No. 1

Date : 12-09-2025

Pert. 3

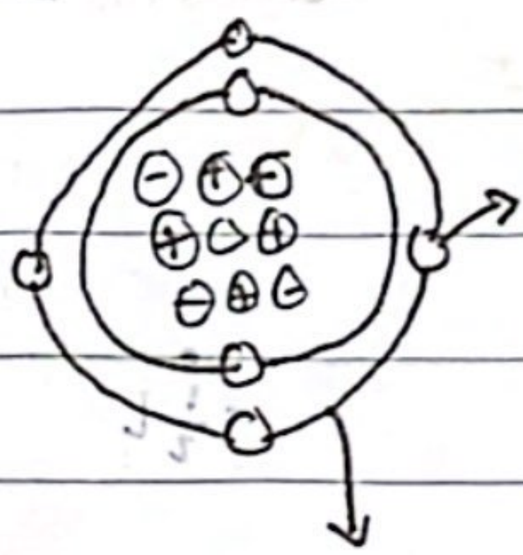
MEDAN ELEKTROMAGNETIK

Medan oleh Muatan Diskrit

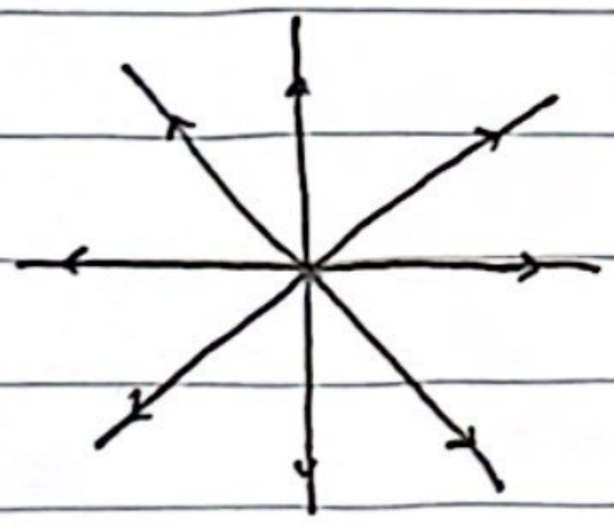
q (muatan) = $\pm Ne$

= $2e^-$

Proton q, elektron q = stabil



Note: arah ke atas, maka simbolnya $\hat{r}$



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

Muatan terperangkap di sistem koordinat

Note: Muatan adalah kata sifat dari atom

Medan ($\vec{E}$) terdistribusi dalam bahan

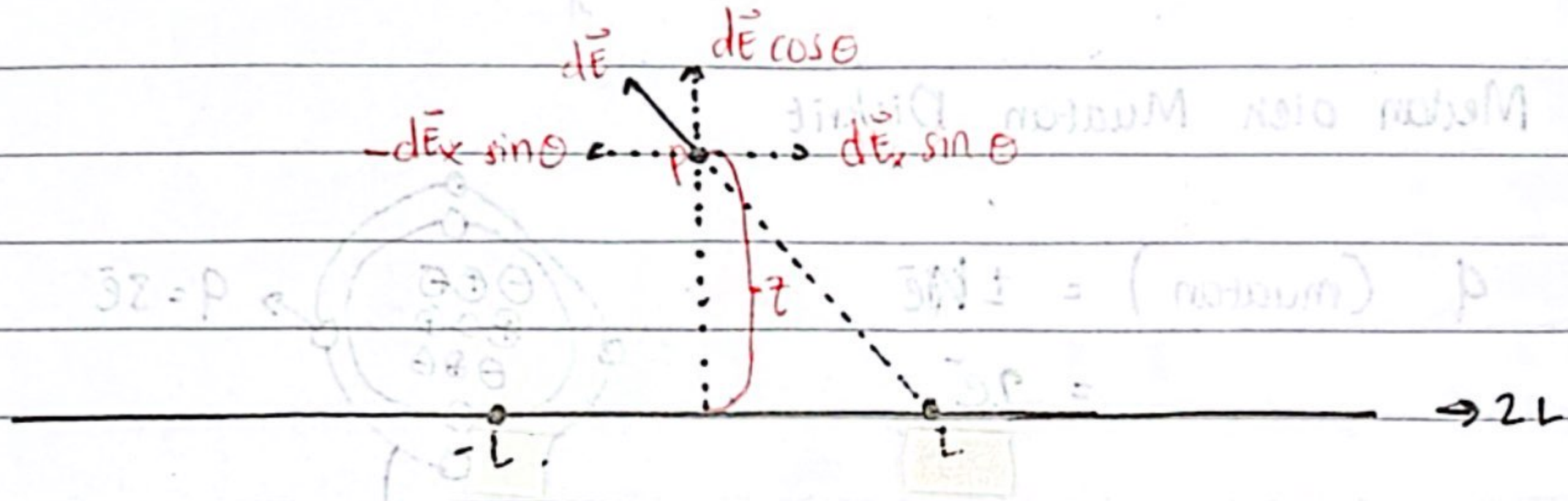
$\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r}_0 \longrightarrow$ diskrit

