Basic Derivatives Rules

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

Constant Multiple Rule: $\frac{d}{dx}\left[cf(x)\right] = cf'(x)$

Power Rule: $\frac{d}{dx}(x^n) = nx^{n-1}$

Sum Rule: $\frac{d}{dx}\left[f(x) + g(x)\right] = f'(x) + g'(x)$

Difference Rule: $\frac{d}{dx}\left[f(x) - g(x)\right] = f'(x) - g'(x)$

Product Rule: $\frac{d}{dx}\left[f(x)g(x)\right] = f(x)g'(x) + g(x)f'(x)$

Quotient Rule: $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{\left[g(x)\right]^2}$

Chain Rule: $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$

Derivative Rules

Exponential Functions

$$\frac{d}{dx}\left(e^{x}\right) = e^{x}$$

$$\frac{d}{dx}\left(a^{x}\right) = a^{x}\ln a$$

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

$$\frac{d}{dx}\left(a^{g(x)}\right) = \ln(\mathrm{a})\,\mathrm{a}^{g(x)}\,g'(x)$$

Logarithmic Functions

$$\frac{d}{dx}(\ln x) = \frac{1}{x},\ x > 0$$

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

$$\frac{d}{dx}\left(\log_a x\right) = \frac{1}{x\ln a},\ x > 0$$

$$\frac{d}{dx}\left(\log_a g(x)\right) = \frac{g'(x)}{g(x)\ln a}$$

Trigonometric Functions

$$\frac{d}{dx}(\sin x) = \cos x$$

$$\frac{d}{dx}(\cos x) = -\sin x$$

$$\frac{d}{dx}(\tan x) = \sec^2 x$$

$$\frac{d}{dx}(\csc x) = -\csc x\cot x$$

$$\frac{d}{dx}(\sec x) = \sec x\tan x$$

$$\frac{d}{dx}(\cot x) = -\csc^2 x$$

Inverse Trigonometric Functions

$$\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}},\ x \neq \pm 1$$

$$\frac{d}{dx}\left(\cos^{-1} x\right) = \frac{-1}{\sqrt{1-x^2}},\ x \neq \pm 1$$

$$\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$$

$$\frac{d}{dx}\left(\cot^{-1} x\right) = \frac{-1}{1+x^2}$$

$$\frac{d}{dx}\left(\sec^{-1} x\right) = \frac{1}{x\sqrt{x^2-1}},\ x \neq \pm 1, 0$$

$$\frac{d}{dx}\left(\csc^{-1} x\right) = \frac{-1}{x\sqrt{x^2-1}},\ x \neq \pm 1, 0$$

Hyperbolic Functions

$$\frac{d}{dx}(\sinh x) = \cosh x$$

$$\frac{d}{dx}(\cosh x) = \sinh x$$

$$\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$$

$$\frac{d}{dx}(\operatorname{csch} x) = -\operatorname{csch} x\coth x$$

$$\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x\tanh x$$

$$\frac{d}{dx}(\coth x) = -\operatorname{csch} x$$

Inverse Hyperbolic Functions

$$\frac{d}{dx}\left(\sinh^{-1} x\right) = \frac{1}{\sqrt{1+x^2}}$$

$$\frac{d}{dx}\left(\cosh^{-1} x\right) = \frac{1}{\sqrt{x^2-1}},\ x > 1$$

$$\frac{d}{dx}\left(\tanh^{-1} x\right) = \frac{1}{1-x^2},\ |x| < 1$$

$$\frac{d}{dx}\left(\operatorname{csch}^{-1} x\right) = \frac{-1}{|x|\sqrt{1-x^2}},\ x \neq 0$$

$$\frac{d}{dx}\left(\operatorname{sech}^{-1} x\right) = \frac{-1}{x\sqrt{1-x^2}},\ 0 < x < 1$$

$$\frac{d}{dx}\left(\coth^{-1} x\right) = \frac{1}{1-x^2},\ |x| > 1$$