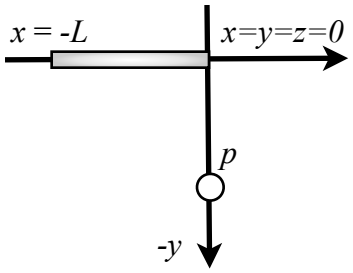
EP440: ENGINEERING ELECTROMAGNETICS
Fall 2014, J. B. Snively
Homework #2: Due 9/10/2014

For this assignment... Work out the following problems on separate sheets. Staple all, including this front page, for your submission.

1) For the pictured line charge distribution, with total charge *Q*, find <u>*by integration*</u> the vector electric field **E** at "*p*". Your solution should be a proper "EP440" approach, i.e., no PS250-style handwaving allowed. Feel free to integrate by table!



2) A volume charge ρ_v is distributed throughout a sphere with radius *a*, which is then surrounded by a thin concentric spherical shell having surface charge ρ_s and radius *b* (*b*>*a*). If the electric field **E**=0 at a radius *R*>*b*, find an expression for ρ_v in terms of ρ_s. Find the electric field **E** in the regions of *R*<*a* and a≤*R*≤*b. Assume that the permittivity everywhere is equal to that of free space.*

3) An infinite line charge ρ_l is surrounded by a *conducting* coaxial cylindrical shell with inner radius *a* and outer radius *b,* which is then surrounded fully by a coaxial charged shell with uniform volume charge ρ_v, having inner radius *b* and outer radius radius *c* (where *c*>*b*>*a*). If the electric field **E**=0 at a radius *r*>*c*, find an expression for ρ_v in terms of ρ_l. Find the electric field **E** in the regions of *r*<*a* and a≤*r*≤*b* and b≤*r*≤*c. Assume that the permittivity everywhere is equal to that of free space. Draw a picture for clarity, and explain what happens at the conductor's surfaces.*

4) The charged circular disk has radius *a* and surface charge density ρ_s. Find the electric field at a distance *z* above the center of the charge distribution. Find the electric field where *z*<<*a*, and demonstrate that this result agrees with a simpler solution using Gauss's law.