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

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **(P2)** **October/November 2011**

1 hour 15 minutes

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

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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.
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.

At the end of the examination, fasten all your work securely together.
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.

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

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1 Find the gradient of the curve $y = \ln(5x + 1)$ at the point where $x = 4$. [3]

2 Solve the inequality $|2x - 3| \leqslant |3x|$. [4]

3 Solve the equation $2\ln(x + 3) - \ln x = \ln(2x - 2)$. [5]

4 **(i)** Express $\cos^2 x$ in terms of $\cos 2x$. [1]

(ii) Hence show that

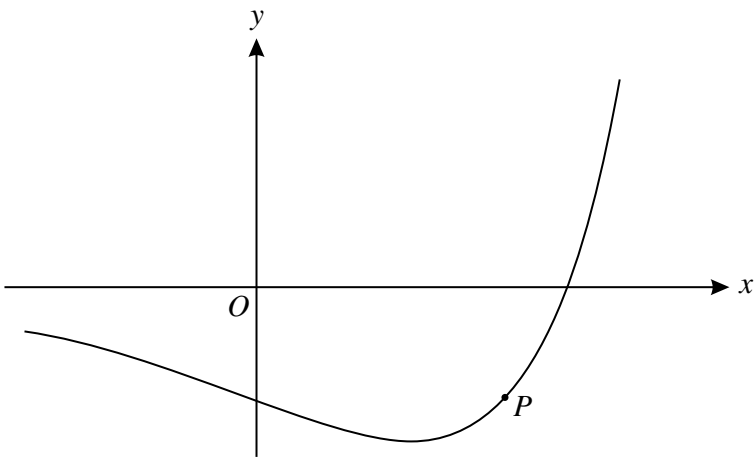
$$\int_0^{\frac{1}{6}\pi} (\cos^2 x + \sin 2x)\,\mathrm{d}x = \tfrac{1}{8}\sqrt{3} + \tfrac{1}{12}\pi + \tfrac{1}{4}.$$ [5]

5 Solve the equation $5\sec^2 2\theta = \tan 2\theta + 9$, giving all solutions in the interval $0° \leqslant \theta \leqslant 180°$. [6]

6 **(i)** The polynomial $x^4 + ax^3 - x^2 + bx + 2$, where a and b are constants, is denoted by $\mathrm{p}(x)$. It is given that $(x - 1)$ and $(x + 2)$ are factors of $\mathrm{p}(x)$. Find the values of a and b. [5]

(ii) When a and b have these values, find the quotient when $\mathrm{p}(x)$ is divided by $x^2 + x - 2$. [3]

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The diagram shows the curve $y = (x - 4)\mathrm{e}^{\frac{1}{2}x}$. The curve has a gradient of 3 at the point P.

(i) Show that the x-coordinate of P satisfies the equation

$$x = 2 + 6\mathrm{e}^{-\frac{1}{2}x}.$$ [4]

(ii) Verify that the equation in part **(i)** has a root between $x = 3.1$ and $x = 3.3$. [2]

(iii) Use the iterative formula $x_{n+1} = 2 + 6\mathrm{e}^{-\frac{1}{2}x_n}$ to determine this root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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8 The equation of a curve is $2x^2 - 3x - 3y + y^2 = 6$.

(i) Show that $\frac{dy}{dx} = \frac{4x - 3}{3 - 2y}$. [3]

(ii) Find the coordinates of the two points on the curve at which the gradient is -1. [6]

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