OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS

Core Mathematics 1

4721

Candidates answer on the Answer Booklet

OCR Supplied Materials:
- 8 page Answer Booklet
- List of Formulae (MF1)

Other Materials Required:
None

Friday 9 January 2009
Morning

Duration: 1 hour 30 minutes

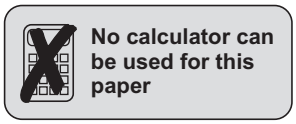
4721

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.



1 Express $\sqrt{45} + \dfrac{20}{\sqrt{5}}$ in the form $k\sqrt{5}$, where k is an integer. **[3]**

2 Simplify

(i) $\left(\sqrt[3]{x}\right)^6$, **[1]**

(ii) $\dfrac{3y^4 \times (10y)^3}{2y^5}$. **[3]**

3 Solve the equation $3x^{\frac{2}{3}} + x^{\frac{1}{3}} - 2 = 0$. **[5]**

4 **(i)** Sketch the curve $y = \dfrac{1}{x^2}$. **[2]**

(ii) The curve $y = \dfrac{1}{x^2}$ is translated by 3 units in the negative x-direction. State the equation of the curve after it has been translated. **[2]**

(iii) The curve $y = \dfrac{1}{x^2}$ is stretched parallel to the y-axis with scale factor 4 and, as a result, the point $P\,(1, 1)$ is transformed to the point Q. State the coordinates of Q. **[2]**

5 Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in each of the following cases:

(i) $y = 10x^{-5}$, **[2]**

(ii) $y = \sqrt[4]{x}$, **[3]**

(iii) $y = x(x + 3)(1 - 5x)$. **[4]**

6 **(i)** Express $5x^2 + 20x - 8$ in the form $p(x + q)^2 + r$. **[4]**

(ii) State the equation of the line of symmetry of the curve $y = 5x^2 + 20x - 8$. **[1]**

(iii) Calculate the discriminant of $5x^2 + 20x - 8$. **[2]**

(iv) State the number of real roots of the equation $5x^2 + 20x - 8 = 0$. **[1]**

7 The line with equation $3x + 4y - 10 = 0$ passes through point $A\,(2,\ 1)$ and point $B\,(10,\ k)$.

(i) Find the value of k. **[2]**

(ii) Calculate the length of AB. **[2]**

A circle has equation $(x - 6)^2 + (y + 2)^2 = 25$.

(iii) Write down the coordinates of the centre and the radius of the circle. **[2]**

(iv) Verify that AB is a diameter of the circle. **[2]**

8 **(i)** Solve the equation $5 - 8x - x^2 = 0$, giving your answers in simplified surd form. **[3]**

(ii) Solve the inequality $5 - 8x - x^2 \leqslant 0$. **[2]**

(iii) Sketch the curve $y = (5 - 8x - x^2)(x + 4)$, giving the coordinates of the points where the curve crosses the coordinate axes. **[5]**

9 The curve $y = x^3 + px^2 + 2$ has a stationary point when $x = 4$. Find the value of the constant p and determine whether the stationary point is a maximum or minimum point. **[7]**

10 A curve has equation $y = x^2 + x$.

(i) Find the gradient of the curve at the point for which $x = 2$. **[2]**

(ii) Find the equation of the normal to the curve at the point for which $x = 2$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. **[4]**

(iii) Find the values of k for which the line $y = kx - 4$ is a tangent to the curve. **[6]**