UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level

MATHEMATICS **9709/02**

Paper 2 Pure Mathematics 2 **(P2)**

May/June 2006

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
At the end of the examination, fasten all your work securely together.

This document consists of **3** printed pages and **1** blank page.

1 Solve the inequality $|2x - 7| > 3$. [3]

2 **(i)** Prove the identity

$$\cos(x + 30^\circ) + \sin(x + 60^\circ) \equiv (\sqrt{3})\cos x.$$ [3]

(ii) Hence solve the equation

$$\cos(x + 30^\circ) + \sin(x + 60^\circ) = 1,$$

for $0^\circ < x < 90^\circ$. [2]

3 The equation of a curve is $y = x + 2\cos x$. Find the x-coordinates of the stationary points of the curve for $0 \leqslant x \leqslant 2\pi$, and determine the nature of each of these stationary points. [7]

4 The cubic polynomial $ax^3 + bx^2 - 3x - 2$, where a and b are constants, is denoted by $\mathrm{p}(x)$. It is given that $(x - 1)$ and $(x + 2)$ are factors of $\mathrm{p}(x)$.

(i) Find the values of a and b. [5]

(ii) When a and b have these values, find the other linear factor of $\mathrm{p}(x)$. [2]

5 The equation of a curve is $3x^2 + 2xy + y^2 = 6$. It is given that there are two points on the curve where the tangent is parallel to the x-axis.

(i) Show by differentiation that, at these points, $y = -3x$. [4]

(ii) Hence find the coordinates of the two points. [4]

6 **(i)** By sketching a suitable pair of graphs, show that there is only one value of x that is a root of the equation $x = 9\mathrm{e}^{-2x}$. [2]

(ii) Verify, by calculation, that this root lies between 1 and 2. [2]

(iii) Show that, if a sequence of values given by the iterative formula

$$x_{n+1} = \tfrac{1}{2}(\ln 9 - \ln x_n)$$

converges, then it converges to the root of the equation given in part **(i)**. [2]

(iv) Use the iterative formula, with $x_1 = 1$, to calculate the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

7 **(i)** Differentiate $\ln(2x + 3)$. [2]

(ii) Hence, or otherwise, show that

$$\int_{-1}^{3} \frac{1}{2x + 3}\,\mathrm{d}x = \ln 3.$$ [3]

(iii) Find the quotient and remainder when $4x^2 + 8x$ is divided by $2x + 3$. [3]

(iv) Hence show that

$$\int_{-1}^{3} \frac{4x^2 + 8x}{2x + 3}\,\mathrm{d}x = 12 - 3\ln 3.$$ [3]

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