

Differentiation Rules Calculus I

General Formulas

1. $\frac{d}{dx} k = 0$.
2. $\frac{d}{dx}(u + v) = \frac{du}{dx} + \frac{dv}{dx}$.
3. $\frac{d}{dx}(u - v) = \frac{du}{dx} - \frac{dv}{dx}$.
4. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$.
5. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$.
6. $y = f(u)$, $u = u(x)$, $\frac{dy}{dx} = \frac{dy}{du} \frac{du}{dx}$.

Basic Functions

1. $\frac{d}{dx} u^n = nu^{n-1} \frac{du}{dx}$.
2. $\frac{d}{dx} \ln|u| = \frac{1}{u} \frac{du}{dx}$.
3. $\frac{d}{dx} e^u = e^u \frac{du}{dx}$.
4. $\frac{d}{dx} \sin u = \cos u \frac{du}{dx}$.
5. $\frac{d}{dx} \cos u = -\sin u \frac{du}{dx}$.
6. $\frac{d}{dx} \tan u = \sec^2 u \frac{du}{dx}$.
7. $\frac{d}{dx} \sec u = \sec u \tan u \frac{du}{dx}$.
8. $\frac{d}{dx} \cot u = -\csc^2 u \frac{du}{dx}$.
9. $\frac{d}{dx} \csc u = -\csc u \cot u \frac{du}{dx}$.
10. $\frac{d}{dx} \ln|\sec u| = \tan u \frac{du}{dx}$.
11. $\frac{d}{dx} \ln|\sec u + \tan u| = \sec u \frac{du}{dx}$.
12. $\frac{d}{dx} \sinh u = \cosh u \frac{du}{dx}$.
13. $\frac{d}{dx} \cosh u = \sinh u \frac{du}{dx}$.
14. $\frac{d}{dx} \tanh u = \operatorname{sech}^2 u \frac{du}{dx}$.
15. $\frac{d}{dx} \sin^{-1} u = \frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$.
16. $\frac{d}{dx} \tan^{-1} u = \frac{1}{1+u^2} \frac{du}{dx}$.
17. $\frac{d}{dx} \sec^{-1} u = \frac{1}{u\sqrt{u^2-1}} \frac{du}{dx}$.
18. $\frac{d}{dx} \sinh^{-1} u = \frac{1}{\sqrt{1+u^2}} \frac{du}{dx}$.
19. $\frac{d}{dx} \tanh^{-1} u = \frac{1}{1-u^2} \frac{du}{dx}$.

Integration Formulas Calculus I

General Formulas

1. $\int k \, dx = kx + C$.
2. $\int (u + v) \, dx = \int u \, dx + \int v \, dx$.
3. $\int (u - v) \, dx = \int u \, dx - \int v \, dx$.
4. $\int u \, dv = uv - \int v \, du$. (Integration by parts)
5. No "Quotient Rule".
6. $\int f(u) \, du = \int f(u(x))u'(x) \, dx$. (Substitution)

Basic Formulas

1. $\int u^n \, du = \frac{1}{n+1} u^{n+1} + C$; $n \neq -1$.
2. $\int \frac{1}{u} \, du = \ln|u| + C$.
3. $\int e^u \, du = e^u + C$.
4. $\int \sin u \, du = -\cos u + C$.
5. $\int \cos u \, du = \sin u + C$.
6. $\int \sec^2 u \, du = \tan u + C$.
7. $\int \sec u \tan u \, du = \sec u + C$.
8. $\int \csc^2 u \, du = -\cot u + C$.
9. $\int \csc u \cot u \, du = -\csc u + C$.
10. $\int \tan u \, du = \ln|\sec u| + C$.
11. $\int \sec u \, du = \ln|\sec u + \tan u| + C$.
12. $\int \sinh u \, du = \cosh u + C$.
13. $\int \cosh u \, du = \sinh u + C$.
14. $\int \operatorname{sech}^2 u \, du = \tanh u + C$.
15. $\int \frac{1}{\sqrt{a^2-u^2}} \, du = \sin^{-1} \frac{u}{a} + C$.
16. $\int \frac{1}{a^2+u^2} \, du = \frac{1}{a} \tan^{-1} \frac{u}{a} + C$.
17. $\int \frac{1}{u\sqrt{u^2-a^2}} \, du = \frac{1}{a} \sec^{-1} \frac{u}{a} + C$.
18. $\int \frac{1}{\sqrt{a^2+u^2}} \, du = \sinh^{-1} \frac{u}{a} + C$.
19. $\int \frac{1}{a^2-u^2} \, du = \frac{1}{a} \tanh^{-1} \frac{u}{a} + C$. if $u^2 < a^2$.