No

Date

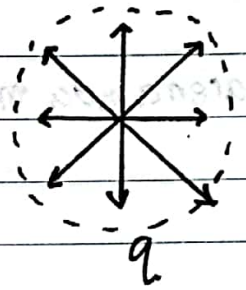
Senin, 25 Maret 2024

Kelistrikan dan Kemagnetan

Hukum Gaus

$\Delta V \neq dv$

$$\oint_s \vec{E}\,\vec{da} = \int_v (\nabla \cdot \vec{E})\, dG$$



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

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

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

$$\boxed{\oint \vec{E}.dq = \frac{4\pi q}{4\pi\varepsilon_0}}$$

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

$$\iiint \nabla.E\,dG = \iiint \frac{\rho\, dG}{\varepsilon_0}$$

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

Differensial (Turunan)
↳ kecepatan, percepatan.

$$\int_v (\nabla.\vec{E})\, dG$$

$$Q_{net} = \begin{cases} \int dG \\ = \sigma dq \\ = \lambda dl \end{cases}$$

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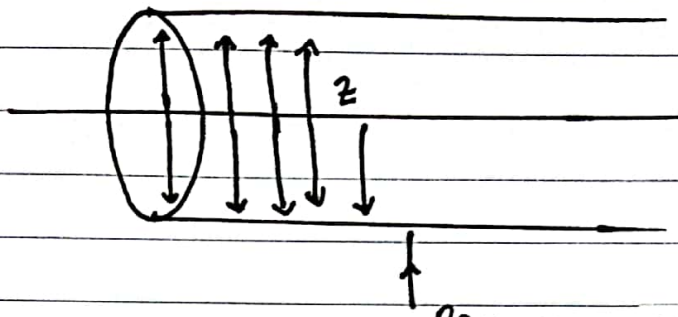
Contoh



Gauss ↓
fluks yang muncul pada daerah tertentu karena ada muatan.

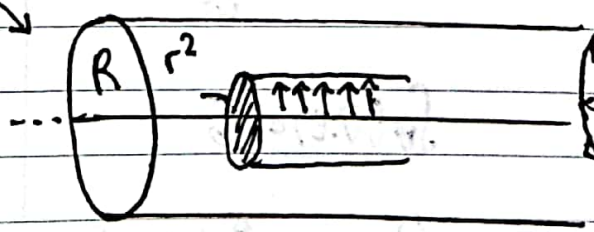
$\oint \vec{E} \cdot d\vec{q} = \frac{q}{\varepsilon_0}$ $\quad \lambda \cdot l$

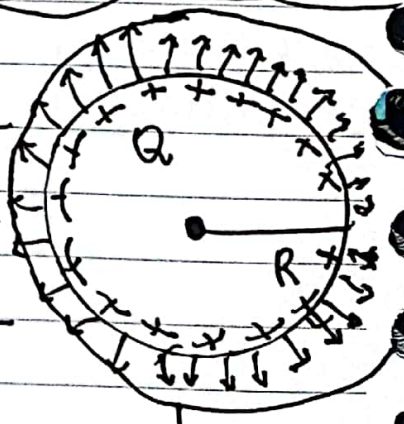
$\vec{E}(2\pi\rho \cdot l) = \frac{\lambda l}{\varepsilon_0}$

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

$$\boxed{\vec{E} = \frac{\lambda}{2\pi\varepsilon_0 \rho} \hat{P_0}}$$

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





Permukaan gauss

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

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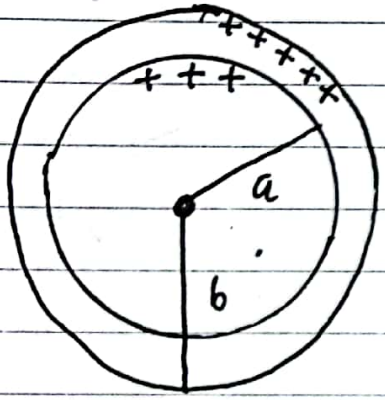
$$\oint_s \vec{E}.da = \frac{Q_{inc}}{\varepsilon_0}$$

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



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

$a < r < b$

$$\oint \vec{E}.da = \frac{Q}{\varepsilon_0}$$

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

$$= \frac{1}{\varepsilon_0} \int_0^a \int_0^{\pi} \int_0^{2\pi} r^2 \sin\theta \, d\theta \, d\phi \, dr$$

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

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

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

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

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

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

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

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

$r > b$

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

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

$$= \frac{\rho \cdot 4\pi}{3\varepsilon_0} (b^3 - a^3)$$

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