

**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.

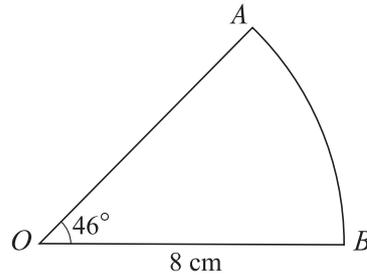
ADVICE TO CANDIDATES

- 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



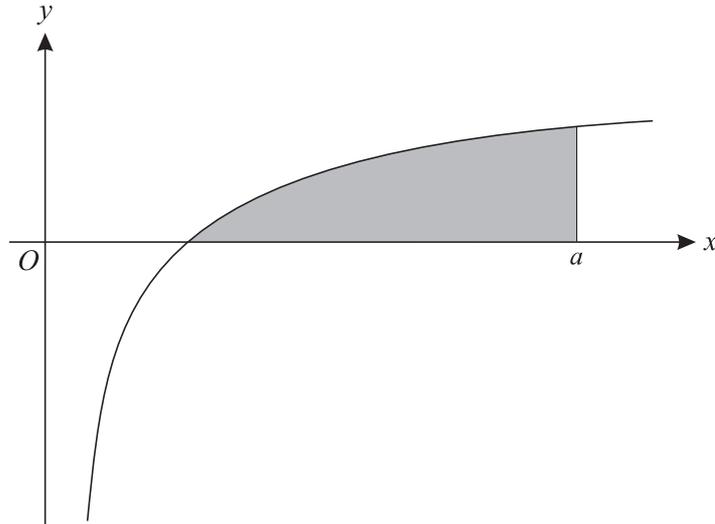
The diagram shows a sector OAB of a circle, centre O and radius 8 cm. The angle AOB is 46° .

- (i) Express 46° 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° and 360° . [3]
- (ii) Solve the equation $2 \cos x = \sin x$, giving all values of x between -180° and 180° . [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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