Pertemuan 5

No Senin. 18/03 2024
Date

Kelistrikan dan kemagnetan

1. $\vec{E} = 1/4\pi\varepsilon_0 \; q/r^2 \cdot \hat{r}$
   $= k \; q/r^2 \cdot \hat{r}_0$ → oleh muatan distrik (terpisah)
2. $\vec{E} = 1/4\pi\varepsilon_0 \int \lambda \, dL/r^2$
   $= q = \lambda L$ → muatan berdistribusi pada penggaris
3. $\vec{E} = 1/4\pi\varepsilon_0 \iint r \, da/r^2 \cdot \hat{r}_0$ → dL muatan
   ▭ Luas permuataan
4. $\vec{E} = 1/4\pi\varepsilon_0 \iiint \rho \, dt/r^2 \, \hat{r}_0$ Pada ruang
   Muda terkini pada volume

Contoh soal · Hal 50

1. Muatan berdistribusi dengan panjang tertentu (L) muatan seragam Q teletak pada garis $\bar{y}$ panjangnya L. disepanjang sumbu X, X = 0 sampai X = L. densitas muatan $Q = \lambda L$. Hitung medan listrik pada titik P, $\bar{y}$ terletak pada $X_0 > L$!

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

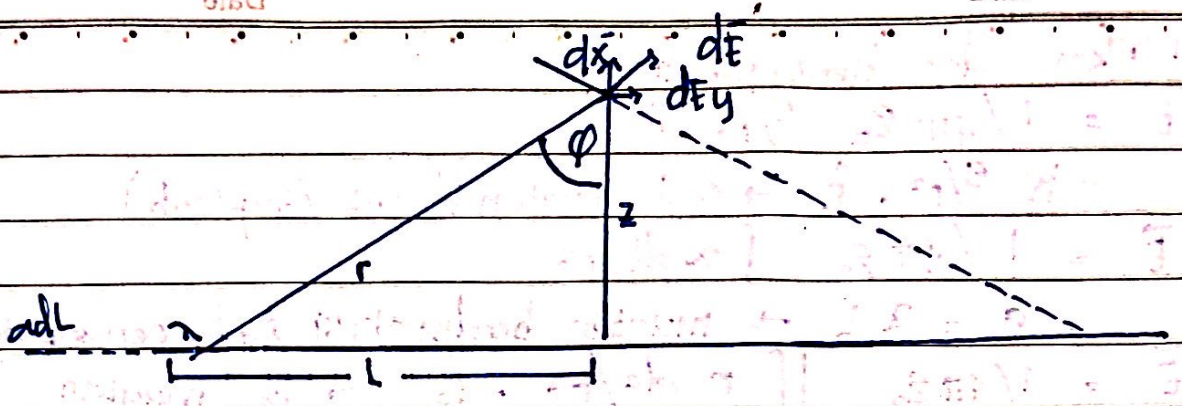
$$= \frac{1}{4\pi\varepsilon_0} \lambda \int_0^2 (x_0 - x)^{-2} \, dx = \frac{\lambda}{4\pi\varepsilon_0} (x_0 - x)^{-1} \Big|_0^2$$

$$= \frac{\lambda}{4\pi\varepsilon_0} \left(\frac{1}{x_0 - x} \right) \Big|_0^2 = \frac{\lambda}{4\pi\varepsilon_0} \left(\frac{1}{x_0^{-2}} - \frac{1}{x_0 - 0} \right)$$

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

Soal no 2 hal 51

Hitung medan listrik sejauh z. Panjang λ = homogen



$x = -\theta$ $\quad \cos\theta = z/r$ $\quad \tan = \frac{x}{\theta}$

$\varphi = -\pi/2$ $\quad r = \frac{z}{\cos\theta}$

$\infty = \pi/2$ $\quad x = z\tan\theta$

$dx = \cos^2\theta$

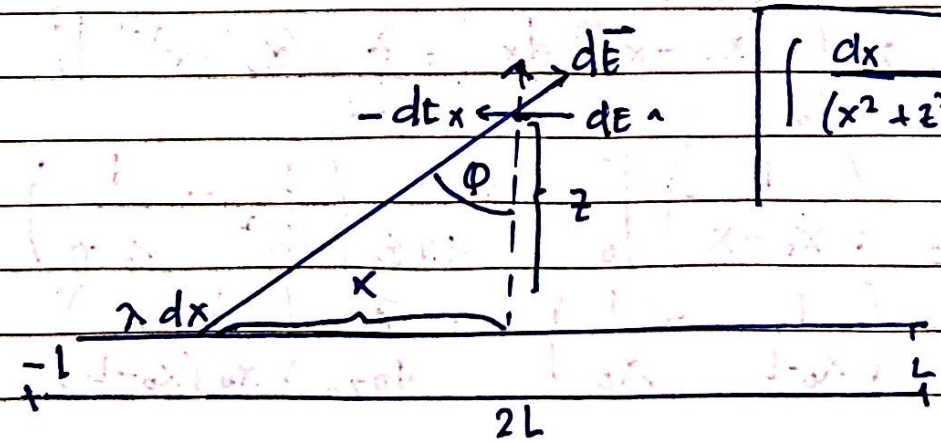
$\vec{E} = dE_x + dE_y$

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

$= \frac{\lambda}{4\pi\varepsilon_0} \int_{-\infty}^{\infty} r^2\, dx \cos\theta$

Soal no. 3 hal 52

Hitunglah medan listrik dititik P.



$$\int \frac{dx}{(x^2+z^2)^{3/2}} = \frac{x}{z^2\sqrt{x^2+z^2}}$$

$d\vec{E} = dE_y + dE_x$ → saling meniadakan

$= dE_y$

$dE_y = dE \cos\theta$

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

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

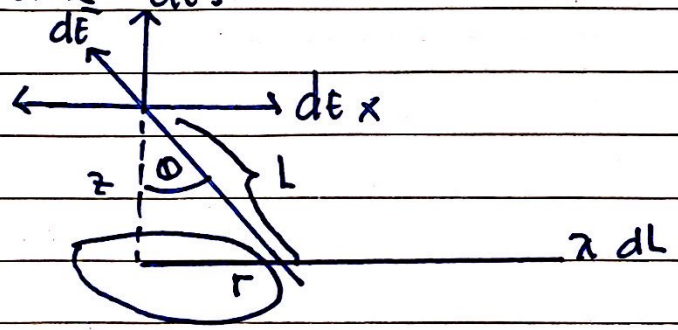
$$E = \frac{2\pi z}{4\pi\varepsilon_0}\int_0^L \frac{dx}{(x^2+z^2)^{3/2}}$$

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

$$= \frac{2\lambda z}{2\pi\varepsilon_0}\left(\frac{L}{L^2\sqrt{L^2+z^2}}\right) - 0$$

Soal no 3 hal 53

3. Hitung medan listrik dEy



$$E = 1/4\pi\varepsilon_0 \int_0^{2\pi} z\,\lambda dL/(z^2+r^2)^{3/2}$$

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

$$= \frac{z\lambda}{4\pi\varepsilon_0(z^2+r^2)^{3/2}} \cdot L\Big|_0^{2\pi} = \frac{z\lambda}{4\pi\varepsilon_0(z^2+r^2)^{3/2}}(2\pi R - r)$$

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