Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*2662660072*

**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.


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**[Turn over**

**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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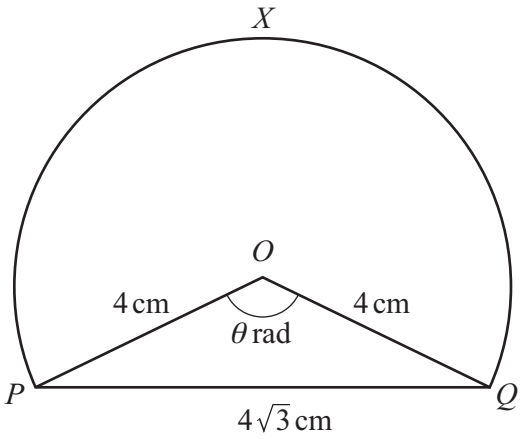
**5**




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 $\theta$. [2]

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

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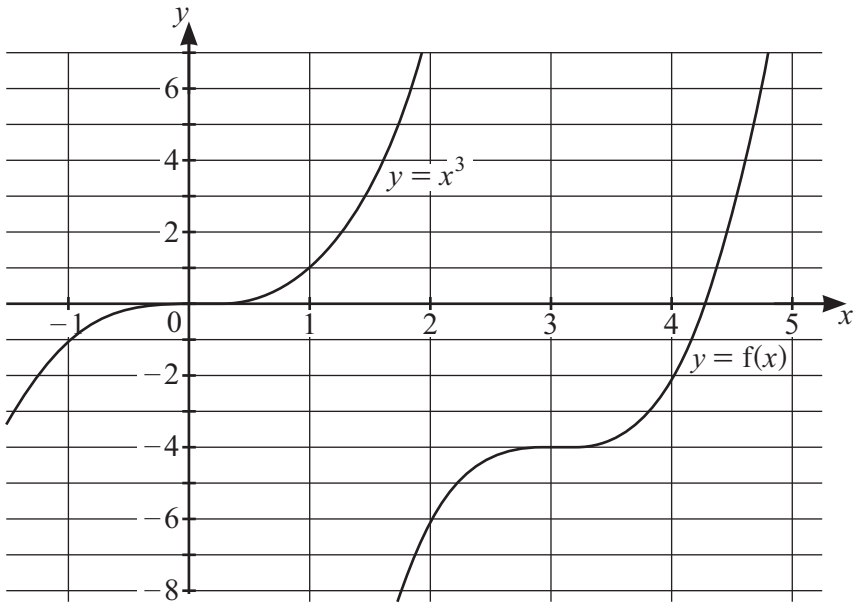
**6**




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]

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**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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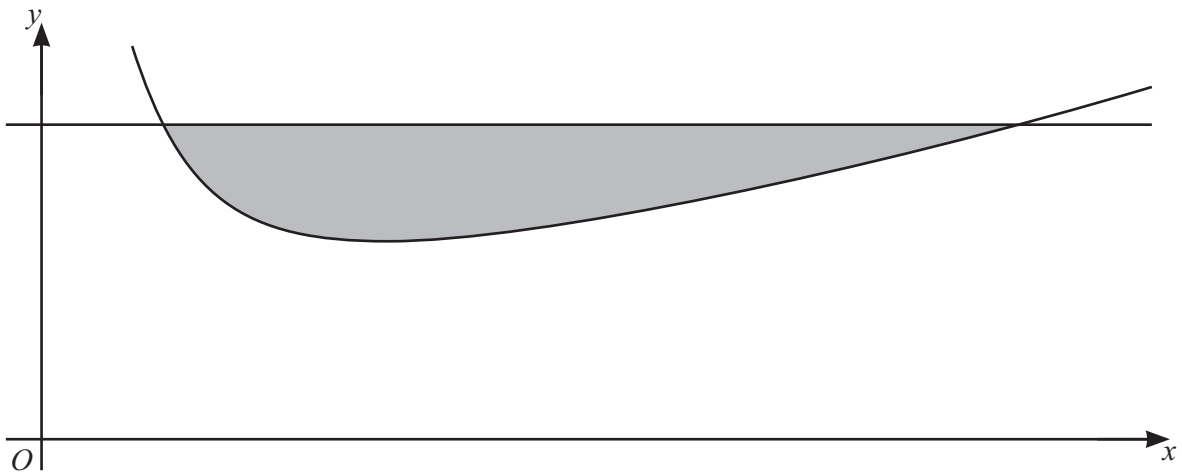
**9**




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]

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**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]

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**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]

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**(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

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