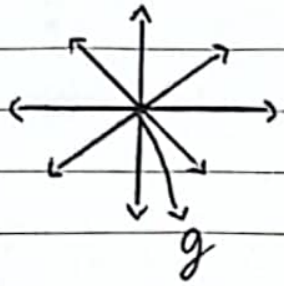
Kalisma — Pertemuan 6 — Date 25 - 03 - 2024

Hukum Gauss

$\Delta v \neq dv$

Persamaan gauss dalam bentuk integral

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



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

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

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

$$\oint \vec{E}\, da = \frac{2\pi q}{4\pi\varepsilon_0}$$

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

diferensial dalam fisika digunakan Pada GLBB

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

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

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

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

JOYKO 30 Lines, 6 mm

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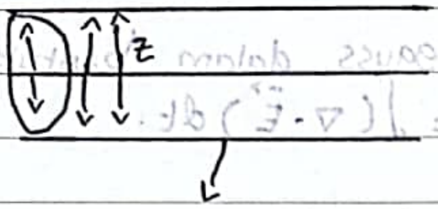

Permukaan Gauss.

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

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

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

$$\boxed{\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 x} \rho_0}$$

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

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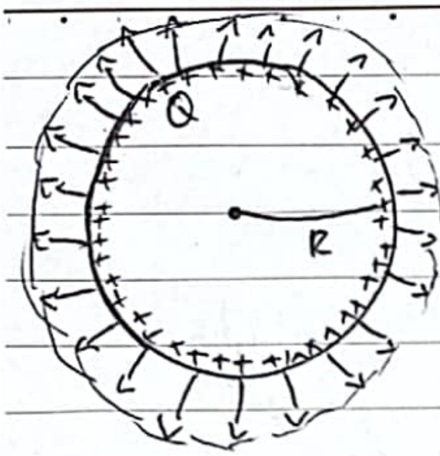
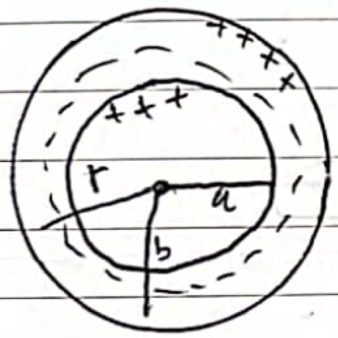


Hitung $\vec{E}$ Pada
a) $P < R$
b) $P > R$

$$\oint_S \vec{E} \cdot da = \frac{Q_{ink}}{\epsilon_0}$$

$$\vec{E}(4\pi r^2) = \frac{Q_{ink}}{\epsilon_0} = \frac{Q}{4\pi\epsilon_0 r^2}\hat{r}_0$$



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

$a < r < b$

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

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

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

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

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$$\vec{E}(4\pi r^2) = \frac{4\pi}{\varepsilon_0}\int_0^a r^2\,dr$$

$$= \frac{4\pi}{\varepsilon_0}\left(\frac{1}{3} r^3 \Big|_0^a\right.$$

$$\vec{E}(4\pi r^2) = \frac{4}{3}\,\frac{\pi a^3}{\varepsilon_0} = \vec{E} = \frac{\rho a^3}{3\varepsilon_0 r^2}\hat{r}$$

$\vec{E} \to r > b$

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

$$\vec{E}\cdot(4\pi r^2) = \frac{1}{\varepsilon_0}\int_0^b\int_0^\pi\int_0^\pi \rho\, r^2 \sin\theta\, d\theta\, d\phi\, dr$$

P > b

$$\vec{E}(4\pi r^2) = \frac{r}{\varepsilon_0}\, 4\pi \int_a^b r^2\,dr$$

$$= \frac{r4\pi}{\varepsilon_0}\left(\frac{1}{3}\, r^3 \Big|_a^b\right)$$

$$= \frac{r4\pi}{3\varepsilon_0}(b^3 - a^3)$$

$$\vec{E} = \frac{r}{3\varepsilon_0 r^2}(b^3 - a^3)$$

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