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
March 2013

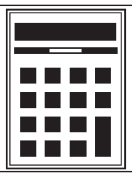
Mathematics 43603H

Unit 3

Wednesday 6 March 2013 9.00 am to 10.30 am

H

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



Time allowed
- 1 hour 30 minutes

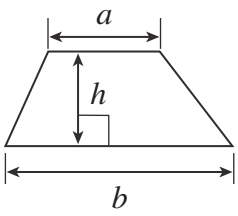
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

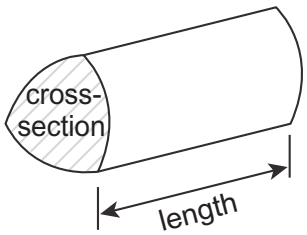
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

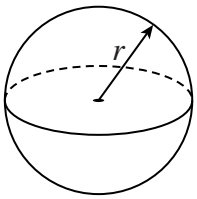


Volume of prism = area of cross-section × length



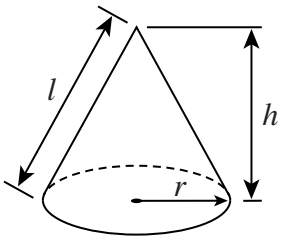
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

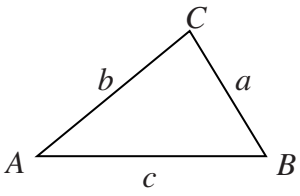
Curved surface area of cone = $\pi r l$



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

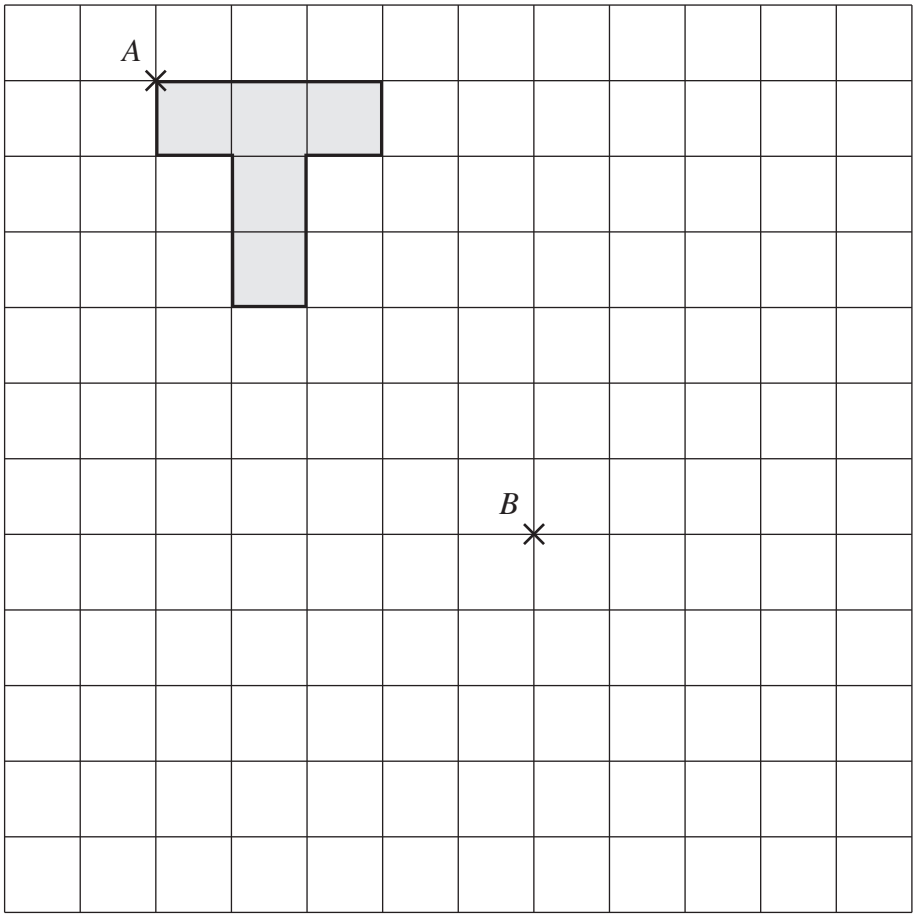
The Quadratic Equation

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



(1 mark)

1 (b) Describe the translation.

