

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2 (P2)

May/June 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.

- 1** The polynomial $p(x)$ is defined by

$$p(x) = 4x^3 + (k + 1)x^2 - mx + 3k,$$

where k and m are constants. Given that $(x + 1)$ is a factor of $p(x)$, express m in terms of k . [3]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 2 (i) Solve the equation $|4 + 2x| = |3 - 5x|$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Hence solve the equation $|4 + 2e^{3y}| = |3 - 5e^{3y}|$, giving the answer correct to 3 significant figures. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 3** Find the exact coordinates of the stationary point of the curve with equation $y = \frac{3x}{\ln x}$. [5]

[illegible]

- 4 (a) Find the exact value of $\int_0^{\frac{1}{2}\pi} (4 \sin 2x + 2 \cos^2 x) dx$. Show all necessary working. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Use the trapezium rule with two intervals to find an approximation to $\int_2^8 \sqrt{\ln(1+x)} dx$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

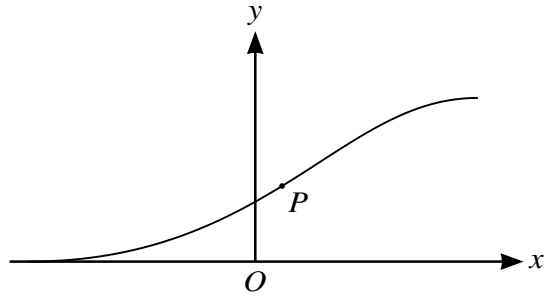
.....

.....

5 (i) Find the quotient and remainder when $2x^3 + x^2 - 8x$ is divided by $(2x + 1)$. [3]

[illegible]

This image shows a full page of a worksheet designed for handwriting practice. It features 20 evenly spaced, horizontal dashed lines across the entire width of the page. The background is plain white, and there are no margins, text, or other markings present.



The diagram shows the curve with parametric equations

$$x = 3t - 6e^{-2t}, \quad y = 4t^2 e^{-t},$$

for $0 \leq t \leq 2$. At the point P on the curve, the y -coordinate is 1.

- (i) Show that the value of t at the point P satisfies the equation $t = \frac{1}{2}e^{\frac{1}{2}t}$. [2]

.....

.....

.....

.....

.....

.....

.....

- (ii) Use the iterative formula $t_{n+1} = \frac{1}{2}e^{\frac{1}{2}t_n}$ with $t_1 = 0.7$ to find the value of t at P correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

© UCLES 2019

- 7 (a) (i) Express $4 \sin \theta + 4 \cos \theta$ in the form $R \sin(\theta + \alpha)$, where $R > 0$ and $0^\circ < \alpha < 90^\circ$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Hence find the smallest positive value of θ satisfying the equation $4 \sin \theta + 4 \cos \theta = 5$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Solve the equation

$$4 \cot 2x = 5 + \tan x$$

for $0 < x < \pi$, showing all necessary working and giving the answers correct to 2 decimal places.

[6]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[illegible]

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.