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.**

X   **WARNING**

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

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

    Registered Charity Number: 1066969   **[Turn over**

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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 $y = (5\sqrt{x}) - 3$.   [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 $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ 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 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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