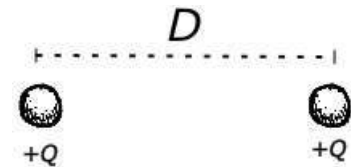


NAME \_\_\_\_\_

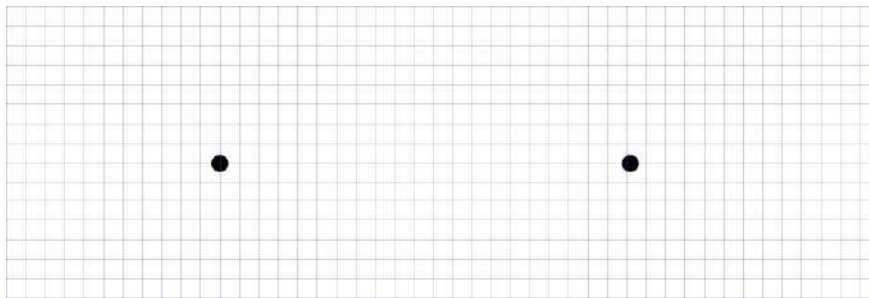
DATE \_\_\_\_\_

**Scenario**

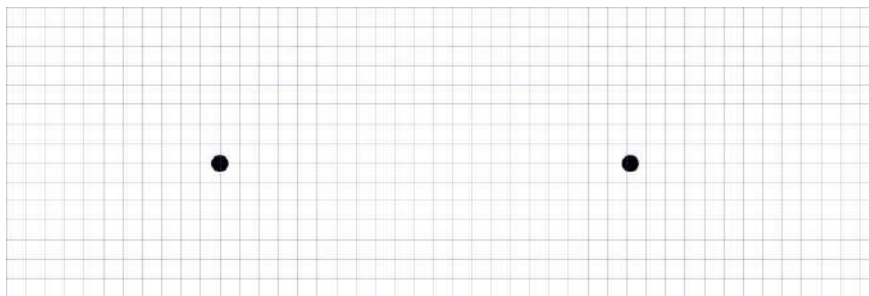
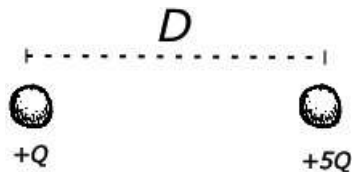
Two identical point charges  $+Q$  and  $+Q$  are fixed a distance  $D$  apart from each other. (The point charges are so small that we can ignore the effects of gravity.)

**Using Representations**

- PART A:** The dots below represent the two point charges. Draw free-body diagrams showing and labeling the electric forces only (not components) exerted on each point charge. Draw the relative lengths of all vectors to reflect the relative magnitudes of all the forces.



- PART B:** The dots below represent the two point charges; the magnitude of the charge on the right was increased to  $+5Q$ . Draw free-body diagrams showing and labeling the electric forces only (not components) exerted on each point charge. Draw the relative lengths of all vectors to reflect the relative magnitudes of all the forces.

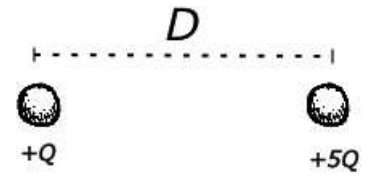


- PART C:** If the force between the two point charges for Part A was  $F$ , determine an expression for the force,  $F'$ , between the two point charges after the magnitude of the right charge is increased to  $+5Q$ .

$$F' =$$

## Data Analysis

**PART D:** On the image to the right, determine a position where a third point charge ( $-2Q$ ) could be placed so that the net electric force on it from the other two point charges is zero. Mark the position with an  $X$  and explain your answer without determining the exact position mathematically.



## Argumentation

**PART E:** Two point charges  $-Q$  and  $-q$  (where  $Q > q$ ) are a fixed distance  $D$  apart from each other. Angela makes the following statement about the direction of the force on  $-Q$ : “Coulomb’s law says that the force between the two point charges is equal to  $F_E = \frac{kQq}{D^2}$ , and the two charges are both negative, the force on  $-Q$  will be positive, which means that the force on  $-Q$  will point to the right.”

Explain what is wrong with this statement in a few sentences. Explain the error and state how to correct it.