Electric Field

We have already seen a gravitational field $\vec{g}$. We got this from pre solving all of the constants in our gravitational force formula.

There is an equivalent for Electric Field, $\vec{E}$.

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

Where the direction of the $\vec{E}$ is ALWAYS out from +ive and in towards -ive.

This is fundamentally wrong. Very wrong. It makes me angry.

If I ever get a flux capacitor - I'll go back and fix this.

Early physicists only knew about protons. The assumption was that protons moved. Later, they found electrons - but they had already done the math… now we deal with this snafu every time we study electricity. The actual direction and the mathematical direction are NOT the same.

Let's look at some charges in space and the field lines that emanate:

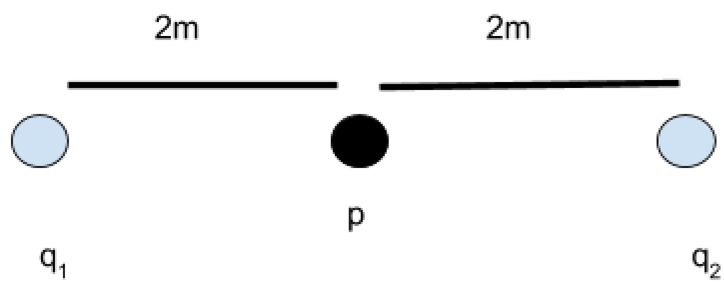
$\vec{E}$ about a -ive charge	$\vec{E}$ about a +ive charge

Field lines follow 3 rules:

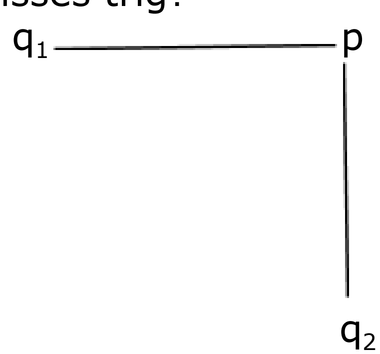
1) Out from +ive, in to -ive.
2) Density $\propto$ to magnitude.
3) Never cross.

$\vec{E}$ about opposite charges

If we have multiple contributions to an $\vec{E}$ at a point - it is the combination that is reported.
$q_1 = 4\ \mu\text{C}$ and $q_2 = 8\ \mu\text{C}$.
What is the $\vec{E}$ at point, p?



Who misses trig?



Find $\vec{E}$ at point p, if $q_1 = -2\ \mu\text{C}$ and $q_2 = 4\ \mu\text{C}$.

Electric Field Diagrams:

Opposite charge Equal magnitude	Same Charge Equal magnitude
Opposite charge Unequal magnitude	Same charge Unequal magnitude

But -- sometimes we want a constant $\vec{E}$. How could you solve this problem?

This is called a capacitor. It is basically two parallel plates. Any distortion in field is out the outside of the plates.

In this situation the $\vec{E}$ is $\propto$ to the voltage and inversely $\propto$ to the separation distance.

$$\vec{E} = \frac{\Delta V}{d}$$

HW: 1, 2, 3, 4, 6, 10