

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

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1 Simplify

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

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

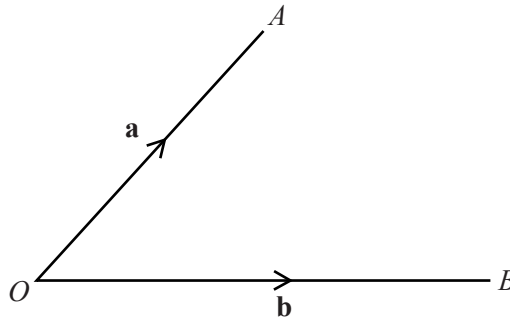
(ii) State the set of values of x for which this expansion is valid. [1]

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

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

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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