

Surname					Other Names				
Centre Number					Candidate Number				
Candidate Signature									

Leave blank
-------------

General Certificate of Secondary Education  
June 2005



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

**H**

Tuesday 7 June 2005 1.30 pm to 2.45 pm

<p><b>In addition to this paper you will require:</b> mathematical instruments.</p> <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.

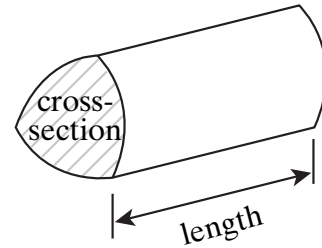
**Advice**

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

### Formulae Sheet: Higher Tier

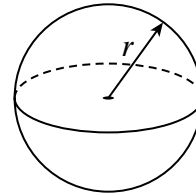
You may need to use the following formulae:

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



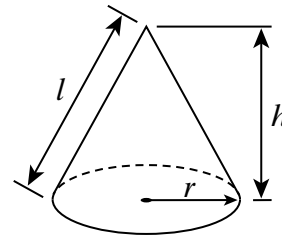
**Volume of sphere** =  $\frac{4}{3} \pi r^3$

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



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

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

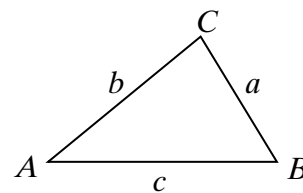


**In any triangle ABC**

**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

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

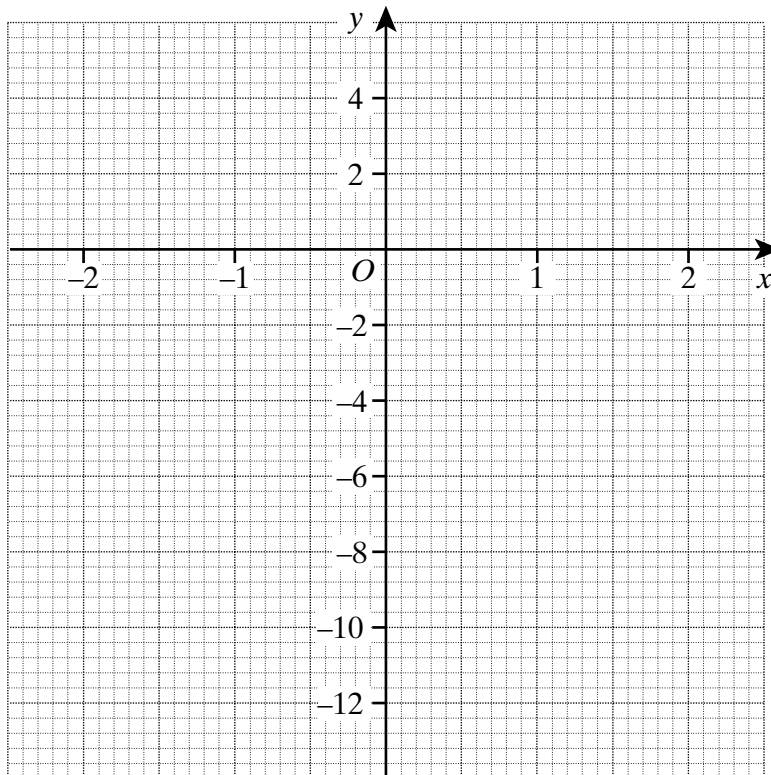
Answer **all** questions in the spaces provided.

- 1 (a) Complete the table of values for  $y = x^3 - 4$

$x$	-2	-1	0	1	2
$y$		-5			4

(2 marks)

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



(2 marks)

- 2 (a) Solve the inequality  $3x + 5 \leq 16$

.....  
.....  
.....

Answer ..... (2 marks)

- (b) Write down the integer value satisfied by the inequality  $5 < 2x < 7$

.....  
.....

Answer ..... (2 marks)

- 3 (a) Factorise  $r^6 - 3r^4$

.....

Answer ..... (1 mark)

- (b) (i) Factorise  $x^2 + 5x - 14$

.....  
.....  
.....

