Hukum Gauss dan Aplikasi

$$\oint_S \bar{E} \cdot d\bar{a} = \oint_V (\nabla \cdot \bar{E})\, d\tau$$

$\tau = V$

$$\oint \bar{E} \cdot da = \oint \frac{q}{4\pi\epsilon_0 r^2} r^2 \sin\theta \, d\theta \, d\phi$$

$$= \frac{q}{4\pi\epsilon_0} \int_0^{\pi}\int_0^{\pi} \sin\theta \, d\theta \, d\phi$$

$$= \frac{\cancel{4\pi} q}{\cancel{4\pi}\epsilon_0}$$

$$\boxed{\oint_S \bar{E} \cdot da = \frac{q}{\epsilon_0}}$$

Persamaan Gauss dalam bentuk deprensial

$$\int_V (\nabla \cdot \bar{E})\, d\tau$$

$$Q = \rho \, d\tau$$

asalnya dari $\oint \bar{E} \cdot d\bar{a} = \int_V (\nabla \cdot E)\, d\tau$

$$\int_V (\nabla \cdot \bar{E})\, d\tau = \frac{Q}{\epsilon_0}$$

$$= \frac{1}{\epsilon_0} \int_V \rho \, d\tau$$

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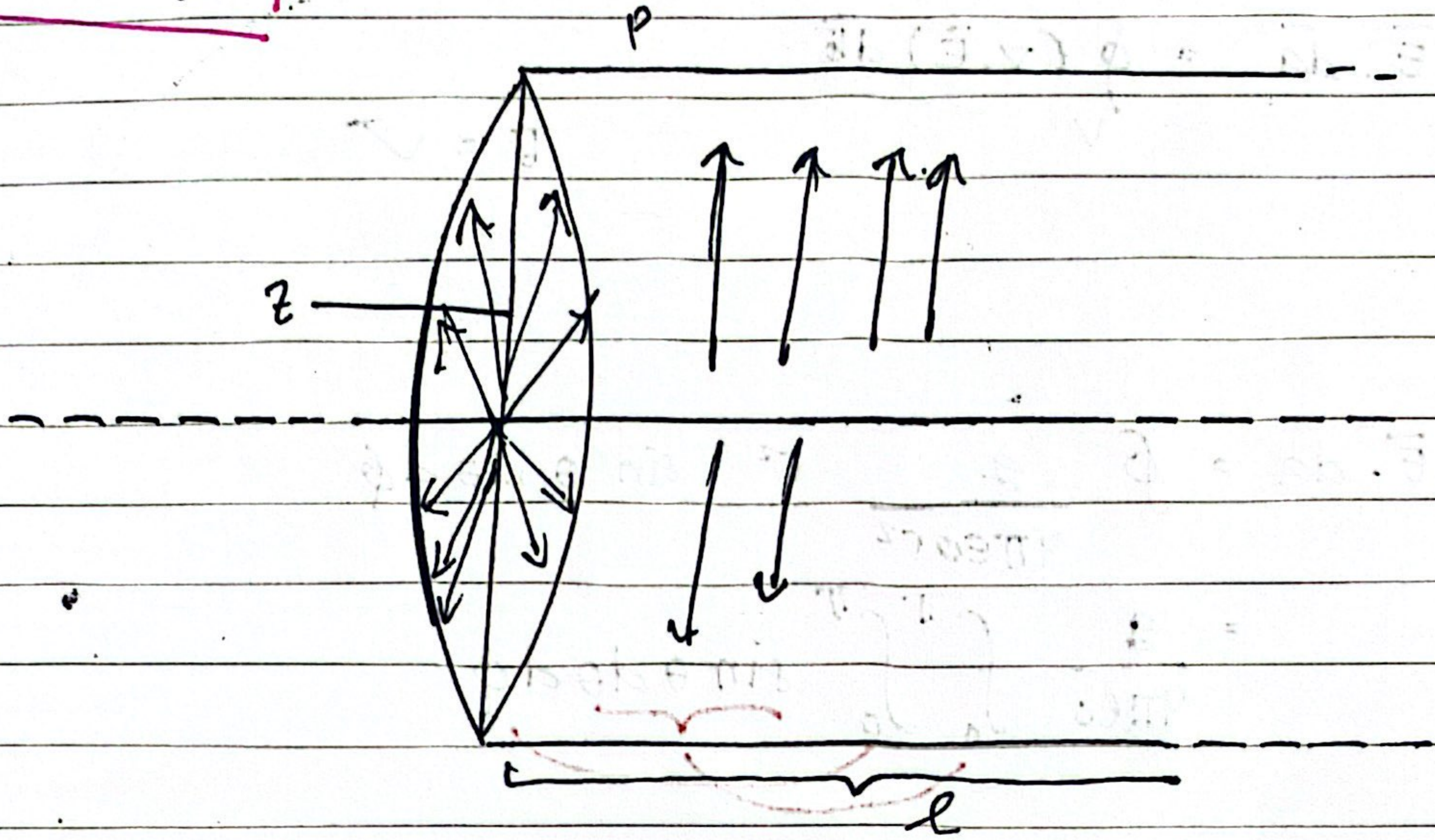
$$\boxed{\nabla \cdot \bar{E} = \frac{\rho}{\varepsilon_0}}$$ Hukum gauss dalam bentuk defferensial



