



Thursday 21 June 2012 – Afternoon

## A2 GCE MATHEMATICS

4724 Core Mathematics 4

### QUESTION PAPER

Candidates answer on the Printed Answer Book.

**OCR supplied materials:**

- Printed Answer Book 4724
- 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 in the centre of 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.

## 2

## 1 Simplify

$$(i) \frac{1-x}{x^2-3x+2}, \quad [2]$$

$$(ii) \frac{(x+1)}{(x-1)(x-3)} - \frac{(x-5)}{(x-3)(x-4)}. \quad [4]$$

2 Use integration by parts to find  $\int \ln(x+2) dx$ . [5]

3 (i) Expand  $\frac{1+x^2}{\sqrt{1+4x}}$  in ascending powers of  $x$ , up to and including the term in  $x^3$ . [6]

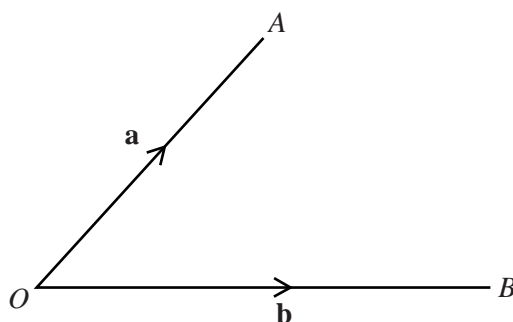
(ii) State the set of values of  $x$  for which this expansion is valid. [1]

4 Solve the differential equation

$$e^{2y} \frac{dy}{dx} + \tan x = 0,$$

given that  $x = 0$  when  $y = 0$ . Give your answer in the form  $y = f(x)$ . [6]

## 5



In the diagram the points  $A$  and  $B$  have position vectors  $\mathbf{a}$  and  $\mathbf{b}$  with respect to the origin  $O$ . Given that  $|\mathbf{a}| = 3$ ,  $|\mathbf{b}| = 4$  and  $\mathbf{a} \cdot \mathbf{b} = 6$ , find

(i) the angle  $AOB$ , [2]

(ii)  $|\mathbf{a} - \mathbf{b}|$ . [3]

6 Use the substitution  $u = 1 + \sqrt{x}$  to show that

$$\int_4^9 \frac{1}{1+\sqrt{x}} dx = 2 + 2 \ln \frac{3}{4}. \quad [7]$$

## 3

7 Find the exact value of  $\int_0^{\frac{1}{6}\pi} (1 - \sin 3x)^2 dx$ . [7]

8 (a) Find the gradient of the curve  $x^2 + xy + y^2 = 3$  at the point  $(-1, -1)$ . [4]

(b) A curve  $C$  has parametric equations

$$x = 2t^2 - 1, \quad y = t^3 + t.$$

(i) Find the coordinates of the point on  $C$  at which the tangent is parallel to the  $y$ -axis. [3]

(ii) Find the values of  $t$  for which  $x$  and  $y$  have the same rate of change with respect to  $t$ . [3]

9 (i) Express  $\frac{x^2 - x - 11}{(x + 1)(x - 2)^2}$  in partial fractions. [5]

(ii) Find the exact value of  $\int_3^4 \frac{x^2 - x - 11}{(x + 1)(x - 2)^2} dx$ , giving your answer in the form  $a + \ln b$ , where  $a$  and  $b$  are rational numbers. [4]

10 Lines  $l_1$  and  $l_2$  have vector equations

$$\mathbf{r} = -\mathbf{i} + 2\mathbf{j} + 7\mathbf{k} + t(2\mathbf{i} + 2\mathbf{j} + \mathbf{k}) \quad \text{and} \quad \mathbf{r} = 2\mathbf{i} + 9\mathbf{j} - 4\mathbf{k} + s(\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})$$

respectively. The point  $A$  has coordinates  $(-3, 0, 6)$  relative to the origin  $O$ .

(i) Show that  $A$  lies on  $l_1$  and that  $OA$  is perpendicular to  $l_1$ . [3]

(ii) Show that the line through  $O$  and  $A$  intersects  $l_2$ . [4]

(iii) Given that the point of intersection in part (ii) is  $B$ , find the ratio  $|\overrightarrow{OA}| : |\overrightarrow{BA}|$ . [3]

**THERE ARE NO QUESTIONS WRITTEN ON THIS PAGE.**



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