

OCR

Oxford Cambridge and RSA

Friday 23 June 2017 – Morning

A2 GCE MATHEMATICS

4724/01 Core Mathematics 4

QUESTION PAPER

Candidates answer on the Printed Answer Book.

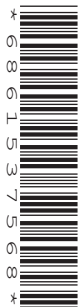
OCR supplied materials:

- 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 barcodes.
- 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 (i) Find the first three terms in ascending powers of x in the binomial expansion of $\sqrt[4]{1+8x}$. [3]
 (ii) State the range of values for which this expansion is valid. [1]

- 2 The equations of two lines are

$$\mathbf{r} = \begin{pmatrix} 3 \\ 0 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 1 \\ 3 \end{pmatrix} \text{ and } \mathbf{r} = \begin{pmatrix} -1 \\ 8 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} -3 \\ 1 \\ -5 \end{pmatrix}.$$

Find the coordinates of the point where these lines intersect. [4]

- 3 Show that $\int_0^1 16xe^{4x} dx = 3e^4 + 1$. [5]

- 4 Express $\frac{9x^2 + 43x + 8}{(3+x)(1-x)(2x+1)}$ in partial fractions. [5]

- 5 (i) Find the quotient and the remainder when $6x^4 + 12x^3 - 3x^2 - 11x - 2$ is divided by $2x^2 + 4x + 1$. [3]
 (ii) Hence show that $\int_0^3 \frac{6x^4 + 12x^3 - 3x^2 - 11x - 2}{2x^2 + 4x + 1} dx = A + B \ln C$, where A , B and C are constants to be found. [3]

- 6 The equation of a curve is $4\sqrt{y} + x^2y - 8 = 0$. The curve meets the line $y = 1$ at two points. Find the gradient of the curve at each of these points. [7]

- 7 The surface of a pond is covered by water lilies. The area of water lilies is denoted by $A \text{ m}^2$. At $t = 0$, $A = 10$ and $\frac{dA}{dt} = 0.48$. It is thought that eventually the lilies will cover the whole of the surface area of the pond. A biologist proposes that this situation is modelled by the differential equation

$$\left(\frac{1}{A} + \frac{1}{250-A} \right) \frac{dA}{dt} = k$$

where t is the time in days and k is a constant.

- (i) Solve this differential equation to express A in terms of t and k . [6]
 (ii) Find the value of k . [1]
 (iii) Assuming the model is reliable, find the surface area of the pond. [1]

- 8 (i) Given that $y = \ln\left(\frac{1 + \sin 4x}{\cos 4x}\right)$, show that $\frac{dy}{dx} = \frac{4}{\cos 4x}$. [4]
- (ii) Find $\int\left(\frac{\cos 2x}{\cos 2x + \sin 2x} + \frac{\sin 2x}{\cos 2x - \sin 2x}\right)dx$. [4]
- 9 Use the substitution $u = 1 + \ln x + x$ to find $\int \frac{3(x+1)(1 - \ln x - x)}{x(1 + \ln x + x)} dx$. [6]
- 10 (i) Write down a vector equation of the line through the points $A(5, 1, 9)$ and $B(8, 7, 15)$. [1]
 P is the point $(11, -2, 15)$.
- (ii) Show that triangle APB is isosceles and find angle PAB . [4]
 The point D lies on the line through A and B . Angle $PAD =$ angle PDA .
- (iii) Find the coordinates of D . [4]
- 11 The parametric equations of a curve are
- $$x = \frac{1}{\sqrt{2+t}} \text{ and } y = t^3 - 3t \text{ for } -2 < t \leq 0.$$
- (i) Find $\frac{dy}{dx}$ in terms of t . [3]
- (ii) Find the coordinates of the stationary point on the curve and determine its nature. [4]
- (iii) State the range of values of x and the range of values of y . [2]
- (iv) Sketch the curve. [1]

END OF QUESTION PAPER

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