No. 25-03-2024

Date Senin

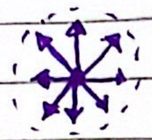
kalisma

$\boxed{\text{Hukum Gauss}}$

$au \neq du$

$\oint \vec{E}\, dq = \int (\nabla \vec{E})\, dl$

menentukan lipat 2 atau 1



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

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

$-\cos\pi - (\cos 0)$

$1 + 1 = 2$

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

$$= \frac{q\,(2\pi)}{4\pi\varepsilon_0} \cdot 2$$

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

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

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

$$Q_{inc} = \rho\, d\tau = \sigma\, da = \lambda\, dl$$

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

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

Persamaan Gauss dalam bentuk differensial

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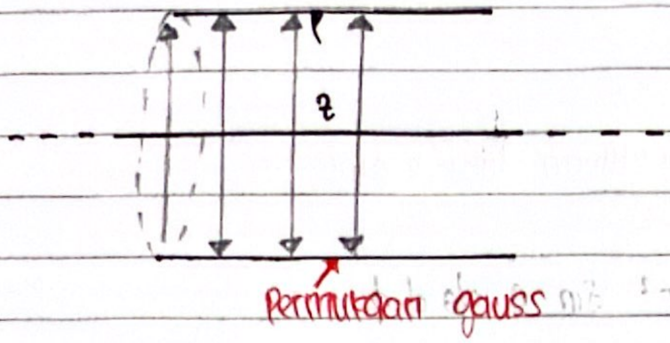
Contoh :



$\oint \vec{E} : dq_n \cdot \frac{q_n}{\varepsilon_0} : \lambda \cdot l$

$\oint \vec{E} \; (d\vec{a}) : \frac{\lambda l}{\varepsilon_0}$

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

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

$$\boxed{\vec{E} : \frac{\lambda}{2\pi \varepsilon_0} \; \hat{r}_0}$$

Fluks yang muncul pada luasan tertutup karena ada sumber muatan disebut hukum gauss.

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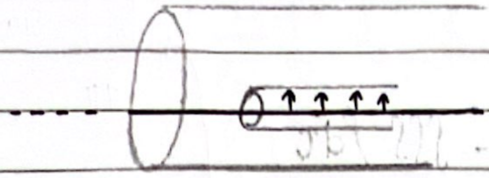
$$\oint \vec{E} \cdot d\vec{a} = \frac{q}{\varepsilon_0}$$

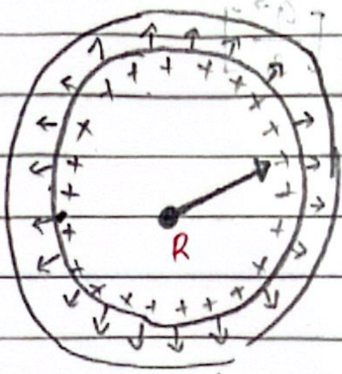


$$\vec{E} = \frac{Q}{4\pi\varepsilon_0 r^2}\hat{r}_0$$

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

$$\vec{E}\,(2\pi r e) = \frac{Q}{\varepsilon_0}$$

$\vec{E} = \dfrac{Q}{2\pi\varepsilon_0 r}\hat{r}_0$, dimana $r<R$



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

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

$E = \dfrac{q}{4\pi\varepsilon_0 r^2}\hat{r}_0$, dimana $r<R$

Hitung

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

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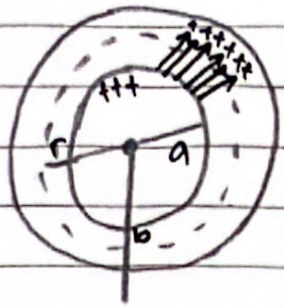

$r < a \rightarrow \vec{E} = 0$

$a < r < b$

$\oint \vec{E}\, dq = \frac{Q}{\varepsilon_0}$

$\vec{E}(4\pi r^2) = \frac{1}{\varepsilon_0} \iiint \rho\, d\tau$

$\int_0^{\pi}\int_0^{2\pi} \sin\theta\, d\theta\, d\phi$

$= 4\pi$

$= \frac{\rho}{\varepsilon_0} \int_0^a \boxed{\int_0^{\pi}\int_0^{2\pi} r^2 \sin\theta\, d\theta\, d\phi\, d\tau}$

$= \frac{4\pi}{\varepsilon_0} \int_0^a r^2\, d\rho$

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

$= \frac{4\pi}{\varepsilon_0} \left[\frac{1}{3}(a^3) - \frac{1}{3}(0)^3 \right]$

$= \frac{4\pi}{\varepsilon_0} \left[\frac{a^3}{3} \right]$

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

$\vec{E} = \frac{\rho a^3}{3\varepsilon_0 r^2}$

$\vec{E} = \frac{\rho a^3}{3\varepsilon_0 r^2}$

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

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

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

$$= \frac{\rho}{\varepsilon_0} \int_a^b \boxed{\int_0^{2\pi} \int_0^{\pi} \sin\theta \, d\theta \, d\phi \, \phi r} \to \text{hasilnya } 4\pi$$

$$= \frac{4\pi\rho}{\varepsilon_0} \int_a^b r^2 \, dr$$

$$= \frac{4\pi\rho}{\varepsilon_0} \left[\frac{1}{3} r^3 \Big|_a^b \right]$$

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

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