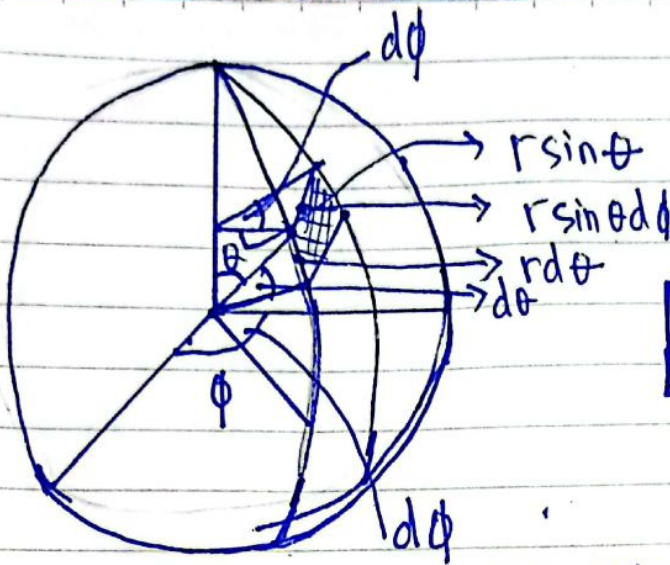


Sistem koordinat Bola

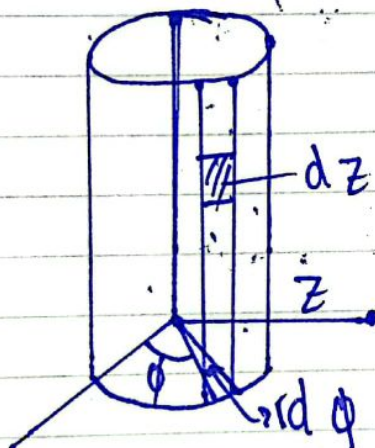


$$\begin{aligned}
 da &= dr \cdot r \sin \theta \cdot d\theta \\
 &= r \sin \theta \cdot r d\theta \\
 &= r^2 \sin \theta d\theta d\phi
 \end{aligned}$$

$$dV = r^2 \sin \theta d\theta d\phi dr$$

Satuan Volume
Satuan Luas

Sistem koordinat Silinder



$$\begin{aligned}
 x &= r \sin \theta \\
 \sin \theta &= \frac{x}{y}
 \end{aligned}$$

$$\text{Gradien} = \nabla T =$$

$$\begin{aligned}
 &\frac{\partial T}{\partial x} \hat{i} + \frac{\partial T}{\partial y} \hat{j} + \frac{\partial T}{\partial z} \hat{k} \\
 &= \frac{\partial T}{\partial r} \hat{r} + \frac{1}{r} \frac{\partial T}{\partial \theta} \hat{\theta} + \frac{1}{r \sin \theta} \frac{\partial T}{\partial \phi} \hat{\phi}
 \end{aligned}$$

$$\begin{aligned}
 A &= r d\phi dz \\
 V &= r d\phi dz dr
 \end{aligned}$$

$$\begin{aligned}
 \text{Luas} = dA &= dr \cdot r d\phi \\
 &= r d\phi dr
 \end{aligned}$$

$$\begin{aligned}
 \text{Volume} &= dV = r d\phi dz dr \\
 \text{Gradien} &= \nabla T
 \end{aligned}$$

$$\begin{aligned}
 \text{Luas} &= A \int_0^{2\pi} \int_0^{\pi} r^2 \sin \theta d\theta d\phi \\
 &= r^2 \int_0^{2\pi} d\phi \int_0^{\pi} \sin \theta d\theta
 \end{aligned}$$

$$\begin{aligned}
 &= 2\pi r^2 \int_0^{\pi} \sin \theta d\theta \\
 &= 2\pi r^2 [\cos \theta]_0^{\pi} \\
 &= 2\pi r^2 (1 - (-1)) \\
 &= 4\pi r^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Volume} = V &= \int_0^{2\pi} \int_0^{\pi} \int_0^r r^2 \sin \theta d\theta d\phi dr \\
 &= \left(\int_0^{\pi} \sin \theta d\theta \right) \left(\int_0^{2\pi} d\phi \right) \left(\int_0^r r^2 dr \right)
 \end{aligned}$$