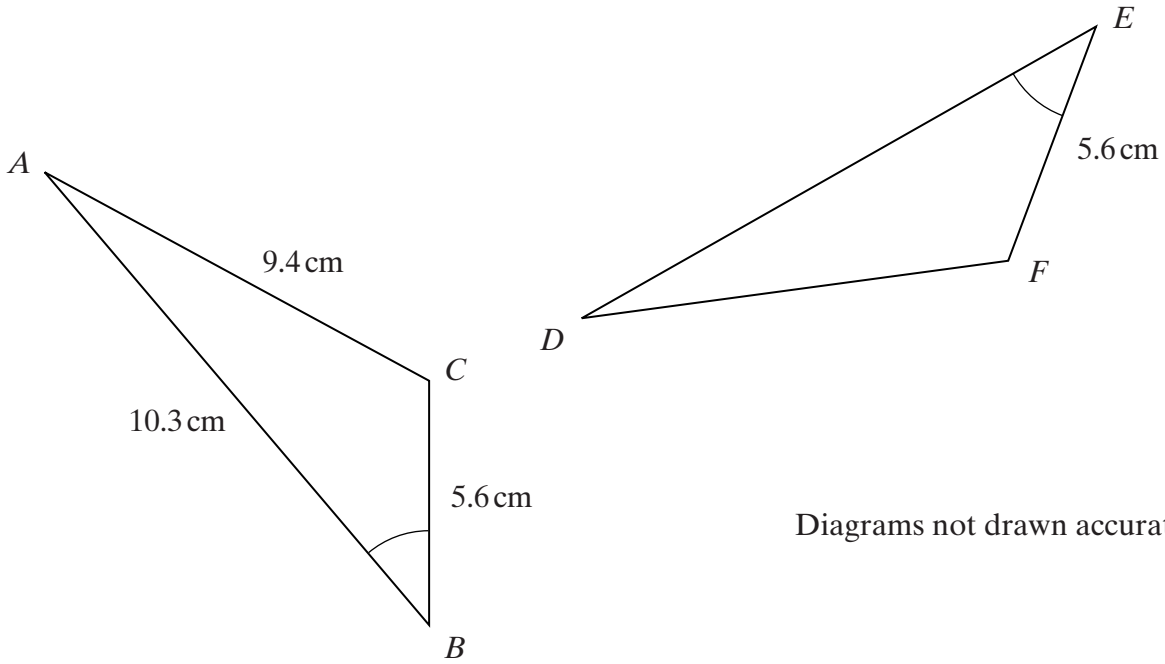
Answer ..... (2 marks)

- (ii) Hence solve the equation  $x^2 + 5x - 14 = 0$

.....  
.....

Answer ..... (1 mark)

- 4 Two congruent triangles are shown.  
Angle  $B =$  Angle  $E$



- (a) Write down the length of  $DF$ .

Answer ..... cm (1 mark)

- (b) Explain why angle  $A =$  angle  $D$

.....  
 .....  
 (1 mark)

- 5 (a) Write down the equation of a line that is parallel to the line  $y = 5x$

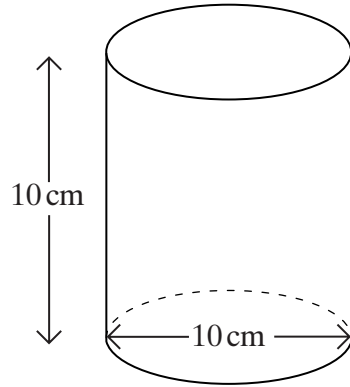
Answer ..... (1 mark)

- (b) Work out the gradient of the line  $y + 2x = 6$

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

Turn over

- 6 The diagram shows a cylinder.  
The diameter of the cylinder is 10 cm.  
The height of the cylinder is 10 cm.



Not drawn accurately

- (a) Work out the volume of the cylinder.  
Give your answer in terms of  $\pi$ .

.....

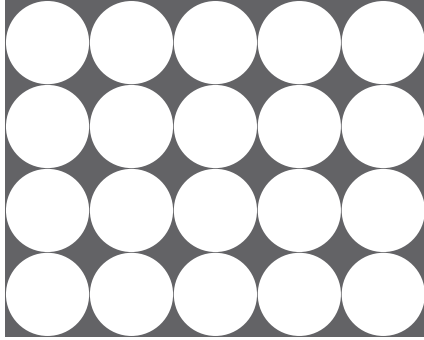
.....

.....

.....

