



Cambridge International AS & A Level

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MATHEMATICS**9709/11**

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.

- [illegible]

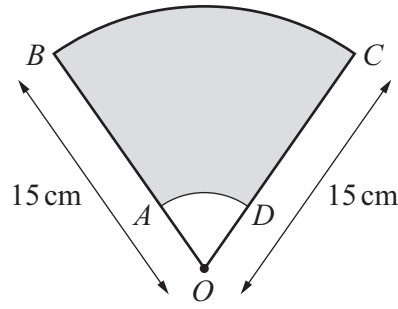
Find the values of the constants a and b .

[4]

[illegible]



3



The diagram shows a sector of a circle, centre O , where $OB = OC = 15$ cm. The size of angle BOC is $\frac{2}{5}\pi$ radians. Points A and D on the lines OB and OC respectively are joined by an arc AD of a circle with centre O . The shaded region is bounded by the arcs AD and BC and by the straight lines AB and DC . It is given that the area of the shaded region is $\frac{209}{5}\pi$ cm².

Find the perimeter of the shaded region. Give your answer in terms of π .

[5]

This image shows a full page of white paper with horizontal dotted 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.



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5 The equation of a curve is such that $\frac{dy}{dx} = 4x - 3\sqrt{x} + 1$.

(a) Find the x -coordinate of the point on the curve at which the gradient is $\frac{11}{2}$. [3]

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(b) Given that the curve passes through the point (4, 11), find the equation of the curve. [4]

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6 Circles C_1 and C_2 have equations

$$x^2 + y^2 + 6x - 10y + 18 = 0 \text{ and } (x-9)^2 + (y+4)^2 - 64 = 0$$

respectively.

(a) Find the distance between the centres of the circles.

[4]

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P and Q are points on C_1 and C_2 respectively. The distance between P and Q is denoted by d .

(b) Find the greatest and least possible values of d .

[3]

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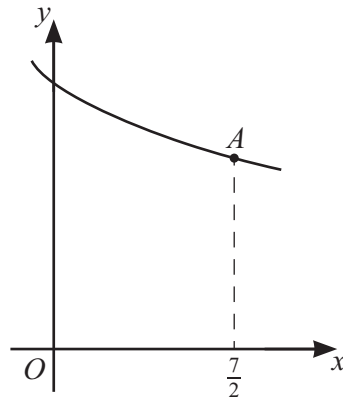
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The diagram shows part of the curve with equation $y = \frac{12}{\sqrt[3]{2x+1}}$. The point A on the curve has coordinates $\left(\frac{7}{2}, 6\right)$.

- (a) Find the equation of the tangent to the curve at A . Give your answer in the form $y = mx + c$. [4]

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 present.

[illegible]

- Express $\tan^2 \beta - 3 \sin \beta \cos \beta$ in terms of a . [3]

[illegible]



[5]

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(a) Find the set of values of x for which y decreases as x increases. [4]

[illegible]



[4]

[illegible]

- (a) Find the value of d .

[illegible]



- Find the value of $S_{77} - G_{10}$. [5]

[illegible]



11 The function f is defined by $f(x) = 3 + 6x - 2x^2$ for $x \in \mathbb{R}$.

- (a) Express $f(x)$ in the form $a - b(x - c)^2$, where a , b and c are constants, and state the range of f . [3]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school writing 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.

- (b)** The graph of $y = f(x)$ is transformed to the graph of $y = h(x)$ by a reflection in one of the axes followed by a translation. It is given that the graph of $y = h(x)$ has a minimum point at the origin.

Give details of the reflection and translation involved. [2]

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11

- (d)** Sketch the graph of $y = g^{-1}(x)$ on your diagram in **(c)**, and find an expression for $g^{-1}(x)$. You should label the two graphs in your diagram appropriately and show any relevant mirror line. [4]



