

DERIVATIVES AND INTEGRALS

Basic Differentiation Rules

- $\frac{d}{dx}[cu] = cu'$
- $\frac{d}{dx}[u \pm v] = u' \pm v'$
- $\frac{d}{dx}[uv] = uv' + vu'$
- $\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$
- $\frac{d}{dx}[c] = 0$
- $\frac{d}{dx}[u^n] = nu^{n-1}u'$
- $\frac{d}{dx}[x] = 1$
- $\frac{d}{dx}[|u|] = \frac{u}{|u|}(u'), \quad u \neq 0$
- $\frac{d}{dx}[\ln u] = \frac{u'}{u}$
- $\frac{d}{dx}[e^u] = e^u u'$
- $\frac{d}{dx}[\log_a u] = \frac{u'}{(\ln a)u}$
- $\frac{d}{dx}[a^u] = (\ln a)a^u u'$
- $\frac{d}{dx}[\sin u] = (\cos u)u'$
- $\frac{d}{dx}[\cos u] = -(\sin u)u'$
- $\frac{d}{dx}[\tan u] = (\sec^2 u)u'$
- $\frac{d}{dx}[\cot u] = -(\csc^2 u)u'$
- $\frac{d}{dx}[\sec u] = (\sec u \tan u)u'$
- $\frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$
- $\frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$
- $\frac{d}{dx}[\arctan u] = \frac{u'}{1+u^2}$
- $\frac{d}{dx}[\operatorname{arccsc} u] = \frac{-u'}{|u|\sqrt{u^2-1}}$
- $\frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$
- $\frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}}$
- $\frac{d}{dx}[\operatorname{arcsch} u] = \frac{-u'}{|u|\sqrt{1+u^2}}$
- $\frac{d}{dx}[\sinh u] = (\cosh u)u'$
- $\frac{d}{dx}[\cosh u] = (\sinh u)u'$
- $\frac{d}{dx}[\tanh u] = (\operatorname{sech}^2 u)u'$
- $\frac{d}{dx}[\coth u] = -(\operatorname{csch}^2 u)u'$
- $\frac{d}{dx}[\operatorname{sech} u] = -(\operatorname{sech} u \tanh u)u'$
- $\frac{d}{dx}[\operatorname{csch} u] = -(\operatorname{csch} u \coth u)u'$
- $\frac{d}{dx}[\sinh^{-1} u] = \frac{u'}{\sqrt{u^2+1}}$
- $\frac{d}{dx}[\cosh^{-1} u] = \frac{u'}{\sqrt{u^2-1}}$
- $\frac{d}{dx}[\tanh^{-1} u] = \frac{u'}{1-u^2}$
- $\frac{d}{dx}[\coth^{-1} u] = \frac{u'}{1-u^2}$
- $\frac{d}{dx}[\operatorname{sech}^{-1} u] = \frac{-u'}{u\sqrt{1-u^2}}$
- $\frac{d}{dx}[\operatorname{csch}^{-1} u] = \frac{-u'}{|u|\sqrt{1+u^2}}$

Basic Integration Formulas

- $\int kf(u) du = k \int f(u) du$
- $\int [f(u) \pm g(u)] du = \int f(u) du \pm \int g(u) du$
- $\int du = u + C$
- $\int a^u du = \left(\frac{1}{\ln a}\right)a^u + C$
- $\int e^u du = e^u + C$
- $\int \sin u du = -\cos u + C$
- $\int \cos u du = \sin u + C$
- $\int \tan u du = -\ln|\cos u| + C$
- $\int \cot u du = \ln|\sin u| + C$
- $\int \sec u du = \ln|\sec u + \tan u| + C$
- $\int \csc u du = -\ln|\csc u + \cot u| + C$
- $\int \sec^2 u du = \tan u + C$
- $\int \csc^2 u du = -\cot u + C$
- $\int \sec u \tan u du = \sec u + C$
- $\int \csc u \cot u du = -\csc u + C$
- $\int \frac{du}{\sqrt{a^2 - u^2}} = \arcsin \frac{u}{a} + C$
- $\int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a} \operatorname{arcsec} \frac{|u|}{a} + C$
- $\int \frac{du}{a^2 + u^2} = \frac{1}{a} \arctan \frac{u}{a} + C$