P1320L, E-field Superposition
Lab 4, Work Sheet

Submitted by: _____ Experiment's date: _____

Team members:

1.- _____ 2.- _____

3.- _____ 4.- _____

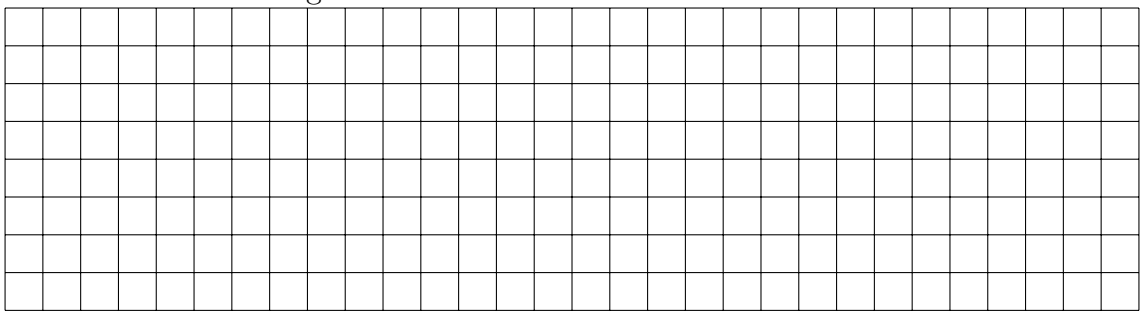
Instructor must initial:_____

Data

Follow the steps on this worksheet, using your lab manual as a guide, unless directed to do otherwise by your lab instructor. In your sketches below, include the x,y coordinates, in meters, of the sensor and charges.

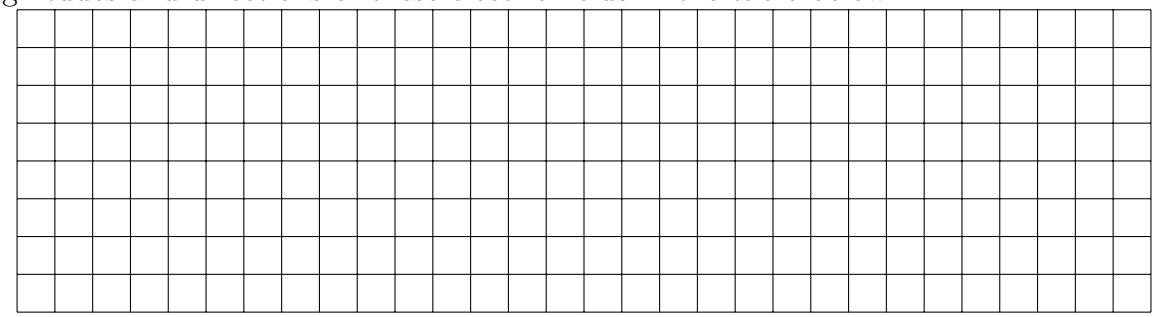
Single Charge

For this experiment, sketch the electric field at the location of each sensor in the following chart and collect their magnitudes and directions in the table below.



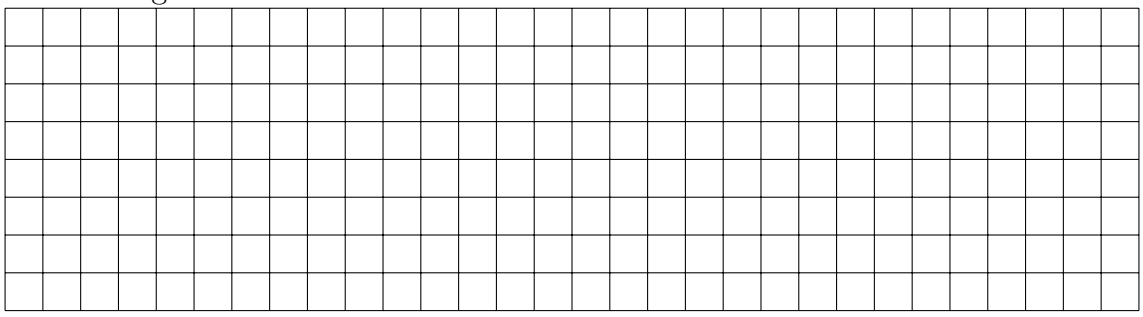
Dipole

Use the next grid and different colors to sketch the following vectors at the sensor location: 1) electric field due to the dipole, 2) electric field due only to the positive charge, 3) electric field due only to the negative charge. Make your sketches in the next grid and record the magnitudes and directions of these electric fields in the table below.



Quadrupole

In the next grid, sketch the electric field when all charges that form the quadrupole are present. Next, use different colors to sketch the electric fields due to the individual charges. Record the magnitudes and directions of all these electric fields in the table below.



Analysis

1. From its definition, calculate the Electric field at the location of the sensors, and compare it with your measurements by percentage difference.

Superposition Principle

Dipole

2. Find the Cartesian components of the electric field due only to the positive charge.

3. Find the Cartesian components of the electric field due only to the negative charge.

4. Use the superposition principle to combine the electric field results from the negative and positive charges That is determine the resultant electric vector field.

5. Determine the magnitude and direction of resultant electric field.

6. Compare the magnitude of the superimposed fields to the magnitude of the measured field when both charges were present. (compare them by percentage difference).

7. Compare the direction of the superimposed fields to the direction of the measured field when both charges were present. (compare them by percentage difference).

Quadrupole

8. Write down the Cartesian components of the net electric field vector.

9. Find the Cartesian components of the electric field due to the individual charges. Show only a sample calculation for the charge on the top left corner of the quadrupole. Record the components for this and the rest of the charges in the table below.

E_{1x}	E_{1y}						

10. Determine the components for the superimposition of the fields due to the individual charges.

11. Compare resultant components of the superimposition to the components of the field when all charges are present. (compare them by percentage difference).

1 Questions

12. What would be the components of the electric field at the center of the quadrupole if the charge at the upper-left corner is removed?
Do not use the simulation to produce the answer; show your calculations.

13. Use equation (4.1) from the lab Manual to verify the equivalence between Newtons per Coulomb and Volts per meter.

14. Based on your observations on discrete charges, what would you say is the direction of the Electric field around an infinite line with a uniform distribution of positive charge? Explain your response using a sketch.
Hint: think of this continuous charge distribution as made up of very small discrete charges.