Problem #1

Three charges are put on the corners of a triangle as shown in the figure.

a) (4pts) What is the magnitude and direction (just draw a line with an arrow to represent the direction) of the force that A exerts on C?

\[ |\vec{F}_{AC}| = \frac{k|q_A|q_C}{r^2} = \frac{9kQ^2}{a^2} \]

b) (4pts) What is the magnitude and direction (just draw a line with an arrow to represent the direction) of the electric force that B exerts on C?

\[ |\vec{F}_{BC}| = \frac{k|q_B|q_C}{r^2} = \frac{9kQ^2}{2a^2} \]

c) (8pts) What is the x component of the electric force on C?

\[ F_{Cx} = F_{CxA} + F_{CBx} \]

\[ F_{CxA} = \frac{9kQ^2}{a^2} \cos(135^\circ) + \frac{9kQ^2}{2a^2} \cos(0) = \frac{9kQ^2}{a^2} \left[ -\frac{1}{\sqrt{2}} + \frac{1}{2} \right] = \frac{1.9kQ^2}{a^2} \]

Problem #2

Three identical conducting spheres each initially have an excess charge +Q. The spheres are separated from each other by a very large distance.

a) (3pts) If sphere #1 is connected to ground what is excess charge remaining on this sphere?

Grounding sphere #1 will drain off the excess charge so the remaining charge will be zero.

b) (3pts) Sphere #2 is now moved such that it touches sphere #1 and then is moved far away from sphere #1.

What is the excess charge on sphere #1? Note: The wire connecting sphere #1 to ground is disconnected before sphere #2 is moved.

Since sphere #1 and 2 are identical they will share the excess charge equally. Sphere #1 will wind up with \( \frac{Q}{2} \).

c) (3pts) The position of the three spheres is now re-arranged so that there is zero (not just small) electric force on sphere #3.

Make a sketch showing the possible positions of the three spheres. Be sure to label the distance between the spheres.

We need to put #3equidistant between spheres #1 and #2. For example: \( a \quad a \quad a \)