

Nama Irwani Triana

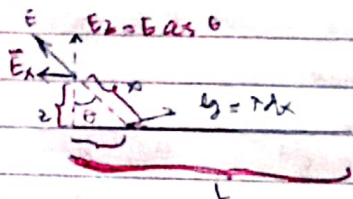
NPM A013020002

Kelas B

Tugas

1. Hitung Medan listrik pd setiap satu ujung kawat yg panjangnya  $L$  yg membawa muatan seragam  $\lambda$ . Berapakah besar  $E$ , jika  $z \gg L$ .

Jawab



$$\vec{E} = \vec{E}_z + \vec{E}_x$$
$$\vec{E}_z = \frac{1}{4\pi\epsilon_0} \int_0^L d\vec{E} \cos \theta$$

Atau

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

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

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

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

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

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

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

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

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

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

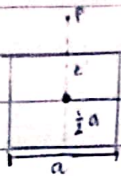
$$= -\frac{\lambda}{4\pi\epsilon_0} \left[ -\left( \frac{1}{\sqrt{z^2 + x^2}} - \frac{1}{z} \right) \right]$$

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

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



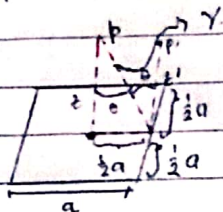
2) Jawab



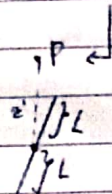
Solusi: U/ menyelesaikan soal Assimpang, gunakan konsep 8  
 yaitu konsep yg penerapannya 2L, dg  $E = \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z^2}$

$$E = \frac{1}{4\pi\epsilon_0} \frac{2\lambda L}{z^2} \quad (\text{kami tulis no. 5})$$

Konsep



Letih no 3



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

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

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

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

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

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

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

4. tugas No 4 hal 53

Tentukan medan listrik berarah z diatas pusat permukaan ke bentuk lingkaran dg jari-jari R

yg membarua permukaan: silindris

Jawab

$$d\vec{E} = dE_x \hat{x} + dE_y \hat{y}$$



elemen luas

$$\sim ds = da = r \times d\phi = dr' \cdot r' d\phi$$

$$da = r' dr' d\phi$$

$$\sim d\vec{E} = dE_y + dE_x = 0$$

$$= dE \cos \theta$$

$$\rightarrow E = \frac{1}{4\pi\epsilon_0} \int_0^R \int_0^{2\pi} \frac{r}{r^2} \cos \theta \cdot r' dr' d\phi \quad \sim E = \frac{1}{4\pi\epsilon_0} \int_0^R \frac{\sigma_2 a \cos \theta}{r^2}$$

bukan  $\cos \theta$ , dg  $r^2$  selanjutnya

$$E = \frac{1}{4\pi\epsilon_0} \sigma_2 \int_0^R \int_0^{2\pi} \frac{r' dr' d\phi}{(r'^2 + z^2)^{3/2}}$$

$$= \frac{2\pi\sigma_2}{4\pi\epsilon_0} \int_0^R \frac{r' dr'}{(r'^2 + z^2)^{3/2}}$$

$$= \frac{\sigma_2}{2\epsilon_0} \int_0^R \frac{d(r'^2 + z^2)^{1/2}}{(r'^2 + z^2)^{3/2}}$$