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

MATHEMATICS **9709/02**

Paper 2 Pure Mathematics 2 **(P2)** **May/June 2009**

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.
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.

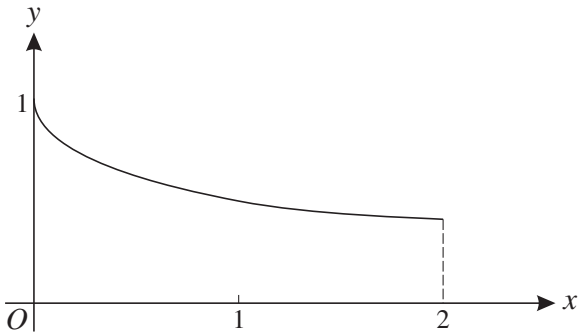
UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 Given that $(1.25)^x = (2.5)^y$, use logarithms to find the value of $\frac{x}{y}$ correct to 3 significant figures. [3]

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

3



The diagram shows the curve $y = \frac{1}{1 + \sqrt{x}}$ for values of x from 0 to 2.

(i) Use the trapezium rule with two intervals to estimate the value of

$$\int_0^2 \frac{1}{1 + \sqrt{x}} \, \mathrm{d}x,$$

giving your answer correct to 2 decimal places. [3]

(ii) State, with a reason, whether the trapezium rule gives an under-estimate or an over-estimate of the true value of the integral in part **(i)**. [1]

4 The parametric equations of a curve are

$$x = 4 \sin \theta, \quad y = 3 - 2 \cos 2\theta,$$

where $-\frac{1}{2}\pi < \theta < \frac{1}{2}\pi$. Express $\frac{\mathrm{d}y}{\mathrm{d}x}$ in terms of θ, simplifying your answer as far as possible. [5]

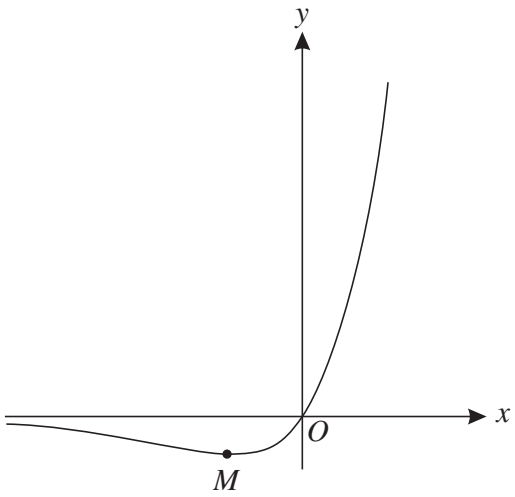
5 Solve the equation $\sec x = 4 - 2 \tan^2 x$, giving all solutions in the interval $0° \leqslant x \leqslant 180°$. [6]

6 The polynomial $x^3 + ax^2 + bx + 6$, where a and b are constants, is denoted by $\mathrm{p}(x)$. It is given that $(x - 2)$ is a factor of $\mathrm{p}(x)$, and that when $\mathrm{p}(x)$ is divided by $(x - 1)$ the remainder is 4.

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

(ii) When a and b have these values, find the other two linear factors of $\mathrm{p}(x)$. [3]

7



The diagram shows the curve $y = xe^{2x}$ and its minimum point M.

(i) Find the exact coordinates of M. [5]

(ii) Show that the curve intersects the line $y = 20$ at the point whose x-coordinate is the root of the equation

$$x = \tfrac{1}{2}\ln\left(\frac{20}{x}\right).$$ [1]

(iii) Use the iterative formula

$$x_{n+1} = \tfrac{1}{2}\ln\left(\frac{20}{x_n}\right),$$

with initial value $x_1 = 1.3$, to calculate the root correct to 2 decimal places, giving the result of each iteration to 4 decimal places. [3]

8 **(a)** Find the equation of the tangent to the curve $y = \ln(3x - 2)$ at the point where $x = 1$. [4]

(b) **(i)** Find the value of the constant A such that

$$\frac{6x}{3x-2} \equiv 2 + \frac{A}{3x-2}.$$ [2]

(ii) Hence show that $\displaystyle\int_2^6 \frac{6x}{3x-2}\,\mathrm{d}x = 8 + \tfrac{8}{3}\ln 2.$ [5]

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