No. Senin,

Date 25 . 03 . 2024

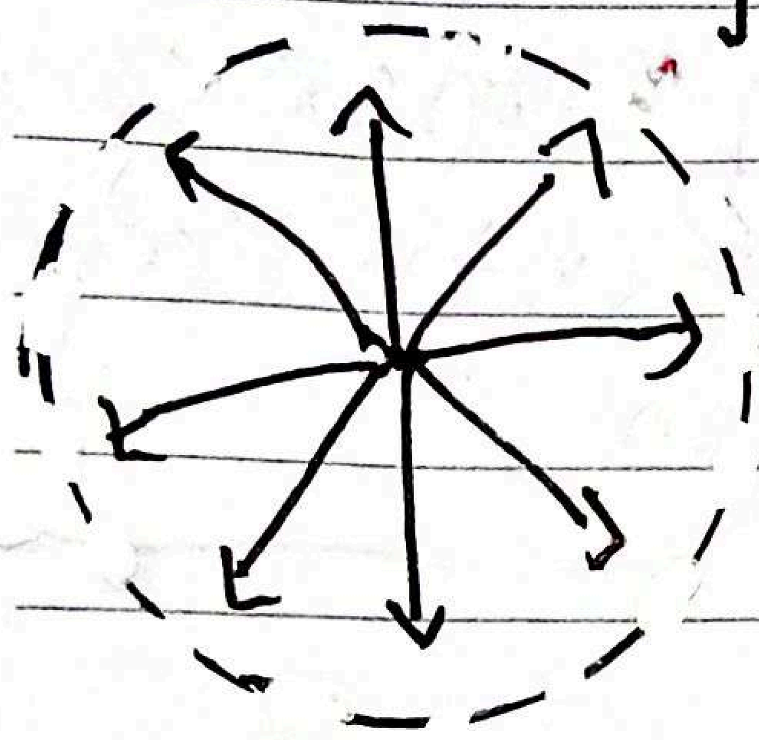
Kalisma

Hukum Gauss

$\Delta V \neq dV$

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

$$\oint \vec{E} \cdot d\vec{a} = \oint \frac{q}{4\pi\varepsilon_0 r^2} r^2 \sin\theta \, d\theta \, d\phi$$



q

$$= \frac{q}{4\pi\varepsilon_0} \int_0^{\pi} \int_0^{2\pi} \sin\theta \, d\theta \, d\phi$$

$$= \frac{q(2\pi)}{4\pi\varepsilon_0} \int_0^{\pi} \underbrace{\sin\theta \, d\theta}$$

$$\oint \vec{E} \cdot d\vec{a} = \frac{4\pi q}{4\pi\varepsilon_0}$$

$$\boxed{\oint \vec{E} \cdot d\vec{a} = \frac{q}{\varepsilon_0}}$$

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

$$\left.\begin{aligned} Q_{enc} &= \rho \, d\tau \\ &= \sigma \, da \\ &= \lambda \, dl \end{aligned}\right\}$$

$$\iiint \nabla \cdot E \, d\tau = \iiint \frac{\rho \, d\tau}{\varepsilon_0}$$

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

Differensial (Turunan)
↳ Kecepatan, Percepatan.

