Inverse Hyperbolic Functions

$\sinh^{-1}x = \ln\left(x + \sqrt{x^2+1}\right)$

$\frac{d}{dx}\sinh^{-1}x = \frac{1}{\sqrt{1+x^2}}$

$\cosh^{-1}x = \ln\left(x + \sqrt{x^2-1}\right)$ $(x\geq 1)$

$\frac{d}{dx}\cosh^{-1}x = \frac{1}{\sqrt{x^2-1}}$

$(x>1)$

$\tanh^{-1}x = \frac{1}{2}\ln\frac{1+x}{1-x} \quad (|x|<1)$

$\frac{d}{dx}\tanh^{-1}x = \frac{1}{1-x^2}$ $(|x|<1)$

$\coth^{-1}x = \frac{1}{2}\ln\frac{1+x}{1-x} \quad (|x|>1)$

$\frac{d}{dx}\coth^{-1}x = \frac{1}{1-x^2}$ $(|x|>1)$

$\operatorname{sech}^{-1}x = \ln\left(\frac{1+\sqrt{1-x^2}}{x}\right)$ $(0<x\leq 1)$

$\frac{d}{dx}\operatorname{sech}^{-1}x = \frac{-1}{x\sqrt{1-x^2}}$ $(0<x<1)$

$\operatorname{csch}^{-1}x = \ln\left(\frac{1}{x} + \frac{\sqrt{1+x^2}}{|x|}\right)$ $(x\neq 0)$

$\frac{d}{dx}\operatorname{csch}^{-1}x = \frac{-1}{|x|\sqrt{1+x^2}}$ $(x\neq 0)$

$$\int \frac{1}{\sqrt{1+x^2}}\,dx = \sinh^{-1}x + C$$

$$\int \frac{1}{\sqrt{x^2-1}}\,dx = \cosh^{-1}x + C \quad (x>1)$$

$$\int \frac{1}{1-x^2}\,dx = \begin{Bmatrix} \tanh^{-1}x + C & |x|<1 \\ \coth^{-1}x + C & |x|>1 \end{Bmatrix} = \frac{1}{2}\ln\left|\frac{1+x}{1-x}\right| + C$$

$$\int \frac{1}{x\sqrt{1-x^2}}\,dx = -\operatorname{sech}^{-1}|x| + C$$

$$\int \frac{1}{x\sqrt{1+x^2}}\,dx = -\operatorname{csch}^{-1}|x| + C$$