

Centre Number						Candidate Number				
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For Examiner's Use	
Examiner's Initials	
Pages	Mark
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TOTAL	



General Certificate of Secondary Education
Higher Tier
March 2013

Mathematics

43603H

Unit 3

Wednesday 6 March 2013 9.00 am to 10.30 am

H

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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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 6 and 15. 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.



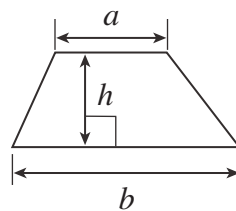
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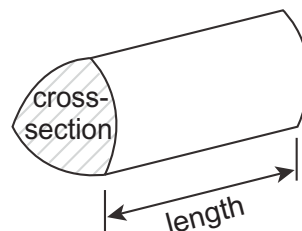
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Formulae Sheet: Higher Tier

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

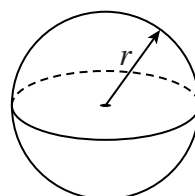


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



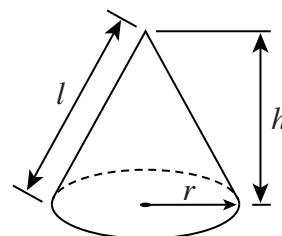
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

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



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

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

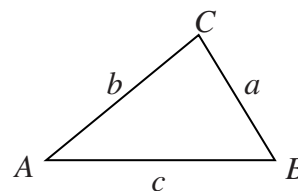


In any triangle ABC

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

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

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



The Quadratic Equation

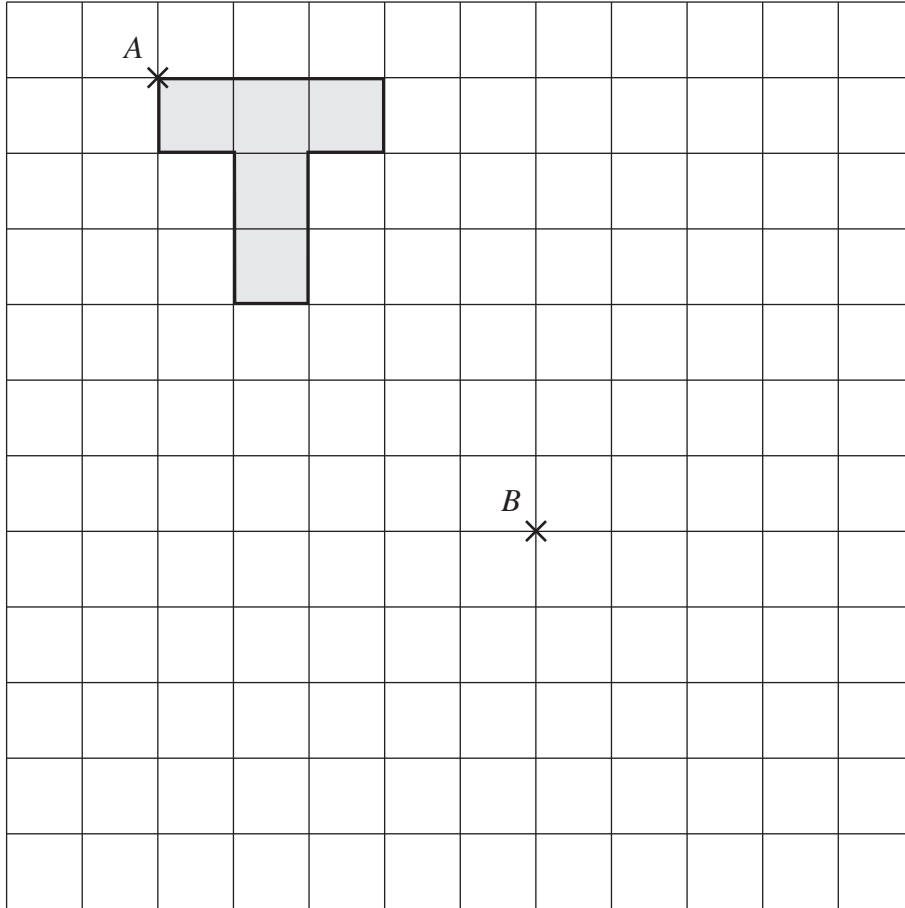
The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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



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

1 (a) Translate this T-shape so that point *A* moves to point *B*.