$$\oint \bar{E} \cdot da = \frac{q}{\varepsilon_0}$$

λ : rapat muatan pada kawat

$$\bar{E} \cdot (2\pi z \cdot l) = \frac{\lambda \cdot l}{\varepsilon_0}$$

$$\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 z} \hat{z}_0$$

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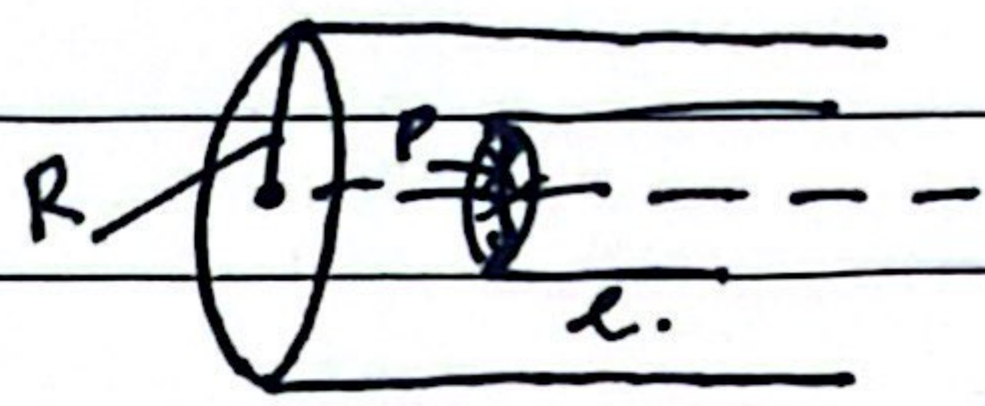


