

# Standard Integral Guide

## Rules

### Linearity

$$\int [af(x) \pm bg(x)] \, dx = a \int f(x) \, dx \pm b \int g(x) \, dx, \quad \text{for constants } a \text{ and } b$$

### Power

$$\int x^a \, dx = \frac{x^{a+1}}{a+1} + C, \quad \text{for constant } a \neq -1$$

### Substitution

$$\int f(u(x)) \frac{du}{dx} \, dx = \int f(u) du$$

## Standard Functions

### Exponential

$$\int e^x \, dx = e^x + C$$

$$\int \frac{1}{x} \, dx = \ln(|x|) + C$$

$$\int a^x \, dx = \frac{a^x}{\ln(a)} + C$$

$$\int \ln(x) \, dx = x \ln(x) - x + C$$

$$\int \log_a(x) \, dx = \frac{x}{\ln(a)} (\ln(x) - 1) + C$$

### Trigonometric

$$\int \sin(x) \, dx = -\cos(x) + C$$

$$\int \cos(x) \, dx = \sin(x) + C$$

$$\int \tan(x) \, dx = -\ln(|\cos(x)|) + C$$

$$\int \cot(x) \, dx = \ln(|\sin(x)|) + C$$

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

$$\int \frac{1}{a^2 + x^2} \, dx = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right) + C$$

### Hyperbolic

$$\int \sinh(x) \, dx = \cosh(x) + C$$

$$\int \cosh(x) \, dx = \sinh(x) + C$$

$$\int \tanh(x) \, dx = \ln(\cosh(x)) + C$$

$$\int \frac{1}{\sqrt{x^2 + a^2}} \, dx = \sinh^{-1}\left(\frac{x}{a}\right) + C$$

$$\int \frac{1}{\sqrt{x^2 - a^2}} \, dx = \cosh^{-1}\left(\frac{x}{a}\right) + C$$