Homework week 7

1. A positive point charge is situated at on the z-axis at position (0,0,z). A metal plate that stretches to infinity in both the x- and y-directions is situated in the xy-plane.

a. What is the direction of the electric field just above the metal plate?

b. What do you know about the electric potential in the metal plate?

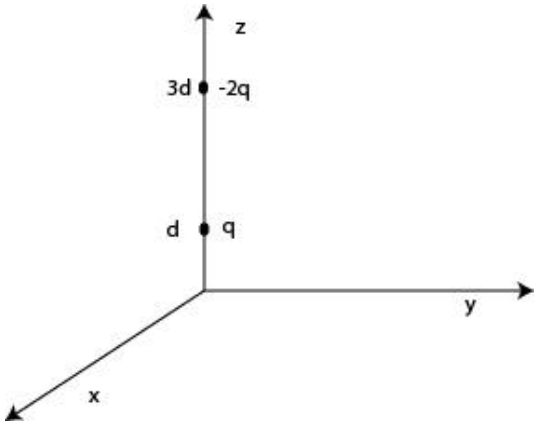
c. Now remove the metal plate be keep the point charge at (0,0,z). Can you add charges to the negative half space (i.e. the volume $z<0$) that together with the point charge at (0,0,z) creates an electric field distribution that is consistent with your answer on (a).

d. Is your choice for the answer on c consistent with (b). Explain!

e. Use your answer on (c) to determine the electric field distribution around the point charge and the metal plate.

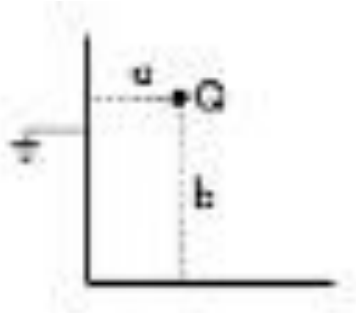
f. Use (e) to determine the charge density on the metal plate.

2. Assume a grounded metal plate in the xy-plane. Furthermore assume a point charge q, at a distance d above the plane (on the z-axis), and a charge -2q at a position 3d above the plane (also on the z-axis). Find the force on the point charge q. Determine the force on the point charge closest to the metal plane.



3. A long wire with charge per unit length λ is suspended a distance *d* above a grounded conducting plane. Find (a) the electrostatic potential everywhere above the plane and (b) the surface charge density induced on the plane.

4. Find the electrostatic potential due to a point charge in the "corner" near two grounded conductors. (b) Find the surface charge density induced on the plane at x = 0.



5. Additional problem only for PHYS5270 graduate students:

   Study example 3.2 and then work problem 3.12 on page 130.