(1 mark)

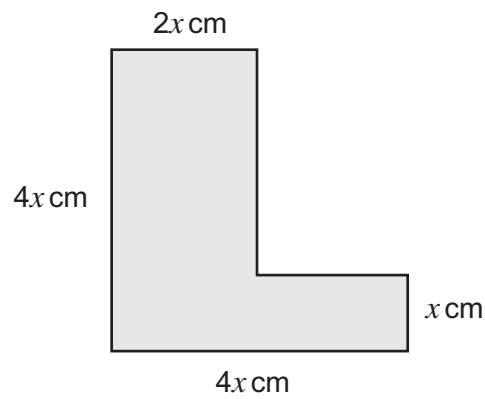
1 (b) Describe the translation.

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(2 marks)



- 2 The perimeter of this L-shape is 56 cm.



Not drawn accurately

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

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$x =$ (4 marks)

- 3 Work out the circumference of a circle, radius 4.2 cm.
Give your answer to 1 decimal place.

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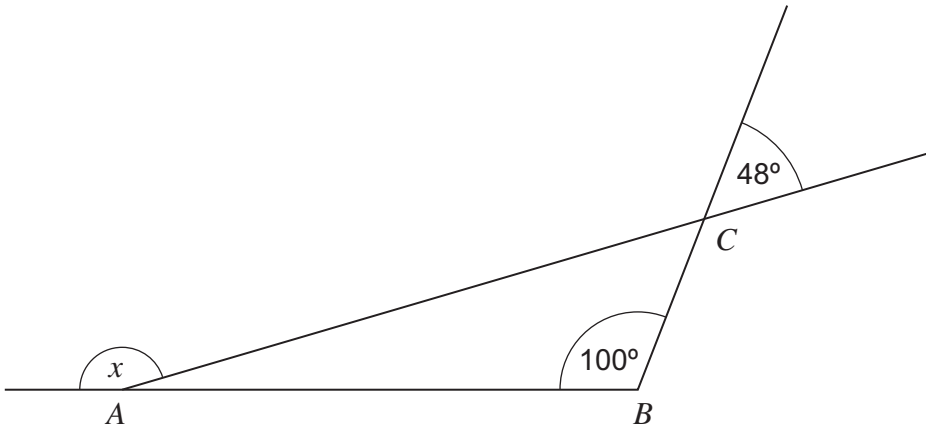
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Answer cm (3 marks)



4 The diagram shows a triangle ABC with sides extended.

Not drawn
accurately



Work out the value of x .

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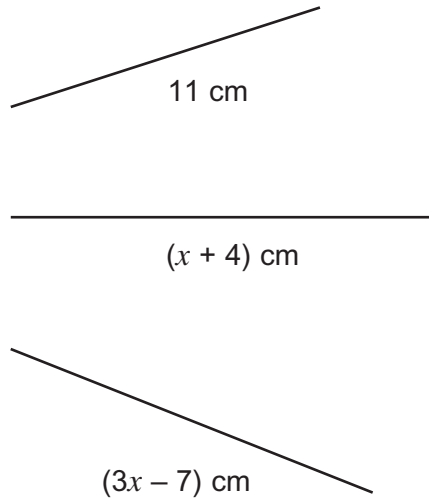
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Answer degrees (3 marks)

Turn over for the next question



5 The diagram shows three rods.



Not drawn accurately

Two of the rods are the same length.

Work out the **three** possible values for x .

