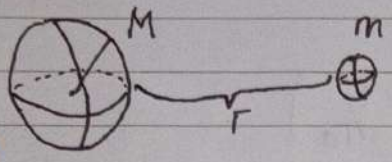
No. Senin

Date 1 April 2024.

Potensial Listrik
(Electric Potensial)

→ Potensial adalah massa persatuan muatan



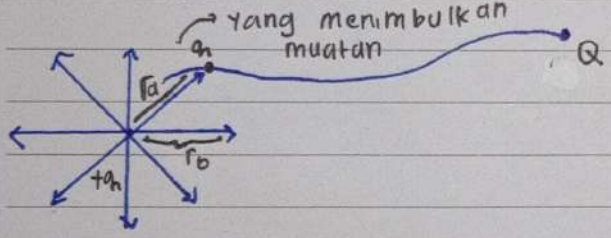
$$W = G\frac{Mm}{r}$$

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

$$V = \frac{W}{M} = \frac{Gm}{r} \qquad V = \frac{W}{M}$$

$$V = \frac{W}{g} = \frac{F.r}{g} \rightarrow = \frac{k\frac{q_n \cdot r}{r^2}}{Q} = \boxed{V = k\frac{q_1}{r}}$$

→ potensial listrik (V) adalah usaha listrik setiap satuan muatan yang terjadi ketika muatan uji dipindahkan ke suatu titik.

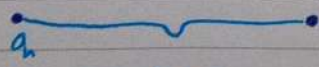


$$\int_a^b V = -\int \vec{E} \cdot dr$$

$$V\Big|_a^b = -\int \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\,dr$$

$$= -\frac{q}{4\pi\varepsilon_0}\int_{ra}^{rb}\frac{1}{r^2}\,dr = -\frac{q_n}{4\pi\varepsilon_0}\left(-\frac{1}{r}\Big|_{ra}^{r_b}\right)$$

$$= \boxed{V_b - V_a = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)}$$

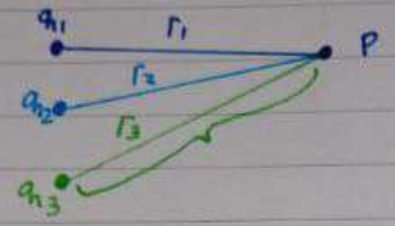


$V = k\frac{q_n}{r}$

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

$k\frac{q_n Q}{r}$

$\rightarrow V = k\frac{q_n}{r}$



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

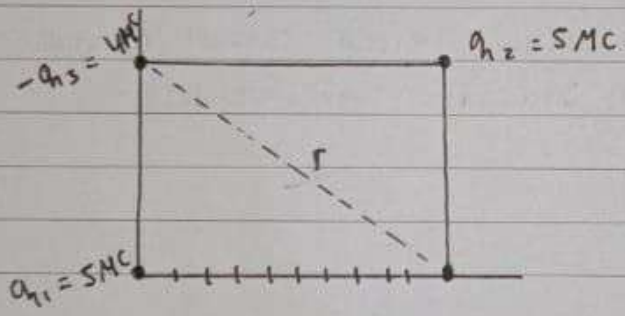
$$= k \sum_{i=1}^{n} \frac{q_i}{r_i}$$

$$V_b - V_a = \frac{q}{4\pi\varepsilon_0}\left(1/r_b - 1/r_a\right)$$

$$V_b - V_a = k\frac{Q}{R} \quad \text{(didalam)}$$

kalau diluar $V_b = V_a = k\frac{Q}{r}$

1)



$$V = k\frac{q_1}{r_1} + k\frac{q_2}{r_2} + k\frac{(-q_3)}{r_3}$$

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

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

- Persamaan poisson dan persamaan lapalace

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

$$\nabla E = -\nabla^2 V$$

$$\nabla V = \frac{\rho}{\varepsilon_0}$$

$$\nabla^2 V = -\frac{\rho}{\varepsilon_0} \quad \text{poisson}$$

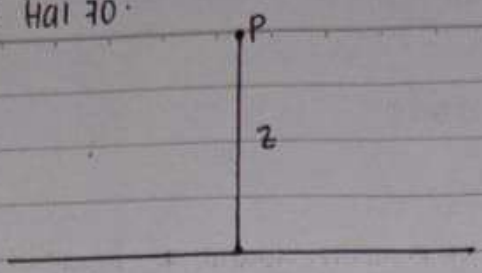
} poisson.

$\nabla^2 V = 0$ lapalace

~ Persamaan laplace n Poisson. ~

Tugas Hal 70.

1. a)



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

$\oint \vec{E}.da = \frac{\lambda . \ell}{\varepsilon_0}$

$\vec{E}(2\pi r \ell) = \frac{\lambda . \ell}{\varepsilon_0}$

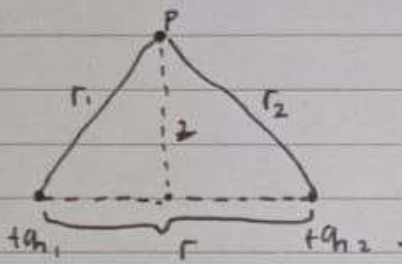
$\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 r}$

$V = -\int \vec{E}.dr$

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

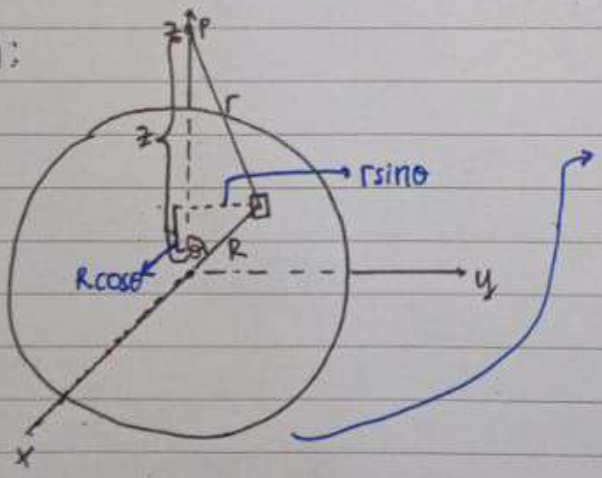
$= -\frac{\lambda}{2\pi\varepsilon_0} \int \frac{1}{r} dr$

b)



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

contoh soal:



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

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

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

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

$r = \sqrt{R^2(\sin^2\theta + \cos\theta^2)z^2 - 2zR\cos\theta}$ ($\sin^2\theta + \cos\theta^2 = 1$)

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

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

$da \rightarrow R^2 \sin\theta \, d\theta d\phi$

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

r disini adalah R besar di gambar

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

R disini adalah r kecil pd gambar

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

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

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

$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0} 2\left(R^2+z^2-2Rz\cos\theta\right)^{\frac{1}{2}}\Big|_0^{\pi}$$