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| Surname             |  |  |  |  | Other Names      |  |  |  |  |
| Centre Number       |  |  |  |  | Candidate Number |  |  |  |  |
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General Certificate of Secondary Education  
June 2004



**MATHEMATICS (MODULAR) (SPECIFICATION B) 33005/H1**  
**Module 5 Higher Tier**  
**Paper 1 Non-Calculator**

**H**

Tuesday 8 June 2004 1.30 pm to 2.45 pm

|  |  |
|--|--|
| <p><b>In addition to this paper you will require:</b></p> <ul style="list-style-type: none"> <li>mathematical instruments.</li> </ul> <p>You must <b>not</b> use a calculator.</p> |  |
|--|--|

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

Time allowed: 1 hour 15 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this booklet.

**Information**

- The maximum mark for this paper is 70.
- Mark allocations are shown in brackets.
- Additional answer paper, graph paper and tracing paper will be issued on request and must be tagged securely to this answer booklet.

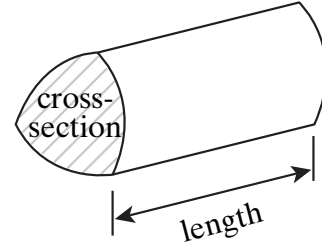
**Advice**

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

### Formulae Sheet: Higher Tier

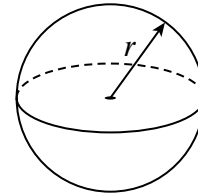
You may need to use the following formulae:

**Volume of prism** = area of cross-section  $\times$  length



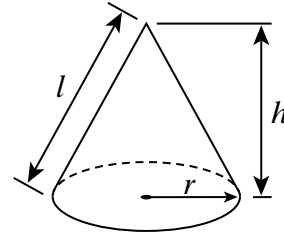
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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



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

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

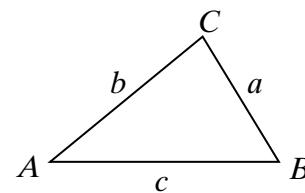


**In any triangle ABC**

**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 sequence of numbers is shown.

2      5      8      11      14

(a) Find an expression for the  $n$ th term of the sequence.

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.....

Answer ..... (2 marks)

(b) Explain why 99 will not be a term in this sequence.

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.....  
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(2 marks)

**TURN OVER FOR THE NEXT QUESTION**



**Turn over** ►

- 2 (a) The line  $LM$  is drawn below.



Use ruler and compasses to construct the perpendicular bisector of  $LM$ .  
You **must** show clearly all your construction arcs.

(2 marks)

- (b) Complete the sentence.

The perpendicular bisector of  $LM$  is the locus of points which are .....

.....

(1 mark)

3 Here is a list of quadrilaterals.

kite    rectangle    rhombus    square    trapezium

For each of the following descriptions, choose the correct name from the list.  
You may find it helpful to sketch the quadrilaterals in the spaces provided.

- (a) One pair of sides are parallel.  
The other two sides are not parallel.

Answer ..... (1 mark)

- (b) All the angles are the same size.  
Only opposite sides are equal.

Answer ..... (1 mark)

- (c) All the sides are the same length.  
The diagonals are not equal in length.

Answer ..... (1 mark)

Turn over ►

6

- 4 (a) Complete the table of values for  $y = 2x^2 - 4x - 1$

|     |    |    |    |   |    |   |
|-----|----|----|----|---|----|---|
| $x$ | -2 | -1 | 0  | 1 | 2  | 3 |
| $y$ | 15 |    | -1 |   | -1 | 5 |

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(2 marks)

- (b) On the grid opposite, draw the graph of  $y = 2x^2 - 4x - 1$  for values of  $x$  from -2 to +3.

(2 marks)

- (c) An approximate solution of the equation  $2x^2 - 4x - 1 = 0$  is  $x = 2.2$

- (i) Explain how you can find this from the graph.