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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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.
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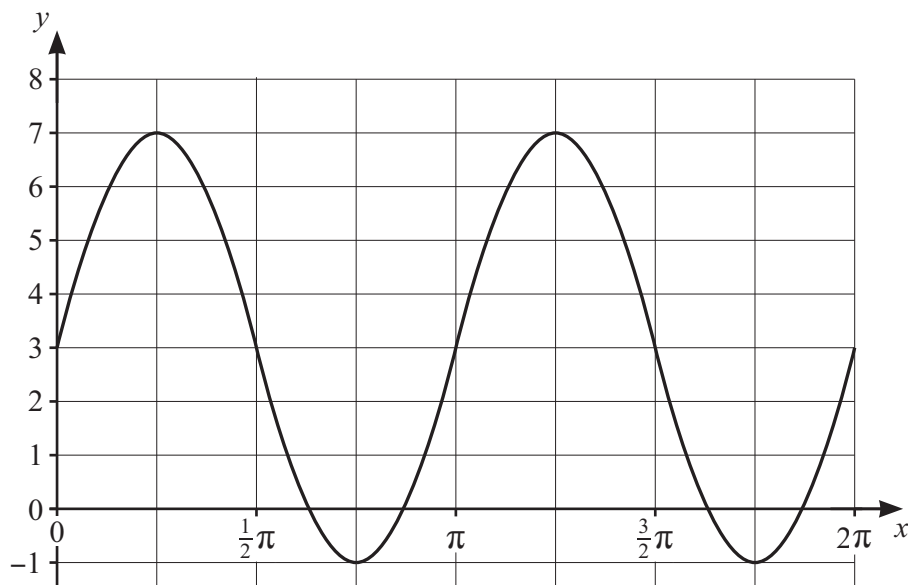
INFORMATION

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- 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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3 The equation of a curve is $y = 2x^2 - 3$. Two points A and B with x -coordinates 2 and $(2 + h)$ respectively lie on the curve.

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

This image shows a full page of white paper with ten horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the paper.

(b) Explain how the gradient of the curve at the point A can be deduced from the answer to part **(a)**, and state the value of this gradient. [2]

[illegible]



[illegible]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend 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]

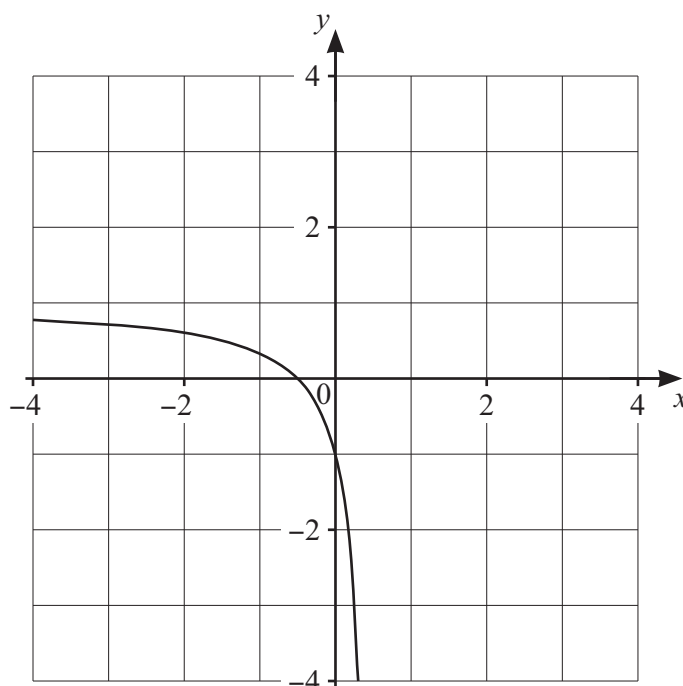
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(ii)



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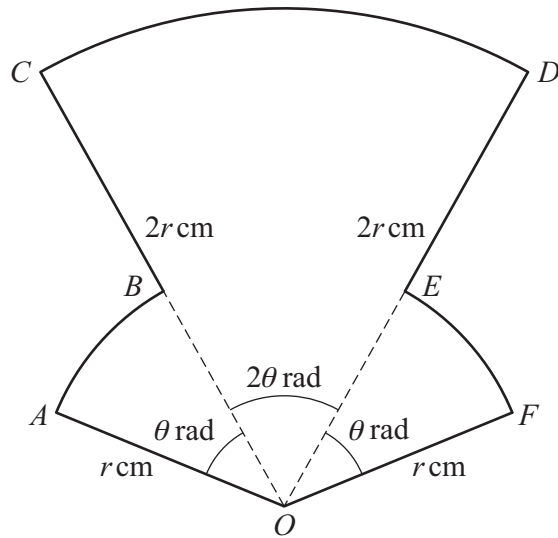
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The diagram shows a metal plate $OABCDEF$ consisting of sectors of two circles, each with centre O . The radii of sectors AOB and EOF are r cm and the radius of sector COD is $2r$ cm. Angle $AOB = \text{angle } EOF = \theta$ radians and angle $COD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

[illegible]

