

Cambridge International AS & A Level

CANDIDATE
NAME

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MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1

October/November 2020

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 [].

This document has **20** pages. Blank pages are indicated.

- 1 (a)** Express $x^2 + 6x + 5$ in the form $(x + a)^2 + b$, where a and b are constants. [2]

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- (b)** The curve with equation $y = x^2$ is transformed to the curve with equation $y = x^2 + 6x + 5$.
Describe fully the transformation(s) involved. [2]

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- 2 The function f is defined by $f(x) = \frac{2}{(x+2)^2}$ for $x > -2$.

(a) Find $\int_1^{\infty} f(x) \, dx$. [3]

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- (b) The equation of a curve is such that $\frac{dy}{dx} = f(x)$. It is given that the point $(-1, -1)$ lies on the curve.

Find the equation of the curve. [2]

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- 3** Solve the equation $3 \tan^2 \theta + 1 = \frac{2}{\tan^2 \theta}$ for $0^\circ < \theta < 180^\circ$. [5]

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

- 4** A curve has equation $y = 3x^2 - 4x + 4$ and a straight line has equation $y = mx + m - 1$, where m is a constant.

Find the set of values of m for which the curve and the line have two distinct points of intersection.

[5]

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

- 5** In the expansion of $(a + bx)^7$, where a and b are non-zero constants, the coefficients of x , x^2 and x^4 are the first, second and third terms respectively of a geometric progression.

Find the value of $\frac{a}{b}$.

[5]

This image shows a single sheet 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.

- 6 The function f is defined by $f(x) = \frac{2x}{3x-1}$ for $x > \frac{1}{3}$.

(a) Find an expression for $f^{-1}(x)$. [3]

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(b) Show that $\frac{2}{3} + \frac{2}{3(3x-1)}$ can be expressed as $\frac{2x}{3x-1}$. [2]

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(c) State the range of f . [1]

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- 7 The first and second terms of an arithmetic progression are $\frac{1}{\cos^2 \theta}$ and $-\frac{\tan^2 \theta}{\cos^2 \theta}$, respectively, where $0 < \theta < \frac{1}{2}\pi$.

(a) Show that the common difference is $-\frac{1}{\cos^4 \theta}$. [4]

This image shows a full page of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The lines are thin and light gray, set against a plain white background. There are no margins, text, or other markings on the page.

[Turn over

8 The equation of a curve is $y = 2x + 1 + \frac{1}{2x+1}$ for $x > -\frac{1}{2}$.

(a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [3]

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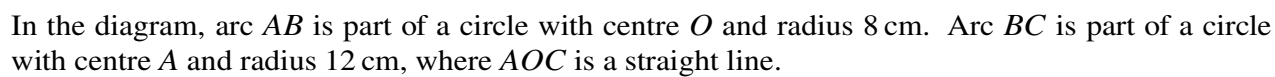
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[illegible]



- [illegible]

(b) Find the area of the shaded region.

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(c) Find the perimeter of the shaded region.

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- Find the value of k .

[4]

This image shows a full page of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The lines are thin and light gray, set against a plain white background. There are no margins, text, or other markings on the page.

[5]

[illegible]

11 A circle with centre C has equation $(x - 8)^2 + (y - 4)^2 = 100$.

- (a)** Show that the point $T(-6, 6)$ is outside the circle. [3]

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Two tangents from T to the circle are drawn.

- (b)** Show that the angle between one of the tangents and CT is exactly 45° . [2]

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The two tangents touch the circle at A and B .

- (c) Find the equation of the line AB , giving your answer in the form $y = mx + c$. [4]

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- (d) Find the x -coordinates of A and B . [3]

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[illegible]

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