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Centre Number						Candidate Number					
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General Certificate of Secondary Education  
June 2006



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

33005/H1

**H**

Monday 5 June 2006 1.30 pm to 2.45 pm

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>mathematical instruments</li> </ul> <p>You must <b>not</b> use a calculator.</p>	
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For Examiner's Use	
Pages	Mark
3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16	
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.
- Answer the questions in the spaces provided.
- Do all rough work in this book.

**Information**

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You may ask for more answer paper, graph paper and tracing paper. This must be tagged securely to this answer book.

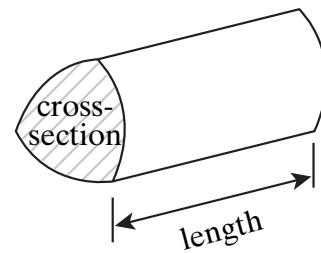
**Advice**

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

### Formulae Sheet: Higher Tier

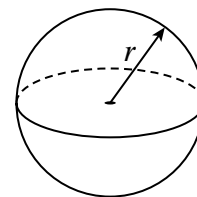
You may need to use the following formulae:

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



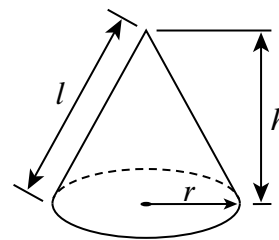
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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



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

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

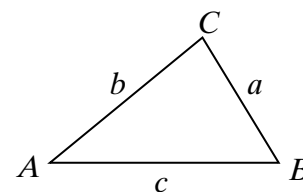


**In any triangle ABC**

**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) Multiply out  $6(3p + q)$

.....

Answer ..... (1 mark)

(b) Multiply out  $-2(2p + 3q)$

.....

Answer ..... (1 mark)

(c) Multiply out and simplify  $6(3p + q) - 2(2p + 3q)$

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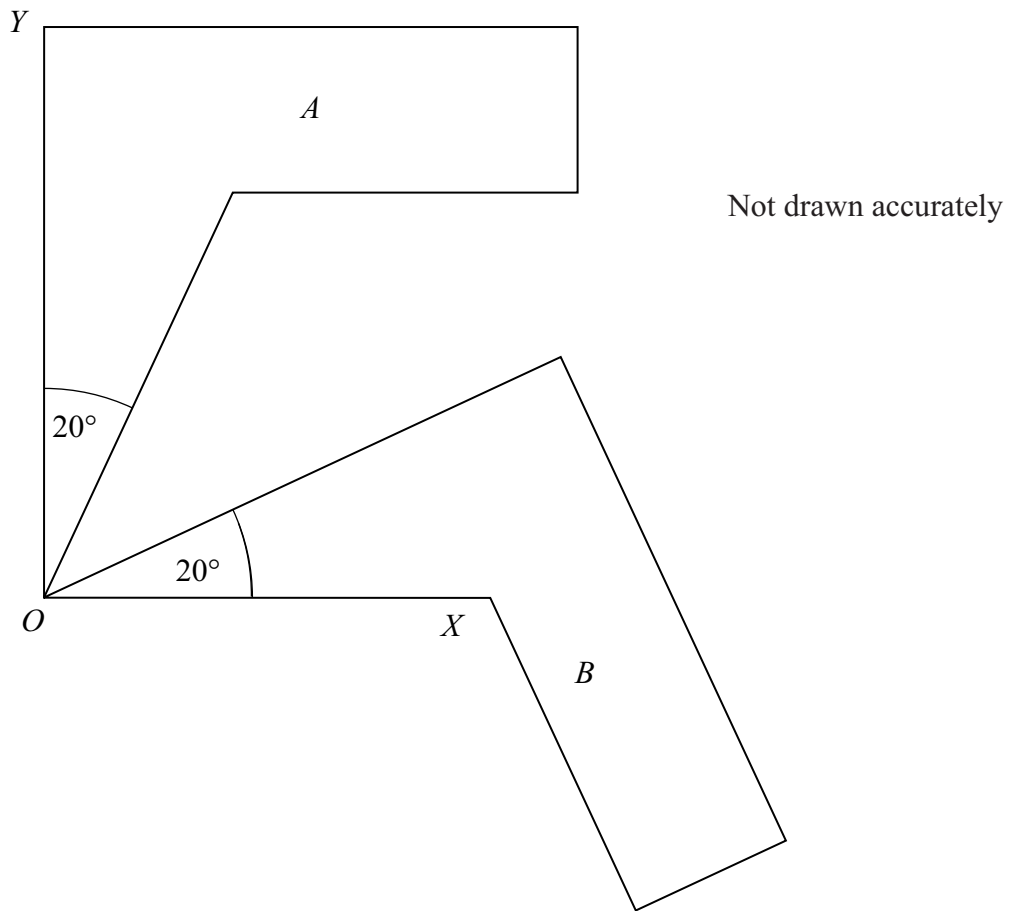
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Answer ..... (1 mark)

