Homework 8, due 11-8

In class we introduced the Fermi gas model of nuclei. Consider a Fermi gas of protons and neutrons. The total energy depends on the number of protons, Z, and the number of neutrons, N. Write the total energy in the form

$$E = a_V A + a_A \frac{(Z - A/2)^2}{A} + \ldots,$$

where $\ldots$ are terms of higher order in $(Z - A/2)$. Express the volume energy a_V and the asymmetry energy a_A in units of the (average) Fermi energy

$$\epsilon_F = \frac{\hbar^2 \bar{k}_F^2}{2m_N},$$

where $\bar{k}_F$ is the (average) Fermi momentum.