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

MATHEMATICS **9709/21**

Paper 2 Pure Mathematics 2 **(P2)** **October/November 2009**

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.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 Solve the inequality $|2x + 3| < |x - 3|$. [4]

2 Solve the equation $\ln(3 - x^2) = 2 \ln x$, giving your answer correct to 3 significant figures. [4]

3 The polynomial $4x^3 - 8x^2 + ax - 3$, where a is a constant, is denoted by $\mathrm{p}(x)$. It is given that $(2x + 1)$ is a factor of $\mathrm{p}(x)$.

(i) Find the value of a. [2]

(ii) When a has this value, factorise $\mathrm{p}(x)$ completely. [4]

4 **(i)** Show that the equation $\sin(60^\circ - x) = 2 \sin x$ can be written in the form $\tan x = k$, where k is a constant. [4]

(ii) Hence solve the equation $\sin(60^\circ - x) = 2 \sin x$, for $0^\circ < x < 360^\circ$. [2]

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

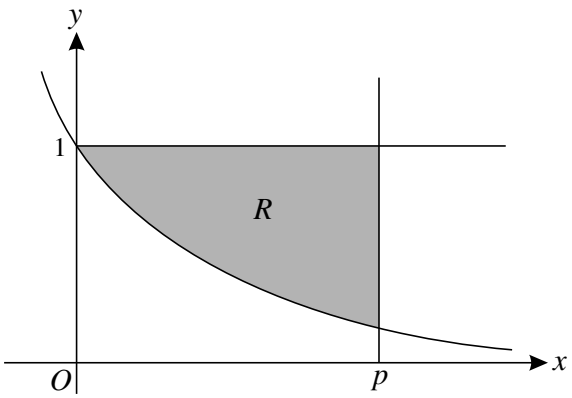
(ii) Hence find the exact value of $\int_0^{\frac{1}{8}\pi} \cos^2 2x \, \mathrm{d}x$. [4]

6 The curve with equation $y = x \ln x$ has one stationary point.

(i) Find the exact coordinates of this point, giving your answers in terms of e. [5]

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

7



The diagram shows the curve $y = e^{-x}$. The shaded region R is bounded by the curve and the lines $y = 1$ and $x = p$, where p is a constant.

(i) Find the area of R in terms of p. [4]

(ii) Show that if the area of R is equal to 1 then

$$p = 2 - e^{-p}.$$ [1]

(iii) Use the iterative formula

$$p_{n+1} = 2 - e^{-p_n},$$

with initial value $p_1 = 2$, to calculate the value of p correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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

(i) Find the coordinates of the two points on the curve where $x = 1$. [2]

(ii) Show by differentiation that at one of these points the tangent to the curve is parallel to the x-axis. Find the equation of the tangent to the curve at the other point, giving your answer in the form $ax + by + c = 0$. [7]

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