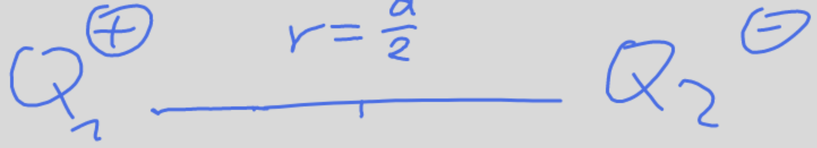


$$E = k \cdot \frac{Q}{r^2}$$

$$E_1(r) = k \cdot \frac{Q}{r^2}$$

$$E_2(r) = \begin{cases} k \cdot \frac{Q}{(r-a)^2} & r > a \\ k \cdot \frac{Q}{(a-r)^2} & r < 0 \end{cases}$$

$$E_{ges}(r) = E_1(r) - E_2(r)$$

$$= k \cdot Q \cdot \left(\frac{1}{r^2} - \frac{1}{(r-a)^2} \right) \quad r > a$$

$$= k \cdot Q \cdot \left(\frac{1}{r^2} - \frac{1}{(a-r)^2} \right) \quad r < 0$$

$$E_1(r) = E_2(r)$$

$$\frac{1}{r^2} = \frac{1}{(a-r)^2}$$

$$r^2 = (a-r)^2$$

$$r^2 = a^2 - 2ar + r^2 \quad | -r^2$$

$$0 = a^2 - 2ar \quad | +2ar$$

$$2ar = a^2 \quad | :2a$$

$$r = \frac{1}{2}a$$

$$\frac{1}{r^2} = \frac{1}{(r-a)^2}$$

$$r^2 = r^2 - 2ar + a^2 \quad | -r^2$$

$$0 = -2ar + a^2 \quad | +2ar$$

$$2ar = a^2 \quad | :2a$$

$$r = \frac{1}{2}a$$

geg: m, l, d, $\varepsilon_r = 1$

$$\sin(\alpha) = \frac{\frac{d}{2}}{l}$$

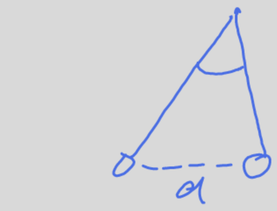
$$\tan(\alpha) = \frac{\vec{f_e}}{\vec{f_g}}$$

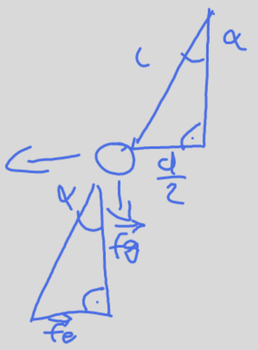
$$\vec{f_e} = \tan(\alpha) \cdot \vec{f_g}$$

$$\alpha = \sin^{-1}\left(\frac{\frac{d}{2}}{l}\right)$$

GAGA
HHAG

$$\vec{f_e} = \tan\left(\sin^{-1}\left(\frac{\frac{d}{2}}{l}\right)\right) \cdot \vec{f_g}$$





$$\frac{K \cdot Q^2}{r^2} = \tan\left(\sin^{-1}\left(\frac{\frac{d}{2}}{l}\right)\right) \cdot \vec{f_g} \quad | \cdot r^2 \; | : K$$

$$Q^2 = \tan\left(\sin^{-1}\left(\frac{\frac{d}{2}}{l}\right)\right) \cdot \vec{f_g} \cdot r^2 \cdot 4\pi\varepsilon_0 \qquad \vec{f_g} = m \cdot g$$

$$\sin(\alpha) = \frac{\vec{F_e}}{\vec{F_g}} \cdot \cos(\alpha) = \frac{1}{2}\frac{d}{l}$$

$$\frac{1}{2}\frac{d}{l} \cdot \vec{F_g} \cdot \frac{1}{\cos(\alpha)} = \vec{F_e}$$

$$Q = \sqrt{\tan\left(\sin^{-1}\left(\frac{2\,cm}{50\,cm}\right)\right) \cdot 0{,}002\,kg \cdot 9{,}81\,\frac{m}{s^2} \cdot 0{,}16\,m^2 \cdot 4\pi \cdot 8{,}854 \cdot 10^{-12}\,\frac{C^2}{N \cdot m^2}}$$

$$Q = 7{,}2 \cdot 10^{-8}\,C$$