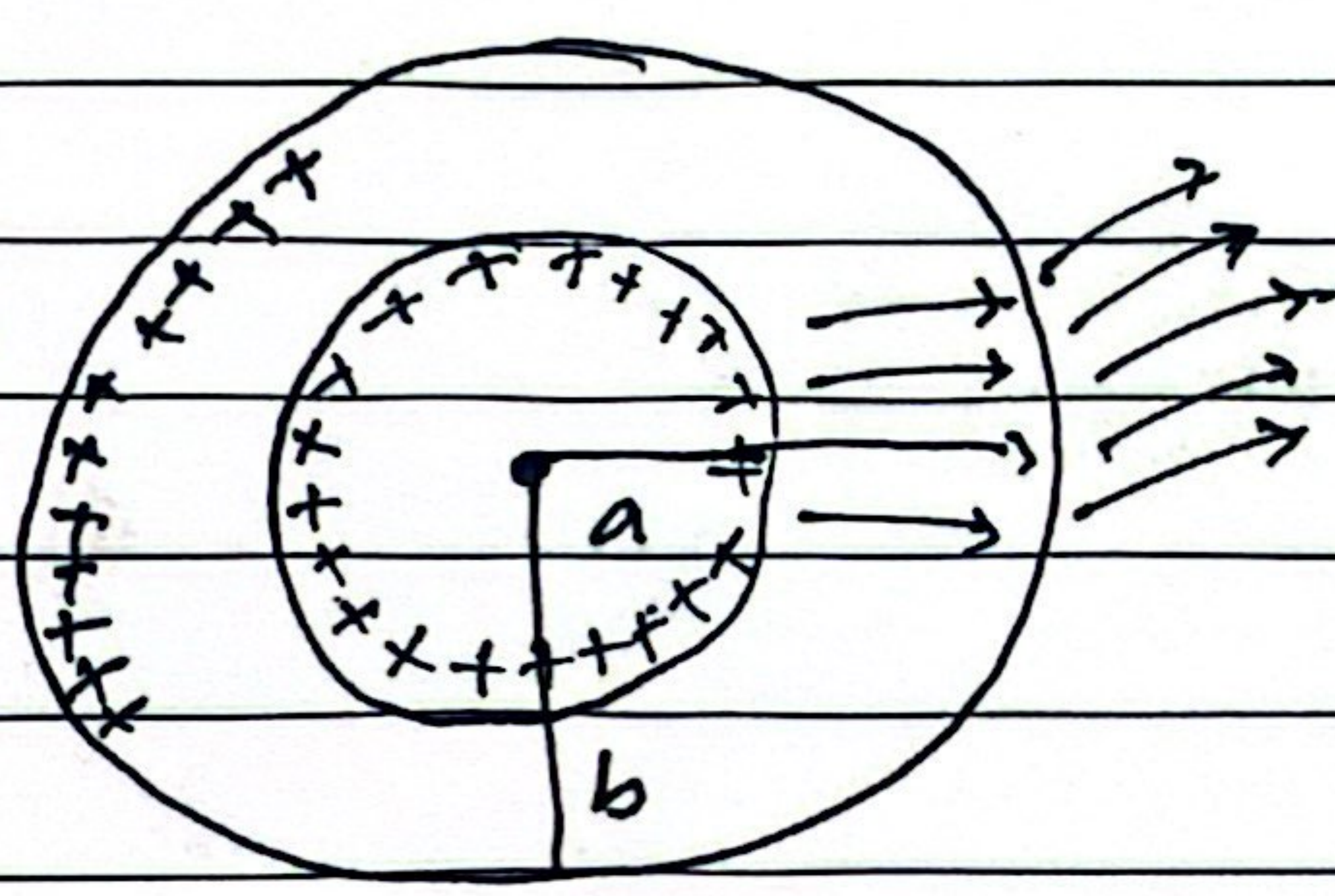
$$\oint \bar{E}\, da = \frac{Q}{\epsilon_0}$$

$$\vec{E}(2\pi r . l) = \frac{Q}{\epsilon_0}$$

$$\bar{E} = \frac{Q}{2\pi\epsilon_0 r l}\hat{r}_0$$

menggunakan r kecil karna yang dihitung medan magnet berarti didlm

1.)



