



Cambridge International AS & A Level

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MATHEMATICS**9709/33**

Paper 3 Pure Mathematics 3

October/November 2024**1 hour 50 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 75.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages.



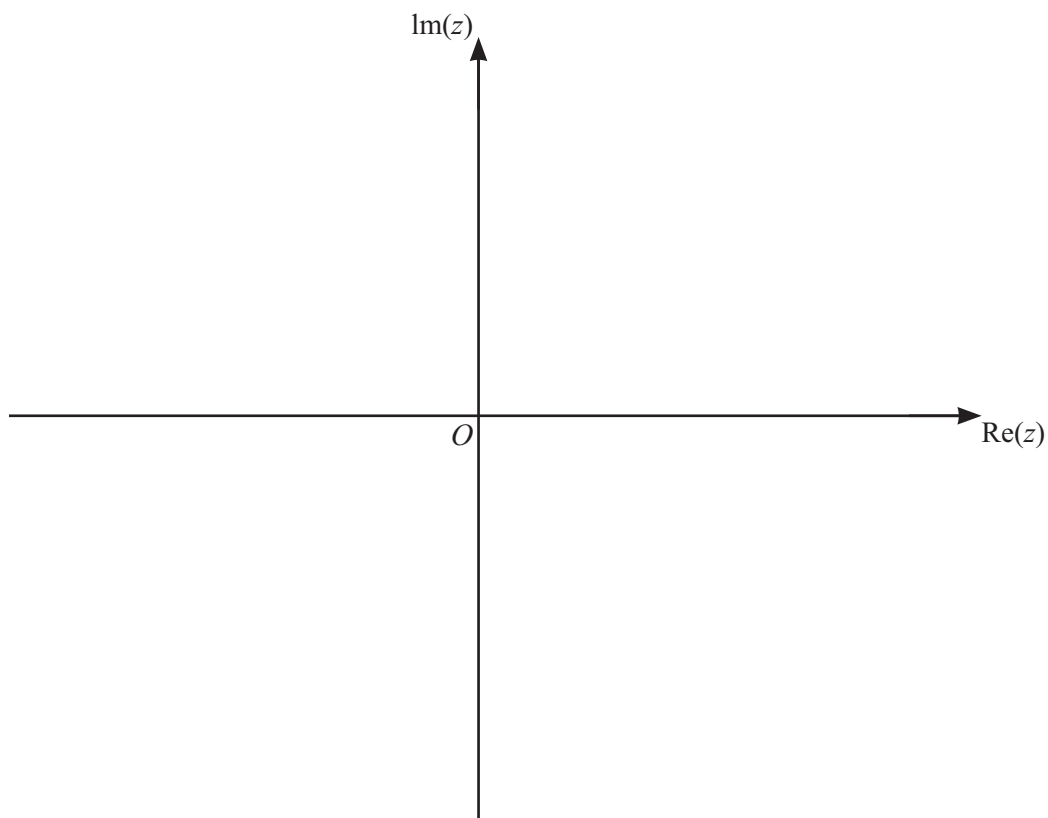
1 The complex number z satisfies $|z| = 2$ and $0 \leq \arg z \leq \frac{1}{4}\pi$.

(a) On the Argand diagram below, sketch the locus of the points representing z .

[2]

(b) On the **same diagram**, sketch the locus of the points representing z^2 .

[2]



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(a) Show that if a sequence of values given by the iterative formula

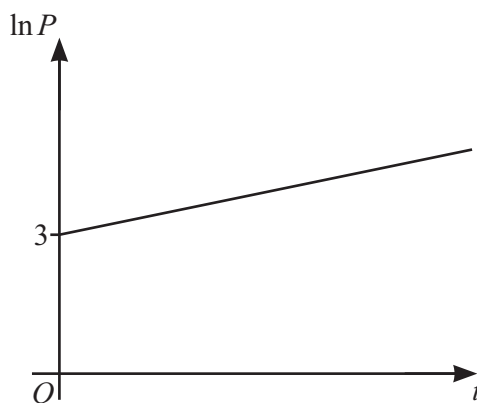
converges, then it converges to a root of the equation $f(x) = 0$. [2]

Use the iterative formula from part (a) and an initial value of 1.2 to determine the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

[illegible]



3



The number of bacteria in a population, P , at time t hours is modelled by the equation $P = ae^{kt}$, where a and k are constants. The graph of $\ln P$ against t , shown in the diagram, has gradient $\frac{1}{20}$ and intersects the vertical axis at $(0, 3)$.

- (a) State the value of k and find the value of a correct to 2 significant figures. [3]

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- (b) Find the time taken for P to double. Give your answer correct to the nearest hour. [2]

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5

$$\frac{z-3i}{z+3i} = \frac{2-9i}{5}.$$

[5]

[illegible]

[illegible]



(b) Solve the equation $\cos^4 \alpha - \sin^4 \alpha = 4 \sin^2 \alpha \cos^2 \alpha$ for $0^\circ \leq \alpha \leq 180^\circ$. [3]

This image shows a full page of a worksheet designed for handwriting practice. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The entire page is otherwise blank, with no text or other markings.



6 The lines l and m have vector equations

l: $\mathbf{r} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k} + \lambda(-\mathbf{i} + 2\mathbf{k})$ and *m:* $\mathbf{r} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k} + \mu(2\mathbf{i} - \mathbf{j} + 5\mathbf{k})$.

Lines l and m intersect at the point P .

(a) State the coordinates of P .

[1]

[illegible]

(b) Find the exact value of the cosine of the acute angle between l and m .

[3]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, which is otherwise blank.



[3]

[illegible]

$$x = 3 \sin 2t, \quad y = \tan t + \cot t,$$

(a) Show that $\frac{dy}{dx} = \frac{-2}{3 \sin^2 2t}$. [5]

[illegible]



This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.

(a) Express $f(x)$ in partial fractions.

[3]

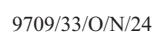
This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



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

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

This image shows a full page of a handwriting practice worksheet. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.





[5]

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The paper is otherwise blank, with no margins, text, or other markings.

- (a) Show that $200 \frac{dh}{dt} = 250 - 3h$. [3]

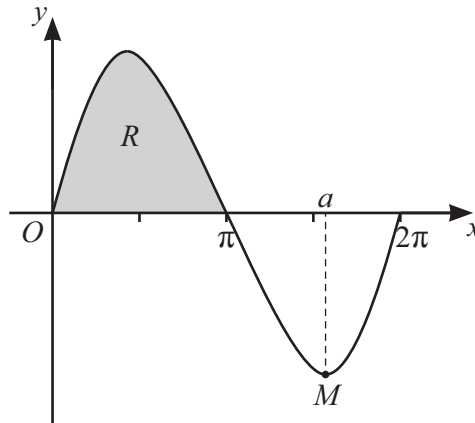
[illegible]



5

[5]

[illegible]



The diagram shows the curve $y = 2 \sin x \sqrt{2 + \cos x}$, for $0 \leq x \leq 2\pi$, and its minimum point M , where $x = a$.

- (a) Find the value of a correct to 2 decimal places. [5]

[illegible]



[6]

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal dotted lines spaced evenly down the page, providing a guide for handwriting practice. The paper is otherwise blank, with no margins, text, or other markings.

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