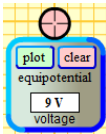


Name: _____ Block: _____ Date: _____

Electrical Potentials and Electrical Fields: Potentially Dangerous Situations

Part A: Introduction

1. Open the Charges and Fields application.
2. On the right-hand-side, activate the “grid” and “show numbers” options.
3. Using your mouse, place a + charge in grid’s center.
4. Drag the potential tool around the grid paying attention to both the numbers and color inside the circle.



What did you observe? _____

5. Using your formulas presented in class, predict the electric potential _____
1.0 meter to the left of the positive charge.
6. Check your prediction using the potential tool. Does it agree? _____
7. Without changing the location of your potential tool, click plot. What does this function tell you?

8. Predict the electrical potential 2.0 meters to the right of the charge. _____
9. Check your prediction using the potential tool. Does it agree? _____
10. What is the electric potential 2.0 meters below the charge? _____
11. How did you determine this? _____

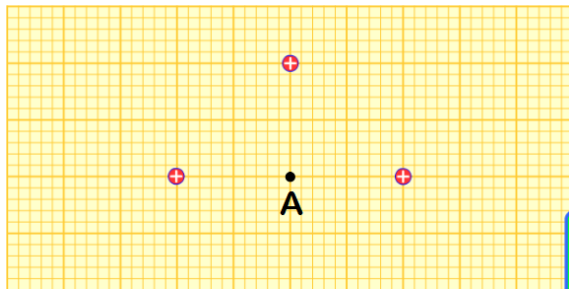
12. Place the positive charge back in the bin and replace it with a negative charge.
13. Drag the potential tool around the grid paying attention to both the numbers and color inside the circle. What did you observe?

14. Predict the electrical potential 1.0 meters to the left of the - charge. _____
15. Check your prediction using the potential tool. Does it agree? _____
16. Predict the electrical potential 2.0 meters to the right of the - charge. _____
17. Check your prediction using the potential tool. Does it agree? _____

Part B: Electric Potentials and Superposition

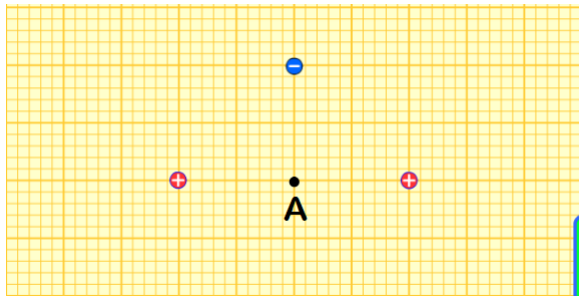
For each situation, predict the total electric potential at point *using information from Part A* and check your prediction using the potential tool.

Explain how you are going to do this. _____



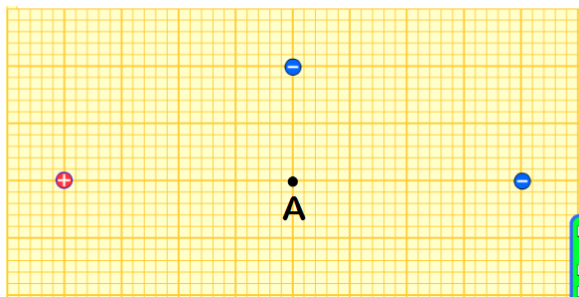
Predicted electric potential at A: _____

Measured electric potential at A: _____



Predicted electric potential at A: _____

Measured electric potential at A: _____



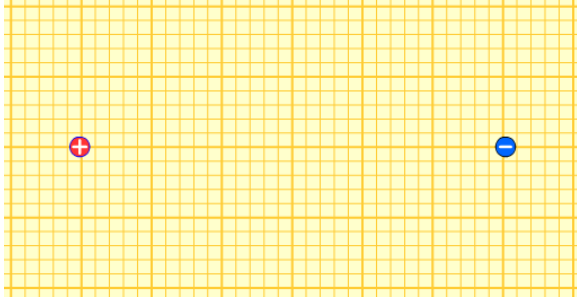
Predicted electric potential at A: _____

Measured electric potential at A: _____

Part C: Electric Potentials and Electric Fields

What equation relates electric fields to electric potentials? _____

How does it relate electric fields to electric potentials? _____



1. Set up two charges as shown to the left. Predict the total electric potential at the midpoint between the two charges.

