

$$f(x) = a^x \quad \left(e^{\ln b} = b \text{ se } b = a^x \Rightarrow e^{\ln(a^x)} = a^x \right)$$

$$f(x) = a^x = e^{\ln(a^x)} = e^{x \ln(a)}$$

$$f'(x) = e^{x \ln(a)} \cdot \ln(a) = a^x \ln(a)$$

Se $f(x) = a^x$ $f'(x) = a^x \ln a$

Se $y = \log_a x \Leftrightarrow a^y = x$

$$a^y \ln(a) \cdot y' = 1 \Rightarrow y' = \frac{1}{a^y \ln a} = \frac{1}{x \ln a}$$

$$\frac{d}{dx} (\log_a x) = \frac{1}{x \ln a}$$

$y = \log_2(x) \Rightarrow y' = \frac{1}{x \ln 2}$

$y = \ln(x) = \log_e(x) \Rightarrow y' = \frac{1}{x \ln(e)} = \frac{1}{x}$

$$\frac{d}{dx} \ln(x) = \frac{1}{x}$$

$y = \ln(3x^2 + 1) \Rightarrow y' = \frac{1}{3x^2 + 1} \cdot 3 \cdot 2x = \frac{6x}{3x^2 + 1}$

$y = \ln(f(x)) \Rightarrow y' = \frac{1}{f(x)} \cdot f'(x) = \frac{f'(x)}{f(x)}$

$y = \ln(\sin x) \Rightarrow y' = \frac{\cos x}{\sin x}$

$y = \ln|x|$

se $x > 0 \Rightarrow y = \ln x \Rightarrow y' = \frac{1}{x}$

se $x < 0 \Rightarrow y = \ln(-x) \Rightarrow y' = \frac{1}{-x} \cdot -1 = \frac{1}{x}$

$$\frac{d}{dx} (\ln|x|) = \frac{1}{x}$$