Differentiation Rules

$\frac{d}{dx}(c) = 0 \qquad \frac{d}{dx}[cf(x)] = cf'(x)$

$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$

$\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$

$\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$$

$\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$

$\frac{d}{dx}(x^n) = nx^{n-1}dx \qquad \frac{d}{dx}(e^x) = e^x \mathrm{dx}$

$\frac{d}{dx}\ln|x| = \frac{1}{x}dx \qquad \frac{d}{dx}(a^x) = a^x \ln(a)dx$

$\frac{d}{dx}(\log_a x) = \frac{1}{x \ln a}dx$

$\frac{d}{dx}(\sin x) = \cos x\, dx \quad \frac{d}{dx}(\cos x) = -\sin x\, dx$

$\frac{d}{dx}(\tan x) = \sec^2 x dx \qquad \frac{d}{dx}(\cot x) = -\csc^2 x\, dx$

$\frac{d}{dx}(\csc x) = -\csc x \cot x\, dx$

$\frac{d}{dx}(\sec x) = \sec x \tan x\, dx$

$\frac{d}{dx}(\sin^{-1} x) = \frac{dx}{\sqrt{1-x^2}} \qquad \frac{d}{dx}(\cos^{-1} x) = -\frac{dx}{\sqrt{1-x^2}}$

$\frac{d}{dx}(\tan^{-1} x) = \frac{dx}{1+x^2} \qquad \frac{d}{dx}(\cot^{-1} x) = -\frac{dx}{1+x^2}$

$\frac{d}{dx}(\sec^{-1} x) = \frac{dx}{x\sqrt{x^2-1}} \qquad \frac{d}{dx}(\csc^{-1} x) == -\frac{dx}{x\sqrt{x^2-1}}$

$\frac{d}{dx}(\sinh x) = \cosh x dx \qquad \frac{d}{dx}(\cosh x) = \sinh x \mathrm{dx}$

$\mathrm{Sinh\ x} = \frac{e^x - e^{-x}}{2} \qquad \mathrm{cosh\ x} = \frac{e^x + e^{-x}}{2}$

Integration Rules

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

$$\int u^n du = \frac{u^{n+1}}{n+1} + C, \quad n \neq -1$$

$$\int \frac{du}{u} = \ln|u| + C$$

$\int e^u du = e^u + C$

$\int \sin(u)du = -\cos(u) + C$

$\int \cos(u)du = \sin(u) + C$

$\int \tan(u)du = \ln|\sec u| + C$

$\int \sec(u)du = \ln|\sec u + \tan u| + C$

$\int \csc(u)du = \ln|\csc u - \cot u| + C$

$\int \cot(u)du = \ln|\sin u| + C$

$\int \sec^2(u)du = \tan(u) + C$

$\int \csc^2(u)du = -\cot(u) + C$

$\int \sec(u)\tan(u)du = \sec(u) + C$

$\int \csc(u)\cot(u)du = -\csc(u) + C$

$$\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1}\left|\frac{u}{a}\right| + C, \quad a > 0$$

$$\int \frac{du}{a^2 + u^2} = \frac{1}{a}\tan^{-1}\left|\frac{u}{a}\right| + C$$

$$\int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a}\sec^{-1}\left|\frac{u}{a}\right| + C$$

$\int \ln|u|du = u\ln|u| - u + C$