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

- (b) Twenty of the cylinders are packed in a box of height 10 cm.  
The diagram shows how the cylinders are arranged inside the box.  
The shaded area is the space between the cylinders.



Not drawn accurately

Work out the volume inside the box that is **not** filled by the cylinders.  
Give your answer in terms of  $\pi$ .

.....

.....

.....

.....

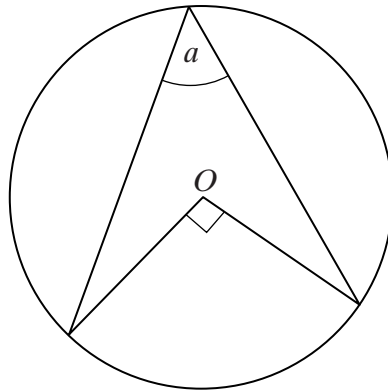
.....

.....

.....

Answer .....  $\text{cm}^3$  (4 marks)

- 7 (a) In the diagram,  $O$  is the centre of the circle.

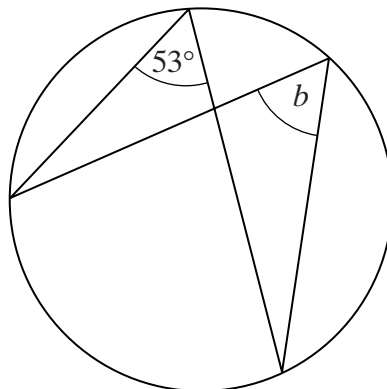


Not drawn accurately

Write down the value of  $a$ .

Answer ..... degrees (1 mark)

- (b)



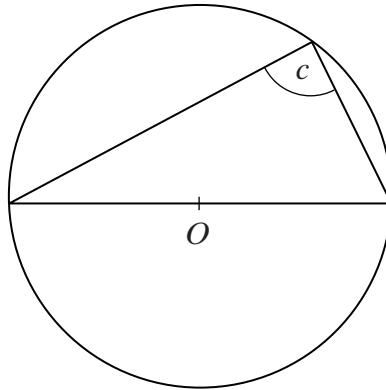
Not drawn accurately

Write down the value of  $b$ .

Answer ..... degrees (1 mark)



(c) In the diagram,  $O$  is the centre of the circle.

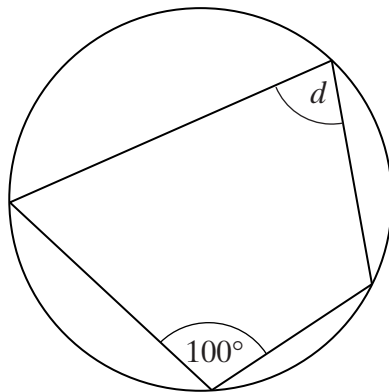


Not drawn accurately

Write down the value of  $c$ .

Answer ..... degrees (1 mark)

(d)

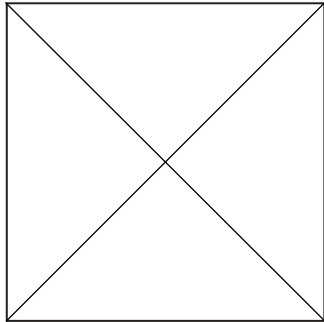


Not drawn accurately

Write down the value of  $d$ .

Answer ..... degrees (1 mark)

- 8 (a) The diagram shows a square and its diagonals.  
Each diagonal is 8 centimetres long.



Not drawn accurately

Calculate the area of the square.

.....

.....

.....

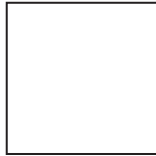
.....

.....

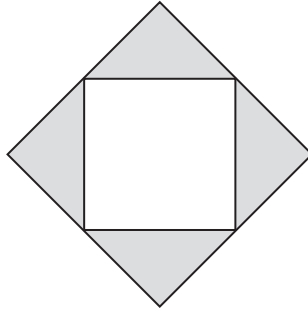
.....

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

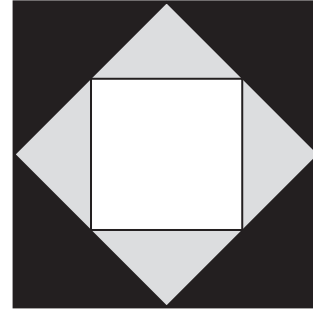
(b) A pattern is made using different squares as shown.