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Answer 1 $x =$

Answer 2 $x =$

Answer 3 $x =$

(5 marks)



*6 Here are two bottles of the same perfume.



Normal price £40
20% off



£55

Which is the better value?
You **must** show your working.

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(6 marks)



7 (a) The scale on a map is 1 : 250 000

What is the actual distance represented by 1 centimetre?
Give your answer in kilometres.

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Answer km (3 marks)

7 (b) The scale on a different map is 1 inch represents 4 miles.
A road on the map measures 6 inches to the nearest inch.

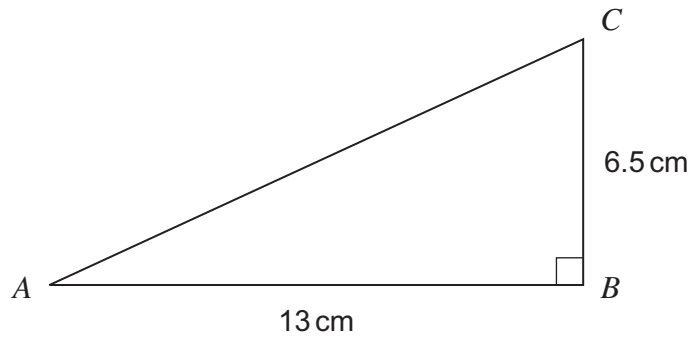
What is the shortest possible distance of the road?

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Answer miles (3 marks)



8 Work out the length AC .



Not drawn accurately

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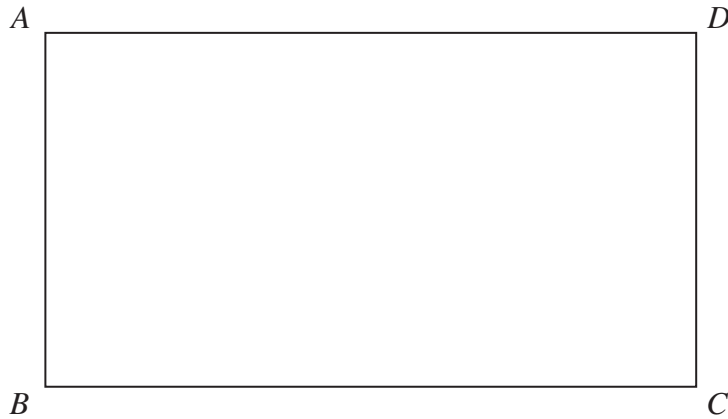
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Answer cm (3 marks)

Turn over for the next question

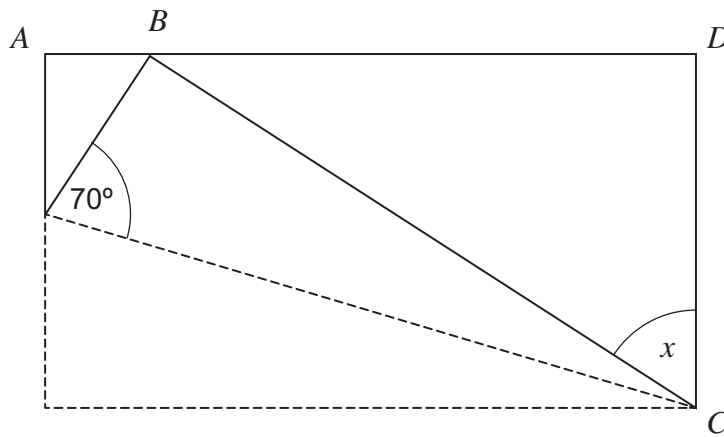


9 The diagram shows a rectangular sheet of paper $ABCD$.



Not drawn
accurately

Corner B is folded to meet side AD as shown.



Not drawn
accurately

Work out the angle marked x on the diagram.

