# J06T.2 - Liquid-Gas Phase Transition

## Problem

Consider the following approximate equation of state describing a liquid-gas phase transition and critical point:

$$p(V - Nb) = Nk_BT \exp(-Na/(k_BTV)),$$

where $a$ and $b$ are constants (not necessarily the same constants that appear in the usual van der Waals equation of state).

a)   Breifly describe the physical meaning of the constants $a$ and $b$.

b)   On a $p$-$V$ diagram sketch some representative isotherms for this gas, showing all qualitatively important effects. Be sure to show and clearly label the critical isotherm, at least one isotherm at a higher temperature than the critical isotherm and at least one isotherm at a lower temperature than the critical isotherm. Show qualitatively correct equilibrium isotherms **after allowing for phase separation; do not show any metastable or unstable states**.

c)   Determine $p_c, V_c$ and $T_c$, that is, the pressure, volume and temperature at the critical point, given the above equation of state.