Pattern 1



Pattern 2



Diagrams  
not drawn accurately

Pattern 3

The area of the square in Pattern 1 is  $25 \text{ cm}^2$ .

(i) Work out the area shaded black in Pattern 3.

.....  
 .....  
 .....

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

(ii) A sheet of A4 paper measures 29.7 cm by 21 cm.

The pattern above is continued.

What is the pattern number of the largest pattern which could be drawn accurately on a sheet of A4 paper?

.....  
 .....  
 .....  
 .....

Answer Pattern ..... (2 marks)

9 Make  $x$  the subject of the formula

$$y = \frac{m + x}{x - 2}$$

.....

.....

.....

.....

.....

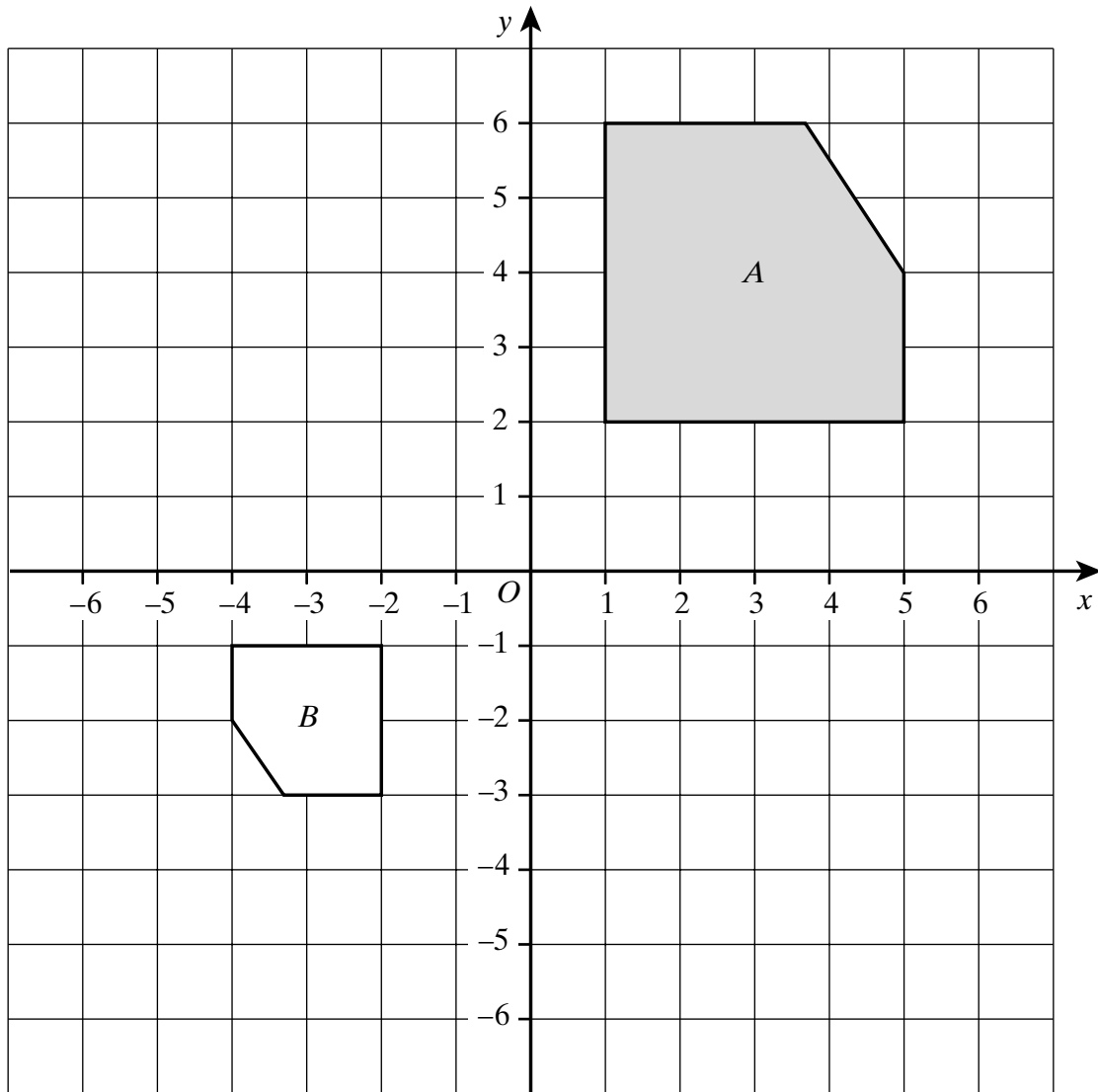
.....