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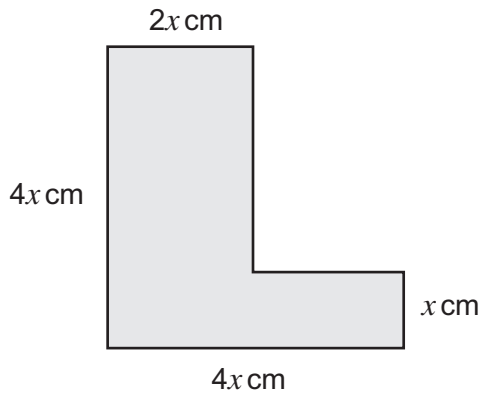
(2 marks)

3

Turn over ▶

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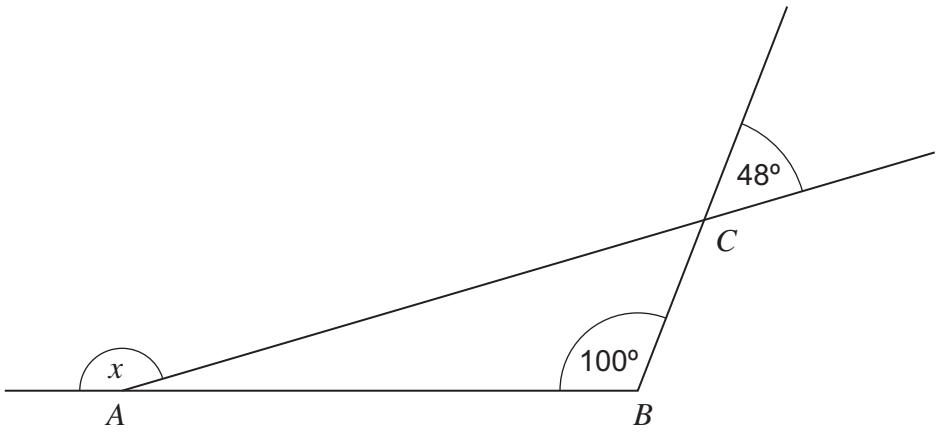
Answer ..... cm *(3 marks)*

4 The diagram shows a triangle ABC with sides extended.

Not drawn accurately



Work out the value of x.

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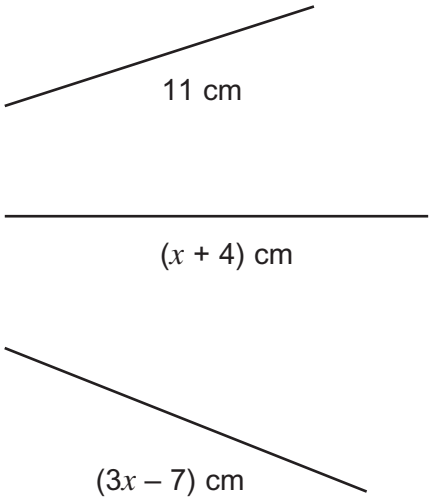
Answer ..... degrees *(3 marks)*

Turn over for the next question

10

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)