2. Check your prediction using your potential tool. Does it agree? _____

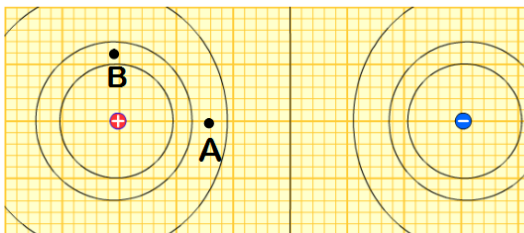
3. Use your potential tool plot equipotential surfaces for -15 V, -10 V, -5 V, 0 V, +5 V, +10 V and +15 V.

4. Why do these surfaces get closer together the closer you get to the charges? _____

5. Display the electric fields by checking "Show E-field" option. How is the electric field strength displayed by the simulation?

6. How is the field direction related to the equipotential surfaces? _____

7. How is the field strength related to the equipotential surfaces? _____



8. How would you estimate the electric field strength and direction at points A and B?

9. Estimated electric field both magnitude direction.

Point A: _____

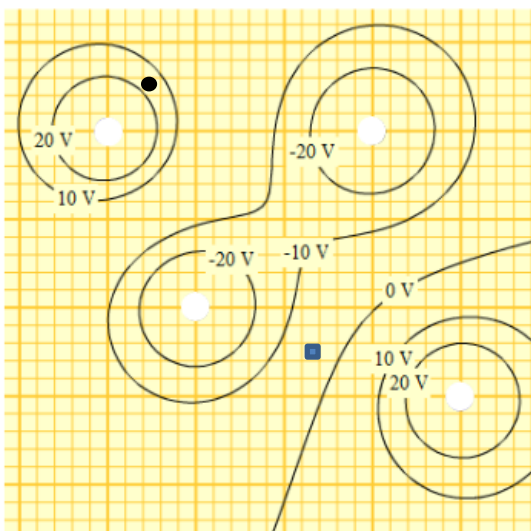
Point B: _____

Scratch work:

10. Use the E-field Sensor to check your estimate.

Point A: _____

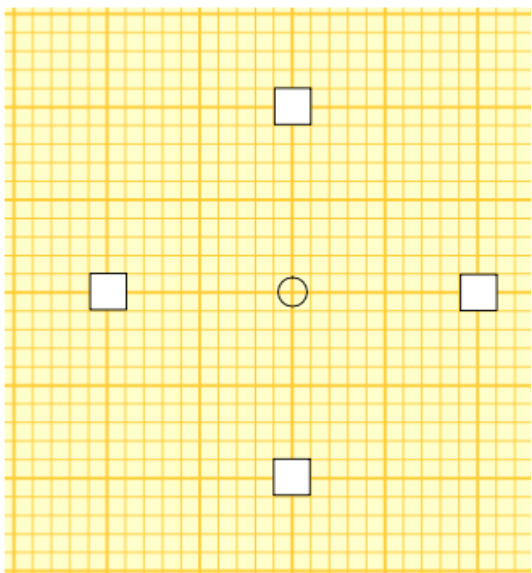
Point B: _____



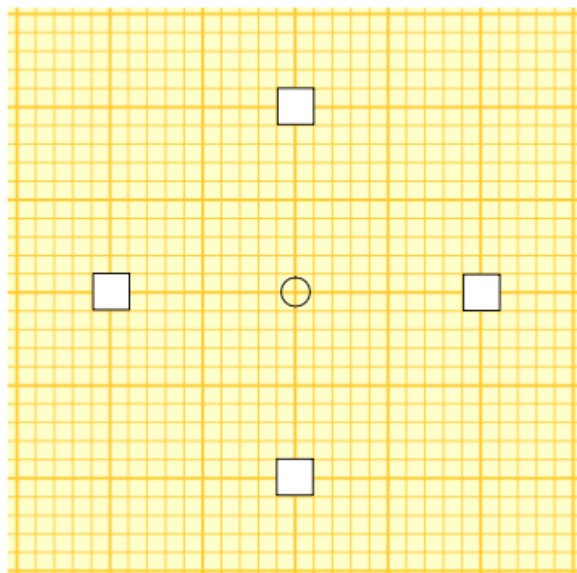
11. Identify the charge values by placing + or – signs in the empty circles for the diagram shown on the left.
12. Sketch the electric fields lines for the diagram.
13. Where is the electric field the strongest: At the point marked by a circle or the point marked by a square? _____
 Explain: _____

