Date 10-03-2024

$\boxed{\text{Rumus}}$ $\Rightarrow$ Medan Listrik ($\vec{E}$)

1. $\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} \hat{r}_0 = k \frac{q}{r^2} \hat{r}_0$ $\Rightarrow$ Oleh muatan diskrit

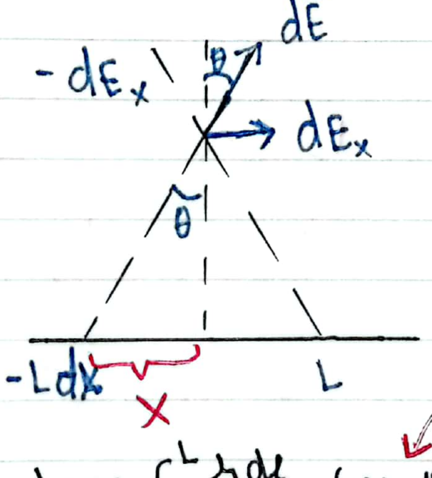
2. $\vec{E} = \frac{1}{4\pi\varepsilon_0} \int \frac{\lambda \, dr}{r^2} \hat{r}_0 \Rightarrow q = \lambda l$ $\Rightarrow$ muatan terdistribusi pada

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

4. $\vec{E} = \frac{1}{4\pi\varepsilon_0} \iiint \frac{\rho \, dE}{r^2} \hat{r}_0$ $\rightarrow$ Pada ruang muatan kekiri pada volume

$\int_{\text{surface}}$ $\int_{\text{volume}}$ $\frac{k}{r^2} = \frac{1}{4\pi\varepsilon_0}$

Contoh: Hitunglah medan magnet pada gambar dibawah



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

$$d\vec{E} = dE_y + dE_x$$
$$d\vec{E} = dE_y$$
$$dE_y = dE \cos\theta$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \int_{-L}^{L} \frac{\lambda \, dl}{r^2} \cos\theta$$

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

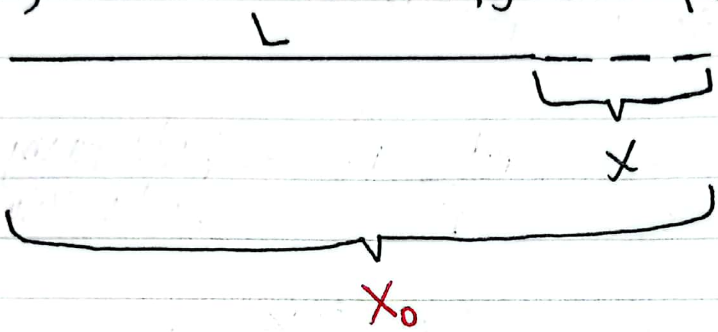
$$\vec{E} = \frac{2\lambda z}{4\pi\varepsilon_0} \int_0^L \frac{dx}{(x^2+z^2)^{3/2}}$$

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

$$= \square \left[\frac{1}{z^2\sqrt{L^2+z^2}} - \frac{0}{z^2\sqrt{0+z^2}} \right]$$

$$= \square \left[\frac{L}{z^2\sqrt{L^2+z^2}} \right]$$

Contoh : Hitung medan listrik pada P, ỹ terletak pada $X_0 > L$!



$$\vec{E} = \frac{1}{4\pi\epsilon_0} \int_0^L \frac{\lambda\, dx}{(X_0 - x)^2} = \vec{E} = \frac{1}{4\pi\epsilon_0} \lambda \int_0^L (X_0 - x)^{-2}\, dx$$

$$= \square \left[(X_0 - x)^{-1} \right]_0^L$$

$$= \square \left(\frac{1}{(X_0 - x)} \right|_0^L$$

$$= \square \left(\frac{1}{(X_0 - L)} - \frac{1}{(X_0 - 0)} \right)$$

$$= \square \left[\frac{X_0 - (X_0 - L)}{X_0 (X_0 - L)} \right]$$

$$= \frac{L}{X_0 (X_0 - L)}$$