

# Cambridge International AS & A Level

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**MATHEMATICS**

**9709/11**

Paper 1 Pure Mathematics 1

**October/November 2024**

**1 hour 50 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 75.
- The number of marks for each question or part question is shown in brackets [ ].

- 1** In the expansion of  $\left(kx + \frac{2}{x}\right)^4$ , where  $k$  is a positive constant, the term independent of  $x$  is equal to 150. Find the value of  $k$  and hence determine the coefficient of  $x^2$  in the expansion. [4]

This image shows a full page of a document template designed for handwriting practice or general note-taking. It consists of approximately 28 evenly spaced horizontal dotted lines across the entire width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.

- TE

[4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dotted lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no margins or additional markings.

The diagram shows a circle with center  $O$ . Two sectors are shown: a larger sector  $ABC$  and a smaller sector  $AOD$ . Both sectors have a radius of  $15\text{ cm}$ . The region between the two arcs, bounded by  $B$ ,  $C$ , and the arc  $BC$ , is shaded gray. The region between the two arcs, bounded by  $A$ ,  $D$ , and the arc  $AD$ , is unshaded.

Find the perimeter of the shaded region. Give your answer in terms of  $\pi$ . [5]

[illegible]

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- This image shows a full page of a document template designed for handwriting practice or as a general writing guide. It consists of approximately 20 evenly spaced, horizontal dotted lines running across the entire width of the page. The background is plain white, and there are no margins, headers, footers, or other markings present.

5 The equation of a curve is such that  $\frac{dy}{dx} = 4x - 3\sqrt{x} + 1$ .

(a) Find the  $x$ -coordinate of the point on the curve at which the gradient is  $\frac{11}{2}$ . [3]

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(b) Given that the curve passes through the point (4, 11), find the equation of the curve. [4]

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- 6 Circles  $C_1$  and  $C_2$  have equations

$$x^2 + y^2 + 6x - 10y + 18 = 0 \quad \text{and} \quad (x-9)^2 + (y+4)^2 - 64 = 0$$

respectively.

- (a) Find the distance between the centres of the circles.

[4]

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$P$  and  $Q$  are points on  $C_1$  and  $C_2$  respectively. The distance between  $P$  and  $Q$  is denoted by  $d$ .

- (b) Find the greatest and least possible values of  $d$ .

[3]

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**(a)** Find the equation of the tangent to the curve at  $A$ . Give your answer in the form  $y = mx + c$ . [4]

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- [illegible]

- Express  $\tan^2 \beta - 3 \sin \beta \cos \beta$  in terms of  $a$ . [3]

[illegible]

[illegible]

- (a)** Find the set of values of  $x$  for which  $y$  decreases as  $x$  increases.

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- (a) Find the value of  $d$ . [3]

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- Find the value of  $S_{77} - G_{10}$ .

[illegible]

11 The function  $f$  is defined by  $f(x) = 3 + 6x - 2x^2$  for  $x \in \mathbb{R}$ .

- (a) Express  $f(x)$  in the form  $a - b(x - c)^2$ , where  $a$ ,  $b$  and  $c$  are constants, and state the range of  $f$ . [3]

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- (b) The graph of  $y = f(x)$  is transformed to the graph of  $y = h(x)$  by a reflection in one of the axes followed by a translation. It is given that the graph of  $y = h(x)$  has a minimum point at the origin.

Give details of the reflection and translation involved. [2]

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The function  $g$  is defined by  $g(x) = 3 + 6x - 2x^2$  for  $x \leq 0$ .

- (c) Sketch the graph of  $y = g(x)$  and explain why  $g$  is a one-one function. You are **not** required to find the coordinates of any intersections with the axes. [2]

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- (d)** Sketch the graph of  $y = g^{-1}(x)$  on your diagram in **(c)**, and find an expression for  $g^{-1}(x)$ . You should label the two graphs in your diagram appropriately and show any relevant mirror line. [4]

[illegible]

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