

## M08T.2 - van der Waals Gas

### Problem

The van der Waals equation of state is

$$P = \frac{Nk_B T}{V - Nb} - a \frac{N^2}{V^2}$$

for the pressure  $P$  of a fluid  $N$  interacting atoms in a volume  $V$  at temperature  $T$ . This models the liquid-gas phase transition and its critical point.

- a) **Briefly** explain the physics of each of the two above corrections to the ideal gas equation of state (corresponding to the parameters  $b$  and  $a$ ).
- b) Calculate the parameters at the critical point: the critical pressure  $P_c$ , critical temperature  $T_c$ , and the critical density  $n_c = (N/V)_c$ .