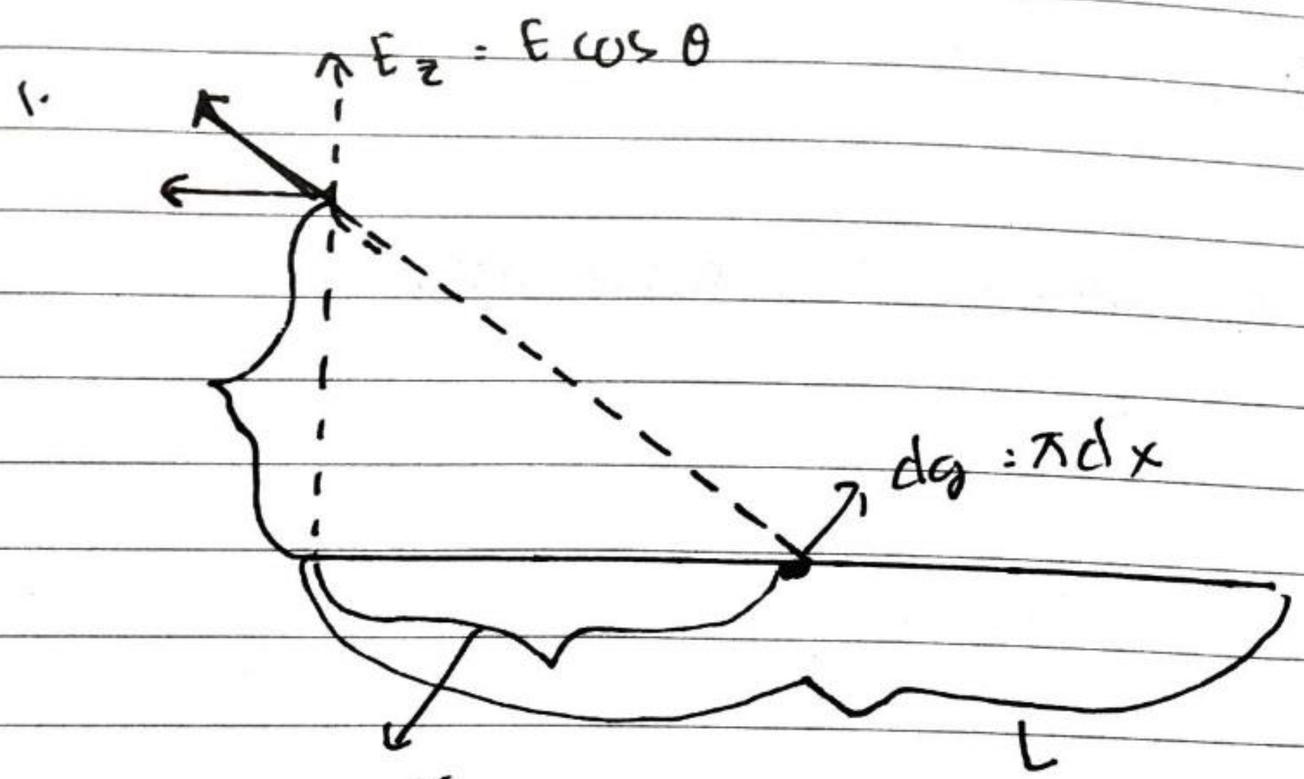
Nama : Elpin Hurul Fahmayani
Npm : 20B022038



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

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

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

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

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

lihat diatas integral $\int_0^L \frac{dx}{(z^2+x^2)^{\frac{3}{2}}} = \frac{1}{z^2}\frac{x}{\sqrt{z^2+x^2}}\Big|_0^L$

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

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

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

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

Date

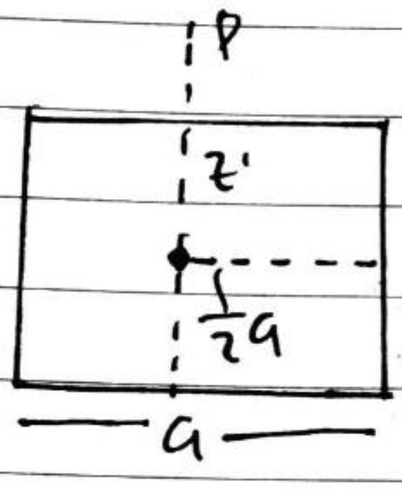
$$= -\frac{\lambda}{4\pi\varepsilon_0} \cdot \frac{1}{2} \cdot \left[-2 \frac{1}{(z^2+x^2)^{\frac{1}{2}}} \right]_0^L$$

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

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

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

2.



