



Cambridge International AS & A Level

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MATHEMATICS**9709/13**

Paper 1 Pure Mathematics 1

October/November 2024**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.

[3]

[illegible]

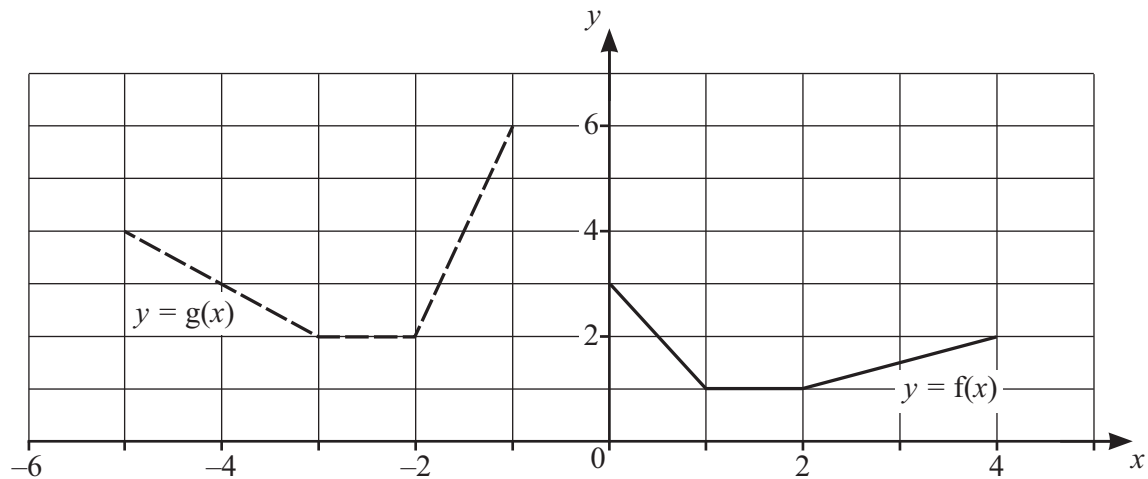


This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- [illegible]

- [illegible]

[illegible]



In the diagram, the graph with equation $y = f(x)$ is shown with solid lines and the graph with equation $y = g(x)$ is shown with broken lines.

- (a) Describe fully a sequence of three transformations which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. [6]

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- (b) Find an expression for $g(x)$ in the form $af(bx + c)$, where a , b and c are integers. [2]

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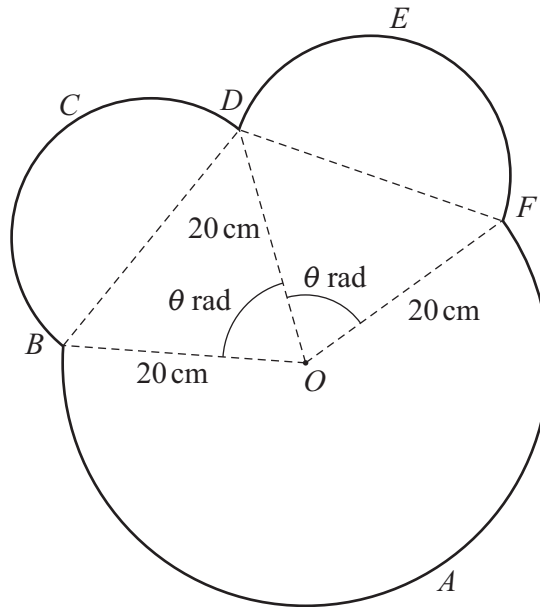
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Find the two possible values of the sum to infinity. [5]

[illegible]



The diagram shows a metal plate $ABCDEF$ consisting of five parts. The parts BCD and DEF are semicircles. The part $BAFO$ is a sector of a circle with centre O and radius 20 cm, and D lies on this circle. The parts OBD and ODF are triangles. Angles BOD and DOF are both θ radians.

- (a) Given that $\theta = 1.2$, find the area of the metal plate. Give your answer correct to 3 significant figures. [5]

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- (b) Given instead that the area of each semicircle is $50\pi\text{ cm}^2$, find the exact perimeter of the metal plate. [5]





8 (a) Express $3x^2 - 12x + 14$ in the form $3(x+a)^2 + b$, where a and b are constants to be found. [2]

[illegible]

The function $f(x) = 3x^2 - 12x + 14$ is defined for $x \geq k$, where k is a constant.

(b) Find the least value of k for which the function f^{-1} exists. [1]

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For the rest of this question, you should assume that k has the value found in part (b).

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

[illegible]



(d) Hence or otherwise solve the equation $ff(x) = 29$. [3]



The graph shows two cubic functions plotted on a Cartesian coordinate system. The x-axis and y-axis are shown, with the origin labeled O . The function $y = x^3 - 3x + 3$ is represented by a solid black curve. The function $y = 2x^3 - 4x^2 + 3$ is represented by a solid black curve. The two curves intersect at the origin $(0,0)$ and at another point where $x \approx 1.5$. The region between the two curves, starting from $x \approx 0.5$ and ending at $x \approx 1.5$, is shaded gray.

(a) Find the x -coordinates of the points of intersection of the curves. [3]

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[4]

[illegible]

[illegible]



[5]

This image shows a full page of primary-ruled paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for handwriting practice. The background is white, and there are no margins or other markings present.

- (a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of k . [2]

[illegible]

- Find the coordinates of the stationary point and determine its nature. [4]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



- Find this value of k .

[6]

This image shows a full page of primary-ruled paper. It features multiple horizontal rows, each defined by two parallel dashed lines. The lines are evenly spaced across the entire page, providing a guide for handwriting practice. There are no margins, text, or other markings present.



Additional page

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

Lined area for writing answers, consisting of multiple horizontal dotted lines.

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