Integration Rules Cheat Sheet

Essential integration rules and techniques for calculus. Remember: integration is the reverse of differentiation.

Basic Integration Rules

Power rule: integral of x^n dx = $x^{(n+1)}/(n+1)$ + C, n =/= -1

Constant: integral of k dx = kx + C

Sum rule: integral of (f + g) dx = integral of f dx + integral of g dx

Constant multiple: integral of cf(x) dx = c x integral of f(x) dx

Trigonometric Integrals

integral of sin x dx = -cos x + C

integral of cos x dx = sin x + C

integral of sec² x dx = tan x + C

integral of csc² x dx = -cot x + C

integral of sec x tan x dx = sec x + C

integral of csc x cot x dx = -csc x + C

Exponential & Logarithmic

integral of e^x dx = e^x + C

integral of a^x dx = a^x/ln(a) + C

integral of 1/x dx = ln|x| + C

Power Rule Examples

integral of x^3 dx = $x^4/4$ + C

integral of $x^{(-2)}$ dx = $-x^{(-1)}$ + C = -1/x + C

integral of x dx = integral of $x^{(1/2)}$ dx = $(2/3)x^{(3/2)}$ + C

Integration Techniques

U-Substitution

Step 1: Identify the inner function u = g(x)

Step 2: Compute du = g'(x) dx

Step 3: Rewrite the integral in terms of u

Step 4: Integrate with respect to u

Step 5: Substitute back x for u

Integration by Parts

Formula: integral of u dv = uv - integral of v du

LIATE rule for choosing u: Logs, Inverse trig, Algebraic, Trig, Exponential

Pick u from earlier in LIATE, dv from later. This usually simplifies the integral.

U-Substitution Example

Problem: integral of $2x(x^2 + 1)^3$ dx

Let: $u = x^2 + 1$, du = 2x dx

Rewrite: integral of u^3 du = $u^4/4$ + C

Answer: $(x^2 + 1)^4/4$ + C

Definite Integrals & FTC

FTC Part 1: d/dx[integral from a to x of f(t) dt] = f(x)

FTC Part 2: integral from a to b of f(x) dx = F(b) - F(a)

Meaning: Definite integral gives the net area under the curve

No + C: Definite integrals produce a number, not a function

Always add + C for indefinite integrals. Check your answer by differentiating it. If you get back the original integrand, your integration is correct.