OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE **4722/01**

MATHEMATICS

Core Mathematics 2

THURSDAY 15 MAY 2008 Morning

Time: 1 hour 30 minutes

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

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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.
- **You are reminded of the need for clear presentation in your answers.**

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

[Turn over

1 Find and simplify the first three terms in the expansion of $(2 - 3x)^6$ in ascending powers of x. [4]

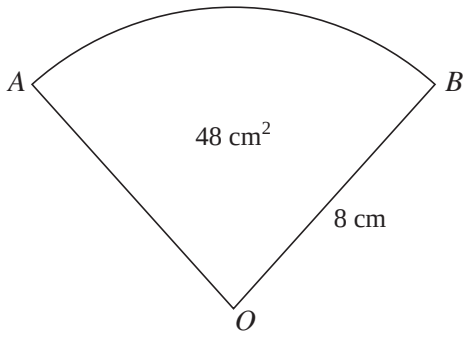
2 A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 3 \quad \text{and} \quad u_{n+1} = 1 - \frac{1}{u_n} \text{ for } n \geqslant 1.$$

(i) Write down the values of u_2, u_3 and u_4. [3]

(ii) Describe the behaviour of the sequence. [1]

3



The diagram shows a sector AOB of a circle with centre O and radius 8 cm. The area of the sector is 48 cm^2.

(i) Find angle AOB, giving your answer in radians. [2]

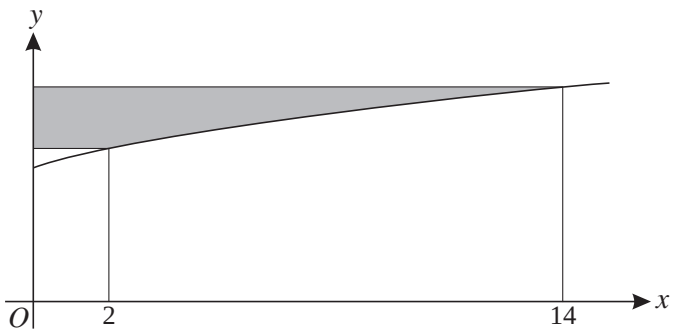
(ii) Find the area of the segment bounded by the arc AB and the chord AB. [3]

4 The cubic polynomial $ax^3 - 4x^2 - 7ax + 12$ is denoted by $\text{f}(x)$.

(i) Given that $(x - 3)$ is a factor of $\text{f}(x)$, find the value of the constant a. [3]

(ii) Using this value of a, find the remainder when $\text{f}(x)$ is divided by $(x + 2)$. [2]

5



The diagram shows the curve $y = 3 + \sqrt{x + 2}$.

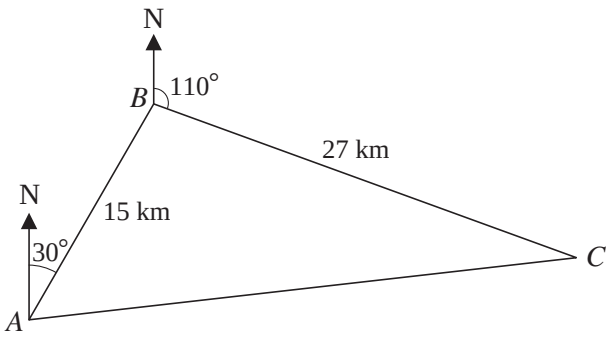
The shaded region is bounded by the curve, the y-axis, and two lines parallel to the x-axis which meet the curve where $x = 2$ and $x = 14$.

(i) Show that the area of the shaded region is given by

$$\int_5^7 (y^2 - 6y + 7)\,\mathrm{d}y.$$ [3]

(ii) Hence find the exact area of the shaded region. [4]

6



In the diagram, a lifeboat station is at point A. A distress call is received and the lifeboat travels 15 km on a bearing of 030° to point B. A second call is received and the lifeboat then travels 27 km on a bearing of 110° to arrive at point C. The lifeboat then travels back to the station at A.

(i) Show that angle ABC is 100°. [1]

(ii) Find the distance that the lifeboat has to travel to get from C back to A. [2]

(iii) Find the bearing on which the lifeboat has to travel to get from C to A. [4]

7 **(a)** Find $\int x^3(x^2 - x + 5)\,\mathrm{d}x$. [4]

(b) **(i)** Find $\int 18x^{-4}\,\mathrm{d}x$. [2]

(ii) Hence evaluate $\int_2^\infty 18x^{-4}\,\mathrm{d}x$. [2]

[Turn over

8 **(i)** Sketch the curve $y = 2 \times 3^x$, stating the coordinates of any intersections with the axes. [3]

(ii) The curve $y = 2 \times 3^x$ intersects the curve $y = 8^x$ at the point P. Show that the x-coordinate of P may be written as

$$\frac{1}{3 - \log_2 3}.$$ [5]

9 **(a)** **(i)** Show that the equation

$$2 \sin x \tan x - 5 = \cos x$$

can be expressed in the form

$$3 \cos^2 x + 5 \cos x - 2 = 0.$$ [3]

(ii) Hence solve the equation

$$2 \sin x \tan x - 5 = \cos x,$$

giving all values of x, in radians, for $0 \leqslant x \leqslant 2\pi$. [4]

(b) Use the trapezium rule, with four strips each of width 0.25, to find an approximate value for

$$\int_0^1 \cos x \, \mathrm{d}x,$$

where x is in radians. Give your answer correct to 3 significant figures. [4]

10 Jamie is training for a triathlon, which involves swimming, running and cycling.

- On Day 1, he swims 2 km and then swims the same distance on each subsequent day.
- On Day 1, he runs 2 km and, on each subsequent day, he runs 0.5 km further than on the previous day. (Thus he runs 2.5 km on Day 2, 3 km on Day 3, and so on.)
- On Day 1 he cycles 2 km and, on each subsequent day, he cycles a distance 10% further than on the previous day.

(i) Find how far Jamie runs on Day 15. [2]

(ii) Verify that the distance cycled in a day first exceeds 12 km on Day 20. [3]

(iii) Find the day on which the total distance cycled, up to and including that day, first exceeds 200 km. [4]

(iv) Find the total distance travelled, by swimming, running and cycling, up to and including Day 30. [4]