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

MATHEMATICS **9709/02**

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

October/November 2004

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.

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1 Solve the inequality $|x+1| > |x|$. [3]

2 Solve the equation $x^{3.9} = 11x^{3.2}$, where $x \neq 0$. [3]

3 Find the values of x satisfying the equation

$$3\sin 2x = \cos x,$$

for $0° \leqslant x \leqslant 90°$. [4]

4 The cubic polynomial $2x^3 - 5x^2 + ax + b$ is denoted by $\mathrm{f}(x)$. It is given that $(x-2)$ is a factor of $\mathrm{f}(x)$, and that when $\mathrm{f}(x)$ is divided by $(x+1)$ the remainder is -6. Find the values of a and b. [5]

5 The curve with equation $y = x^2 \ln x$, where $x > 0$, has one stationary point.

(i) Find the x-coordinate of this point, giving your answer in terms of e. [4]

(ii) Determine whether this point is a maximum or a minimum point. [2]

6 **(i)** By sketching a suitable pair of graphs, show that there is only one value of x in the interval $0 < x < \frac{1}{2}\pi$ that is a root of the equation

$$\cot x = x.$$ [2]

(ii) Verify by calculation that this root lies between 0.8 and 0.9 radians. [2]

(iii) Show that this value of x is also a root of the equation

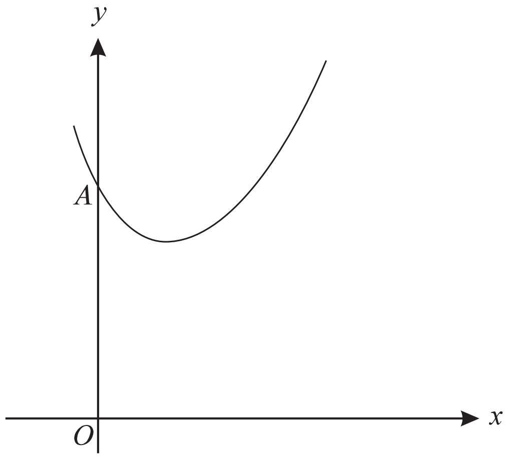
$$x = \tan^{-1}\left(\frac{1}{x}\right).$$ [1]

(iv) Use the iterative formula

$$x_{n+1} = \tan^{-1}\left(\frac{1}{x_n}\right)$$

to determine this root correct to 2 decimal places, showing the result of each iteration. [3]

7



The diagram shows the curve $y = 2e^x + 3e^{-2x}$. The curve cuts the y-axis at A.

(i) Write down the coordinates of A. [1]

(ii) Find the equation of the tangent to the curve at A, and state the coordinates of the point where this tangent meets the x-axis. [6]

(iii) Calculate the area of the region bounded by the curve and by the lines $x = 0$, $y = 0$ and $x = 1$, giving your answer correct to 2 significant figures. [4]

8 **(i)** Express $\cos\theta + \sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$, giving the exact values of R and α. [3]

(ii) Hence show that

$$\frac{1}{(\cos\theta + \sin\theta)^2} = \frac{1}{2}\sec^2(\theta - \tfrac{1}{4}\pi).$$ [1]

(iii) By differentiating $\frac{\sin x}{\cos x}$, show that if $y = \tan x$ then $\frac{dy}{dx} = \sec^2 x$. [3]

(iv) Using the results of parts **(ii)** and **(iii)**, show that

$$\int_0^{\frac{1}{2}\pi} \frac{1}{(\cos\theta + \sin\theta)^2}\,d\theta = 1.$$ [3]

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