



## Cambridge International AS & A Level

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**MATHEMATICS**

**9709/33**

Paper 3 Pure Mathematics 3

**May/June 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 [ ].

This document has **20** pages. Any blank pages are indicated.

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**3**

**1** Find, in terms of  $a$ , the set of values of  $x$  satisfying the inequality

$$2|3x + a| < |2x + 3a|,$$

where  $a$  is a positive constant.

[4]

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2 Solve the equation  $\cos(\theta - 60^\circ) = 3 \sin \theta$ , for  $0^\circ \leq \theta \leq 360^\circ$ . [5]

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- 3 (a) Show that the equation  $\log_3(2x + 1) = 1 + 2\log_3(x - 1)$  can be written as a quadratic equation in  $x$ . [3]

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- (b) Hence solve the equation  $\log_3(4y + 1) = 1 + 2\log_3(2y - 1)$ , giving your answer correct to 2 decimal places. [2]

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4 The curve  $y = e^{-4x} \tan x$  has two stationary points in the interval  $0 \leq x < \frac{1}{2}\pi$ .

- (a) Obtain an expression for  $\frac{dy}{dx}$  and show it can be written in the form  $\sec^2 x(a + b \sin 2x)e^{-4x}$ , where  $a$  and  $b$  are constants. [4]

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5 The complex number  $3 - i$  is denoted by  $u$ .

- (a) Show, on an Argand diagram with origin  $O$ , the points  $A$ ,  $B$  and  $C$  representing the complex numbers  $u$ ,  $u^*$  and  $u^* - u$  respectively.

State the type of quadrilateral formed by the points  $O$ ,  $A$ ,  $B$  and  $C$ . [3]

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- (b) Express  $\frac{u^*}{u}$  in the form  $x + iy$ , where  $x$  and  $y$  are real. [3]

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- (b) Given also that  $N = 625$  when  $t = 50$ , find the value of  $k$ . [2]

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- (c) Obtain an expression for  $N$  in terms of  $t$ , and find the greatest value of  $N$  predicted by this model. [2]

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(c) Hence find the position vector of the reflection of  $A$  in  $l$ . [2]

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- (b) Verify by calculation that  $a$  lies between 2.4 and 2.8. [2]

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- (c) Use an iterative formula based on the equation in part (a) to determine  $a$  correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]

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