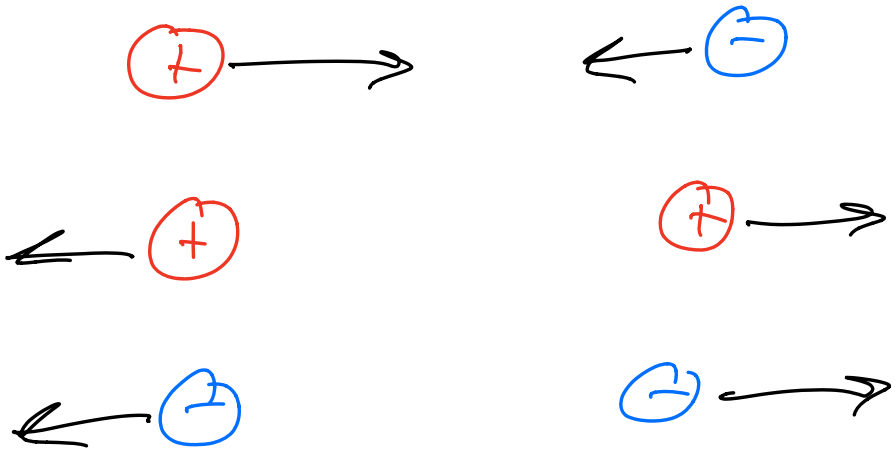
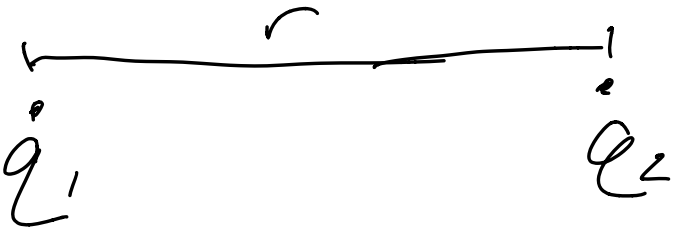


Chg electron $= |e| = 1.6 \times 10^{-19}\ C$

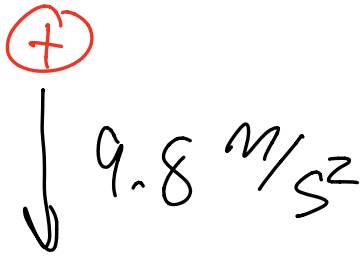


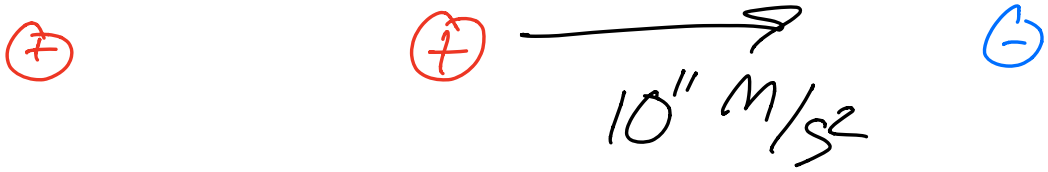
$$|\vec{F}| \propto q_1 q_2$$

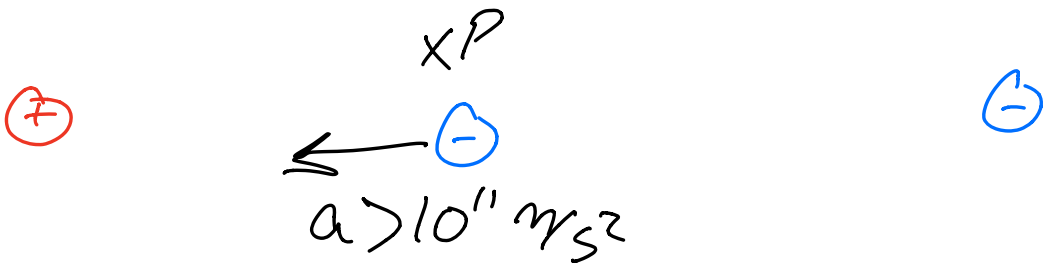
$$|\vec{F}| \propto \frac{1}{r^2}$$

$$|\vec{F}| \propto \frac{q_1 q_2}{r^2}$$

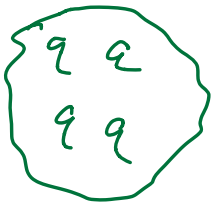
$$|\vec{F}| = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}; \quad \epsilon_0 = 8.85 \times 10^{-12}\ \frac{C^2}{Nm}$$

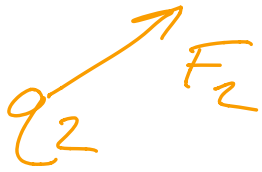






Electric Field





$$\vec{F}_2 = q_2 \vec{E}_1$$

$$\vec{E}_1 = \frac{\vec{F}_2}{q_2}$$

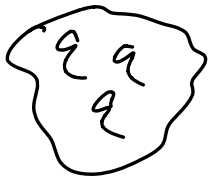
Properties of $\vec{E}$

- vector
- property of pt in space

$\vec{E} = \vec{E}(x, y, z)$ f(x)