.....

.....

Answer ..... (4 marks)

10 In the diagram, shape *B* is an enlargement of the shaded shape *A*.



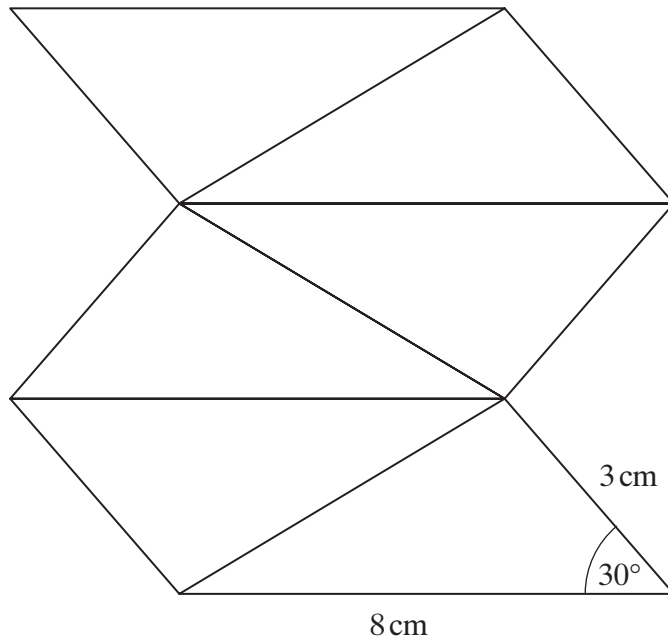
(a) Write down the coordinates of the centre of enlargement.

Answer ..... (1 mark)

(b) Write down the scale factor of the enlargement.

Answer ..... (1 mark)

- 11 A shape is made from 6 congruent triangles as shown.



Not drawn accurately

You are given that  $\sin 30^\circ = 0.5$

Calculate the area of the shape.

.....

.....

.....

.....

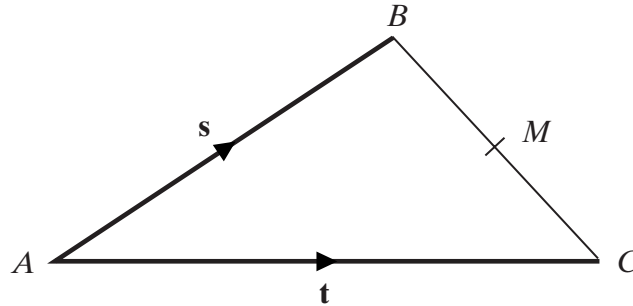
.....

.....

Answer ..... (4 marks)

12 In triangle  $ABC$ ,  $M$  is the mid-point of  $BC$ .

$\vec{AB} = \mathbf{s}$  and  $\vec{AC} = \mathbf{t}$



- (a) Find  $\vec{AM}$  in terms of  $\mathbf{s}$  and  $\mathbf{t}$ .  
Give your answer in its simplest form.

.....

.....

.....

.....

.....

.....

Answer ..... (3 marks)

- (b)  $\vec{AD} = \mathbf{s} + \mathbf{t}$

The length of  $AB$  is **not** equal to the length of  $AC$ .

- (i) Write down the name of the shape  $ABDC$ .

Answer ..... (1 mark)

- (ii) Write down one fact about the points  $A$ ,  $M$  and  $D$ .  
Explain your answer.

Fact .....

Explanation .....

.....

(2 marks)

Turn over

**13** Here are the equations of two straight lines.

$$y = 2x + 3$$
$$y = -2x - 1$$

When both these lines are drawn on a grid there are two lines of symmetry.

Find the equations of these lines of symmetry.

You may use the graph paper opposite to help you.

.....

.....

.....

.....

