EE 340(04) Quiz 2

Name:

I.D. Number: 233539

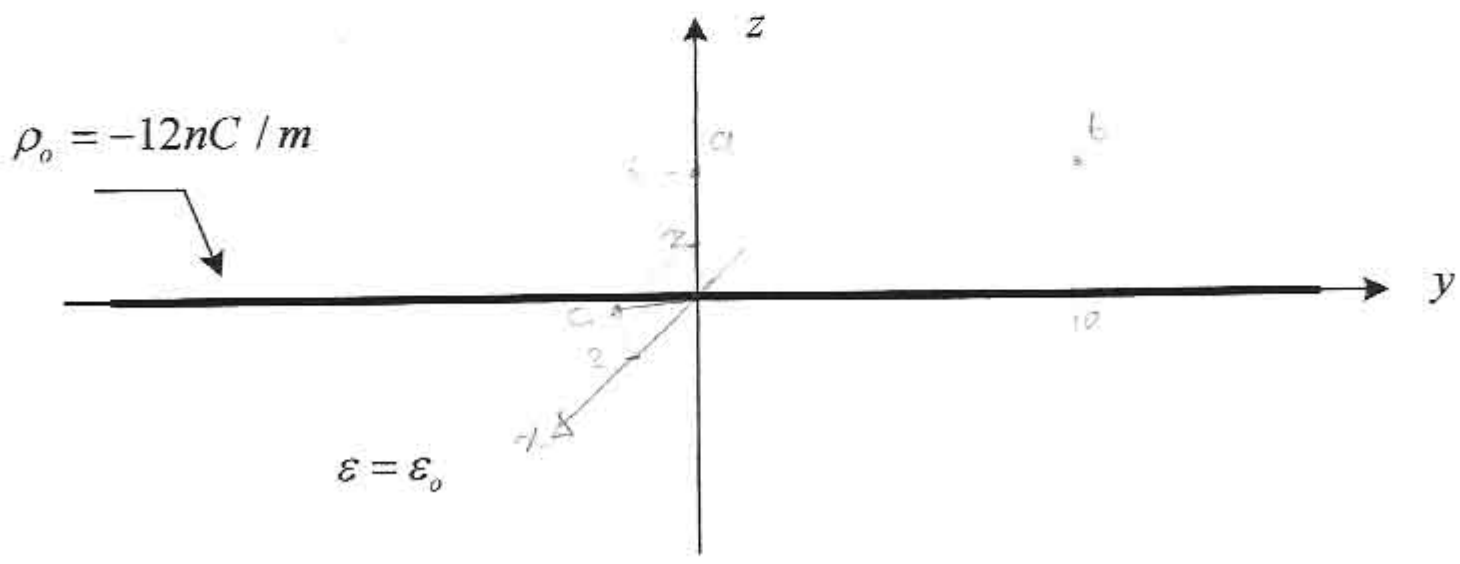
(15/15)

An infinitely long line of uniform charge density lies on the $y-$ axis. The charge density is given by $\rho_o = -12nC/m$. Assume the surrounding medium is air. Calculate the resulting electric field intensity vector $\vec{E}$ at the observation point P whose rectangular coordinates are given by:

a) (0, 0, 6).

b) (0, 10, 6).

c) (2, 0, 2).



a) $\vec{E} = \frac{\rho_L}{2\pi\varepsilon_0 \rho}\vec{a}_\rho$, $\rho = 6$, $\vec{a}_\rho = \vec{a}_z$

$= \frac{-12\times10^{-9}}{2\pi\left(\frac{1}{36\pi}\times10^{-9}\right)(6)}\vec{a}_z$

$= -36\,\vec{a}_z$ ✓

b) $\rho = 6$, $\vec{a}_\rho = \vec{a}_z$

$\vec{E} = -36\,\vec{a}_z$ ✓

c) $\rho = \sqrt{2^2+2^2} = \sqrt{8}$, $\vec{a}_\rho = \frac{1}{\sqrt{2}}\vec{a}_x + \frac{1}{\sqrt{2}}\vec{a}_z$

$\vec{E} = \frac{\rho_L}{2\pi\varepsilon_0 \rho}\vec{a}_\rho$

$= \frac{-12\times10^{-9}}{2\pi\varepsilon_0(\sqrt{8})}\left(\frac{1}{\sqrt{2}}\vec{a}_x + \frac{1}{\sqrt{2}}\vec{a}_z\right)$ ✓

$= -76.367\left(\frac{1}{\sqrt{2}}\vec{a}_x + \frac{1}{\sqrt{2}}\vec{a}_z\right) = -54\,\vec{a}_x - 54\,\vec{a}_z$ ✓