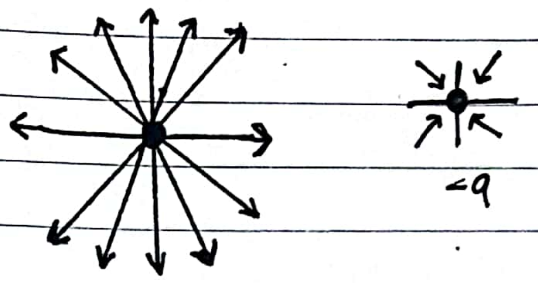
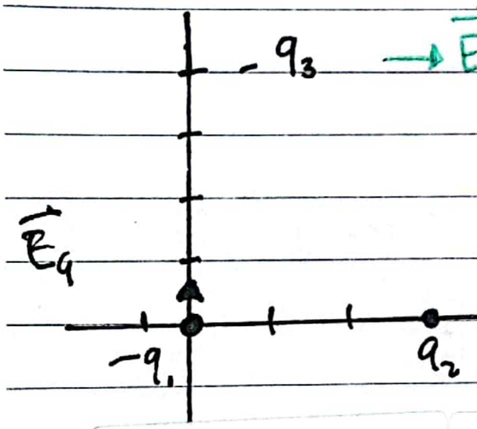
Senin, 18 Maret 2024

Kelistrikan dan Kemagnetan

Medan Listrik ($\vec{E}$)





$$\to \vec{E}_1 = \frac{\vec{F}}{q_1} = \frac{F_{q3}}{q_1} + \frac{F_{q3}}{q_2}$$

$$\vec{E} = k\frac{q_3}{r^2} + k\frac{q_2}{r^2}$$

1. $\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\hat{r}$

   $= k\frac{q}{r^2}\hat{r}_0 \to$ Oleh muatan deskrit $\to$ Tidak saling berhubungan.

2. $\vec{E} = \frac{1}{4\pi\varepsilon_0}\int\frac{\rho\, dl}{r^2}\hat{r}_0 \to q = \lambda l \to$ muatan terdistribusi pd. penggaris

3. $\vec{E} = \frac{1}{4\pi\varepsilon_0}\iint\frac{\sigma\, da}{r^2}\hat{r}_0$

4. $\vec{E} = \frac{1}{4\pi\varepsilon_0}\iiint\frac{\rho\, dl}{r^2}\hat{r}_0$ $\to$ luas Permukaan

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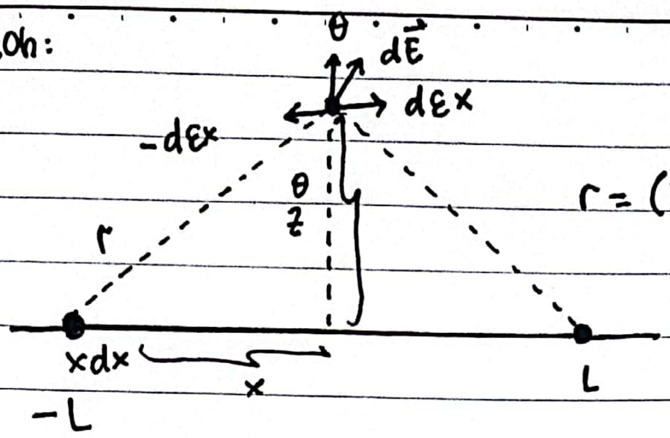
Contoh:



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

$$d\vec{E} = d\varepsilon y + d\varepsilon x$$

$$d\vec{E} = d\varepsilon y$$

$$d\varepsilon y = d\varepsilon \cos\theta$$

$$\cancel{d\varepsilon}\ \vec{E} = \frac{1}{4\pi\varepsilon} \int_{-L}^{L} \frac{a\,dL}{r^2} \cos\theta \quad dx$$

$$= \frac{2}{4\pi\varepsilon_0} \int_0^L \frac{x\,dx}{(x^2 x z^2)} \cos\theta$$

Latihan:

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

$$= \boxed{\frac{2\lambda z}{4\pi\varepsilon_0}} \left(\frac{x}{z^2\sqrt{x^2+z^2}} \right) \Bigg|_0^L$$

$$= \boxed{\frac{2\lambda z}{4\pi\varepsilon_0}} \left[\frac{l}{z^2\sqrt{l^2+z^2}} - \frac{0}{z^2\sqrt{0+z^2}} \right]$$

$$= \boxed{\frac{2\lambda z}{4\pi\varepsilon_0}} \left[\frac{l}{z^2\sqrt{l^2+z^2}} \right]$$

