

PROOF OF FORMULA 4.235.2

$$\int_0^\infty \ln x \frac{(1-x^2)x^{m-1}}{1-x^{2n}} dx = -\frac{\pi^2 \sin\left(\frac{(m+1)\pi}{n}\right) \sin\frac{\pi}{n}}{4n^2 \sin^2\left(\frac{m\pi}{2n}\right) \sin^2\left(\frac{(m+2)\pi}{2n}\right)}$$

Start with

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

The result now follows from entry **4.254.2**

$$\int_0^\infty \frac{x^{p-1} \ln x}{1-x^q} dx = -\frac{\pi^2}{q^2 \sin^2\left(\frac{\pi p}{q}\right)}.$$