

**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.**

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**This question paper consists of 4 printed pages.**

- 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  $AB = 10$  cm,  $BC = 7$  cm and angle  $B = 80^\circ$ . Calculate

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

(ii) the length of  $CA$ , [2]

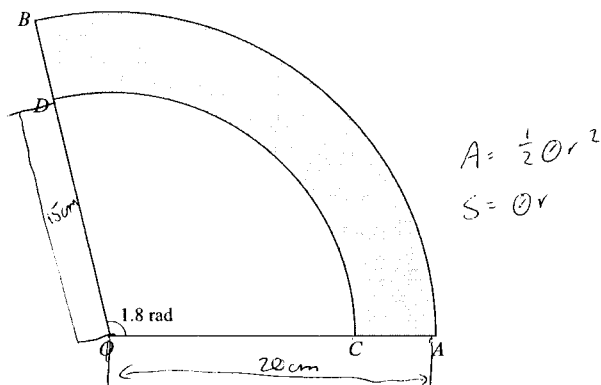
(iii) the size of angle  $C$ . [2]

- 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

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

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  $OA = OB = 20$  cm and  $OC = OD = 15$  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  $\int (x^{\frac{1}{2}} + 4) \, dx$ . [4]

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

(ii) Deduce the value of  $\int_1^{\infty} 4x^{-2} \, dx$ . [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  $f(x)$ . It is given that  $(x + 1)$  is a factor of  $f(x)$ .

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

(ii) Find  $\int_{-1}^2 f(x) \, dx$ . [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  $y = f(x)$  and the  $x$ -axis for  $-1 \leq x \leq 2$ . [2]

[Question 9 is printed overleaf.]

- 9 (i) Sketch, on a single diagram showing values of  $x$  from  $-180^\circ$  to  $+180^\circ$ , 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  $-180^\circ \leq x \leq 180^\circ$ . These are denoted by  $\alpha$  and  $\beta$ , where  $\alpha < \beta$ .

- (ii) Show  $\alpha$  and  $\beta$  on your sketch, and express  $\beta$  in terms of  $\alpha$ . [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]

