CLASSICAL ELECTRODYNAMICS I
Homework Set 2
January 30, 2015

1. Two long, cylindrical nonconductors of radii a_1 and a_2 are parallel with their axes along the z direction. The cylinder with radius a_1 has charge per unit length $+\lambda$ and the cylinder with radius a_2 has charge per unit length $-\lambda$; the distance between the centers of the cylinders is d. Calculate an expression for the capacitance per unit length C and show that if $d \gg a_1$ and $d \gg a_2$, then

$$C \approx \pi\epsilon_0 \left(\ln\frac{d}{a} \right)^{-1} ,$$

   where $a = \sqrt{a_1 a_2}$ is the geometrical mean of the two radii.

2. A grounded conducting spherical shell of radius R is located with its center at the origin. A point charge q is located inside of the shell at a distance a from the center of the shell. Use the method of images to find the electrostatic potential everywhere inside the shell. As a special case, give an explicit formula for the potential when q is located at the center of the shell.