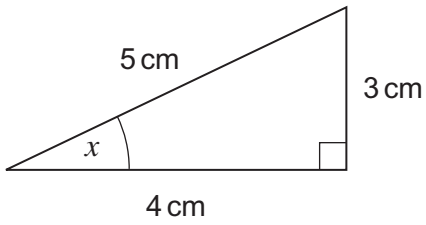
Answer ..... minutes *(4 marks)*

Do not write outside the box

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



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Write down the value of sin x.

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

12 (b) In a different right-angled triangle, tan $y = 0.7$

Work out the value of y.

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

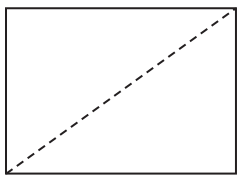
Turn over for the next question

6

Do not write outside the box

13 (a) The diagram shows a rectangle.

Not drawn accurately



Work out the length of the diagonal.

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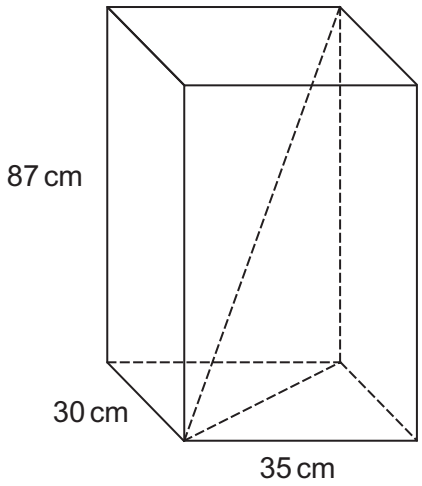
Answer ..... cm *(3 marks)*

Do not write outside the box

13 (b) The rectangle in part (a) is the base of this box.
The box is a cuboid.



Will a straight rod of length 1 metre fit in the box?
You **must** show your working.

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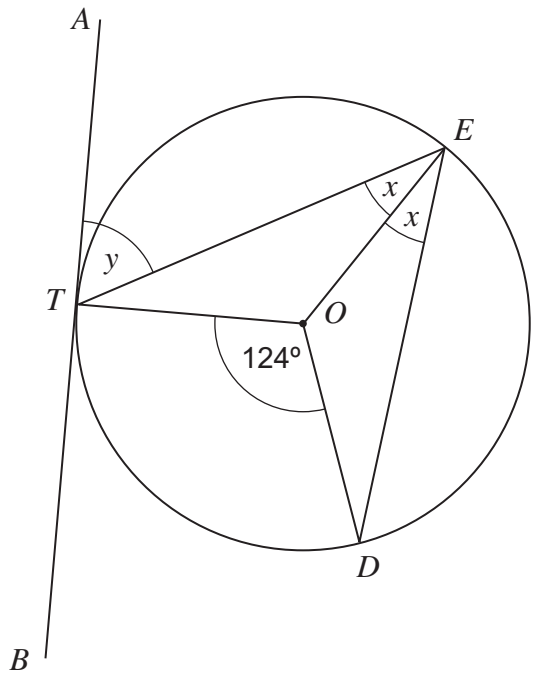
(3 marks)

Turn over for the next question

6

Do not write outside the box

14 The diagram shows a circle, centre O.
ATB is a tangent at T.



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14 (a) Work out the value of x.

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

14 (b) Work out the value of y.

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

Do not write outside the box

15 W is inversely proportional to x.
When $W = 6$, $x = 20$

Work out the value of W when $x = 24$

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Answer ..... *(4 marks)*

Turn over for the next question

9

Do not write outside the box

16 (a) You are given that 1 mile = 1.6 kilometres

Convert $6\frac{1}{2}$ miles into kilometres.

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

***16 (b)** A manufacturer claims a car like mine uses 5.5 litres per 100 km.

My car does 50 miles per gallon.

Is my car using more or less fuel than the manufacturer claims?
You **must** show your working.

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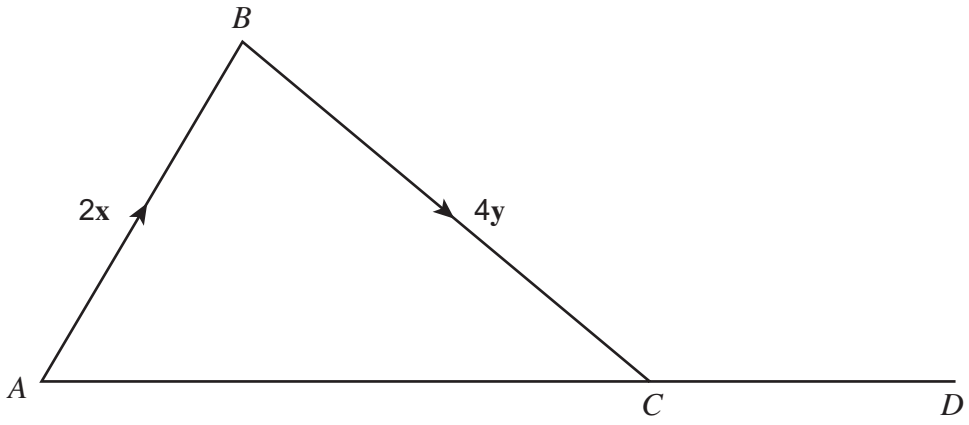
(5 marks)

