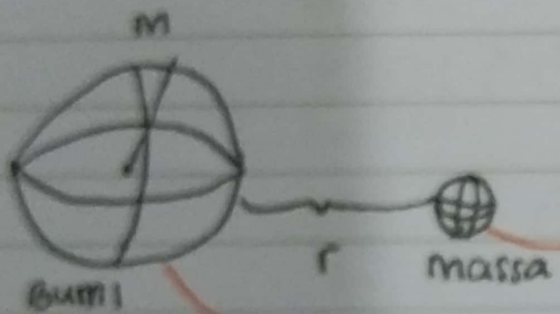
1. 04. 2024

Potensial Listrik (elektric Potensial)



$$w = G\frac{Mm}{r}$$

$$V = G\frac{M}{r}$$

$$V = \frac{W}{m}$$

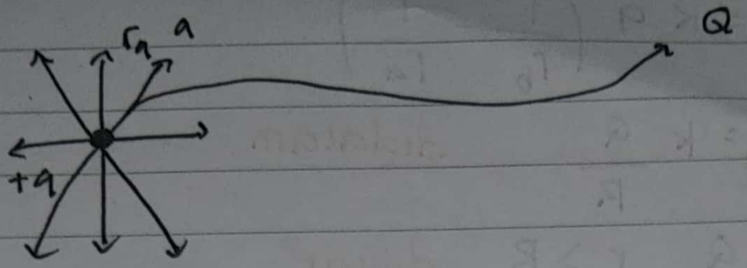
$$V = \frac{W}{M} = G\frac{M}{r}$$

$$V = \frac{W}{Q} = \frac{F \cdot r}{Q}$$

$$= \frac{k\frac{q_1 Q}{r^2} \cdot r}{Q}$$

$$\boxed{V = k\frac{q}{r}}$$

Potensial listrik adalah usaha untuk melakukan perpindahan.



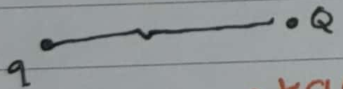
$$\int_a^b dv = -\int \bar{E}\cdot dr$$

$$V\Big|_a^b = -\int \frac{1}{4\pi\epsilon_0}\,\frac{q}{r^2}\,dr$$

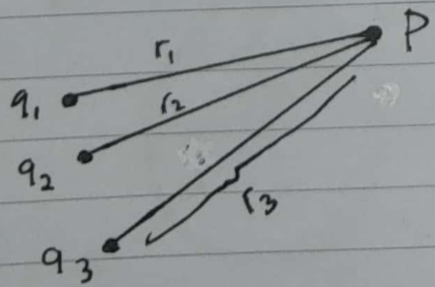
$$= -\frac{q}{4\pi\epsilon_0}\int_{r_a}^{r_b}\frac{1}{r^2}\,dr = -\frac{q}{4\pi\epsilon_0}\left(-\frac{1}{r}\Big|_{r_a}^{r_b}\right)$$

$$\boxed{= V_b - V_a = \frac{q}{4\pi\epsilon_0}\left(\frac{1}{r_b}-\frac{1}{r_a}\right)}$$

$$V = k\frac{q}{r}$$



$$V = \frac{W}{Q} \qquad \frac{kqQ}{r} \qquad \rightarrow V = k\frac{q}{r}$$



$$V_p = k\left[\frac{q_1}{r_1}+\frac{q_2}{r_2}+\frac{q_3}{r_3}\right]$$

$$= k\sum_{i=1}^{n}\frac{q_i}{r_i}$$

$$V = \frac{W}{q} = \frac{\bar{F}\cdot\bar{s}}{q} = k\frac{q}{r}$$

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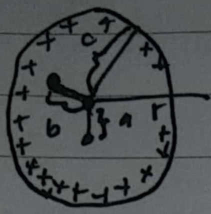
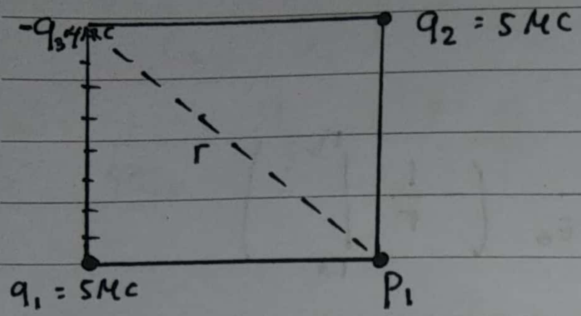


