

Prove $\cosh^2 x - \sinh^2 x = 1$

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$$\begin{aligned} & \cosh^2 x - \sinh^2 x \\ &= \left(\frac{e^x + e^{-x}}{2} \right)^2 - \left(\frac{e^x - e^{-x}}{2} \right)^2 \\ &= \frac{e^{2x} + 2 + e^{-2x}}{4} - \frac{e^{2x} - 2 + e^{-2x}}{4} \\ &= \frac{4}{4} \\ &= 1 \end{aligned}$$