* 0000800000001 *

Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*7268412163*

**MATHEMATICS** **9709/12**

Paper 1 Pure Mathematics 1 **February/March 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.

DC (CE/SG) 342349/3
© UCLES 2025

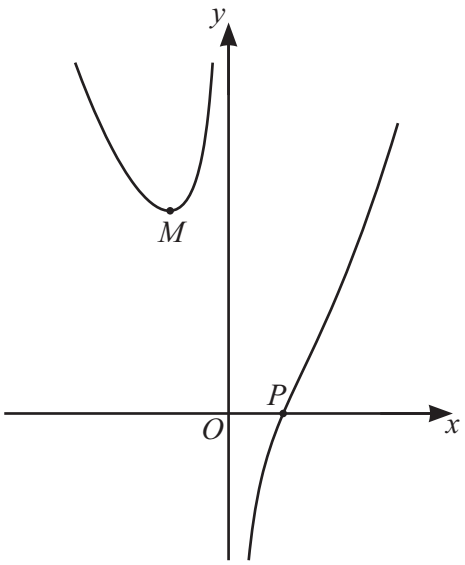
**[Turn over**

**1** A curve has equation $y = 5 + 3x - 2x^2$ and a straight line has equation $y = kx + 13$, where $k$ is a constant.

Find the set of values of $k$ for which the curve and the line do **not** meet. [4]

DO NOT WRITE IN THIS MARGIN

2




The diagram shows the curve with equation $y = 2x^2 - \frac{5}{x} + 3$. The curve crosses the $x$-axis at the point $P(1, 0)$ and $M$ is a minimum point.

**(a)** Find the gradient of the curve at $P$. [2]

.....

.....

.....

.....

.....

.....

**(b)** Find the coordinates of $M$. Give each coordinate correct to 3 significant figures. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**3** **(a)** Find the complete expansion of $\left(2x-\frac{3}{x}\right)^4$. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(b)** Hence determine the coefficient of $x^2$ in the expansion of $\left(x^2+5\right)\left(2x-\frac{3}{x}\right)^4$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN

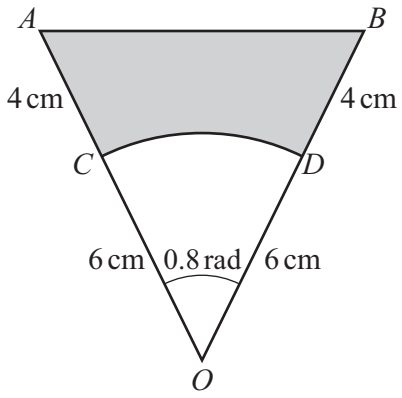
DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

4




The diagram shows a triangle $OAB$ where $OA = OB = 10$ cm and angle $AOB = 0.8$ radians. Points $C$ and $D$ on $OA$ and $OB$ respectively are such that the arc $CD$ is part of a circle with centre $O$ and radius 6 cm. The shaded region is bounded by the arc $CD$ and the line segments $CA$, $AB$ and $BD$.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

.....

.....

.....

.....

.....

.....

.....

.....

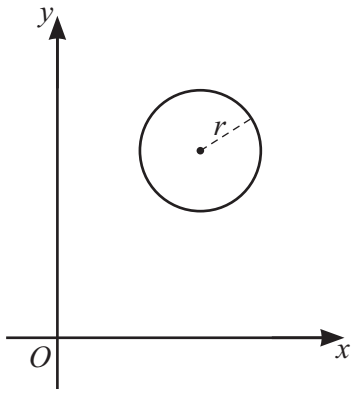
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**5** An arithmetic progression has first term 5 and common difference 6.

For this progression, find the sum of all the terms that lie between 150 and 400. [6]

DO NOT WRITE IN THIS MARGIN

6




The diagram shows a circle $C$ of radius $r$, where $x > 0$ and $y > 0$ for all points on $C$. The least distance between any point on $C$ and the $x$-axis is 8 units, and the least distance between any point on $C$ and the $y$-axis is 5 units.

**(a)** State the coordinates of the centre of the circle in terms of $r$. [1]

.....

**(b)** Given that the distance between the origin and the centre of the circle is 15 units, find the value of $r$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

**(c)** The point on the circle furthest from the origin is denoted by $P$.

Find the gradient of the tangent to the circle at $P$. [2]

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**7** **(a)** Show that $3\tan^2\theta + 5\sin^2\theta \equiv \dfrac{8\sin^2\theta - 5\sin^4\theta}{1-\sin^2\theta}$. [3]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**(b)** Hence solve the equation $3\tan^2\theta + 5\sin^2\theta = 9$ for $0° < \theta < 270°$. [4]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**8** A geometric progression is such that its second term is $-120$ and its sum to infinity is 160.

**(a)** Find the common ratio. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(b)** The first nine terms of the progression are now removed.

Find the sum to infinity of the remaining terms of the progression. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**9** A curve is such that $\frac{d^2y}{dx^2} = \frac{6}{x^4} - \frac{5}{x^3}$. It is given that the curve has a stationary point at $\left(\frac{1}{2}, 9\right)$.

**(a)** Use the expression for $\frac{d^2y}{dx^2}$ to determine whether the stationary point is a maximum or a minimum point. [2]

.....

.....

.....

.....

**(b)** Find the equation of the curve. [7]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

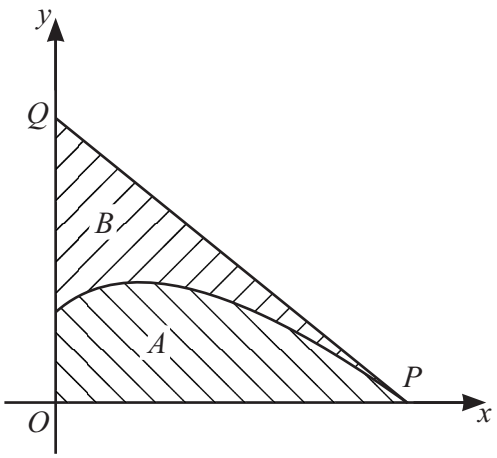
.....

.....

.....

.....

**10**




The diagram shows the curve with equation

$$y = 4(3x+4)^{\frac{1}{2}} - 2x - 6$$

for values of $x$ such that $0 \leqslant x \leqslant 7$. The tangent to the curve at the point $P\,(7, 0)$ meets the $y$-axis at the point $Q$. Region $A$ is bounded by the curve and the two axes. Region $B$ is bounded by the curve, the line segment $PQ$ and the $y$-axis.

**(a)** Find the area of region $A$. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**(b)** Find the area of region $B$. [5]

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**11** Functions f and g are defined for all real values of $x$ by

$$\mathrm{f}(x) = 4x^2 - c \quad \text{and} \quad \mathrm{g}(x) = 2x + k,$$

where $c$ and $k$ are positive constants. It is given that $\mathrm{g}^{-1}(3k+1) = c$.

**(a)** Show that $\mathrm{gf}(x) = 8x^2 - k - 1$. [4]



DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN
DO NOT WRITE IN THIS MARGIN

**(b)** The curve with equation $y = 8x^2 - k - 1$ is transformed to the curve with equation $y = \mathrm{h}(x)$ by the following sequence of transformations.

Translation of $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$
Stretch in the $y$-direction by scale factor $k$
Reflection in the $x$-axis

Find an expression for $\mathrm{h}(x)$ in terms of $x$ and $k$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

**(c)** The range of h is given by $\mathrm{h}(x) \leqslant 15$.

Find the values of $c$ and $k$. [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

## Additional page

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.