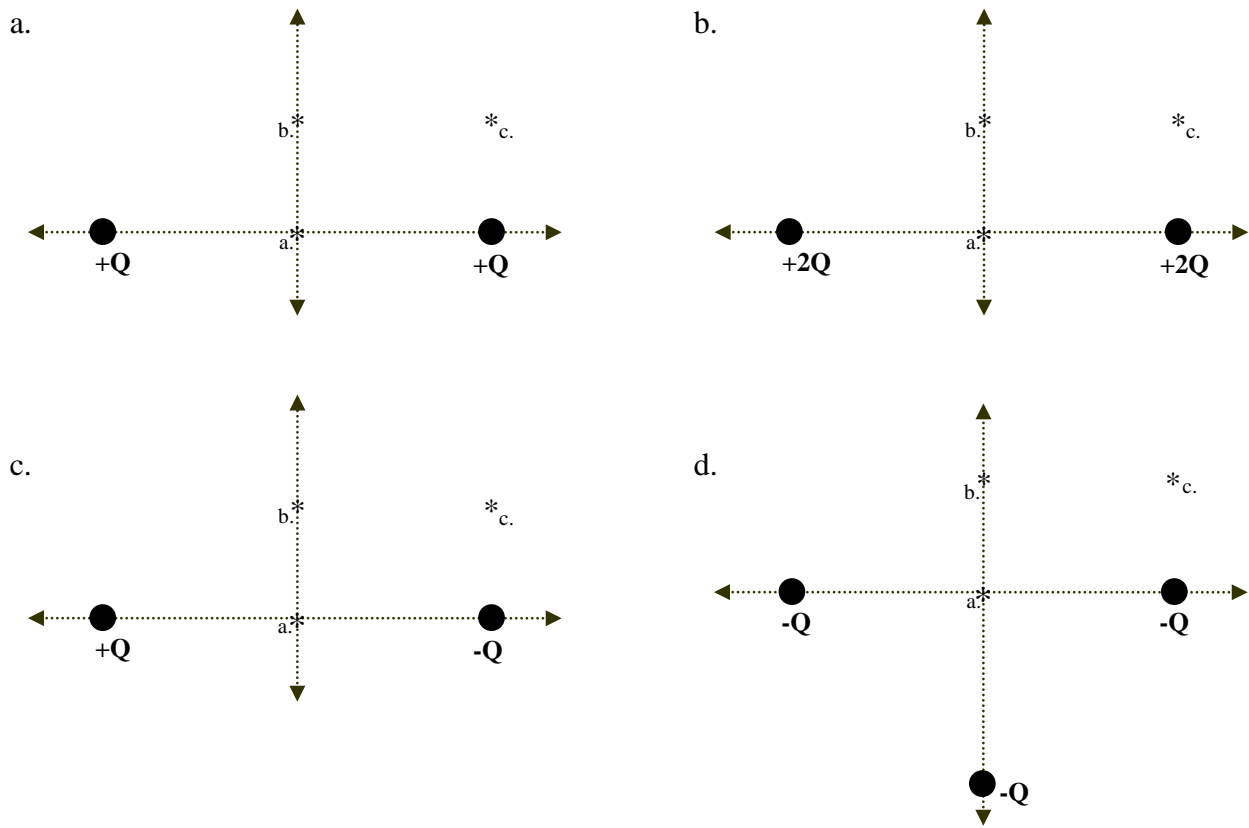


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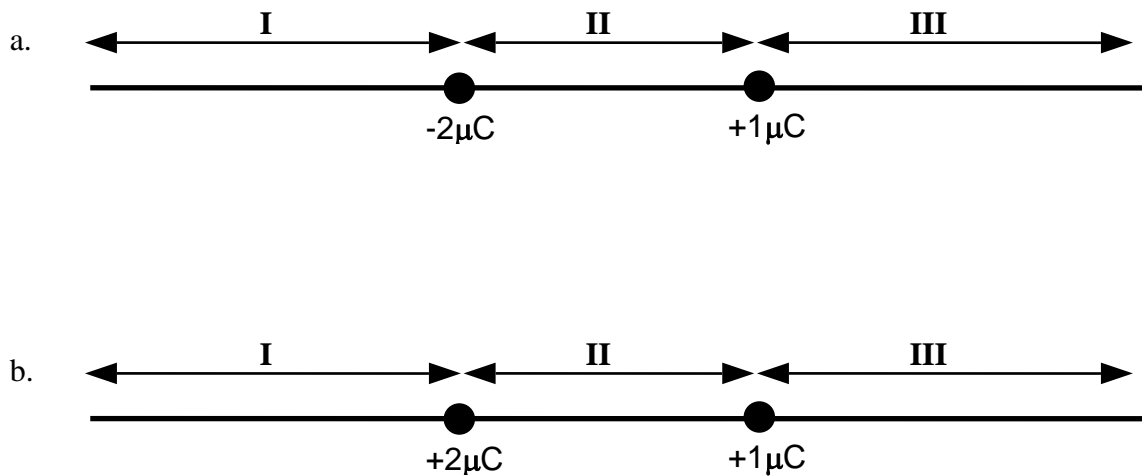
## E&M Unit I – Worksheet 5: Electric Fields

