$$\boxed{\text{Assignment 14}} \qquad \text{Find } f'(x)$$

①
$$f(x) = (x^3 + x^2) \cdot (x^4 + x^5)$$

$$f'(x) = (x^3 + x^2)' \cdot (x^4 + x^5) + (x^3 + x^2) \cdot (x^4 + x^5)'$$

$$= (3x^2 + 2x)(x^4 + x^5) + (x^3 + x^2) \cdot (4x^3 + 5x^4)$$

product

②
$$f(x) = (2x^4 + 6x + 1) \cdot (6x^4 + 3x^2 + 2024)$$

$$f'(x) = (2x^4 + 6x + 1)' \cdot (6x^4 + 3x^2 + 2024) + (2x^4 + 6x + 1) \cdot (6x^4 + 3x^2 + 2024)'$$

$$= (8x^3 + 6) \cdot (6x^4 + 3x^2 + 2024) + (2x^4 + 6x + 1) \cdot (24x^3 + 6x)$$

③
$$f(x) = (\sqrt{x} + 1) \cdot (2x^3 + x + 1)$$

$$f'(x) = (x^{1/2} + 1)' \cdot (2x^3 + x + 1) + (\sqrt{x} + 1)(2x^4 + x + 1)'$$

$$f'(x) = \frac{1}{2}x^{-1/2} \cdot (2x^3 + x + 1) + (\sqrt{x} + 1)(8x^3 + 1)$$

④ Do #1 not using the product rule.

$$f(x) = (x^3 + x^2) \cdot (x^4 + x^5)$$

$$f(x) = x^3 \cdot x^4 + x^3 \cdot x^5 + x^2 \cdot x^4 + x^2 \cdot x^5$$

$$f(x) = \underline{x^7} + x^8 + x^6 + \underline{x^7}$$

$$f(x) = x^8 + 2x^7 + x^6$$

$$\boxed{f'(x) = 8 \cdot x^7 + 14x^6 + 6x^5}$$

Rule 6 : Quotient Rule

$$\left[\frac{top}{bot} \right]' = \frac{(top)' \cdot bot - top \cdot (bot)'}{(bot)^2}$$

Quotient

Example :

① $$f(x) = \frac{3x + 1}{7x + 2}$$

$$\Rightarrow f'(x) = \frac{(3x+1)' \cdot (7x+2) - (3x+1) \cdot (7x+2)'}{(7x+2)^2}$$

$$f'(x) = \frac{3 \cdot (7x + 2) - (3x + 1) \cdot 7}{(7x + 1)^2} \qquad (\text{done taking derivative})$$

$$f'(x) = \frac{21x + 6 - 21x - 7}{(7x + 1)^2} \qquad \text{simplifying}$$

$$\boxed{f'(x) = \frac{-1}{(7x + 1)^2}}$$

② Find $f'(x)$ and simplify $f'(x)$

$$f(x) = \frac{x^2 + 2x}{x^2 + 7}$$

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

$$f'(x) = \frac{(2x + 2)(x^2 + 7) - (x^2 + 2x)(2x)}{(x^2 + 7)^2}$$

$$f'(x) = \frac{2x^3 + 14x + 2x^2 + 14 - 2x^3 - 4x^2}{(x^2 + 7)^2}$$

$$f'(x) = \frac{-2x^2 + 14x + 14}{(x^2 + 7)^2}$$

Assignment 15:

① Find $f'(x)$ (no need to simplify $f'(x)$)

(a) $f(x) = \dfrac{x^3 + x}{x^2 + 2x}$

(b) $f(x) = \dfrac{x^7 + x^6}{x^6 + 2x^5 + 2024}$

(c) $f(x) = \dfrac{x^3 + 3}{x + 3}$

(d) $f(x) = \dfrac{2x^6 + 2x}{2x^5 + 7}$

② Find $f'(x)$ and simplify $f'(x)$

(a) $f(x) = \dfrac{7x + 2}{6x + 9}$

(b) $f(x) = \dfrac{x^2 + 2}{x^2 + 3}$

(c) $f(x) = \dfrac{x^2 + 1}{x^3 + 2}$