

# Cambridge International AS & A Level

CANDIDATE  
NAME

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CENTRE  
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## MATHEMATICS

**9709/22**

Paper 2 Pure Mathematics 2

October/November 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 [ ].

This document has **16** pages. Any blank pages are indicated.

**1** When the polynomial

$$ax^3 + 4ax^2 - 7x - 5$$

is divided by  $(x + 2)$ , the remainder is 33.

Find the value of the constant  $a$ .

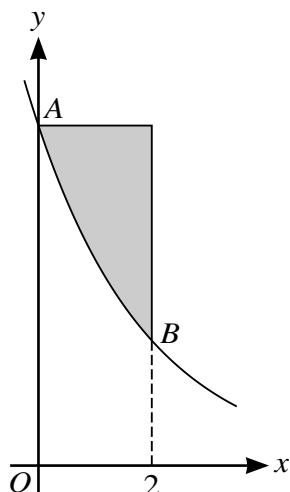
[2]

This image shows a single page of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

**2** Solve the equation  $\sec \theta \cos(\theta - 60^\circ) = 4$  for  $-180^\circ < \theta < 180^\circ$ .

[5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



(a) Find the exact gradient of the curve at  $B$ . [2]

[illegible]

**(b)** Find the exact area of the shaded region.

[3]

[illegible]

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

- (b) Solve the inequality  $|3 - x| > 9 - 2x$ . [3]

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- (c) Use logarithms to solve the inequality  $2^{3x-10} < 500$ . Give your answer in the form  $x < a$ , where the value of  $a$  is given correct to 3 significant figures. [3]

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- (d) List the integers that satisfy both of the inequalities  $|3 - x| > 9 - 2x$  and  $2^{3x-10} < 500$ . [1]

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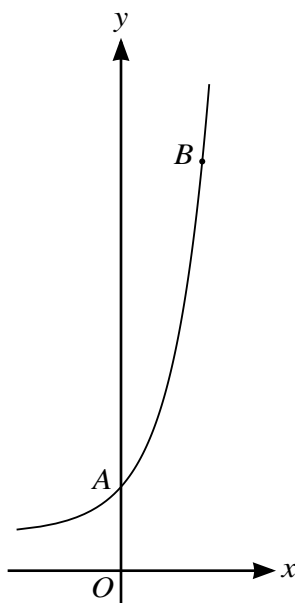
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- 5** (a) Find the quotient when  $6x^3 - 5x^2 - 24x - 4$  is divided by  $(2x + 1)$ , and show that the remainder is 6. [3]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.







The diagram shows the curve with parametric equations

$$x = 3 \ln(2t - 3), \quad y = 4t \ln t.$$

The curve crosses the y-axis at the point A. At the point B, the gradient of the curve is 12.

(a) Find the exact gradient of the curve at A.

[5]

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- (b) Show that the value of the parameter  $t$  at  $B$  satisfies the equation

$$t = \frac{9}{1 + \ln t} + \frac{3}{2}. \quad [2]$$

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- (c) Use an iterative formula, based on the equation in (b), to find the value of  $t$  at  $B$ , giving your answer correct to 3 significant figures. Use an initial value of 5 and give the result of each iteration to 5 significant figures. [3]

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- 7 (a) Prove that  $\sin 2x(\cot x + 3 \tan x) \equiv 4 - 2 \cos 2x$ . [4]

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- (b) Hence find the exact value of  $\cot \frac{1}{12}\pi + 3 \tan \frac{1}{12}\pi$ . [2]

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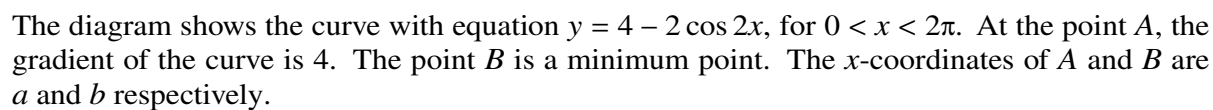
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