Simulation Worksheet: Electric Field in Two Dimensions

Name: _____          Date: _____

1.  At first, just a single charge is present, and there is also a small positive test
    charge that you can drag around the screen to sample the electric field at any one
    point. The charged object can also be dragged around the screen. Note that you
    can change the charge on the charged particle by using the "Charge on particle 1"
    slider.

    If you reduce the charge on the charged particle by a factor of 2, what happens to the
    electric field everywhere?

    If you increase the distance between the charged particle and the test charge by a
    factor of 2, what happens to the electric field at the location of the test charge?

     If you flip the sign on the charge of the charged particle, while keeping the
    magnitude of the charge the same, what happens to the electric field everywhere?

2.   Use the "Show field vectors" check box to turn on the grid of field vectors.
    Explore the behavior of the field vectors as you drag the charged particle around
    the screen and change the sign and magnitude of the charge on the charged
    particle. Describe how the field vectors represent the sign and magnitude of the
    electric field at the grid points around the screen.

3. Now, explore what happens when there is a second charged particle present, by moving the "Number of charges" slider to 2. For this part, it is probably best to turn off the field vectors by un-checking the "Show field vectors" checkbox. Choose a particular sign, magnitude, and position for charge 1, and a particular sign, magnitude, and position for charge 2, and then place the test charge in a position such that the field at that location from charge 1 is in a different direction from the field in that location from charge 2. The figure at right shows the kind of relative positions that we're after in this part.
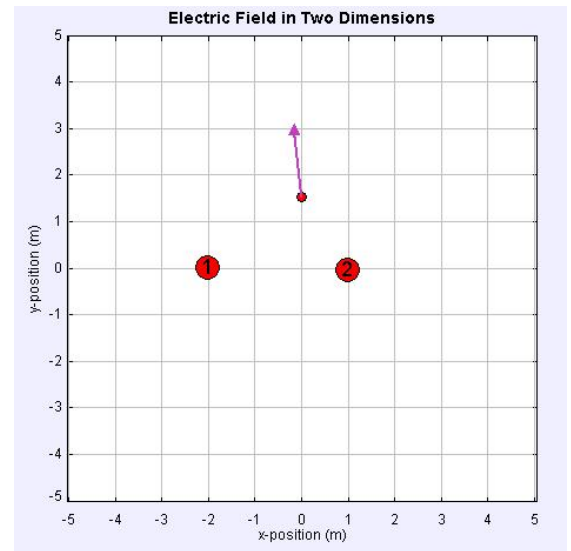


Note that you can turn off the first charge by setting its charge to zero, and you can turn off the second charge either by setting its charge to zero, or by re-setting the "Number of charges" to zero. In the table below, record the field (both the components and the magnitude) at the position of the test charge from charge 1 only, from charge 2 only, and then when both charge 1 and charge 2 are turned on.

| | x-component (N/C) | y-component (N/C) | Magnitude (N/C) |
|---|---|---|---|
| From charge 1 only | | | |
| From charge 2 only | | | |
| From both charges | | | |

Describe how the net field, when both charges are on, is obtained from the individual fields. In particular, is the magnitude of the net field equal to the sum of the magnitudes of the individual fields? Explain why or why not.

4. Could you generalize the method in step 3, for adding two fields together to get the net field, when there are more than two charged particles present? If so, describe the general method for combining individual fields to get the net field when a few charges are present.