

# Derivatives Cheat sheet

## Common Functions

Equation	Derivative
$c$	0
$c * x$	$c * \frac{d}{dx}(x)$
$e^x$	$e^x$
$e^{f(x)}$	$f'(x) * e^{f(x)}$
$\ln(x)$	$\frac{1}{x}$
$\ln(f(x))$	$\frac{1}{f(x)} * f'(x)$
$a^{f(x)}$	$a^{f(x)} * \ln(a) * f'(x)$

## Trigonometric Derivatives

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

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

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

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

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

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

## Derivative Rules

Power Rule

$$\frac{d}{dx}(x^n) = n * x^{n-1}$$

Product Rule

$$\frac{d}{dx}(f(x) * g(x)) = f'(x)g(x) + g'(x)f(x)$$

Quotient Rule

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

Chain Rule

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

Nested Chain Rule

$$\begin{aligned} \frac{d}{dx}f(g(h(x))) &= f'(g(h(x))) \\ &\quad * g'(h(x)) \\ &\quad * h'(x) \end{aligned}$$

## Other things to note

$$\ln\left(\frac{x}{y}\right) = \ln(x) - \ln(y)$$

$$\ln(xy) = \ln(x) + \ln(y)$$

$$\ln(x^y) = y * \ln(x)$$