

ADVANCED SUBSIDIARY GCE UNIT MATHEMATICS

4721/01

Core Mathematics 1

Morning

Time: 1 hour 30 minutes

THURSDAY 7 JUNE 2007

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]

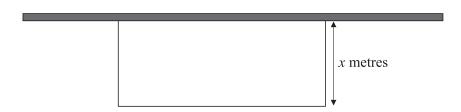
- **(b)** Describe a transformation that transforms the curve $y = x^3$ to the curve $y = 8x^3$. [2]
- 3 Simplify the following, expressing each answer in the form $a\sqrt{5}$.

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

(ii)
$$\sqrt{500} + \sqrt{125}$$

- 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

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

[4]

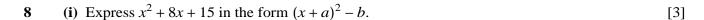
- (ii) Use differentiation to find the maximum value of A.
- **6** By using the substitution $y = (x + 2)^2$, find the real roots of the equation

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

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- (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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