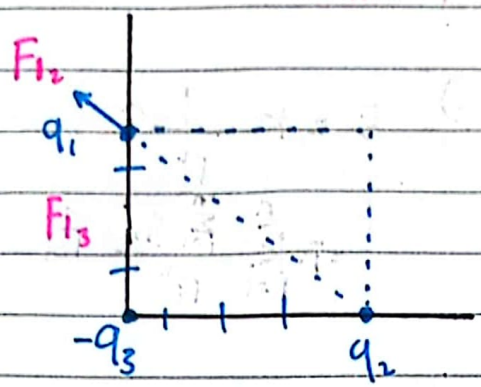
No. 5

Date 18 Maret 2024

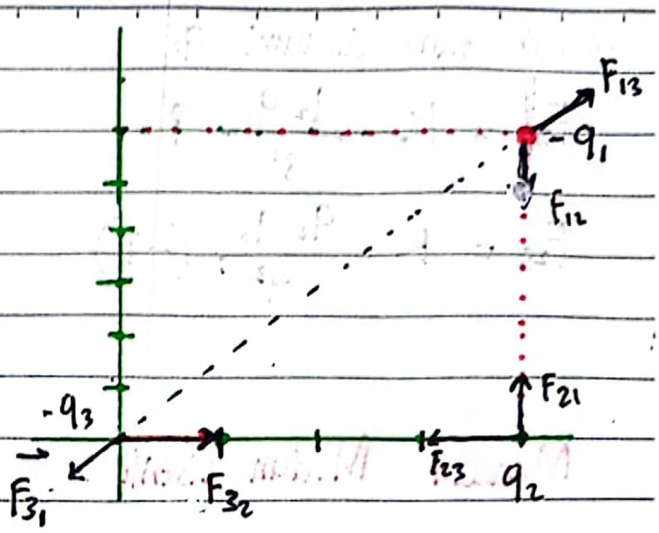


$$\vec{F}_{12} = k\frac{q_1 q_2}{5^2}\left(\frac{-4\hat{i}+3\hat{j}}{5}\right)$$

$$\hat{r}_0 = \frac{\vec{r}}{|r|}$$

$$F_{13} = k\frac{q_1 - q_3}{3^2}(-\hat{j})$$

$$\frac{(0\hat{i}-3\hat{j})}{\sqrt{0^2+3^2}} = \frac{-3\hat{j}}{3} = -\hat{j}$$



Gaya yang dialami oleh q_3

$$\vec{F}_{31} = \frac{1}{4\pi\varepsilon_0}\frac{q_3 q_1}{5^2}\left(\frac{-4\hat{i}-3\hat{j}}{5}\right)$$

$$\vec{F}_{32} = \frac{1}{4\pi\varepsilon_0}\frac{q_3 q_2}{4^2}\hat{i}$$

Gaya yang dialami oleh

$$\vec{F}_{12} = k\frac{q_1 q_2}{3^2}\left(\frac{0\hat{i}+3\hat{j}}{3}\right)$$

$$\vec{F}_{12} = -k\frac{q_1 q_2}{3^2}\hat{j}$$

Gaya yang dialami q_1

$$\vec{F}_{13} = k\frac{q_1 q_3}{5^2}\left(\frac{4\hat{i}+3\hat{j}}{5}\right)$$

$\hat{j}$ → tegak lurus

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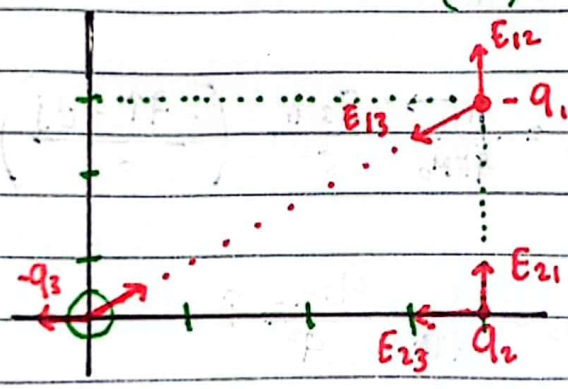
Gaya yang dialami q_2

$$F_{21} = K \frac{q_2 q_1}{3^2} \hat{j}$$

$$F_{23} = K \frac{q_2 q_3}{4^2} (-\hat{i})$$

Mencari Medan Listrik

Arah Medan (E)



