▶ Potensial listrik

Usaha persatuan muatan

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

Perpindahan muatan dari jauh tak hingga sampai ke titik tertentu.

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

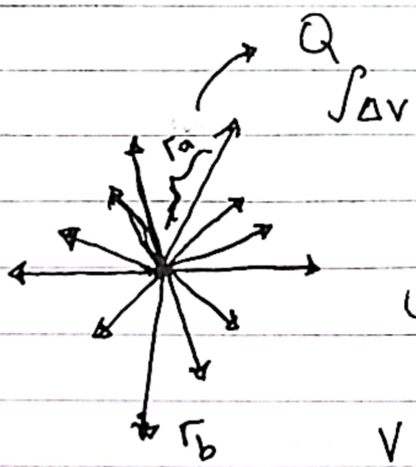
$$V = \frac{M}{m}$$

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

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

$$\frac{\frac{k\,q\,.\,\cancel{Q}\,.\,\cancel{r}}{\cancel{r^2}}}{\cancel{Q}}$$

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



$$\int_a^b dV = -\int \vec{E}\,dr$$

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

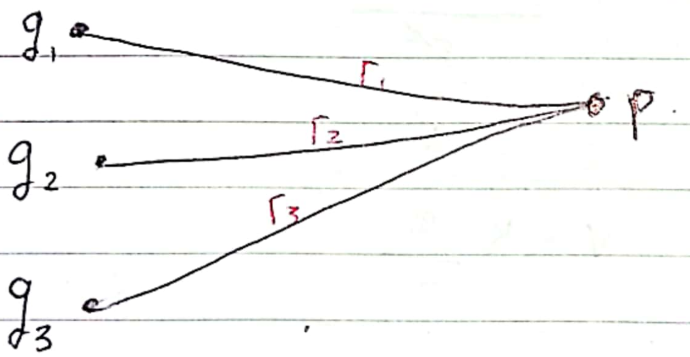
$$= -\frac{q}{4\pi\varepsilon_0}\int_{r_a}^{r_b} = \frac{-q}{4\pi\varepsilon_0}\left(-\frac{1}{r}\Big|_{r_a}^{r_b}\right)$$

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

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

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

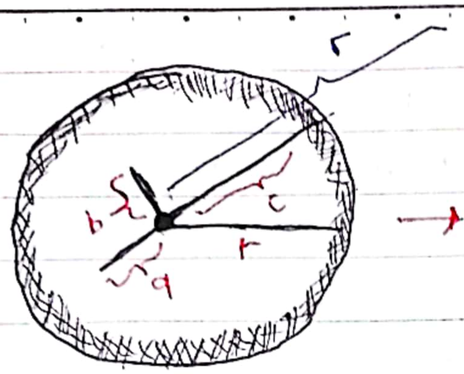
$$\boxed{= k\,\frac{q}{r}}$$



$$V = \frac{W}{q} = \frac{\vec{P}\cdot\vec{S}}{q} = k\,\frac{q}{p}$$

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

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

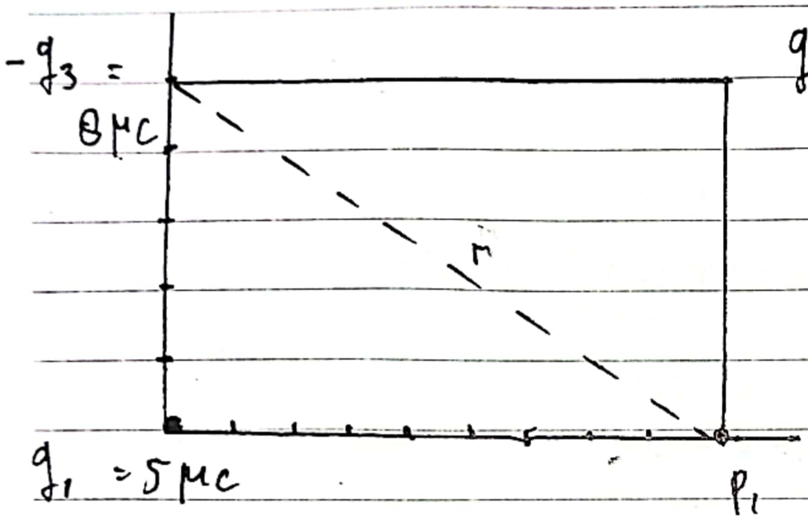


$$V_b - V_a = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

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

$$\boxed{V = k = \frac{Q}{r} = r > R}$$ Persamaan diluar

1. ... ada 2 muatan positif sama besarnya + 5 μC pada sumbu x. Satu dipusat (0,0) dan yang lain pada (8,0) cm. Tentukan potensial di (a) titik P, pada posisi (8,6) cm.



