Derivatives

1. **Product Rule**:
$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$$

2. **Quotient Rule**:
$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v(du/dx) - u(dv/dx)}{v^2}$$

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

4. **Chain Rule**: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

5. $f(x) = |x| \to f'(x) = \frac{|x|}{x}$

6. $f(x) = \sin x \to f'(x) = \cos x$

   $f(x) = \cos x \to f'(x) = -\sin x$

   $f(x) = \tan x \to f'(x) = \sec^2 x$

   $f(x) = \cot x \to f'(x) = -\csc^2 x$

   $f(x) = \sec x \to f'(x) = \sec x \tan x$

   $f(x) = \csc x \to f'(x) = -\csc x \cot x$

7. $f(x) = \sinh x \to f'(x) = \cosh x$

   $f(x) = \cosh x \to f'(x) = \sinh x$

   $f(x) = \tanh x \to f'(x) = \operatorname{sech}^2 x$

   $f(x) = \coth x \to f'(x) = -\operatorname{csch}^2 x$

   $f(x) = \operatorname{csch} x \to f'(x) = -\operatorname{csch} x \coth x$

   $f(x) = \operatorname{sech} x \to f'(x) = -\operatorname{sech} x \tanh x$

8. $f(x) = \ln x \to f'(x) = \frac{1}{x}$

   $f(x) = \log_a x \to f'(x) = \frac{1}{x \ln a}$

9. $f(x) = e^x \to f'(x) = e^x$

   $$\frac{d}{dx}(e^{u(x)}) = \frac{du}{dx} \cdot e^{u(x)}$$

   $f(x) = a^x \to f'(x) = a^x \ln a$

10. $f(x) = \sin^{-1} x \to f'(x) = \frac{1}{\sqrt{1-x^2}}$

    $f(x) = \cos^{-1} x \to f'(x) = \frac{-1}{\sqrt{1-x^2}}$

    $f(x) = \tan^{-1} x \to f'(x) = \frac{1}{1+x^2}$

    $f(x) = \cot^{-1} x \to f'(x) = \frac{-1}{1+x^2}$

    $f(x) = \sec^{-1} x \to f'(x) = \frac{1}{x\sqrt{x^2-1}}$

    $f(x) = \csc^{-1} x \to f'(x) = \frac{-1}{x\sqrt{x^2-1}}$

11. $f(x) = \sinh^{-1} x \to f'(x) = \frac{1}{\sqrt{x^2+1}}$

    $f(x) = \cosh^{-1} x \to f'(x) = \frac{1}{\sqrt{x^2-1}} \; ; x > 1$

    $f(x) = \tanh^{-1} x \to f'(x) = \frac{1}{1-x^2} ; |x| < 1$

    $f(x) = \coth^{-1} x \to f'(x) = \frac{1}{1-x^2} ; |x| > 1$