Logarithmic Derivatives

(1)

$$y = \ln x = \log_e x$$

$$e^y = x$$

$$e^y \cdot \frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{e^y} = \frac{1}{x}$$

(2)

$$y = \log_a x = \frac{\ln x}{\ln a}$$

$$\frac{dy}{dx} = \frac{1}{\ln a} \cdot \frac{1}{x} = \frac{1}{x \ln a}$$

(3)

$$y = x^n$$

$$\ln y = \ln x^n = n \ln x$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{n}{x}$$

$$\frac{dy}{dx} = \frac{ny}{x} = \frac{nx^n}{x} = nx^{n-1}$$