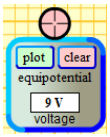
Name: _____ Block: _____ Date: _____

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?

_____

_____

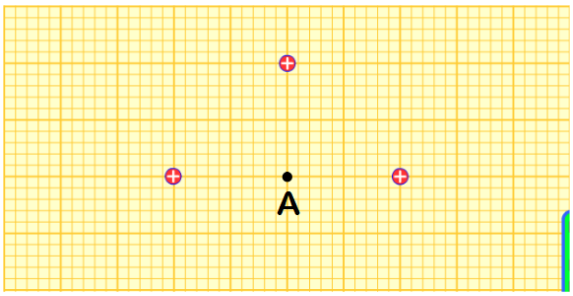
14. Predict the electrical potential 1.0 meters to the left of the - charge. _____
15. Check your prediction using the potential tool. Does it agree? _____
16. Predict the electrical potential 2.0 meters to the right of the - charge. _____
17. Check your prediction using the potential tool. Does it agree?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

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.

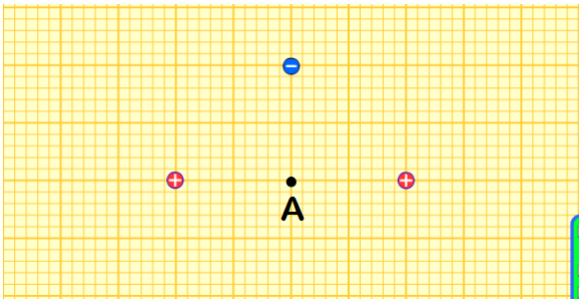
Explain how you are going to do this. _____

_____



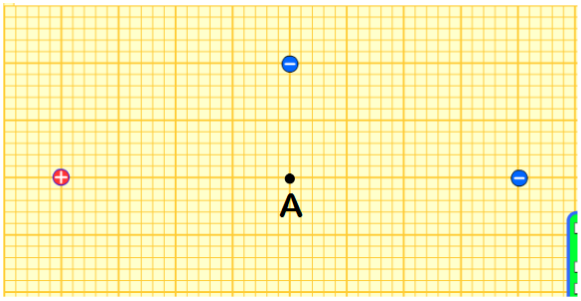
Predicted electric potential at A: _____

Measured electric potential at A:_____



Predicted electric potential at A: _____

Measured electric potential at A:_____



Predicted electric potential at A: _____

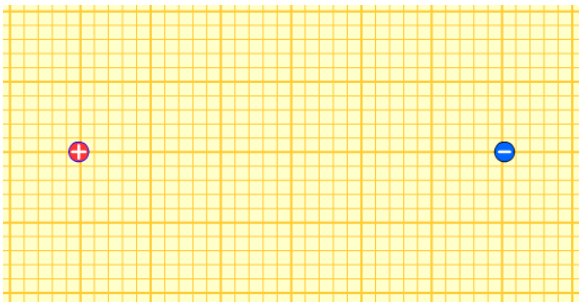
Measured electric potential at A:_____

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?

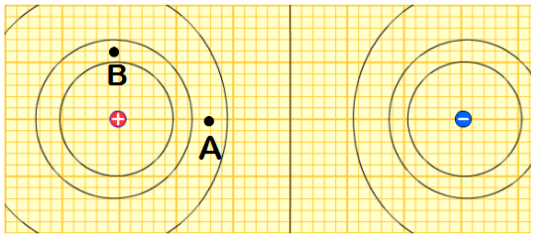
   _____

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: _____

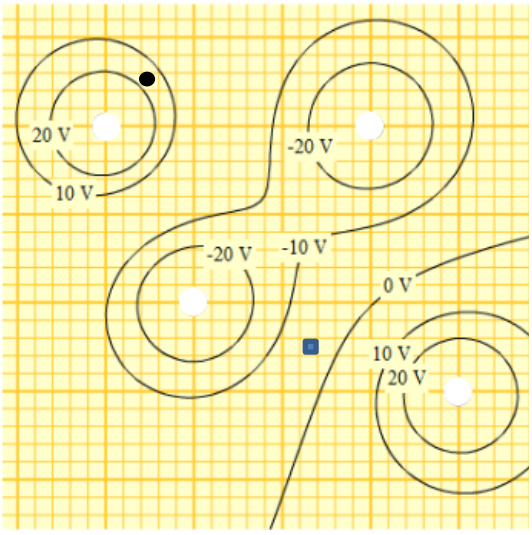
   Point B: _____

   Scratch work:

