

PROOF OF FORMULA 3.524.15

$$\int_0^{\infty} x^7 \frac{\sinh ax}{\cosh bx} dx = \sin \frac{\pi a}{2b} \left(\frac{\pi}{2b} \sec \frac{\pi a}{2b} \right)^8 \left(5040 - 4200 \cos^2 \frac{\pi a}{2b} + 546 \cos^4 \frac{\pi a}{2b} - \cos^6 \frac{\pi a}{2b} \right)$$

Entry 3.524.4 states that

$$\int_0^{\infty} x^7 \frac{\sinh ax}{\cosh bx} dx = \frac{\pi}{2b} \left(\frac{d}{da} \right)^7 \sec \frac{\pi a}{2b}.$$

The result follows by computing the derivative.