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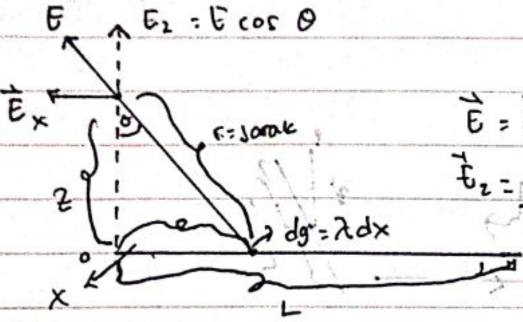
NPM : 2013022022

Kelas : B

Tugas Hal 53 No 1



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

$$\vec{E}_z = \frac{1}{4\pi\varepsilon_0}\int_0^2 d\vec{E}\cos\theta$$

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

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

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

$$\int_0^2 \frac{dx}{(z^2+x^2)^{3/2}} = \frac{1}{z^2}\frac{x}{\sqrt{z^2+x^2}}\Big|_0^{\cancel{L}} = \frac{z\lambda}{4\pi\varepsilon_0}\int_0^2 \frac{dx}{(z^2+x^2)^{3/2}}$$

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

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

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

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

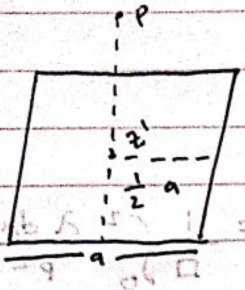
$$= -\frac{\lambda}{4\pi\varepsilon_0}\cdot\frac{1}{2}\cdot\left[-2\frac{1}{(z^2+x^2)^{1/2}}\right]_0^2$$

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

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

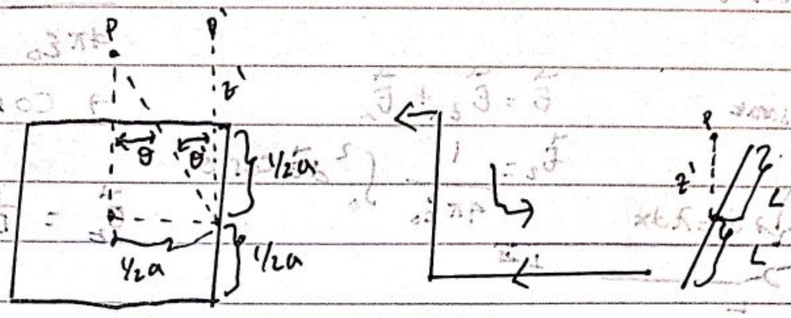
Jadi $\vec{E} = \vec{E}_z + \vec{E}_x$

Tugas no 2 Hal 53



Solusi: contoh no.3, yaitu kawat yang panjangnya $2L$, dengan $\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{2\lambda L}{z^2}$

Gambar konsep



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

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

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

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

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

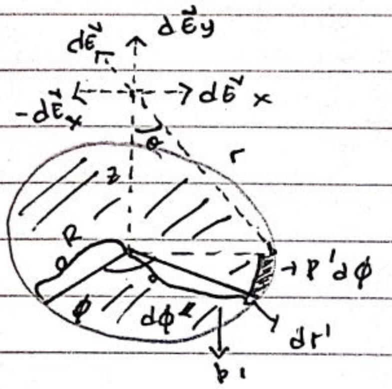
$$\vec{E} = 4 \cdot \frac{1}{4\pi\varepsilon_0} \frac{2\lambda(\frac{1}{2}a) \cdot z}{(z^2 + (\frac{1}{2}a)^2)\sqrt{z^2 + (\frac{1}{2}a)^2}}$$

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

Dipindai dengan CamScanner

Tugas 3

Tentukan medan listrik berjarak z diatas pusat permukaan berbentuk lingkaran dengan jari2 R yang membawa permukaan seragam



$$ds = da = p \times l$$
$$= dp' \cdot p' d\phi$$
$$da = p' \, dr' d\phi$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_0^z \frac{\sigma da}{r^2} \cos\theta$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_0^R \int_0^{2\pi} \frac{r}{r^2} \cos\theta \, r' ds' d\phi$$

$$d\vec{E} = d\vec{E}_y + d\vec{E}_x = 0$$
$$= dE \cos\theta$$

$\cos\theta$ dg p^2, menjadi

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

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

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

$$\vec{E} =$$