

[tex167] Paramagnetic FD gas VII: isobaric expansivity

There are again two distinct quantities that go by this name:

$$\alpha_{pM} \doteq \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_{pMN}, \quad \alpha_{pH} \doteq \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_{pHN}. \quad (1)$$

For the special case $H = M = 0$ the two quantities coincide. Show that the expression for this special case is

$$\alpha_p = \frac{1}{T} \left[\left(\frac{\mathcal{D}}{2} + 1 \right) \frac{f_{\mathcal{D}/2+1}(z) f_{\mathcal{D}/2-1}(z)}{[f_{\mathcal{D}/2}(z)]^2} - \frac{\mathcal{D}}{2} \right]. \quad (2)$$

Then tackle the general cases separately and show that each reduces to (2) for the limiting cases.

Solution: