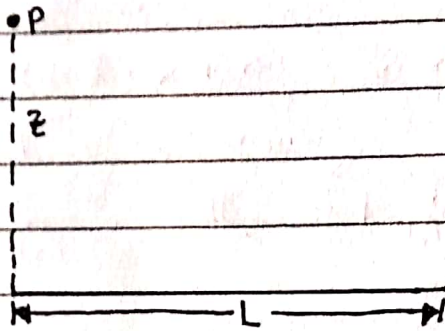


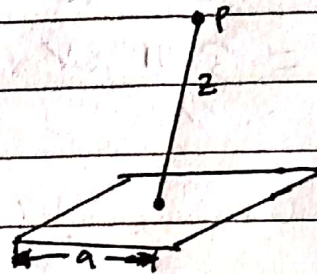
Nama: SHOLEA MUTIARA.

NPM: 20130220908

1. Hitunglah Medan Listrik pada salah satu ujung kawat yg panjangnya L <gambar 2.10> yang membawa muatan ~~seragam~~ seragam λ .
Besarnya besar E , jika $z \gg x$



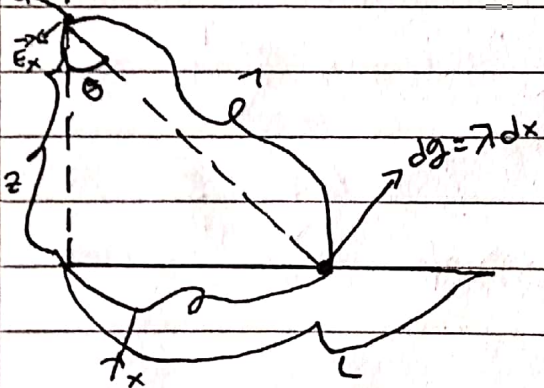
gambar 2.10.



gambar 2.11.

Penyelesaian.

1. $E_z = E \cos \theta$



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

ambil : $\vec{E}_z = \frac{1}{4\pi\epsilon_0} \int_0^L \frac{dq}{r^2} = \frac{1}{4\pi\epsilon_0} \int_0^L \frac{\lambda dx}{r^2} \cos \theta$

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

$$\vec{E}_z = \frac{1}{4\pi\epsilon_0} \int_0^L \frac{z \lambda dx}{r^3} = \frac{1}{4\pi\epsilon_0} \int_0^L \frac{z \lambda dx}{(z^2 + x^2)^{3/2}}$$

$$= \frac{z \lambda}{4\pi\epsilon_0} \int_0^L \frac{dx}{(z^2 + x^2)^{3/2}}$$

Lihat diatas Integral $\int_0^L \frac{dx}{(z^2 + x^2)^{3/2}} = \frac{1}{z^2} \cdot \frac{x}{\sqrt{z^2 + x^2}} \Big|_0^L$

A Champion is someone who gets up even when they can't

$$\vec{L} = \frac{1}{4\pi\epsilon_0} \lambda z \left[\frac{1}{z^2} \frac{x}{\sqrt{z^2+x^2}} \right]_0^L$$

$$\vec{E}_z = \frac{\lambda z}{4\pi\epsilon_0} \frac{L}{z^2 \sqrt{z^2+x^2}} = \frac{\lambda}{4\pi\epsilon_0} \frac{L}{z \sqrt{z^2+x^2}}$$

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

olah $\vec{E}_x$ kekiri

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

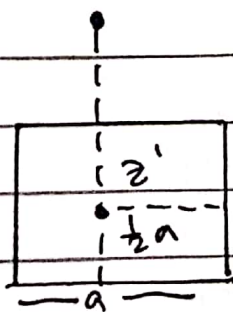
$$= -\frac{\lambda}{4\pi\epsilon_0} \cdot \frac{1}{2} \left[-2 \frac{1}{(z^2+x^2)^{1/2}} \right]_0^L$$

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

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

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

2. hitunglah medan listrik sejauh z dari titik tengah loop sisi empat panjang <gambar 2.11> yang membawa muatan seragam
1. gunakan contoh no. 3 untuk menyelesaikan permasalahan ini.

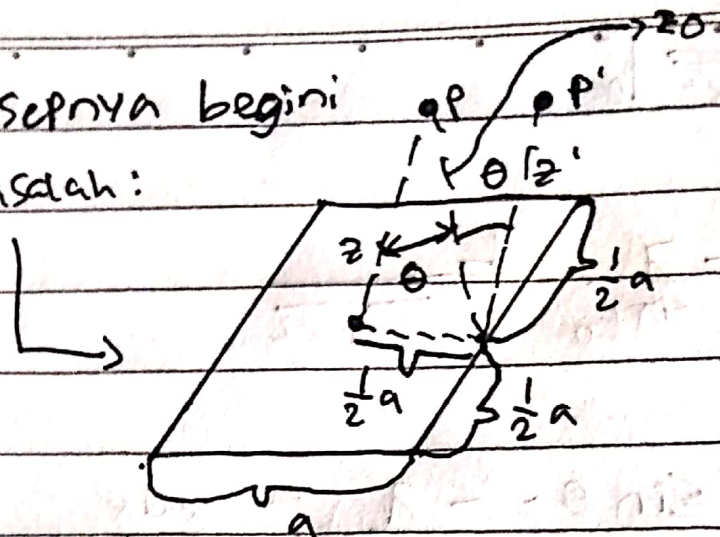


solusi: untuk menyelesaikan soal diatas gunakan contoh no. 3 yaitu kawat yang panjangnya $2L$ dengan $\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z^2}$