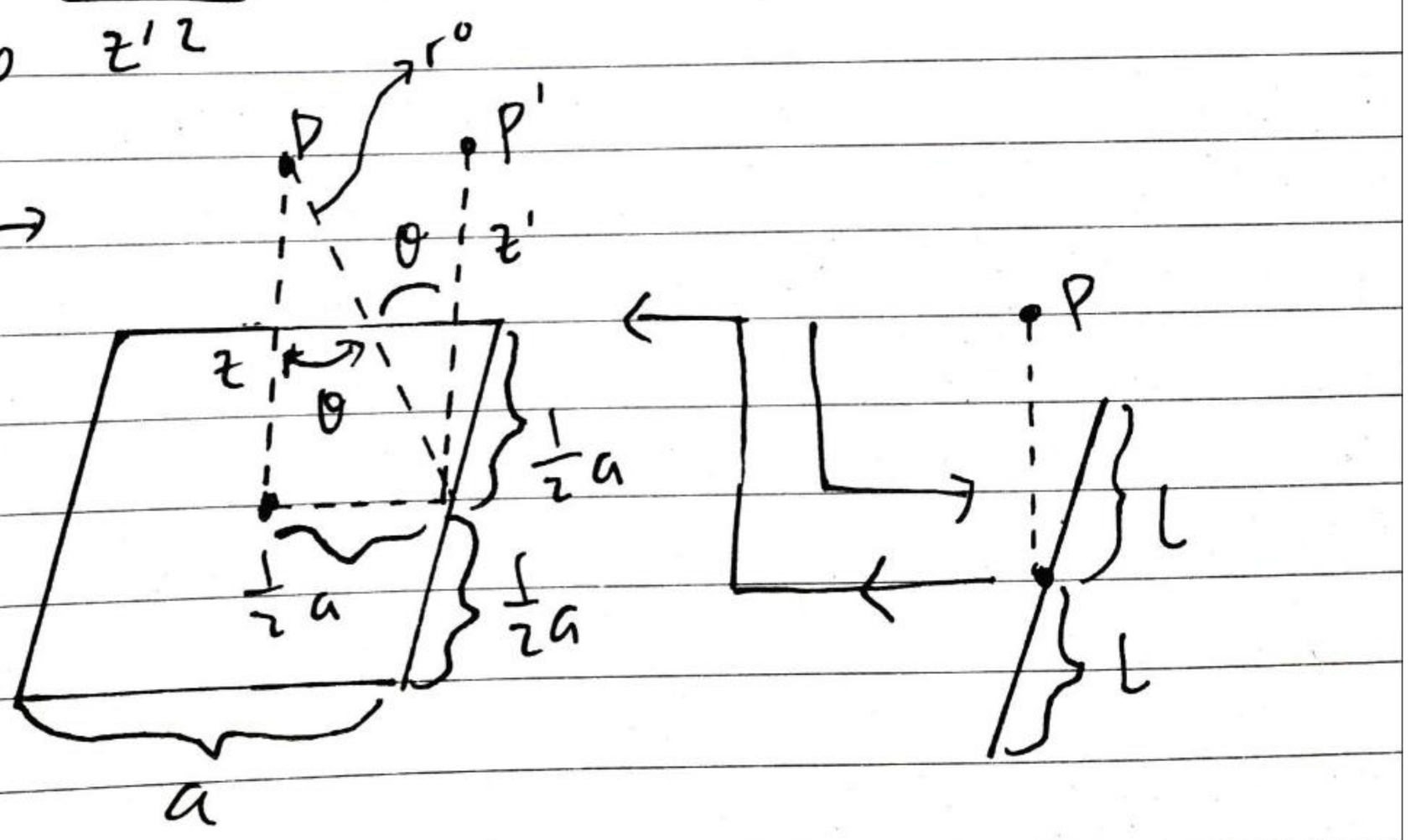
Solusi : untuk menyelesaikan soal diatas gunakan contoh no.3 yaitu kawat yg panjangnya 2L. dengan :

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

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

Konsep :

masalah →



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

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

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

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

$$\cos\theta = \frac{z}{\sqrt{z^2 + \left(\frac{1}{2}a\right)^2}}, \text{ maka :}$$

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

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