

**ADVANCED SUBSIDIARY GCE**  
**MATHEMATICS**  
Core Mathematics 2

**4722**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- List of Formulae (MF1)

**Other Materials Required:**

None

**Friday 15 January 2010**  
**Afternoon**

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

- 1 (i) Show that the equation

$$2 \sin^2 x = 5 \cos x - 1$$

can be expressed in the form

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

- (ii) Hence solve the equation

$$2 \sin^2 x = 5 \cos x - 1,$$

giving all values of  $x$  between  $0^\circ$  and  $360^\circ$ . [4]

- 2 The gradient of a curve is given by  $\frac{dy}{dx} = 6x - 4$ . The curve passes through the distinct points  $(2, 5)$  and  $(p, 5)$ .

(i) Find the equation of the curve. [4]

(ii) Find the value of  $p$ . [3]

- 3 (i) Find and simplify the first four terms in the expansion of  $(2 - x)^7$  in ascending powers of  $x$ . [4]

(ii) Hence find the coefficient of  $w^6$  in the expansion of  $(2 - \frac{1}{4}w^2)^7$ . [2]

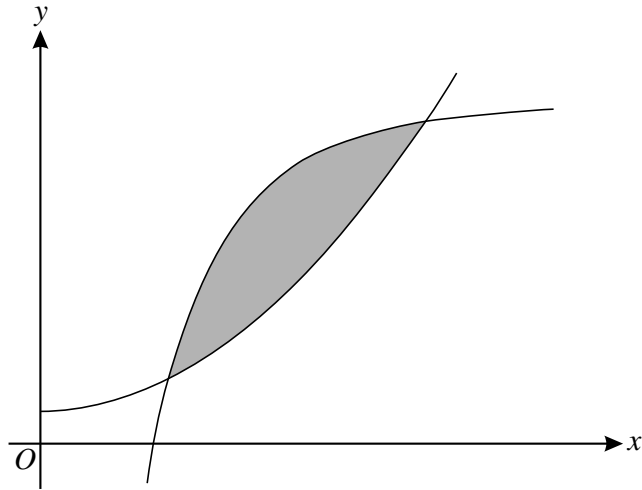
- 4 (i) Use the trapezium rule, with 4 strips each of width 0.5, to find an approximate value for

$$\int_3^5 \log_{10}(2 + x) dx,$$

giving your answer correct to 3 significant figures. [4]

(ii) Use your answer to part (i) to deduce an approximate value for  $\int_3^5 \log_{10} \sqrt{2 + x} dx$ , showing your method clearly. [2]

5



The diagram shows parts of the curves  $y = x^2 + 1$  and  $y = 11 - \frac{9}{x^2}$ , which intersect at  $(1, 2)$  and  $(3, 10)$ . Use integration to find the exact area of the shaded region enclosed between the two curves. [7]

6 The cubic polynomial  $f(x)$  is given by

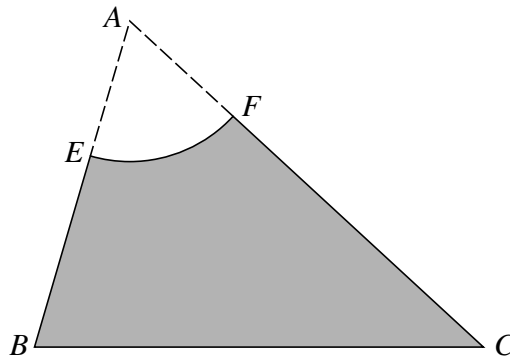
$$f(x) = 2x^3 + ax^2 + bx + 15,$$

where  $a$  and  $b$  are constants. It is given that  $(x + 3)$  is a factor of  $f(x)$  and that, when  $f(x)$  is divided by  $(x - 2)$ , the remainder is 35.

(i) Find the values of  $a$  and  $b$ . [6]

(ii) Using these values of  $a$  and  $b$ , divide  $f(x)$  by  $(x + 3)$ . [3]

7



The diagram shows triangle  $ABC$ , with  $AB = 10$  cm,  $BC = 13$  cm and  $CA = 14$  cm.  $E$  and  $F$  are points on  $AB$  and  $AC$  respectively such that  $AE = AF = 4$  cm. The sector  $AEF$  of a circle with centre  $A$  is removed to leave the shaded region  $EBCF$ .

(i) Show that angle  $CAB$  is 1.10 radians, correct to 3 significant figures. [2]

(ii) Find the perimeter of the shaded region  $EBCF$ . [3]

(iii) Find the area of the shaded region  $EBCF$ . [5]

8 A sequence  $u_1, u_2, u_3, \dots$  is defined by

$$u_1 = 8 \quad \text{and} \quad u_{n+1} = u_n + 3.$$

(i) Show that  $u_5 = 20$ . [2]

(ii) The  $n$ th term of the sequence can be written in the form  $u_n = pn + q$ . State the values of  $p$  and  $q$ . [2]

(iii) State what type of sequence it is. [1]

(iv) Find the value of  $N$  such that  $\sum_{n=1}^{2N} u_n - \sum_{n=1}^N u_n = 1256$ . [5]

9 (i) Sketch the curve  $y = 6 \times 5^x$ , stating the coordinates of any points of intersection with the axes. [3]

(ii) The point  $P$  on the curve  $y = 9^x$  has  $y$ -coordinate equal to 150. Use logarithms to find the  $x$ -coordinate of  $P$ , correct to 3 significant figures. [3]

(iii) The curves  $y = 6 \times 5^x$  and  $y = 9^x$  intersect at the point  $Q$ . Show that the  $x$ -coordinate of  $Q$  can be written as  $x = \frac{1 + \log_3 2}{2 - \log_3 5}$ . [5]



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