# Cambridge International AS & A Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		

MATHEMATICS 9709/22

Paper 2 Pure Mathematics 2

February/March 2023

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 [ ].

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3	The polynomial	p(x) is	defined	by

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

where a and b are constants. It is given that (x + 2) is a factor of p(x), and that the remainder is 35 when p(x) is divided by (x - 3).

(a)	Find the values of $a$ and $b$ .	[5]

Hence factorise $p(x)$ and show that the equation $p(x) = 0$ has exactly one real root.	
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4	(a)	Sketch, on the same diagram, the graphs of $y =  2x - 11 $ and $y = 3x - 3$ .	[2]

(D)	Solve the inequality $ 2x-11  < 3x-3$ .	[3]
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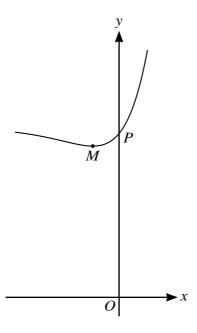
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(c)	Find the smallest integer N satisfying the inequality $ 2 \ln N - 11  < 3 \ln N - 3$ . [2]	1
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5	It is	given that $\int_{1}^{a} \left( \frac{4}{1+2x} + \frac{3}{x} \right) dx = \ln 10$ , where a is a constant greater than 1.
	(a)	Show that $a = \sqrt[3]{90(1+2a)^{-2}}$ . [5]

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ngures.	Use an initi	iai vaiue o	i i., and	give the	result of	each hera	mon to 3	sigillica	nı ilgui
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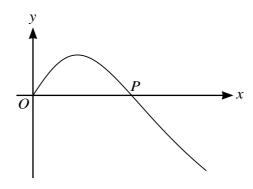


The diagram shows the curve with equation  $y = \frac{4e^{2x} + 9}{e^x + 2}$ . The curve has a minimum point M and crosses the y-axis at the point P.

(a)	Find the exact value of the gradient of the curve at <i>P</i> .	[4]
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)	Find the exact coordinates of $M$ .	[4]
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The diagram shows the curve with parametric equations

$$x = k \tan t, \qquad y = 3 \sin 2t - 4 \sin t,$$

for  $0 < t < \frac{1}{2}\pi$ . It is given that k is a positive constant. The curve crosses the x-axis at the point P.

(a)	Find the value of $\cos t$ at $P$ , giving your answer as an exact fraction.	[3]
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Express $\frac{\mathrm{d}y}{\mathrm{d}x}$							
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Given that t	he normal	to the curv	e at P has	gradient $\frac{9}{10}$ ,	find the val	ue of $k$ , giv	ving your a
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## **Additional Page**

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

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16

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