Derivatives

Basic Properties/Formulas/Rules

$\frac{d}{dx}\left(cf(x)\right) = cf'(x)$, c is any constant.

$\left(f(x) \pm g(x)\right)' = f'(x) \pm g'(x)$

$\frac{d}{dx}\left(x^n\right) = nx^{n-1}$, n is any number.

$\frac{d}{dx}(c) = 0$, c is any constant.

$(fg)' = f'g + fg'$ – **(Product Rule)**

$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$ – **(Quotient Rule)**

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

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

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

Common Derivatives

Polynomials

$\frac{d}{dx}(c) = 0$ $\quad \frac{d}{dx}(x) = 1$ $\quad \frac{d}{dx}(cx) = c$ $\quad \frac{d}{dx}\left(x^n\right) = nx^{n-1}$ $\quad \frac{d}{dx}\left(cx^n\right) = ncx^{n-1}$

Trig Functions

$\frac{d}{dx}(\sin x) = \cos x$ $\quad \frac{d}{dx}(\cos x) = -\sin x$ $\quad \frac{d}{dx}(\tan x) = \sec^2 x$

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

Inverse Trig Functions

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

$\frac{d}{dx}\left(\sec^{-1} x\right) = \frac{1}{|x|\sqrt{x^2-1}}$ $\quad \frac{d}{dx}\left(\csc^{-1} x\right) = -\frac{1}{|x|\sqrt{x^2-1}}$ $\quad \frac{d}{dx}\left(\cot^{-1} x\right) = -\frac{1}{1+x^2}$

Exponential/Logarithm Functions

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

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

Hyperbolic Trig Functions

$\frac{d}{dx}(\sinh x) = \cosh x$ $\quad \frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$ $\quad \frac{d}{dx}(\cosh x) = \sinh x\, dx$

