

Problem 3

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

$$f(x) = 2x^{10} - \frac{2x^2}{3} + x - \sqrt{x} + \frac{\sqrt[4]{x}}{3} + \frac{1}{x} - \frac{1}{x^5} + 10$$

(Rewrite $f(x)$) $f(x) = 2x^{10} - \frac{2x^2}{3} + x - x^{1/2} + \frac{x^{1/4}}{3} + x^{-1} - x^{-5} + 10$

(taking derivative)

$$\Rightarrow f'(x) = 2 \cdot 10 \cdot x^{10-1} - \frac{2}{3} \cdot 2x^{2-1} + 1 - \frac{1}{2}x^{1/2-1} + \frac{1/4 x^{1/4-1}}{3} - 1 \cdot x^{-1-1} + 5x^{-5-1}$$

$$= 20x^9 - \frac{4}{3}x + 1 - \frac{1}{2}x^{-1/2} + \frac{1/4 x^{-3/4}}{3} - x^{-2} + 5x^{-6}$$

Problem 4

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

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

$$f'(x) = (x^3)' \cdot 3^x + (3^x)' \cdot x^3$$

$$= 3x^2 \cdot 3^x + 3^x \cdot (\ln 3) \cdot x^3$$

Problem 5

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

$$\frac{x^9 + 1}{x^9 - 1}$$

$$f'(x) = \frac{(x^9 + 1)' \cdot (x^9 - 1) - (x^9 - 1)' \cdot (x^9 + 1)}{(x^9 - 1)^2}$$

$$= \frac{9x^8(x^9 - 1) - 9x^8(x^9 + 1)}{(x^9 - 1)^2}$$

$$= \frac{\cancel{9x^{17}} - 9x^8 - \cancel{9x^{17}} - 9x^8}{(x^9 - 1)^2}$$

$$= \frac{-18x^8}{(x^9 - 1)^2}$$