$$= 2 \left(\frac{r^3}{3} \right) (2\pi)$$

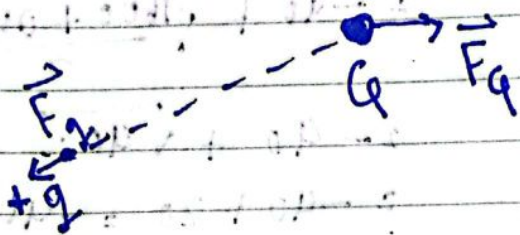
$$= \frac{4}{3} \pi r^3$$

listrik Statis

→ Muatan listrik

+q : kekurangan elektron

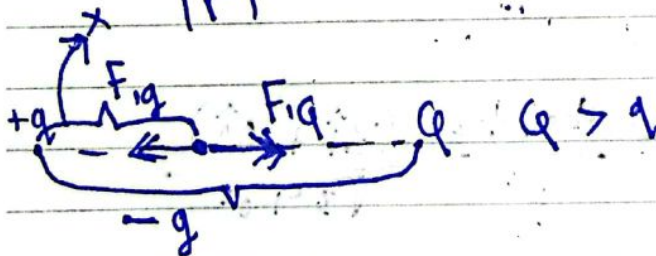
$$q = \pm (N)e$$



$$\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{qQ}{r^2} \hat{r}_0 = \vec{F}_q = \vec{F}_Q$$

$$\hat{r}_0 = \frac{\vec{r}}{|\vec{r}|}$$

$$\vec{F}_q = F \cdot q$$



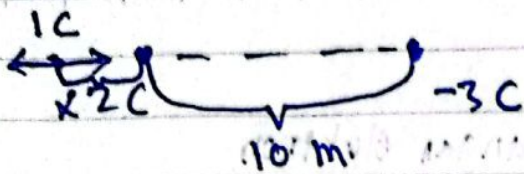
q_1

$$\frac{k q_1 q}{(r-x)^2} = k \frac{q_1 q}{(x^2)} = x ?$$

$$\frac{Q}{(r^2 - 2rx + x^2)} = \frac{q}{x^2}$$

$$Qx^2 = q(r^2 - 2rx + x^2)$$

Contoh:



$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{(-40) \pm \sqrt{(-40)^2 - 4 \cdot 1 \cdot (-200)}}{2 \cdot 1}$$

$$= \frac{-40 \pm \sqrt{1600 + 800}}{2}$$

$$= \frac{-40 \pm \sqrt{2400}}{2}$$

$$= \frac{-40 \pm 48.99}{2}$$

$$= \frac{-40 + 48.99}{2} = \frac{8.99}{2} = 4.495$$

$$= \frac{-40 - 48.99}{2} = \frac{-88.99}{2} = -44.495$$

$$k \frac{1 \cdot 2}{x^2} = k \frac{1 \cdot 3}{(10+x)^2}$$

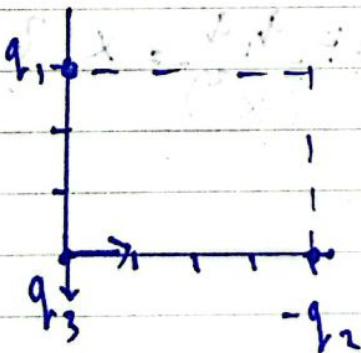
$$\frac{2}{x^2} = \frac{3}{x^2 + 20x + 100}$$

$$3x^2 = 2x^2 + 40x + 200$$

$$3x^2 - 2x^2 - 40x - 200 = 0$$

$$x^2 - 40x - 200 = 0$$

$$(x-20)(x-60)$$



$$\vec{F}_{32} = k \frac{q_3 \cdot q_2}{4^2} \cdot \frac{(3\hat{i} + 0\hat{j})}{\sqrt{3^2 + 0^2}}$$

$$= k \frac{q_3 q_2}{16} \hat{i}$$

$$\vec{F}_{31} = k \frac{q_3 q_1}{3^2} (-\hat{j}) = -k \frac{q_3 q_1}{9} \hat{j}$$

$$|\vec{F}| = \sqrt{0^2 + 0^2} \rightarrow k \sqrt{0^2 + 0^2}$$

$$\vec{F} = k q_3 \left[\frac{q_3}{16} \hat{i} - \frac{q_1}{9} \hat{j} \right]$$

$$\text{arah} = \tan^{-1} \frac{y}{x} = 90^\circ$$

$$|\vec{F}| = k q_3 \sqrt{\left(\frac{q_3}{16}\right)^2 + \left(\frac{q_1}{9}\right)^2}$$