DERIVATIVE OF A FUNCTION: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ or $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

DIFFERENTIATION RULES:
(Where "**u**" and "**v**" are differentiable functions of x, and "**a**" is a constant.)

$$\frac{d}{dx} au = a \bullet \frac{du}{dx}$$

$$\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$$

$$\frac{d}{dx} u^n = n\, u^{n-1} \bullet \frac{du}{dx}$$

$$\frac{d}{dx} a = 0$$

$$\frac{d}{dx}(uv) = u \bullet \frac{dv}{dx} + v \bullet \frac{du}{dx}$$

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v \bullet \frac{du}{dx} - u \bullet \frac{dv}{dx}}{v^2}$$

CHAIN RULE: $\frac{dy}{dx} = \frac{dy}{du} \bullet \frac{du}{dx}$

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

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

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

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

$$\frac{d}{dx} \sec u = \sec u \tan u \frac{du}{dx}$$

$$\frac{d}{dx} \csc u = -\csc u \cot u \frac{du}{dx}$$

$$\frac{d}{dx} \ln u = \frac{1}{u} \frac{du}{dx}$$

$$\frac{d}{dx} e^u = e^u \frac{du}{dx}$$

$$\frac{d}{dx} a^u = a^u \ln a \frac{du}{dx}$$

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

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

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

$$\frac{d}{dx} \cot^{-1} u = \frac{-\frac{du}{dx}}{1+u^2}$$

$$\frac{d}{dx} \sec^{-1} u = \frac{\frac{du}{dx}}{|u|\sqrt{u^2-1}}$$

$$\frac{d}{dx} \csc^{-1} u = \frac{-\frac{du}{dx}}{|u|\sqrt{u^2-1}}$$

INTEGRATION FORMULAS:

$\int f(x)\,dx = F(x) + C, where\ F'(x) = f(x)$

$\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$ [First Fundamental Theorem]

Remember the Chain Rule!!!: $\frac{d}{dx}\int_a^u f(t)\,dt = f(u)\cdot D_u$

$\int_a^b f(x)\,dx = F(b) - F(a), where\ F'(x) = f(x)$ [Second Fundamental Theorem]

$$\int u^n\,du = \frac{u^{n+1}}{n+1} + C,\ n \neq -1$$

$$\int \frac{du}{u} = \ln|\ u\ | + C$$

$$\int e^u\,du = e^u + C$$

$$\int a^u\,du = \frac{a^u}{\ln a} + C, (a > 0,\ a \neq 1)$$

$$\int \sin u\,du = -\cos u + C$$

$$\int \cos u\,du = \sin u + C$$

$$\int \sec^2 u\,du = \tan u + C$$

$$\int \csc^2 u\,du = -\cot u + C$$

$$\int \sec u \bullet \tan u\,du = \sec u + C$$

$$\int \csc u \bullet \cot u\,du = -\csc u + C$$

$$\int \sec u\,du = \ln|\ \sec u + \tan u\ | + C$$

$$\int \tan u\,du = \ln|\ \sec u\ | + C$$

$$\int \csc u\,du = \ln|\ \csc u - \cot u\ | + C$$

$$\int \cot u\,du = \ln|\ \sin u\ | + C$$

$$\int \sin^2 u\,du = \frac{1}{2}u - \frac{1}{4}\sin\ 2u + C$$

$$\int \cos^2 u\,du = \frac{1}{2}u + \frac{1}{4}\sin\ 2u + C$$

$$\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1}\left(\frac{u}{a}\right) + C$$

$$\int \frac{du}{a^2 + u^2} = \frac{1}{a} \bullet \tan^{-1}\left(\frac{u}{a}\right) + C$$

$$\int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a} \bullet \sec^{-1}\left|\ \frac{u}{a}\ \right| + C$$

$$\int \frac{du}{u^2 - a^2} = \frac{1}{2a}\ln\left(\frac{u-a}{u+a}\right) + C$$

$$\int u\,dv = uv - \int v\,du$$