



Cambridge International AS & A Level

CANDIDATE
NAME



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NUMBER

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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.

- Find the 30th term of the progression.

[3]



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1

[2]



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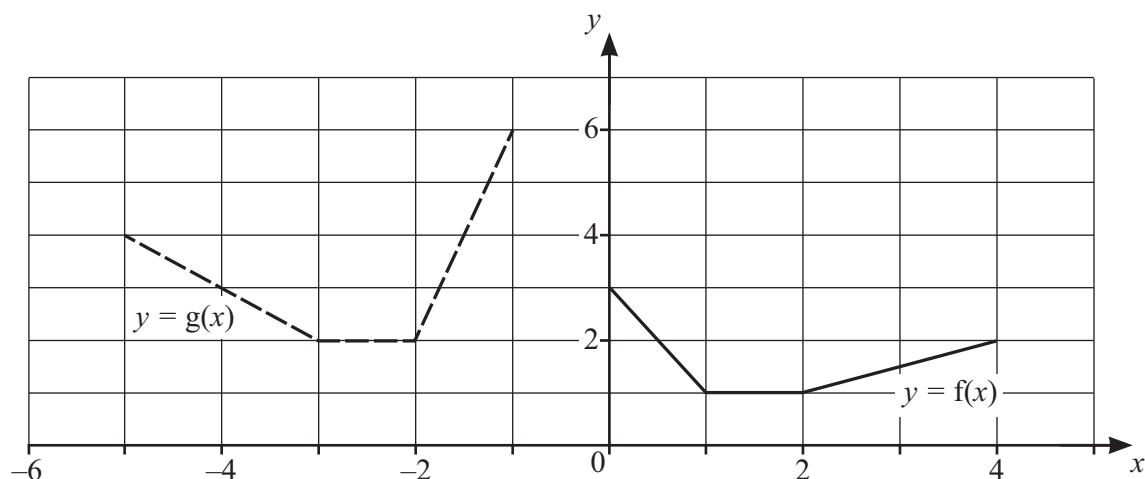


[4]



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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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- 6 The first term of a convergent geometric progression is 10. The sum of the first 4 terms of the progression is p and the sum of the first 8 terms of the progression is q . It is given that $\frac{q}{p} = \frac{17}{16}$.

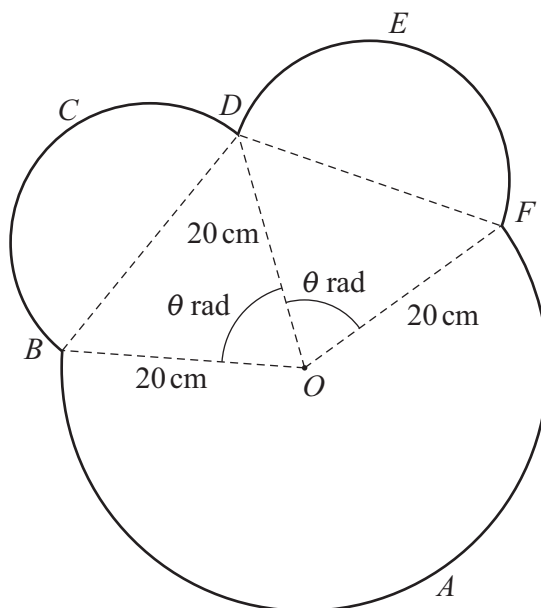
Find the two possible values of the sum to infinity.

[5]



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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]





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



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- 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]



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]

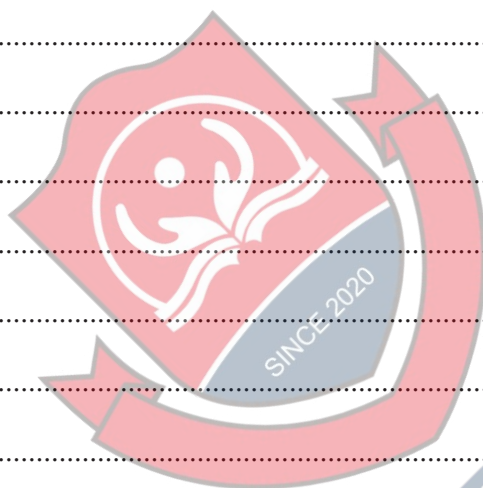
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(d) Hence or otherwise solve the equation $ff(x) = 29$.

[3]



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A Cartesian coordinate system with x and y axes. The origin is labeled O. Two curves are plotted:

- The upper curve is labeled $y = x^3 - 3x + 3$.
- The lower curve is labeled $y = 2x^3 - 4x^2 + 3$.

The curves intersect at the origin (0,0) and at another point in the first quadrant. The region between the curves, starting from the origin and ending at their second intersection point, is shaded in light blue.

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

[3]

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[4]



[4]



[5]



- (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]

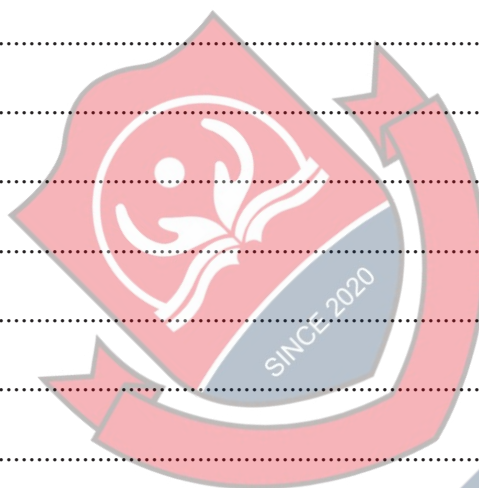


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- (c) Points A and B on the curve have x -coordinates 0.25 and 1 respectively. For a different value of k , the tangents to the curve at the points A and B meet at a point with x -coordinate 0.6.

Find this value of k .

[6]





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, featuring horizontal dotted lines. A large, faint watermark is visible across the center of the page, reading "4Uadmission" diagonally. Above the watermark is a red shield-shaped logo with a white stylized figure and the text "SINCE 2020".

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