Do not write outside the box

17 $\overrightarrow{AB} = 2\mathbf{x}$ and $\overrightarrow{BC} = 4\mathbf{y}$
ACD is a straight line.



17 (a) Write down the vector $\overrightarrow{AC}$ in terms of $\mathbf{x}$ and $\mathbf{y}$.

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

17 (b) $AC : CD = 2 : 1$

Work out the vector $\overrightarrow{AD}$ in terms of $\mathbf{x}$ and $\mathbf{y}$.
Give your answer as simply as possible.

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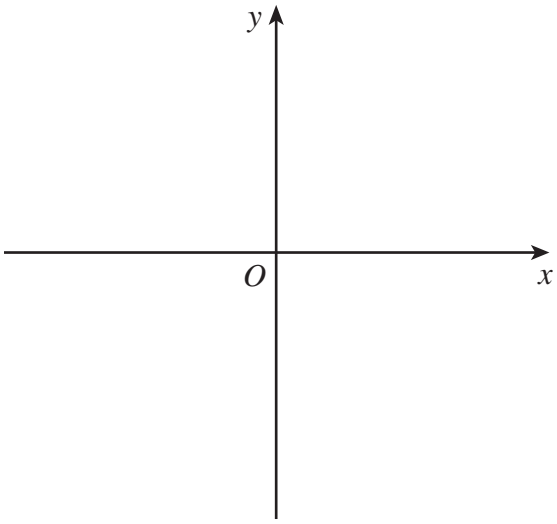
Answer ..... *(2 marks)*

Turn over for the next question

10

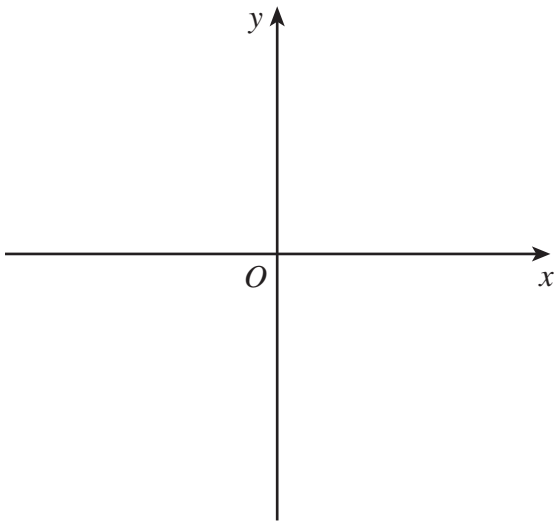
Do not write outside the box

18 (a) On the axes below sketch the graph of $y = x^3$



(1 mark)

18 (b) On the axes below sketch the graph of $y = x^3 + 8$



(1 mark)

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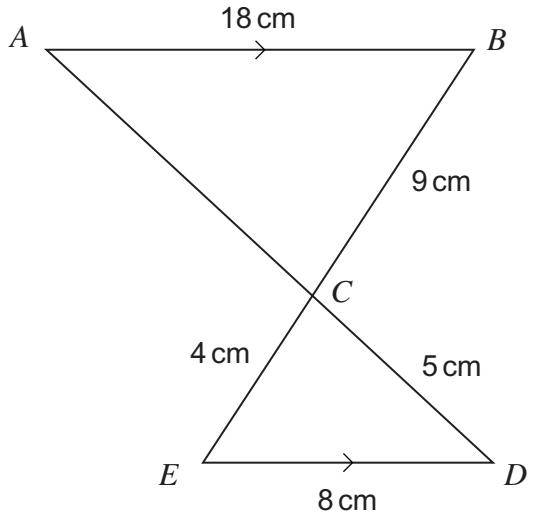
19 ACD and BCE are straight lines.
Triangle ABC is similar to triangle DEC.
AB is parallel to ED.



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Work out the area of triangle ABC.

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Answer ..... cm^2 *(6 marks)*

END OF QUESTIONS

8

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