**Turn over for the next question**

- 2 (a) The diagram shows a rotation of shape  $A$  to shape  $B$ .  
 $OX$  and  $OY$  are perpendicular.



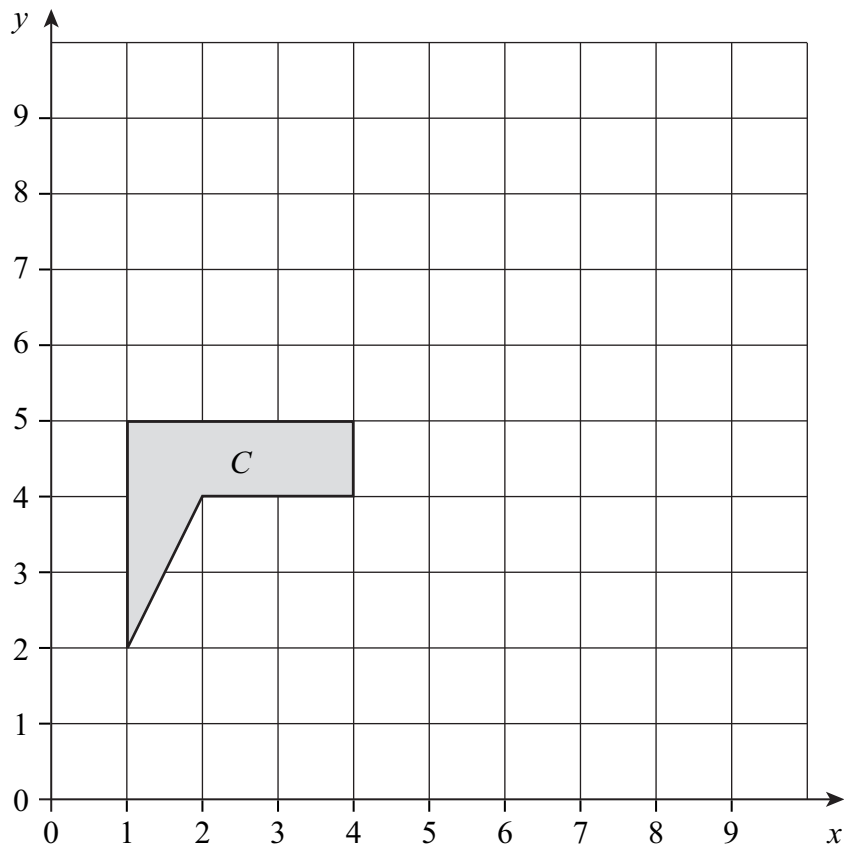
Work out the angle of rotation.

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Answer ..... degrees (2 marks)

- (b) (i) Translate the shaded shape  $C$  by the vector  $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$



(2 marks)

- (ii) Write down the translation vector that would return  $C$  back to its original position.

Answer  $\begin{pmatrix} \phantom{0} \\ \phantom{0} \end{pmatrix}$  (1 mark)

Turn over 

3 (a) Here is a table about squares.

Complete the table for  $n$  squares.

Number of squares	Total number of sides
1	4
2	8
3	12
4	16
5	20
$n$	.....

(1 mark)

(b) Here is a sequence of numbers.

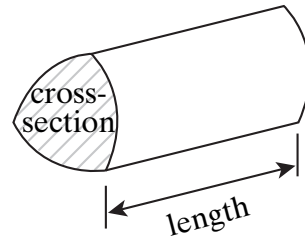
5    9    13    17

Write down an expression for the  $n$ th term.

.....

Answer ..... (2 marks)

- 4 The diagram shows a prism.  
The area of cross-section is  $14 \text{ cm}^2$ .  
The length of the prism is  $14 \text{ cm}$ .



Calculate the volume of the prism.

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

- 5 (a) Expand  $2x(x^2 - 4)$

.....

Answer ..... (2 marks)

- (b) Factorise  $y^2 - 4y$

.....

