

PROOF OF FORMULA 3.524.19

$$\int_0^{\infty} x^7 \frac{\cosh ax}{\sinh bx} dx = 16 \left(\frac{\pi}{2b} \sec \frac{\pi a}{2b} \right)^8 \left(315 - 420 \cos^2 \frac{\pi a}{2b} + 126 \cos^4 \frac{\pi a}{2b} - 4 \cos^6 \frac{\pi a}{2b} \right)$$

Entry 3.524.8 states that

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

The result now comes from computing the derivative.