$$V_b - V_a = Kq\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

$$V_b - V_a = K\frac{Q}{R}$$ didalam

$$V = K\frac{Q}{r}, \quad r > R$$ diluar



$$V = \frac{Kq_1}{r_1} + \frac{Kq_2}{r_2} + \frac{K(-q_3)}{r_3}$$

$$= K\left(\frac{5}{8} + \frac{5}{8} + \frac{(-4)}{\sqrt{8^2+8^2}}\right)$$

$$= K\left(\frac{5}{8} + \frac{5}{8} + \frac{(-4)}{\sqrt{128}}\right)$$

▷ Persamaan Poisson dan Persamaan Lapalace

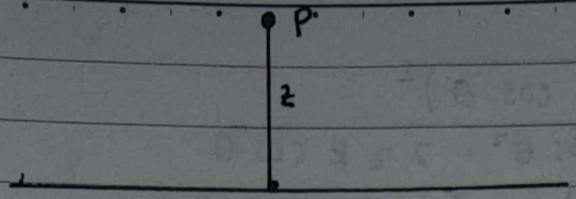
$\bar{E} = -\nabla V$

$\nabla \cdot \bar{E} = -\nabla^2 V$

$\nabla \cdot \bar{E} = \frac{\rho}{\varepsilon_0}$

$\nabla^2 V = \frac{\rho}{\varepsilon_0}$ Paisson

$\nabla^2 V = 0$ lapalace



$$\bar{E} = \frac{\lambda}{2\pi \varepsilon_0 r}$$

$$\oint \bar{E} \cdot da = \frac{\lambda \cdot l}{\varepsilon_0}$$

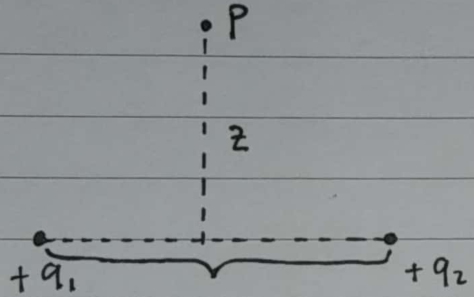
$$\bar{E}(2\pi r \cancel{l}) = \frac{\lambda \cdot \cancel{l}}{\varepsilon_0}$$

$$\bar{E} = \frac{\lambda}{2\pi \varepsilon_0 r}$$

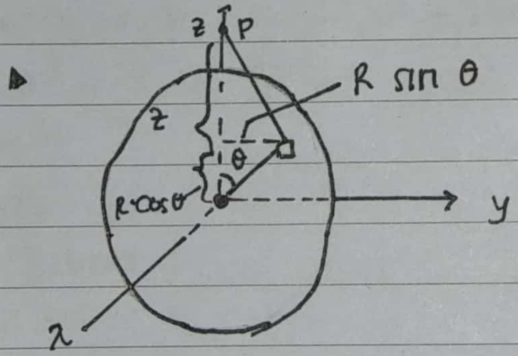
$$V = \int \bar{E} \cdot dr$$

$$= -\int \frac{\lambda}{2\pi \varepsilon_0} \frac{1}{r} \, dr$$

$$= -\frac{\lambda}{2\pi \varepsilon_0} \int \frac{1}{r} \, dr$$



$$V_P = k\left[\frac{q_1}{\sqrt{(1/2\, r)^2 + z^2}} + \frac{q_2}{\sqrt{(1/2\, r)^2 + z^2}}\right]$$



$$V_{(P)} = \frac{1}{4\pi \varepsilon_0} \int \frac{\sigma}{r} \, da$$

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$$r^2 = R^2 + z^2 - 2Rz\cos\theta$$

$$r = \sqrt{(R\sin\theta)^2 + (z - R\cos\theta)^2}$$

$$= \sqrt{R^2\sin^2 + z^2 + R^2\cos\theta^2 - 2zR\cos\theta}$$

$$= \sqrt{R^2(\sin^2\theta + \cos\theta^2) + z^2 - 2zR\cos\theta}$$

$$= \sqrt{R^2 + z^2 - 2zR\cos\theta}$$

$$V = \frac{1}{4\pi\varepsilon_0}\int \frac{\sigma\, da}{r}$$

$$= \frac{1}{4\pi\varepsilon_0}\iint \frac{\sigma\, da}{(R^2+z^2-2Rz\cos\theta)^{\frac{1}{2}}}$$

$$= \frac{\sigma}{4\pi\varepsilon_0}\int_0^{\pi}\int_0^{2\pi} \frac{r^2\sin\theta\, d\theta\, d\phi}{(R^2+z^2-2Rz\cos\theta)^{\frac{1}{2}}}$$

$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\int_0^{\pi} \frac{\sin\theta\, d\theta}{(R^2+z^2-2Rz\cos\theta)^{\frac{1}{2}}}$$

$$V_p = \square\int_0^{\pi} \frac{d(\cos\theta)}{(R^2+z^2-2Rz\cos\theta)^{\frac{1}{2}}}$$

$$= \square\int_0^{\pi} (R^2+z^2-2Rz\cos\theta)^{-\frac{1}{2}}\, d(\cos\theta)$$

$$= \square\, 2\left(R^2+z^2-2Rz\cos\theta\right)^{\frac{1}{2}}\Big|_0^{\pi}$$

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