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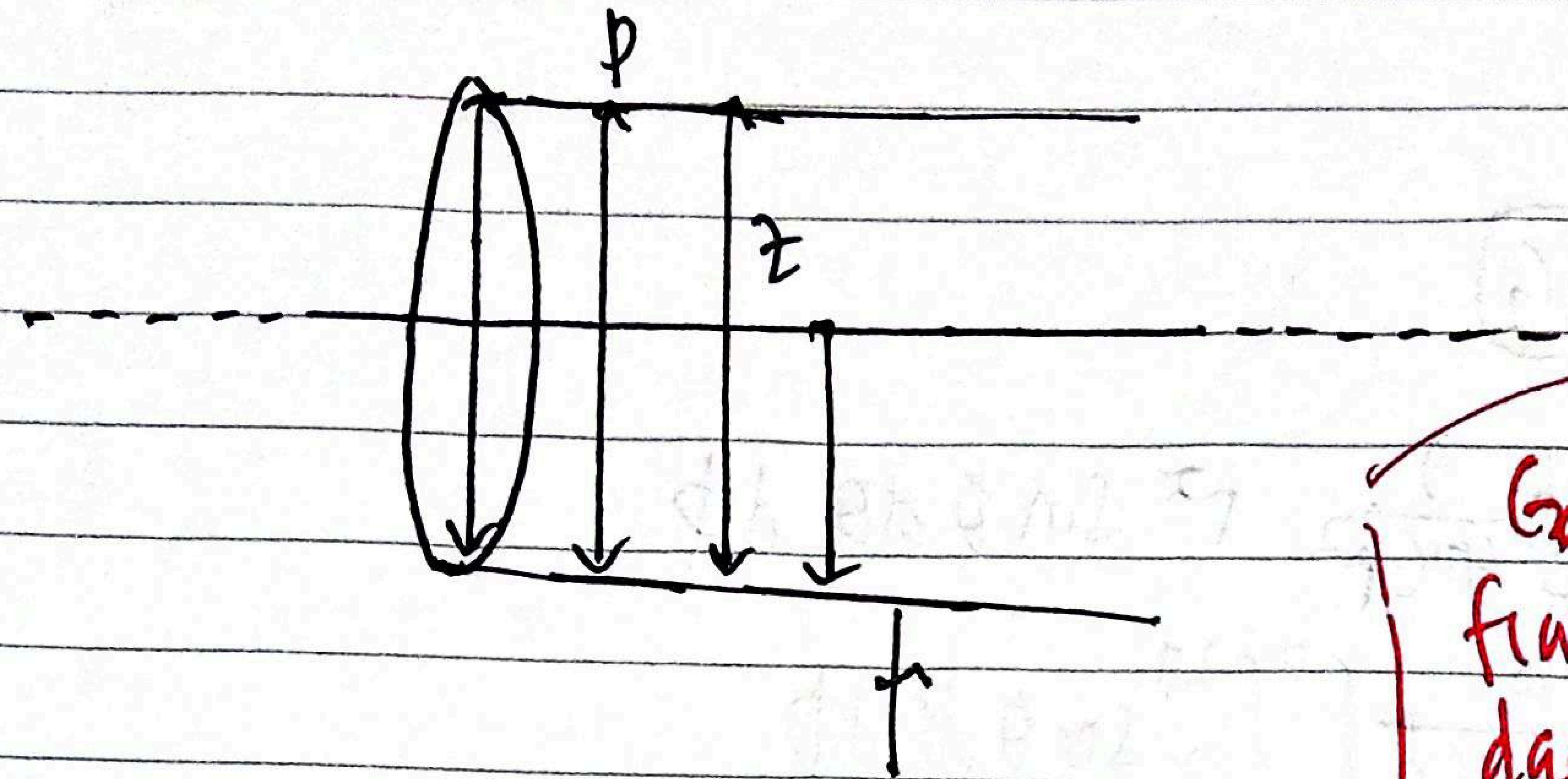
Contoh:



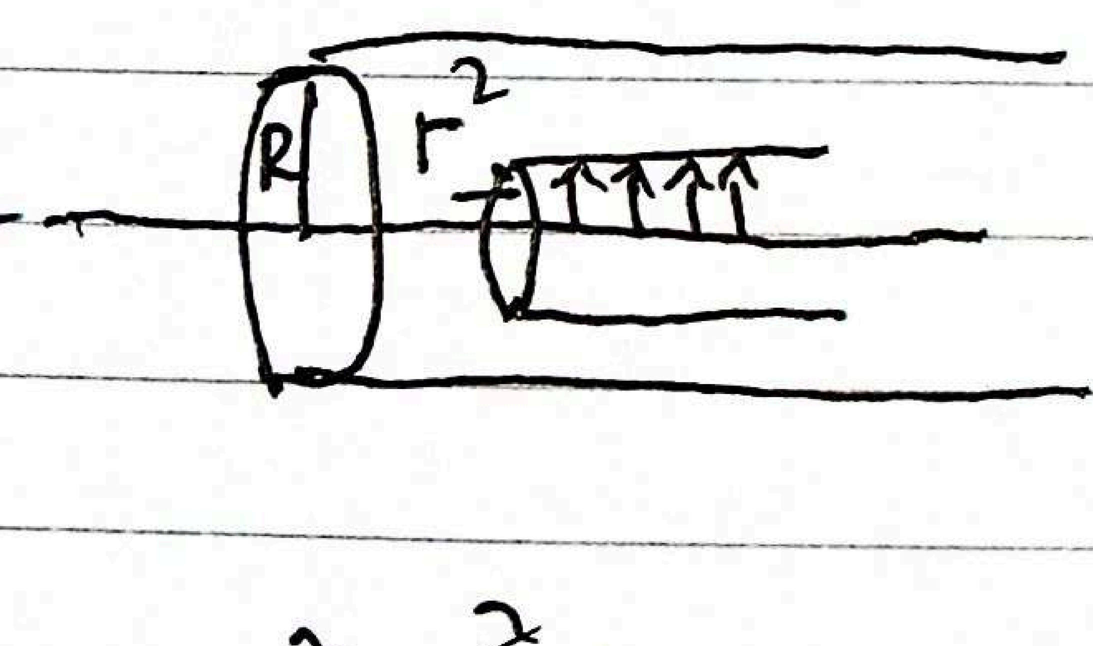
Persamaan Gauss

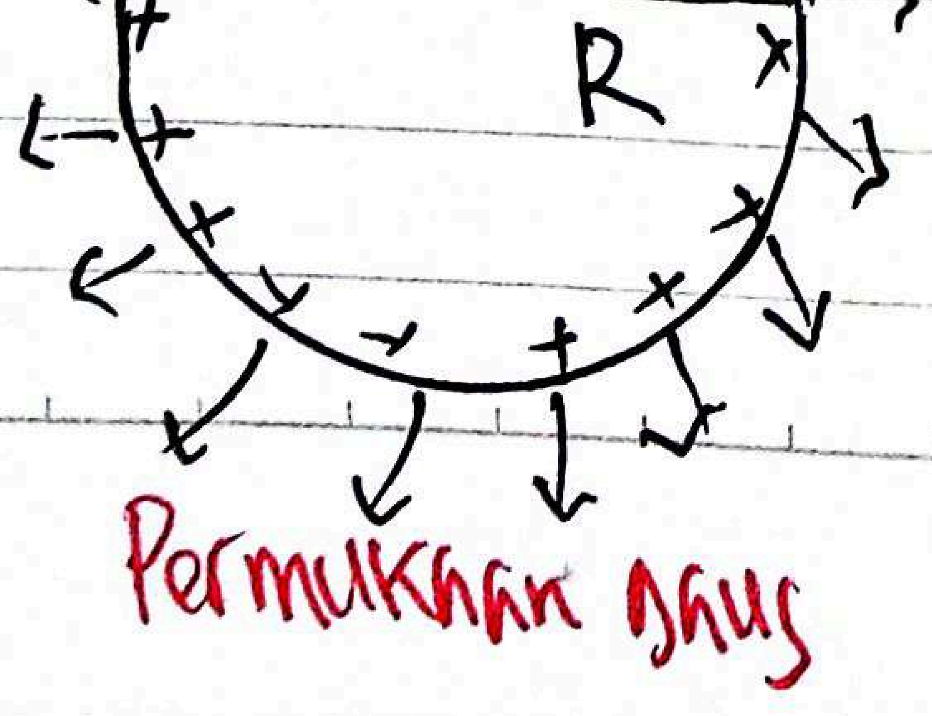
Gaus ↓
fluks yang muncul pada daerah tertentu karena ada muatan

$\oint \vec{E} \cdot d\vec{a} = \frac{q}{\epsilon_0}$ $\quad \lambda \cdot l \quad$ $\vec{E}(2\pi \rho \cdot l) = \frac{\lambda l}{\epsilon_0}$

$\oint \vec{E} \cdot d\vec{a} = \frac{\lambda l}{\epsilon_0}$ $\quad \vec{E} = \frac{\lambda}{2\pi \epsilon_0} \hat{\rho}_0$