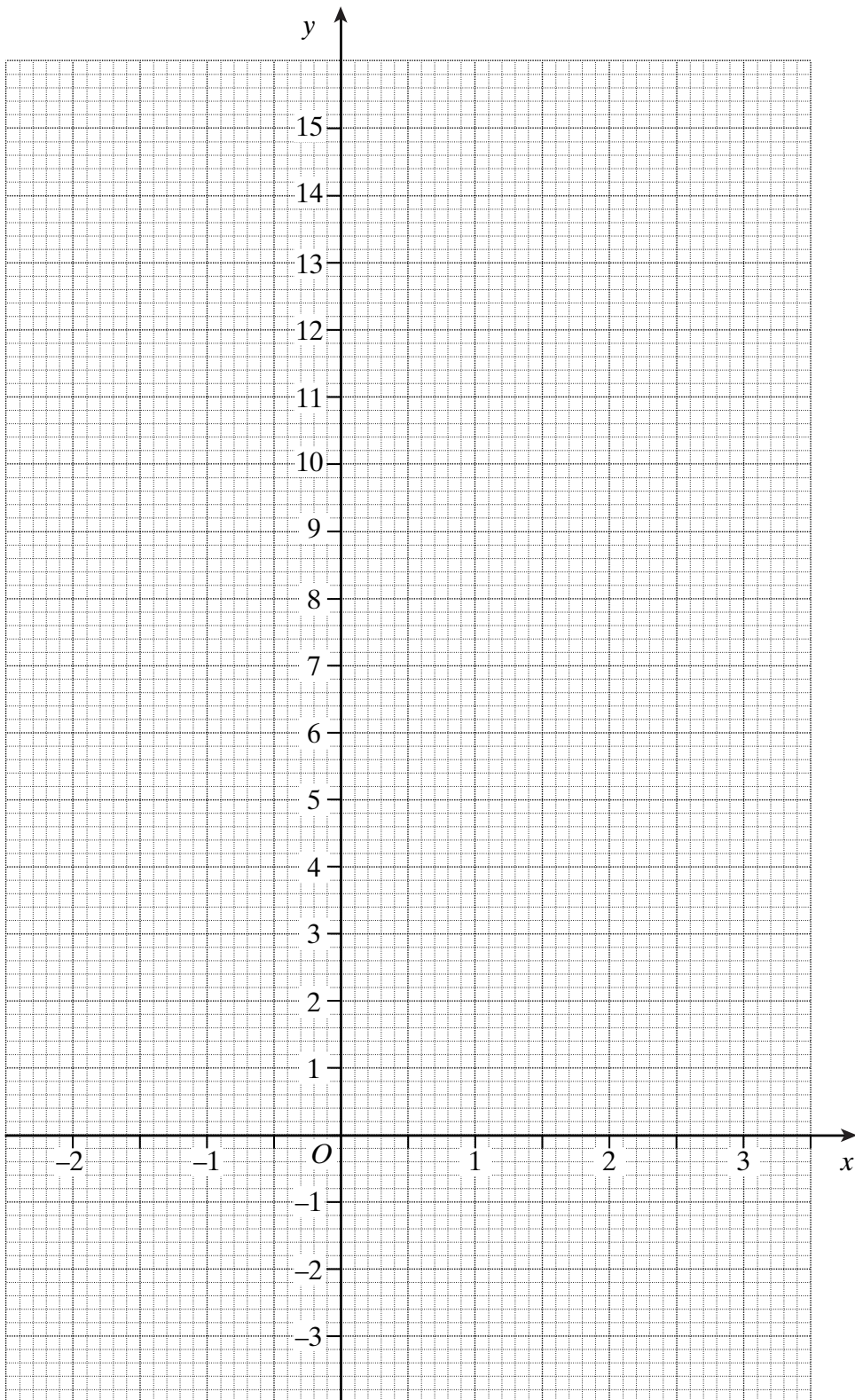
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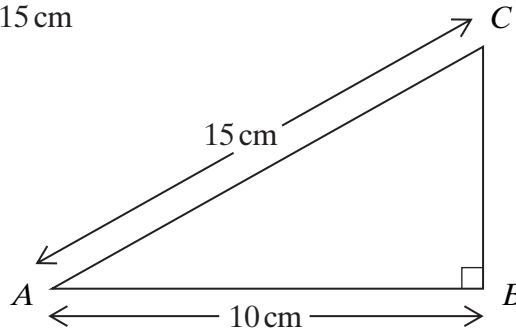
(1 mark)

- (ii) Use your graph to write down another solution of this equation.

