The Derivative: Short-Cut Formulas

* not AB

1. Sum or Difference: $\frac{d}{dx}\left(f \pm g \pm \ldots \right) = f' \pm g' \pm \ldots$

2. Coefficient Rule: $\frac{d}{dx}\left(a\, f(x) \right) = a\, f'(x)$

3. Power Functions: $\frac{d}{dx}\left(a\, x^n \right) = a\, n\, x^{n-1}$

4. Constant Function: $\frac{d}{dx}\left(c \right) = 0$

5. Exponential Functions: $\frac{d}{dx}\left(b^x \right) = (\ln b)\, b^x$

6. The *e* Function: $\frac{d}{dx}\left(e^x \right) = e^x$

7. Chain Rule: $\frac{d}{dx}\left(f(g(x)) \right) = f'(g(x))\, g'(x)$

   ie. Take the derivative of the outside function, then multiply by the derivative of the inside function.

8. Product Rule: $\frac{d}{dx}\left(f\, g \right) = f'\, g + f\, g'$

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

10. Trigonometric Functions:

$$\frac{d}{dx}\left(\sin x \right) = \cos x \qquad \frac{d}{dx}\left(\cos x \right) = -\sin x$$

$$\frac{d}{dx}\left(\tan x \right) = \sec^2 x \quad \text{OR} \quad \frac{1}{\cos^2 x} \qquad * \frac{d}{dx}\left(\cot x \right) = -\csc^2 x \quad \text{OR} \quad -\frac{1}{\sin^2 x}$$

$$\frac{d}{dx}\left(\sec x \right) = \sec x \tan x \qquad * \frac{d}{dx}\left(\csc x \right) = -\csc x \cot x$$

11. Natural log Function: $\frac{d}{dx}\left(\ln x \right) = \frac{1}{x}$

12. Log Functions: $* \frac{d}{dx}\left(\log_b x \right) = \frac{1}{x \ln b}$

13. Inverse Trig Functions: $\frac{d}{dx}\left(\arcsin x \right) = \frac{1}{\sqrt{1-x^2}}$ $\qquad \frac{d}{dx}\left(\arctan x \right) = \frac{1}{1+x^2}$

$$* \frac{d}{dx}\left(\arccos x \right) = \frac{-1}{\sqrt{1-x^2}} \qquad * \frac{d}{dx}\left(arc\cot x \right) = \frac{-1}{1+x^2} \qquad * \frac{d}{dx}\left(arc\csc x \right) = \frac{-1}{|x|\sqrt{1-x^2}} \qquad * \frac{d}{dx}\left(arc\sec x \right) = \frac{1}{|x|\sqrt{1-x^2}}$$

14. Implicit Differentiation: $\frac{d}{dx}\left(y \right) = \left(y \right)' \frac{dy}{dx}$

    ie. Take the derivative of *y*, then "attach" the symbol $\frac{dy}{dx}$. This is really an application of the chain rule.

15. Derivatives of Inverses: $(f^{-1})'(a) = \frac{1}{f'[f^{-1}(a)]}$ OR $\left. \frac{d}{dx}\left(f^{-1}(x) \right) \right|_{x=a} = \frac{1}{\left. \frac{d}{dx}\left(f(x) \right) \right|_{y=a}}$

    Above it the book's notation.

    Above is my notation. It's basically the same as the book's notation.

16. Derivative of any Absolute Value Function: $\frac{d}{dx}\left(|f(x)| \right) = \frac{d}{dx}\left(\sqrt{[f(x)]^2} \right)$ Re-write, then apply the chain rule.

    Special Function: $\frac{d}{dx}\left(\ln|x| \right) = \frac{1}{x}$