1. Use Coulomb's Law and the definition of Electric Field to derive an equation for the electric field around a point charge.
2. What is the relationship between the electric field strength and the distance from the point source? If you move three times farther away, what will happen to the field strength?
3. What is the relationship between the electric field strength and the charge of the point source? If the charge of the point source is increased by a factor of three, what happens to the electric field strength?
4. What is the magnitude and direction of the electric field 0.25 meters away from a point charge with  $-5.0 \mu\text{C}$ . Draw a diagram. Use proportional reasoning to find the field strength at positions 0.125 meters away and 0.75 meters away.

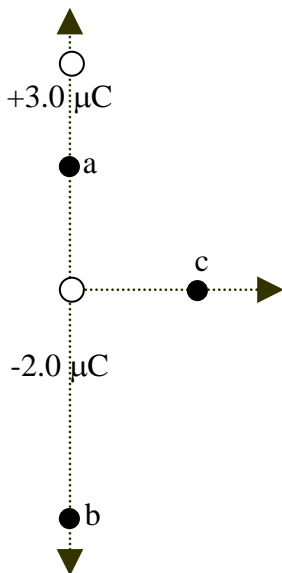
5. Sketch resultant vectors to represent the strength and direction of the electric field at the designated locations (the \*) due to the point charges.



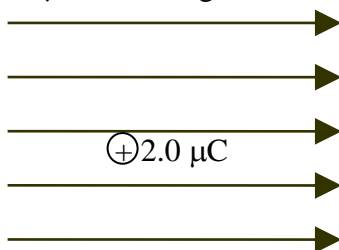
6. Two point charges are fixed in position along a line as shown in the diagram below. In which of the three regions, I, II, or III, could there be a location with no electric field? If there is no possible location, state that as your answer. State your reasoning for the answers you give.



7. Two point charges are placed on the y-axis. One is  $+3.0 \mu\text{C}$  and located at position  $(0, 2 \text{ m})$ , the other is  $-2.0 \mu\text{C}$  and located at the origin. Use the diagram to find the magnitude and direction of the electric field and the force on a  $+1.0 \times 10^{-9} \text{ C}$  test charge placed in the following locations.
- $(0, 1.0 \text{ m})$
  - $(0, -2.0 \text{ m})$
  - $(1.0\text{m}, 0)$



8. A region in space has a uniform electric field of strength equal to  $400. \text{ N/C}$  that points to the right. A  $+2.0 \mu\text{C}$  test charge with a mass of  $0.10 \text{ grams}$  is placed in the field at rest and released.



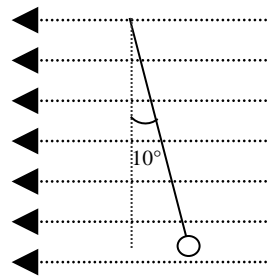
- Describe the motion of the charge in the field after it is released.
- Describe energy changes of the charge/field system as the charge moves in the field.

c. What is the magnitude and direction of the electric force on the charge?

d. What is the acceleration of the charge as it moves in the field?

e. After the charge has moved 1.0 meters, how fast will it be moving?

9. A pith ball that has a mass of 0.25 grams, is hung by a string and suspended in a region of space where there is a uniform electric field that points to the left. The pith ball is observed to deflect to the right and the string makes an angle of 10.0 degrees with the vertical.



a. Draw a force diagram for the pith ball.

b. What is the magnitude of the electric force on the pith ball?

c. What is the sign of the charge on the pith ball? How do you know?

d. If the charge on the ball is  $8.64 \times 10^{-7}$  C, What strength field would be required for this amount of deflection?