Basic Integration Formulas

1. $\int [f(x) \pm g(x)]\ dx = \int f(x)\,dx \pm \int g(x)\,dx$
2. $\int x^n\,dx = \dfrac{x^{n+1}}{n+1} + C,\ n \neq -1$
3. $\int \dfrac{dx}{x} = \ln|x| + C$
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. $\int \dfrac{dx}{\sqrt{a^2 - x^2}} = \arcsin\left(\dfrac{x}{a}\right) + C$
16. $\int \dfrac{dx}{a^2 + x^2} = \dfrac{1}{a}\arctan\left(\dfrac{x}{a}\right) + C$

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 $-\pi/2 \leqslant \theta \leqslant \pi/2$.
- $\sqrt{a^2 + x^2}$ 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 $0 \leqslant \theta < \pi/2$.
  - If $x < a$, use $\sqrt{x^2 - a^2} = -a\tan\theta$, where $\pi/2 < \theta \leqslant \pi$.

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