Answer  $x = \dots\dots\dots$  (1 mark)

Turn over   
6

- 5 (a) The diagram shows a right-angled triangle  $ABC$ .  
 $AB = 10\text{ cm}$  and  $AC = 15\text{ cm}$



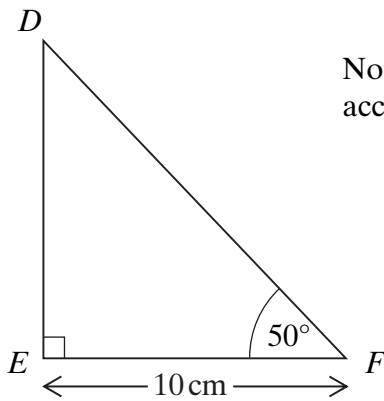
Not drawn accurately

Calculate the length of  $BC$ .  
 Leave your answer as a square root.

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

- (b) The diagram shows a right-angled triangle  $DEF$ .  
 $EF = 10\text{ cm}$   
 Angle  $F = 50^\circ$



Not drawn accurately

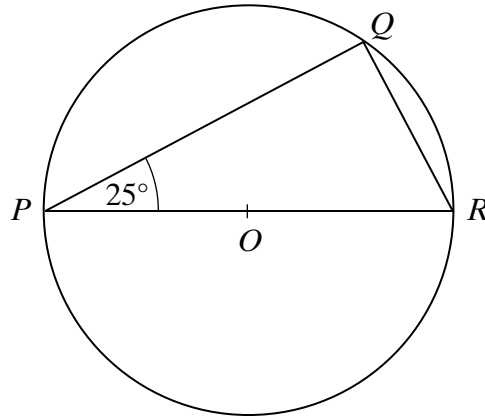
| Angle      | Sine  | Cosine | Tangent |
|------------|-------|--------|---------|
| $40^\circ$ | 0.643 | 0.766  | 0.839   |
| $50^\circ$ | 0.766 | 0.643  | 1.192   |

Use the table of data to work out the length of  $DE$ .

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Answer ..... cm (3 marks)

- 6 (a) In the diagram,  $O$  is the centre of the circle and  $P, Q$  and  $R$  are points on the circumference.  
Angle  $P = 25^\circ$



Not drawn accurately

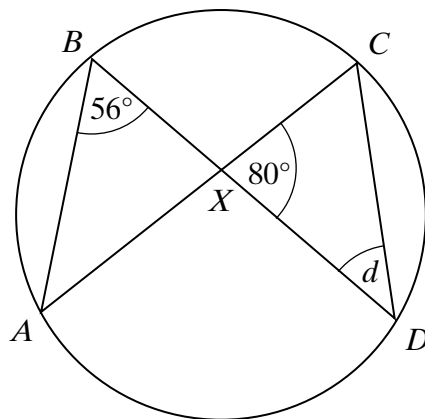
Work out the size of angle  $R$ .

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Answer ..... degrees (2 marks)

- (b)  $A, B, C$  and  $D$  are four points on the circumference of another circle.  
 $AC$  meets  $BD$  at  $X$ .  
Angle  $ABD = 56^\circ$  and angle  $CXD = 80^\circ$



Not drawn accurately

Work out the value of angle  $d$ .  
You **must** show all your working.

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Answer ..... degrees (3 marks)

Turn over ►

7 (a) Factorise  $x^2 - 10x + 25$

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Answer ..... (2 marks)

(b) Factorise  $2x^2 + 3x - 5$

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Answer ..... (2 marks)

8 Solve the simultaneous equations

$$4x + 3y = 5$$

$$2x - 5y = 9$$

You **must** show your working.  
Do **not** use trial and improvement.

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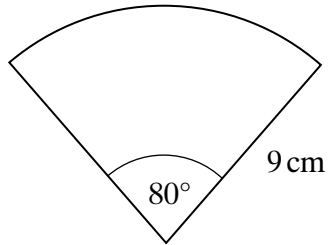
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Answer  $x = \dots\dots\dots$  ,  $y = \dots\dots\dots$  (4 marks)

**TURN OVER FOR THE NEXT QUESTION**

Turn over 

- 9 (a) The diagram shows a sector of a circle of radius 9 centimetres.



Not drawn accurately

Find the perimeter of the sector.  
Give your answer in terms of  $\pi$ .

