

Integral rules and formulas

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Basic integral rules

- **Power rule** $\int x^n dx = \frac{x^{n+1}}{n+1} + C$ for $n \neq -1$
- **Constant multiple rule** $\int a \cdot f(x) dx = a \int f(x) dx$
- **Sum rule** $\int [f(x) + g(x)] dx = \int f(x) dx + \int g(x) dx$
- **Difference rule** $\int [f(x) - g(x)] dx = \int f(x) dx - \int g(x) dx$

Common integrals

- $\int e^x dx = e^x + C$
- $\int a^x dx = \frac{a^x}{\ln(a)} + C$ for $a > 0$ and $a \neq 1$
- $\int e^{u(x)} u'(x) dx = e^{u(x)} + C$ (by substitution)
- $\int a^{u(x)} \ln(a) u'(x) dx = \frac{a^{u(x)}}{\ln(a)} + C$ for $a > 0$ and $a \neq 1$ (by substitution)
- $\int \ln(x) dx = x \ln(x) - x + C$
- $\int \log_a(x) dx = \frac{x \log_a(x)}{\ln(a)} - \frac{x}{\ln(a)} + C$ for $a > 0$ and $a \neq 1$
- $\int \frac{1}{x} dx = \ln|x| + C$

Solving methods

Change of variables (substitution)

If $u = g(x)$, then

$$\int f(g(x))g'(x) dx = \int f(u) du$$

Integration by parts

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

where u and dv are continuously differentiable functions of x .