§ 3.6, Derivatives of logrithmic Functions

- $f(x) = \ln(x)$. what is $f'(x)$.

$$y = \ln(x) \iff x = e^y \iff [x]' = [e^y]'$$

$$\iff 1 = e^y \cdot y'$$

$$y' = \frac{1}{e^y} = \frac{1}{x}$$

$$\boxed{[\ln(x)]' = \frac{1}{x}}, \quad a>0 \quad [\log_a(x)]' = \frac{1}{x \cdot \ln(a)}$$

- $$[\ln(x^2+x)]' = \frac{1}{x^2+x}[x^2+x]' = \frac{2x+1}{x^2+x}$$

$$[x^2 \cdot \ln(x)]' = [x^2]' \ln(x) + x^2 [\ln(x)]'$$

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

$$= 2x \ln(x) + x = x(2\ln(x) + 1)$$

$$[\ln(10x)]' = \frac{1}{10x}[10x]' = \frac{10}{10x} = \frac{1}{x}$$

- $$[\ln(2x)]' = \frac{1}{2x}[2x]' = \frac{2}{2x} = \frac{1}{x}$$

$$[\ln(c \cdot x)]' = [\ln(c) + \ln(x)]' = 0 + \frac{1}{x} = \boxed{\frac{1}{x}}$$