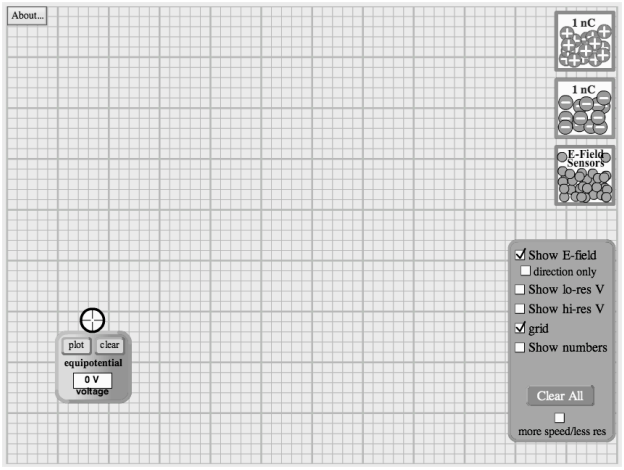
Names: 1. _____

2. _____

3. _____

Electric Field and Electric Force



In this lab you will be utilizing a simulation to investigate the electric force and electric field. After you have logged in to the computer, open the browser and navigate to http://phet.colorado.edu/sims/charges-and-fields/charges-and-fields_en.html. Wait for the simulation to load. After it does, check the boxes for "Show E-field," "grid," and "Show numbers." Then take a few minutes to familiarize yourself with how the simulation works. Go ahead... I'll wait...

Part I:

Place a +1 nC charge on the field. It is helpful to place it on the intersection of two dark lines. Assume that this charge is located at the origin. Place an E-field Sensor at each of the following locations, and complete the data in the table. *(note: 1 V/m = 1 N/C)*

X	Y	r (m)	Field Strength (N/C)	Direction (degrees)
1 m	1 m			
2 m	2 m			
-1 m	1 m			
0.5 m	-1 m			

Part II:

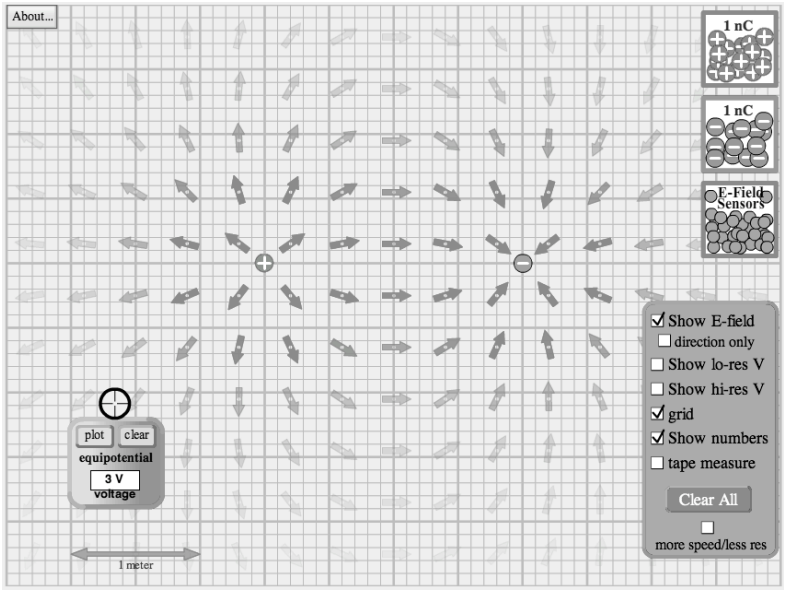
We will now replace the +1 nC charge with a -1 nC charge. Before you make the change, predict what changes you will see in the table:

Now, exchange the +1 nC charge for a -1 nC charge. Make sure the +1 charge is completely removed from the grid, or it will affect your data. Complete the table for the new charge arrangement.

X	Y	r (m)	Field Strength (N/C)	Direction (degrees)
1 m	1 m			
2 m	2 m			
-1 m	1 m			
0.5 m	-1 m			

Part III:

We will now investigate the E-field associated with a multiple charge arrangement. This time, place a +1 nC charge at one point and place a -1 nC charge 2m to the right of the positive charge. To give ourselves a frame of reference, we will establish a point in the middle of this arrangement as the origin, so that our positive charge will be located at coordinates (-1,0) and the negative charge will be at (1,0). Your grid should now look like this:



Place an E-Field Sensor on each of the following “coordinates” and complete the table with the needed information.

X	Y	$r_{positive}$ (m)	$r_{negative}$ (m)	Field Strength (N/C)	Direction (degrees)
0 m	0 m				
0 m	1 m				
-1.5 m	1 m				
0.5 m	-1 m				

Part IV: Analysis

1) For part 1, calculate what the value for the E-field should be for a +1 nC charge at a distance of 1.414 m (that is the square root of 2). Assuming your calculated value is correct, compute the percent error for the computer simulation.

2) Why do you think the error found in question 1 is present?

3) For Part III, where on the grid is the field the strongest? Is there anywhere on the grid that the field equals zero?