OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT **4721/01**

MATHEMATICS

Core Mathematics 1

THURSDAY 7 JUNE 2007 Morning

Time: 1 hour 30 minutes

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

INSTRUCTIONS TO CANDIDATES

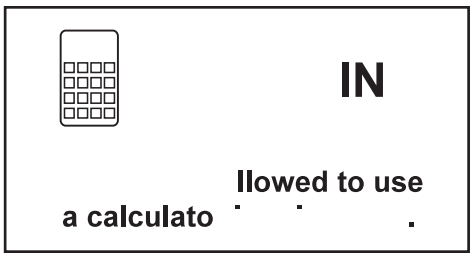
- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You 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.**



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 [Turn over

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]

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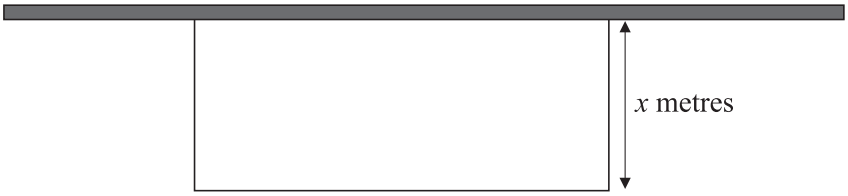

The diagram shows a rectangular enclosure, with a wall forming one side. A rope, of length 20 metres, is used to form the remaining three sides. The width of the enclosure is x metres.

(i) Show that the enclosed area, A m^2, is given by

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

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

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

OCR
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ADVANCED SUBSIDIARY GCE UNIT **4722/01**

MATHEMATICS

Core Mathematics 2

THURSDAY 7 JUNE 2007 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 permitted to use a graphical 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.**

This document consists of **4** printed pages.

[Turn over

1 A geometric progression $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 15 \qquad \text{and} \qquad u_{n+1} = 0.8u_n \text{ for } n \geqslant 1.$$

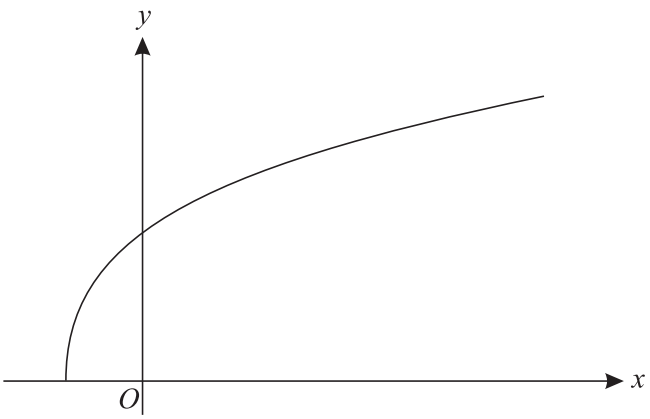
(i) Write down the values of u_2, u_3 and u_4. [2]

(ii) Find $\sum_{n=1}^{20} u_n$. [3]

2 Expand $\left(x + \frac{2}{x}\right)^4$ completely, simplifying the terms. [5]

3 Use logarithms to solve the equation $3^{2x+1} = 5^{200}$, giving the value of x correct to 3 significant figures. [5]

4



The diagram shows the curve $y = \sqrt{4x + 1}$.

(i) Use the trapezium rule, with strips of width 0.5, to find an approximate value for the area of the region bounded by the curve $y = \sqrt{4x + 1}$, the x-axis, and the lines $x = 1$ and $x = 3$. Give your answer correct to 3 significant figures. [4]

(ii) State with a reason whether this approximation is an under-estimate or an over-estimate. [2]

5 **(i)** Show that the equation

$$3\cos^2\theta = \sin\theta + 1$$

can be expressed in the form

$$3\sin^2\theta + \sin\theta - 2 = 0.$$ [2]

(ii) Hence solve the equation

$$3\cos^2\theta = \sin\theta + 1,$$

giving all values of θ between $0°$ and $360°$. [5]

6 **(a)** **(i)** Find $\int x(x^2 - 4)\,\mathrm{d}x$. [3]

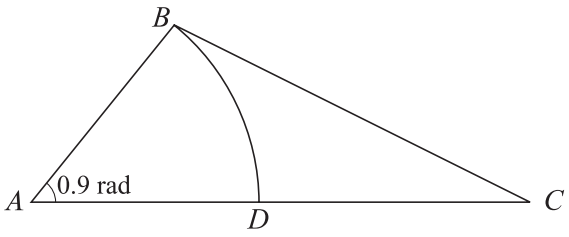
(ii) Hence evaluate $\int_1^6 x(x^2 - 4)\,\mathrm{d}x$. [2]

(b) Find $\int \frac{6}{x^3}\,\mathrm{d}x$. [3]

7 **(a)** In an arithmetic progression, the first term is 12 and the sum of the first 70 terms is 12 915. Find the common difference. [4]

(b) In a geometric progression, the second term is −4 and the sum to infinity is 9. Find the common ratio. [7]

8



The diagram shows a triangle ABC, where angle BAC is 0.9 radians. BAD is a sector of the circle with centre A and radius AB.

(i) The area of the sector BAD is 16.2 cm^2. Show that the length of AB is 6 cm. [2]

(ii) The area of triangle ABC is twice the area of sector BAD. Find the length of AC. [3]

(iii) Find the perimeter of the region BCD. [6]

9 The polynomial $\mathrm{f}(x)$ is given by

$$\mathrm{f}(x) = x^3 + 6x^2 + x - 4.$$

(i) **(a)** Show that $(x + 1)$ is a factor of $\mathrm{f}(x)$. [1]

(b) Hence find the exact roots of the equation $\mathrm{f}(x) = 0$. [6]

(ii) **(a)** Show that the equation

$$2\log_2(x + 3) + \log_2 x - \log_2(4x + 2) = 1$$

can be written in the form $\mathrm{f}(x) = 0$. [5]

(b) Explain why the equation

$$2\log_2(x + 3) + \log_2 x - \log_2(4x + 2) = 1$$

has only one real root and state the exact value of this root. [2]