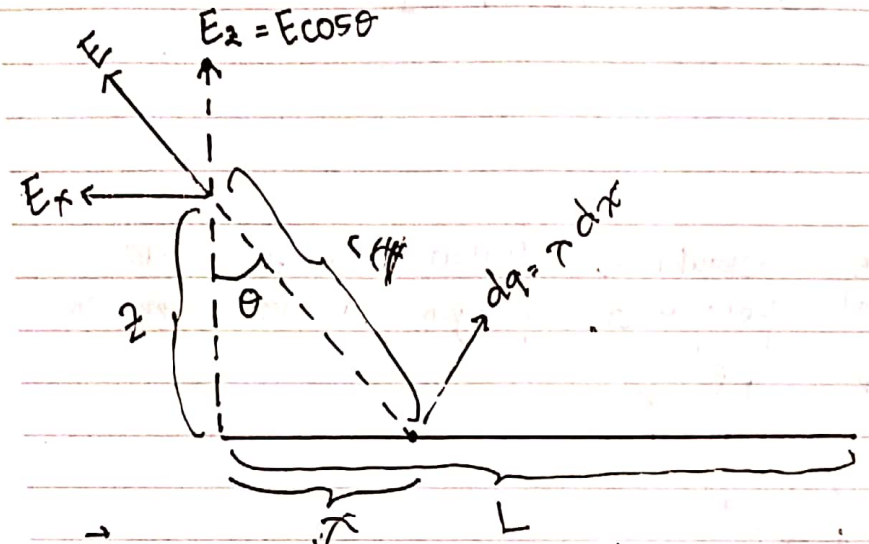
No.

Date

Nama : Chairani Kartini S. Harry
NPM : 2013022028

1. Hitung medan listrik pada salah satu ujung kawat yang panjang L yang membawa muatan λ. Bagaimana besar E, jika $z >> L$.



$$\vec{E} = \vec{E}_z + \vec{E}_x$$

$$\Rightarrow \vec{E}_z = \frac{1}{4\pi\varepsilon_0}\int_0^L \frac{dq}{r^2} = \frac{1}{4\pi\varepsilon_0}\int_0^L \frac{\lambda dx}{r^2}\cdot\cos\theta$$

Dimana $\cos\theta = \frac{z}{r}$

$$\vec{E}_z = \frac{1}{4\pi\varepsilon_0}\int_0^L \frac{z\lambda dx}{r^3} = \frac{1}{4\pi\varepsilon_0}\int_0^L \frac{z\lambda dx}{(z^2+x^2)^{3/2}}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0}\int_0^L \frac{dx}{(z^2+x^2)^{3/2}}$$

ditinjau di daftar integral $\int_0^L \frac{dx}{(z^2+x^2)^{3/2}} = \frac{1}{z^2}\frac{x}{\sqrt{z^2+x^2}}\Big|_0^L$

$$= \frac{1}{4\pi\varepsilon_0}\lambda z\left[\frac{1}{z^2}\frac{x}{\sqrt{z^2+x^2}}\right]_0^L$$

$$\vec{E}_z = \frac{\lambda z}{4\pi\varepsilon_0}\frac{1}{z^2\sqrt{z^2+x^2}} = \frac{\lambda}{4\pi\varepsilon_0}\frac{L}{z\sqrt{z^2+x^2}}$$

Lalu mencari

$$\vec{E}_x = -\frac{1}{4\pi\varepsilon_0}\int_0^L \frac{\lambda dx}{r^2}\sin\theta = -\frac{\lambda}{4\pi\varepsilon_0}\int_0^L \frac{x\,dx}{(z^2+x^2)^{3/2}}$$

arah $\vec{E}_x$ kekiri $= -\frac{\lambda}{4\pi\epsilon_0} \cdot \frac{1}{2} \int_0^L \frac{dx^2}{(z^2+x^2)^{3/2}}$

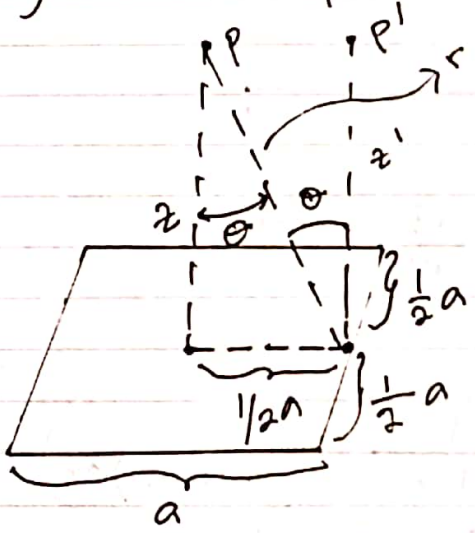
$= -\frac{\lambda}{4\pi\epsilon_0} \cdot \frac{1}{2} \left[(-2) \frac{1}{(z^2+x^2)^{1/2}} \right]_0^L$

$= -\frac{\lambda}{4\pi\epsilon_0} \left[-\left(\frac{1}{\sqrt{z^2+x^2}} - \frac{1}{z} \right) \right]$

$\vec{E}_x = -\frac{\lambda}{4\pi\epsilon_0} \left[\frac{1}{z} - \frac{1}{\sqrt{z^2+x^2}} \right]$

jadi $\vec{E} = \vec{E}_z + \vec{E}_x$

2. Hitung medan listrik sejauh z diatas kawat lurus panjang dengan rapat persatuan panjan λ yg homogen



$P = P' \cos\theta$, karena 4 sisi maka,

$P = 4P' \cos\theta$, sehingga

$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z'^2} = 4 \cdot \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z'^2} \cos\theta$

Karena $L = \frac{1}{2}a$ dan $z' = r = \sqrt{(z^2 + (\frac{1}{2}a)^2}$

dan $\cos\theta = \frac{z}{\sqrt{(z^2 + (\frac{1}{2}a)^2}}$ maka

$\vec{E} = 4 \cdot \frac{1}{4\pi\epsilon_0} \frac{2\lambda (\frac{1}{2}a) \cdot z}{(z^2 + (\frac{1}{2}a)^2) \sqrt{z^2 + (\frac{1}{2}a)^2}}$

$\therefore \vec{E} = \frac{1}{4\pi\epsilon_0} \frac{4\lambda a z}{(z^2 + \frac{a^2}{4}) \sqrt{z^2 + \frac{a^2}{4}}}$

No.

Date

3. Hitung medan listrik diatas pusat kawat melingkar sejauh z yang membawa seragan λ