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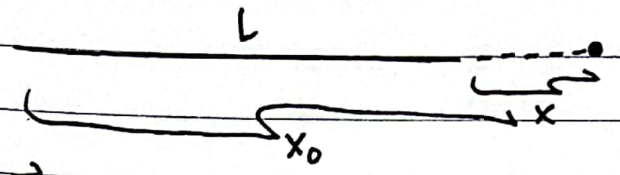

$$\vec{E} = \frac{1}{4\pi}\int_0^L \frac{a\,dx}{(x_0-x)^2}$$

$$\int \frac{dx}{x^2} = \int x^2 dx = 1x^{-1}\Big|_0^L$$

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

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\lambda\int_0^L (x_0-x)^{-2}dx$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}}\lambda(x_0-x)^{-1}\Big|_0^L$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}}\lambda\left(\frac{1}{(x_0-x)}\right)\Big|_0^L$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}}\lambda\left(\frac{1}{(x_0-L)} - \frac{1}{(x_0-0)}\right)$$

kalikan kesini

kalikan kesini

$$= \boxed{\frac{1}{4\pi\varepsilon_0}}\lambda\left[\frac{x_0-(x_0-L)}{x_0\,(x_0-L)}\right] \qquad = \frac{L}{(x_0-L)} - \frac{1}{(x_0-0)}$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}}\lambda\left[\frac{L}{x_0\,(x_0-L)}\right]$$

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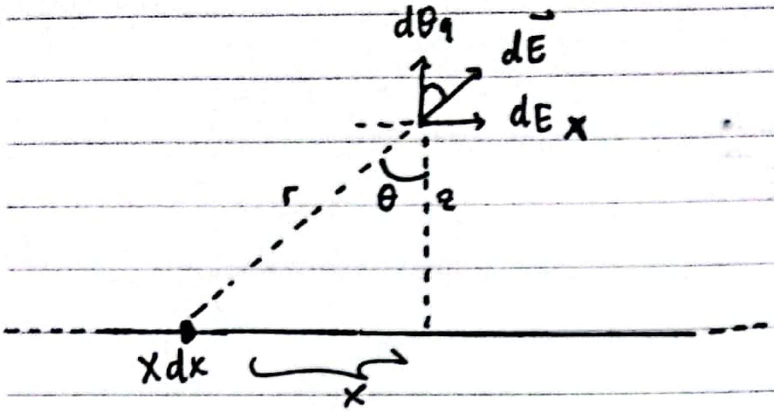

$$\vec{E} = \vec{E}x + \vec{E}_y$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_{\infty}^{\infty} \frac{x\,dx}{r^2} \cos\theta$$

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

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

$$dx = \frac{z}{\cos \sin^2\theta}$$

$$x = -\infty$$

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

$$x = \infty \rightarrow \theta = \frac{\pi}{2}$$

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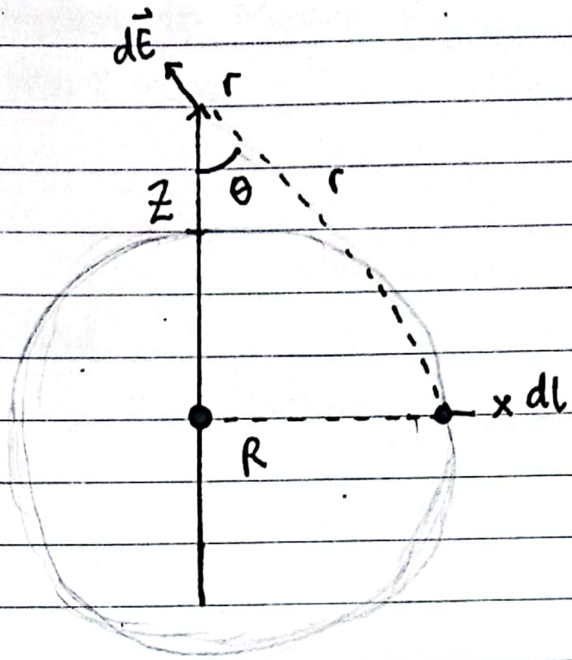

$$\vec{E} = \frac{z\lambda}{4\pi\varepsilon_0 (z^2+z^2)^{\frac{3}{2}}} \int_0^{2\pi r} dl$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}} \, l \Big|_0^{2\pi r}$$

$$= \boxed{\frac{1}{4\pi\varepsilon_0}} (2\pi r - \lambda)$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{\frac{3}{2}}} (2\pi r)$$

Salah

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_0^{2\pi R} \frac{z\lambda \, dl}{(z^2+R^2)^{3/2}}$$

$$= \frac{\cancel{z} \; z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} (l) \Big|_0^{2\pi R}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} \int_0^{2\pi R} dl$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} \int_0^{2\pi R} dl$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} \, l \Big|_0^{2\pi R}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} (2\pi R - R)$$

$$= \frac{z\lambda}{4\pi\varepsilon_0 (z^2+R^2)^{3/2}} (2\pi R)$$