

Saitechinfo NEET-JEE Academy



Comprehensive List of Integral Formulas

Here is a categorized list of the most commonly used integral formulas.

1. Basic Integration Formulas

1. $\int k \, dx = kx + C$, where k is a constant.
 2. $\int x^n \, dx = \frac{x^{n+1}}{n+1} + C$ (for $n \neq -1$).
 3. $\int \frac{1}{x} \, dx = \ln |x| + C$.
 4. $\int e^x \, dx = e^x + C$.
 5. $\int a^x \, dx = \frac{a^x}{\ln a} + C$ (for $a > 0, a \neq 1$).
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2. Trigonometric Integrals

1. $\int \sin(x) \, dx = -\cos(x) + C$.
 2. $\int \cos(x) \, dx = \sin(x) + C$.
 3. $\int \tan(x) \, dx = -\ln |\cos(x)| + C$.
 4. $\int \cot(x) \, dx = \ln |\sin(x)| + C$.
 5. $\int \sec(x) \, dx = \ln |\sec(x) + \tan(x)| + C$.
 6. $\int \csc(x) \, dx = -\ln |\csc(x) + \cot(x)| + C$.
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3. Trigonometric Powers

1. $\int \sin^2(x) \, dx = \frac{x}{2} - \frac{\sin(2x)}{4} + C$.
 2. $\int \cos^2(x) \, dx = \frac{x}{2} + \frac{\sin(2x)}{4} + C$.
 3. $\int \sin^m(x) \cos^n(x) \, dx$: Use trigonometric identities and reduction formulas.
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4. Inverse Trigonometric Integrals

1. $\int \frac{1}{\sqrt{1-x^2}} \, dx = \arcsin(x) + C$.
2. $\int \frac{-1}{\sqrt{1-x^2}} \, dx = \arccos(x) + C$.
3. $\int \frac{1}{1+x^2} \, dx = \arctan(x) + C$.
4. $\int \frac{-1}{1+x^2} \, dx = \text{\textbackslash arccot}(x) + C$.
5. $\int \frac{1}{|x|\sqrt{x^2-1}} \, dx = \text{\textbackslash arcsec}(x) + C$.

$$6. \int \frac{-1}{|x|\sqrt{x^2-1}} dx = \text{arccsc}(x) + C.$$

5. Exponential and Logarithmic Integrals

1. $\int e^{kx} dx = \frac{1}{k}e^{kx} + C, k \neq 0.$
 2. $\int x^n e^x dx$: Use integration by parts.
 3. $\int \ln(x) dx = x \ln(x) - x + C.$
 4. $\int x^n \ln(x) dx$: Use integration by parts.
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6. Hyperbolic Functions

1. $\int \sinh(x) dx = \cosh(x) + C.$
 2. $\int \cosh(x) dx = \sinh(x) + C.$
 3. $\int \tanh(x) dx = \ln |\cosh(x)| + C.$
 4. $\int \coth(x) dx = \ln |\sinh(x)| + C.$
 5. $\int \text{sech}^2(x) dx = \tanh(x) + C.$
 6. $\int \text{csch}^2(x) dx = -\coth(x) + C.$
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7. Special Integrals

1. $\int \frac{1}{a^2+x^2} dx = \frac{1}{a} \arctan\left(\frac{x}{a}\right) + C.$
 2. $\int \frac{1}{\sqrt{a^2-x^2}} dx = \arcsin\left(\frac{x}{a}\right) + C.$
 3. $\int \frac{1}{x\sqrt{x^2-a^2}} dx = \frac{1}{a} \text{arcsec}\left(\frac{x}{a}\right) + C.$
 4. $\int e^{-ax^2} dx$: Related to the error function $\text{erf}(x)$.
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8. Definite Integral Properties

1. Linearity:

$$\int_a^b [cf(x) + dg(x)] dx = c \int_a^b f(x) dx + d \int_a^b g(x) dx$$

2. Reversal of Limits:

$$\int_a^b f(x) dx = - \int_b^a f(x) dx$$

3. Zero Width:

$$\int_a^a f(x) dx = 0$$

4. Additivity:

$$\int_a^b f(x) dx + \int_b^c f(x) dx = \int_a^c f(x) dx$$

9. Reduction Formulas

1. Powers of Sine:

$$\int \sin^n(x) dx = -\frac{\sin^{n-1}(x) \cos(x)}{n} + \frac{n-1}{n} \int \sin^{n-2}(x) dx$$

2. Powers of Cosine:

$$\int \cos^n(x) dx = \frac{\cos^{n-1}(x) \sin(x)}{n} + \frac{n-1}{n} \int \cos^{n-2}(x) dx$$

3. Factorial-like Integrals: For $n \in \mathbb{N}$,

$$\int_0^\infty x^n e^{-x} dx = n!$$

10. Integration by Parts

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

Where u and dv are chosen to simplify the integral.

11. Substitution Rule

$$\int f(g(x))g'(x) dx = \int f(u) du, \quad \text{where } u = g(x), du = g'(x) dx.$$

This formula set provides a powerful toolkit for solving a wide range of integrals in calculus and applied mathematics.