The Dieterici equation of state reads

\[ p = \frac{nRT}{V - nb} \exp\left(-\frac{an}{RTV}\right), \]

where \(a, b\) are phenomenological constants.

(a) Show that the pressure, volume, and temperature at the critical point are

\[ p_c = \frac{a}{4b^2e^2}, \quad V_c = 2nb, \quad T_c = \frac{a}{4Rb}. \]

(b) Rewrite the Dieterici equation of state as a relation between the dimensionless quantities \(\tilde{p} = p/p_c, \tilde{V} = V/V_c, \tilde{T} = T/T_c\) (law of corresponding states).

Solution: