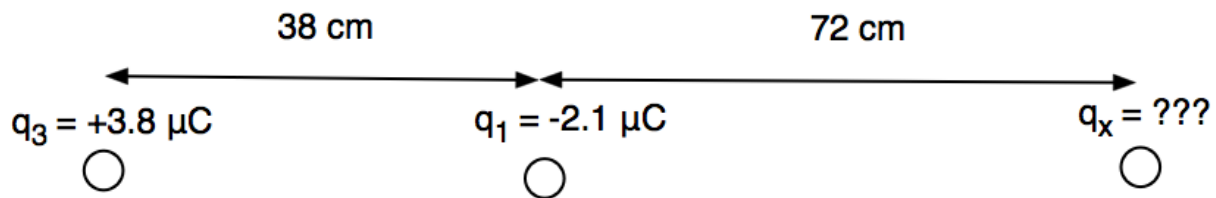


## **Physics 10164 - Spring 2019 Exam 1D**

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (30 pts) Three charges are fixed in place in a line as shown.
- a) If the electric force on charge  $q_x$  is 0.089 N in the +x direction, what is  $q_x$ ?
- b) If  $q_x$  were located exactly halfway between  $q_1$  and  $q_3$ , what would be the magnitude and direction of electric force it feels?



2. (35 pts) A ball with charge  $-38\ \mu\text{C}$  and mass 23 grams is dropped from rest at a height 1.7 meters above the ground. The ball moves down toward the ground and has a speed of 4.3 m/s the instant before it hits the ground. Assume gravity and the electric force are the only relevant forces.

- a) What is the magnitude and direction of the uniform electric field through which the ball moves?
- b) If the voltage and ground level is exactly 0.0 Volts, what is the voltage at the ball's initial position?

3. (35 pts) For the arrangement shown below, assume charge  $q_2$  has a mass of 75 grams, and you can assume the only relevant force is the electric force.

- a) How much work would be done by the electric force if charge  $q_2$  moved from its location shown to location X?
- b) If charge  $q_2$  starts at rest and is free to move from its position shown below, how fast is  $q_2$  moving when it is only 17 cm away from charge  $q_1$ ?