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Answer degrees (4 marks)



10

Use trial and improvement to find a solution to $x^3 - 20x = 60$
Give your answer to 1 decimal place.

x	$x^3 - 20x$	Comment
5	25	Too small

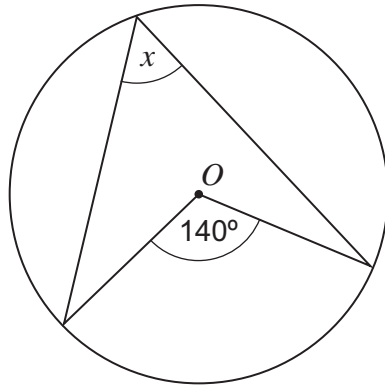
$x =$ (4 marks)

8

Turn over ►



11 (a) The diagram shows a circle, centre O .



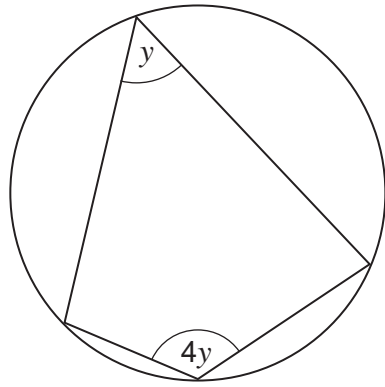
Not drawn accurately

Work out the value of x .

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Answer degrees (1 mark)

11 (b) The diagram shows a cyclic quadrilateral.



Not drawn accurately

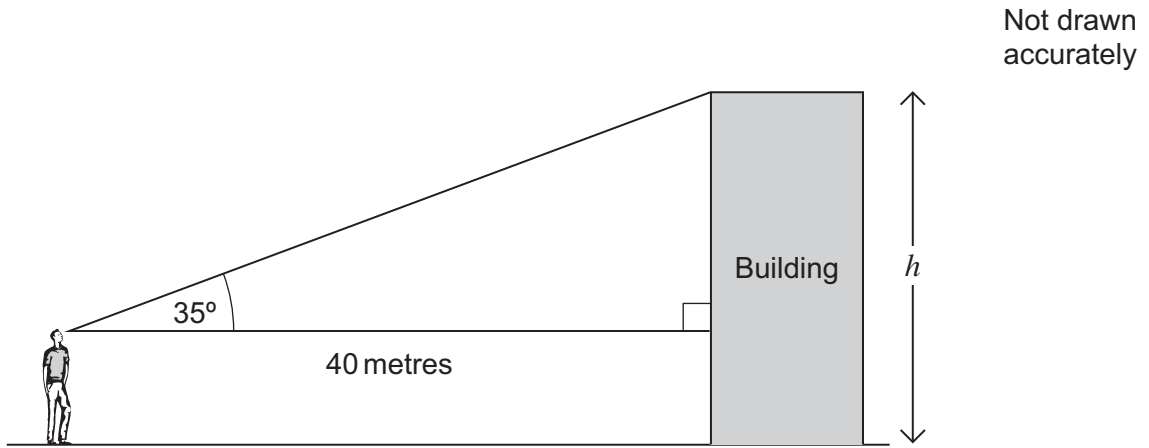
Work out the value of y .

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Answer degrees (2 marks)



12



The man is 1.8 metres tall.

Work out the height of the building, marked h on the diagram.
Give your answer to a suitable degree of accuracy.

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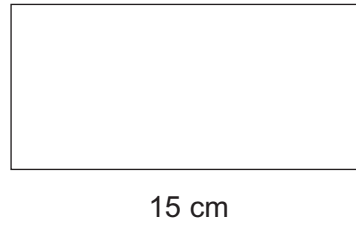
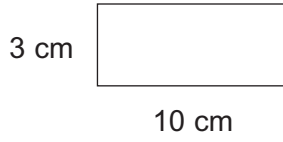
Answer metres (5 marks)

Turn over for the next question



13 Here are two similar rectangles.

Not drawn accurately



Work out the area of the larger rectangle.