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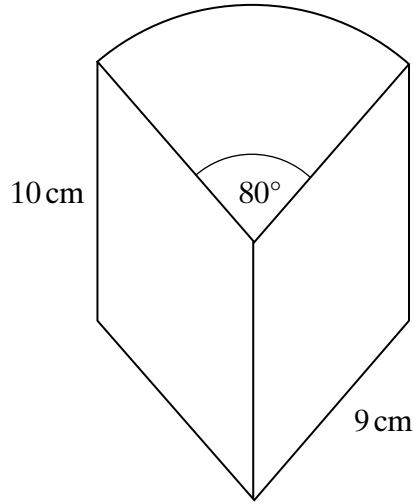
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Answer ..... cm (3 marks)

- (b) The cross-section of a prism is a sector of a circle, of radius 9 centimetres, as shown. The height of the prism is 10 centimetres.



Not drawn accurately

Calculate the volume of the prism.  
Give your answer in terms of  $\pi$ .

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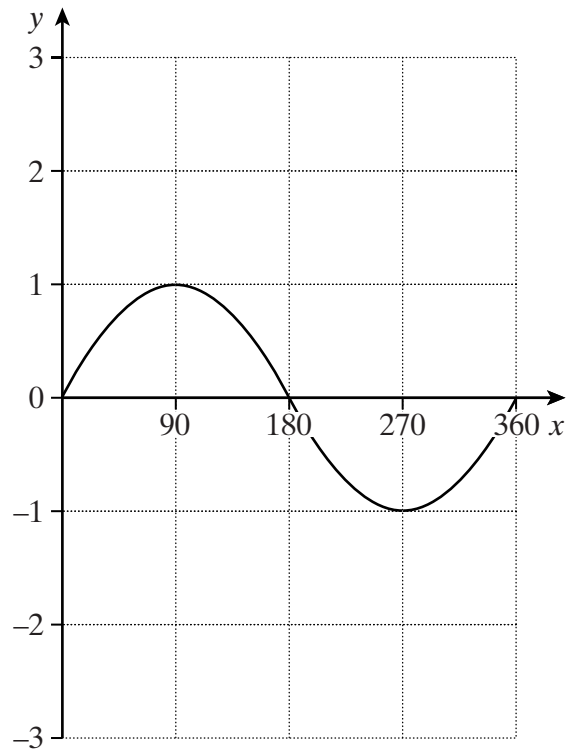
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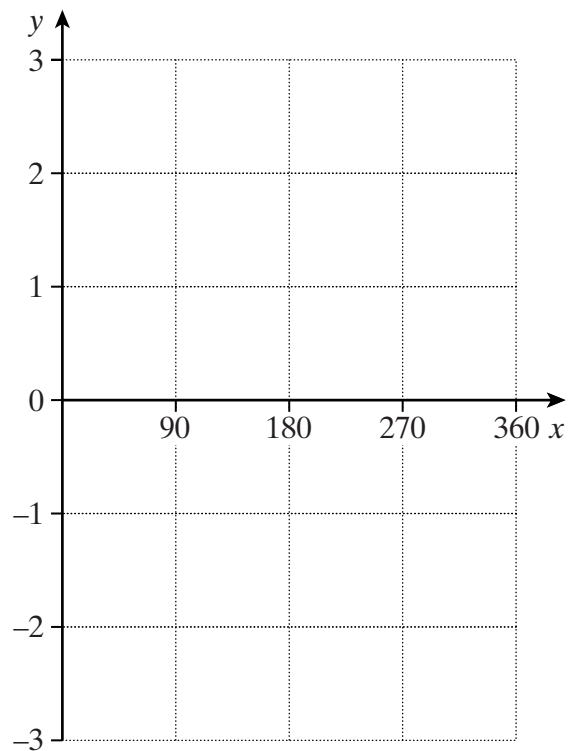
Answer ..... (4 marks)

