

Limits of Trig Functions

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = \lim_{x \rightarrow 0} \frac{x}{\sin x} = 1$$

$$\lim_{x \rightarrow 0} \frac{\cos x - 1}{x} = \lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 0$$

Derivatives of Trig Functions

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

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

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

Derivatives of Inverse Trig Functions

$$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}(\csc^{-1} x) = -\frac{1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$$

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

General Derivative Rules

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

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

Multiple Rule : $\frac{d}{dx}(cf(x)) = c \frac{d}{dx} f(x)$

Sum Rule : $\frac{d}{dx}(f(x) + g(x)) = \frac{d}{dx}(f(x)) + \frac{d}{dx}(g(x))$

Difference Rule : $\frac{d}{dx}(f(x) - g(x)) = \frac{d}{dx}(f(x)) - \frac{d}{dx}(g(x))$

Natural Exponent Rule : $\frac{d}{dx}e^x = e^x$

Product Rule : $\frac{d}{dx}(f(x)g(x)) = (f(x))\frac{d}{dx}(g(x)) + (g(x))\frac{d}{dx}(f(x))$

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

Chain Rule : $F'(x) = f'(g(x))g'(x)$

Log Laws : $\frac{d}{dx}\ln|x| = \frac{1}{x}$

$$\frac{d}{dx}\log_a x = \frac{1}{x \ln a}$$

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

Constant to a Power Rule : $\frac{d}{dx}(a^x) = a^x \ln a$