



## Cambridge International AS & A Level

CANDIDATE  
NAME



CENTRE  
NUMBER

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### MATHEMATICS

9709/23

Paper 2 Pure Mathematics 2

October/November 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 The variables  $x$  and  $y$  satisfy the equation  $a^{2y} = e^{3x+k}$ , where  $a$  and  $k$  are constants. The graph of  $y$  against  $x$  is a straight line.

- (a) Use logarithms to show that the gradient of the straight line is  $\frac{3}{2 \ln a}$ . [1]

- (b) Given that the straight line passes through the points  $(0.4, 0.95)$  and  $(3.3, 3.80)$ , find the values of  $a$  and  $k$ . [4]





2 Solve the inequality  $|x-7| > 4x + 3$ .

[4]





3 The function  $f$  is defined by  $f(x) = \tan^2\left(\frac{1}{2}x\right)$  for  $0 \leq x < \pi$ .

**(a)** Find the exact value of  $f'(\frac{2}{3}\pi)$ . [3]





**(b)** Find the exact value of  $\int_0^{\frac{1}{2}\pi} (f(x) + \sin x) dx$ .

[4]





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

$$p(x) = ax^3 - ax^2 - 15x + 18,$$

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

- (a) Find the value of  $a$ .

[2]

- (b) Hence factorise  $p(x)$  completely.

[3]







5 It is given that  $\int_a^{a^3} \frac{10}{2x+1} dx = 7$ , where  $a$  is a constant greater than 1.

(a) Show that  $a = \sqrt[3]{0.5e^{1.4}(2a+1) - 0.5}$ .

[5]

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- (b) Use an iterative formula, based on the equation in part (a), to find the value of  $a$  correct to 3 significant figures. Use an initial value of 2 and give the result of each iteration to 5 significant figures. [3]





## 6 A curve has parametric equations

$$x = \frac{e^{2t} - 2}{e^{2t} + 1}, \quad y = e^{3t} + 1.$$

- (a) Find an expression for  $\frac{dy}{dx}$  in terms of  $t$ . [4]





(b) Find the exact gradient of the curve at the point where the curve crosses the  $y$ -axis.

[3]





- 7 (a) Prove that  $\cos(\theta + 30^\circ)\cos(\theta + 60^\circ) \equiv \frac{1}{4}\sqrt{3} - \frac{1}{2}\sin 2\theta$ .

- (b) Solve the equation  $5 \cos(2\alpha + 30^\circ) \cos(2\alpha + 60^\circ) = 1$  for  $0^\circ < \alpha < 90^\circ$ .

[4]





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- (c) Show that the exact value of  $\cos 20^\circ \cos 50^\circ + \cos 40^\circ \cos 70^\circ$  is  $\frac{1}{2}\sqrt{3}$ . [3]





## Additional page

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