

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

$$f'(x) = \frac{(x^2+3)(0) - (4)(2x)}{(x^2+3)^2}$$

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

$$3) f(x) = \ln(3x^5)$$

$$f'(x) = \frac{1}{3x^5} \cdot (15x^4)$$

$$= \frac{5}{x} = 5x^{-1}$$

$$6) f(x) = (\ln x)^3$$

$$f'(x) = 3(\ln x)^2 \left(\frac{1}{x} \right) = \frac{3(\ln x)^2}{x}$$

$$10) f(x) = e^{4x^3}$$

$$f'(x) = 12x^2 e^{4x^3}$$

$$= e^{4x^3} \cdot \frac{d}{dx}(4x^3)$$

$$= e^{4x^3} \cdot 12x^2$$

$$= 12x^2 e^{4x^3}$$

more Chain rule examples

Ex 1) use the chain rule to find the derivative of $f(x) = \frac{1}{x^2+1}$

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

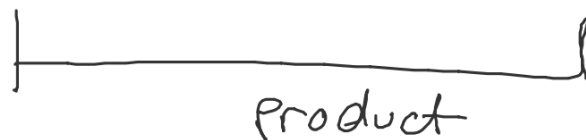
$$f'(x) = -1(x^2+1)^{-2} \cdot (2x)$$

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

Ex 2 $f(x) = x \sqrt{1-x^2} = x \underbrace{(1-x^2)^{1/2}}_{\text{and}}$

Product Rule: first, der 2nd + 2nd der 1st
is necessary

$$f(x) = \underbrace{x \cdot \frac{1}{2}(1-x^2)^{-1/2}(-2x)}_{\text{chain}} + (1-x^2)^{1/2}(1)$$



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

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

$$\underline{\text{Ex 3}} \quad f(x) = e^{2(3x-1)^4}$$

$$f'(x) = e^{2(3x-1)^4} \cdot 8(3x-1)^3 \cdot 3$$

$$= 3 e^{2(3x-1)^4} \cdot 8(3x-1)^3$$

$$= 24 e^{2(3x-1)^4} \cdot (3x-1)^3$$

Ex4) $f(x) = \ln\left(\frac{x}{x^2+1}\right)$

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

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

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

.Hw 7L P219 1,4,5-7,11-13

$$\frac{4}{\frac{1}{2}} = 8$$