OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

MATHEMATICS 4722

Core Mathematics 2

Monday **16 JANUARY 2006** Morning 1 hour 30 minutes

Additional materials:
8 page answer booklet
Graph paper
List of Formulae (MF1)

TIME 1 hour 30 minutes

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.
- Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
- **You are reminded of the need for clear presentation in your answers.**

This question paper consists of 4 printed pages.

[Turn over

1 The 20th term of an arithmetic progression is 10 and the 50th term is 70.

(i) Find the first term and the common difference. [4]

(ii) Show that the sum of the first 29 terms is zero. [2]

2 Triangle ABC has $AB = 10\,\text{cm}$, $BC = 7\,\text{cm}$ and angle $B = 80°$. Calculate

(i) the area of the triangle, [2]

(ii) the length of CA, [2]

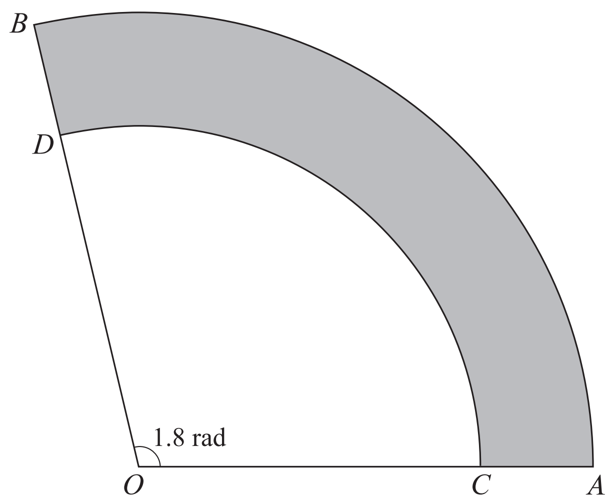
(iii) the size of angle C. [2]

3 **(i)** Find the first three terms of the expansion, in ascending powers of x, of $(1 - 2x)^{12}$. [3]

(ii) Hence find the coefficient of x^2 in the expansion of

$$(1 + 3x)(1 - 2x)^{12}.$$ [3]

4



The diagram shows a sector OAB of a circle with centre O. The angle AOB is 1.8 radians. The points C and D lie on OA and OB respectively. It is given that $OA = OB = 20\,\text{cm}$ and $OC = OD = 15\,\text{cm}$. The shaded region is bounded by the arcs AB and CD and by the lines CA and DB.

(i) Find the perimeter of the shaded region. [3]

(ii) Find the area of the shaded region. [3]

5 In a geometric progression, the first term is 5 and the second term is 4.8.

(i) Show that the sum to infinity is 125. [2]

(ii) The sum of the first n terms is greater than 124. Show that

$$0.96^n < 0.008,$$

and use logarithms to calculate the smallest possible value of n. [6]

6 **(a)** Find $\int \left(x^{\frac{1}{2}} + 4\right) \mathrm{d}x$. [4]

(b) **(i)** Find the value, in terms of a, of $\int_1^a 4x^{-2}\,\mathrm{d}x$, where a is a constant greater than 1. [3]

(ii) Deduce the value of $\int_1^\infty 4x^{-2}\,\mathrm{d}x$. [1]

7 **(i)** Express each of the following in terms of $\log_{10} x$ and $\log_{10} y$.

(a) $\log_{10}\left(\frac{x}{y}\right)$ [1]

(b) $\log_{10}(10x^2y)$ [3]

(ii) Given that

$$2\log_{10}\left(\frac{x}{y}\right) = 1 + \log_{10}(10x^2y),$$

find the value of y correct to 3 decimal places. [4]

8 The cubic polynomial $2x^3 + kx^2 - x + 6$ is denoted by $\mathrm{f}(x)$. It is given that $(x + 1)$ is a factor of $\mathrm{f}(x)$.

(i) Show that $k = -5$, and factorise $\mathrm{f}(x)$ completely. [6]

(ii) Find $\int_{-1}^{2} \mathrm{f}(x)\,\mathrm{d}x$. [4]

(iii) Explain with the aid of a sketch why the answer to part **(ii)** does not give the area of the region between the curve $y = \mathrm{f}(x)$ and the x-axis for $-1 \leqslant x \leqslant 2$. [2]

[Question 9 is printed overleaf.]

9 **(i)** Sketch, on a single diagram showing values of x from $-180°$ to $+180°$, the graphs of $y = \tan x$ and $y = 4\cos x$. [3]

The equation

$$\tan x = 4\cos x$$

has two roots in the interval $-180° \leqslant x \leqslant 180°$. These are denoted by α and β, where $\alpha < \beta$.

(ii) Show α and β on your sketch, and express β in terms of α. [3]

(iii) Show that the equation $\tan x = 4\cos x$ may be written as

$$4\sin^2 x + \sin x - 4 = 0.$$

Hence find the value of $\beta - \alpha$, correct to the nearest degree. [6]