Homework 1, due 2-4

Read chapter 2 of Jackson's book.

1. Show that

   - Any excess charge placed on a conductor must lie entirely on its surface.
   - A closed, hollow conductor shields its interior from fields due to charges outside, but does not shield its exterior from charges inside.

2. Prove the mean value theorem: For charge free space the value of the electrostatic potential at any point is equal to the average of the potential over any sphere centered around that point.

3. Two long, cylindrical conductors of radii a_1 and a_2 are parallel and separated by a distance d which is large compared with either radius. Show that the capacitance per unit length is given approximately by

$$C \simeq \left(4 \log \frac{d}{a}\right)^{-1}$$

   where a is the geometric mean of the two radii.