Phyx 135-2, Quiz 1 (10 am) **Name:** _____

1) The charges and coordinates of two charged particles held fixed in the *xy* plane are:
q_1 = +3.0 μC at x_1 = 3.50 cm and y_1 = 0.50 cm
q_2 = -4.0 μC at x_2 = -2.00 cm and y_2 = 1.50 cm

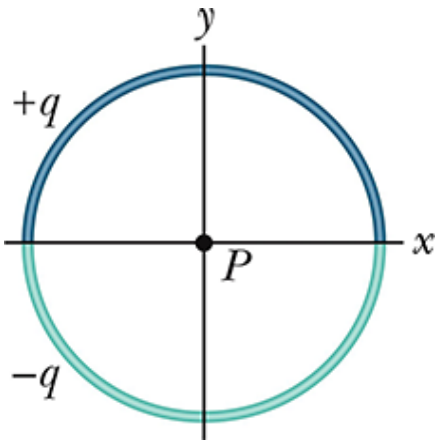
1a) (5 points) Find the magnitude of the electrostatic force on particle 2 due to particle 1.

Solution
The distance r^2 between the two particles is given by $r^2 = (0.035 + 0.02)^2 + (0.005 – 0.015)^2 = 0.003125$
Coulomb's Law then yields $F = (8.99 \times 10^9)(3 \times 10^{-6})(4 \times 10^{-6}) / (3.125 \times 10^{-3}) =$ 34.5 N

1b) (5 points) Find the direction of the electrostatic force on particle 2 due to particle 1. Give the direction as an angle θ where the positive x-axis is θ = 0.

Solution
Because the signs of the charges are different, the charges will attract. Thus the force on particle 2 is pointing towards particle 1. The x-distance moving from particle 2 towards particle 1 is 5.5 cm, whereas the y-distance is -1 cm, so $\tan\theta = -1 / 5.5$, or $\theta = -10.3°$

2) (10 points) Two curved plastic rods of charge +q and –q form a circle of radius R = 8.50 cm in the *xy* plane. The charge is uniformly distributed on both rods. If q = 15 pC, what are the magnitude and direction of the electric field produced at P?



Hint: $E = kq \sin\theta_0 / R^2 \theta_0$, but no, you may not ask the TA exactly what this formula means nor what the symbols stand for.

Solution

The given formula is for the magnitude of the electric field at the center of an arc of opening angle θ_0 and radius R. In this case we have $\theta_0 = \pi/2$, and we have two arcs, with the top one "pushing" and the bottom one "pulling". We will therefore have twice the electric field of one arc, with the direction of the electric field pointed straight down along the y-axis.

$E = 2(8.99 \times 10^{9})(15 \times 10^{-12})(1) / (8.5 \times 10^{-2})^2 (\pi/2) =$ 23.8 N / C