

FP1 Calculus Challenge

Challenge 1

Given that $f(x) = x^4 - 1$:

- (a) write down the value of $f(-1)$; *(1 mark)*
- (b) show that $f(-1 + h) = -4h + 6h^2 - 4h^3 + h^4$; *(3 marks)*
- (c) hence find the value of $f'(-1)$. *(2 marks)*



Challenge 2

The function f is defined for all real values of x by

$$f(x) = x^3 + x$$

- (a) Express $f(2 + h) - f(2)$ in the form

$$ph + qh^2 + rh^3$$

where p , q and r are integers.

(5 marks)

- (b) Use your answer to part (a) to find the value of $f'(2)$.

(2 marks)



Challenge 3

For each of the following improper integrals, find the value of the integral **or** explain briefly why it does not have a value:

(a) $\int_2^{\infty} 8x^{-3} dx;$ *(3 marks)*

(b) $\int_2^{\infty} (8x^{-3} + 1) dx;$ *(1 mark)*

(c) $\int_2^{\infty} 8x^{-3}(x + 1) dx.$ *(3 marks)*

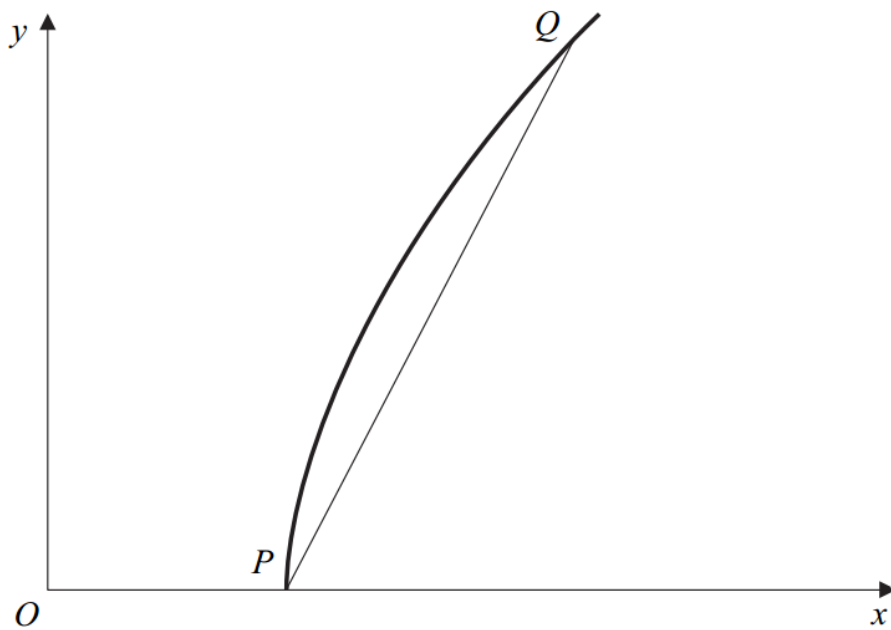


Final Challenge

The diagram shows a part of the curve

$$\frac{x^2}{4} - \frac{y^2}{6} = 1$$

and a chord PQ of the curve, where P lies on the x -axis.



- (a) Write down the coordinates of P . (1 mark)
- (b) The gradient of the chord PQ is 2. Find the coordinates of Q . (7 marks)