[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]

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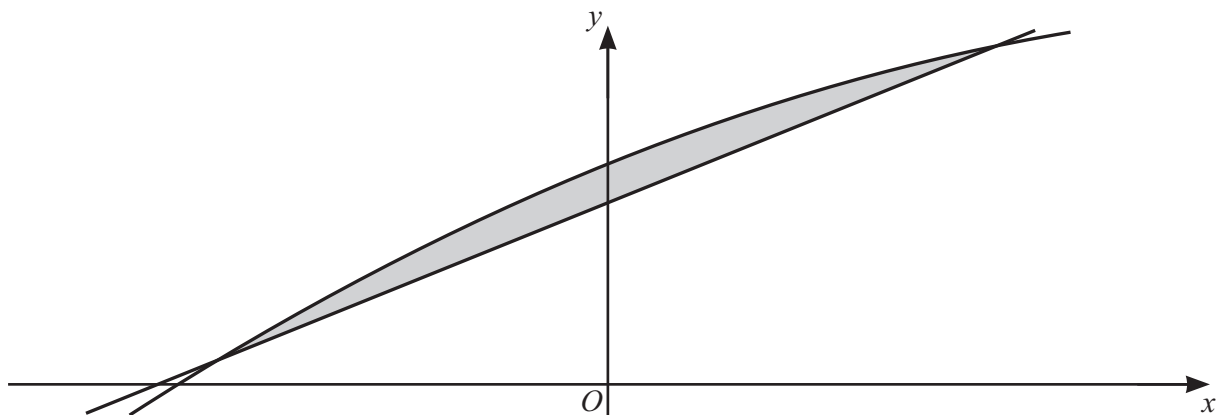
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(b)



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]

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- [illegible]

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[5]

[illegible]

[illegible]

[illegible]

[3]

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5

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

[illegible]

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

[illegible]



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MATHEMATICS

9709/13

Paper 1 Pure Mathematics 1

October/November 2024

1 hour 50 minutes

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- Find the 30th term of the progression.

[3]

[illegible]



[illegible]



- 3 (a) Find the coefficients of x^3 and x^4 in the expansion of $(3 - ax)^5$, where a is a constant. Give your answers in terms of a . [3]

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- (b) Given that the coefficient of x^4 in the expansion of $(ax + 7)(3 - ax)^5$ is 240, find the positive value of a . [3]

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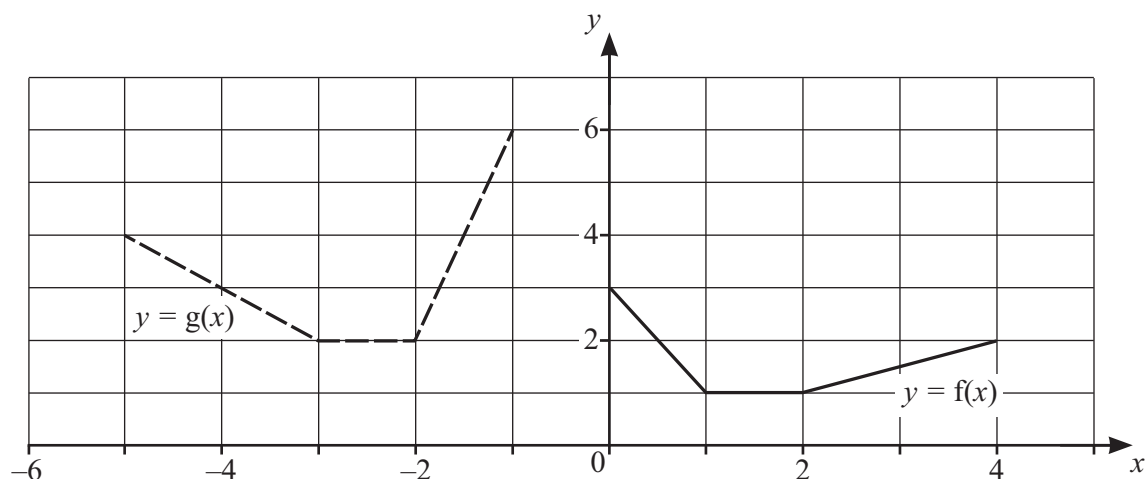
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[4]

