Electric Field Notes

Electric Field - area around a charged object where another charge will feel a force.

- we use test charges to describe the Electric field
  - positive charge with a known value

$$\vec{E} = \frac{\vec{F}_E}{q_{TEST}} = \frac{\dfrac{k q q_{TEST}}{r^2}}{q_{TEST}}$$ ← C's Law

$$\vec{E} = \frac{kq}{r^2}$$ ← distance to any point, not another charge.

Let's find the E-field 2m away from a +20nC charge.

$q = 20nC = 2.0 \times 10^{-8} C$

$r = 2\ m$

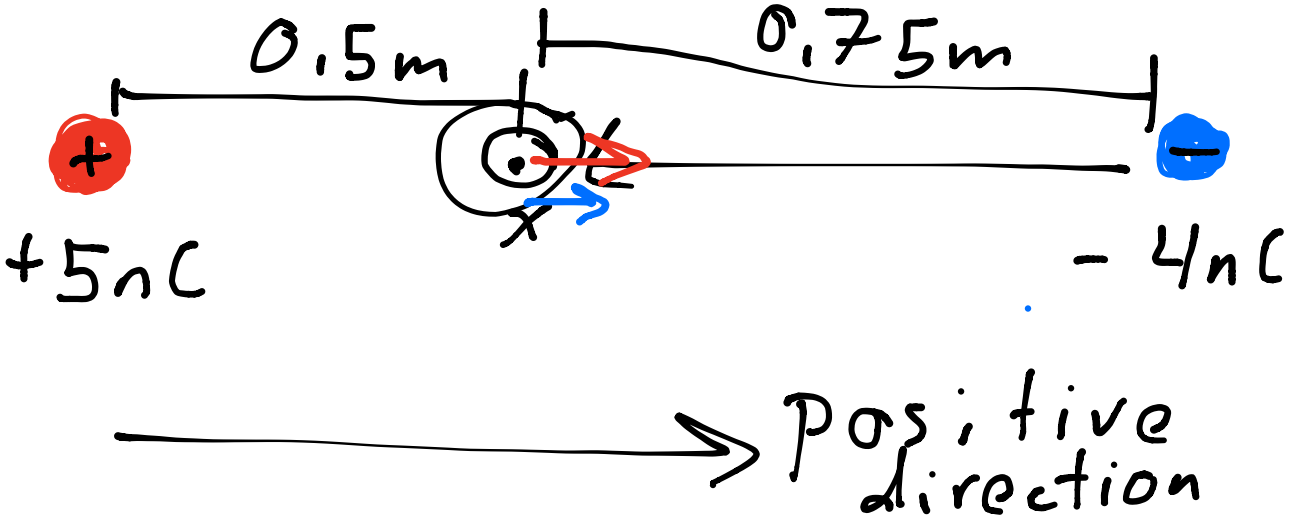
$$E = \frac{kq}{r^2}$$

$$= \frac{9 \times 10^9 \times 2.0 \times 10^{-8}}{2^2}$$

$$= \frac{9 \times 10}{2} = +45\ N/C$$

- symbol = $\vec{E}$ - vector - units = N/C or = V/m

Find the E-field at point X.



$$E_1 = \frac{k(+5\times10^{-9})}{0.5^2} = \frac{45}{0.25} = +180\ N/C$$

$$E_2 = \frac{k(-4\times10^{-9})}{0.75^2} = \frac{-36}{0.5625} = -64\ N/C$$

$$E_{TOT} = E_1 - E_2 = 180 - -64 \rightarrow E = +244\ N/C$$

Electric Field Lines

- show the E-field's direction and strength
- the lines are not a physical object, but they help visualize
- when lines are close together → stronger E-field.

Rules to draw E-field lines

1. Lines start ⊥ to charged objects and extend to ∞.
2. Lines point away from ⊕, towards ⊖.

3. Lines don't cross.