Calculate of $\bar{E}$

1. $r < a$
2. $a < r < b$
3. $r > b$

1. $\bar{E} = 0$
2. $\oint \bar{E} . da = \frac{Q}{\epsilon_0}$

$$\oint \bar{E} . da$$

$$\bar{E} . (4\pi r^2) = \frac{1}{\epsilon_0}\iiint \rho\, d\tau$$

$$= \frac{1}{\epsilon_0}\int^a \int^{2\pi}\int^{\pi} \rho\, r^2 \sin\theta\, d\theta\, d\phi\, dr$$

$$= \frac{4\pi\rho}{\epsilon_0}\int_0^a r^2\, dr \qquad = \frac{4\pi\rho}{\epsilon_0}\left(\frac{1}{3} r^3 \Big|_0^a\right)$$

$r > b$

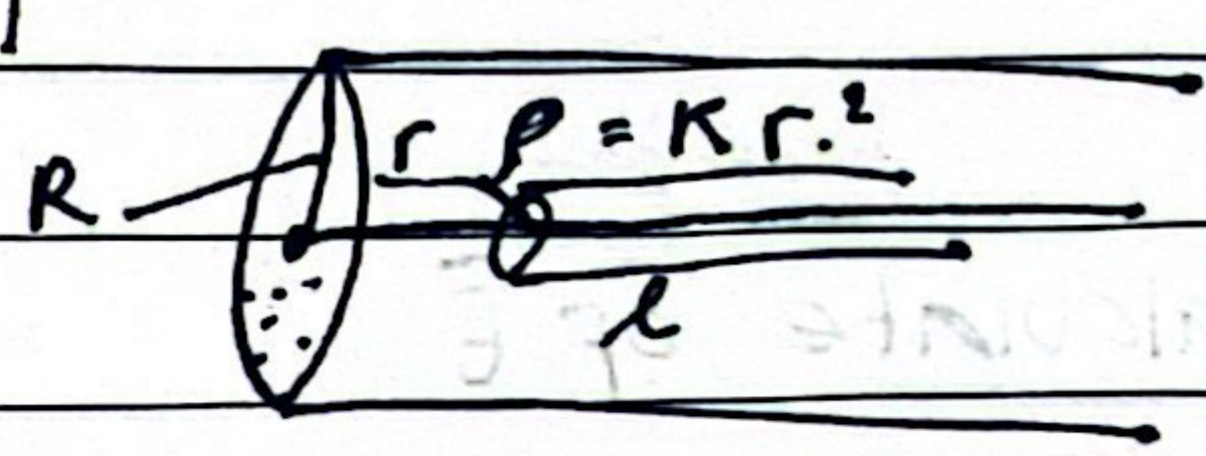
$$\oint E \cdot da = \frac{1}{\epsilon_0} \iiint \rho \, d\tau$$

$$= \frac{1}{\epsilon_0} \iiint \rho \, r^2 \sin\theta \, d\theta \, d\phi \, dr$$

$$= \frac{4\pi\rho}{\epsilon_0} \int_a^b \rho^2 \, dr$$

$$= \frac{4\pi\rho}{\epsilon_0} \left(\frac{1}{3} r^3 \Big|_a^b \right)$$

2.)



1. $r < R$
2. $r > R$

$$\oint \bar{E} \cdot da = \frac{1}{\epsilon_0} \iiint \rho \, d\tau$$

$$E \cdot (2\pi r \cdot l) = \frac{1}{\epsilon_0} \iiint (Kr^2) \, r \, d\phi \, dz \, dr$$

$$= \frac{K(4\pi)}{\epsilon_0} \int_0^a \quad / \quad \frac{2\pi K}{\epsilon_0} \int_0^l dz \int_0^R r^3 \, dr$$

