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

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **(P2)** **October/November 2013**

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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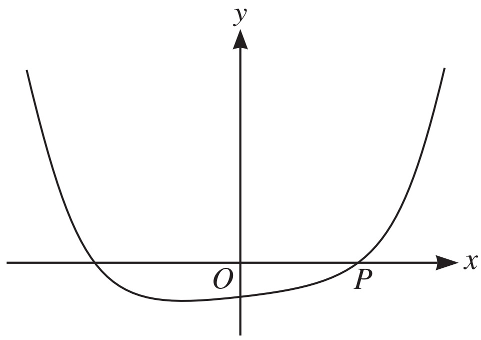
1 Solve the inequality $|x+1| < |3x+5|$. [4]

2



The diagram shows the curve $y = x^4 + 2x - 9$. The curve cuts the positive x-axis at the point P.

(i) Verify by calculation that the x-coordinate of P lies between 1.5 and 1.6. [2]

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

$$x = \sqrt[3]{\left(\frac{9}{x} - 2\right)}.$$ [1]

(iii) Use the iterative formula

$$x_{n+1} = \sqrt[3]{\left(\frac{9}{x_n} - 2\right)}$$

to determine the x-coordinate of P correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

3 The equation of a curve is $y = \frac{1}{2}e^{2x} - 5e^x + 4x$. Find the exact x-coordinate of each of the stationary points of the curve and determine the nature of each stationary point. [6]

4 **(i)** The polynomial $x^3 + ax^2 + bx + 8$, where a and b are constants, is denoted by $p(x)$. It is given that when $p(x)$ is divided by $(x-3)$ the remainder is 14, and that when $p(x)$ is divided by $(x+2)$ the remainder is 24. Find the values of a and b. [5]

(ii) When a and b have these values, find the quotient when $p(x)$ is divided by $x^2 + 2x - 8$ and hence solve the equation $p(x) = 0$. [4]

5 The parametric equations of a curve are

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

for $0 \leqslant \theta \leqslant \pi$.

(i) Show that $\dfrac{dy}{dx} = \dfrac{8\cos\theta}{1 - 4\cos\theta}$. [4]

(ii) Find the coordinates of the point on the curve at which the gradient is -4. [4]

6 **(a)** Find

(i) $\displaystyle\int \frac{e^{2x}+6}{e^{2x}}\,dx$, [3]

(ii) $\displaystyle\int 3\cos^2 x\,dx$. [3]

(b) Use the trapezium rule with 2 intervals to estimate the value of

$$\int_1^2 \frac{6}{\ln(x+2)}\,dx,$$

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

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

(ii) Hence solve the equation

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

giving all solutions in the interval $0° \leqslant x \leqslant 360°$. [5]

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