PH631 Fall 2015

Electromagnetic Theory I

Problem Set #3

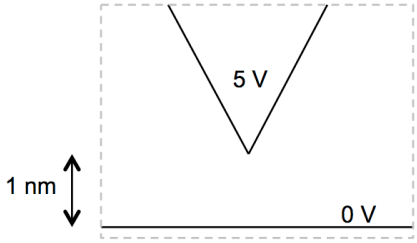
Due: 10-16-2015

1. Using the method of images, consider the problem of a point charge q inside a hollow, grounded, conducting sphere of inner radius a.

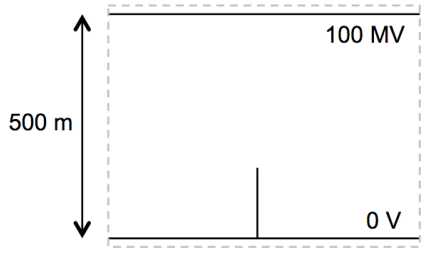
(a) Find the potential inside the sphere;
(b) Find the induced surface-charge density;
(c) Find the magnitude and direction of the force acting on q.
(d) Is there any change in the solution if the sphere is kept at a fixed potential V?

2. Find a comp exam problem that uses method of images. Write up your own solution to the comp exam problem.

3. Use numerical techniques to compute Φ in the volume of interest for **one** of the following two geometries. Visualize your answer using contour plots, and possibly other methods. Use your answer to gain some physical insight about field enhancement (the field near a sharp point is stronger than the spatially-averaged field between two conductors).



A scanning tunneling microscope (STM) tip hovering above a metal surface.
[You are only required to solve the 2d version of the problem]



Lightning rod underneath a thundercloud.
[You are only required to solve the 2d version of the problem]