PROOF OF FORMULA 3.512.2

$$\int_0^\infty \frac{\sinh^\mu x}{\cosh^\nu x}\, dx = \frac{1}{2} B\left(\frac{\mu+1}{2}, \frac{\nu-\mu}{2}\right)$$

The proof begins with the change of variables $a = \cosh x$ to obtain

$$\int_0^\infty \frac{\sinh^\mu x}{\cosh^\nu x}\, dx = \int_1^\infty (a^2-1)^{\frac{\mu-1}{2}} a^{-\nu}\, da.$$

The next change of variables $t = a^{-2}$ produces the integral

$$\frac{1}{2} \int_0^1 t^{\frac{\nu-\mu}{2}-1}(1-t)^{\frac{\nu-\mu}{2}-1}\, dt = \frac{1}{2} B\left(\frac{\mu+1}{2}, \frac{\nu-\mu}{2}\right).$$