



Cambridge International AS & A Level

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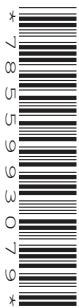


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MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2

May/June 2024

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.



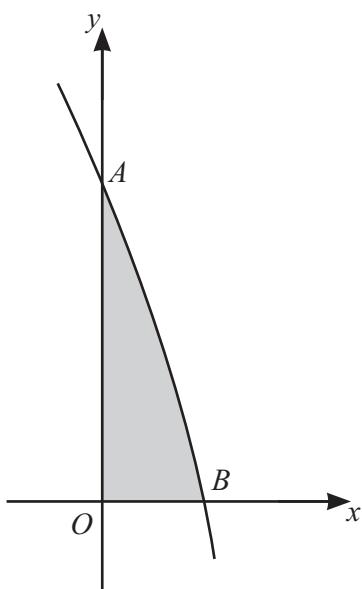
1 Solve the inequality $|5x + 7| > |2x - 3|$.





2 Use logarithms to solve the equation $6^{2x-1} = 5e^{3x+2}$. Give your answer correct to 4 significant figures. [4]





The diagram shows the curve with equation $y = 8e^{-x} - e^{2x}$. The curve crosses the y -axis at the point A and the x -axis at the point B . The shaded region is bounded by the curve and the two axes.

(a) Find the gradient of the curve at A . [3]





(b) Show that the x -coordinate of B is $\ln 2$ and hence find the area of the shaded region.





4 A curve is defined by the parametric equations

$$x = 4 \cos^2 t, \quad y = \sqrt{3} \sin 2t,$$

for values of t such that $0 < t < \frac{1}{2}\pi$.

Find the equation of the normal to the curve at the point for which $t = \frac{1}{6}\pi$. Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. [7]





1

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5 The polynomial $p(x)$ is defined by $p(x) = 9x^3 + 18x^2 + 5x + 4$.

(a) Find the quotient when $p(x)$ is divided by $(3x+2)$, and show that the remainder is 6.

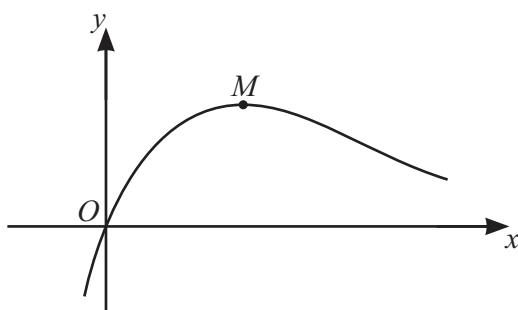
[3]



(b) Find the value of $\int_0^2 \frac{p(x)}{3x+2} dx$, giving your answer in the form $a + \ln b$ where a and b are integers. [5]

[5]





The diagram shows the curve with equation $y = \frac{\ln(2x+1)}{x+3}$. The curve has a maximum point M .

(a) Find an expression for $\frac{dy}{dx}$.

[2]

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(b) Show that the x -coordinate of M satisfies the equation $x = \frac{x+3}{\ln(2x+1)} - 0.5$.

[2]

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(d) Use an iterative formula based on the equation in part (b) to find the x -coordinate of M correct to 4 significant figures. Give the result of each iteration to 6 significant figures. [3]



7 (a) Prove that $2 \sin \theta \operatorname{cosec} 2\theta \equiv \sec \theta$.

(b) Solve the equation $\tan^2 \theta + 7 \sin \theta \cosec 2\theta = 8$ for $-\pi < \theta < \pi$.

[5]





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(c) Find $\int 8 \sin^2 \frac{1}{2}x \operatorname{cosec}^2 x \, dx$.

[3]





Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.





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