

Basic Integration Formulas

1. $\int [f(x) \pm g(x)] dx = \int f(x) dx \pm \int g(x) dx$
2. $\int x^n dx = \frac{x^{n+1}}{n+1} + C, n \neq -1$
3. $\int \frac{dx}{x} = \ln|x| + C$
4. $\int e^x dx = e^x + C$
5. $\int \sin x dx = -\cos x + C$
6. $\int \cos x dx = \sin x + C$
7. $\int \tan x dx = \ln|\sec x| + C$
8. $\int \cot x dx = -\ln|\csc x| + C$
9. $\int \sec x dx = \ln|\sec x + \tan x| + C$
10. $\int \csc x dx = -\ln|\csc x + \cot x| + C$
11. $\int \sec^2 x dx = \tan x + C$
12. $\int \csc^2 x dx = -\cot x + C$
13. $\int \sec x \tan x dx = \sec x + C$
14. $\int \csc x \cot x dx = -\csc x + C$
15. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin\left(\frac{x}{a}\right) + C$
16. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \arctan\left(\frac{x}{a}\right) + C$

FUNDAMENTAL THEOREM OF CALCULUS

$$\int_a^b F'(x) dx = F(b) - F(a)$$

INTEGRATION BY PARTS

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

TRIGONOMETRIC SUBSTITUTION ($a > 0$)

- $\sqrt{a^2 - x^2}$ requires $x = a \sin \theta$. Then $\sqrt{a^2 - x^2} = a \cos \theta$, where $-\pi/2 \leq \theta \leq \pi/2$.
- $\sqrt{a^2 + x^2}$ requires $x = a \tan \theta$. Then $\sqrt{a^2 + x^2} = a \sec \theta$, where $-\pi/2 < \theta < \pi/2$.
- $\sqrt{x^2 - a^2}$ requires $x = a \sec \theta$. Then $\sqrt{x^2 - a^2} = \pm a \tan \theta$.
 - If $x > a$, use $\sqrt{x^2 - a^2} = +a \tan \theta$, where $0 \leq \theta < \pi/2$.
 - If $x < -a$, use $\sqrt{x^2 - a^2} = -a \tan \theta$, where $\pi/2 < \theta \leq \pi$.