$\oint \vec{E} \cdot d\vec{a} = \frac{q}{\epsilon_0}$



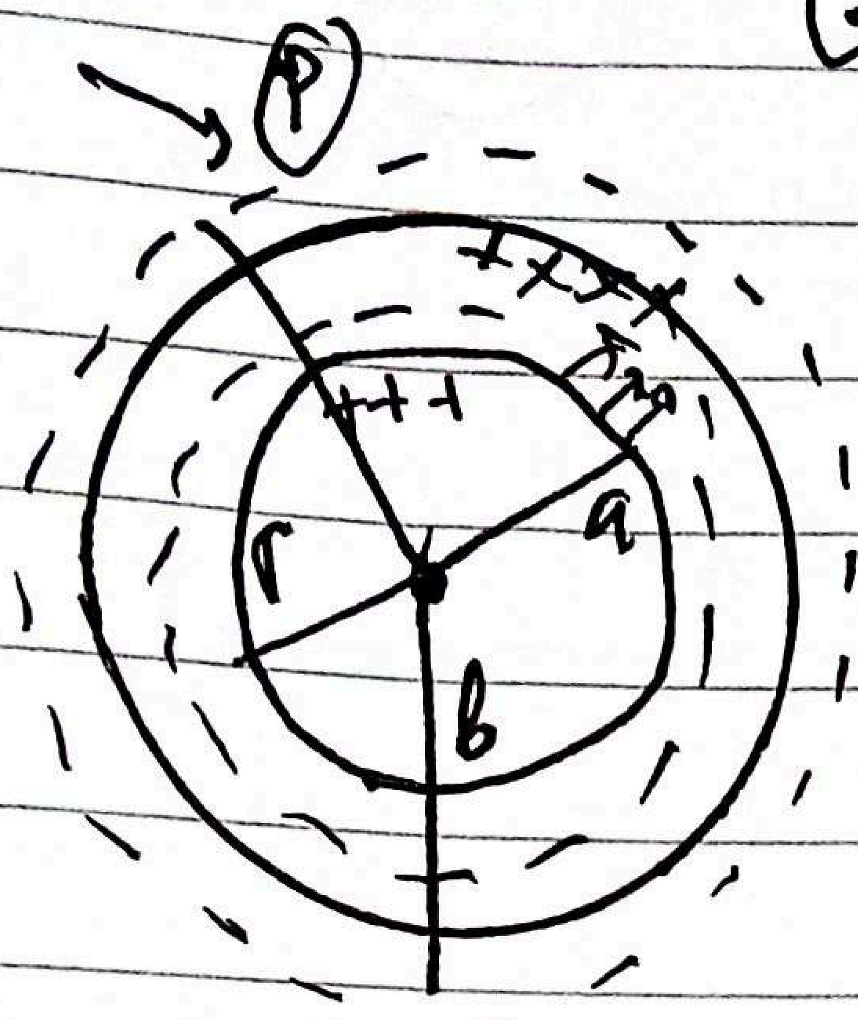


Permukaan gaus

Hitung $\vec{E}$ pada
a. $\rho < R$
b. $\rho > R$

$\oint \vec{E}\, d\vec{a} = \frac{Q_{ro}}{\epsilon_0}$

$\vec{E}(4\pi r^2) = \frac{Q_{nu}}{\epsilon}$



$r < a \rightarrow \vec{E} = 0$

$a < r < b$

$\oint \vec{E} \cdot da = \frac{Q}{\epsilon_0}$

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

$= \frac{1}{\epsilon_0} \int_0^a \int_0^\pi \int_0^{2\pi} r^2 \sin\theta \, d\phi \, \phi \, d\theta.$

$= \frac{4\pi}{\epsilon_0} \int_0^a r^2 \, d\rho.$

$= \int_0^\pi \int_0^{4\pi} \sin\theta \, d\theta$

$= 4\pi$

$\vec{E}(4\pi r^2) = \frac{4\pi}{\epsilon_0} \int_0^a r^2 \, d\rho$

$= \frac{4\pi}{\epsilon_0} \left(\frac{1}{3} r^3 \Big|_0^a \right.$

$\vec{E}(\cancel{4\pi} r^2) = \frac{\cancel{4\pi}}{3} \frac{a^3}{\epsilon_0} = \vec{E} \quad \frac{\rho a}{3\epsilon_0 r^2} \quad \hat{r}_0$

$\vec{E} \longrightarrow \rho > b$

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$$\oint \vec{E}\, d\vec{a} = \frac{Q}{\epsilon_0}$$

$$\vec{E}(4\pi r^2) = \frac{1}{\epsilon_0} \int_a^b \int_0^{\pi} \int_0^{2\pi} \rho^2 \cos\theta \, d\theta \, d\rho \, dr$$

$r > b$

$$\vec{E}(4\pi r^2) = \frac{\rho}{\epsilon_0} 4\pi \int_a^b r^2 \, dr$$

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

$$= \frac{\rho \cdot 4\pi}{3\epsilon_0} (b^3 - a^3)$$

$$\vec{E} = \frac{\rho!}{3\epsilon_0 r^2} (b^3 - a^3)$$