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Cambridge Assessment International Education

# Cambridge International AS & A Level

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**MATHEMATICS** **9709/22**

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.

DC (CE/SW) 329195/3
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**1** Solve the inequality $|5x+7| > |2x-3|$. [4]

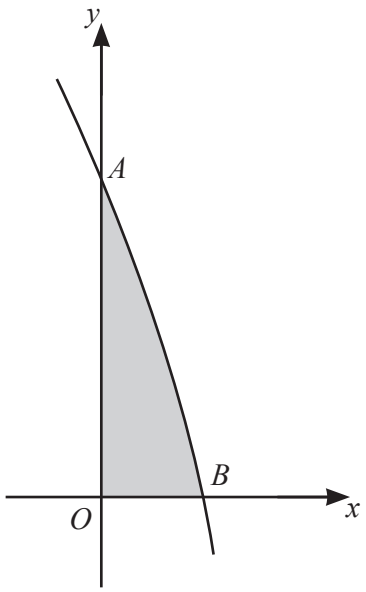
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**2** Use logarithms to solve the equation $6^{2x-1} = 5e^{3x+2}$. Give your answer correct to 4 significant figures. [4]

**3**




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]

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**(b)** Show that the $x$-coordinate of $B$ is $\ln 2$ and hence find the area of the shaded region. [5]

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**4** A curve is defined by the parametric equations

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

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]

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

**(a)** Find the quotient when $\mathrm{p}(x)$ is divided by $(3x + 2)$, and show that the remainder is 6. [3]

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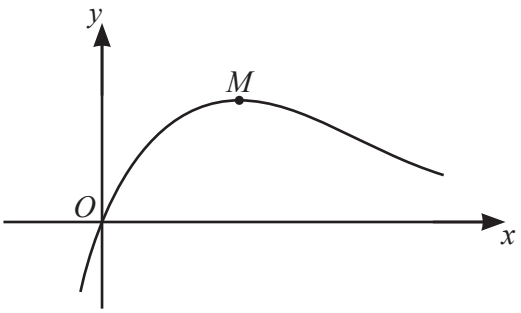


**(b)** Find the value of $\int_0^2 \frac{\mathrm{p}(x)}{3x+2}\,\mathrm{d}x$, giving your answer in the form $a+\ln b$ where $a$ and $b$ are integers. [5]

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**6**




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

**(a)** Find an expression for $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. [2]

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

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**(c)** Show by calculation that the $x$-coordinate of $M$ lies between 2.5 and 3.0 . [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]

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**7** **(a)** Prove that $2\sin\theta\,\mathrm{cosec}\,2\theta \equiv \sec\theta$. [2]

**(b)** Solve the equation $\tan^2\theta + 7\sin\theta\,\mathrm{cosec}\,2\theta = 8$ for $-\pi < \theta < \pi$. [5]

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**(c)** Find $\int 8\sin^2\frac{1}{2}x\,\mathrm{cosec}^2 x\,\mathrm{d}x$. [3]

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## 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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