Symbolab Derivatives Cheat Sheet

Derivative Rules:

- Power Rule: $\frac{d}{dx}(x^a) = a \cdot x^{a-1}$
- Derivative of a Constant: $\frac{d}{dx}(a) = 0$
- Sum/Difference Rule:
  $(f \pm g)' = f' \pm g'$
- Constant Out: $(a \cdot f)' = a \cdot f'$
- Product Rule:
  $(f \cdot g)' = f' \cdot g + f \cdot g'$
- Quotient Rule: $\left(\frac{f}{g}\right)' = \frac{f' \cdot g - g' \cdot f}{g^2}$
- Chain Rule: $\frac{df(u)}{dx} = \frac{df}{du} \cdot \frac{du}{dx}$

Common Derivatives:

- $\frac{d}{dx}(\ln(x)) = \frac{1}{x}$
- $\frac{d}{dx}(\ln(|x|)) = \frac{1}{x}$
- $\frac{d}{dx}(e^x) = e^x$
- $\frac{d}{dx}(\log(x)) = \frac{1}{x \cdot \ln(10)}$
- $\frac{d}{dx}(\log_a(x)) = \frac{1}{x \cdot \ln(a)}$

Trigonometric Derivatives:

- $\frac{d}{dx}(\sin(x)) = \cos(x)$
- $\frac{d}{dx}(\cos(x)) = -\sin(x)$
- $\frac{d}{dx}(\tan(x)) = \sec^2(x)$
- $\frac{d}{dx}(\sec(x)) = \frac{\tan(x)}{\cos(x)}$
- $\frac{d}{dx}(\csc(x)) = \frac{-\cot(x)}{\sin(x)}$
- $\frac{d}{dx}(\cot(x)) = -\frac{1}{\sin^2(x)}$

Arc Trigonometric Derivatives:

- $\frac{d}{dx}(\arcsin(x)) = \frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\arccos(x)) = -\frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}(\arctan(x)) = \frac{1}{x^2+1}$
- $\frac{d}{dx}(\text{arcsec}(x)) = \frac{1}{\sqrt{x^2(x^2-1)}}$
- $\frac{d}{dx}(\text{arccsc}(x)) = -\frac{1}{|x|\sqrt{x^2-1}}$
- $\frac{d}{dx}(\text{arccot}(x)) = -\frac{1}{x^2+1}$

Hyperbolic Derivatives:

- $\frac{d}{dx}(\sinh(x)) = \cosh(x)$
- $\frac{d}{dx}(\cosh(x)) = \sinh(x)$
- $\frac{d}{dx}(\tanh(x)) = \text{sech}^2(x)$
- $\frac{d}{dx}(\text{sech}(x)) = -\text{sech}(x) \cdot \tanh(x)$

- $\frac{d}{dx}(\operatorname{csch}(x)) = -\coth(x)\cdot\operatorname{csch}(x)$
- $\frac{d}{dx}(\coth(x)) = -\operatorname{csch}^2(x)$

Arc Hyperbolic Derivatives:

- $\frac{d}{dx}(\operatorname{arcsinh}(x)) = \frac{1}{\sqrt{x^2+1}}$
- $\frac{d}{dx}(\operatorname{arccosh}(x)) = \frac{1}{\sqrt{x-1}\sqrt{x+1}}$
- $\frac{d}{dx}(\operatorname{arcsech}(x)) = \frac{\sqrt{\frac{2}{x+1}-1}}{x\cdot(x-1)}$
- $\frac{d}{dx}(\operatorname{arctanh}(x)) = \frac{1}{1-x^2}$
- $\frac{d}{dx}(\operatorname{arccsch}(x)) = -\frac{1}{x^2\sqrt{\frac{1}{x^2}+1}}$
- $\frac{d}{dx}(\operatorname{arccoth}(x)) = \frac{1}{1-x^2}$