Derivative Rules w/respect to x

Constant rule: $\frac{d}{dx}[c] = 0,$ c is a constant.

Power rule: $\frac{d}{dx}[x^n] = nx^{n-1}$

Constant times a function: $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Sums and differences: $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$

Reciprocal Rule: $\frac{d}{dx}\left[\frac{1}{g(x)}\right] = \frac{-\frac{d}{dx}[g(x)]}{[g(x)]^2}$

Square Root Rule: $\frac{d}{dx}\left[\sqrt{x}\right] = \frac{1}{2\sqrt{x}}$

Trigonometric Functions:

$\frac{d}{dx}[\sin x] = \cos x$ $\quad$ $\frac{d}{dx}[\cos x] = -\sin x$

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

$\frac{d}{dx}[\sec x] = \sec x \tan x$ $\quad$ $\frac{d}{dx}[\csc x] = -\csc x \cot x$

Exponential Rules:

$\frac{d}{dx}[e^x] = e^x$

$\frac{d}{dx}[b^x] = b^x \ln b$ ***NEW***

Logarithmic Rules:

$\frac{d}{dx}[\ln x] = \frac{1}{x}$

$\frac{d}{dx}[\log_b x] = \frac{1}{x(\ln b)}$

Product rule: $\frac{d}{dx}[f(x) \cdot g(x)] = f(x) \cdot \frac{d}{dx}[g(x)] + g(x) \cdot \frac{d}{dx}[f(x)]$

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

Inverse Trigonometric Functions:

$$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}[\arccos x] = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2}$$

$$\frac{d}{dx}[\operatorname{arccot} x] = \frac{-1}{1+x^2}$$

$$\frac{d}{dx}[\operatorname{arcsec} x] = \frac{1}{|x|\sqrt{x^2-1}}$$

$$\frac{d}{dx}[\operatorname{arccsc} x] = -\frac{1}{|x|\sqrt{x^2-1}}$$

Chain Rule: General Derivative Rules w/respect to u

Power rule: $\frac{d}{dx}[u^n] = nu^{n-1}$

Reciprocal Rule: $\frac{d}{dx}\left[\frac{1}{u}\right] = -\frac{\frac{d}{dx}[u]}{[u]^2} \cdot u'$

Square Root Rule: $\frac{d}{dx}\left[\sqrt{u}\right] = \frac{1}{2\sqrt{u}} \cdot u'$

Trigonometric Functions:

$\frac{d}{dx}[\sin u] = (\cos u) \cdot u'$

$\frac{d}{dx}[\cos u] = (-\sin u) \cdot u'$

$\frac{d}{dx}[\tan u] = (\sec^2 u) \cdot u'$

$\frac{d}{dx}[\cot u] = (-\csc^2 u) \cdot u'$

$\frac{d}{dx}[\sec u] = (\sec u \tan u) \cdot u'$

$\frac{d}{dx}[\csc u] = (-\csc u \cot u) \cdot u'$

Exponential Rules:

$\frac{d}{dx}[e^u] = e^u \cdot u'$

$\frac{d}{dx}[b^u] = b^u \cdot (\ln b)u'$

Logarithmic Rules:

$\frac{d}{dx}[\ln u] = \frac{1}{u} \cdot u', u > 0$

$\frac{d}{dx}[\log_b u] = \frac{1}{u \cdot (\ln b)} \cdot u'$

Inverse Trigonometric Functions:

$\frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}}$

$\frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$

$\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$

$\frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$

$\frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}}$

$\frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$