No.

Date :

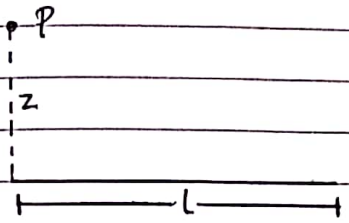
Nama : Sihfa Zhainita

NPM : 2013022062

Mata Kuliah = Kelistrikan dan kemagnetan

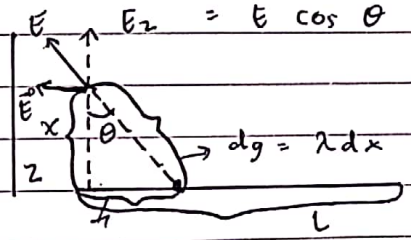
Tugas

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



Gambar 2.10

Jawaban Penyelesaian :



$E_z = E \cos\theta$

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

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

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

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

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

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

Daftar Integral $\int_0^L \frac{dx}{(z^2+x^2)^{3/2}} = \frac{1}{z^2} \frac{x}{\sqrt{z^2+x^2}} \int_0^L$

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

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

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

No.

Date :

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

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

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

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

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

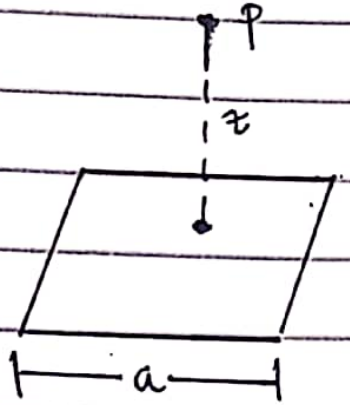
Jadi, $\vec{E} = \vec{E}_z + \vec{E}_x$

//

No.

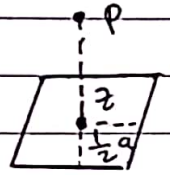
Date :

(2). Hitung medan listrik sejauh z dari titik tengah loop segi empat panjang (Gambar 2.11) yang membawa muatan seragam λ. Gunakan contoh no. 3 untuk menyelesaikan permasalahan ini.



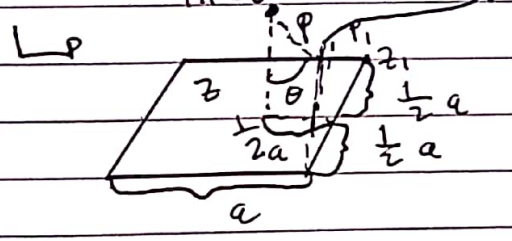
Jawaban Penyelesaian :

Untuk ulasan No. 2



Soluri : Untuk menyelesaikan soal diatas gunakan Contoh no. 3 yaitu kawat yang panjangnya 2L, dengan $\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{2\lambda L}{z'^2}$

$\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{2\lambda L}{z'^2}$ (γ_0)



$p = p' \cos\theta$, karena ada 4 sisi,

maka : $p = 4p' \cos\theta$;

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

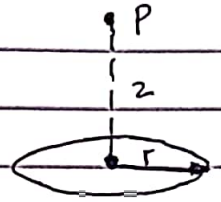
karena $L = \frac{1}{2} a$, dan $z' = r = \sqrt{z^2 + (\frac{1}{2})^2}$

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

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

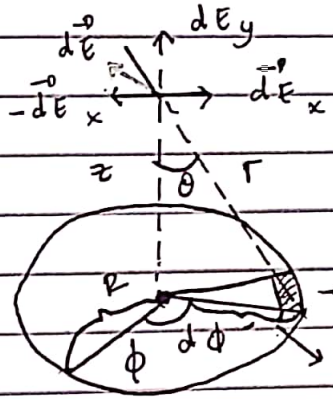
$\therefore \vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{4\lambda a z}{(z^2 + \frac{a^2}{a}\sqrt{z^2 + a^2}}{4} z$

3. Hitung medan listrik diatas pusat kawat melingkar sejauh z yang membawa muatan seragam λ (Gambar 2.12)



Gambar 2.12

Jawaban Penyelesaian :



$\vec{dE} = \vec{dE}_y + \vec{dE}_x = 0$

$= dE \cos\theta$

$ds = da = P \times \ell$

$= dp' \cdot p' d\phi$

$da = p' dr' d\phi$

$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_s \frac{\sigma da}{r^2} \cos\theta$

$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_0^R \int_0^{2\pi} \frac{r}{r^2} \cos\theta \cdot \underbrace{r' dr' d\rho}_{da}$

Maka, $\cos\theta$ dengan r^2, sehingga menjadi

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

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

No.

Date :

$$= \frac{\sigma z}{2\varepsilon_0} \int_0^R \frac{1}{2} \frac{d(\rho' d\rho')}{(\gamma'^2 + z^2)^{3/2}}$$, turun dari ρ'^2, $2\rho'$