No.

Date

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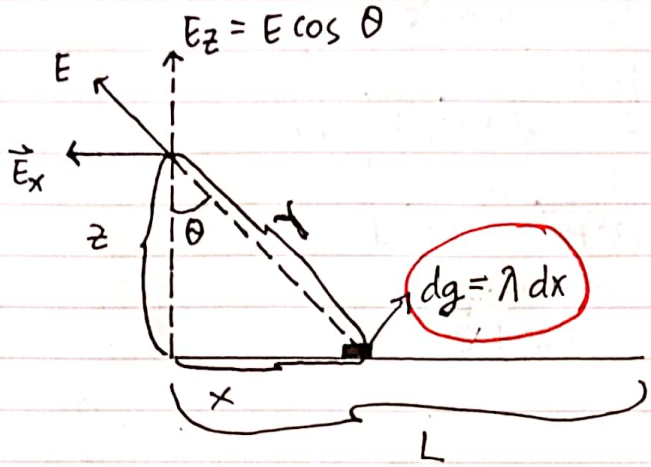
(1.)



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

$$\vec{E}_z = \frac{1}{4\pi\varepsilon_0}\int_0^L d\vec{E}\cos\theta$$

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

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

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

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

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

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

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

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

arah $\vec{E}_x$ kekiri

$$= -\frac{\lambda}{4\pi\varepsilon_0}\cdot\frac{1}{2}\int_0^L \frac{dx^2}{(z^2+x^2)^{\frac{3}{2}}}$$

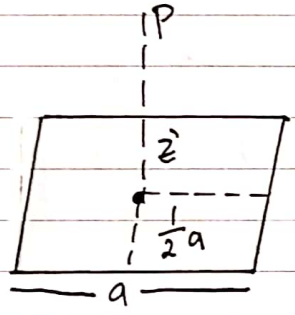
$$= -\frac{\lambda}{4\pi\varepsilon_0}\cdot\frac{1}{2}\left[-2\,\frac{1}{(z^2+x^2)^{\frac{1}{2}}}\right]_0^L$$

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

$$\vec{E}_x = -\frac{\lambda}{4\pi\varepsilon_0}\left[\frac{1}{z} - \frac{1}{\sqrt{z^2+x^2}}\right]$$

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

(2)



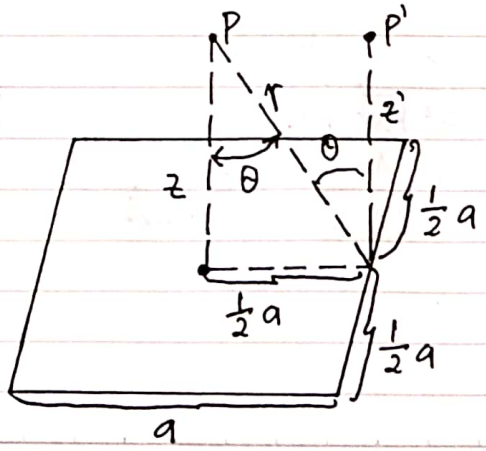
solusi : untuk menyelesaikan soal diatas, gunakan contoh no.3 yaitu kawat yang panjangnya 2L, dengan

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\,\frac{2\lambda L}{z'^2}$$

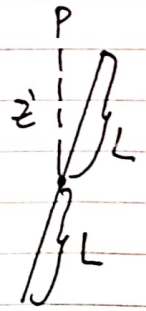
$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\,\frac{2\lambda L}{z'^2}$$ Hasil contoh no.3

Konsepnya begini

Masalah



contoh no.3



$P = P' \cos\theta$; Karena ada 4 sisi, maka

$P = 4P' \cos\theta$; Sehingga

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{2\lambda L}{z'^2} = 4\,\frac{1}{4\pi\varepsilon_0}\frac{2\lambda L}{z'^2}\cos\theta$$

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 :

$$\vec{E} = 4.\frac{1}{4\pi\varepsilon_0}\frac{2\lambda(\frac{1}{2}a).z}{(z^2+(\frac{1}{2}a)^2)\sqrt{z^2+(\frac{1}{2}a)^2}}$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{4\lambda a z}{\left(z^2+\frac{a^2}{4}\right)\sqrt{z^2+\frac{a^2}{4}}}\,\hat{z}$$