

**ADVANCED SUBSIDIARY GCE UNIT  
MATHEMATICS**

Core Mathematics 1

**THURSDAY 7 JUNE 2007**

**4721/01**

Morning

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.
- 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.

**ADVICE TO CANDIDATES**

- Read each question carefully and make sure you know what you have to do before starting your answer.
- **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.

1 Simplify  $(2x + 5)^2 - (x - 3)^2$ , giving your answer in the form  $ax^2 + bx + c$ . [3]

2 (a) On separate diagrams, sketch the graphs of

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

(ii)  $y = x^4$ . [1]

(b) Describe a transformation that transforms the curve  $y = x^3$  to the curve  $y = 8x^3$ . [2]

3 Simplify the following, expressing each answer in the form  $a\sqrt{5}$ .

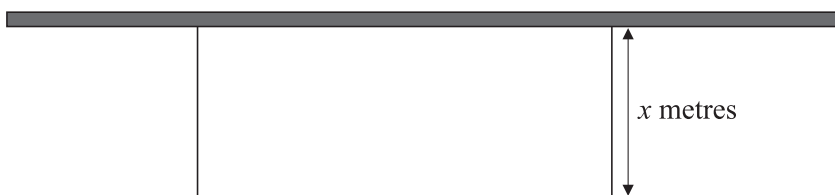
(i)  $3\sqrt{10} \times \sqrt{2}$  [2]

(ii)  $\sqrt{500} + \sqrt{125}$  [3]

4 (i) Find the discriminant of  $kx^2 - 4x + k$  in terms of  $k$ . [2]

(ii) The quadratic equation  $kx^2 - 4x + k = 0$  has equal roots. Find the possible values of  $k$ . [3]

5



The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is  $x$  metres.

(i) Show that the enclosed area,  $A \text{ m}^2$ , is given by

$$A = 20x - 2x^2. \quad [2]$$

(ii) Use differentiation to find the maximum value of  $A$ . [4]

6 By using the substitution  $y = (x + 2)^2$ , find the real roots of the equation

$$(x + 2)^4 + 5(x + 2)^2 - 6 = 0. \quad [6]$$

7 (a) Given that  $f(x) = x + \frac{3}{x}$ , find  $f'(x)$ . [4]

(b) Find the gradient of the curve  $y = x^{\frac{5}{2}}$  at the point where  $x = 4$ . [5]

- 8** (i) Express  $x^2 + 8x + 15$  in the form  $(x + a)^2 - b$ . [3]
- (ii) Hence state the coordinates of the vertex of the curve  $y = x^2 + 8x + 15$ . [2]
- (iii) Solve the inequality  $x^2 + 8x + 15 > 0$ . [4]
- 9** The circle with equation  $x^2 + y^2 - 6x - k = 0$  has radius 4.
- (i) Find the centre of the circle and the value of  $k$ . [4]
- The points  $A(3, a)$  and  $B(-1, 0)$  lie on the circumference of the circle, with  $a > 0$ .
- (ii) Calculate the length of  $AB$ , giving your answer in simplified surd form. [5]
- (iii) Find an equation for the line  $AB$ . [3]
- 10** (i) Solve the equation  $3x^2 - 14x - 5 = 0$ . [3]
- A curve has equation  $y = 3x^2 - 14x - 5$ .
- (ii) Sketch the curve, indicating the coordinates of all intercepts with the axes. [3]
- (iii) Find the value of  $c$  for which the line  $y = 4x + c$  is a tangent to the curve. [6]

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