

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Advanced Subsidiary General Certificate of Education  
Advanced General Certificate of Education**

**MATHEMATICS**

**4721**

Core Mathematics 1

Tuesday

**6 JUNE 2006**

Afternoon

1 hour 30 minutes

Additional materials:

8 page 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**

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

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**This question paper consists of 3 printed pages and 1 blank page.**

- 1** The points  $A(1, 3)$  and  $B(4, 21)$  lie on the curve  $y = x^2 + x + 1$ .
- (i) Find the gradient of the line  $AB$ . [2]
- (ii) Find the gradient of the curve  $y = x^2 + x + 1$  at the point where  $x = 3$ . [2]
- 2** (i) Evaluate  $27^{-\frac{2}{3}}$ . [2]
- (ii) Express  $5\sqrt{5}$  in the form  $5^n$ . [1]
- (iii) Express  $\frac{1 - \sqrt{5}}{3 + \sqrt{5}}$  in the form  $a + b\sqrt{5}$ . [3]
- 3** (i) Express  $2x^2 + 12x + 13$  in the form  $a(x + b)^2 + c$ . [4]
- (ii) Solve  $2x^2 + 12x + 13 = 0$ , giving your answers in simplified surd form. [3]
- 4** (i) By expanding the brackets, show that
- $$(x - 4)(x - 3)(x + 1) = x^3 - 6x^2 + 5x + 12. \quad [3]$$
- (ii) Sketch the curve
- $$y = x^3 - 6x^2 + 5x + 12,$$
- giving the coordinates of the points where the curve meets the axes. Label the curve  $C_1$ . [3]
- (iii) On the same diagram as in part (ii), sketch the curve
- $$y = -x^3 + 6x^2 - 5x - 12.$$
- Label this curve  $C_2$ . [2]
- 5** Solve the inequalities
- (i)  $1 < 4x - 9 < 5$ , [3]
- (ii)  $y^2 \geq 4y + 5$ . [5]
- 6** (i) Solve the equation  $x^4 - 10x^2 + 25 = 0$ . [4]
- (ii) Given that  $y = \frac{2}{5}x^5 - \frac{20}{3}x^3 + 50x + 3$ , find  $\frac{dy}{dx}$ . [2]
- (iii) Hence find the number of stationary points on the curve  $y = \frac{2}{5}x^5 - \frac{20}{3}x^3 + 50x + 3$ . [2]

- 7 (i) Solve the simultaneous equations

$$y = x^2 - 5x + 4, \quad y = x - 1. \quad [4]$$

- (ii) State the number of points of intersection of the curve  $y = x^2 - 5x + 4$  and the line  $y = x - 1$ . [1]

- (iii) Find the value of  $c$  for which the line  $y = x + c$  is a tangent to the curve  $y = x^2 - 5x + 4$ . [4]

- 8 A cuboid has a volume of  $8 \text{ m}^3$ . The base of the cuboid is square with sides of length  $x$  metres. The surface area of the cuboid is  $A \text{ m}^2$ .

- (i) Show that  $A = 2x^2 + \frac{32}{x}$ . [3]

- (ii) Find  $\frac{dA}{dx}$ . [3]

- (iii) Find the value of  $x$  which gives the smallest surface area of the cuboid, justifying your answer. [4]

- 9 The points  $A$  and  $B$  have coordinates  $(4, -2)$  and  $(10, 6)$  respectively.  $C$  is the mid-point of  $AB$ . Find

- (i) the coordinates of  $C$ , [2]

- (ii) the length of  $AC$ , [2]

- (iii) the equation of the circle that has  $AB$  as a diameter, [3]

- (iv) the equation of the tangent to the circle in part (iii) at the point  $A$ , giving your answer in the form  $ax + by = c$ . [5]

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