OCR RECOGNISING ACHIEVEMENT

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.

[Turn over

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 $\dfrac{1 - \sqrt{5}}{3 + \sqrt{5}}$ 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

$$(x - 4)(x - 3)(x + 1) = x^3 - 6x^2 + 5x + 12.$$ [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) $y^2 \geqslant 4y + 5$. [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 $\dfrac{dy}{dx}$. [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

$$y = x^2 - 5x + 4, \qquad y = x - 1.$$ [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 $A = 2x^2 + \dfrac{32}{x}$. [3]

(ii) Find $\dfrac{dA}{dx}$. [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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