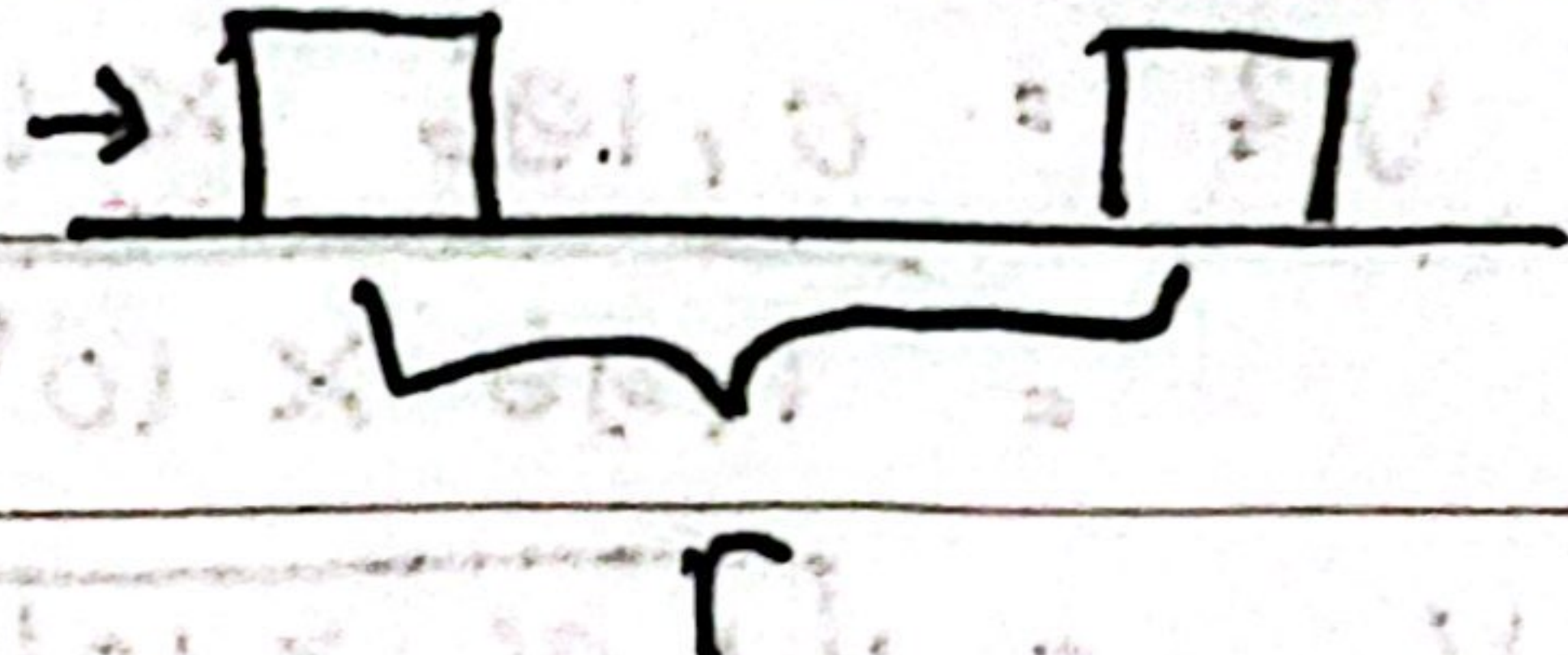


Kaulisma

Usaha dan Energi dalam Kelistrikan

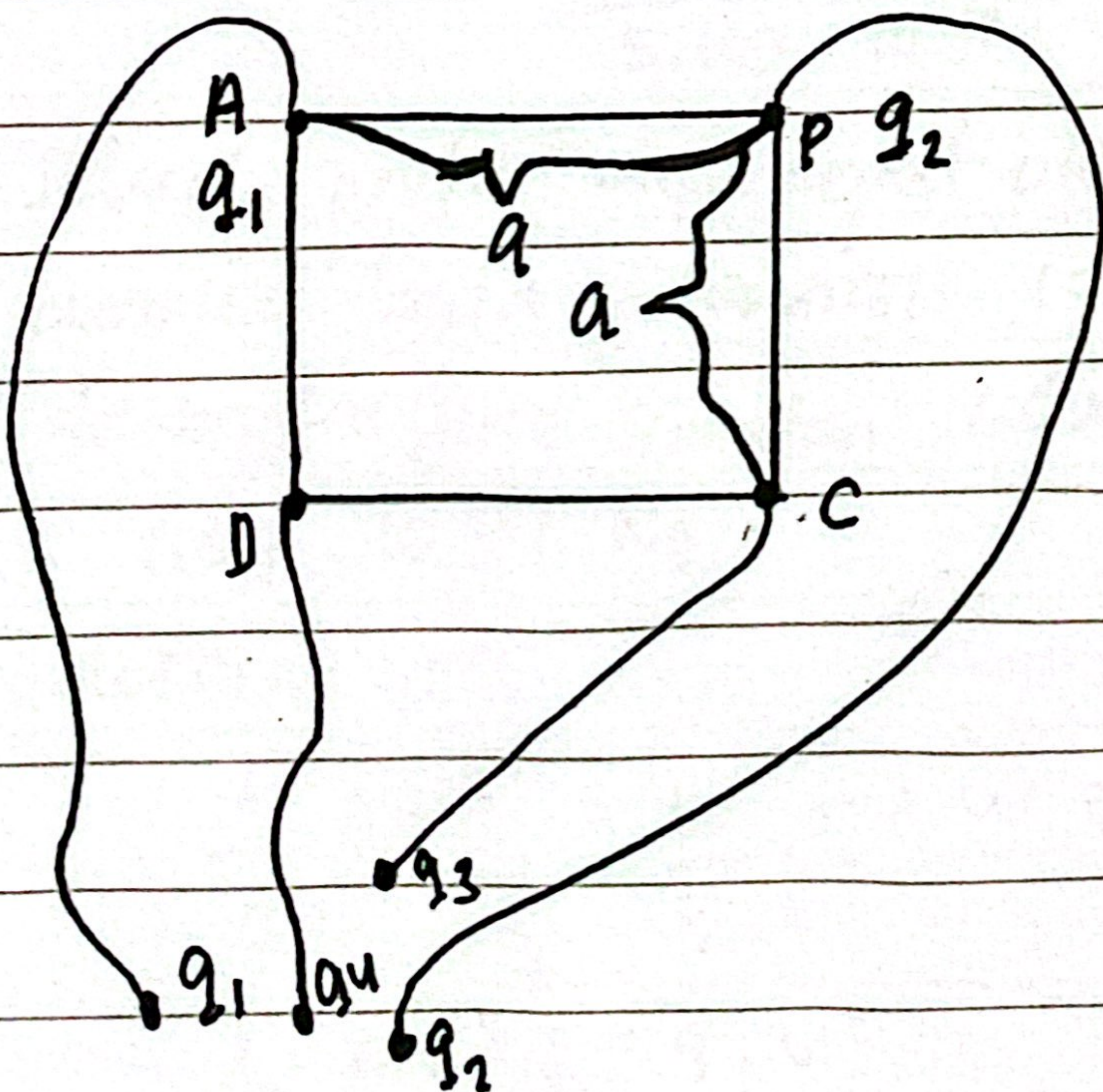
$$W = \int F dr \rightarrow d\vec{r}$$



$$\begin{aligned} W &= \int F dr \\ &= -q \int E dr \\ &= -q \left[-k \frac{Q}{r} \right] = qV \end{aligned}$$

$$\boxed{W = qV}$$

for example :



$$\begin{aligned} W_1 &= q_1 V_1 \\ &= 0 \end{aligned}$$

$$\begin{aligned} W_2 &= q_2 V_2 \\ V_2 &= k \frac{q_1}{a} \end{aligned}$$

$$W_2 = k q_2 \frac{q_1}{a} = k \frac{q_1 q_2}{a}$$

$$W_3 = q_3 V_3$$

$$V_3 = k \frac{q_1}{\sqrt{2}a} + k \frac{q_2}{a}$$

$$W_3 = k \left[\frac{q_1 q_3}{\sqrt{2}a} + \frac{q_2 q_3}{a} \right]$$

$$W_4 = q_4 V_4 \rightarrow V_4 = k \left[\frac{q_1}{a} + \frac{q_2}{\sqrt{2}a} + \frac{q_3}{a} \right]$$

$$= k \left[\frac{q_1 q_4}{a} + \frac{q_2 q_4}{\sqrt{2}a} + \frac{q_3 q_4}{a} \right]$$

$$W_{tot} = W_1 + W_2 + W_3 + W_4$$

$$= \sum_{i=1}^n \sum_{j \neq i}^m \frac{q_i q_j}{4\pi\epsilon_0}$$

$$= \frac{1}{8\pi\epsilon_0} \sum_{i=1}^n q_i \sum_{j \neq i}^n \frac{q_j}{r_{ij}}$$

$$= \frac{1}{2} \sum_{i=1}^n q_i \sum \frac{1}{4\pi\epsilon_0 r_{ij}} q_j$$

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

$$W = \frac{1}{2} \int \lambda v dl$$

$$W = \frac{1}{2} \int \sigma v ds$$

$$W = \frac{1}{2} \int \rho v d\tau$$

potensial oleh
muatan pada
garis.