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

    Point A: _____

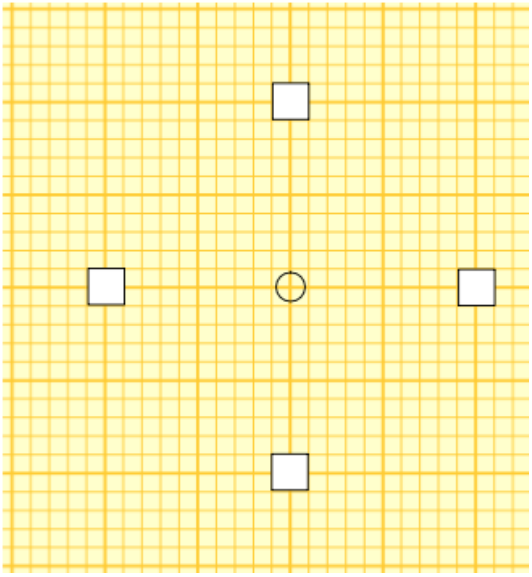
    Point B: _____



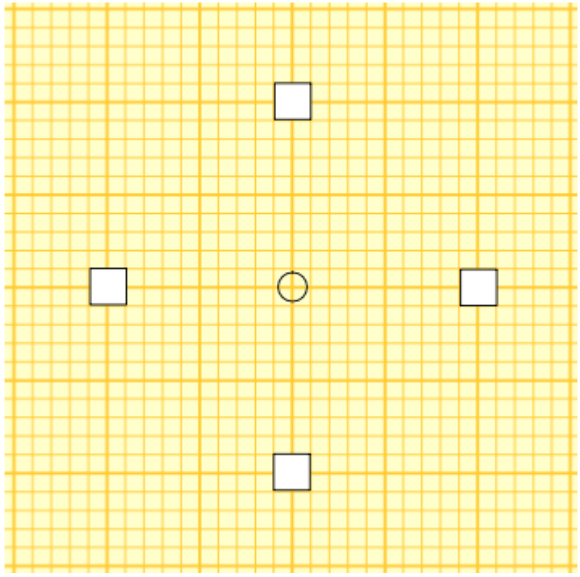
11. Identify the charge values by placing + or – signs in the empty circles for the diagram shown on the left.
12. Sketch the electric fields lines for the diagram.
13. Where is the electric field the strongest: At the point marked by a circle or the point marked by a square? _____
    Explain: _____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

Part D: Electric Potentials and Fields for Multiple Charges

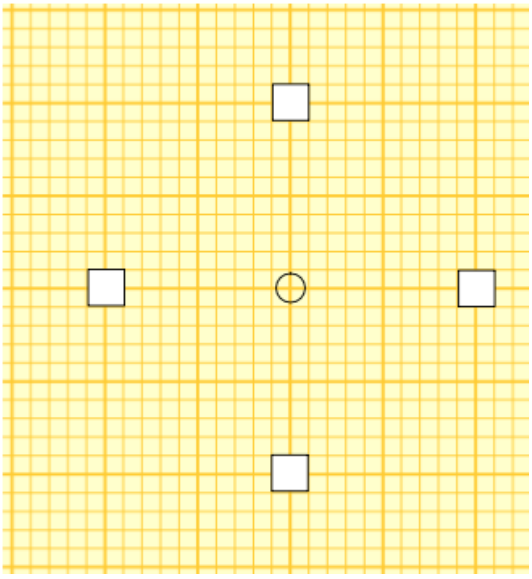
Reproduce the requested electric field and electric potential at the central circle by placing charges (+ or -) in the four squares, recording your choices here. In each case, charges must be placed in all four locations. Check your predictions using your potential tool and e-field sensor.



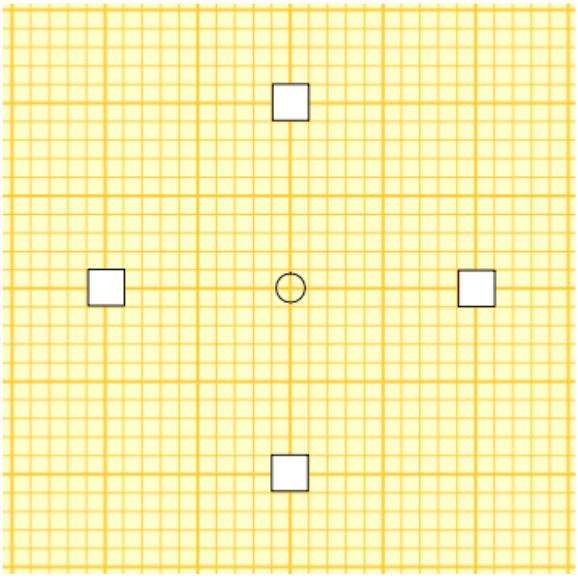
1. Positive electric potential & zero electric field



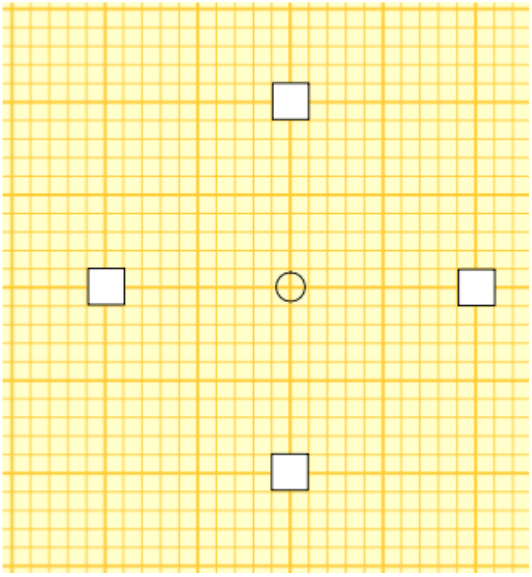
2. Zero electric potential & zero electric field



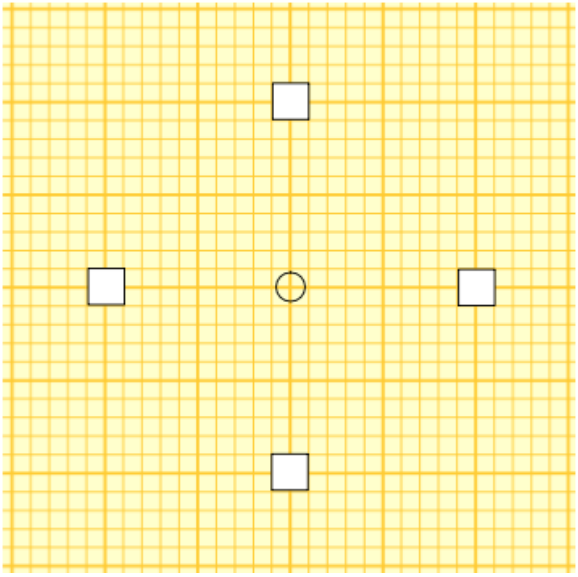
3. Negative electric potential & electric field directed right



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