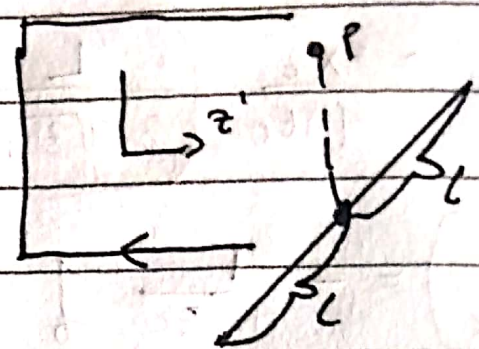
$$\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z^2} \text{ hasil contoh no. 3.}$$

konsepnya begini

MASDAH:



Contoh no.3



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

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

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

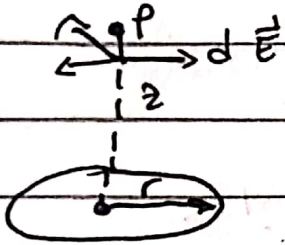
karena $L = \frac{1}{2}a$, dan $z' = r = \sqrt{z^2 + (\frac{1}{2}a)^2}$

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

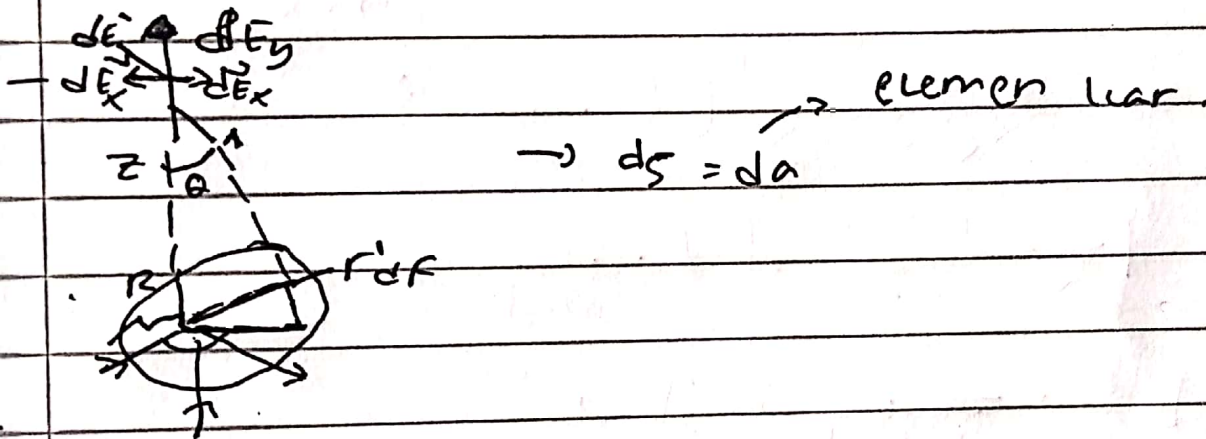
$$\rightarrow E = 4 \cdot \frac{1}{4\pi\epsilon_0} \frac{2\lambda (\frac{1}{2}a) \cdot z}{(\sqrt{z^2 + (\frac{1}{2}a)^2})^2 \cdot \frac{z}{\sqrt{z^2 + (\frac{1}{2}a)^2}}}$$

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

hitung medan listrik diatas pusat kawat melingkar sejauh z yang membawa muatan seragam λ (gambar 2.12).



Jawaban.



$$d\vec{E} = d\vec{E}_y + d\vec{E}_x = 0$$

$$= dE \cos \theta$$

$$\vec{E} = \frac{1}{4\pi\epsilon_0} \int_0^r \int_0^{2\pi} r \cos \theta \, da' \, d\phi$$

$$\vec{E} = \frac{1}{4\pi\epsilon_0} \lambda z \int_0^r \int_0^{2\pi} \frac{r' \, dr' \, d\phi}{(r'^2 + z^2)^{3/2}}$$

$$= \frac{2\pi\lambda z}{4\pi\epsilon_0} \int_0^r \frac{r' \, dr'}{(r'^2 + z^2)^{3/2}}$$

$$= \frac{\lambda z}{2\epsilon_0} \int_0^r \frac{d(r'^2 + z^2)}{(r'^2 + z^2)^{3/2}}$$