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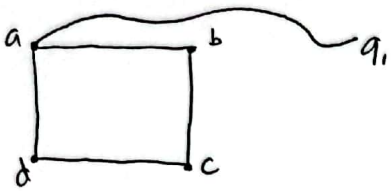
Catatan Offline pertemuan 9

* Rumusan usaha untuk benda yang terdistribusi

$W = Q(V_b - V_a)$ → kalau muatannya negatif

$= V_P \cdot Q$



$W_1 = V_P \cdot Q$

$W = \frac{1}{4\pi\varepsilon_0} \sum_{i=1}^{n} q_i \sum_{i \neq j} V_j$ ⇒ $\frac{Q_j}{R}$

$W = \frac{1}{2} \frac{1}{4\pi\varepsilon_0} \sum q_i \sum_{i \neq j} \frac{q_j}{r}$ ⇒ untuk muatan diskrit

$W = \frac{1}{2} \sum_{i=1}^{n} q_i \sum_{i \neq j} V_j$

$W = \frac{1}{2} V_P \cdot q$

$$W = \frac{1}{2} \sum_{i=1}^{n} q_i \left[\sum_{\substack{i=1 \\ i \neq j}} \frac{1}{4\pi\varepsilon_0} \sum \frac{q_j}{r_j} \right]$$

* Untuk muatan kontinu :

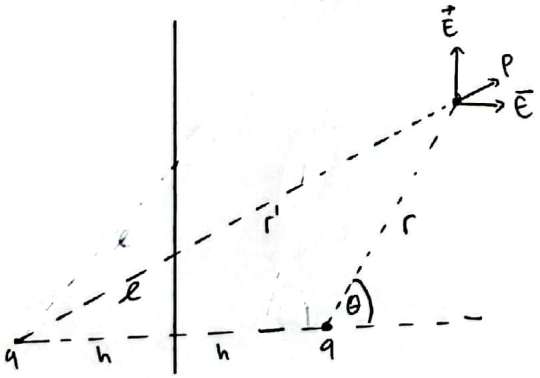
$W = \frac{\varepsilon_0}{2} \int_v E^2 \, dv$

$\int dv = \int_0^R \int_0^{2\pi} \int_0^{\pi} r^2 \sin\theta \, d\theta \, d\phi \, dl$

$= 6\pi \int_0^R r^2 \, dl$

$$W = \frac{1}{2} \int_v \sigma V \, da^{-1}$$
$$= \frac{1}{2} \iint \sigma V \, da$$

* Terdapat kawat panjang berkali



$V_P = \frac{1}{4\pi\varepsilon_0} \left[\frac{Q}{r} - \frac{Q}{r'} \right]$

$r' = \ldots ?$

$r' = (r^2 + 4h^2 + 4hr\cos\theta)^{1/2}$

maka potensial titik p adalah

$V(P) = V(r,\theta) = \frac{Q}{4\pi\varepsilon_0} \left(\frac{1}{r} - \frac{1}{(r^2 + 4h^2 + 4hr\cos\theta)^{1/2}} \right)$

$E_r = -\frac{\partial V}{\partial r} = \frac{1}{4\pi\varepsilon_0} \left[\frac{1}{r^2} - \frac{r + 2h\cos\theta}{r'^3} \right]$

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$$\vec{E} = \frac{-Q}{4\pi\varepsilon_0} \frac{\partial \left[\frac{1}{2} - \frac{1}{(r^2 + 4h^2 + 4hr\cos\theta)^{1/2}}\right]}{\partial r}$$

$$= -\frac{Q}{4\pi\varepsilon_0} \frac{\partial \left[\frac{1}{r} - \frac{1}{(r^2 + 4h^2 + 4hr\cos\theta)^{1/2}}\right]}{\partial r}$$

$$= -\frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r^2} - \frac{2r + 4h\cos\theta}{(r^2 + 4h^2 + 4hr\cos\theta)^{3/2}}\right]$$

→ diturunkan terhadap r

→ pangkatnya ditambahkan

$$= \frac{dv}{dr}\left(r^2 + 4h^2 + 4hr\cos\theta\right)^{-1/2}$$

$$= +\frac{1}{2}\left[\frac{2r + 4h\cos\theta}{(r^2 + 4h^2 + 4hr\cos\theta)^{3/2}}\right] = \frac{r + 2h\cos\theta}{(r^2 + 4h^2 + 4hr\cos\theta)^{3/2}}$$

$$\vec{E_\theta} = -\frac{1}{r}\frac{\partial v}{\partial r}$$

$$= -\frac{1}{r}\frac{Q}{4\pi\varepsilon_0}\frac{d\left(\frac{1}{r} + \frac{1}{(r^2 + 4h + 4hr\cos\theta)^{1/2}}\right)}{d\theta}$$

$$= +\frac{Q}{4\pi\varepsilon_0}\left[+\frac{1}{2}\left(\frac{4hr\sin\theta}{r^2 + 4h + 4hr\cos\theta}\right)^{3/2}\right]$$

$$= \frac{Q}{4\pi\varepsilon_0}\left[\frac{2hr\sin\theta}{(r')^{3/4}}\right]$$

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