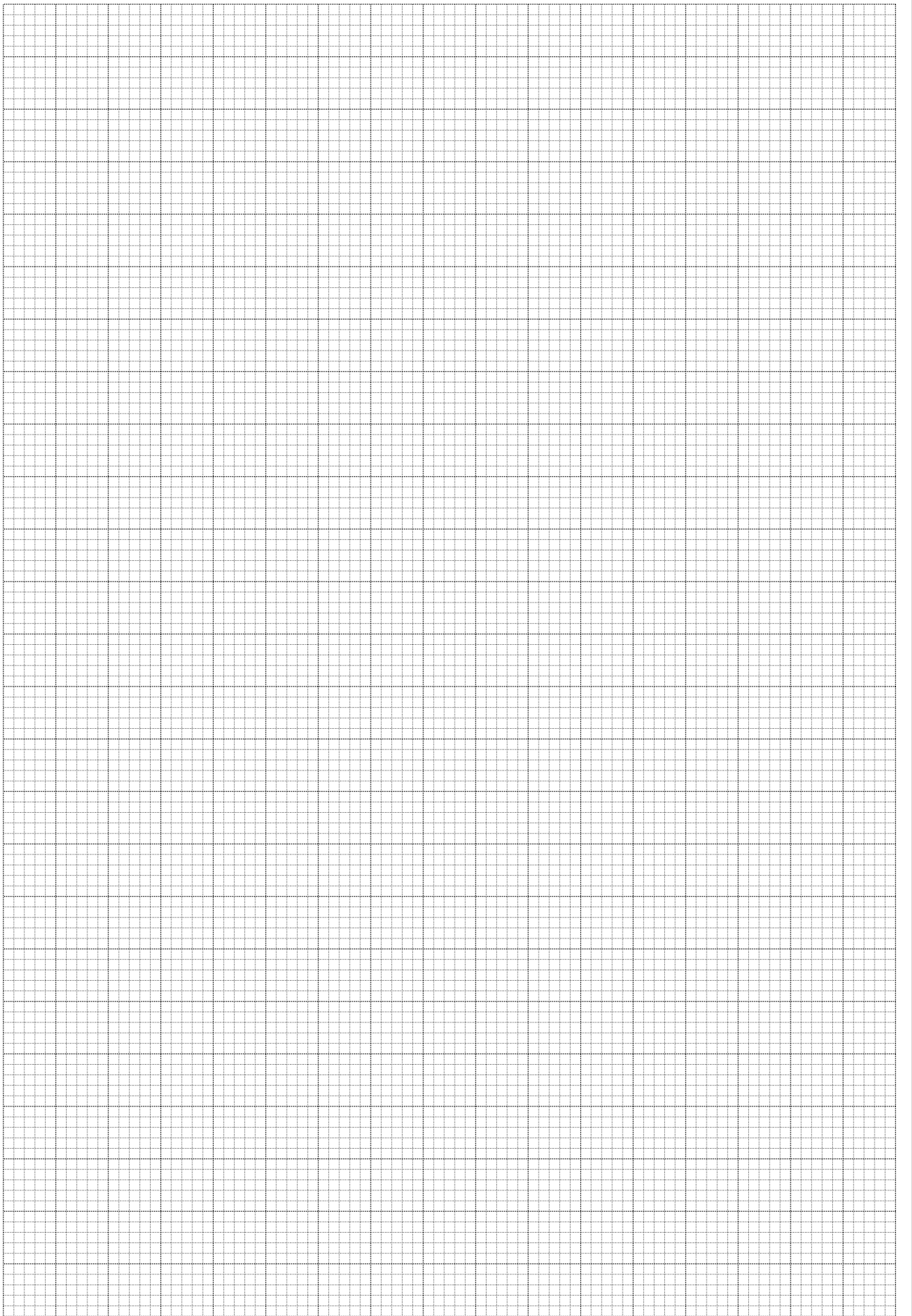
.....

.....

Answer .....

..... (4 marks)





Turn over 

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

$$x^2 + 10x + 40 = (x + a)^2 + b$$

.....

.....

.....

.....

.....

.....

