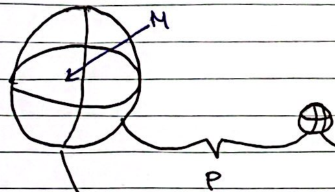
No senin
Date 01 April 2024

Potensial Listrik
(elektric potensial)

secara analog



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

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

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

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

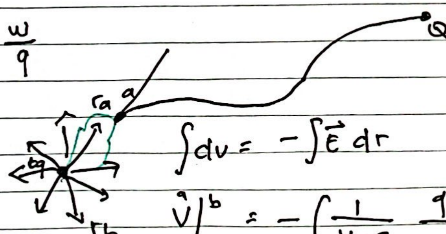
$$V = \frac{W}{q} = \frac{F.p}{q}$$

$$= \frac{k\frac{q.Q.p}{r^2}}{Q}$$

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

secara fisika

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



$$\int dv = -\int \vec{E}\, dr$$

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

$$= -\frac{q}{4\pi\varepsilon_0}\int_{ra}^{rb} \frac{1}{r^2}\, dr$$

$$= -\frac{q}{4\pi\varepsilon_0}\left(-\frac{1}{r}\Big|_{rb}^{rb}\right)$$

JOYKO 30 Lines, 6 mm

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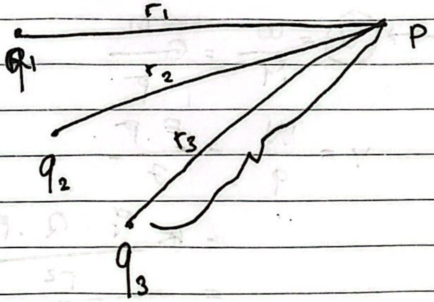
$$= V_b - V_a = \frac{q}{4\pi \varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

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

Kasus → q ⌒ P

$$V = \frac{W}{Q} \rightarrow K = \frac{qQ}{r}$$

Jika skala tidak vektor



$$V = \frac{W}{q} = \frac{\vec{F}.\vec{S}}{q} = k\frac{q}{r}$$

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

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

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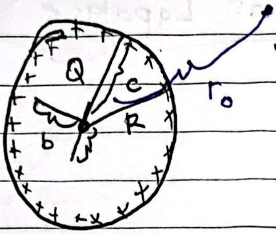


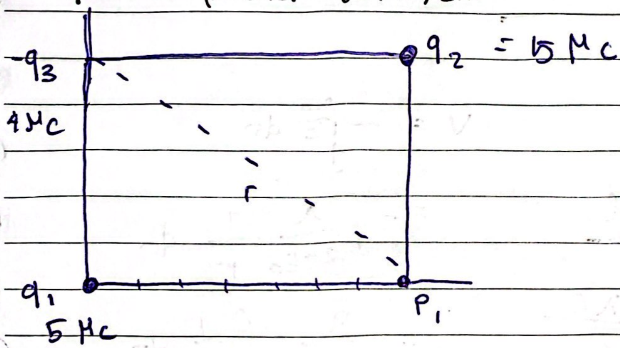
$$V_b - V_a = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

$$V_b - V_a = k\frac{Q}{R}$$

Berapa potensial luar

$$V = k\frac{Q}{r},\ r > R$$

Dua muatan titik positif sama besarnya +5 μc pada sumbu x. Satu dipusat (0, 0) dan yg lain pada (8, 0) cm. Tentukan potensial di (a) titik P_1 pada posisi (8, 6) cm



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

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

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

• Persamaan Poisson dan persamaan Lapalace

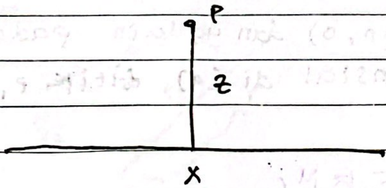
$\vec{E} = -\nabla V$

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

$\nabla \vec{E} = \frac{\rho}{\varepsilon_0}$

$\nabla^2 V = \frac{\rho}{\varepsilon_0}$ (Poisson)

$\nabla^2 V = 0$ (Lapalace)



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

$\oint \vec{E}\, da = \frac{\lambda l}{\varepsilon_0}$

$\vec{E}\,(2\pi\varepsilon_0 r l) = \frac{\lambda l}{\varepsilon_0}$

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

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

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

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

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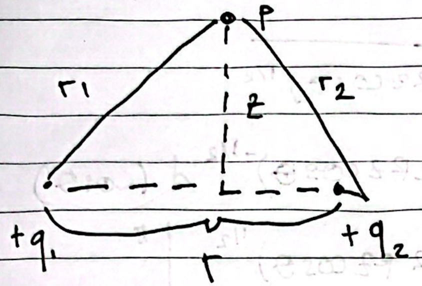
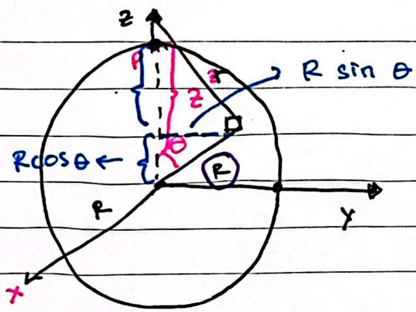


$$V_p = K\left[\frac{q_1}{\sqrt{(\frac{1}{2}r)^2+z^2}} + \frac{q_2}{\sqrt{(\frac{1}{2}r)^2+z^2}}\right]$$



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

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

$$V_{(P)} = \frac{1}{4\pi\varepsilon_0}\int \frac{\sigma}{r}\, da$$
$$= \frac{1}{4\pi\varepsilon_0}\iint \frac{\sigma\, da}{(R^2+z^2-2zR\cos\theta)^{\frac{1}{2}}}$$
$$= \frac{\sigma}{4\pi\varepsilon_0}\int_0^{\pi}\int_0^{2\pi} \frac{r^2 \sin\theta\, d\theta\, d\phi}{(R^2+z^2-2zR\cos\theta)^{\frac{1}{2}}}$$
$$= \frac{\sigma R^2 2\pi}{4\pi\varepsilon_0}\int_0^{\pi} \frac{\sin\theta\, d\theta}{(R^2+z^2-2zR\cos\theta)^{\frac{1}{2}}}$$

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

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

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

$\left(\frac{1}{1/2} : 2\right) = 2$