Electrodynamics I: Assignment 3.
Due October 17 at 11:00am in class or 10:45am in the instructor's mailbox.

1. Two equal charges q are separated by a distance d. A grounded conducting sphere of radius R (with $R << d$) is located at the center of this system on the axis between the two charges. What is the sphere radius that just cancels the Coulomb force between the two charges?

2. A solid cylinder of length L and small radius R is positioned above and parallel to a grounded plane. The axis of the cylinder is a distance d from the plane. The cylinder carries a uniformly-distributed charge with linear charge density λ.
a. Find the force on the cylinder
b. Find the charge density on the plane.

3. (Jackson problem 1.9) For the pair of cylindrical conductors of last week's problem 4, find the attractive force per length between the conductors under the condition: (a) fixed charge per length along the conductor; (b) fixed potential difference across the conductors.

4. Consider a conducting sphere of radius R whose center is a distance d from a grounded conducting plane ($d > r$, they don't touch). To lowest non-non-trivial order in $z = R/2d$ (that is, using the first 2 terms), find the capacitance between the sphere and the plane. This is an image-charge problem with an infinite number of image charges for the exact solution: make a table with the value of the charges and their positions for charges you use in evaluating the lowest-order capacitance.

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