Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/13**

Paper 1 Pure Mathematics 1 **October/November 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.

1 **(a)** Expand $\left(2-\frac{1}{2}x\right)^6$ in ascending powers of x up to and including the term in x^3. [3]

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(b) Hence find the coefficient of x^3 in the expansion of $\left(3-x+2x^3\right)\left(2-\frac{1}{2}x\right)^6$. [2]

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2 **(a)** Solve the equation $\tan^{-1}(5x-3) = -\frac{1}{4}\pi$. [2]

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(b) Solve the equation $5\cos^2\theta = 4\sin\theta + 4$ for $\frac{1}{2}\pi \leqslant \theta \leqslant 2\pi$. [4]

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3 The equation of a curve is $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = \frac{1}{2}x^{\frac{2}{3}}(x-2)^2$. The following points lie on the curve. Non-exact values of the y-coordinates are given correct to 6 decimal places.

$$A(8, 72),\ B(8.001, k),\ C(8.01, 72.300388),\ D(8.1, 75.038882)$$

(a) Find the value of k. Give your answer correct to 6 decimal places. [1]

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The table below shows the gradients of the chords AB and AC, given correct to 4 decimal places.

Chord	AB	AC	AD
Gradient of chord	30.0039	30.0388	

(b) Find the gradient of the chord AD. Give your answer correct to 4 decimal places. [1]

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(c) State what the values in the table suggest about the value of $\mathrm{f}'(8)$. [1]

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4 The first, second and third terms of a progression are 20, k and $k-5$ respectively.

(a) Given that the progression is arithmetic, find the 30th term. [2]

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(b) Given instead that the progression is geometric, find the sum to infinity. [4]

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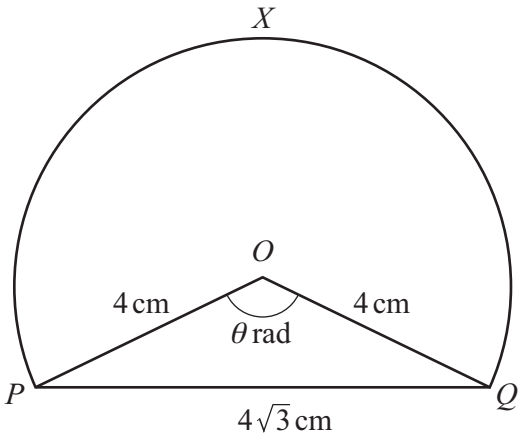

The diagram shows part of a circle with centre O and radius 4 cm. The chord PQ is of length $4\sqrt{3}$ cm and angle $POQ = \theta$ radians. The point X lies on the circle.

(a) Find the exact value of θ. [2]

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(b) Find the exact area of the segment PXQ. [3]

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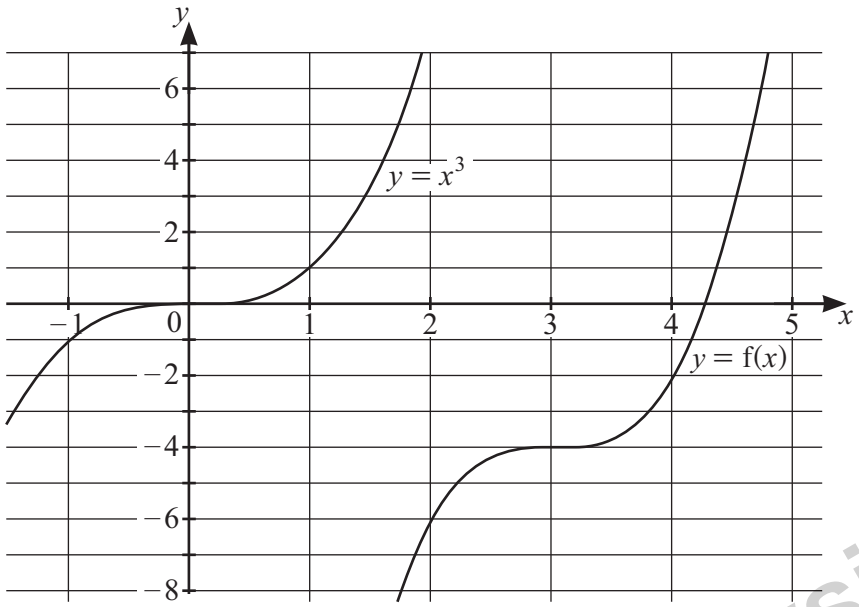

The diagram shows the graphs of $y = x^3$ and $y = \mathrm{f}(x)$. The graph of $y = x^3$ is transformed to the graph of $y = \mathrm{f}(x)$ by a sequence of transformations.

