OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE   **4721/01**

MATHEMATICS

Core Mathematics 1

WEDNESDAY 9 JANUARY 2008   Afternoon

Time: 1 hour 30 minutes

Additional materials: Answer Booklet (8 pages)
                       List of Formulae (MF1)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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.
- **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 document consists of **4** printed pages.

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1   Express $\dfrac{4}{3 - \sqrt{7}}$ in the form $a + b\sqrt{7}$, where a and b are integers. [3]

2   **(i)** Write down the equation of the circle with centre $(0, 0)$ and radius 7. [1]

   (ii) A circle with centre $(3, 5)$ has equation $x^2 + y^2 - 6x - 10y - 30 = 0$. Find the radius of the circle. [2]

3   Given that $3x^2 + bx + 10 = a(x + 3)^2 + c$ for all values of x, find the values of the constants a, b and c. [4]

4   Solve the equations

   (i) $10^p = 0.1$, [1]

   (ii) $\left(25k^2\right)^{\frac{1}{2}} = 15$, [3]

   (iii) $t^{-\frac{1}{3}} = \frac{1}{2}$. [2]

5   **(i)** Sketch the curve $y = x^3 + 2$. [2]

   (ii) Sketch the curve $y = 2\sqrt{x}$. [2]

   (iii) Describe a transformation that transforms the curve $y = 2\sqrt{x}$ to the curve $y = 3\sqrt{x}$. [3]

6   **(i)** Solve the equation $x^2 + 8x + 10 = 0$, giving your answers in simplified surd form. [3]

   (ii) Sketch the curve $y = x^2 + 8x + 10$, giving the coordinates of the point where the curve crosses the y-axis. [3]

   (iii) Solve the inequality $x^2 + 8x + 10 \geqslant 0$. [2]

7   **(i)** Find the gradient of the line l which has equation $x + 2y = 4$. [1]

   (ii) Find the equation of the line parallel to l which passes through the point $(6, 5)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [3]

   (iii) Solve the simultaneous equations

$$y = x^2 + x + 1 \qquad \text{and} \qquad x + 2y = 4.$$ [4]

8   **(i)** Find the coordinates of the stationary points on the curve $y = x^3 + x^2 - x + 3$. [6]

   (ii) Determine whether each stationary point is a maximum point or a minimum point. [3]

   (iii) For what values of x does $x^3 + x^2 - x + 3$ decrease as x increases? [2]

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9 The points A and B have coordinates $(-5, -2)$ and $(3, 1)$ respectively.

   (i) Find the equation of the line AB, giving your answer in the form $ax + by + c = 0$. [3]

   (ii) Find the coordinates of the mid-point of AB. [2]

The point C has coordinates $(-3, 4)$.

   (iii) Calculate the length of AC, giving your answer in simplified surd form. [3]

   (iv) Determine whether the line AC is perpendicular to the line BC, showing all your working. [4]

10 Given that $f(x) = 8x^3 + \dfrac{1}{x^3}$,

   (i) find $f''(x)$, [5]

   (ii) solve the equation $f(x) = -9$. [5]

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