Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

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

[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]

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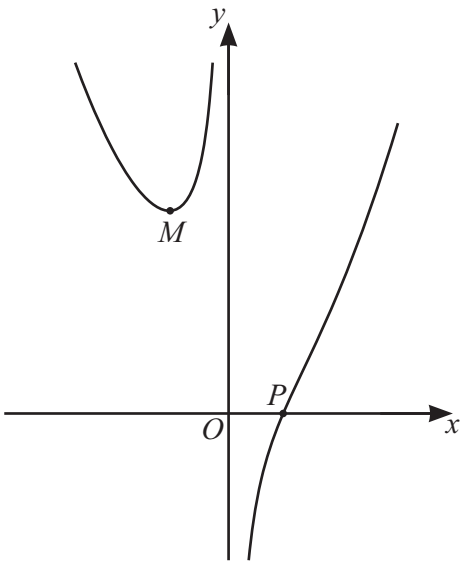

The diagram shows the curve with equation $y = 2x^2 - \frac{5}{x} + 3$. The curve crosses the x-axis at the point $P(1, 0)$ and M is a minimum point.

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

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

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

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(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]

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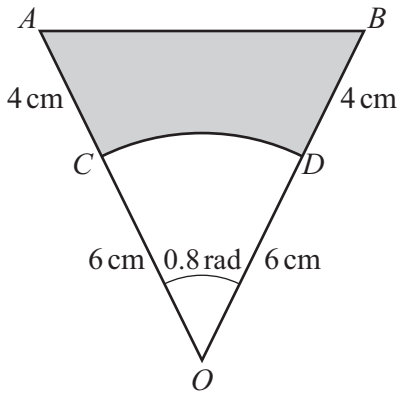

The diagram shows a triangle OAB where $OA = OB = 10$ cm and angle $AOB = 0.8$ radians. Points C and D on OA and OB respectively are such that the arc CD is part of a circle with centre O and radius 6 cm. The shaded region is bounded by the arc CD and the line segments CA, AB and BD.

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

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

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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]

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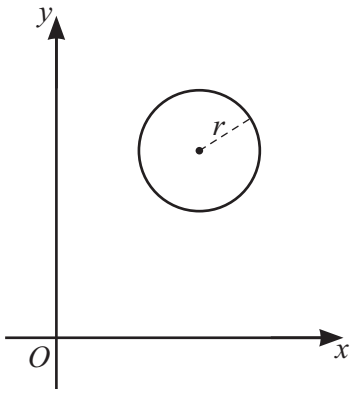

The diagram shows a circle C of radius r, where $x > 0$ and $y > 0$ for all points on C. The least distance between any point on C and the x-axis is 8 units, and the least distance between any point on C and the y-axis is 5 units.

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

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

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(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]

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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]

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

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]

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

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

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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]

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

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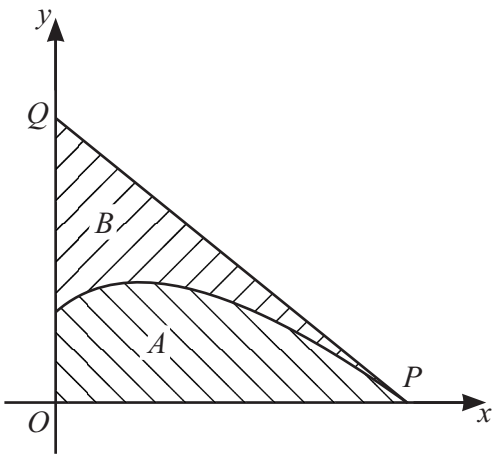

The diagram shows the curve with equation

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

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]

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

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]

(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]

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

Find the values of c and k. [3]

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Additional page

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