Cambridge Assessment International Education
Cambridge International Advanced Subsidiary Level

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

1577296425

MATHEMATICS **9709/23**

Paper 2 Pure Mathematics 2 **(P2)** **October/November 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
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.

This document consists of **12** printed pages.

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[Turn over

1 **(i)** Solve the inequality $|2x - 7| < |2x - 9|$. [3]

(ii) Hence find the largest integer n satisfying the inequality $|2\ln n - 7| < |2\ln n - 9|$. [2]

2 Find the exact value of $\int_1^2 (2e^{2x} - 1)^2 \, dx$. Show all necessary working. [5]

3 A curve has equation $y = \dfrac{3 + 2\ln x}{1 + \ln x}$. Find the exact gradient of the curve at the point for which $y = 4$. [5]

4 The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = ax^3 + ax^2 - 15x - 18,$$

where a is a constant. It is given that $(x - 2)$ is a factor of $\mathrm{p}(x)$.

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

(ii) Using this value of a, factorise $\mathrm{p}(x)$ completely. [3]

(iii) Hence solve the equation $\mathrm{p}\left(\mathrm{e}^{\sqrt{y}}\right) = 0$, giving the answer correct to 2 significant figures. [2]

5 It is given that $\int_0^a (3x^2 + 4\cos 2x - \sin x)\,dx = 2$, where a is a constant.

(i) Show that $a = \sqrt[3]{(3 - 2\sin 2a - \cos a)}$. [4]

(ii) Using the equation in part **(i)**, show by calculation that $0.5 < a < 0.75$. [2]

(iii) Use an iterative formula, based on the equation in part **(i)**, to find the value of a correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

6 **(a)** Showing all necessary working, solve the equation

$$\sec\alpha\operatorname{cosec}\alpha = 7$$

for $0° < \alpha < 90°$. [5]

(b) Showing all necessary working, solve the equation

$$\sin(\beta + 20°) + \sin(\beta - 20°) = 6\cos\beta$$

for $0° < \beta < 90°$. [4]

7 The equation of a curve is $x^2 - 4xy - 2y^2 = 1$.

(i) Find an expression for $\frac{dy}{dx}$ and show that the gradient of the curve at the point $(-1, 2)$ is $-\frac{5}{2}$. [5]

(ii) Show that the curve has no stationary points. [3]

(iii) Find the x-coordinate of each of the points on the curve at which the tangent is parallel to the y-axis. [2]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.