OCR
Oxford Cambridge and RSA

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

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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

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

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 $\int_{\frac{1}{16}\pi}^{\frac{1}{8}\pi}(9-6\cos^2 4x)\,\mathrm{d}x$. **[5]**

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

4 Find the exact value of $\displaystyle\int_1^8 \frac{1}{\sqrt[3]{x}}\ln x\,\mathrm{d}x$, 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.

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

(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 $\displaystyle\int \frac{6x^3+4x}{\sqrt{x^2-2}}\,\mathrm{d}x$. **[6]**

7 Given that the binomial expansion of $(1+kx)^n$ is $1-6x+30x^2+\ldots$, 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

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

where $0° < \alpha < 90°$. It is given that $\overrightarrow{OA}$ and $\overrightarrow{OB}$ 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 $0 \leqslant t \leqslant \pi$.

(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