Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/13**

Paper 1 Pure Mathematics 1 **May/June 2025**

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 **16** pages.

[Turn over

1 A curve has equation $y = 2x + \frac{12}{x^2}$.

Find the equation of the tangent to the curve at the point $(-2, -1)$. Give your answer in the form $y = mx + c$. [4]

2 The first two terms of a geometric progression are

$$4\sin^2\theta, \quad 8\sin^3\theta,$$

where θ is an angle such that $0 < \theta < \frac{1}{6}\pi$.

Given that the sum to infinity of the progression is $\frac{1}{2}$, find the value of θ. Give your answer in the form $\sin^{-1} k$, where k is a rational number. [4]

3 Given that $\int_1^3 \left(\frac{a}{(4x-3)^2} + 2 \right) \mathrm{d}x = 12$, find the value of the constant a. [4]

4 **(a)** Find the first three terms in the expansion of $\left(2-\frac{3}{2}x\right)^5$ in ascending powers of x. [3]

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(b) Use your answer to part **(a)**, with a suitable value of x, to find an approximation to 1.985^5. [3]

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5 Solve the equation

$$4\sin\theta\tan\theta = 1 + 5\cos\theta$$

for $-180° < \theta < 180°$. [6]

6 An arithmetic progression has first term a and common difference 2. The Nth term is 55 and the sum of the first $3N$ terms is 5760.

Find the values of N and a. [6]

7 A curve is such that $\frac{dy}{dx} = 3x^2 + 10x - 8$.

(a) Find the set of values of x for which y decreases as x increases. [3]

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(b) It is given that the maximum point of the curve has y-coordinate 27.

Find the equation of the curve. [4]

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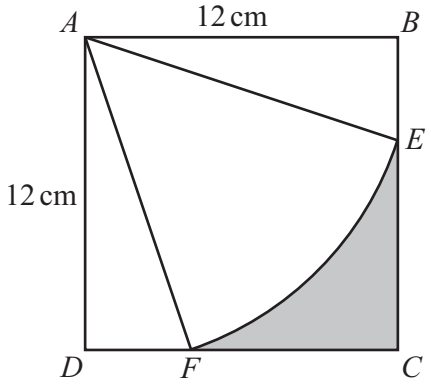

The diagram shows a square $ABCD$ where each side has length 12 cm. Points E and F lie on the sides BC and CD respectively and are such that $BE = \frac{1}{3}BC$ and $DF = \frac{1}{3}DC$. The arc EF is part of a circle with centre A. The shaded region is bounded by the arc EF and the line segments EC and FC.

(a) Show that the size of angle EAF is 0.9273 radians, correct to 4 significant figures. [2]

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(b) Find the perimeter of the shaded region. [3]

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(c) Find the area of the shaded region. [3]

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9 Three points P, Q and R have coordinates $P(-13, 5)$, $Q(5, 1)$ and $R(2, k)$, where k is a constant. It is given that the angle PRQ is a right angle.

(a) Show that one of the possible values of k is 10, and find the other possible value. [4]

(b) It is now given that $k = 10$. A circle passes through the points P, Q and R.

Find the equation of the tangent to the circle at R. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

10 A curve C has equation $y = \frac{9}{2x-5} + 2x - 5$.

(a) Find the coordinates of the two stationary points. [4]

(b) Find $\frac{d^2y}{dx^2}$ and hence determine the nature of each stationary point. [3]

(c) The curve C is transformed to the curve C_1 using a translation of $\begin{pmatrix} -3 \\ 7 \end{pmatrix}$ followed by reflection in the x-axis.

(i) State the coordinates of the maximum point of C_1. [1]

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(ii) Find the equation of C_1 in the form $y = \frac{a}{bx+c} + dx + e$, where a, b, c, d and e are integers. [3]

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11 The function f is defined by $f(x) = x^2 + 4ax + a$ for $x \in \mathbb{R}$, where a is a constant.

The function g is such that $g^{-1}(x) = \sqrt[3]{2x-4}$ for $x \in \mathbb{R}$.

(a) Given that the range of f is $f(x) \geqslant -33$, find the possible values of a. [4]

(b) Given instead that $\mathrm{fgg}(0) = 96$, find the value of a. [6]

Additional page

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

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