

**ADVANCED GCE**  
**MATHEMATICS**  
Core Mathematics 4

**4724**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- List of Formulae (MF1)

**Other Materials Required:**

- Scientific or graphical calculator

**Friday 11 June 2010**  
**Morning**

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- 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.
- You are permitted to use a graphical calculator in this paper.

**INFORMATION FOR CANDIDATES**

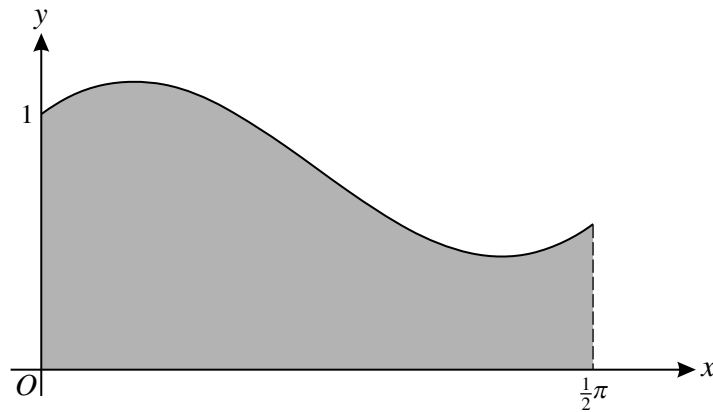
- The number of marks is given in brackets [ ] at the end of each question or part question.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- This document consists of **4** pages. Any blank pages are indicated.

- 1 Expand  $(1 + 3x)^{-\frac{5}{3}}$  in ascending powers of  $x$ , up to and including the term in  $x^3$ . [5]
- 2 Given that  $y = \frac{\cos x}{1 - \sin x}$ , find  $\frac{dy}{dx}$ , simplifying your answer. [4]
- 3 Express  $\frac{x^2}{(x-1)^2(x-2)}$  in partial fractions. [5]
- 4 Use the substitution  $u = \sqrt{x+2}$  to find the exact value of
- $$\int_{-1}^7 \frac{x^2}{\sqrt{x+2}} dx. \quad [7]$$
- 5 Find the coordinates of the two stationary points on the curve with equation
- $$x^2 + 4xy + 2y^2 + 18 = 0. \quad [7]$$
- 6 Lines  $l_1$  and  $l_2$  have vector equations
- $$\mathbf{r} = \mathbf{j} + \mathbf{k} + t(2\mathbf{i} + a\mathbf{j} + \mathbf{k}) \quad \text{and} \quad \mathbf{r} = 3\mathbf{i} - \mathbf{k} + s(2\mathbf{i} + 2\mathbf{j} - 6\mathbf{k})$$
- respectively, where  $t$  and  $s$  are parameters and  $a$  is a constant.
- (i) Given that  $l_1$  and  $l_2$  are perpendicular, find the value of  $a$ . [3]
- (ii) Given instead that  $l_1$  and  $l_2$  intersect, find
- (a) the value of  $a$ , [4]
- (b) the angle between the lines. [3]
- 7 The parametric equations of a curve are  $x = \frac{t+2}{t+1}$ ,  $y = \frac{2}{t+3}$ .
- (i) Show that  $\frac{dy}{dx} > 0$ . [6]
- (ii) Find the cartesian equation of the curve, giving your answer in a form not involving fractions. [5]
- 8 (i) Find the quotient and the remainder when  $x^2 - 5x + 6$  is divided by  $x - 1$ . [3]
- (ii) (a) Find the general solution of the differential equation
- $$\left( \frac{x-1}{x^2 - 5x + 6} \right) \frac{dy}{dx} = y - 5. \quad [3]$$
- (b) Given that  $y = 7$  when  $x = 8$ , find  $y$  when  $x = 6$ . [4]

9 (i) Find  $\int (x + \cos 2x)^2 dx$ .

[9]

(ii)



The diagram shows the part of the curve  $y = x + \cos 2x$  for  $0 \leq x \leq \frac{1}{2}\pi$ . The shaded region bounded by the curve, the axes and the line  $x = \frac{1}{2}\pi$  is rotated completely about the  $x$ -axis to form a solid of revolution of volume  $V$ . Find  $V$ , giving your answer in an exact form. [4]

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