[tex129] BE gas in $\mathcal{D}$ dimensions VII: isobaric expansivity

To derive the parametric expression of the isobaric expansivity of the ideal BE gas at $T > T_c$,

$$T_p\alpha_p = \frac{T_p}{T}\left[\left(\frac{\mathcal{D}}{2}+1\right)\frac{g_{\mathcal{D}/2+1}(z)g'_{\mathcal{D}/2}(z)}{g_{\mathcal{D}/2}(z)g'_{\mathcal{D}/2+1}(z)} - \frac{\mathcal{D}}{2}\right], \quad \frac{T_p}{T} = \left[g_{\mathcal{D}/2+1}(z)\right]^{\mathcal{D}/2+1},$$

where $k_B T_p = \Lambda(p/\Lambda)^{2/(\mathcal{D}+2)}$, $\Lambda \doteq h^2/2\pi m$, and $g_n(z)$ are BE functions, establish first the general thermodynamic relation $\alpha_p = \kappa_T(\partial p/\partial T)_v$ with $v \doteq V/\mathcal{N}$, the BE-specific relation $C_V = \mathcal{N}(\mathcal{D}/2)v(\partial p/\partial T)_v$, and the results for C_V and κ_T calculated in [tex97] and [tex128].

Solution: