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. $\frac{d}{dx}(u-v) = \frac{du}{dx} - \frac{dv}{dx}v.$
4. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}.$
5. $\frac{d}{dx}(\frac{u}{v}) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}.$
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. $\int \frac{1}{a^2-u^2}\,du = \frac{1}{a}\tanh^{-1}\frac{u}{a} + C.$