

Cambridge International AS & A Level

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

MATHEMATICS

9709/22

Paper 2 Pure Mathematics 2

February/March 2021

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.

BLANK PAGE

- 1 (a) Sketch, on the same diagram, the graphs of $y = |3x - 5|$ and $y = x + 2$. [2]

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

2 Solve the equation $\sec^2 \theta \cot \theta = 8$ for $0 < \theta < \pi$.

[5]

[illegible]

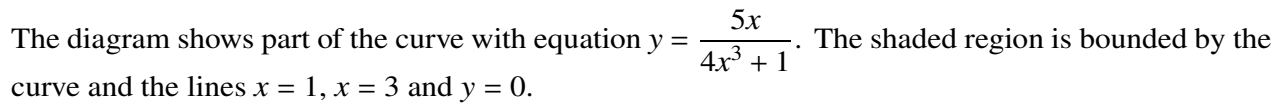
3 The parametric equations of a curve are

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

Find the gradient of the curve at the point for which $t = 0$.

[5]

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



- [illegible]

- (b) Use the trapezium rule with two intervals to find an approximation to the area of the shaded region. Give your answer correct to 2 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) State, with a reason, whether your answer to part (b) is an over-estimate or under-estimate of the exact area of the shaded region. [1]

.....

.....

.....

.....

.....

.....

.....

5 (a) Given that $2 \ln(x+1) + \ln x = \ln(x+9)$, show that $x = \sqrt{\frac{9}{x+2}}$. [3]

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.

- (b) It is given that the equation $x = \sqrt{\frac{9}{x+2}}$ has a single root.

Show by calculation that this root lies between 1.5 and 2.0.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Use an iterative formula, based on the equation in part (b), to find the root correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- 6 The polynomial $p(x)$ is defined by

$$p(x) = x^3 + ax + b,$$

where a and b are constants. It is given that $(x + 2)$ is a factor of $p(x)$ and that the remainder is 5 when $p(x)$ is divided by $(x - 3)$.

- (a) Find the values of a and b .

[5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Hence find the exact root of the equation $p(e^{2y}) = 0$.

[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.

- 7 (a) Express $5\sqrt{3} \cos x + 5 \sin x$ in the form $R \cos(x - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{1}{2}\pi$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) As x varies, find the least possible value of

$$4 + 5\sqrt{3} \cos x + 5 \sin x,$$

and determine the corresponding value of x where $-\pi < x < \pi$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) Find $\int \frac{1}{(5\sqrt{3} \cos 3\theta + 5 \sin 3\theta)^2} d\theta$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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.

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 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 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.