

### Problem 3

Find  $f'(x)$  (Power Rule)

$$f(x) = 3x^{2025} - \frac{3x^2}{5} + x - \sqrt{x} + \frac{\sqrt[3]{x}}{4} + \frac{1}{x} - \frac{1}{x^4} + 1$$

(Rewrite  $f(x)$ )  $f(x) = 3x^{2025} - \frac{3x^2}{5} + x - x^{1/2} + \frac{x^{1/3}}{4} + x^{-1} - x^{-4} + 1$

(taking derivative)

$$\Rightarrow f'(x) = 3 \cdot 2025 \cdot x^{2024} - \frac{3 \cdot 2 \cdot x^{2-1}}{5} + 1 - \frac{1}{2} x^{1/2-1} + \frac{\frac{1}{3} x^{\frac{1}{3}-1}}{4} - 1 \cdot x^{-1-1} - (-4) x^{-4-1}$$

$$= 6075 x^{2024} - \frac{6x}{5} + 1 - \frac{1}{2} x^{-1/2} + \frac{\frac{1}{3} x^{-2/3}}{4} - x^{-2} + 4 x^{-5}$$

### Problem 4

Find  $f'(x)$  (Product Rule)

$$f(x) = x^2 e^x$$

$$f'(x) = (x^2)' \cdot e^x + (e^x)' \cdot x^2$$

$$= 2x e^x + e^x \cdot x^2$$

## Problem 5

Find  $f'(x)$  and simplify (Quotient Rule)

$$\frac{x^2 + 1}{x^2 - 1}$$

$$f'(x) = \frac{(x^2 + 1)' \cdot (x^2 - 1) - (x^2 - 1)' \cdot (x^2 + 1)}{(x^2 - 1)^2}$$

$$= \frac{2x(x^2 - 1) - 2x(x^2 + 1)}{(x^2 - 1)^2}$$

$$= \frac{2x^3 - 2x - 2x^3 - 2x}{(x^2 - 1)^2}$$

$$= \frac{-4x}{(x^2 - 1)^2}$$