ANTIDERIVATIVES: RULES, FORMULAS, ETC.

Definition: An **antiderivative** of a function $f(x)$ is a function $F(x)$ for which $F'(x) = f(x)$.

Note: The Mean Value Theorem states that all antiderivatives of a given function differ at most by a constant. Thus if F is an antiderivative of f, *any* antiderivative of f must be of the form $F(x) + C$, where C is a constant.

General Rules:

- $\int kf(x)\,dx = k\int f(x)\,dx$, where k is a constant.
- $\int f(x) + g(x)\,dx = \int f(x)\,dx + \int g(x)\,dx$
- $\int f(x) - g(x)\,dx = \int f(x)\,dx - \int g(x)\,dx$

Formulas:

- $\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$, for $n \neq -1$.
- $\int \frac{dx}{x} = \ln|x| + C$
- $\int \sin x\,dx = -\cos x + C$
- $\int \cos x\,dx = \sin x + C$
- $\int \tan x = \ln|\sec x| + C = -\ln|\cos x| + C$
- $\int \cot x = -\ln|\csc x| + C = \ln|\sin x| + C$
- $\int \sec x = \ln|\sec x + \tan x| + C$
- $\int \csc x = \ln|\csc x - \cot x| + C$
- $\int \sec^2 x\,dx = \tan x + C$
- $\int \csc^2 x\,dx = -\cot x + C$

- $\int \sec x \tan x \, dx = \sec x + C$
- $\int \csc x \cot x \, dx = -\csc x + C$
- $\int e^x \, dx = e^x + C$
- $\int a^x \, dx = \dfrac{a^x}{\ln a}$, for $a > 0, a \neq 1$
- $\int \dfrac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \dfrac{x}{a} + C$
- $\int \dfrac{dx}{a^2 + x^2} = \dfrac{1}{a} \tan^{-1} \dfrac{x}{a} + C$
- $\int \dfrac{dx}{x\sqrt{x^2 - a^2}} = \dfrac{1}{a} \sec^{-1} \left| \dfrac{x}{a} \right| + C$