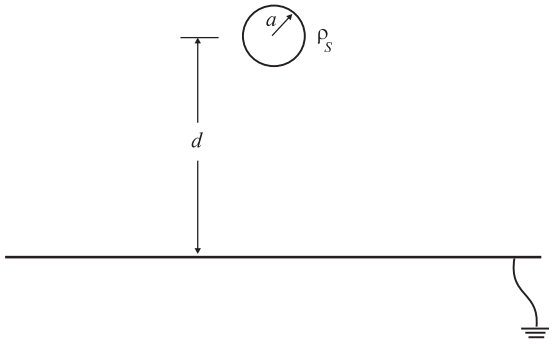
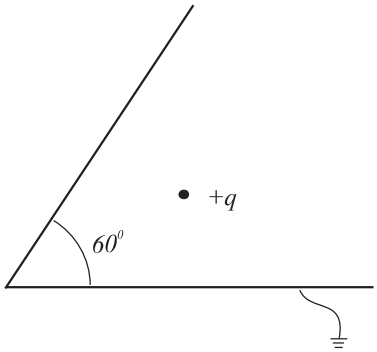
Homework set 7
EE 314/Phys 314
Fall 2025

1. A point charge sits a distance d above a grounded conducting plane. Determine the amount of work required to move the charge to a distance point along the z-axis (i.e. $z \to \infty$).

2. A small conducting sphere of radius a and uniform charge density ρ_s, sits a distance $d \gg a$ above a grounded conducting plane. Determine the capacitance of this system.



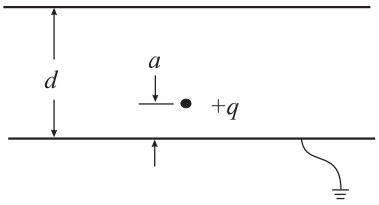
3. A point charge having charge q, and located midway (30°) between two infinite, grounded conducting planes forming a 60° angle, as shown below.



   (a) Use the method of images to determine the system of charges to replace the conducting boundaries.

   (b) Suppose that the angle is increased to 120° and that the point charge is again centered between the two conductors (i.e. 60°). Can the method of images be used in this case? If so, present your solution. If not explain why.

4. Use the method of images to determine the system of charges necessary to replace two grounded parallel conducting plates, separated by a distance d. Assume a point charge q is located the distance a from the bottom conductor. *Hint: Imagine looking at your reflection in the mirror with a second mirror behind you. How many images to you see?*



5. A point charge q is located **inside** and at a distance d from the center of a grounded spherical conducting shell of radius a, as shown in the figure below.

   What is the net force on this charge? (*Hint: Make use the method of images.*)