



Cambridge International AS & A Level

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MATHEMATICS**9709/12**

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.

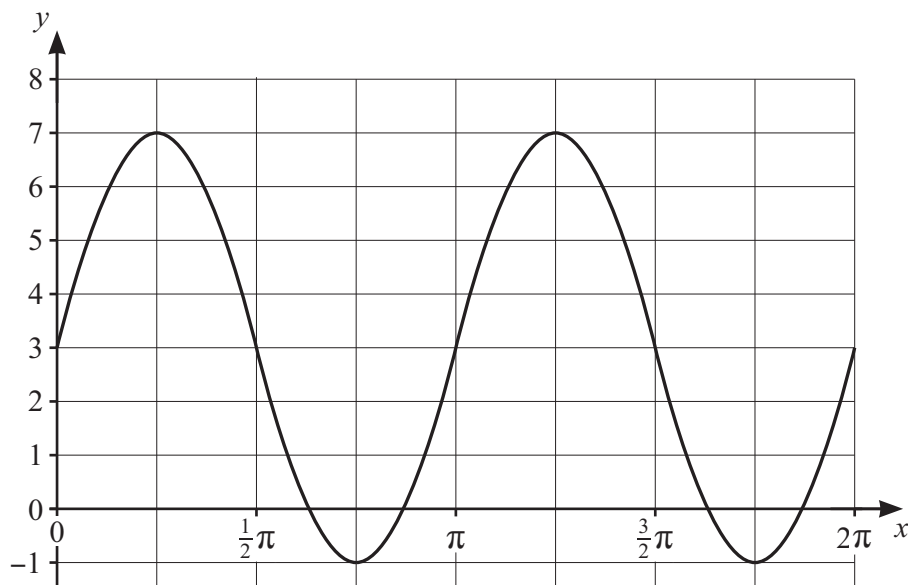
INFORMATION

- 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.



1



The diagram shows the curve with equation $y = a \sin(bx) + c$ for $0 \leq x \leq 2\pi$, where a , b and c are positive constants.

- (a) State the values of a , b and c . [3]

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- (b) For these values of a , b and c , determine the number of solutions in the interval $0 \leq x \leq 2\pi$ for each of the following equations:

- (i) $a \sin(bx) + c = 7 - x$ [1]

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- (ii) $a \sin(bx) + c = 2\pi(x - 1)$. [1]

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2 The first term of an arithmetic progression is -20 and the common difference is 5 .

(a) Find the sum of the first 20 terms of the progression. [2]

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It is given that the sum of the first $2k$ terms is 10 times the sum of the first k terms.

(b) Find the value of k . [3]

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(a) Find and simplify an expression for the gradient of the chord AB in terms of h . [3]

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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.



5 The function f is defined by $f(x) = \frac{2x+1}{2x-1}$ for $x < \frac{1}{2}$.

(a) (i) State the value of $f(-1)$.

[1]

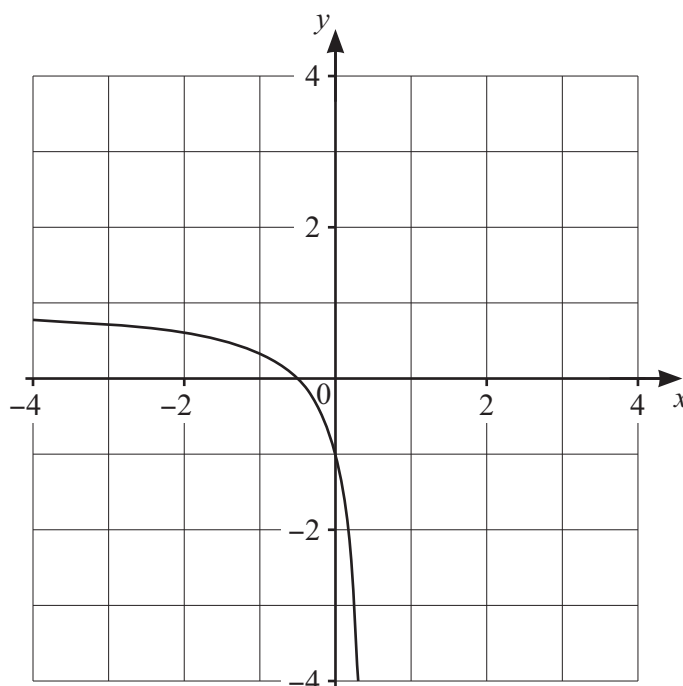
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(ii)



The diagram shows the graph of $y = f(x)$. Sketch the graph of $y = f^{-1}(x)$ on this diagram. Show any relevant mirror line.