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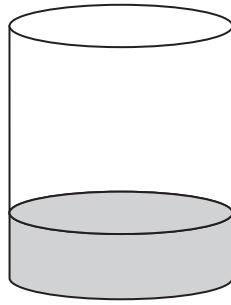
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Answer cm² (5 marks)



14 The cylindrical tank is one-quarter full of oil.



1 litre = 1000 cm³

The radius of the base of the cylinder is 90 cm.
The height of the cylinder is 200 cm.

Work out the number of litres of oil in the tank.

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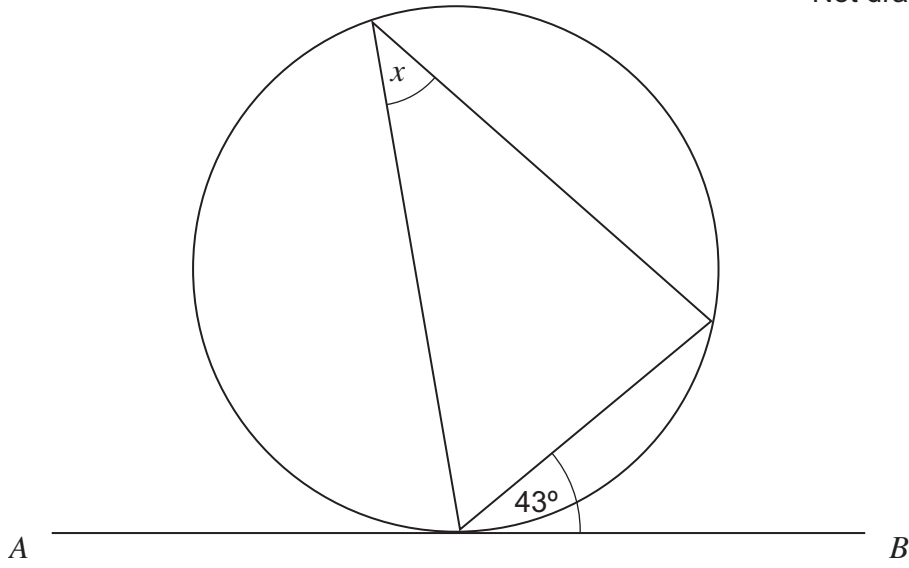
Answer litres (4 marks)



***15**

AB is a tangent to the circle.

Not drawn accurately



Write down the value of x .
Give a reason for your answer.

Answer degrees

Reason
(2 marks)



16 Use the quadratic formula to solve

$$6x^2 + 5x - 3 = 0$$

Give your answers to 2 decimal places.

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Answer and (3 marks)

Turn over for the next question

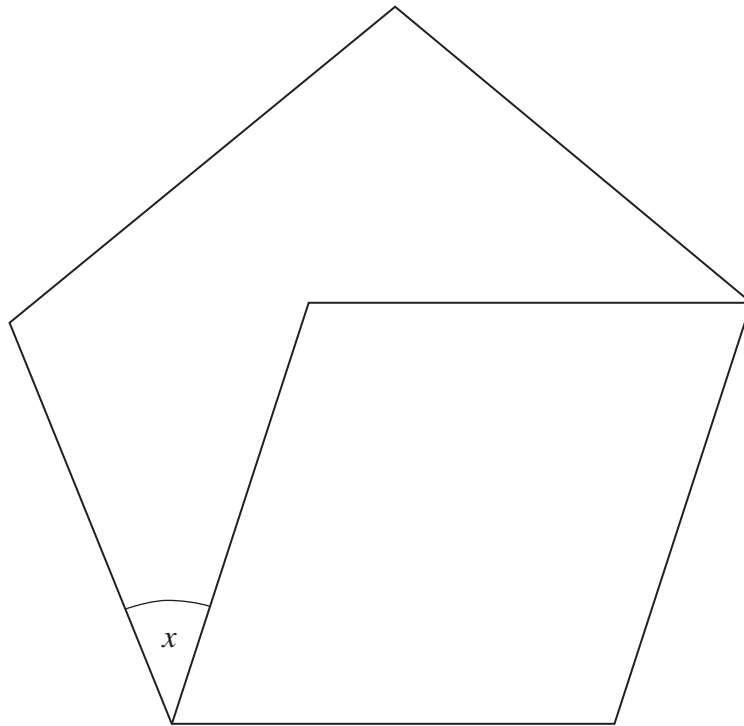
5

Turn over ►



17 The diagram shows a rhombus inside a regular pentagon.

Not drawn
accurately



Work out the value of x .