Answer ..... (1 mark)

- (c) Make  $x$  the subject of the formula  $y = 3 + x$

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Answer  $x =$  ..... (1 mark)

6 Show clearly that  $(n - 2)(n + 3) + (6 - n) = n^2$

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(4 marks)

7 In each of the following expressions  $x$ ,  $y$  and  $z$  represent lengths.

For each expression state whether it could represent a length, an area, a volume or none of these.

(a)  $x + y$

Answer ..... (1 mark)

(b)  $xy$

Answer ..... (1 mark)

(c)  $\frac{xy}{z}$

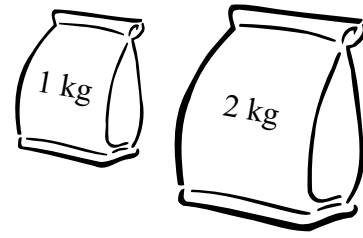
Answer ..... (1 mark)

(d)  $\frac{x}{y + z}$

Answer ..... (1 mark)



- 8 There are 70 bags of sugar on a shelf.  
 There are  $x$  bags that weigh 1 kg.  
 There are  $y$  bags that weigh 2 kg.



- (a) Write down an equation connecting  $x$  and  $y$ .

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Answer ..... (1 mark)

- (b) The total weight of the bags is 96 kg.

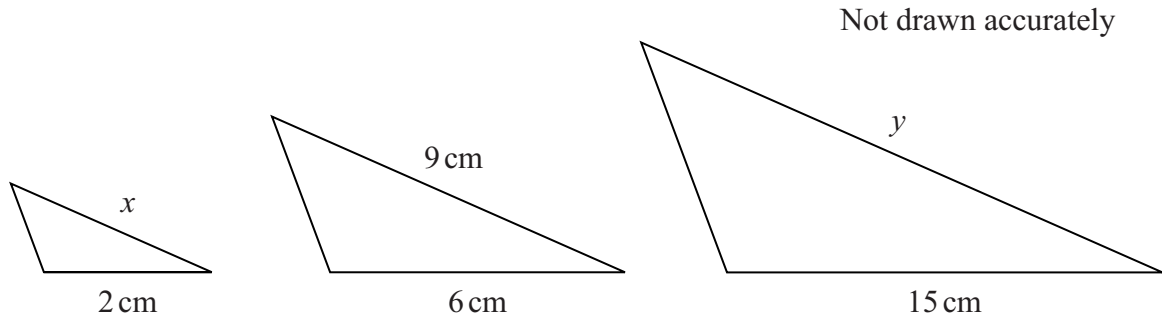
Use algebra to work out the values of  $x$  and  $y$ .  
 You **must** show your working.

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Answer  $x =$  ..... ,  $y =$  ..... (4 marks)

**Turn over for the next question**

9 The diagram shows three similar triangles.



(a) Work out the value of  $x$ .

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Answer ..... cm (2 marks)

(b) Work out the value of  $y$ .

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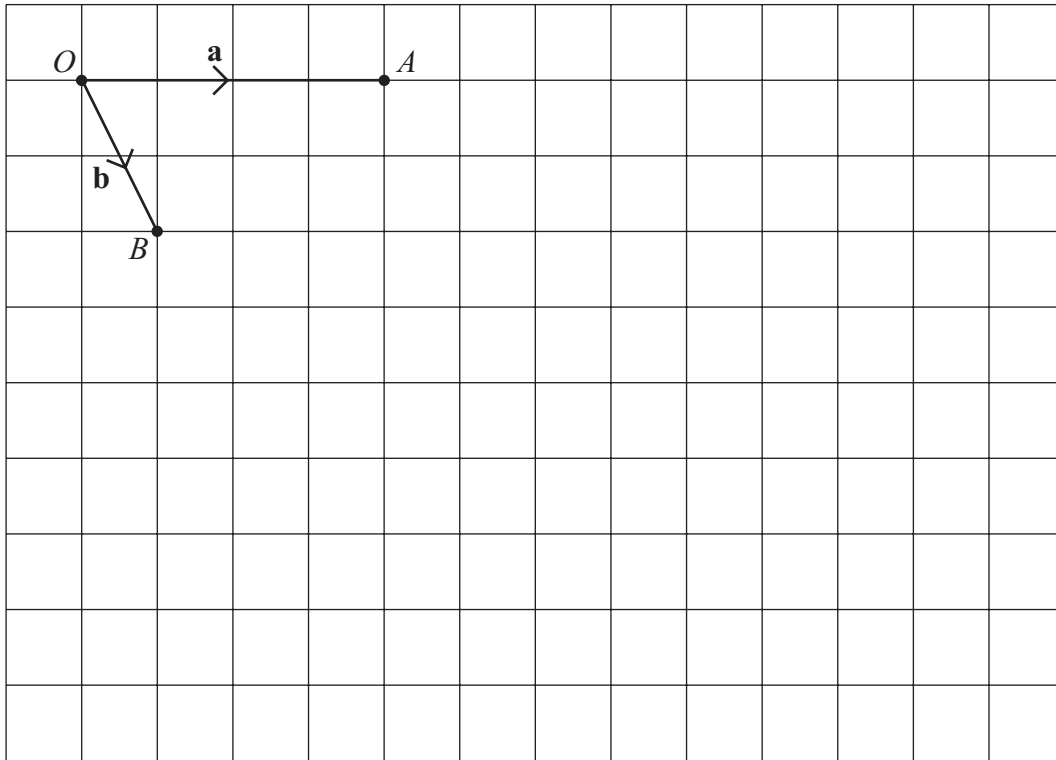
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Answer ..... cm (3 marks)

