



# Cambridge International AS & A Level

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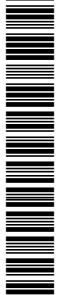
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**MATHEMATICS**

**9709/22**

Paper 2 Pure Mathematics 2

**October/November 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 **12** pages.



2 The solutions of the equation  $|4x - 1| = |x + 3|$  are  $x = p$  and  $x = q$ , where  $p < q$ .

Find the exact values of  $p$  and  $q$ , and hence determine the exact value of  $|p - 2| - |q - 1|$ . [5]

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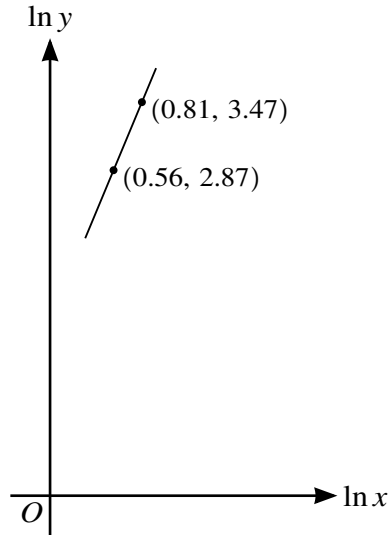
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The variables  $x$  and  $y$  satisfy the equation  $y = Ax^k$ , where  $A$  and  $k$  are constants. The graph of  $\ln y$  against  $\ln x$  is a straight line passing through the points  $(0.56, 2.87)$  and  $(0.81, 3.47)$ , as shown in the diagram.

Find the value of  $k$ , and the value of  $A$  correct to 2 significant figures. [5]

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

$$p(x) = ax^3 + 23x^2 - ax - 8,$$

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

(a) Find the value of  $a$  and hence factorise  $p(x)$  completely. [5]

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(b) Hence solve the equation  $p(e^{4y}) = 0$ , giving your answer correct to 3 significant figures. [2]

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5 The curve with equation  $y = x \ln(4x + 1) - 3x$  has one stationary point  $P$ .

(a) Show that the  $x$ -coordinate of  $P$  satisfies the equation

$$x = \frac{2x + 0.75}{\ln(4x + 1)} - 0.25. \quad [4]$$

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(b) Show by calculation that the  $x$ -coordinate of  $P$  lies between 1.8 and 1.9. [2]

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

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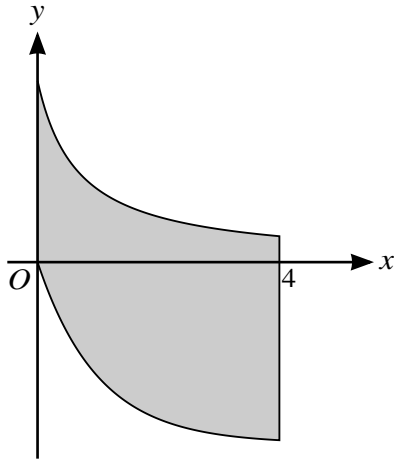
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The diagram shows the curves  $y = \frac{6}{3x+2}$  and  $y = 3e^{-x} - 3$  for values of  $x$  between 0 and 4. The shaded region is bounded by the two curves and the lines  $x = 0$  and  $x = 4$ .

Find the exact area of the shaded region, giving your answer in the form  $\ln a + b + ce^d$ . [9]

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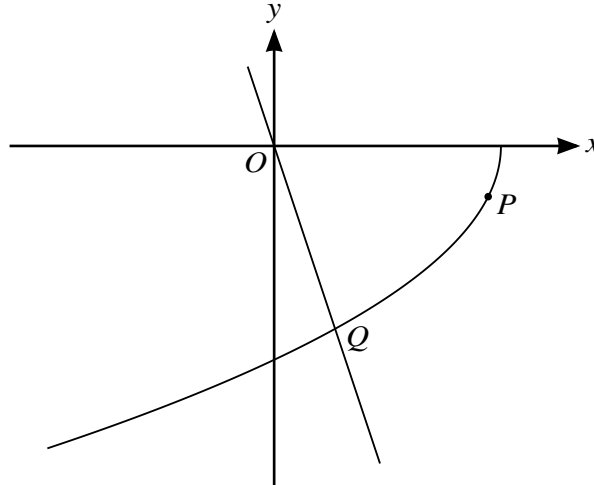
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The diagram shows the curve with parametric equations

$$x = 3 \cos 2\theta, \quad y = 4 \sin \theta,$$

for  $\pi \leq \theta \leq \frac{3}{2}\pi$ . Points  $P$  and  $Q$  lie on the curve. The gradient of the curve at  $P$  is 2. The straight line  $3x + y = 0$  meets the curve at  $Q$ .

(a) Find the value of  $\theta$  at  $P$ , giving your answer correct to 3 significant figures. [5]

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**Additional Page**

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