PROOF OF FORMULA 4.235.2

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

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

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