10 The diagram shows two vectors.

$$\vec{OA} = \mathbf{a} \text{ and } \vec{OB} = \mathbf{b}$$



(a) On the grid label clearly each of the following points.

(i)  $C$  such that  $\vec{OC} = 2\mathbf{b}$

(1 mark)

(ii)  $D$  such that  $\vec{OD} = \mathbf{a} + \mathbf{b}$

(1 mark)

(iii)  $E$  such that  $\vec{BE} = 3\mathbf{b}$

(1 mark)

(iv)  $F$  such that  $\vec{EF} = 2\mathbf{a} - 2\mathbf{b}$

(1 mark)

(b) Complete the sentences.

(i) Shape  $OADB$  is a ..... (1 mark)

(ii) Shape ..... is a trapezium. (1 mark)

- 11 (a) Show, by eliminating  $y$ , that the  $x$  coordinates of the simultaneous equations

$$\begin{aligned} & y = x - 7 \\ \text{and} \quad & x^2 + y^2 = 29 \end{aligned}$$

are the solutions of

$$x^2 - 7x + 10 = 0$$

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(3 marks)

- (b) Hence, solve the simultaneous equations

$$\begin{aligned} & y = x - 7 \\ & x^2 + y^2 = 29 \end{aligned}$$

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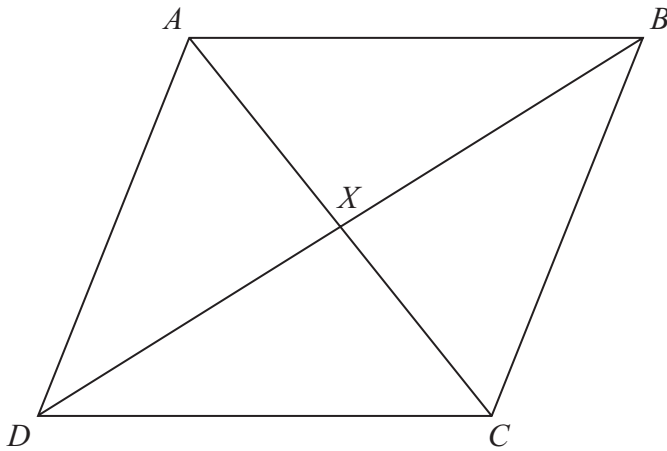
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Answer  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$

or  $x = \dots\dots\dots$ ,  $y = \dots\dots\dots$  (3 marks)

- 12 The diagram shows a rhombus  $ABCD$ .  
The diagonals intersect at  $X$ .



Not drawn accurately

Prove that triangle  $ABX$  is congruent to triangle  $CDX$ .