Potensial oleh
muatan pada
permukaan

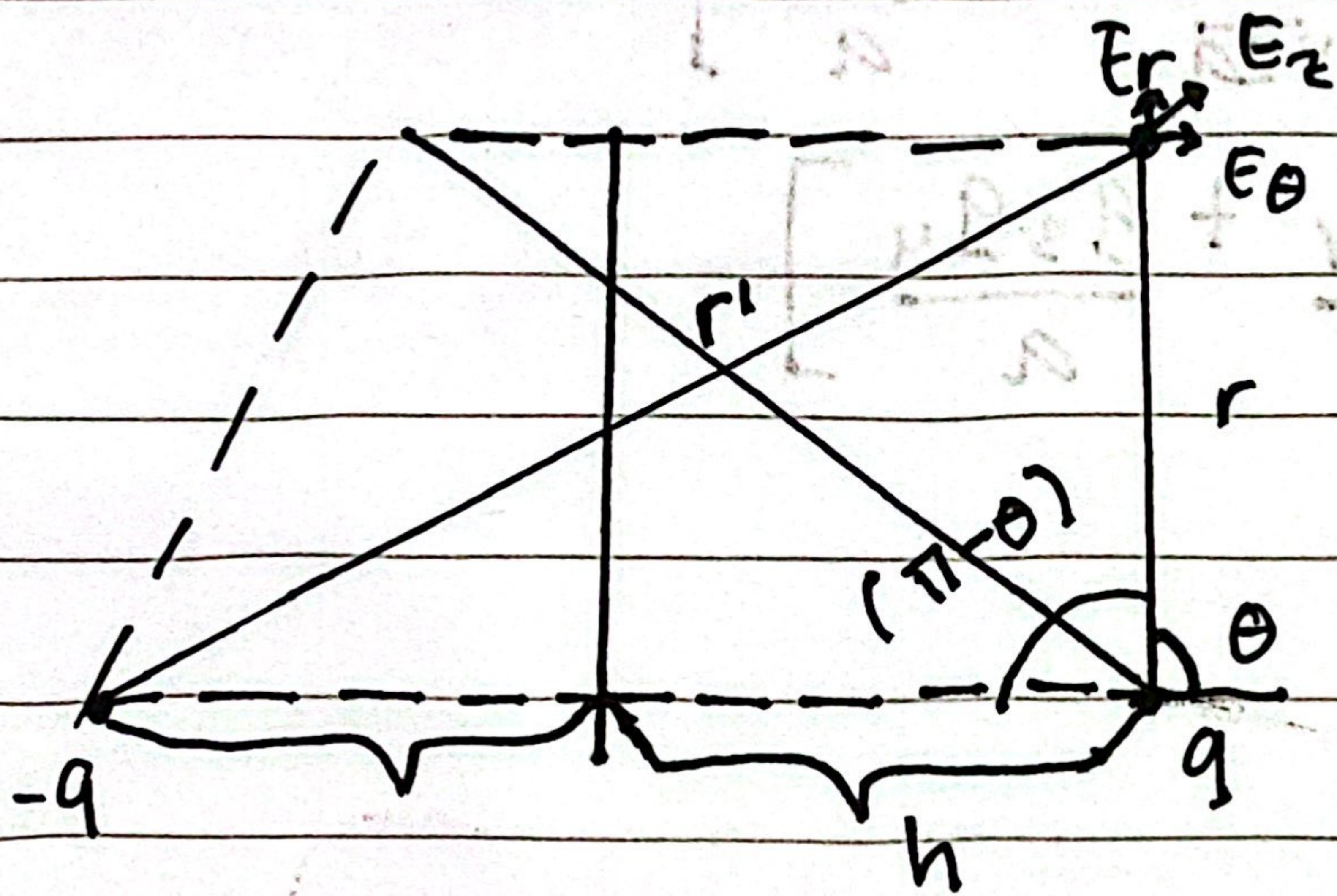
Volume

$$\rho = \epsilon_0 \cdot \nabla \cdot \vec{E} \rightarrow \nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0}$$