11

Turn over ▶

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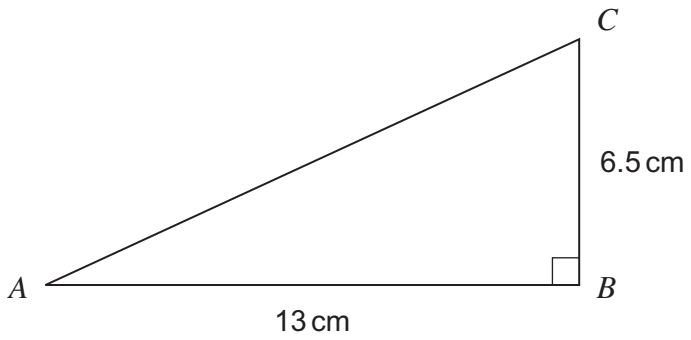
Answer ..... miles *(3 marks)*

8 Work out the length AC.



Not drawn accurately

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

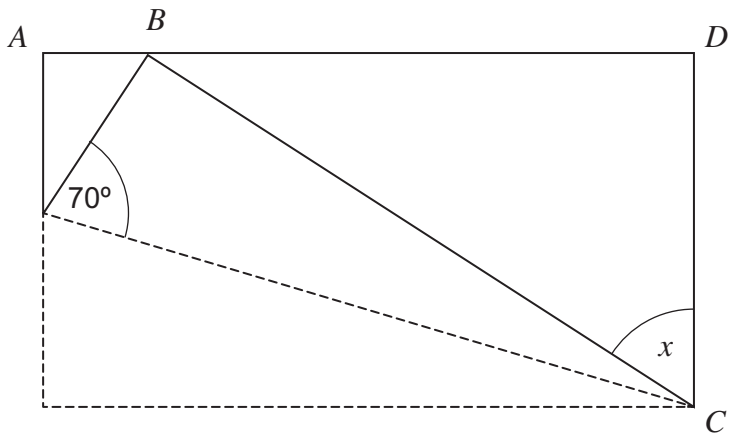
Turn over for the next question

9

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)*

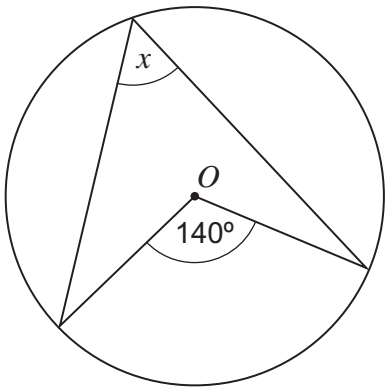
10 Use trial and improvement to find a solution to $x^3 - 20x = 60$
Give your answer to 1 decimal place.

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

x = ... *(4 marks)*

8

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



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Work out the value of x.

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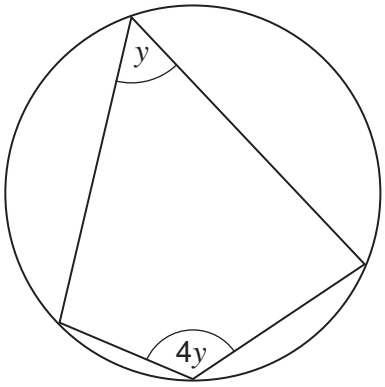
Answer ..... degrees *(1 mark)*

11 (b) The diagram shows a cyclic quadrilateral.



Not drawn accurately

Work out the value of y.

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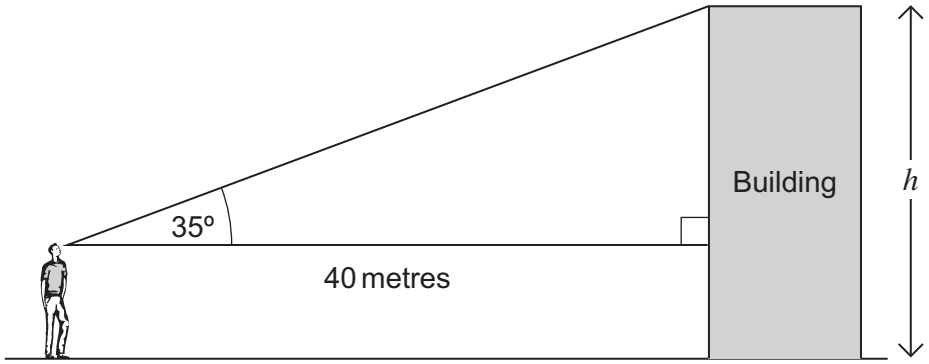
Answer ..... degrees *(2 marks)*

