



## Cambridge International AS & A Level

CANDIDATE  
NAME

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**MATHEMATICS**

**9709/22**

Paper 2 Pure Mathematics 2

**May/June 2022**

**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.





- 2 (a) Sketch, on the same diagram, the graphs of  $y = |2x - 9|$  and  $y = 5x - 3$ . [2]

- (b) Solve the equation  $|2x - 9| = 5x - 3$ . [2]

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3 A curve has equation  $e^{2x} \cos 2y + \sin y = 1$ .

Find the exact gradient of the curve at the point  $(0, \frac{1}{6}\pi)$ .

[5]

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- 4 (a) Use the trapezium rule with three intervals to show that the value of  $\int_1^4 \ln x \, dx$  is approximately  $\ln 12$ . [4]

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- (b) Use a graph of  $y = \ln x$  to show that  $\ln 12$  is an under-estimate of the true value of  $\int_1^4 \ln x \, dx$ . [2]

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

$$p(x) = 2x^3 + ax^2 - 3x - 4,$$

where  $a$  is a constant. It is given that  $(x - 4)$  is a factor of  $p(x)$ .

(a) Find the value of  $a$  and hence factorise  $p(x)$ .

[4]

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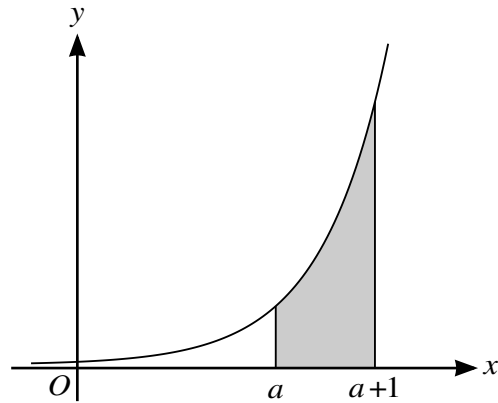
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The diagram shows the curve  $y = 3e^{2x-1}$ . The shaded region is bounded by the curve and the lines  $x = a$ ,  $x = a + 1$  and  $y = 0$ , where  $a$  is a constant. It is given that the area of the shaded region is 120 square units.

(a) Show that  $a = \frac{1}{2} \ln(80 + e^{2a-1}) - \frac{1}{2}$ . [5]

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(b) Use an iterative formula, based on the equation in part (a), to find the value of  $a$  correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]

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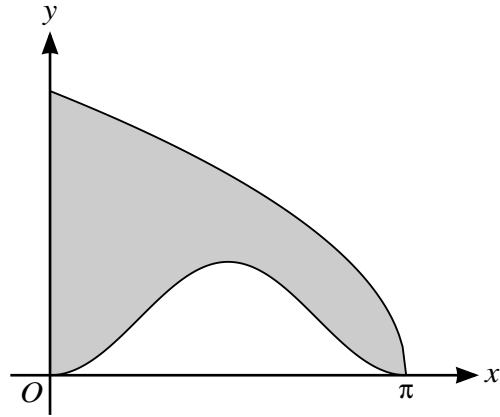
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The diagram shows the curves  $y = \sqrt{2\pi - 2x}$  and  $y = \sin^2 x$  for  $0 \leq x \leq \pi$ . The shaded region is bounded by the two curves and the line  $x = 0$ .

Find the exact area of the shaded region. [8]

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A series of horizontal dotted lines providing a template for writing.

8 (a) Express  $3 \sin 2\theta \sec \theta + 10 \cos(\theta - 30^\circ)$  in the form  $R \sin(\theta + \alpha)$  where  $R > 0$  and  $0^\circ < \alpha < 90^\circ$ .  
Give the value of  $\alpha$  correct to 2 decimal places. [6]

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- (b) Hence solve the equation  $3 \sin 4\beta \sec 2\beta + 10 \cos(2\beta - 30^\circ) = 2$  for  $0^\circ < \beta < 90^\circ$ . [3]

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**Additional Page**

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