

**PROOF OF FORMULA 4.271.6**

$$\int_0^1 \frac{(\ln x)^{2n} dx}{1+x^2} = \frac{1}{2} \int_0^\infty \frac{(\ln x)^{2n} dx}{1+x^2} = \frac{\pi^{2n+1}}{2^{2n+2}} |E_{2n}|$$

Split the integral at  $x = 1$  and make the change  $x \mapsto 1/x$  to see the first identity. Entry 4.271.5 states that

$$\int_0^1 \frac{(\ln x)^{2n} dx}{1+x^2} = (2n)! \sum_{k=0}^{\infty} \frac{(-1)^k}{(2k+1)^{2n+1}}.$$

The result follows from the expression of this series in terms of the Euler numbers

$$\sum_{k=0}^{\infty} \frac{(-1)^k}{(2k+1)^{2n+1}} = \frac{\pi^{2n+1} |E_{2n}|}{(2n)! 2^{2n+2}}.$$