12

Not drawn accurately



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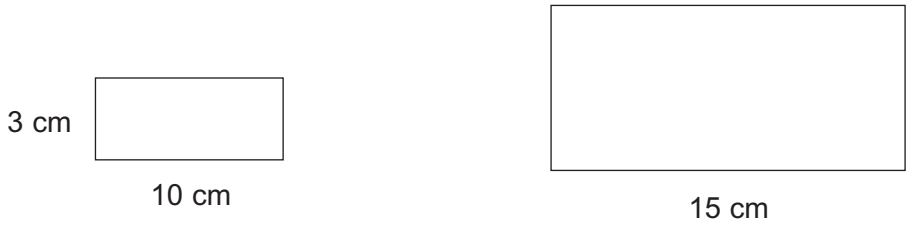
Answer ..... metres *(5 marks)*

Turn over for the next question

8

13 Here are two similar rectangles.

Not drawn accurately



Work out the area of the larger rectangle.

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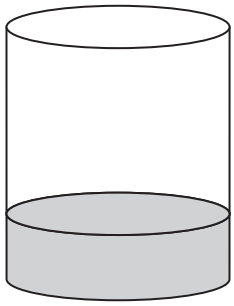
Answer ..... cm^2 *(5 marks)*

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



1 litre = 1000 cm^3

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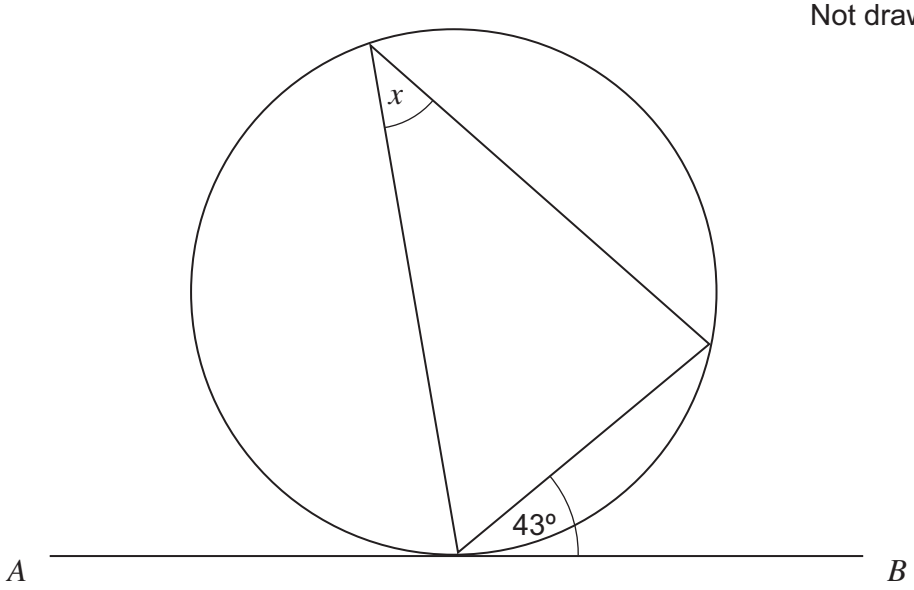
Answer ..... litres *(4 marks)*

