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MATHEMATICS

9709/32

Paper 3 Pure Mathematics 3

February/March 2026

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. Do **not** use correction fluid or tape.
- 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. Any blank pages are indicated.



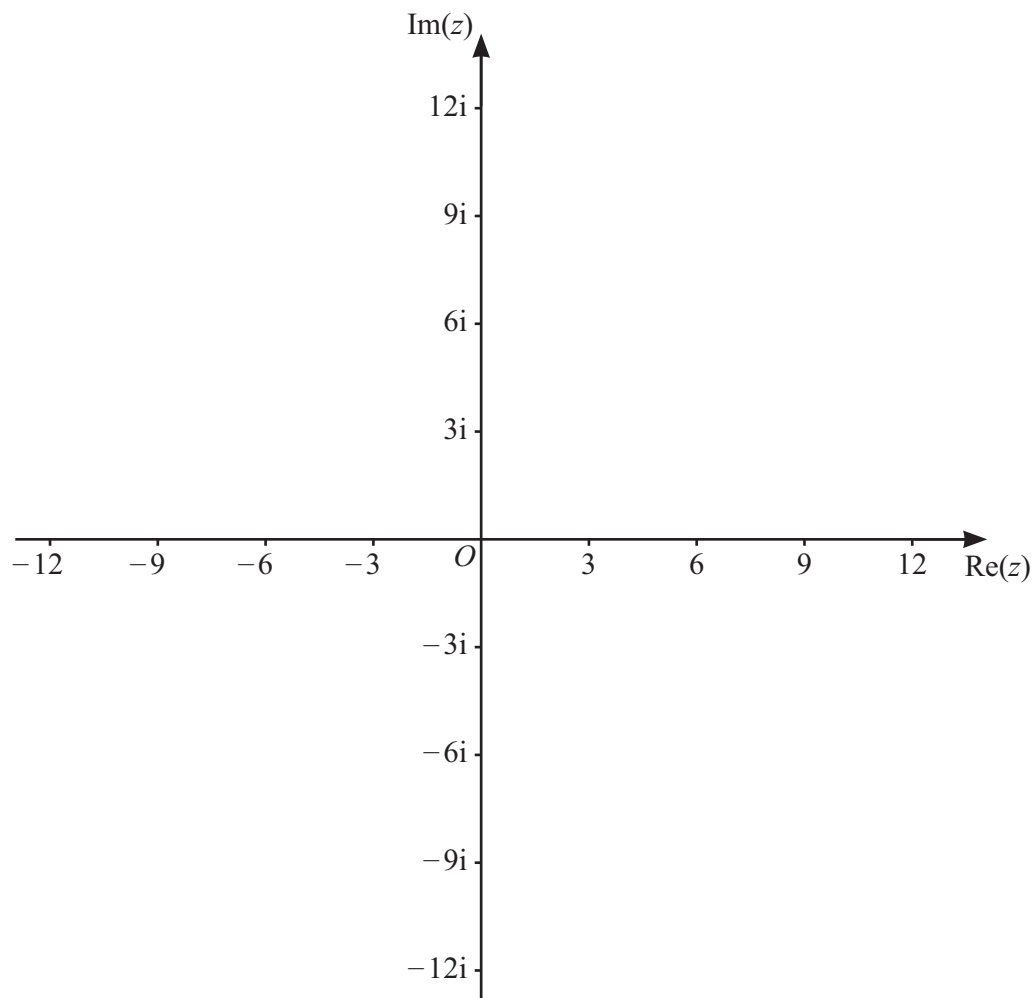
- 1** Solve the equation $4 \times 2^{x+2} - 5 \times 2^{2-x} = 3$. Give your answer correct to 3 significant figures. [4]

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- 2 The complex number z satisfies $|z| = 9$ and $\frac{1}{2}\pi \leq \arg z \leq \pi$.

(a) On the Argand diagram, sketch the locus of the points representing z . [2]

(b) On the **same diagram**, sketch the locus of the points representing $z^* + 3$. [2]





- 3** Find the exact value of $\int_{\frac{1}{4}\pi}^{\frac{1}{3}\pi} 3 \sin x \sin 2x \, dx$.

Give your answer in the form $p\sqrt{3} + q\sqrt{2}$, where p and q are rational.

[4]

[illegible]



4 The coefficient of x^3 in the expansion of $(1 - ax)^{\frac{2}{5}}$ is 1.

(a) Find the value of a .

[2]

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(b) Hence, find the coefficient of x^4 in the expansion of $(2x + 1)(1 - ax)^{\frac{2}{5}}$.

[3]

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(c) State the set of values of x for which the expansion in 4(b) is valid.

[1]

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5 It is given that $z = \frac{3 + \lambda i}{\lambda + 2i}$, where λ is a real constant.

(a) Find the value of λ for which $\arg z = \frac{1}{4}\pi$.

[4]

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(b) When λ has the value found in 5(a), find the exact value of $|z|$, making your method clear.

[2]

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6 The polynomial $2x^4 + ax^3 + 4x^2 + bx - 3$ is denoted by $p(x)$.

It is given that $(x^2 + x + 1)$ is a factor of $p(x)$.

(a) Find the values of a and b .

[4]

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(b) Hence, show that $(x + 3)$ is a factor of $p(x)$.

[2]

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- 7 (a) By sketching a suitable pair of graphs, show that the equation $\ln x = \operatorname{cosec} \frac{1}{2}x$ has exactly one root in the interval $0 < x < \pi$. [2]

- (b) Verify by calculation that this root lies between 2.6 and 2.9. [2]

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- (c) Use the iterative formula $x_{n+1} = \exp\left(\operatorname{cosec}\frac{1}{2}x_n\right)$ to determine the root correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

[$\exp(x)$ is an alternative notation for e^x .]

[illegible]



8 The variables x and y satisfy the differential equation

$$ye^{3x} \frac{dy}{dx} = x(y+5).$$

It is given that $y = 0$ when $x = 0$.

Solve the differential equation to obtain an equation in x and y .

[8]

[illegible]



11

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9 Let $I = \int_1^3 \frac{x^3}{3+x^2} dx$.

(a) Using the substitution $x = \sqrt{3} \tan u$, show that $I = \int_{\frac{1}{6}\pi}^{\frac{1}{3}\pi} 3 \tan^3 u \, du$. [4]

[illegible]



- (b)** Hence, or otherwise, find the exact value of I . Give your answer in the form $p + q \ln r$, where p, q and r are rational.

[5]

[illegible]



(a) Show that $\frac{dy}{dx} = \frac{2y}{x^2 - 4}$.

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dotted lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.



(b) Given that $k = 5$, find the angle between the tangents to the curve when $x = 3$.

Give your answer in the form $a \tan^{-1}\left(\frac{b}{c}\right)$, where a , b and c are integers.

[4]





- 11** The points A and B have position vectors $\overrightarrow{OA} = 2\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and $\overrightarrow{OB} = 4\mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$ relative to the origin, O .

(a) Show that the perpendicular distance from A to the line through O and B is $\frac{1}{3}\sqrt{65}$. [5]

[illegible]



(b) The point C has position vector $\overrightarrow{OC} = 3\mathbf{i} + p\mathbf{j} + q\mathbf{k}$, where p and q are constants.

Given that

- $\overrightarrow{OC}$ is perpendicular to $\overrightarrow{AB}$ and
- angle $AOC = \text{angle } COB$,

find the values of p and q .

[7]

[illegible]



Additional page

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

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