



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.

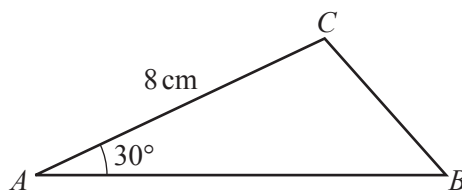
- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question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

INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

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Answer **all** the questions.

1

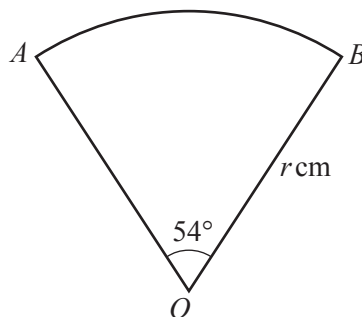


The diagram shows triangle ABC , with $AC = 8\text{ cm}$ and angle $CAB = 30^\circ$.

(i) Given that the area of the triangle is 20 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 $r\text{ cm}$. The angle AOB is 54° . The perimeter of the sector is 60 cm .

(i) Express 54° 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 $n \geq 1$.

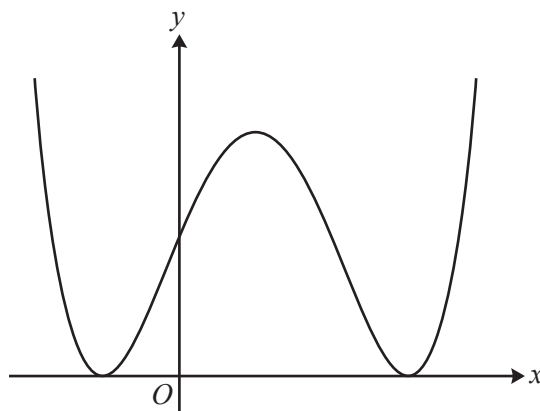
(ii) Find the sum of the first 16 terms of this geometric progression, giving your answer correct to 3 significant figures. [2]

(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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