



## Cambridge International AS & A Level

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### MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2

May/June 2025

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.

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- 1 Show that  $\int_2^{11} \frac{8}{4x+1} dx = \ln a$ , where  $a$  is an integer to be found. [3]





- 2 (a)** Sketch on the same diagram the graphs of  $y = |2x - 9|$  and  $y = 4x - 5$ . [2]

(b) Solve the inequality  $|2x - 9| < 4x - 5$ . [3]

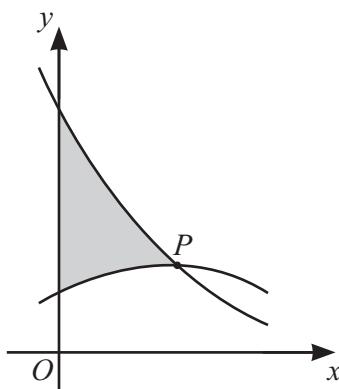




- 3 Find the coordinates of the stationary points of the curve with equation  $y = \frac{8x}{2x+3} - 6x + 5$ . [5]

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The diagram shows parts of the curves with equations  $y = 4e^{-2x}$  and  $y = 1 + 0.5 \sin 3x$ . Point  $P$  is a point of intersection of the curves, and the shaded region is bounded by the two curves and the  $y$ -axis.

- (a) Show that the  $x$ -coordinate of  $P$  satisfies the equation  $x = -0.5 \ln(0.25 + 0.125 \sin 3x)$ . [1]

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- (b) Use an iterative formula, based on the equation in part (a), to find the  $x$ -coordinate of  $P$  correct to 4 significant figures. Use an initial value of 0.5 and give the result of each iteration to 6 significant figures. [3]





(c) Hence find the area of the shaded region. Give your answer correct to 2 significant figures. [4]





- 5** The polynomial  $p(x)$  is defined by

$$p(x) = ax^4 + bx^3 + 13x^2 - 35x + 15,$$

where  $a$  and  $b$  are constants. It is given that  $(2x - 1)$  and  $(x - 3)$  are factors of  $p(x)$ .

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

[4]





- (b) Hence factorise  $p(x)$ .

[3]

- (c) Find the least positive value of  $\theta$  in radians such that  $p(\cot 2\theta) = 0$ .

[2]





- 6** A curve has equation  $(x^2 - 3)\ln y + 6x = 14$ .

- (a) Show that there is no point on the curve at which the  $y$ -coordinate is  $e^{-1}$ .

[3]

- (b) Find the equation of the tangent to the curve at the point  $(2, e^2)$ . Give your answer in the form  $y = mx + c$ , where  $m$  and  $c$  are exact constants. [6]

[6]

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- 7 (a) Express  $4\cos\theta\sin(\theta+30^\circ)$  in the form  $R\cos(2\theta-\alpha)+k$ , where  $R > 0$ ,  $0^\circ < \alpha < 90^\circ$  and  $k$  is a constant. [6]





(b) Hence solve the equation

$$12 \cos 2\phi \sin (2\phi + 30^\circ) = 5$$

for  $0^\circ < \phi < 90^\circ$ .

[5]





## Additional page

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