

Rules of Differentiation

Constant Multiple Rule

$$\frac{d}{dx} c f(x) = c \frac{d}{dx} f(x) = c f'(x)$$

Sum Rule

$$\frac{d}{dx} (f(x) + g(x)) = \frac{d}{dx} f(x) + \frac{d}{dx} g(x)$$

Product Rule

$$\frac{d}{dx} (f(x) \cdot g(x)) = \left(\frac{d}{dx} f(x) \right) \cdot g(x) + f(x) \cdot \left(\frac{d}{dx} g(x) \right)$$

Quotient Rule

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{g(x)f'(x) - f(x)g'(x)}{(g(x))^2}$$

Chain Rule

$$\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$$

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Rules for specific functions

Power Rule

$$\frac{d}{dx} u^n = n u^{n-1} \frac{du}{dx}$$

Exponential

$$\frac{d}{dx} \exp(u) = \exp(u) \frac{du}{dx}$$

Logarithm

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

Trig functions

$$\begin{aligned} \frac{d}{dx} \sin(u) &= \cos(u) \frac{du}{dx} \\ \frac{d}{dx} \cos(u) &= -\sin(u) \frac{du}{dx} \end{aligned}$$