

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

$$\int_{-1}^{7} \frac{x^2}{\sqrt{x+2}} \, \mathrm{d}x.$$
 [7]

5 Find the coordinates of the two stationary points on the curve with equation

$$x^2 + 4xy + 2y^2 + 18 = 0.$$
 [7]

6 Lines l_1 and l_2 have vector equations

$$\mathbf{r} = \mathbf{j} + \mathbf{k} + t(2\mathbf{i} + a\mathbf{j} + \mathbf{k})$$
 and $\mathbf{r} = 3\mathbf{i} - \mathbf{k} + s(2\mathbf{i} + 2\mathbf{j} - 6\mathbf{k})$

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

$$\left(\frac{x-1}{x^2-5x+6}\right)\frac{dy}{dx} = y - 5.$$
 [3]

(b) Given that y = 7 when x = 8, find y when x = 6. [4]



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The diagram shows the part of the curve $y = x + \cos 2x$ for $0 \le x \le \frac{1}{2}\pi$. 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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