

# Derivatives and Integrals

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This document will give basic derivative rules and integration formulas.

## Basic Differentiation Rules

- $\frac{d}{dx}[cu] = cu'$
- $\frac{d}{dx}[u \pm v] = u' \pm v'$
- $\frac{d}{dx}[uv] = uv' + vu'$
- $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$
- $\frac{d}{dx}[c] = 0$
- $\frac{d}{dx}[x] = 1$
- $\frac{d}{dx}[u^n] = nu^{n-1}u'$
- $\frac{d}{dx}[|u|] = \frac{u}{|u|}(u'), u \neq 0$
- $\frac{d}{dx}[\ln u] = \frac{u'}{u}$
- $\frac{d}{dx}[e^u] = e^u u'$
- $\frac{d}{dx}[\sin u] = (\cos u) u'$
- $\frac{d}{dx}[\cos u] = -(\sin u) u'$
- $\frac{d}{dx}[\tan u] = (\sec^2 u) u'$
- $\frac{d}{dx}[\sec u] = (\sec u \tan u) u'$
- $\frac{d}{dx}[\cot u] = -(\csc^2 u) u'$
- $\frac{d}{dx}[\csc u] = -(\csc u \cot u) u'$
- $\frac{d}{dx}[\sin^{-1} u] = \frac{u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\cos^{-1} u] = -\frac{u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\tan^{-1} u] = \frac{u'}{1+u^2}$
- $\frac{d}{dx}[\cot^{-1} u] = -\frac{u'}{1+u^2}$
- $\frac{d}{dx}[\sec^{-1} u] = \frac{u'}{u\sqrt{u^2-1}}$
- $\frac{d}{dx}[\csc^{-1} u] = -\frac{u'}{|u|\sqrt{u^2-1}}$

## Basic Integration Formulas

- $\int [f(u) \pm g(u)] du = \int f(u) du \pm \int g(u) du$
- $\int kf(u) du = k \int f(u) du$
- $\int du = u + C$
- $\int u^n du = \frac{u^{n+1}}{n+1} + C, n \neq -1$
- $\int \frac{du}{u} = \ln |u| + C$
- $\int e^u du = e^u + C$
- $\int \sin u du = -\cos u + C$
- $\int \cos u du = \sin u + C$
- $\int \tan u du = -\ln |\cos u| + C$
- $\int \cot u du = \ln |\sin u| + C$
- $\int \sec u du = \ln |\sec u + \tan u| + C$
- $\int \csc u du = -\ln |\csc u + \cot u| + C$
- $\int \sec^2 u du = \tan u + C$
- $\int \csc^2 u du = -\cot u + C$
- $\int \sec u \tan u du = \sec u + C$
- $\int \csc u \cot u du = -\csc u + C$
- $\int \frac{du}{\sqrt{a^2-u^2}} = \sin^{-1} \frac{u}{a} + C$
- $\int \frac{du}{a^2+u^2} = \frac{1}{a} \tan^{-1} \frac{u}{a} + C$
- $\int \frac{du}{u\sqrt{a^2-u^2}} = \frac{1}{a} \sec^{-1} \frac{u}{a} + C$