Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/12**

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 **20** pages. Any blank pages are indicated.

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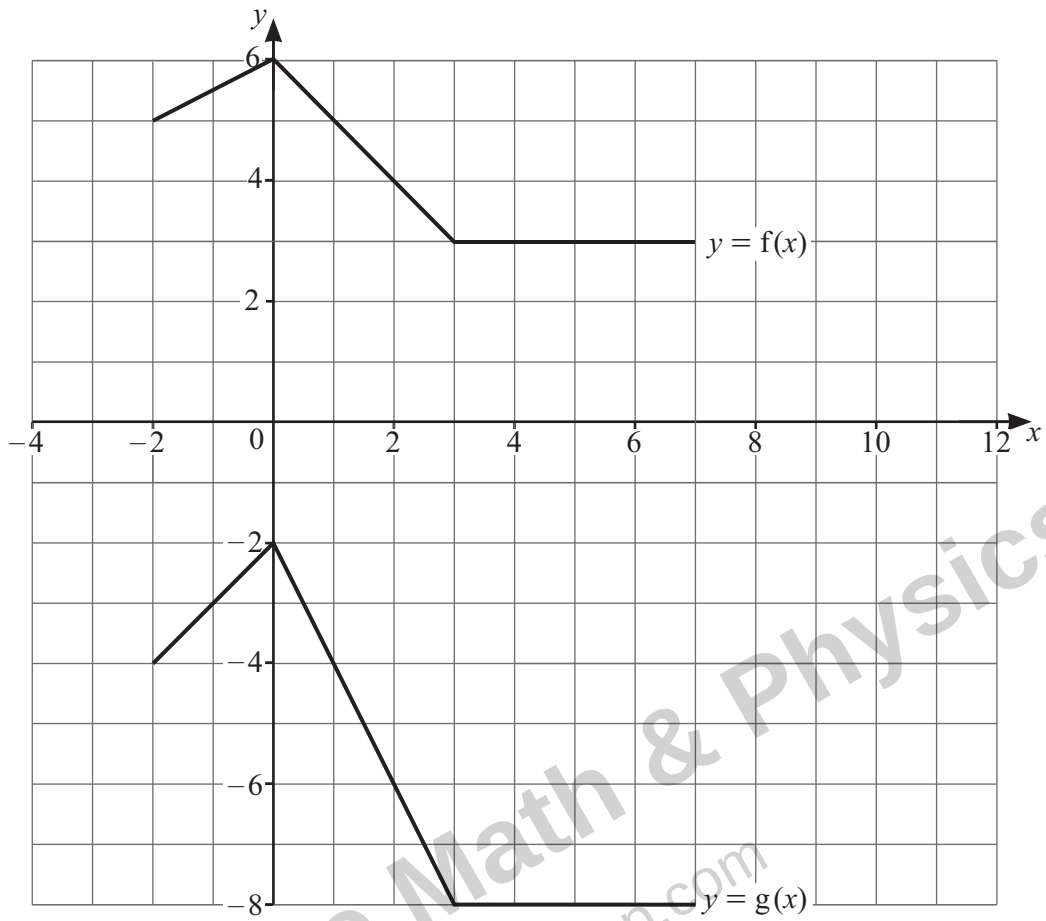
1



The diagram shows the graphs with equations $y = f(x)$ and $y = g(x)$.

Describe fully a sequence of two transformations which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. Make clear the order in which the transformations should be applied. [4]

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2 Find the coordinates of the points of intersection of the curve and the line with equations

$$2xy + 5y^2 = 24 \quad \text{and} \quad 2x + y + 4 = 0.$$ [4]

3 The coefficient of x^7 in the expansion of $\left(px^2 + \frac{4}{p}x\right)^5$ is 1280.

Find the value of the constant p. [4]

4 A point P is moving along the curve with equation $y = ax^{\frac{3}{2}} - 12x$ in such a way that the x-coordinate of P is increasing at a constant rate of 5 units per second.

