Problem Set 2: Random Hints

In order to do most of these problems, you will need to either read the material on your own, or wait until Thursday in class when we cover the rest of the material. We will go over many of the problems in class on Thursday and recitation on Friday - so don't worry too much if you are stuck in a few places so far. By the end of Thursday, everything should be clear. The examples in the text and notes should help you in the mean time.

#2: For a conductor, the field inside is zero. Based on Gauss' law, the field outside any spherically symmetric charge distribution is the same (see the notes, toward the end of Chapter 3). Inside the insulator, think about how much charge is still inside a radius r. If you are a distance r from the center, the charge outside r does not contribute to the electric field. We'll go over this one in class on Thursday.

#3: There is a very similar problem solved at the end of Chapter 3 in the course notes.

#4: The following approximation may be useful:

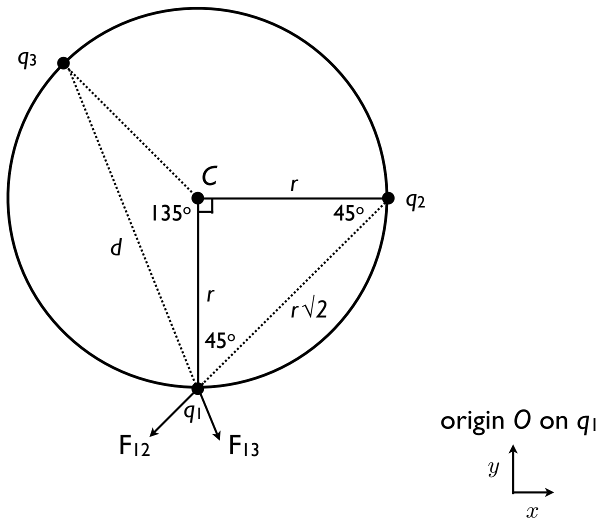
$$\frac{x}{(x^2 - a^2)^2} \approx \frac{x}{x^4} = \frac{1}{x^3} \qquad x \gg a$$

#5: You need to balance the gravitational and electrical forces between the proton and electron.

#6: Relate the electric force to the electric field. The total force acting on the proton is just the electric force, which must then equal mass times acceleration. You may be given more information than you need to solve the problem ...

#7: The geometry is somewhat ... pathological in this case. We will go over this one in class on Thursday in detail. The portions we went over in class on Tuesday should give you enough to get started. The following unexplained figures should help considerably.

#8: The total flux through the whole cube is related to the charge by Gauss' law in a simple way. If you know the flux through the whole cube, how much has to go through any given face if everything is symmetric? Parts a and b are no more than that ...



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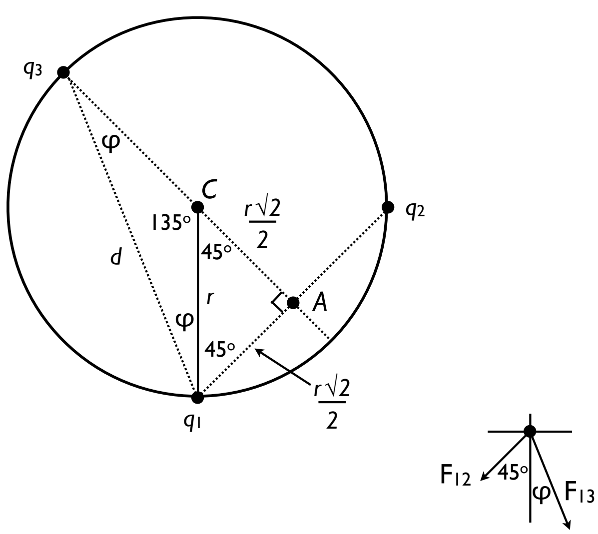

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