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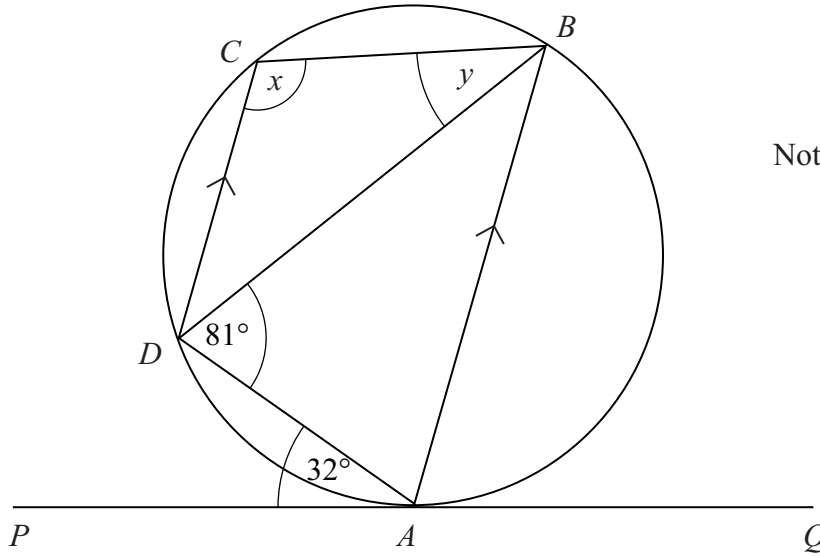
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(4 marks)

Turn over

- 13  $ABCD$  is a cyclic quadrilateral.  
 $PAQ$  is the tangent to the circle at  $A$ .  
 $AB$  is parallel to  $DC$ .  
 Angle  $DAP = 32^\circ$  and angle  $BDA = 81^\circ$



Not drawn accurately

- (a) Work out the size of angle  $BCD$ , marked  $x$  on the diagram.  
 You **must** show your working.

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Answer  $x =$  ..... degrees (4 marks)

- (b) Work out the size of angle  $CBD$ , marked  $y$  on the diagram.  
 You **must** show your working.

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Answer  $y =$  ..... degrees (2 marks)

- 14 (a) You are given the identity  $x^2 - ax + 144 \equiv (x - b)^2$

Work out the values of  $a$  and  $b$ .

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Answer  $a =$  .....

$b =$  ..... (3 marks)

- (b) Simplify  $\frac{x^2 - 4x + 4}{x^2 - 4}$

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Answer ..... (3 marks)

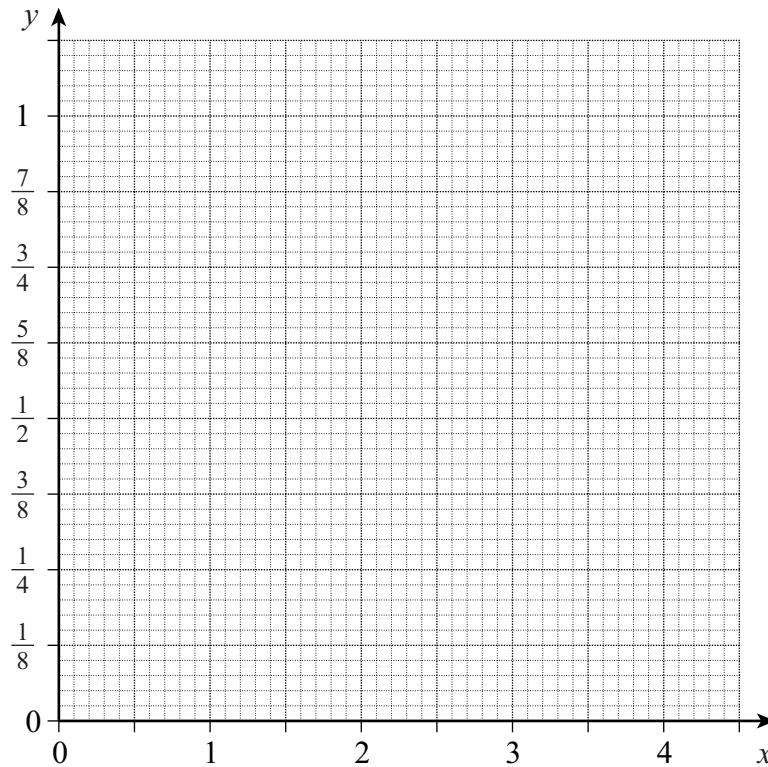
**Turn over for the next question**

15 (a) Complete the table of values for  $y = \left(\frac{1}{2}\right)^x$

$x$	0	1	2	3	4
$y$					

(3 marks)

(b) On the grid, draw the graph of  $y = \left(\frac{1}{2}\right)^x$  for values of  $x$  from 0 to 4.



(2 marks)

(c) Use your graph to estimate the value of  $\left(\frac{1}{2}\right)^{\frac{1}{2}}$

.....

Answer ..... (2 marks)

**END OF QUESTIONS**