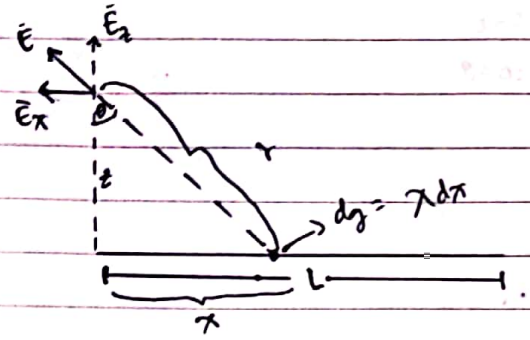
No.

Date :

1. Hitung medan listrik pada salah satu ujung kawat yang panjangnya L (gambar 2.10) yang membawa muatan seragam $\lambda$. Bagaimana besar E, jika $z \gg L$.




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

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

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

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

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

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

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

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

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

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

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

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

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

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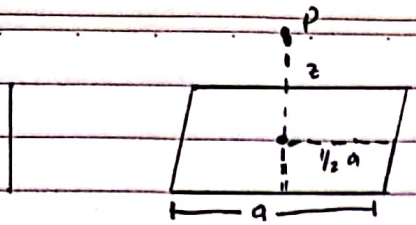
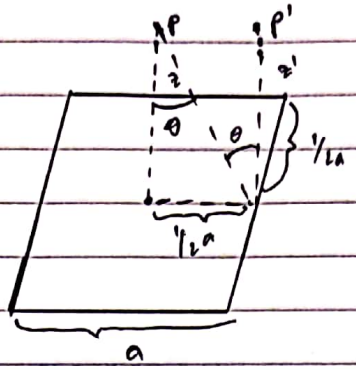
2.




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




$$P = P'\cos\theta$$

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

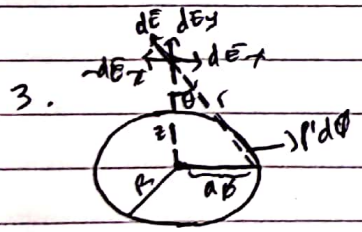
$$\Rightarrow \bar{E} = \frac{1}{4\pi\varepsilon_0}\frac{2\lambda L}{z'^2} = \frac{4.1}{4\pi\varepsilon_0}\frac{2\lambda L}{z'^2}\cos\theta$$

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

$$\Rightarrow \bar{E} = \frac{4.1}{4\pi\varepsilon_0}\frac{2\lambda(\frac{1}{2}a).z}{(z^2+(\frac{1}{2})^2)\sqrt{z^2+(\frac{1}{2})^2}}$$

$$\bar{E} = \frac{1}{4\pi\varepsilon}\frac{4\lambda a z}{(z^2+(\frac{a^2}{4}))\sqrt{z^2+\frac{a^2}{4}}}$$

3.




$$\bar{E} = \frac{1}{4\pi\varepsilon_0}\int_s \frac{\sigma\, ds}{\rho^2}\cos\theta$$

$$\bar{E} = \frac{1}{4\pi\varepsilon_0}\int_0^R\int_0^{2\pi}\frac{r}{\rho^2}\cos\theta.\sigma'.ds'.d\rho$$

$$\bar{E} = \frac{1}{4\pi\varepsilon_0}\sigma z\int_0^R\int_0^{2\pi}\frac{\rho' d\rho' d\phi}{(\rho^2+z^2)^{3/2}}$$

$$= \frac{2\pi\sigma z}{4\pi\varepsilon_0}\int_0^R\frac{\rho' d\rho'}{(\rho'^2+z^2)^{3/2}} = \frac{\sigma z}{2\varepsilon_0}\int_0^R\frac{1}{2}\frac{d(\rho'^2+z^2)}{(\rho'^2+z^2)^{3/2}}$$