Formula List

Differentiation

Rules of Differentiation

1. $\frac{d}{dx}(constant) = 0$
2. $\frac{d}{dx}\big(cf(x)\big) = c\frac{d}{dx}f(x)$
3. $\frac{d}{dx}\big(f(x)+g(x)\big) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$ (Sum Rule)
4. $\frac{d}{dx}\big(f(x)g(x)\big) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$ (Product Formula)
5. $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{[g(x)]^2}$ (Quotient Rule)

Derivative of Algebraic Function

1. $\frac{d}{dx}u^n = nu^{n-1}\frac{du}{dx}$

Derivatives of Trigonometric Functions

1. $\frac{d}{dx}sinu = \cos u\frac{du}{dx}$
2. $\frac{d}{dx}cosu = -\sin u\frac{du}{dx}$
3. $\frac{d}{dx}tanu = sec^2u\frac{du}{dx}$
4. $\frac{d}{dx}secu = \sec u\tan u\frac{du}{dx}$
5. $\frac{d}{dx}cosecu = -cosecu\ cotu\frac{du}{dx}$
6. $\frac{d}{dx}cotu = -cosec^2u\frac{du}{dx}$

Derivatives of Inverse Trigonometric Functions

1. $\frac{d}{dx}sin^{-1}u = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$
2. $\frac{d}{dx}cos^{-1}u = -\frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$
3. $\frac{d}{dx}tan^{-1}u = \frac{1}{1+u^2}\frac{du}{dx}$
4. $\frac{d}{dx}sec^{-1}u = \frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$
5. $\frac{d}{dx}cosec^{-1}u = -\frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$

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6. $\frac{d}{dx}cot^{-1}u = -\frac{1}{1+u^2}\frac{du}{dx}$

Derivative of Logarithmic Function

1. $\frac{d}{dx}lnu = \frac{1}{u}\frac{du}{dx}$

Derivative of Exponential Function

1. $\frac{d}{dx}e^u = e^u\frac{du}{dx}$

Derivatives of Hyperbolic Functions

1. $\frac{d}{dx}sinhu = coshu\frac{du}{dx}$
2. $\frac{d}{dx}coshu = sinhu\frac{du}{dx}$
3. $\frac{d}{dx}tanhu = sech^2u\frac{du}{dx}$
4. $\frac{d}{dx}sechu = -\operatorname{sech} u \tanh u\frac{du}{dx}$
5. $\frac{d}{dx}cosechu = -\operatorname{cosech} u \coth u\frac{du}{dx}$
6. $\frac{d}{dx}\coth u = -\operatorname{cosech}^2 u\ \frac{du}{dx}$

Derivatives of Inverse Hyperbolic Functions

1. $\frac{d}{dx}sinh^{-1}u = \frac{1}{\sqrt{1+u^2}}\frac{du}{dx}$
2. $\frac{d}{dx}\cosh^{-1} u = \frac{1}{\sqrt{u^2-1}}\frac{du}{dx}\ , u > 1$
3. $\frac{d}{dx}\tanh^{-1} u = \frac{1}{1-u^2}\frac{du}{dx}\ , |u| < 1$
4. $\frac{d}{dx}\operatorname{csch}^{-1} u = -\frac{1}{|u|\sqrt{1+u^2}}\frac{du}{dx}\ , u \neq 0$
5. $\frac{d}{dx}\coth^{-1} u = \frac{1}{1-u^2}\frac{du}{dx}\ , |u| < 1$

Where u is a function of x

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