



# Cambridge International AS & A Level

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**MATHEMATICS**

**9709/32**

Paper 3 Pure Mathematics 3

**February/March 2022**

**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 [ ].

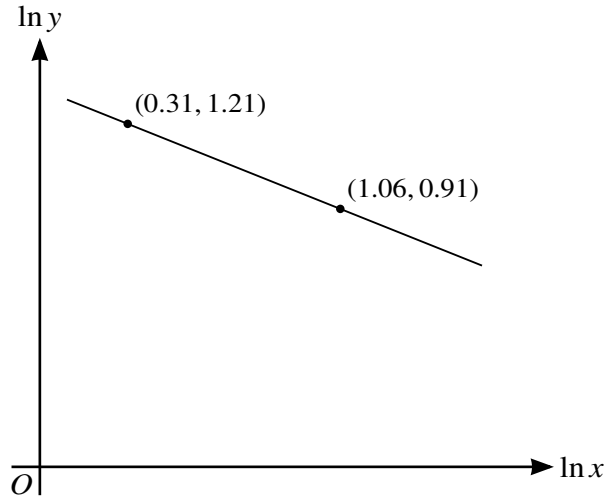
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- 2 On a sketch of an Argand diagram, shade the region whose points represent complex numbers  $z$  satisfying the inequalities  $|z + 2 - 3i| \leq 2$  and  $\arg z \leq \frac{3}{4}\pi$ . [4]

3



The variables  $x$  and  $y$  satisfy the equation  $x^n y^2 = C$ , where  $n$  and  $C$  are constants. The graph of  $\ln y$  against  $\ln x$  is a straight line passing through the points  $(0.31, 1.21)$  and  $(1.06, 0.91)$ , as shown in the diagram.

Find the value of  $n$  and find the value of  $C$  correct to 2 decimal places. [5]

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4 The parametric equations of a curve are

$$x = 1 - \cos \theta, \quad y = \cos \theta - \frac{1}{4} \cos 2\theta.$$

Show that  $\frac{dy}{dx} = -2 \sin^2(\frac{1}{2}\theta)$ . [5]

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- 7 (a) By sketching a suitable pair of graphs, show that the equation  $4 - x^2 = \sec \frac{1}{2}x$  has exactly one root in the interval  $0 \leq x < \pi$ . [2]

- (b) Verify by calculation that this root lies between 1 and 2. [2]

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- (c) Use the iterative formula  $x_{n+1} = \sqrt{4 - \sec \frac{1}{2}x_n}$  to determine the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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8 (a) Find the quotient and remainder when  $8x^3 + 4x^2 + 2x + 7$  is divided by  $4x^2 + 1$ . [3]

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(b) Hence find the exact value of  $\int_0^{\frac{1}{2}} \frac{8x^3 + 4x^2 + 2x + 7}{4x^2 + 1} dx$ . [5]

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**10** The points  $A$  and  $B$  have position vectors  $2\mathbf{i} + \mathbf{j} + \mathbf{k}$  and  $\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$  respectively. The line  $l$  has vector equation  $\mathbf{r} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k} + \mu(\mathbf{i} - 3\mathbf{j} - 2\mathbf{k})$ .

(a) Find a vector equation for the line through  $A$  and  $B$ . [3]

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(b) Find the acute angle between the directions of  $AB$  and  $l$ , giving your answer in degrees. [3]

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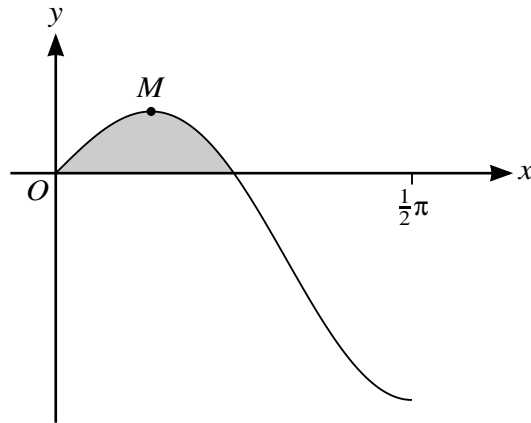
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11



The diagram shows the curve  $y = \sin x \cos 2x$  for  $0 \leq x \leq \frac{1}{2}\pi$ , and its maximum point  $M$ .

(a) Find the  $x$ -coordinate of  $M$ , giving your answer correct to 3 significant figures. [6]

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