



## 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)

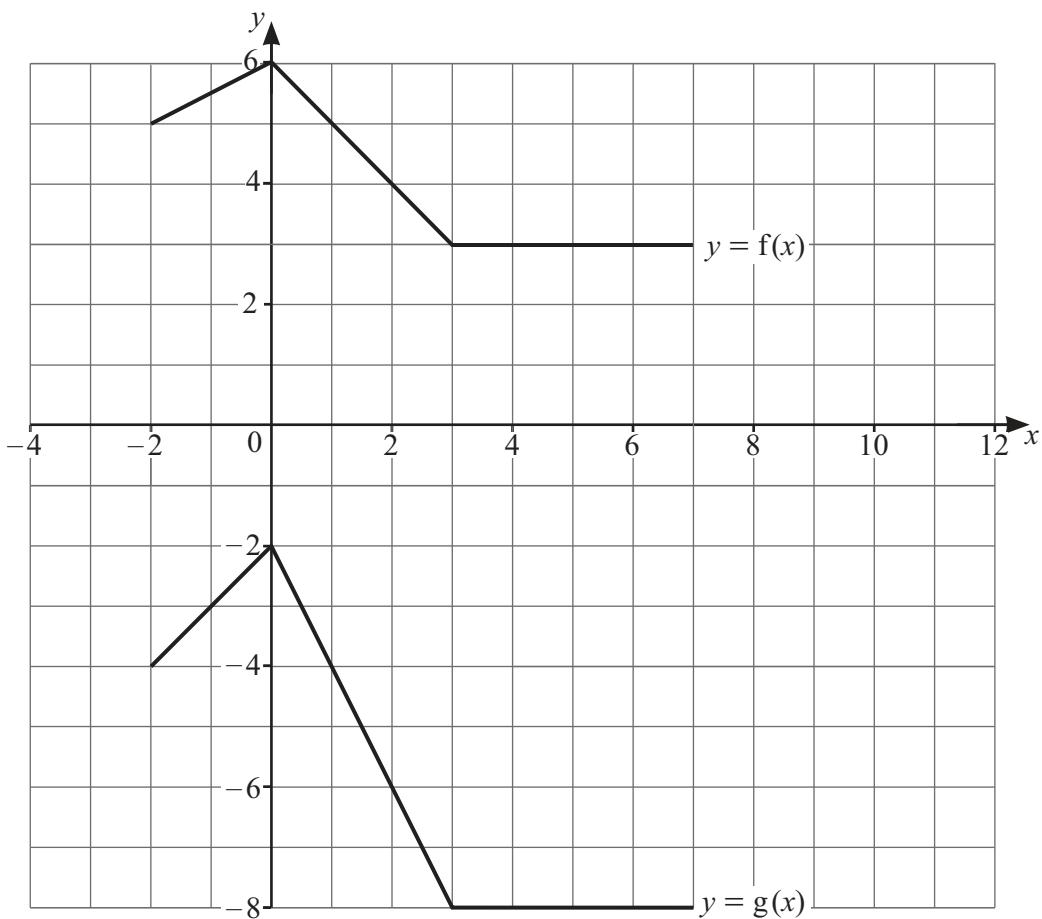
### INSTRUCTIONS

- 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.



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]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....





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]





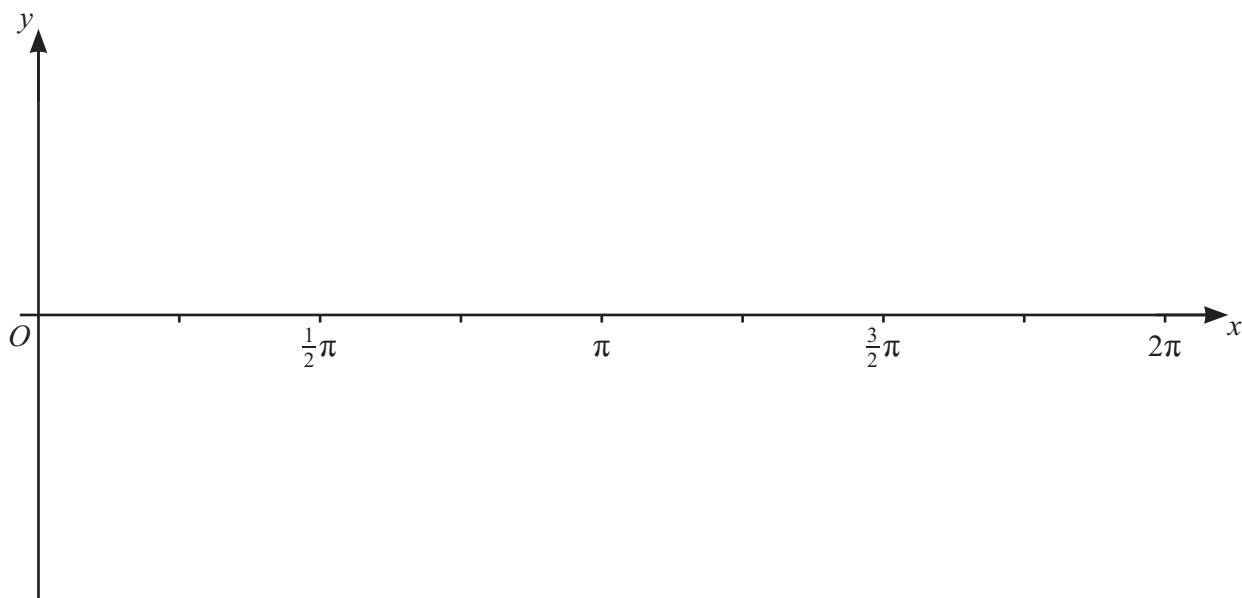
5 The equation of a curve is  $y = 4 \cos 2x + 3$  for  $0 \leq x \leq 2\pi$ .

