



Cambridge International AS & A Level

CANDIDATE
NAME
CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS
9709/23

Paper 2 Pure Mathematics 2

May/June 2024
1 hour 15 minutes

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

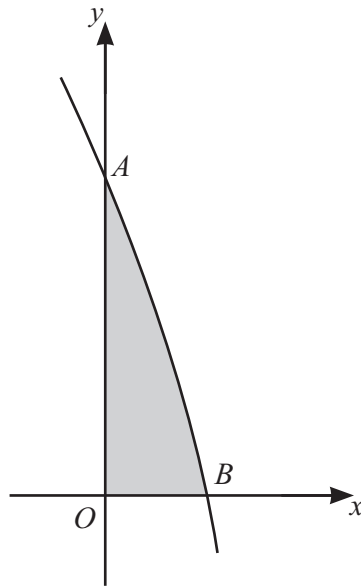
- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [].

 This document has **16** pages. Any blank pages are indicated.

[4]

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing 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.

[illegible]



The diagram shows the curve with equation $y = 8e^{-x} - e^{2x}$. The curve crosses the y -axis at the point A and the x -axis at the point B . The shaded region is bounded by the curve and the two axes.

- (a) Find the gradient of the curve at A . [3]

[illegible]



[5]

[illegible]



4 A curve is defined by the parametric equations

$$x = 4 \cos^2 t, \quad y = \sqrt{3} \sin 2t,$$

for values of t such that $0 < t < \frac{1}{2}\pi$.

Find the equation of the normal to the curve at the point for which $t = \frac{1}{6}\pi$. Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. [7]

This image shows a full page of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page, typical of notebook or legal stationery. There are no margins, text, or other markings on the page.

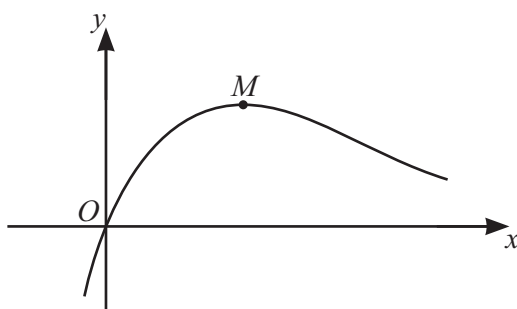


This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(a) Find the quotient when $p(x)$ is divided by $(3x+2)$, and show that the remainder is 6. [3]

[illegible]

[illegible]



The diagram shows the curve with equation $y = \frac{\ln(2x+1)}{x+3}$. The curve has a maximum point M .

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Show that the x -coordinate of M satisfies the equation $x = \frac{x+3}{\ln(2x+1)} - 0.5$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





(c) Show by calculation that the x -coordinate of M lies between 2.5 and 3.0 .

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(d) Use an iterative formula based on the equation in part (b) to find the x -coordinate of M correct to 4 significant figures. Give the result of each iteration to 6 significant figures.

[3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



[2]

[illegible]

[5]

[illegible]



(c) Find $\int 8 \sin^2 \frac{1}{2}x \operatorname{cosec}^2 x \, dx$.

[3]



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

[illegible]

* 0019655441015 *



15

BLANK PAGE



DO NOT WRITE IN THIS MARGIN





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 Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

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

