DERIVATIVE FORMULAS

Constant Rule
$$\frac{d}{dx}[c] = 0$$

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

Sum Rule
$$\frac{d}{dx}[u+v] = u' + v'$$

Difference Rule
$$\frac{d}{dx}[u-v] = u' - v'$$

Product Rule
$$\frac{d}{dx}[uv] = u'v + uv'$$

Quotient Rule
$$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{u'v - uv'}{v^2}$$

WITHOUT CHAIN RULE

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

$$\frac{d}{dx}[cx^n] = cnx^{n-1}$$

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

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

Logarithmic
$$\frac{d}{dx}[\log_a x] = \frac{1}{\ln a} \cdot \frac{1}{x}$$

Absolute Value
$$\frac{d}{dx}[|x|] = \frac{x}{|x|}$$

Trig Functions

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

Inverse Trig Functions

$$\frac{d}{dx}[\sin^{-1} x] = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}[\csc^{-1} x] = \frac{-1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}[\cos^{-1} x] = \frac{-1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}[\sec^{-1} x] = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}[\tan^{-1} x] = \frac{1}{1+x^2} \qquad \frac{d}{dx}[\cot^{-1} x] = \frac{-1}{1+x^2}$$

WITH CHAIN RULE

Chain Rule
$$\frac{d}{dx}[u^n] = nu^{n-1}u'$$

$$\frac{d}{dx}[cu^n] = cnu^{n-1}u'$$

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

Natural Log
$$\frac{d}{dx}[\ln u] = \frac{1}{u}u'$$

Logarithmic
$$\frac{d}{dx}[\log_a u] = \frac{1}{\ln a} \cdot \frac{1}{u} \cdot u'$$

Absolute Value
$$\frac{d}{dx}[|u|] = \frac{u}{|u|}u'$$

Trig Functions

$$\frac{d}{dx}[\sin u] = (\cos u)u' \qquad \frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$$
$$\frac{d}{dx}[\cos u] = -(\sin u)u' \qquad \frac{d}{dx}[\sec u] = (\sec u \tan u)u'$$
$$\frac{d}{dx}[\tan u] = (\sec^2 u)\,u' \qquad \frac{d}{dx}[\cot u] = -(\csc^2 u)u'$$

Inverse Trig Functions

$$\frac{d}{dx}[\sin^{-1} u] = \frac{u'}{\sqrt{1-u^2}} \qquad \frac{d}{dx}[\csc^{-1} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$$
$$\frac{d}{dx}[\cos^{-1} u] = \frac{-u'}{\sqrt{1-u^2}} \qquad \frac{d}{dx}[\sec^{-1} u] = \frac{u'}{|u|\sqrt{u^2-1}}$$
$$\frac{d}{dx}[\tan^{-1} u] = \frac{u'}{1+u^2} \qquad \frac{d}{dx}[\cot^{-1} u] = \frac{-u'}{1+u^2}$$