

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

- 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 (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

**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.