

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2 (P2)

October/November 2018

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 **13** printed pages and **3** blank pages.



BLANK PAGE

- 1 (i) Solve the equation $|9x - 2| = |3x + 2|$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (ii) Hence, using logarithms, solve the equation $|3^{y+2} - 2| = |3^{y+1} + 2|$, giving your answer correct to 3 significant figures. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

2 Show that $\int_1^7 \frac{6}{2x+1} dx = \ln 125$.

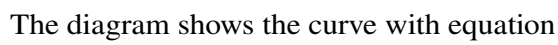
[5]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- 3** Solve the equation $\sec^2 \theta = 3 \operatorname{cosec} \theta$ for $0^\circ < \theta < 180^\circ$.

[5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



The curve crosses the x -axis at points with coordinates $(\alpha, 0)$ and $(\beta, 0)$.

- $$x^4 + 2x^3 + 2x^2 - 12x - 32. \quad [2]$$

This image shows a single sheet 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.

- (ii) Show that β satisfies an equation of the form $x = \sqrt[3]{p + qx}$, and state the values of p and q . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (iii) Use an iterative formula based on the equation in part (ii) to find the value of β correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5 A curve has parametric equations

$$x = t + \ln(t + 1), \quad y = 3te^{2t}.$$

(i) Find the equation of the tangent to the curve at the origin.

[5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

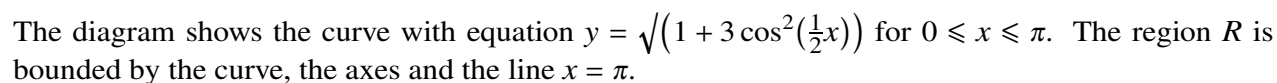
.....

.....

.....

.....

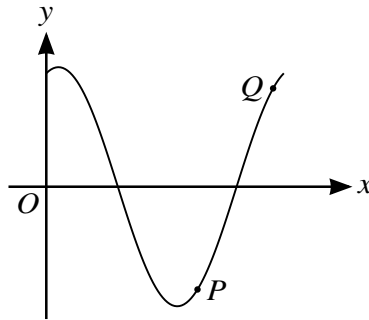
[illegible]



- [illegible]

- (ii) The region R is rotated completely about the x -axis. Without using a calculator, find the exact volume of the solid produced. [5]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



The diagram shows the curve with equation $y = \sin 2x + 3 \cos 2x$ for $0 \leq x \leq \pi$. At the points P and Q on the curve, the gradient of the curve is 3.

- (i) Find an expression for $\frac{dy}{dx}$. [2]

.....

.....

.....

.....

.....

.....

- (ii) By first expressing $\frac{dy}{dx}$ in the form $R \cos(2x + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$, find the x -coordinates of P and Q , giving your answers correct to 4 significant figures. [8]

.....

.....

.....

.....

.....

.....

.....

.....

.....

[illegible]

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

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