

PROOF OF FORMULA 3.524.13

$$\int_0^\infty x^3 \frac{\sinh ax}{\cosh bx} dx = \sin \frac{\pi a}{2b} \left(\frac{\pi}{2b} \sec \frac{\pi a}{2b} \right)^4 \left(6 - \cos^2 \frac{\pi a}{2b} \right)$$

Entry 3.524.4 states that

$$\int_0^\infty x^3 \frac{\sinh ax}{\cosh bx} dx = \frac{\pi}{2b} \left(\frac{d}{da} \right)^3 \sec \frac{\pi a}{2b}.$$

The result follows by computing the derivative.