

**ADVANCED SUBSIDIARY GCE UNIT  
MATHEMATICS**

Core Mathematics 2

**TUESDAY 16 JANUARY 2007**

**4722/01**

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 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.

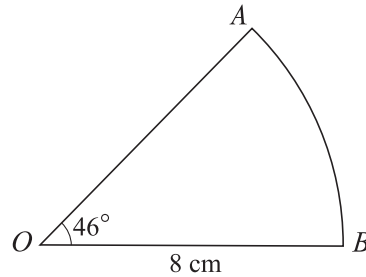
**ADVICE TO CANDIDATES**

- 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.

- 1 In an arithmetic progression the first term is 15 and the twentieth term is 72. Find the sum of the first 100 terms. [4]

2



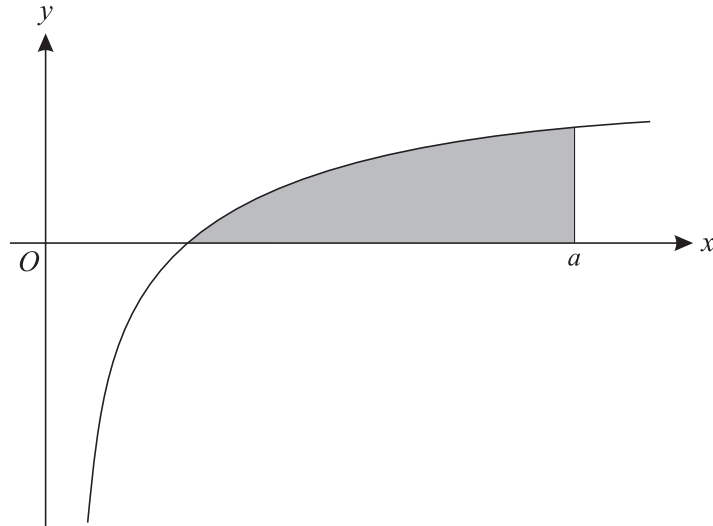
The diagram shows a sector  $OAB$  of a circle, centre  $O$  and radius 8 cm. The angle  $AOB$  is  $46^\circ$ .

- (i) Express  $46^\circ$  in radians, correct to 3 significant figures. [2]
- (ii) Find the length of the arc  $AB$ . [1]
- (iii) Find the area of the sector  $OAB$ . [2]
- 3 (i) Find  $\int (4x - 5) dx$ . [2]
- (ii) The gradient of a curve is given by  $\frac{dy}{dx} = 4x - 5$ . The curve passes through the point  $(3, 7)$ . Find the equation of the curve. [3]
- 4 In a triangle  $ABC$ ,  $AB = 5\sqrt{2}$  cm,  $BC = 8$  cm and angle  $B = 60^\circ$ .
- (i) Find the exact area of the triangle, giving your answer as simply as possible. [3]
- (ii) Find the length of  $AC$ , correct to 3 significant figures. [3]
- 5 (a) (i) Express  $\log_3(4x + 7) - \log_3 x$  as a single logarithm. [1]
- (ii) Hence solve the equation  $\log_3(4x + 7) - \log_3 x = 2$ . [3]
- (b) Use the trapezium rule, with two strips of width 3, to find an approximate value for
- $$\int_3^9 \log_{10} x dx,$$
- giving your answer correct to 3 significant figures. [4]

- 6 (i) Find and simplify the first four terms in the expansion of  $(1 + 4x)^7$  in ascending powers of  $x$ . [4]
- (ii) In the expansion of
- $$(3 + ax)(1 + 4x)^7,$$
- the coefficient of  $x^2$  is 1001. Find the value of  $a$ . [3]
- 7 (i) (a) Sketch the graph of  $y = 2 \cos x$  for values of  $x$  such that  $0^\circ \leq x \leq 360^\circ$ , indicating the coordinates of any points where the curve meets the axes. [2]
- (b) Solve the equation  $2 \cos x = 0.8$ , giving all values of  $x$  between  $0^\circ$  and  $360^\circ$ . [3]
- (ii) Solve the equation  $2 \cos x = \sin x$ , giving all values of  $x$  between  $-180^\circ$  and  $180^\circ$ . [3]
- 8 The polynomial  $f(x)$  is defined by  $f(x) = x^3 - 9x^2 + 7x + 33$ .
- (i) Find the remainder when  $f(x)$  is divided by  $(x + 2)$ . [2]
- (ii) Show that  $(x - 3)$  is a factor of  $f(x)$ . [1]
- (iii) Solve the equation  $f(x) = 0$ , giving each root in an exact form as simply as possible. [6]
- 9 On its first trip between Malby and Grenlish, a steam train uses 1.5 tonnes of coal. As the train does more trips, it becomes less efficient so that each subsequent trip uses 2% more coal than the previous trip.
- (i) Show that the amount of coal used on the fifth trip is 1.624 tonnes, correct to 4 significant figures. [2]
- (ii) There are 39 tonnes of coal available. An engineer wishes to calculate  $N$ , the total number of trips possible. Show that  $N$  satisfies the inequality
- $$1.02^N \leq 1.52. \quad [4]$$
- (iii) Hence, by using logarithms, find the greatest number of trips possible. [4]

[Question 10 is printed overleaf.]

10



The diagram shows the graph of  $y = 1 - 3x^{-\frac{1}{2}}$ .

- (i) Verify that the curve intersects the  $x$ -axis at  $(9, 0)$ . [1]
- (ii) The shaded region is enclosed by the curve, the  $x$ -axis and the line  $x = a$  (where  $a > 9$ ). Given that the area of the shaded region is 4 square units, find the value of  $a$ . [9]

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