$$\vec{E}_{32} = \frac{F}{q_3} = K \frac{q_3 q_2 / r^2}{q_3}$$

$$= K \frac{q_2}{r^2}$$

$$\vec{E}_{31} = K \frac{q}{5^2} \left(\frac{4\hat{i} + 3\hat{j}}{5} \right)$$

$$\vec{E}_{32} = K \frac{q_2}{4^2} (-\hat{i})$$

Medan

Jika (+) maka menjauhi, jika (-) maka mendekati

Muatan Non Diskrit

① $$E = K \frac{q}{r^2} \hat{r}$$

$$= K \sum_{i=1}^{n} \frac{q_i}{r_i^2} \hat{r}_{oi}$$

② Panjang penggaris

$$\vec{E} = K \int \frac{dq}{r^2} \hat{r}_o$$

$$= K \int \frac{\lambda \, dx}{r^2} \hat{r}_o$$

Medan pada kawat

③

$$\vec{E} = K \iint \frac{\sigma \, dq}{r^2} \hat{r}_o$$

④ volume

$$\vec{E} = K \iiint \frac{\rho \, d\tau}{r^2} \hat{r}_o$$

kesamping $\hat{i}$

keatas $\hat{j}$

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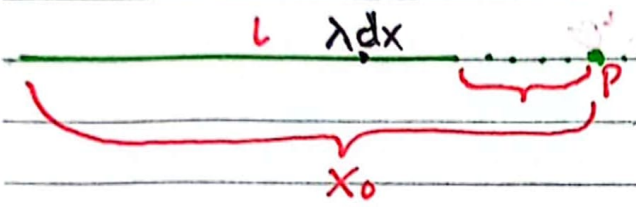
Contoh soal

1.



$\vec{E}_p = ?$

• Jawab:

$$\vec{E} = k \int_0^L \frac{x\,dx}{(x_0 - x)^2}$$

$$= k\lambda \int \frac{dx}{(x_0 - x)^2}$$

$$\int \frac{dx}{x^2} = \int_0^1 x^{-2}\,dx$$

Teori dasar $= x^{-1}\Big|_0^L$

$$= \frac{1}{x}\Big|_0^L$$

$$= k\lambda \int_0^L (x_0 - x)^{-2}\,dx$$

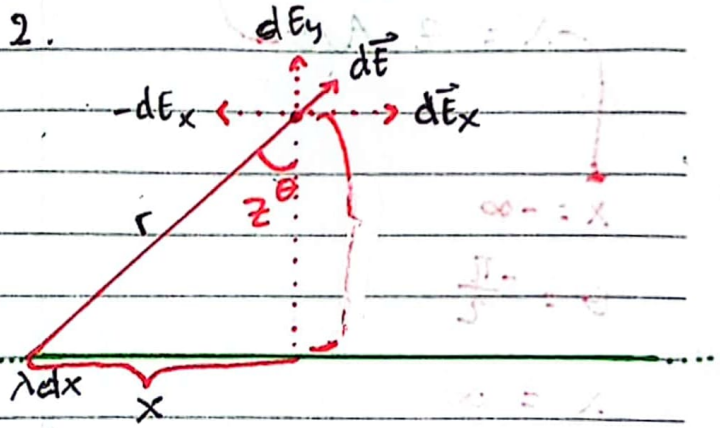
$$= k\lambda \left[\frac{1}{(x_0 - x)}\Big|_0^L \right]$$

$$= k\lambda \left[\frac{1}{(x_0 - L)} - \frac{1}{(x_0 - 0)} \right]$$

$$= k\lambda \left[\frac{x_0 - (x_0 - L)}{x_0 (x_0 - L)} \right]$$

$$= \frac{L}{x_0 (x_0 - L)}$$

2.



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

$$d\vec{E} = d\vec{E}_y$$

$$dE_y = dE \cos\theta$$

$dq = \lambda dx$

$$\vec{E} = k \int_{-\infty}^{\infty} \frac{\lambda dx}{r^2} \cos\theta$$

ruan ∫ adalah diferensiasi

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Misal:

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

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

tangen teta

$tg\,\theta = \frac{x}{z}$

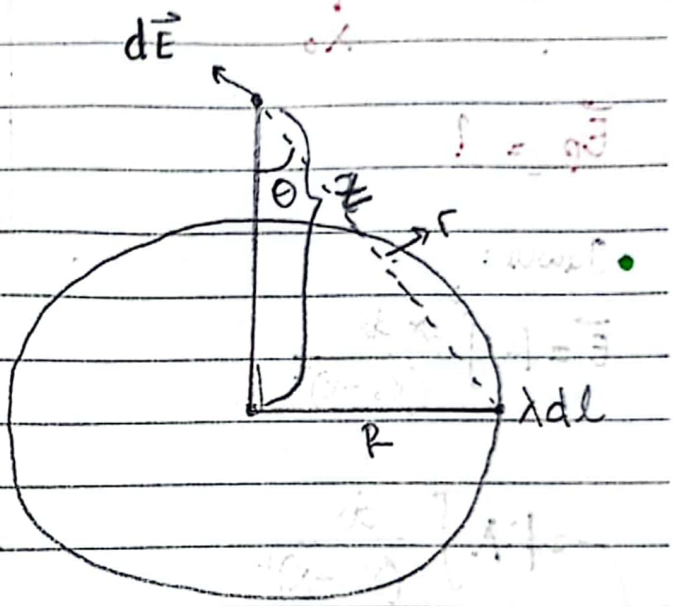
$x = z\,tg\,\theta$ → $dx = \frac{z}{\cos^2\theta}$

$x = -\infty$

$\theta = \frac{-\pi}{2}$

$x = \infty$

$\theta = \frac{\pi}{2}$



$$\vec{E} = k\int_0^{2\pi R} \frac{\lambda dl}{(R^2+z^2)} \cos\theta$$

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

$r = (z^2+R^2)^2$

$r^2 = (z^2+R^2)^{\frac{1}{2}}$

$$= k\lambda z \int_0^{2\pi R} \frac{dl}{(R^2+z^2)^{5/2}}$$

Buku Hal. 51