10 The diagram shows the graph of  $y = \sin x^\circ$  for  $0 \leq x \leq 360$



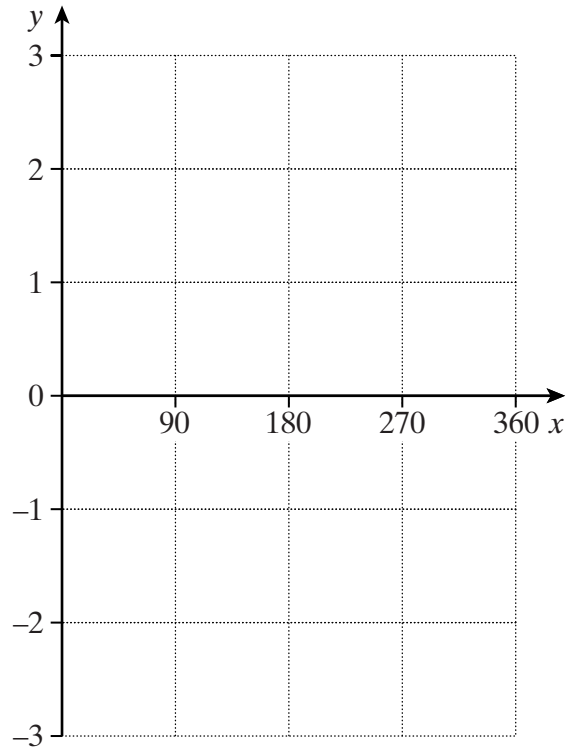
On the axes below sketch the following graphs.

(a)  $y = 2 \sin x^\circ$  for  $0 \leq x \leq 360$



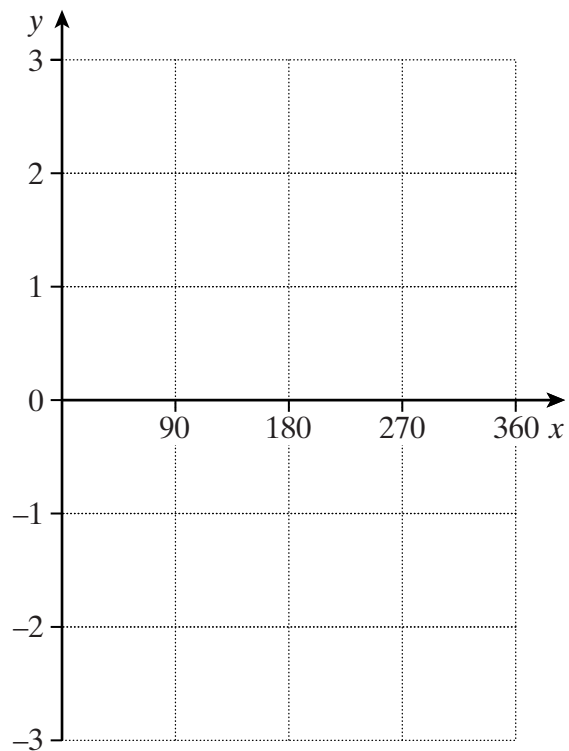
(1 mark)

(b)  $y = \sin 2x^\circ$  for  $0 \leq x \leq 360$



(1 mark)

(c)  $y = 2 + \sin x^\circ$  for  $0 \leq x \leq 360$

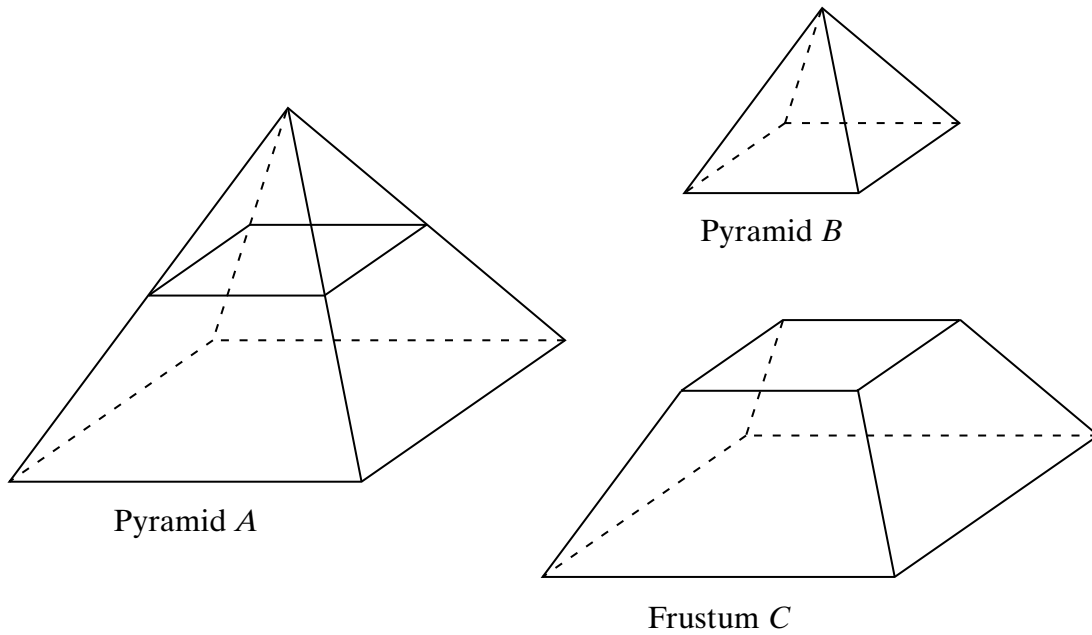


(1 mark)

Turn over ►

3

- 11 A square-based pyramid *A* is divided into two parts: a square-based pyramid *B* and a frustum *C*, as shown.



