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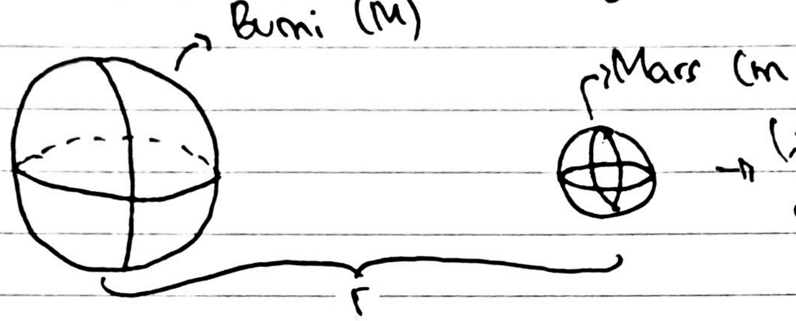
No
Date senin, 01. April. 2024

→ Potensial Listrik. (Potensial Elektrik).

• Distrik

Tanggal 15 April 2024 akan diadakan UTS secara online materi yang digunakan tentang listrik dan kontinus



→ (jika berada di Mars maka Bumi yang menimbulkan potensial)

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

$$V = G\frac{M}{r} \rightarrow$$ Potensial untuk di Bumi:

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

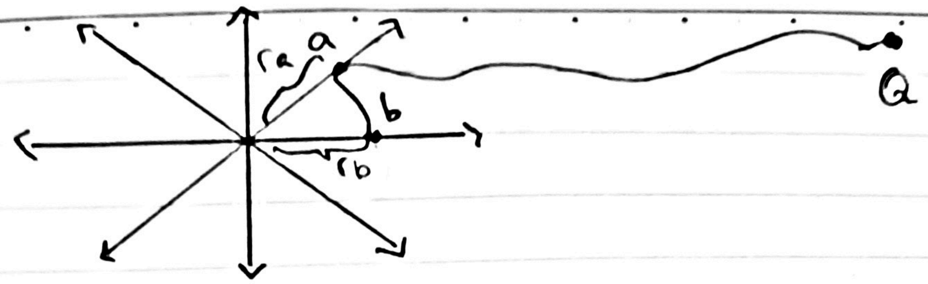
$$V = \frac{W}{M} \rightarrow$$ Potensial untuk di Mars.

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

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

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

$$V = k\frac{q}{r} \quad \ldots (1)$$



$$\int_a^b dV = -\int \vec{E}\, dr$$ → (negatif karena melawan medan).

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

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

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

$$V_b - V_a = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r_b}-\frac{1}{r_a}\right) \quad \ldots (2)$$

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

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

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

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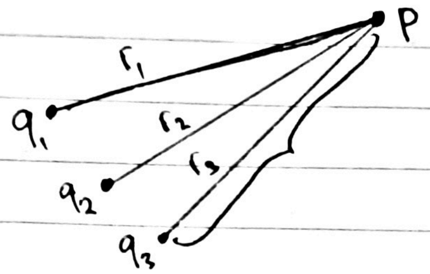
Contoh:

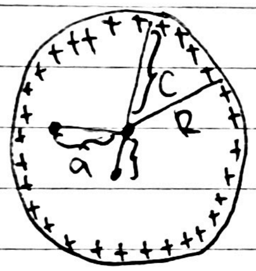


$$V = \frac{W}{q} = \frac{\vec{P}\cdot\vec{s}}{q} = k\frac{q}{r}$$

Persamaan 1 digunakan saat mendapati kasus seperti ini:

$$V_p = k\left[\frac{q_1}{r_1} + \frac{q_2}{r_2} + \frac{q_3}{r_3}\right]$$
$$= k\sum_{i=1}^{n} \frac{q_i}{r_i}$$

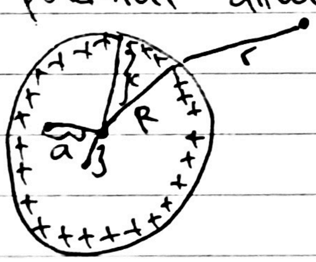
Sedangkan untuk persamaan 2 digunakan saat mendapati kasus seperti ini:



$$V_b - V_a = \frac{\overset{0}{q}}{4\pi\varepsilon_0}\left(\frac{1}{r_b} - \frac{1}{r_a}\right)$$

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

Jika potensial diluar:



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

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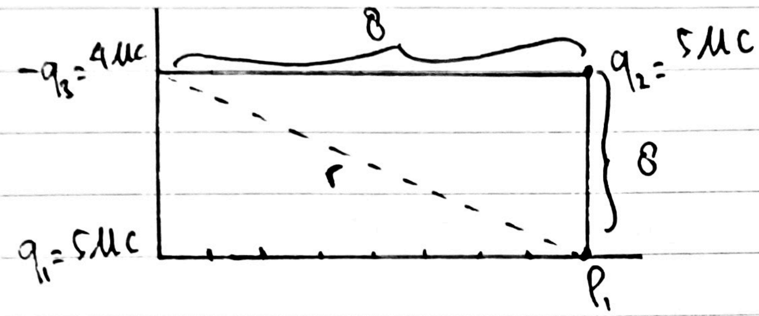
Soal 1

1. Ada 2 buah muatan positif besarnya 5μC terletak pada sudut berlawanan yang panjang sisinya 8 cm. Satu muatan negatif diletakkan pada sudut yang kosong. Berapa potensial pada sudut yang kosong.



