PROOF OF FORMULA 4.321.1

$$\int_{-\infty}^{\infty} x \ln\cosh x \, dx = 0$$

Entry 3.457.3 states that

$$\int_{-\infty}^{\infty} \frac{x \, dx}{(a^2 e^x + e^{-x})^\mu} = -\frac{1}{2a^\mu} B\left(\frac{\mu}{2}, \frac{\mu}{2}\right) \ln a.$$

In the special case $a = 1$ gives

$$\int_{-\infty}^{\infty} \frac{x \, dx}{(e^x + e^{-x})^\mu} = 0.$$

Now differentiate with respect to the parameter μ.