OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MATHEMATICS **4721**

Core Mathematics 1

Monday **10 JANUARY 2005** Afternoon 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

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 **(i)** Express 11^{-2} as a fraction. [1]

(ii) Evaluate $100^{\frac{3}{2}}$. [2]

(iii) Express $\sqrt{50} + \dfrac{6}{\sqrt{3}}$ in the form $a\sqrt{2} + b\sqrt{3}$, where a and b are integers. [3]

2 Given that $2x^2 - 12x + p = q(x - r)^2 + 10$ for all values of x, find the constants p, q and r. [4]

3 **(i)** The curve $y = 5\sqrt{x}$ is transformed by a stretch, scale factor $\frac{1}{2}$, parallel to the x-axis. Find the equation of the curve after it has been transformed. [2]

(ii) Describe the single transformation which transforms the curve $y = 5\sqrt{x}$ to the curve $y = \left(5\sqrt{x}\right) - 3$. [2]

4 Solve the simultaneous equations

$$x^2 - 3y + 11 = 0, \qquad 2x - y + 1 = 0.$$ [5]

5 On separate diagrams,

(i) sketch the curve $y = \dfrac{1}{x}$, [2]

(ii) sketch the curve $y = x(x^2 - 1)$, stating the coordinates of the points where it crosses the x-axis, [3]

(iii) sketch the curve $y = -\sqrt{x}$. [2]

6 **(i)** Calculate the discriminant of $-2x^2 + 7x + 3$ and hence state the number of real roots of the equation $-2x^2 + 7x + 3 = 0$. [3]

(ii) The quadratic equation $2x^2 + (p + 1)x + 8 = 0$ has equal roots. Find the possible values of p. [4]

7 Find $\dfrac{dy}{dx}$ in each of the following cases:

(i) $y = \frac{1}{2}x^4 - 3x$, [2]

(ii) $y = (2x^2 + 3)(x + 1)$, [4]

(iii) $y = \sqrt[5]{x}$. [3]

8 The length of a rectangular children's playground is 10 m more than its width. The width of the playground is x metres.

(i) The perimeter of the playground is greater than 64 m. Write down a linear inequality in x. [1]

(ii) The area of the playground is less than $299\,\text{m}^2$. Show that $(x-13)(x+23) < 0$. [2]

(iii) By solving the inequalities in parts **(i)** and **(ii)**, determine the set of possible values of x. [5]

9 **(i)** Find the gradient of the curve $y = 2x^2$ at the point where $x = 3$. [2]

(ii) At a point A on the curve $y = 2x^2$, the gradient of the normal is $\frac{1}{8}$. Find the coordinates of A. [3]

Points $P_1\,(1, y_1)$, $P_2\,(1.01, y_2)$ and $P_3\,(1.1, y_3)$ lie on the curve $y = kx^2$. The gradient of the chord P_1P_3 is 6.3 and the gradient of the chord P_1P_2 is 6.03.

(iii) What do these results suggest about the gradient of the tangent to the curve $y = kx^2$ at P_1? [1]

(iv) Deduce the value of k. [3]

10 The points D, E and F have coordinates $(-2, 0)$, $(0, -1)$ and $(2, 3)$ respectively.

(i) Calculate the gradient of DE. [1]

(ii) Find the equation of the line through F, parallel to DE, giving your answer in the form $ax + by + c = 0$. [3]

(iii) By calculating the gradient of EF, show that DEF is a right-angled triangle. [2]

(iv) Calculate the length of DF. [2]

(v) Use the results of parts **(iii)** and **(iv)** to show that the circle which passes through D, E and F has equation $x^2 + y^2 - 3y - 4 = 0$. [5]

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