(*) Scalar multiplication rule.

$$[s \cdot f(x)]' = s \cdot f'(x)$$

s: scalar

Example:

$$(x^{10})' = 10x^9$$

$$(23x^{10})' = 23(x^{10})'$$

$$= 23 \cdot 10 x^9$$

$$= 230 x^9$$

(*) Addition / subtraction Rule:

$$[f(x) + g(x)]' = f'(x) + g'(x)$$

$$[f(x) - g(x)]' = f'(x) - g'(x)$$

Examples: Find $f'(x)$

(1) $f(x) = x^{10} + x^9 + 7x + 2$

$f'(x) = 10x^9 + 9x^8 + 7$

(2) $f(x) = \frac{x^6}{5} + 2x^4 - 7x - 20$

$f'(x) = \frac{6x^5}{5} + 2 \cdot 4x^3 - 7$

$f'(x) = \frac{6x^5}{5} + 8x^3 - 7$

(3) $f(x) = \frac{x}{3} + \frac{2x^5}{7} + 2x^{100} - x^2 + 1000$

$f'(x) = \frac{1}{3} + \frac{2 \cdot 5 x^4}{7} + 2 \cdot 100 x^{99} - 2x$

$= \frac{1}{3} + \frac{10x^4}{7} + 200x^{99} - 2x$

Assignment 13 – Part 1:

① $f(x) = 2x^7 + 4x^6 - 9x^{10} + 7x + 201$

② $f(x) = \frac{x^2}{4} + \frac{2x^6}{5} + \frac{2x}{3} + 20$

③ $f(x) = 7x^9 - 6x^3 + \frac{4x^3}{5} + 20x + 9$

④ $f(x) = 6x^2 + 7x^3 - 8x^4 + \frac{x^3}{9} + \frac{2x^6}{7} - 7x + 6$

Example:

① $f(x) = \frac{1}{x^2} + \frac{1}{x^3} + \frac{2}{x^4} + \frac{6}{x^9} + 7x + 3$

$f(x) = x^{-2} + x^{-3} + 2x^{-4} + 6x^{-9} + 7x + 3$

$f'(x) = -2x^{-2-1} - 3x^{-3-1} + 2(-4)\cdot x^{-4-1} + 6\cdot(-9)\cdot x^{-9-1} + 7$

$f'(x) = -2x^{-3} - 3x^{-4} - 8x^{-5} - 54x^{-10} + 7$

② $f(x) = \sqrt{x} + 3\cdot\sqrt[7]{x} - 6\sqrt[3]{x} + \frac{2x}{5} + x^{10} + 7$

$f(x) = x^{1/2} + 3\cdot x^{1/7} - 6x^{1/3} + \frac{2x}{5} + x^{10} + 7$

$f'(x) = \frac{1}{2}x^{1/2-1} + 3\cdot\frac{1}{7}x^{1/7-1} - 6\cdot\frac{1}{3}x^{1/3-1} + \frac{2}{5} + 10x^9$

$$f(x) = \frac{1}{2}x^{-1/2} + \frac{3}{7}x^{-6/7} - 2x^{-2/3} + \frac{2}{5} + 10x^{9}$$

Assignment 13 – Part 2. Find $f'(x)$

(1) $f(x) = 6\sqrt{x} + 6x^{2} + 7\sqrt[10]{x} - \frac{\sqrt[3]{x}}{4} + x + 1$

(2) $f(x) = 9x^{3} + \frac{1}{x^{2}} + \frac{3}{x^{10}} + \frac{6}{x^{4}} - 7x + 1$

(3) $f(x) = 6x + \frac{2x^{3}}{3} + \frac{2}{3x^{3}} + \frac{\sqrt[3]{x}}{5} - 7x + 7$

(4) $f(x) = 9x^{2} + 7\sqrt{x} - \frac{1}{x^{3}} - 2x^{3} + 9x + 16$