Table of Fundamental Derivatives

In the following tables, $u = u(x)$ and $v = v(x)$ are differentiable functions in x; c and p are *Real* constants; a is a positive *Real* exponent/logarithm base, $a \neq 1$.

Derivative Rules: Arithmetic and Composite (Chain Rule)

$$\frac{d}{dx}c = 0 \quad (\textit{Constant Rule})$$

$$\frac{d}{dx}cu = c\frac{du}{dx} \quad (\textit{Constant Multiplier Rule})$$

$$\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx} \quad (\textit{Sum Rule})$$

$$\frac{d}{dx}(u-v) = \frac{du}{dx} - \frac{dv}{dx} \quad (\textit{Difference Rule})$$

$$\frac{d}{dx}uv = u\frac{dv}{dx} + v\frac{du}{dx} \quad (\textit{Product Rule})$$

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2} \quad (\textit{Quotient Rule})$$

$$\frac{d}{dx}u\big(v(x)\big) = \frac{du}{dv}\cdot\frac{dv}{dx} = u'\big(v(x)\big)\cdot v'(x) \quad (\textit{Chain Rule for a Composite Function})$$

Derivatives of Basic Function Types (includes Chain Rule)

(Hyperbolic Functions not included)

$$\frac{d}{dx}u^p = pu^{p-1}\cdot\frac{du}{dx} \quad (\textit{Power Rule}, p \textit{ Real})$$

$$\frac{d}{dx}e^u = e^u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}a^u = a^u\ln a\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\ln|u| = \frac{1}{u}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\log_a|u| = \frac{1}{u\ln a}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}|u| = \frac{|u|}{u}\cdot\frac{du}{dx} \quad (\textit{note: } |u| = \sqrt{u^2})$$

$$\frac{d}{dx}\sin u = \cos u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cos u = -\sin u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\tan u = \sec^2 u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\csc u = -\csc u\cot u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\sec u = \sec u\tan u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cot u = -\csc^2 u\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\sin^{-1} u = \frac{1}{\sqrt{1-u^2}}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cos^{-1} u = -\frac{1}{\sqrt{1-u^2}}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\tan^{-1} u = \frac{1}{1+u^2}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\csc^{-1} u = -\frac{1}{|u|\sqrt{u^2-1}}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\sec^{-1} u = \frac{1}{|u|\sqrt{u^2-1}}\cdot\frac{du}{dx}$$

$$\frac{d}{dx}\cot^{-1} u = -\frac{1}{1+u^2}\cdot\frac{du}{dx}$$