

PROOF OF FORMULA 3.524.9

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

Entry **3.524.2** states that

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

Now simply evaluate the second derivative to produce the result.