2.) $\oint \bar{E} \cdot da = \frac{Q}{\epsilon_0}$

$$\bar{E} \cdot (2\pi r \cdot l) = \frac{1}{\epsilon_0} \int_0^R \int_0^\pi$$

$W = F \cdot s$

$V = \frac{W}{q} = \frac{F \cdot s}{q} = k\,\frac{\frac{q \cdot q}{r}\, s}{q}$

$\boxed{s = p}$

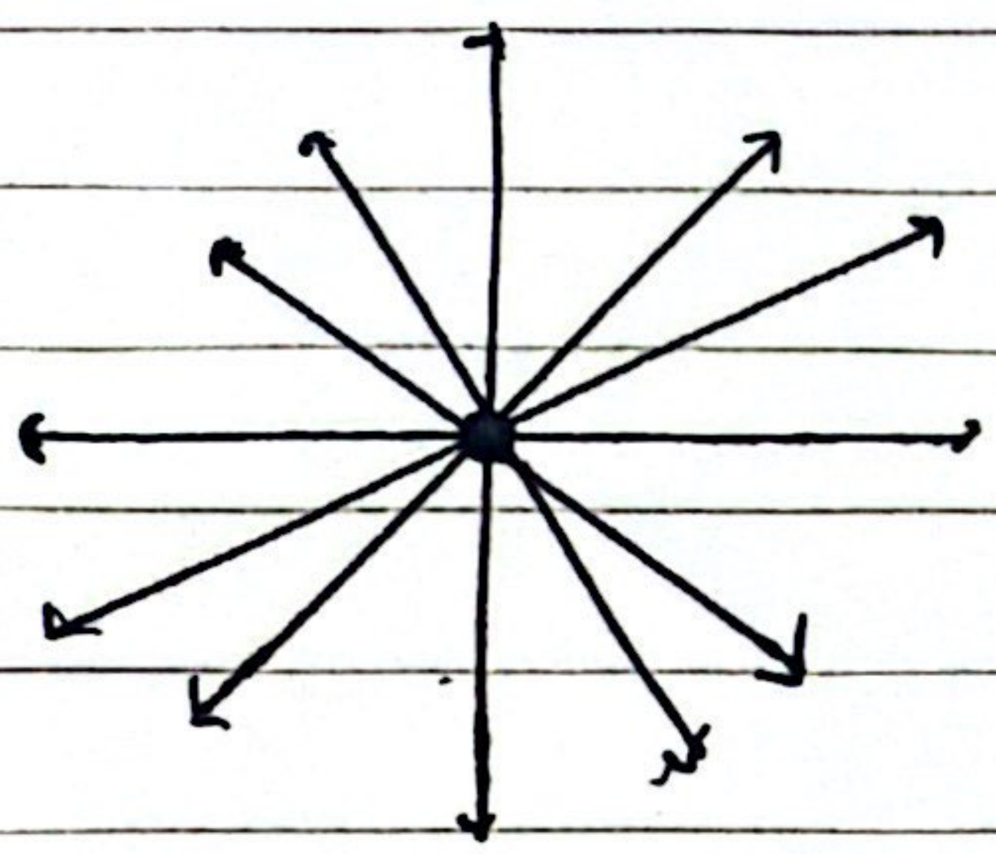
$\boxed{V = k\,\frac{q}{p}}$ $\boxed{V = -\int \bar{E}\, dr}$

Potensial

> potensial oleh muatan listrik

> beda potensial oleh arus listrik

Potensial listrik (usaha memindahkan muatan dari jauh ketitik tertentu.)



$\nabla V \neq dV$

$dV = -\oint_{r_1}^{r_2} \bar{E}\, dr$

$V_1 - V_2 = -\int \bar{E}\, dr$

$\Delta V = -\int_{r_1}^{r_2} \frac{Q}{4\pi\varepsilon_0 r^2}\, dr$

$= \frac{q}{4\pi\varepsilon_0} \int_{r_1}^{r_2} r^{-2}\, dr$

$= \square \int_{r_1}^{r_2} r^{-2}\, dr$

$= \square \left(-\frac{1}{r} \Big|_{r_1}^{r_2} \right)$

$= \square \left(\frac{1}{r_2} - \frac{1}{r_1} \right)$

$V = \frac{1}{4\pi\varepsilon_0} \frac{q}{r} = k\,\frac{q}{r}$