$$V = \frac{Kq_1}{r_1} + \frac{Kq_2}{r_2} + \frac{k(-q_3)}{5}$$

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

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

▸ Persamaan poisson dan Persamaan la palace

$E = -\Delta V$

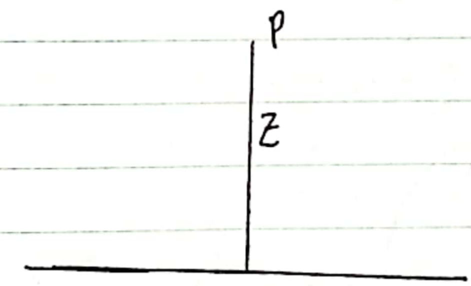
$\nabla E = -\nabla^2 V$

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

$\boxed{\nabla^2 V = -\frac{\rho}{\varepsilon_0}}$ → Poisson → Potensial atau besaran yang berasal dari sumbernya

$\boxed{\nabla^2 V = 0}$ → lapalace → potensial atau besaran yang tidak memiliki sumber (0)

▸ Potensial muatan terdistribusi (distrik)



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

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

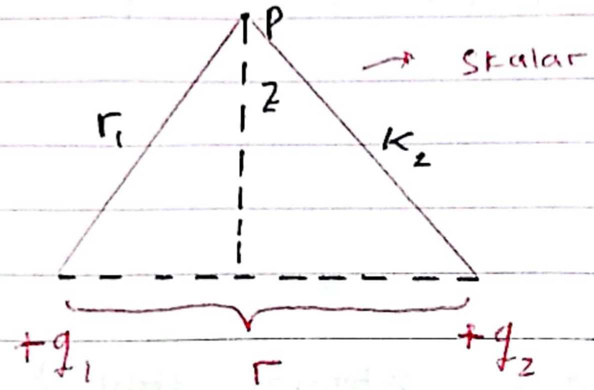
$\vec{E}\,(2\pi r \cancel{l}) = \frac{\lambda \cdot \cancel{l}}{\varepsilon_0}$

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

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

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

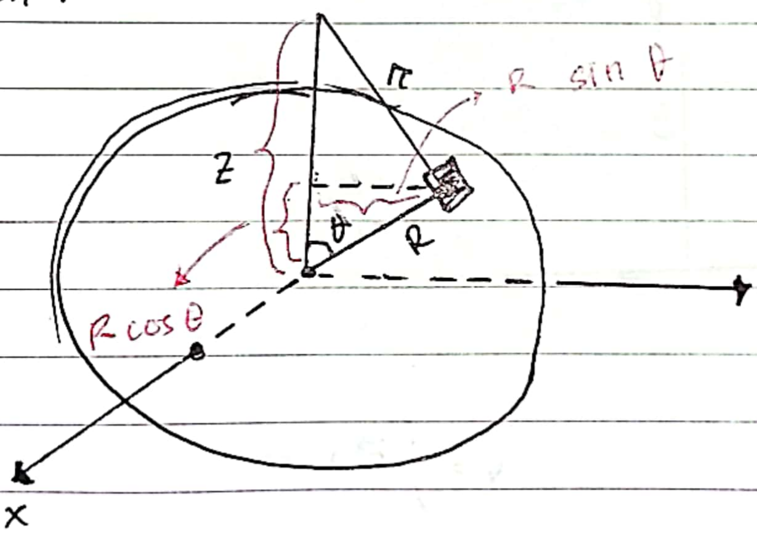
$= -\frac{\lambda}{2\pi\varepsilon_0} \int \frac{1}{r}\, dr$



$$V_p = \ldots ?$$

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

Soal :



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

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

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

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

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

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

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

$dq = \sigma\, da$

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

$\to R^2$

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

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

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

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

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