

Friday 24 June 2016 – Morning

A2 GCE MATHEMATICS

4724/01 Core Mathematics 4

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4724/01
- 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 **16** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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Answer **all** the questions.

1 Find the quotient and the remainder when $4x^3 + 8x^2 - 5x + 12$ is divided by $2x^2 + 1$. [3]

2 Use integration to find the exact value of $\int_{\frac{1}{16}^{\pi}}^{\frac{1}{8}^{\pi}} (9 - 6 \cos^2 4x) dx$. [5]

3 Given that $y \sin 2x + \frac{1}{x} + y^2 = 5$, find an expression for $\frac{dy}{dx}$ in terms of x and y . [5]

4 Find the exact value of $\int_1^8 \frac{1}{\sqrt[3]{x}} \ln x dx$, giving your answer in the form $A \ln 2 + B$, where A and B are constants to be found. [5]

5 The vector equations of two lines are as follows.

$$L: \mathbf{r} = \begin{pmatrix} 1 \\ 4 \\ 5 \end{pmatrix} + s \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} \quad M: \mathbf{r} = \begin{pmatrix} 3 \\ 2 \\ -5 \end{pmatrix} + t \begin{pmatrix} 5 \\ -3 \\ 1 \end{pmatrix}$$

(i) Show that the lines L and M meet, and find the coordinates of the point of intersection. [4]

(ii) Show that the line L can also be represented by the equation $\mathbf{r} = \begin{pmatrix} 7 \\ 1 \\ 14 \end{pmatrix} + u \begin{pmatrix} -4 \\ 2 \\ -6 \end{pmatrix}$. [2]

6 Use the substitution $u = x^2 - 2$ to find $\int \frac{6x^3 + 4x}{\sqrt{x^2 - 2}} dx$. [6]

7 Given that the binomial expansion of $(1 + kx)^n$ is $1 - 6x + 30x^2 + \dots$, find the values of n and k . State the set of values of x for which this expansion is valid. [6]

- 8 The points A and B have position vectors relative to the origin O given by

$$\vec{OA} = \begin{pmatrix} 3 \sin \alpha \\ 2 \cos \alpha \\ -1 \end{pmatrix} \text{ and } \vec{OB} = \begin{pmatrix} 2 \cos \alpha \\ 4 \sin \alpha \\ 3 \end{pmatrix},$$

where $0^\circ < \alpha < 90^\circ$. It is given that \vec{OA} and \vec{OB} are perpendicular.

- (i) Calculate the two possible values of α . [5]
- (ii) Calculate the area of triangle OAB for the smaller value of α from part (i). [4]
- 9 A curve has parametric equations $x = 1 - \cos t$, $y = \sin t \sin 2t$, for $0 \leq t \leq \pi$.
- (i) Find the coordinates of the points where the curve meets the x -axis. [3]
- (ii) Show that $\frac{dy}{dx} = 2 \cos 2t + 2 \cos^2 t$. Hence find, in an exact form, the coordinates of the stationary points. [7]
- (iii) Find the cartesian equation of the curve. Give your answer in the form $y = f(x)$, where $f(x)$ is a polynomial. [3]
- (iv) Sketch the curve. [2]
- 10 (i) Express $\frac{16 + 5x - 2x^2}{(x + 1)^2(x + 4)}$ in partial fractions. [5]

- (ii) It is given that

$$\frac{dy}{dx} = \frac{(16 + 5x - 2x^2)y}{(x + 1)^2(x + 4)}$$

and that $y = \frac{1}{256}$ when $x = 0$. Find the exact value of y when $x = 2$. Give your answer in the form Ae^n . [7]

END OF QUESTION PAPER

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