(a) Find the rate at which the y-coordinate of P is changing when $x = 9$. Give your answer in terms of the constant a. [3]

(b) Given that the curve has a minimum point when $x = \frac{1}{4}$, find the value of a. [2]

5 The equation of a curve is $y = 4\cos 2x + 3$ for $0 \leqslant x \leqslant 2\pi$.

(a) State the greatest and least possible values of y. [2]

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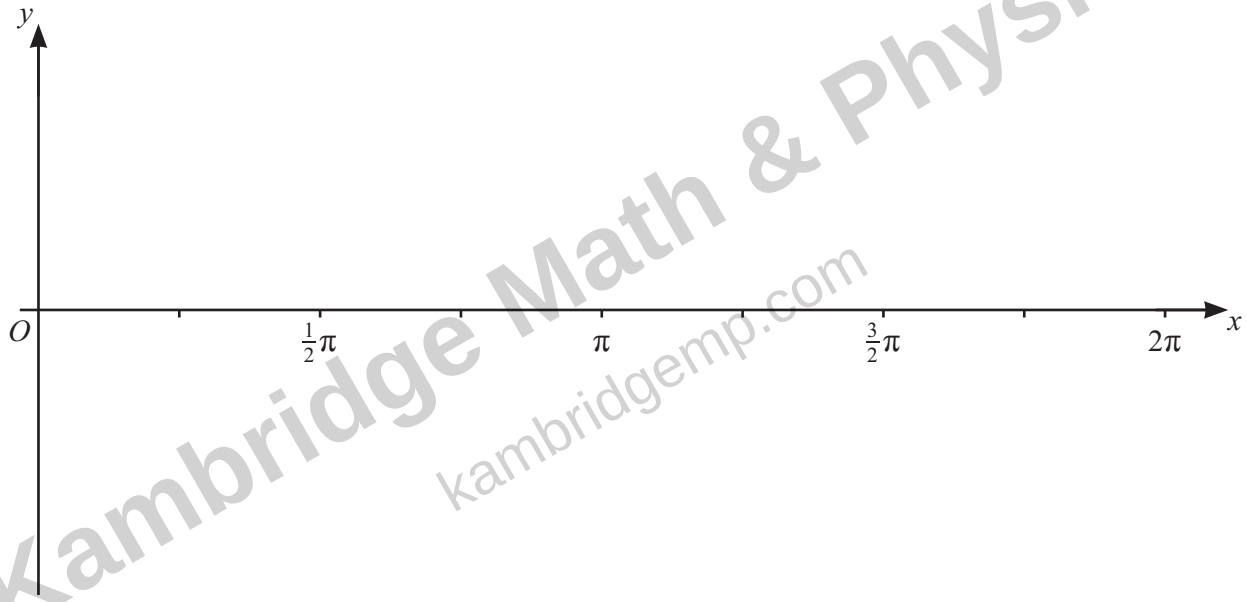
(b) Sketch the curve. [2]



(c) Hence determine the number of solutions of the equation $4\cos 2x + 3 = 2x - 1$ for $0 \leqslant x \leqslant 2\pi$. [1]

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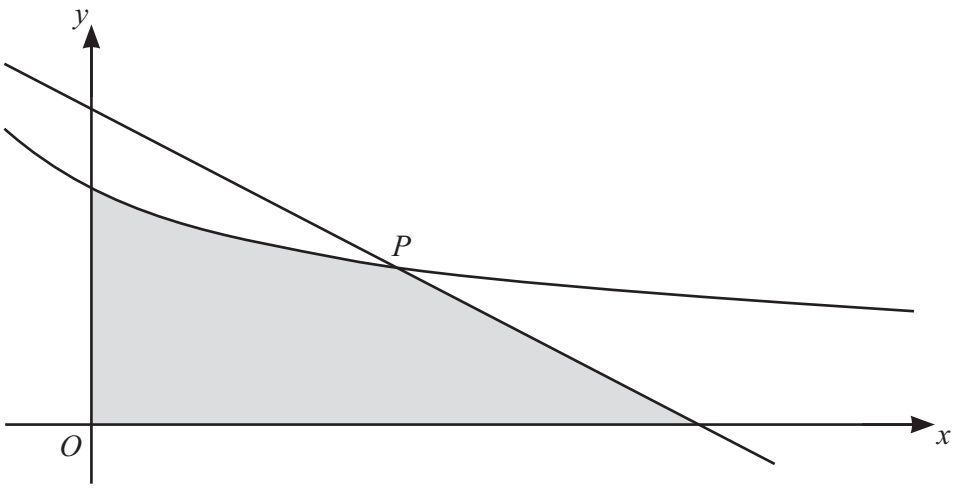