(a) Describe fully a suitable sequence of transformations. Make clear the order in which the transformations are applied. [5]

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(b) You are given that $\mathrm{f}(x) = a(x+b)^3 + c$.

State the values of the constants a, b and c. [3]

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7 The function g is defined by $g(x) = \frac{2}{ax-3} + \frac{1}{2}$ for $x > \frac{3}{a}$, where a is a positive constant.

Find $g^{-1}(x)$ and hence verify that if $a = 6$ then $g^{-1}(x) \equiv g(x)$. [4]

8 The points (6, 1) and (−2, 7) lie at the opposite ends of a diameter of a circle.

(a) Find the equation of the circle. [3]

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(b) There are two tangents to the circle which have gradient $-\frac{1}{2}$.

Find the exact values of the x-coordinates of the points at which these tangents touch the circle. [5]

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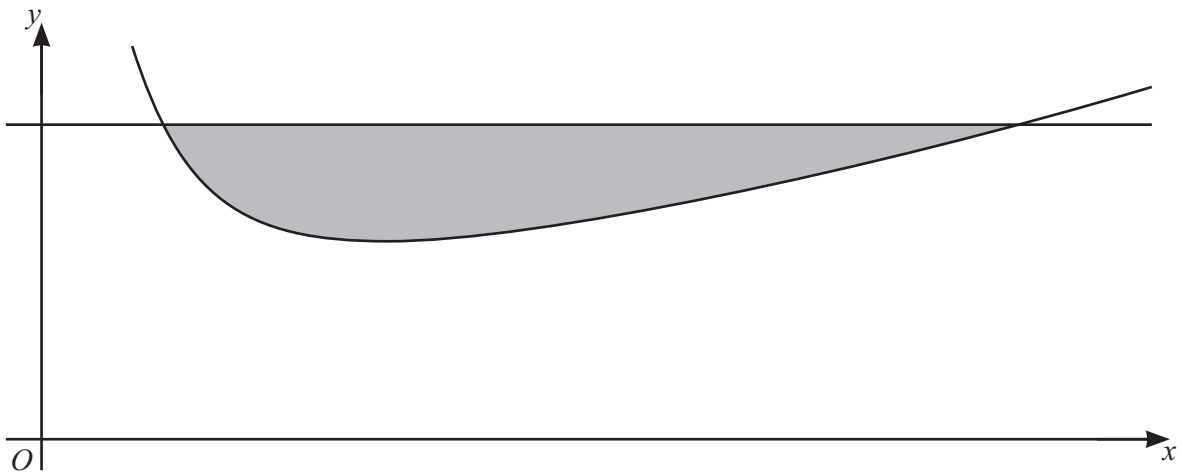

The diagram shows part of the curve with equation $y = \frac{1}{2}x + \frac{4}{x}$ and the line $y = 4.5$.

Find the exact volume of the solid formed when the shaded region is rotated through 360° about the x-axis. [8]

10 A function f is defined by $f(x) = px^2 + 4x + q$ for $x \in \mathbb{R}$, where p and q are constants.

(a) It is given that $p = 2$ and $q = 10$.

(i) Express $f(x)$ in the form $a(x+b)^2 + c$, where a, b and c are constants. [3]

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

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(b) It is given instead that $q = -5$ and the roots of $f(x) = 0$ are $5m$ and $-9m$, where m is a constant.

Find the values of p and m. [5]

11 The equation of a curve is $y = \frac{8}{3x-8} - \frac{6}{x-1}$.

(a) Find the coordinates of the point at which the tangent to the curve at the point (3, 5) intersects the line $y = -8x$. [6]

(b) (i) Find the x-coordinates of each of the stationary points of the curve. [3]

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(ii) Find $\frac{d^2y}{dx^2}$ and hence determine the nature of each of the stationary points. [4]

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Additional page

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