Solve these problems for a maximum of 10 points added to your 2nd exam score. This is how it works: You must go to the tutoring center. They have this assignment along with solutions I have provided. They will help you with concepts on the problems you are not understanding. They will provide as much help as you need, but you must solve the problems yourself. They will check your work, as many times as needed, and once you have completed a problem and they see you are understanding it, they will sign your sheet with the solved problem. Then you bring your signed sheet to me, and the tutoring center will send me the list of students that went there, what did they work on, for how long were they there.

I want you to learn, I don’t want to see problems solved as in a solution manual.

The schedule for OSL tutoring hours are posted at the bottom of the class website, under “getting help”.

You have a week to do this assignment. You must turn it in to me, WITH SIGNATURES from the tutors, no later than Tuesday, November 04, at the beginning of the class.

Good luck!

Problems

Show all your work! Explain each step. Make sure the notation you are using in the equations is consistent with the notation you use in figures. Write formulas first, plug in numbers later.

1) (3 points)
Charge \( q_1 = 6.0nC \) is at \((0.30m, 0)\), charge \( q_2 = -1.0nC \) is at \((0, 0.10m)\), and charge \( q_3 = 5.0nC \) is at \((0, 0)\).
   a) What are the magnitude and direction of the net electrostatic force on the \( q_3 \) due to the other charges? \((K = 1/4\pi\epsilon_0 = 8.99 \times 10^{-9} N \cdot m^2/C^2)\)
   b) What is the electric field magnitude and direction at \((0, 0)\) due to charges \( q_1 \) and \( q_2 \)?

2) (3 points)
An electron is released from rest at a distance of 9.00 cm from a proton. If the proton is held in place, how fast will the electron be moving when it is 3.00 cm from the proton? \((m = 9.11 \times 10^{-31} kg, e = 1.60 \times 10^{-19} C, K = 1/4\pi\epsilon_0 = 8.99 \times 10^{-9} N \cdot m^2/C^2)\)

3) (1 point)
In a certain region, the electric potential due to a charge distribution is given by the equation \( V(x, y) = 2xy-x^2-y \), where \( V \) is in Volts and \( x \) and \( y \) are measured in meters. At which point is the electric field equal to zero?

4) (3 points)
A parallel-plate capacitor has plates of area 0.40m\(^2\) and plate separation of 0.20mm. The capacitor is connected across a 9.0V potential source.
   a) What are the magnitude of the electric field between the plates (\( E \)), the capacitance (\( C \)) and the magnitude of the charge on each plate of the capacitor?
   b) After the capacitor is disconnected from the source, the space between the plates is filled with an insulating material with a dielectric constant \( \kappa = 2.3 \). What is the capacitance (\( C' \)) now?