

7.3 Hyperbolic Functions:

$$\begin{aligned}\sinh x &= \frac{e^x - e^{-x}}{2} & csch x &= \frac{1}{\sinh x} \\ \cosh x &= \frac{e^x + e^{-x}}{2} & sech x &= \frac{1}{\cosh x} \\ \tanh x &= \frac{\sinh x}{\cosh x} & coth x &= \frac{1}{\tanh x}\end{aligned}$$

Identities: $(\cosh x)^2 - (\sinh x)^2 = 1$

Derivatives:

$$\begin{aligned}\frac{d}{dx} \sinh x &= \cosh x \\ \frac{d}{dx} \cosh x &= \sinh x\end{aligned}$$

Graphs:

Example: Evaluate $\int \tanh x \, dx$.

Solution: Let $u = \cosh x$ and $du = \sinh x \, dx$ so that

$$\int \tanh x \, dx = \ln |\cosh x| + C$$