The diagram shows the curve with equation $y = \dfrac{9}{(5x+4)^{\frac{1}{2}}}$ and the line $y = 6 - 3x$. The line and the curve intersect at the point P which has y-coordinate 3.

Find the area of the shaded region. [6]

7 **(a)** Prove the identity $\dfrac{\tan\theta+7}{\tan^2\theta-3} \equiv \dfrac{\sin\theta\cos\theta+7\cos^2\theta}{1-4\cos^2\theta}$. [3]

(b) Hence solve the equation $\dfrac{\sin\theta\cos\theta + 7\cos^2\theta}{1 - 4\cos^2\theta} = \dfrac{5}{\tan\theta}$ for $0° \leqslant \theta \leqslant 180°$. [4]

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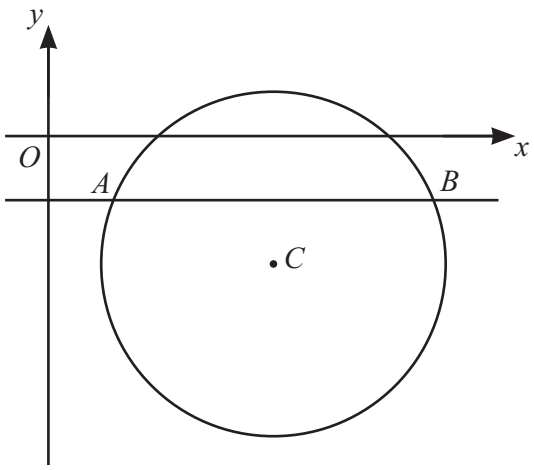

The diagram shows the circle with equation $x^2+y^2-14x+8y+36=0$ and the line $y=-2$. The line intersects the circle at the points A and B. The centre of the circle is C.

(a) Find the coordinates of A, B and C. [3]

(b) Find the angle ACB in radians. Give your answer correct to 3 significant figures. [2]

(c) The chord AB divides the circle into two segments.

Find the area of the larger segment. [4]

9 The equation of a curve is such that $\frac{d^2y}{dx^2} = -\frac{24}{x^3}$. It is given that the curve has a stationary point at $(-2, 19)$.

(a) Find an expression for $\frac{dy}{dx}$. [3]

(b) Find the x-coordinate of the other stationary point of the curve, and determine the nature of this stationary point. [2]

(c) Find the equation of the curve. [3]

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(d) Find the equation of the normal to the curve at the point where $\frac{dy}{dx} = -\frac{9}{4}$ and x is positive. Express your answer in the form $px + qy + r = 0$, where p, q and r are integers. [4]

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10 (a) The first, second and third terms of an arithmetic progression are $4k$, k^2 and $8k$ respectively, where k is a non-zero constant.

(i) Find the value of k. [2]

(ii) Find the sum of the first 20 terms of the progression. [3]

(b) The fourth and sixth terms of a geometric progression are 36 and 6 respectively. The common ratio of the progression is positive.

Find the sum to infinity of the progression. Give your answer in the form $\frac{a}{\sqrt{b}-c}$, where a, b and c are integers. [5]

11 **(a)** Express x^2+4x+2 in the form $(x+a)^2+b$, where a and b are integers. [2]

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The functions f and g are defined as follows.

$$\text{f}(x) = x^2+4x+2 \qquad \text{for } x \leqslant -2$$

$$\text{g}(x) = -x-4 \qquad \text{for } x \geqslant -2$$

(b) **(i)** Find an expression for $\text{f}^{-1}(x)$. [3]

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(ii) Find an expression for $(gf)^{-1}(x)$. [4]

Additional page

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