PROOF OF FORMULA 4.235.1

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

Start with

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

and use Entry 4.254.2

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

to obtain the result.