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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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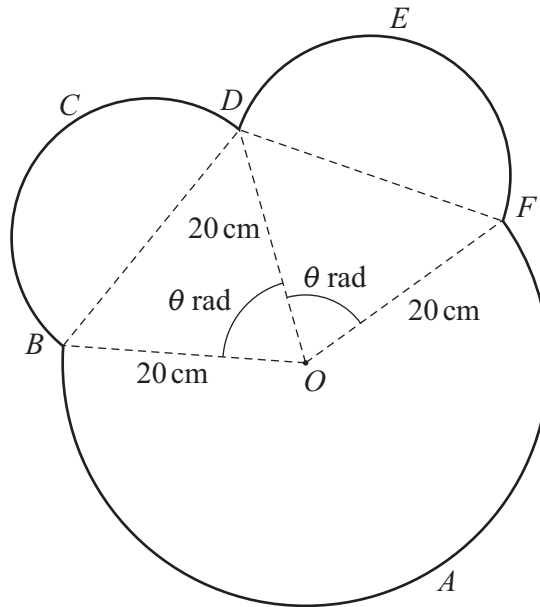




Find the two possible values of the sum to infinity.

[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]

[illegible]



- (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).

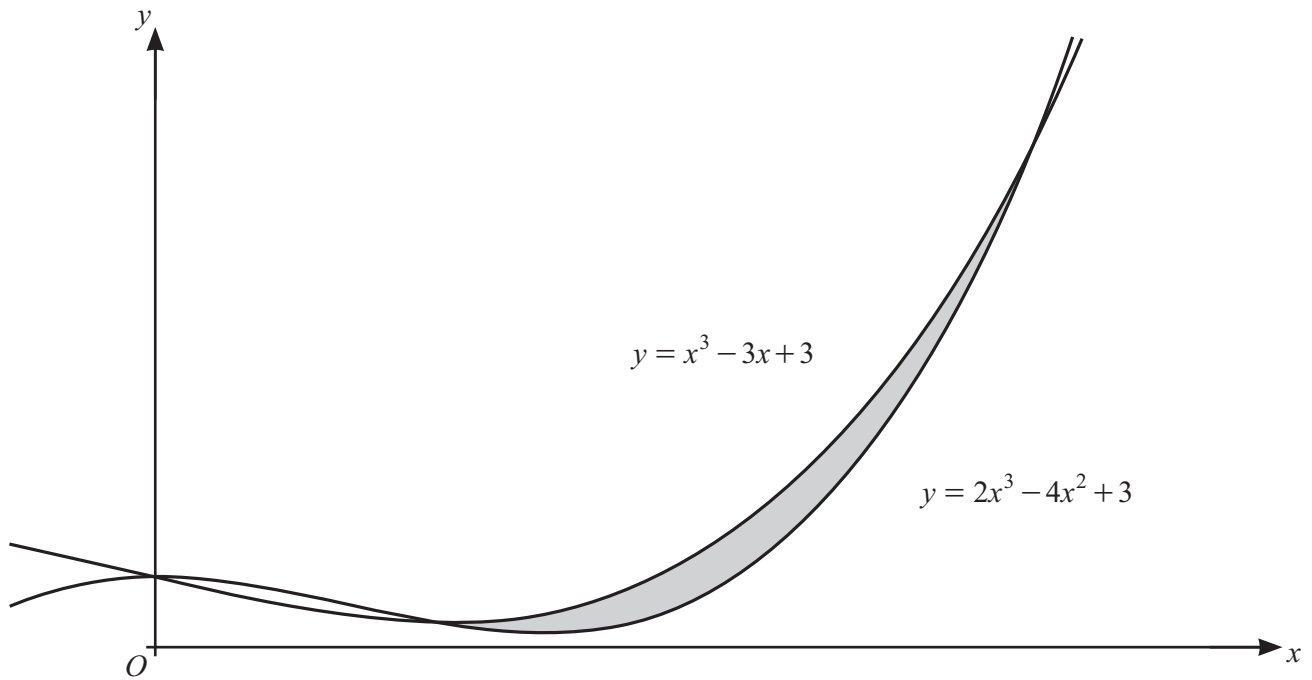
(c) Find an expression for $f^{-1}(x)$. [3]

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



[illegible]



[4]

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(a) Show that the centre of the circle lies on the line $y = \frac{1}{2}x - 4$. [4]

This image shows a full page of a worksheet designed for handwriting practice. It features approximately 20 evenly spaced horizontal dotted lines across the entire page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



[5]

This image shows a full page of white paper with horizontal dashed lines, typical of primary school handwriting practice 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.

- (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]

[illegible]



- Find this value of k .

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