9

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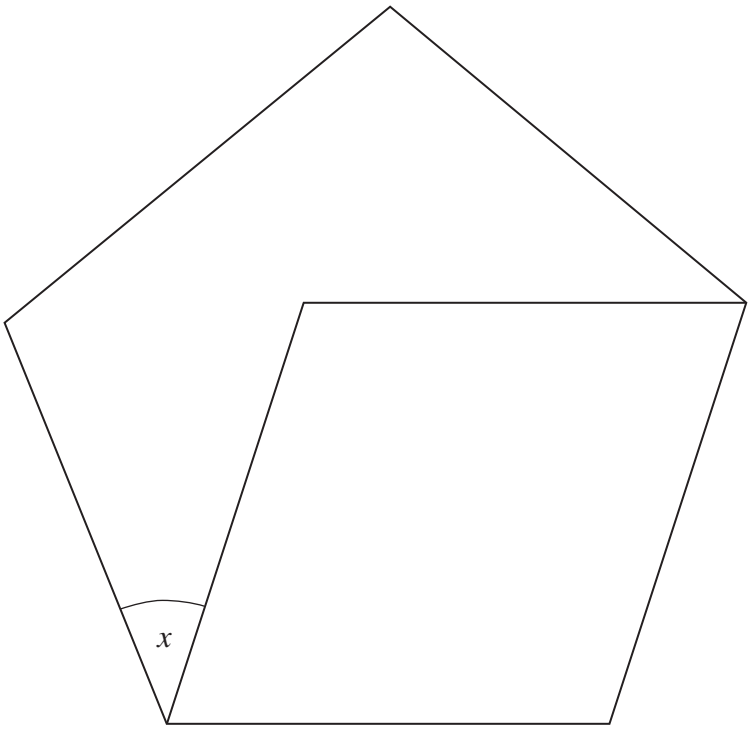
Answer ..... and ..... *(3 marks)*

Turn over for the next question

5

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.

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

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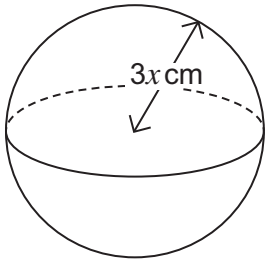
Answer ..... *(3 marks)*

9

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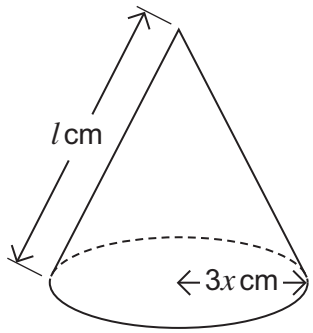
Answer ..... cm^2 *(2 marks)*

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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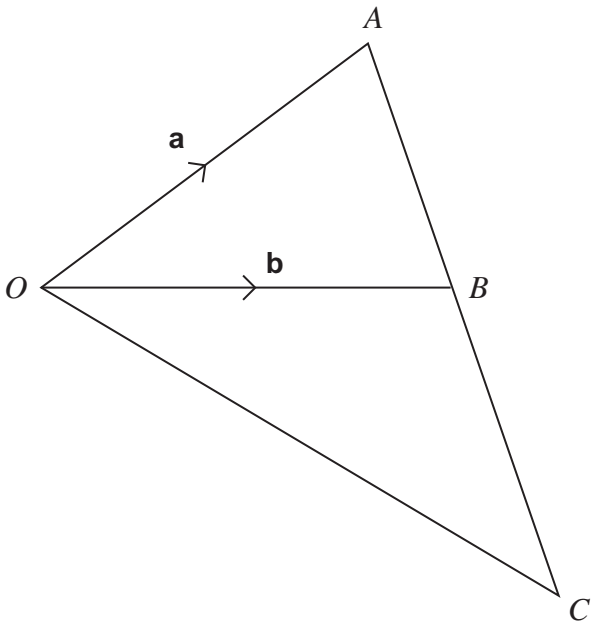
l = ... *(2 marks)*

Turn over for the next question

4

20 The diagram shows vectors $\overrightarrow{OA}$ = **a** and $\overrightarrow{OB}$ = **b**

Not drawn accurately



20 (a) Write vector $\overrightarrow{AB}$ in terms of **a** and **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 **a** and **b**.

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

END OF QUESTIONS

4

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED