

Section B (36 marks)

8 Fig. 8 shows part of the curve $y = x \cos 3x$.

The curve crosses the x -axis at O, P and Q.

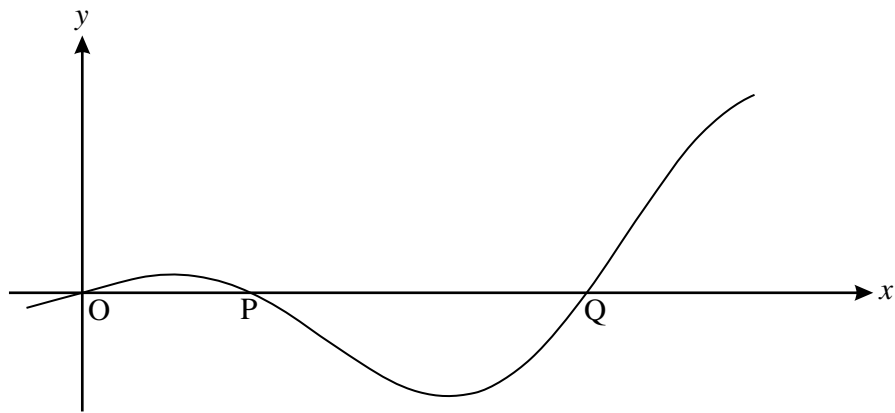


Fig. 8

(i) Find the exact coordinates of P and Q. [4]

(ii) Find the exact gradient of the curve at the point P.

Show also that the turning points of the curve occur when $x \tan 3x = \frac{1}{3}$. [7]

(iii) Find the area of the region enclosed by the curve and the x -axis between O and P, giving your answer in exact form. [6]

[Question 9 is printed overleaf.]

- 9 Fig. 9 shows the curve $y = f(x)$, where $f(x) = \frac{2x^2 - 1}{x^2 + 1}$ for the domain $0 \leq x \leq 2$.

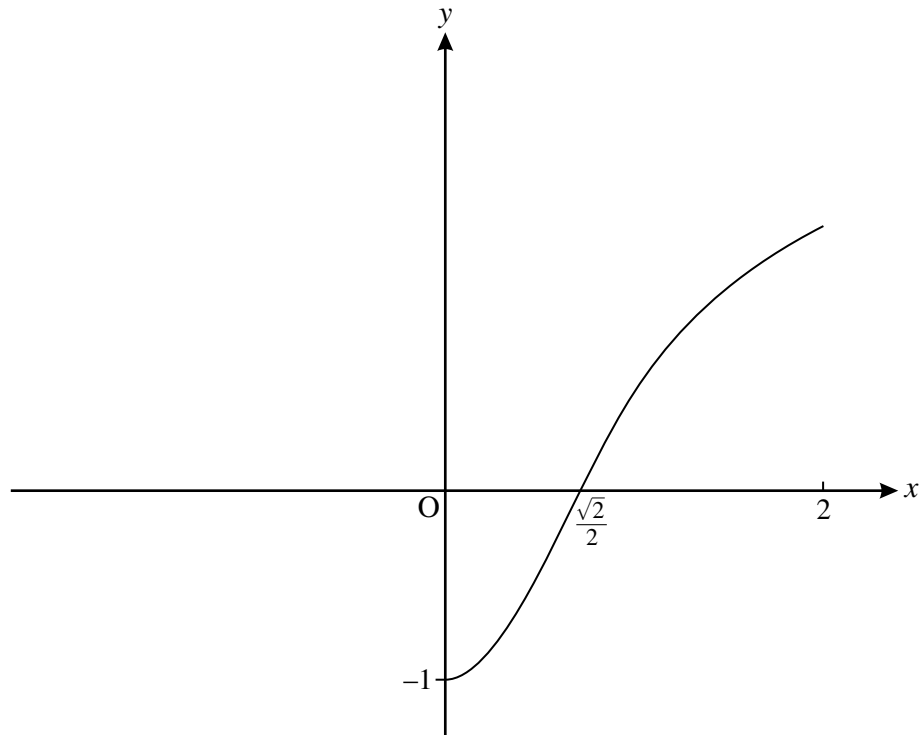


Fig. 9

- (i) Show that $f'(x) = \frac{6x}{(x^2 + 1)^2}$, and hence that $f(x)$ is an increasing function for $x > 0$. [5]
- (ii) Find the range of $f(x)$. [2]
- (iii) Given that $f''(x) = \frac{6 - 18x^2}{(x^2 + 1)^3}$, find the maximum value of $f'(x)$. [4]

The function $g(x)$ is the inverse function of $f(x)$.

- (iv) Write down the domain and range of $g(x)$. Add a sketch of the curve $y = g(x)$ to a copy of Fig. 9. [4]
- (v) Show that $g(x) = \sqrt{\frac{x+1}{2-x}}$. [4]

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