VE230 HW2

Due: Tuesday 4th June, 2019

P.3–8 A line charge of uniform density ρ_ℓ in free space forms a semicircle of radius b. Determine the magnitude and direction of the electric field intensity at the center of the semicircle.

P.3–9 Three uniform line charges—$\rho_{\ell 1}$, $\rho_{\ell 2}$, and $\rho_{\ell 3}$, each of length L—form an equilateral triangle. Assuming that $\rho_{\ell 1} = 2\rho_{\ell 2} = 2\rho_{\ell 3}$, determine the electric field intensity at the center of the triangle.

P.3–12 Two infinitely long coaxial cylindrical surfaces, $r = a$ and $r = b$ $(b > a)$, carry surface charge densities ρ_{sa} and ρ_{sb}, respectively.

a) Determine $\mathbf{E}$ everywhere.

b) What must be the relation between a and b in order that $\mathbf{E}$ vanishes for $r > b$?

P.3–13 Determine the work done in carrying a -2 (μC) charge from $P_1(2, 1, -1)$ to $P_2(8, 2, -1)$ in the field $\mathbf{E} = \mathbf{a}_x y + \mathbf{a}_y x$

a) along the parabola $x = 2y^2$,

b) along the straight line joining P_1 and P_2.

P.3–16 A finite line charge of length L carrying uniform line charge density ρ_ℓ is coincident with the x-axis.

a) Determine V in the plane bisecting the line charge.

b) Determine $\mathbf{E}$ from ρ_ℓ directly by applying Coulomb's law.

c) Check the answer in part (b) with $-\nabla V$.

P.3–19 A charge Q is distributed uniformly over the wall of a circular tube of radius b and height h. Determine V and $\mathbf{E}$ on its axis

a) at a point outside the tube, then

b) at a point inside the tube.