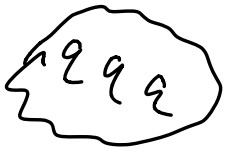
Function (→ ℒ

- Exists at $\langle x, y, z \rangle$ even if no chg there

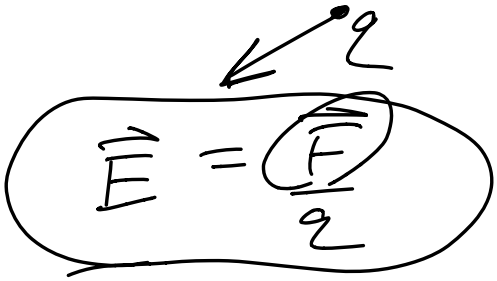


×

- created by other charges elsewhere



⊗ $\vec{E} = ?$



$$\vec{E} = \frac{\vec{F}}{q}$$

$$\vec{E} = \frac{\vec{F}}{-q}$$

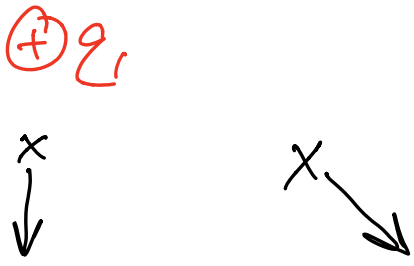
$$\hat{E} = -\hat{F}$$

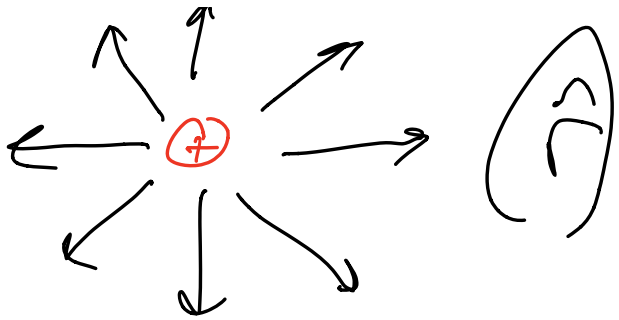
$\vec{E}$ field of a pt charge?

$$|\vec{F}| = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}$$

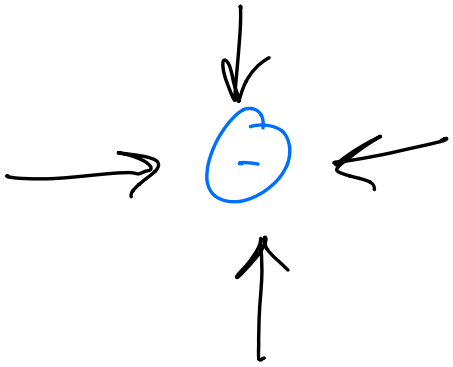
$$|\vec{E}_1| = \frac{|\vec{F}_2|}{q_2} = \frac{1}{4\pi\epsilon_0}\frac{q_1}{r^2}$$

$$|\vec{E}_1| = \frac{1}{4\pi\epsilon_0}\frac{q_1}{r^2}$$





$$\vec{E}_{pt} = \frac{1}{4\pi\epsilon_0}\frac{q_1}{|\vec{r}|^2}\hat{r}$$

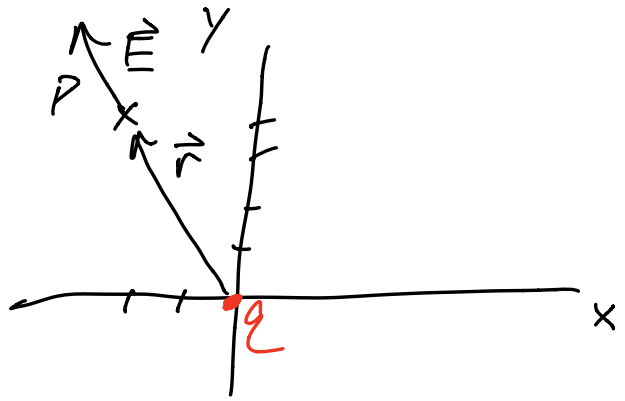


$$E \sim \frac{1}{r^2} \qquad E_{new} = \frac{E_{old}}{16}$$

Ex: Charged pt particle

$q = 6\,\mu C$

What is the field @ $\vec{r} = \langle -0.2, 0.4, 0 \rangle$ m?



$$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{q}{|\vec{r}|^2}\hat{r}$$

$$|\vec{r}| = \sqrt{.2^2 + .4^2} \approx .45\ m$$

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|} = \left\langle \frac{-.2}{.45}, \frac{.4}{.45}, 0 \right\rangle$$

$$\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{6\times10^{-6}}{.45^2}\langle -.44, .88, 0\rangle$$

$$\epsilon_0 = 8.85\times10^{-12}\ \frac{C^2}{Nm^2}$$

Read 13.5 – 13.6