

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary General Certificate of Education**

**Advanced General Certificate of Education**

**MATHEMATICS**

**4721**

**Core Mathematics 1**

**Monday**

**23 MAY 2005**

**Morning**

**1 hour 30 minutes**

**Additional materials:**

Answer booklet

Graph paper

List of Formulae (MF1)

**TIME** 1 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You are not permitted to use a calculator in this paper.**

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**



**WARNING**

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a calculator in this paper.**

**This question paper consists of 4 printed pages.**

- 1 Solve the inequality  $x^2 - 6x - 40 \geq 0$ . [4]
- 2 (i) Express  $3x^2 + 12x + 7$  in the form  $3(x + a)^2 + b$ . [4]  
 (ii) Hence write down the equation of the line of symmetry of the curve  $y = 3x^2 + 12x + 7$ . [1]
- 3 (i) Sketch the curve  $y = x^3$ . [1]  
 (ii) Describe a transformation that transforms the curve  $y = x^3$  to the curve  $y = -x^3$ . [2]  
 (iii) The curve  $y = x^3$  is translated by  $p$  units, parallel to the  $x$ -axis. State the equation of the curve after it has been transformed. [2]
- 4 Solve the equation  $x^6 + 26x^3 - 27 = 0$ . [5]
- 5 (a) Simplify  $2x^{\frac{2}{3}} \times 3x^{-1}$ . [2]  
 (b) Express  $2^{40} \times 4^{30}$  in the form  $2^n$ . [2]  
 (c) Express  $\frac{26}{4 - \sqrt{3}}$  in the form  $a + b\sqrt{3}$ . [3]
- 6 Given that  $f(x) = (x + 1)^2(3x - 4)$ ,  
 (i) express  $f(x)$  in the form  $ax^3 + bx^2 + cx + d$ , [3]  
 (ii) find  $f'(x)$ , [2]  
 (iii) find  $f''(x)$ . [2]

WARNING



You are not allowed to use a calculator in this paper.

- 7 (i) Calculate the discriminant of each of the following:

- (a)  $x^2 + 6x + 9$ ,  
 (b)  $x^2 - 10x + 12$ ,  
 (c)  $x^2 - 2x + 5$ .

[3]

(ii)

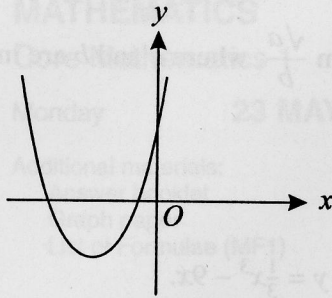


Fig. 1

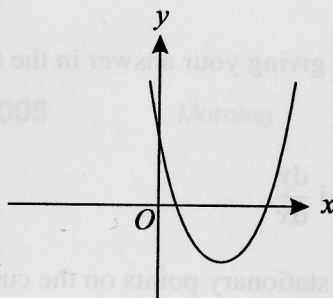


Fig. 2

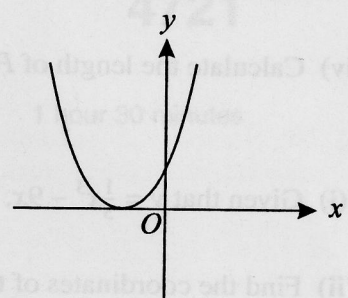


Fig. 3

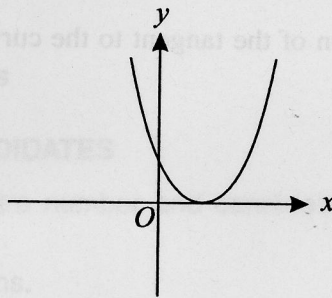


Fig. 4

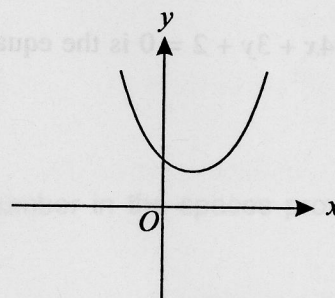


Fig. 5

State with reasons which of the diagrams corresponds to the curve

- (a)  $y = x^2 + 6x + 9$ ,  
 (b)  $y = x^2 - 10x + 12$ ,  
 (c)  $y = x^2 - 2x + 5$ .

[4]

- 8 (i) Describe completely the curve  $x^2 + y^2 = 25$ .

[2]

- (ii) Find the coordinates of the points of intersection of the curve  $x^2 + y^2 = 25$  and the line  $2x + y - 5 = 0$ .

[6]

[Questions 9 and 10 are printed overleaf.]



- 9 (i) Find the gradient of the line  $l_1$  which has equation  $4x - 3y + 5 = 0$ . [1]
- (ii) Find an equation of the line  $l_2$ , which passes through the point  $(1, 2)$  and which is perpendicular to the line  $l_1$ , giving your answer in the form  $ax + by + c = 0$ . [4]

The line  $l_1$  crosses the  $x$ -axis at  $P$  and the line  $l_2$  crosses the  $y$ -axis at  $Q$ .

- (iii) Find the coordinates of the mid-point of  $PQ$ . [3]
- (iv) Calculate the length of  $PQ$ , giving your answer in the form  $\frac{\sqrt{a}}{b}$ , where  $a$  and  $b$  are integers. [3]
- 10 (i) Given that  $y = \frac{1}{3}x^3 - 9x$ , find  $\frac{dy}{dx}$ . [2]
- (ii) Find the coordinates of the stationary points on the curve  $y = \frac{1}{3}x^3 - 9x$ . [3]
- (iii) Determine whether each stationary point is a maximum point or a minimum point. [3]
- (iv) Given that  $24x + 3y + 2 = 0$  is the equation of the tangent to the curve at the point  $(p, q)$ , find  $p$  and  $q$ . [5]