Part D: Electric Potentials and Fields for Multiple Charges

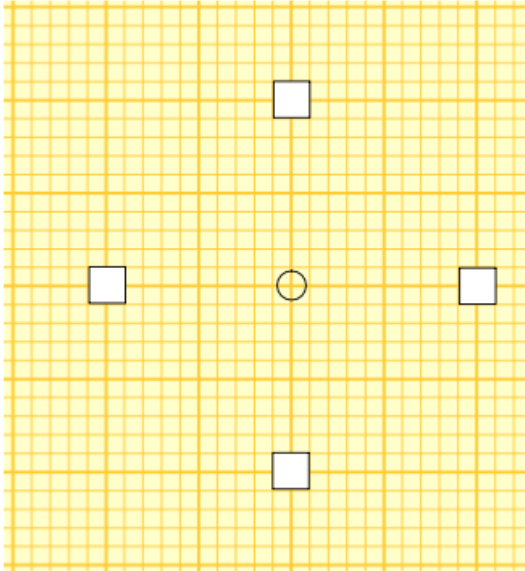
Reproduce the requested electric field and electric potential at the central circle by placing charges (+ or -) in the four squares, recording your choices here. In each case, charges must be placed in all four locations. Check your predictions using your potential tool and e-field sensor.



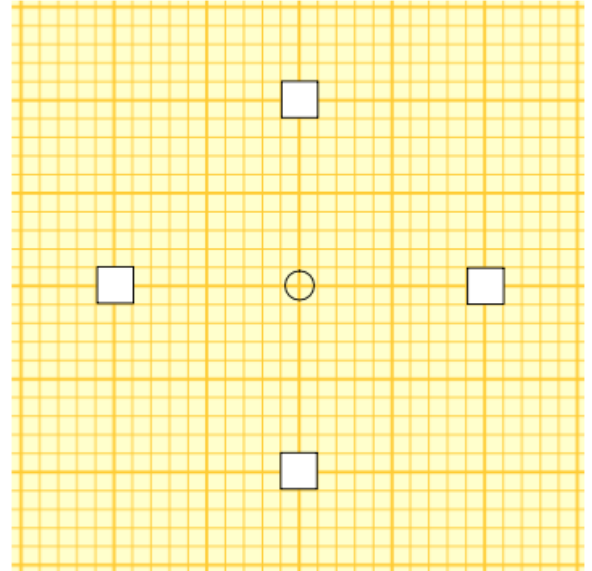
1. Positive electric potential & zero electric field



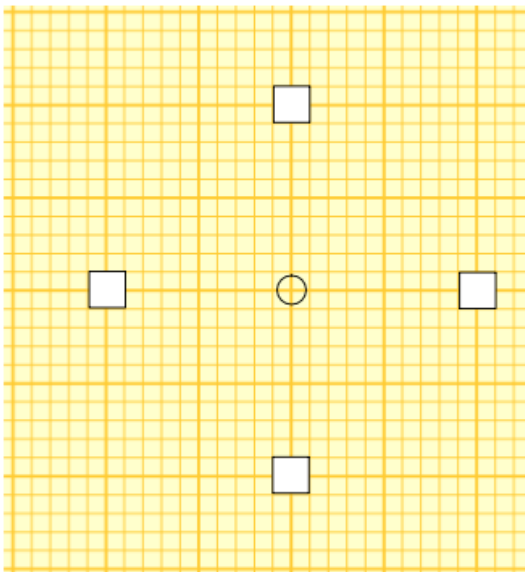
2. Zero electric potential & zero electric field



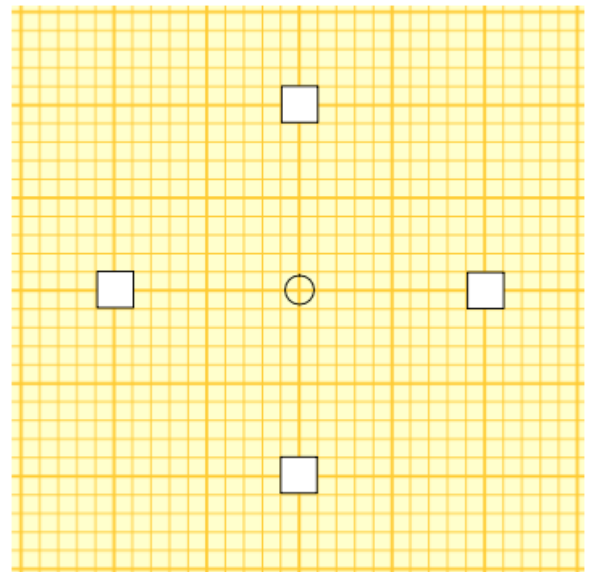
3. Negative electric potential & electric field directed right



5. Zero electric potential & electric field directed at 315 degrees



4. Zero electric potential & electric field directed at 45 degrees



6. Positive potential & electric field directed at 180 degrees