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Answer degrees (4 marks)



18 (a) Here are four equations connecting y and x .
 k is a constant.

$$y = kx$$

$$y = \frac{k}{x}$$

$$y = kx^2$$

$$y = \frac{k}{x^2}$$

Match each equation to its statement.

y is **directly** proportional to x

Equation

y is **directly** proportional to x^2

Equation

y is **inversely** proportional to x

Equation

y is **inversely** proportional to x^2

Equation

(2 marks)

18 (b) y is **inversely** proportional to x .
When $x = 3$, $y = 8$

Work out the value of y when $x = 5$

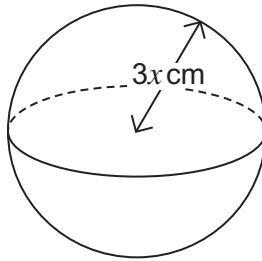
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Answer

(3 marks)



- 19 (a) A sphere has radius $3x$ cm.



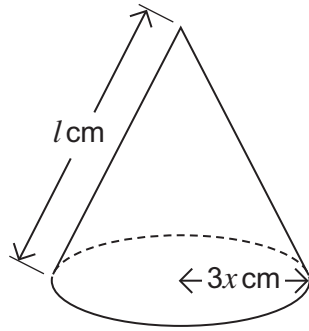
Write down an expression for the surface area of the sphere in terms of π and x .
Give your answer in its simplest form.

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Answer cm^2 (2 marks)



19 (b) A cone has base radius $3x$ cm and slant height l cm.



The curved surface area of the cone is equal to the surface area of the sphere.

Express l in terms of x .
Give your answer in its simplest form.

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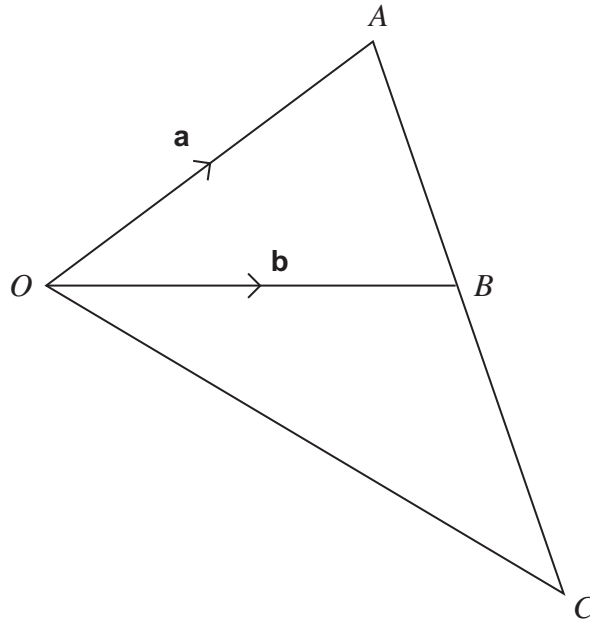
$l =$ (2 marks)

Turn over for the next question



20 The diagram shows vectors $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

Not drawn accurately



20 (a) Write vector \vec{AB} in terms of \mathbf{a} and \mathbf{b} .

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Answer (1 mark)



20 (b) The point B divides \overrightarrow{AC} in the ratio $2 : 3$
Work out vector \overrightarrow{OC} in terms of \mathbf{a} and \mathbf{b} .

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Answer (3 marks)

END OF QUESTIONS



There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED**

