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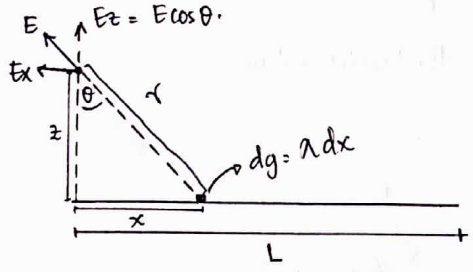
Tugas Hal 53. no 1.



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

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

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

Sehingga.

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

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

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

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

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

=> Untuk $\vec{E}_x$

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

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

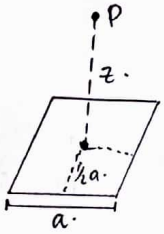
$$= -\frac{\lambda}{4\pi\varepsilon_0}\frac{1}{2}\left[-2\frac{1}{(z^2+x^2)^{1/2}}\right]_0^L$$

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

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

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

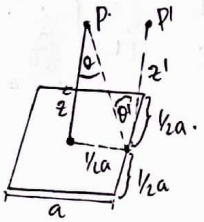
Tugas Hal 53. no 2



Solusi :
Untuk memperluaskan soal diatas gunakan contoh no 3 yaitu kawat yang panjangnya 2L dengan $\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{2\lambda L}{z'^2}$

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

Konsepnya adalah.
masalah ⇝



contoh no-3.

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

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

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

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

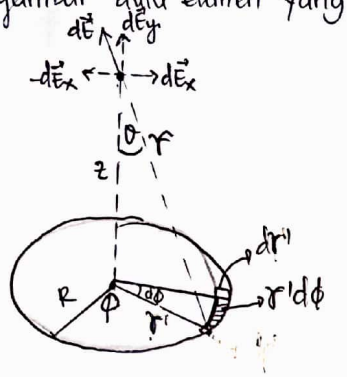
$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{4\lambda a z}{(z^2 + \frac{a^2}{4})\sqrt{z^2+\frac{a^2}{4}}} \hat{z}$$

1). Problem 2.6 . Tugas Hal 53 no. 4.

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

Pemecahan masalah:

1). Anda gambar dulu elemen yang menimbulkan medan di titik.



elemen luas

$ds = da = p \times l$

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

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

Belum paham.

$d\vec{E} = d\vec{E}_y + d\vec{E}_x = 0.$

$= dE \cos\theta$

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

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

Belum paham.

buka $\cos\theta$ dengan r^2 sehingga menjadi.

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