

Combined Functions Rules

Given two functions $u(x)$ and $v(x)$:

Product Rule

$$(uv)' = u'v + v'u$$

Quotient Rule

$$\left(\frac{u}{v}\right)' = \frac{u'v - v'u}{v^2}$$

Chain Rule

$$u(v)' = u'(v) \cdot v'$$

Note this is "u-prime-of-v,"
not "u-prime-times-v."

Three Common limits

While we're on the subject,
here are three limits that
come up a lot:

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

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

$$\lim_{x \rightarrow 0} \left(1 + \frac{1}{x}\right)^x = e$$

Common Derivatives

Trigonometric Functions

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

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

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

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

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

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

$$\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2}$$

Exponents and logarithms

In the following, a represents a constant value.

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

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

$$\frac{d}{dx} a^x = a^x \ln a$$

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