[2]

(iii) Find an expression for $f^{-1}(x)$ and state the domain of the function f^{-1} .

[4]

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The function g is defined by $g(x) = 3x + 2$ for $x \in \mathbb{R}$.

- (b) Solve the equation $f(x) = gf\left(\frac{1}{4}\right)$. [3]

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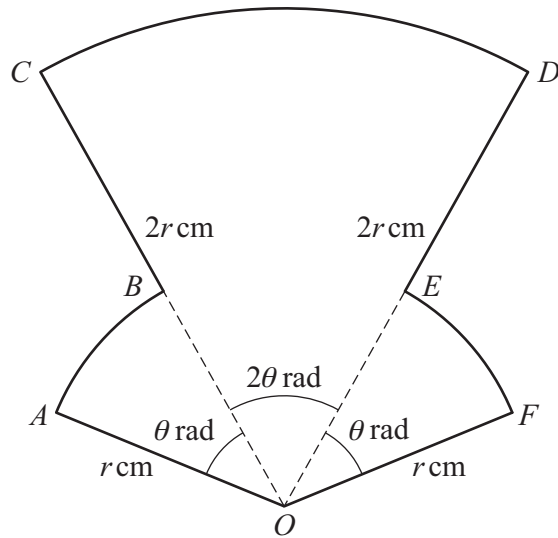
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The diagram shows a metal plate $OABCDEF$ consisting of sectors of two circles, each with centre O . The radii of sectors AOB and EOF are r cm and the radius of sector COD is $2r$ cm. Angle $AOB = \text{angle } EOF = \theta$ radians and angle $COD = 2\theta$ radians.

It is given that the perimeter of the plate is 14 cm and the area of the plate is 10 cm^2 .

Given that $r > \frac{3}{2}$ and $\theta < \frac{3}{4}$, find the values of r and θ . [6]

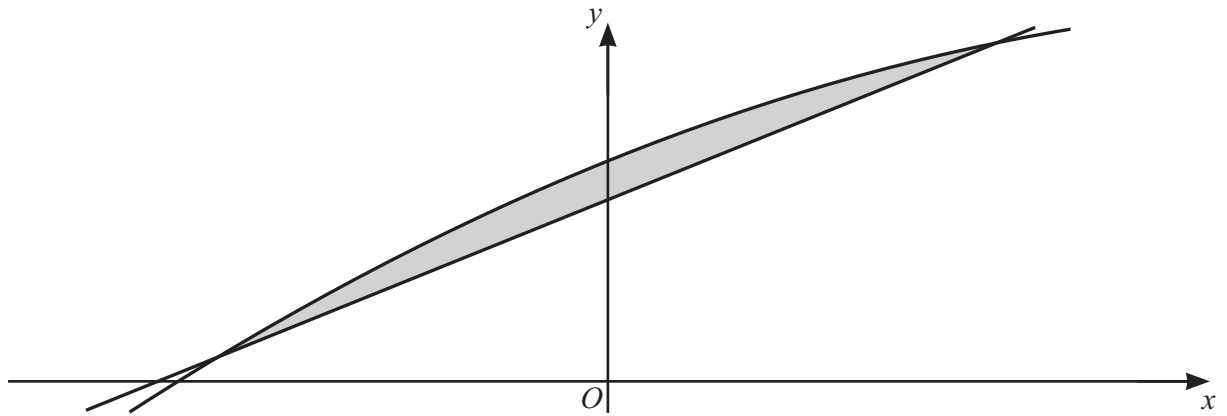
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[illegible]

- 7 (a) By expressing $-2x^2 + 8x + 11$ in the form $-a(x-b)^2 + c$, where a , b and c are positive integers, find the coordinates of the vertex of the graph with equation $y = -2x^2 + 8x + 11$. [3]

[illegible]

(b)



The diagram shows part of the curve with equation $y = -2x^2 + 8x + 11$ and the line with equation $y = 8x + 9$.

Find the area of the shaded region. [5]

[illegible]

[illegible]

- A series of horizontal dotted lines for writing.

[illegible]



[5]

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[illegible]

[illegible]

[3]

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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.



(c) Determine, making your reasoning clear, whether f is an increasing function, a decreasing function or neither. [3]

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