Basic integration formulas

$$\int x^n \, \mathrm{d}x = \frac{x^{n+1}}{n+1} + C \qquad \int \frac{1}{x} \, \mathrm{d}x = \ln|x| + C$$

$$\int a^x \, \mathrm{d}x = \frac{a^x}{\ln a} + C$$

$$\int \sin x \, \mathrm{d}x = -\cos x + C \qquad \int \cos x \, \mathrm{d}x = \sin x + C$$

$$\int \sec^2 x \, \mathrm{d}x = \tan x + C \qquad \int \sec x \tan x \, \mathrm{d}x = \sec x + C$$

$$\int \csc^2 x \, \mathrm{d}x = -\cot x + C \qquad \int \csc x \cot x \, \mathrm{d}x = -\csc x + C$$

$$\int \tan x \, \mathrm{d}x = \ln|\sec x| + C \qquad \int \cot x \, \mathrm{d}x = \ln|\sin x| + C$$

$$\int \sec x \, \mathrm{d}x = \ln|\sec x + \tan x| + C \qquad \int \csc x \, \mathrm{d}x = -\ln|\csc x + \cot x| + C$$

$$\int \frac{1}{\sqrt{a^2 - x^2}} \, \mathrm{d}x = \arcsin(\frac{x}{a}) + C \qquad \int \frac{1}{x^2 + a^2} \, \mathrm{d}x = \frac{1}{a} \arctan(\frac{x}{a}) + C$$

$$\int \frac{1}{x\sqrt{x^2 - a^2}} \, \mathrm{d}x = \frac{1}{a} \mathrm{arcsec}|\frac{x}{a}| + C$$

u-substitution:

$$\int g(f(x)) \cdot f'(x) \, \mathrm{d}x = \int g(u) \, \mathrm{d}u \Big|_{u=f(x)} + C$$

Special case: $\displaystyle\int \frac{f'(x)}{f(x)} \, \mathrm{d}x = \ln|f(x)| + C$

Integration by parts:

$$\int u \, \mathrm{d}v = uv - \int v \, \mathrm{d}u + C$$

Partial Fractions: to integrate a function like $\displaystyle\frac{ax+b}{(x+c)(x+d)}$:

Write $\displaystyle\frac{ax+b}{(x+c)(x+d)} = \frac{A}{(x+c)} + \frac{B}{(x+d)} = \frac{A(x+d) + B(x+c)}{(x+c)(x+d)}$,
so $ax + b = A(x+d) + B(x+c) = (A+B)x + (Ad+Bc)$, so $a = A+B$ and $b = Ad+Bc$; solve for A and B .

The approach for more general denomenator can be found in nearly any calculus textbook.