$\vec{E} = \frac{1}{4\pi\varepsilon_0 r^2}\int \frac{q}{r^2} dl \rightarrow$ terbentuk garis

No. 2

Date :

Contoh:



Penyelesan:

$$d\vec{E} = dEy + \overbrace{dEx}^{=0}$$

$$= dEy$$

$$d\vec{E} = dE\cos\theta$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_{-L}^{L}\frac{d\vec{q}}{r^2}$$

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

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{2L}\frac{\lambda dl}{r^2}\cos\theta \;\frac{1}{0}\int_{0}^{2L}\frac{\lambda dl}{r^2}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{2L}\frac{\lambda z}{r^2}dl$$

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{2L}\frac{\lambda z\, dl}{(z^2+l^2)^{3/2}}$$

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

No. 3

Date :

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

diganti dengan zl (L)

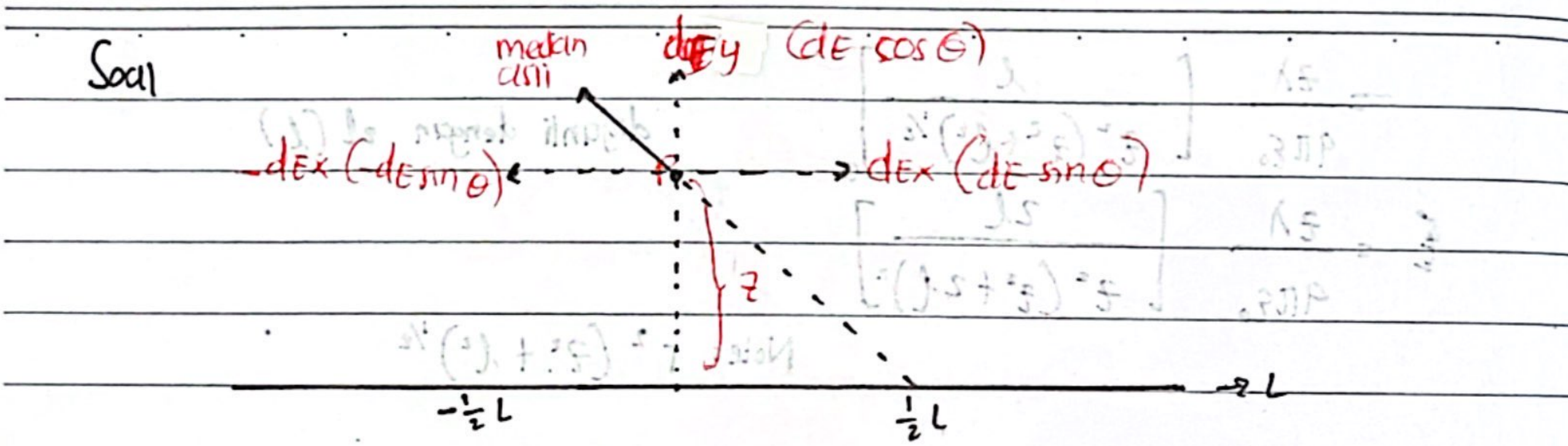
$$\vec{E} = \frac{z\lambda}{4\pi\varepsilon_0} \left[\frac{2l}{z^2 (z^2 + 2l)^2} \right]$$

Note: $r^2 (z^2 + l^2)^{1/2}$

No. 9

Date : 12-09-2025

Soal



Jawab:

$$d\vec{E} = dE_y + dE_x \quad (dE_x = 0)$$

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

$$d\vec{E} = dE\cos\theta$$

Note: $r = (z^2 + l^2)^{1/2}$

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

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

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{L} \frac{\lambda dl}{r^2}\cos\theta = \frac{1}{4\pi\varepsilon_0}\int_{0}^{L} \frac{\lambda dl}{r^2}\cos\theta$$

$$= \frac{1}{4\pi\varepsilon_0}\int_{0}^{L} \frac{dz}{r^3}\,dl$$

$$\vec{E} = \frac{1}{4\pi\varepsilon_0}\int_{0}^{L} \frac{z\lambda dl}{(z^2+l^2)^{3/2}}$$

$$= \frac{z\lambda}{4\pi\varepsilon_0}\int_{0}^{L} \frac{dl}{(z^2+l^2)^{3/2}}$$

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

$$E = \frac{z\lambda}{4\pi\varepsilon_0}\left[\frac{L}{z^2\left(z^2+(L)^2\right)}\right]$$

$$E = \frac{1}{4\pi\varepsilon_0}\left[\frac{\lambda L}{z^2\left(z^2+(L)^2\right.}\right]$$