PROOF OF FORMULA 3.523.6

$$\int_0^\infty \frac{x^3\,dx}{\sinh x} = \frac{\pi^4}{8}$$

Formula 3.523.2 states that

$$\int_0^\infty \frac{x^{2n-1}\,dx}{\sinh ax} = \frac{2^{2n}-1}{2n}\left(\frac{\pi}{a}\right)^{2n}|B_{2n}|.$$

The special case $n = 2$ and $a = 1$, using the value $B_4 = -1/30$ give the result.