(a) State the greatest and least possible values of  $y$ .

[2]

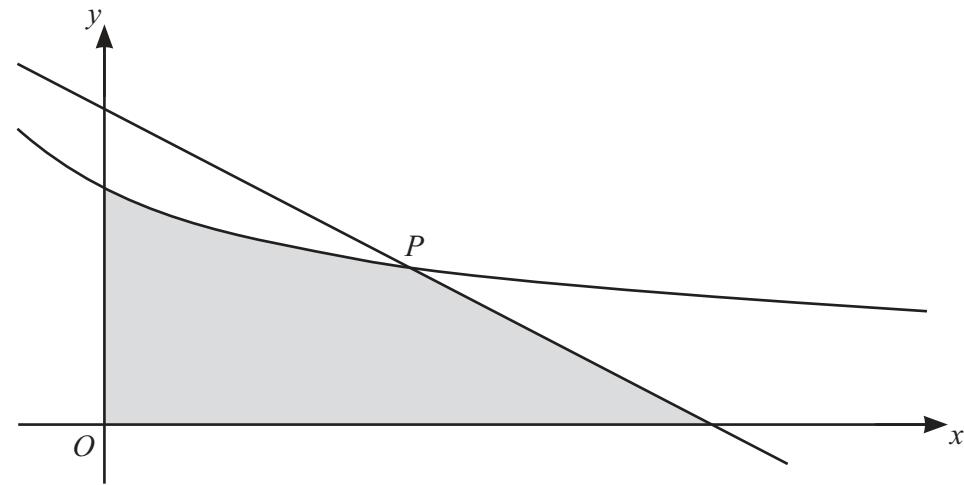
(b) Sketch the curve.

[2]



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





The diagram shows the curve with equation  $y = \frac{9}{(5x+4)^{\frac{1}{2}}}$  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  $\frac{\tan \theta + 7}{\tan^2 \theta - 3} \equiv \frac{\sin \theta \cos \theta + 7 \cos^2 \theta}{1 - 4 \cos^2 \theta}$ . [3]

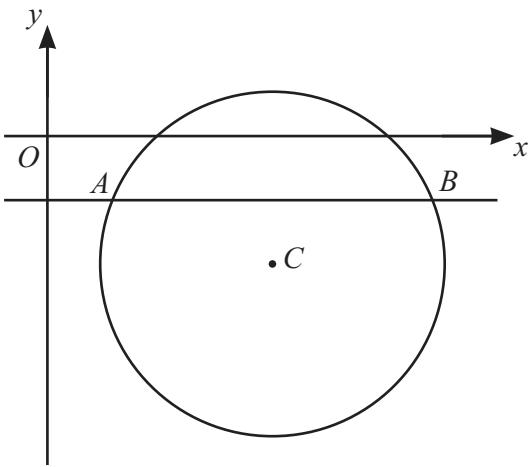




(b) Hence solve the equation  $\frac{\sin\theta\cos\theta+7\cos^2\theta}{1-4\cos^2\theta} = \frac{5}{\tan\theta}$  for  $0^\circ \leq \theta \leq 180^\circ$ .

[4]





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.

(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.

(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]





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]





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]

The functions  $f$  and  $g$  are defined as follows.

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

$$g(x) = -x - 4 \quad \text{for } x \geq -2$$

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





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





## 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





**BLANK PAGE**

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](http://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.

