PROOF OF FORMULA 4.256

$$\int_0^1 \ln\left(\frac{1}{x}\right) \frac{x^{\mu-1}\,dx}{\sqrt[n]{(1-x^n)^{n-m}}} = \frac{1}{n^2} B\left(\frac{\mu}{n}, \frac{m}{n}\right) \left[\psi\left(\frac{\mu+m}{n}\right) - \psi\left(\frac{\mu}{n}\right)\right]$$

The change of variable $t = x^n$ yields

$$\int_0^1 \ln\left(\frac{1}{x}\right) \frac{x^{\mu-1}\,dx}{\sqrt[n]{(1-x^n)^{n-m}}} = -\frac{1}{n^2}\int_0^1 t^{\mu/n-1}(1-t)^{m/n-1}\,\ln t.$$

The result now follows from the identity

$$\int_0^1 t^{a-1}(1-t)^{b-1}\,\ln t\,dt = B(a,b)\left[\psi(a)-\psi(a+b)\right].$$