$$W = \frac{\epsilon_0}{2} \int (\nabla \cdot \vec{E}) v d\tau$$

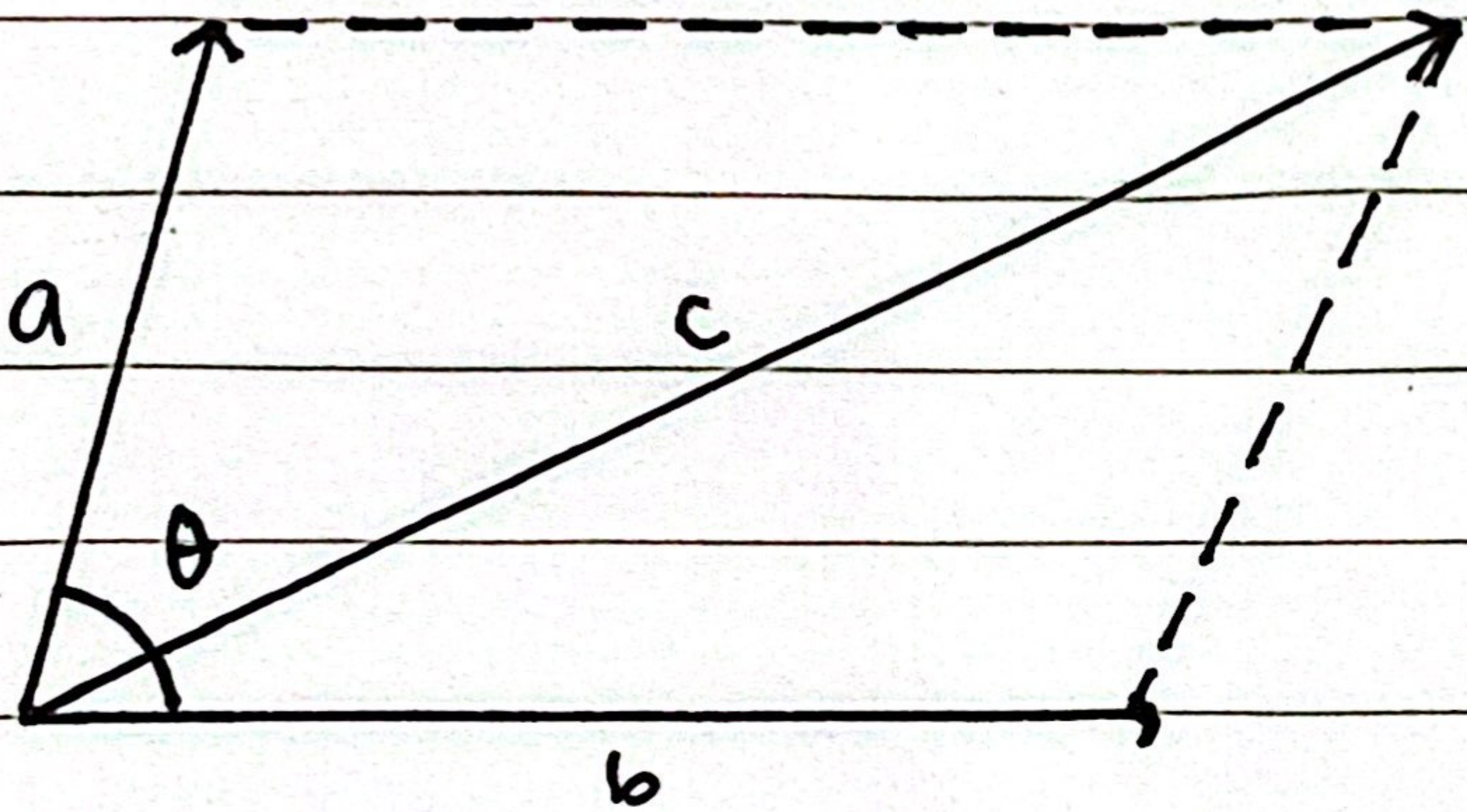
$$W = \frac{\epsilon_0}{2} \int E^2 d\tau$$

Metode Bayangan



$$V_p = k \left[\frac{q}{r} + \frac{-q}{r'} \right]$$

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



$$\vec{E}_r = -\frac{\partial V}{\partial r}$$

 $\vec{E}_r$

$$W = \int \vec{E} \cdot d\vec{r}$$

$$W = \int \vec{E} \cdot d\vec{r}$$

$$W = \int \vec{E} \cdot d\vec{r}$$

Volume

Potential along

Electric field

Electric field

Potential along

Electric field

Electric field

$$\vec{E} = -\nabla V$$

$$W = \int \vec{E} \cdot d\vec{r}$$

$$W = \int \vec{E} \cdot d\vec{r}$$