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

(b) Hence, or otherwise, write down the minimum value of  $x^2 + 10x + 40$

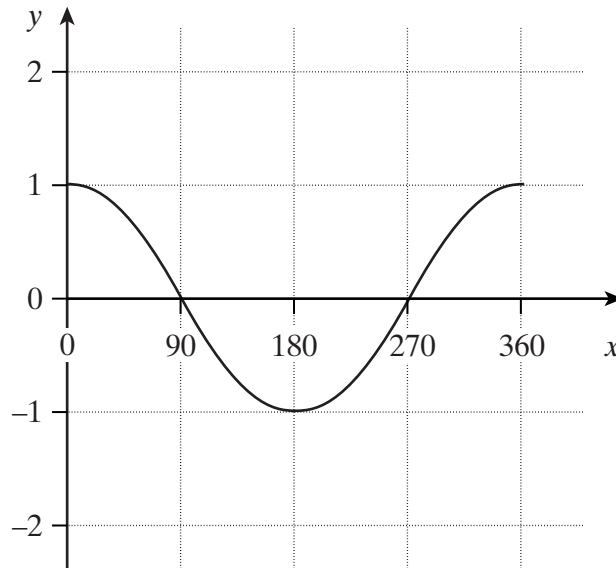
.....

.....

.....

Answer ..... (1 mark)

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



Write down the number of solutions in the range  $0^\circ \leq x \leq 360^\circ$  for each equation.

(a)  $\cos x = -0.5$

.....

Answer ..... (1 mark)

(b)  $2 \cos x = -0.5$

.....

Answer ..... (1 mark)

(c)  $\frac{1}{2} \cos x = -0.5$

.....

Answer ..... (1 mark)

(d)  $\cos 2x = -0.5$

.....

Answer ..... (1 mark)



Turn over ►

**16** Prove that  $\frac{x+2}{x} - \frac{x-1}{x+1} = \frac{2(2x+1)}{x(x+1)}$

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

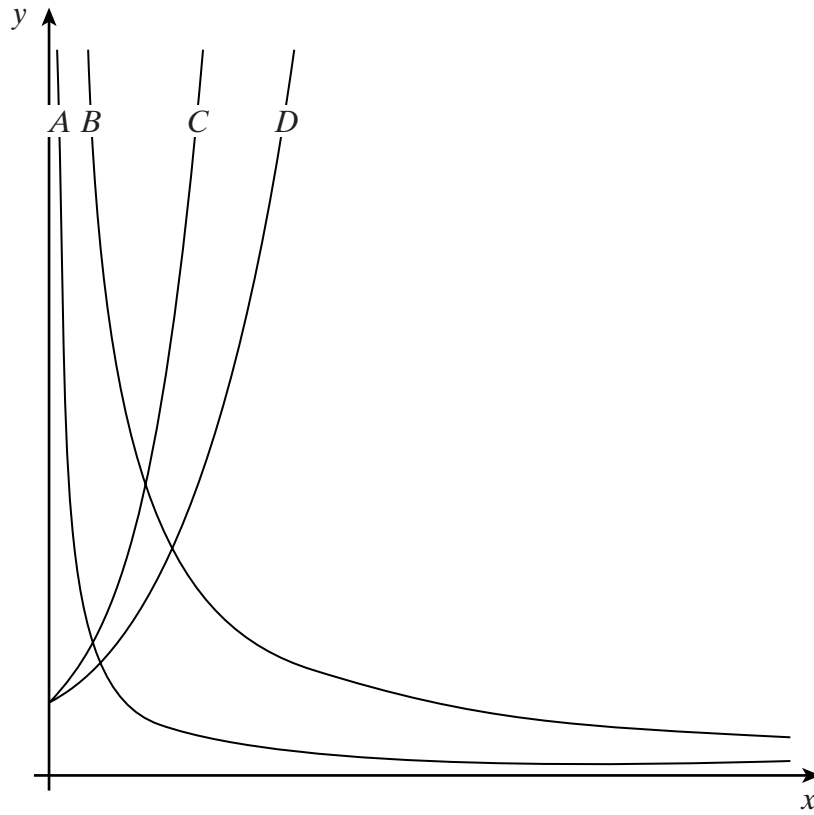
.....

.....

.....

(4 marks)

17 The graph shows four curves *A*, *B*, *C* and *D*.



Match each curve to its equation.

(a)  $y = \frac{1}{x}$  is curve .....

(1 mark)

(b)  $y = 2^x$  is curve .....

(1 mark)

(c)  $y = 3^x$  is curve .....

(1 mark)

(d)  $y = \frac{4}{x}$  is curve .....

(1 mark)

**END OF QUESTIONS**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**