Physics 831 Quiz #4
Friday, Oct. 4, 2013

1. (15 pts) Consider the equation of state

$$P(\rho, T) = \rho T e^{\rho/\rho_0} - a\frac{\rho^2}{\rho_0}.$$

Solve for the critical density ρ_c and the critical temperature T_c in terms of ρ_0 and a.

2. (15 pts) Given $Z(T, \alpha = -\mu/T)$ (where μ corresponds to a particle number N) find

$$\left\langle (E - \bar{E})^2 (N - \bar{N}) \right\rangle,$$

where $\bar{N} = \langle N \rangle$ and $\bar{E} = \langle E \rangle$. Express your answer in terms of $\ln Z$ and derivatives of $\ln Z$.