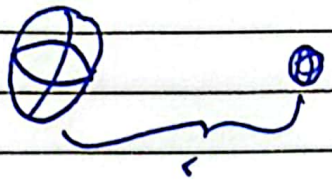
Potensial Listrik (Elektrik potensial)

No 1-4-24
Date



$$W = G\frac{M.m}{r}$$

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

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

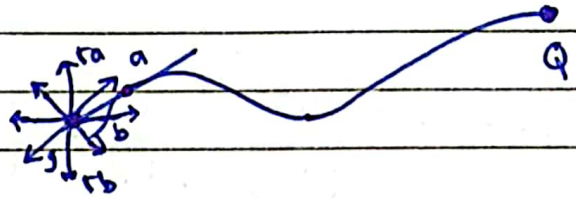
$$V = \frac{W}{m} = G\frac{M}{r}$$

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

$$= k\frac{q}{r^2}$$

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

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



$$\int_a^b dv = -\int \vec{E}.dr$$

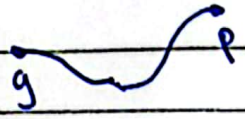
$$V\Big|_a^b = -\int \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}dr$$

$$= -\frac{q}{4\pi\varepsilon_0}\int_{ra}^{b}\frac{1}{r^2}dr = -\frac{q}{4\pi\varepsilon_0}\left(-\frac{1}{r}\Big|_a^b\right)$$

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

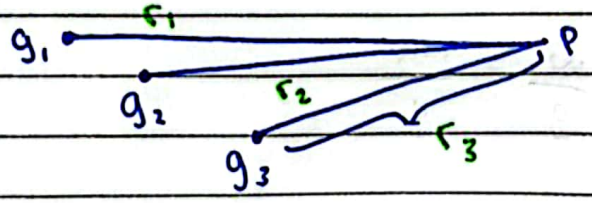
No
Date

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



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

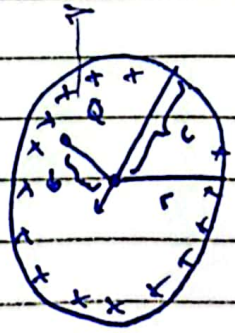
Contoh soal



$V = \frac{W}{q} = \frac{\vec{P}\cdot\vec{s}}{q} = k\frac{q}{r}$

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

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

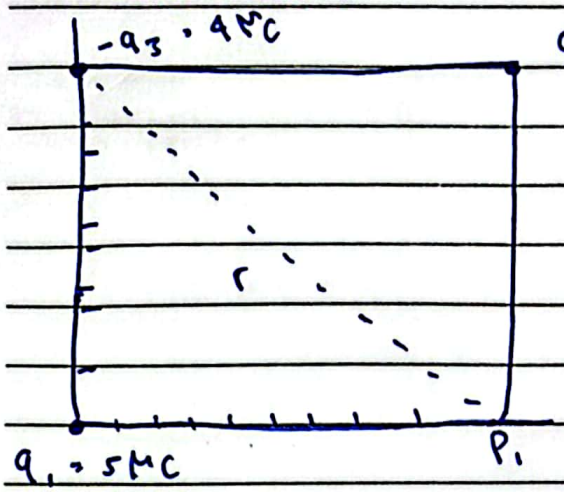


$V_b - V_a = \frac{q^{=0}}{4\pi\epsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$

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

No
Date

Contoh soal :



$$V = \frac{kq_1}{r_1} + \frac{kq_2}{r_2} + \frac{k(-q_3)}{r_3}$$

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

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

No
Date

Persamaan Poisson & Laplace

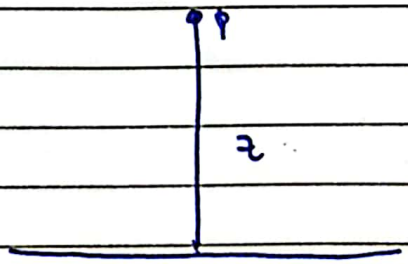
$$E = -\nabla V$$

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

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

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

$$\nabla^2 V = 0 \quad \text{Laplace}$$



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

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

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

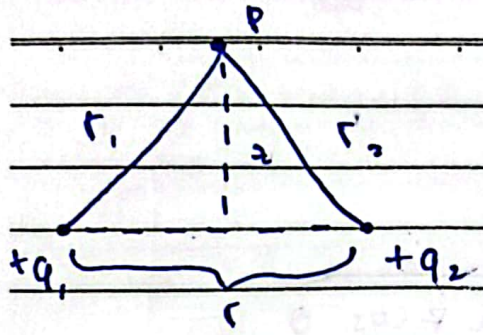
$$\boxed{E = \frac{\lambda}{2\pi\varepsilon_0 r}}$$

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

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

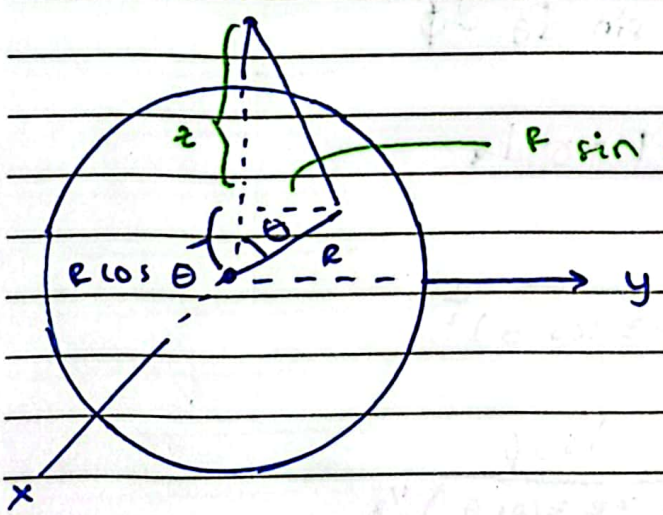
$$= -\frac{\lambda}{2\pi\varepsilon_0} \int \frac{1}{r}\, dr$$

No
Date



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

Contoh soal :



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

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

No
Date

Cara membuktikan :

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

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

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

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

$$V = \frac{1}{4\pi\varepsilon_0}\int \frac{\sigma\, da}{r} \qquad da = R^2\sin d\theta\, d\phi$$

$$dq = \sigma\, da$$

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

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

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

No
Date

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

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

$\frac{1}{-1/2}$

$$= \square_2 (R^2 + z^2 - 2Rz\cos\theta)^{1/2} \Big|_0^{\pi}$$