

# OCR

Oxford Cambridge and RSA

## Wednesday 25 May 2016 – Morning

### AS GCE MATHEMATICS

4722/01 Core Mathematics 2

### QUESTION PAPER

Candidates answer on the Printed Answer Book.

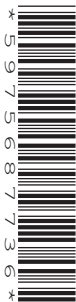
**OCR supplied materials:**

- Printed Answer Book 4722/01
- List of Formulae (MF1)

**Other materials required:**

- Scientific or graphical calculator

**Duration:** 1 hour 30 minutes



### INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- 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.

### INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

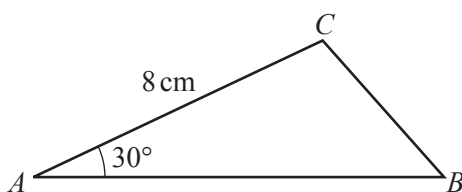
- The number of marks is given in brackets [ ] at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

### INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

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Answer **all** the questions.

1

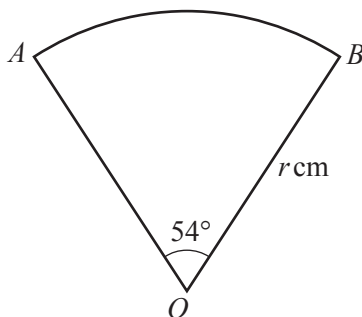


The diagram shows triangle  $ABC$ , with  $AC = 8$  cm and angle  $CAB = 30^\circ$ .

(i) Given that the area of the triangle is  $20 \text{ cm}^2$ , find the length of  $AB$ . [2]

(ii) Find the length of  $BC$ , giving your answer correct to 3 significant figures. [2]

2



The diagram shows a sector  $AOB$  of a circle with centre  $O$  and radius  $r$  cm. The angle  $AOB$  is  $54^\circ$ . The perimeter of the sector is 60 cm.

(i) Express  $54^\circ$  exactly in radians, simplifying your answer. [2]

(ii) Find the value of  $r$ , giving your answer correct to 3 significant figures. [3]

3 (i) Find the binomial expansion of  $(3 + kx)^3$ , simplifying the terms. [4]

(ii) It is given that, in the expansion of  $(3 + kx)^3$ , the coefficient of  $x^2$  is equal to the constant term. Find the possible values of  $k$ , giving your answers in an exact form. [2]

4 (i) Express  $2\log_3 x - \log_3(x + 4)$  as a single logarithm. [2]

(ii) Hence solve the equation  $2\log_3 x - \log_3(x + 4) = 2$ . [4]

5 (a) Find  $\int (x^2 + 2)(2x - 3) dx$ . [3]

(b) (i) Find, in terms of  $a$ , the value of  $\int_1^a (6x^{-2} - 4x^{-3}) dx$ , where  $a$  is a constant greater than 1. [4]

(ii) Deduce the value of  $\int_1^{\infty} (6x^{-2} - 4x^{-3}) dx$ . [1]

6 An arithmetic progression  $u_1, u_2, u_3, \dots$  is defined by  $u_1 = 5$  and  $u_{n+1} = u_n + 1.5$  for  $n \geq 1$ .

(i) Given that  $u_k = 140$ , find the value of  $k$ . [3]

A geometric progression  $w_1, w_2, w_3, \dots$  is defined by  $w_n = 120 \times (0.9)^{n-1}$  for  $n \geq 1$ .

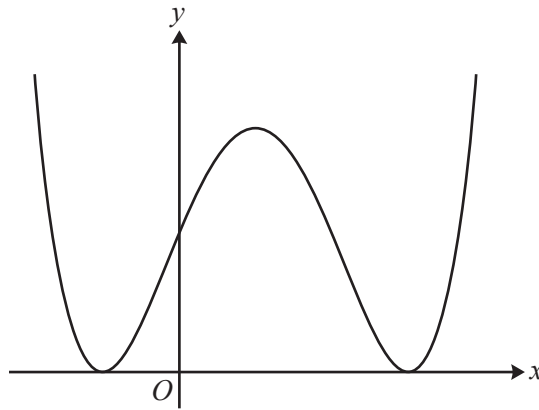
(ii) Find the sum of the first 16 terms of this geometric progression, giving your answer correct to 3 significant figures. [2]

(iii) Use an algebraic method to find the smallest value of  $N$  such that  $\sum_{n=1}^N u_n > \sum_{n=1}^{\infty} w_n$ . [6]

7 The cubic polynomial  $f(x)$  is defined by  $f(x) = x^3 - 3x^2 - x + 3$ .

(i) Find the quotient and remainder when  $f(x)$  is divided by  $(x + 1)$ . [3]

(ii) Hence find the three roots of the equation  $f(x) = 0$ . [3]



The diagram shows the curve  $C$  with equation  $y = x^4 - 4x^3 - 2x^2 + 12x + 9$ .

(iii) Show that the  $x$ -coordinates of the stationary points on  $C$  are given by  $x^3 - 3x^2 - x + 3 = 0$ . [2]

(iv) Use integration to find the exact area of the region enclosed by  $C$  and the  $x$ -axis. [4]

- 8 (i) The curve  $y = 3^x$  can be transformed to the curve  $y = 3^{x-2}$  by a translation. Give details of the translation. [2]
- (ii) Alternatively, the curve  $y = 3^x$  can be transformed to the curve  $y = 3^{x-2}$  by a stretch. Give details of the stretch. [2]
- (iii) Sketch the curve  $y = 3^{x-2}$ , stating the coordinates of any points of intersection with the axes. [2]
- (iv) The point  $P$  on the curve  $y = 3^{x-2}$  has  $y$ -coordinate equal to 180. Use logarithms to find the  $x$ -coordinate of  $P$ , correct to 3 significant figures. [3]
- (v) Use the trapezium rule, with 2 strips each of width 1.5, to find an estimate for  $\int_1^4 3^{x-2} dx$ . Give your answer correct to 3 significant figures. [3]
- 9 A curve has equation  $y = \sin(ax)$ , where  $a$  is a positive constant and  $x$  is in radians.
- (i) State the period of  $y = \sin(ax)$ , giving your answer in an exact form in terms of  $a$ . [1]
- (ii) Given that  $x = \frac{1}{5}\pi$  and  $x = \frac{2}{5}\pi$  are the two smallest positive solutions of  $\sin(ax) = k$ , where  $k$  is a positive constant, find the values of  $a$  and  $k$ . [3]
- (iii) Given instead that  $\sin(ax) = \sqrt{3} \cos(ax)$ , find the two smallest positive solutions for  $x$ , giving your answers in an exact form in terms of  $a$ . [4]

**END OF QUESTION PAPER**

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