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

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

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

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

→ Persamaan Poisson dan Persamaan Lapalace

$$E = -\nabla V$$

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

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

$$\nabla^2 V = -\frac{\rho}{\varepsilon_0}$$ → Persamaan Poisson.

$$\nabla^2 V = 0$$ → Lapalace

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- Persamaan Hukum Gauss:

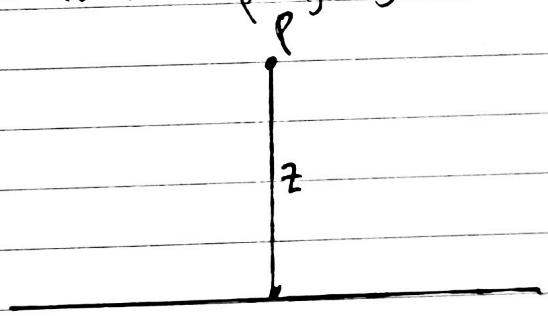
$$\oint_S \vec{E} \cdot d\vec{a} = \int_V (\nabla \cdot \vec{E})\, d\tau$$

- Medan = gradien dari suatu P
- P = potensial.
- Gradien = perubahan pluks.

- Potensial elektrik adalah perubahan energi gravitasi:
- Potensial listrik adalah usaha persatuan muatan. Usaha itu bekerja untuk memindahkan muatan ke titik tertentu.

Non diskrit.

→ Kawat lurus panjang.



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

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

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

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

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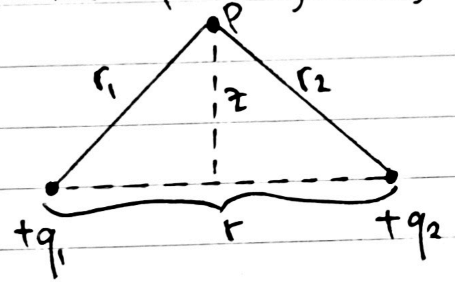
$$V = -\int \vec{E}\, dr$$

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

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

Soal!

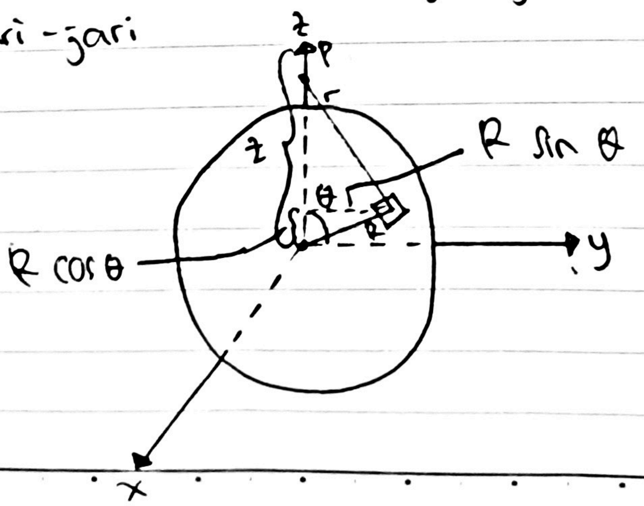
1. Hitung potensial pada titik sejauh z di tengah-tengah distribusi muatan pada garis yang panjangnya d, 2L, dan loop.



$V_p = \ldots ?$

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

2. Temukan potensi dari cangkang bola seragam bermuatan R jari-jari



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

$$V = \frac{1}{4\pi\varepsilon_0}\int \frac{\sigma}{r}\,da$$
$$= \frac{1}{4\pi\varepsilon_0}\iint \frac{\sigma}{(R^2+z^2-2Rz\cos\theta)^{1/2}}\,da$$
$$= \frac{\sigma}{4\pi\varepsilon_0}\int_0^{\pi}\int_0^{2\pi} \frac{R^2\sin\theta\,d\theta\,d\phi}{(R^2+z^2-2Rz\cos\theta)^{1/2}}$$
$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\int_0^{\pi} \frac{\sin\theta\,d\theta}{(R^2+z^2-2Rz\cos\theta)^{1/2}}$$
$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\int_0^{\pi} \frac{d(\cos\theta)}{(R^2+z^2-2Rz\cos\theta)^{1/2}}$$
$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\int_0^{\pi} (R^2+z^2-2Rz\cos\theta)^{-1/2}\,d(\cos\theta)$$
$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\,2\,(R^2+z^2-2Rz\cos\theta)^{1/2}\Big|_0^{\pi}$$
$$= \frac{\sigma R 2\pi}{4\pi\varepsilon_0}\,2\,(R^2+z^2-2Rz\cos\pi)^{1/2} - (R^2+z^2-2Rz\cos 0)^{1/2}$$