

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.**

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 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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