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

**MATHEMATICS** **9709/02**

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

October/November 2005

**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.
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.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

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



UNIVERSITY *of* CAMBRIDGE
International Examinations

**1** Solve the inequality $(0.8)^x < 0.5$.

**2** The polynomial $x^3 + 2x^2 + 2x + 3$ is denoted by $\mathrm{p}(x)$.

**(i)** Find the remainder when $\mathrm{p}(x)$ is divided by $x - 1$. [2]

**(ii)** Find the quotient and remainder when $\mathrm{p}(x)$ is divided by $x^2 + x - 1$. [4]

**3** **(i)** Express $12\cos\theta - 5\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0° < \alpha < 90°$, giving the exact value of $R$ and the value of $\alpha$ correct to 2 decimal places. [3]

**(ii)** Hence solve the equation

$$12\cos\theta - 5\sin\theta = 10,$$

giving all solutions in the interval $0° \leqslant \theta \leqslant 360°$. [4]

**4** The equation of a curve is $x^3 + y^3 = 9xy$.

**(i)** Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{3y - x^2}{y^2 - 3x}$. [4]

**(ii)** Find the equation of the tangent to the curve at the point $(2, 4)$, giving your answer in the form $ax + by = c$. [3]

**5** **(i)** By sketching a suitable pair of graphs, show that there is only one value of $x$ that is a root of the equation

$$\frac{1}{x} = \ln x. \qquad [2]$$

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

**(iii)** Show that this root also satisfies the equation

$$x = \mathrm{e}^{\frac{1}{x}}. \qquad [1]$$

**(iv)** Use the iterative formula

$$x_{n+1} = \mathrm{e}^{\frac{1}{x_n}},$$

with initial value $x_1 = 1.8$, to determine this root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

**6** A curve is such that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \mathrm{e}^{2x} - 2\mathrm{e}^{-x}$. The point $(0, 1)$ lies on the curve.

**(i)** Find the equation of the curve. [4]

**(ii)** The curve has one stationary point. Find the $x$-coordinate of this point and determine whether it is a maximum or a minimum point. [5]

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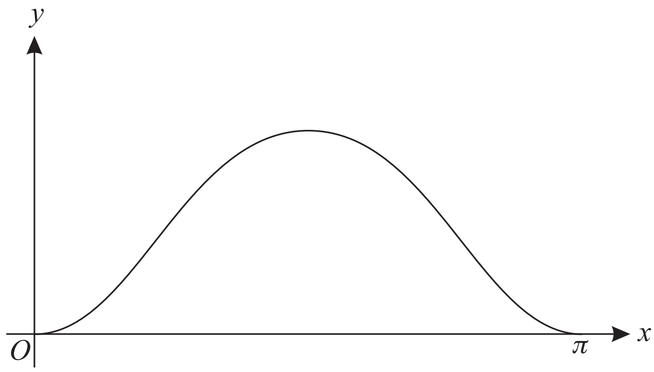


The diagram shows the part of the curve $y = \sin^2 x$ for $0 \leqslant x \leqslant \pi$.

**(i)** Show that $\dfrac{dy}{dx} = \sin 2x$. [2]

**(ii)** Hence find the $x$-coordinates of the points on the curve at which the gradient of the curve is 0.5. [3]

**(iii)** By expressing $\sin^2 x$ in terms of $\cos 2x$, find the area of the region bounded by the curve and the $x$-axis between 0 and $\pi$. [5]

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