Pyramid *A* is similar to pyramid *B*.

The base of pyramid *A* is a square of side 10 cm.  
The base of pyramid *B* is a square of side 5 cm.

The vertical height of pyramid *A* is 12 cm.

- (a) You are given the formula

$$\text{Volume of a pyramid} = \frac{1}{3} \times \text{area of base} \times \text{vertical height}$$

Calculate the volume of the frustum *C*.

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Answer ..... cm<sup>3</sup> (4 marks)

- (b) Express the volume of the frustum  $C$  as a fraction of the volume of the larger pyramid  $A$ .  
Give your answer in its simplest form.

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Answer ..... (2 marks)

**TURN OVER FOR THE NEXT QUESTION**

**12** (a) Simplify  $\frac{6(x+5)^2}{2(x+5)}$

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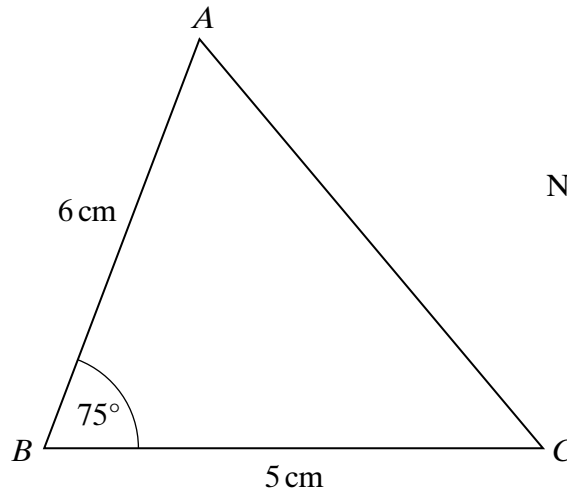
Answer ..... (2 marks)

(b) Simplify  $\frac{x^2-9}{x^2+3x}$

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Answer ..... (3 marks)

- 13 The diagram shows a triangle  $ABC$ .  
 $AB = 6\text{ cm}$ ,  $BC = 5\text{ cm}$  and angle  $B = 75^\circ$



You are given that  $\sin 75^\circ = 0.966$  to 3 significant figures.

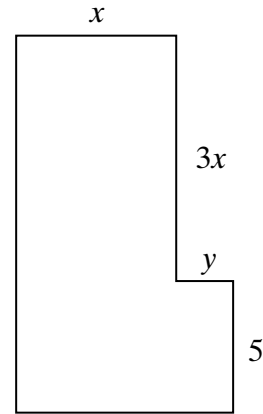
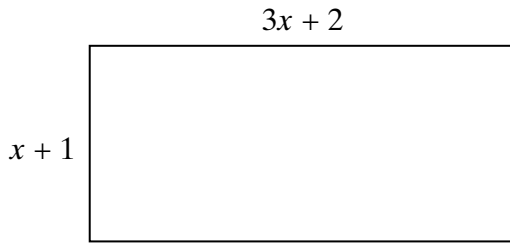
Calculate the area of the triangle.  
Give your answer to a suitable degree of accuracy.

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Answer .....  $\text{cm}^2$  (3 marks)

- 14** The diagrams show a rectangle and an L shape.  
All the angles are right angles.  
All lengths are in centimetres.  
The shapes are equal in area.

Diagrams not to scale



Calculate the value of  $y$ .

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Answer ..... cm (6 marks)

15 (a) Find the values of  $a$  and  $b$  such that

$$x^2 + 6x - 3 = (x + a)^2 + b$$

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Answer  $a =$  ..... ,  $b =$  ..... (2 marks)

(b) Hence, or otherwise, solve the equation

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

giving your answers in surd form.

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Answer ..... (3 marks)

**END OF QUESTIONS**

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