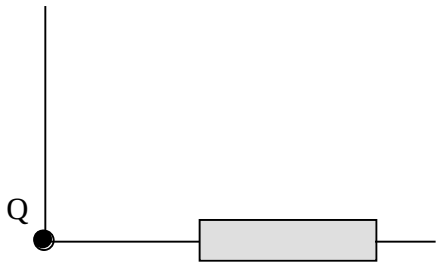
Name _____

Which section?, Wed. Rec.____ , Thur. Rec.____

Work directly on these pages and show your work clearly. Properly labeled figures are important and will figure into the grading.

You do not need to evaluate any of the integrals, but do show the limits of integration and reduce a vector problem so that there are no vectors within the integral itself.

1. [*4 pts*] The uncharged conducting rod in shown shaded in the figure will be
(a) attracted toward the positive charge at the origin
(b) repelled away from the origin
(c) experience no force



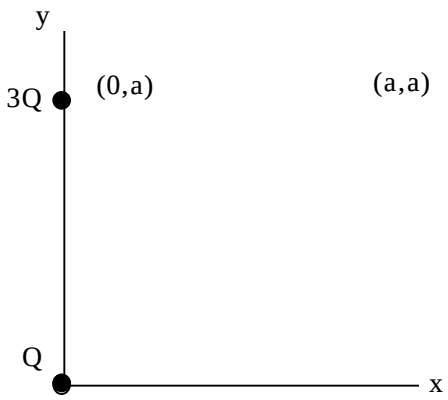
2. [4 *pts*] Gauss's law says that the field outside a conducting sphere holding charge Q
(a) is zero
(b) is the same as having Q/ε_0 at the center
(c) is the same as having Q at the center

3. [*4 pts*] The capacitance of a rigid object depends on
(a) the charge on the object
(b) the voltage across the object
(c) both of the above
(d) none of the above

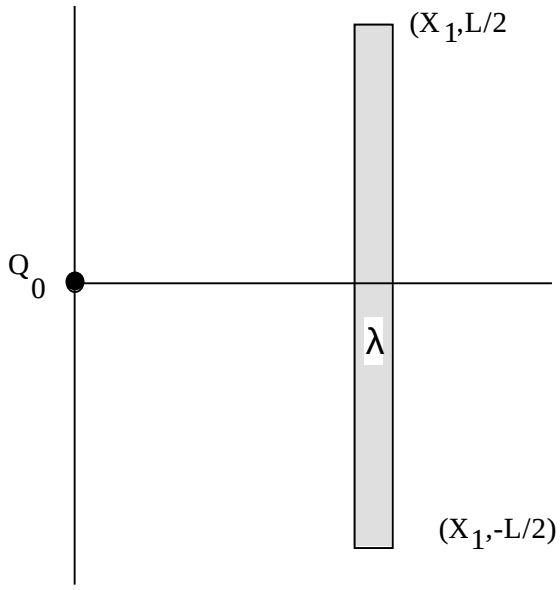
4. [*4 pts*] For an electrostatic problem, a conductor differs from an insulator in that
(a) charges are free to rearrange themselves in a conductor
(b) there is no electric field in a conductor
(c) neither (a) nor (b)
(d) both (a) and (b)

5. [*4 pts*] Indicate **all** of the items in the following list that must be described by vectors.
(a) Force
(b) Electric potential
(c) Electric field
(d) Potential Energy

6. [*15 pts*] Determine an expression for the electric field at point (a,a) given charge Q at the origin and 3Q at (0,a).



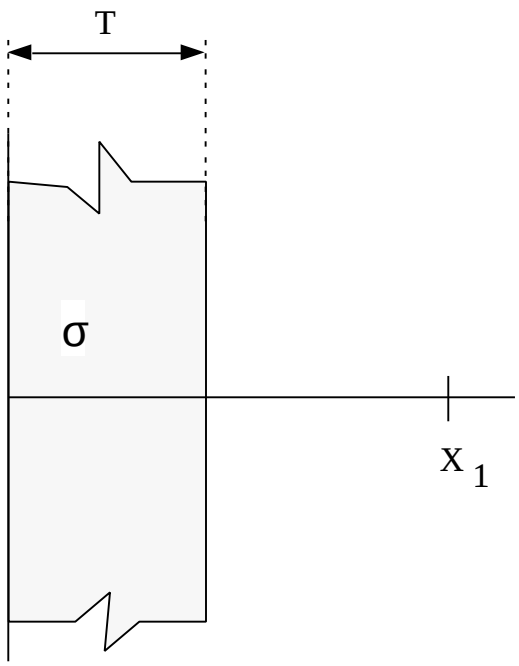
7. [*15 pts*] A nonconducting rod of length L with a linear charge density λ is oriented perpendicular to the x axis at a position $(X_1,0)$ so that the axis bisects its length. Determine an expression for the force on the rod caused by a charge Q_0 located at the origin. You may use a symmetry argument to simplify the problem.



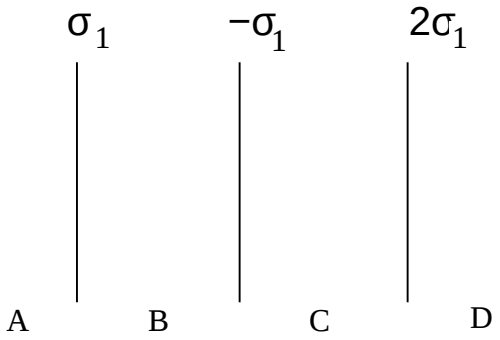
8. [*20 pts*] The electric field at a distance r away from an infinitely long line of charge is

$$\mathbf{E} = \frac{\lambda}{2\pi\varepsilon_0 r}\hat{\mathbf{r}}$$

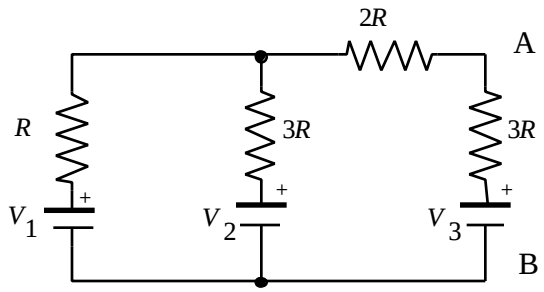
where **r** is perpendicular to the line and λ is the **linear** charge density.
Use this result to determine an expression for the electric field at the point X_1 on the x axis for the infinitely long sheet of charge shown in the figure. The sheet is in the plane of the paper. Note that the σ given is the **surface** charge density. It is related to λ by σT = λ. There is no λ in the answer!



9. [*15 pts*] If the magnitude of the field next to an infinite parallel plate with charge density σ is $\sigma/2\varepsilon_0$, determine the electric field in regions B and D for the infinite plate configuration shown.



10. [*15 pts*] (a) Label the figure with branch currents and write the minimum set of equations necessary to solve for the currents. Do not solve.



(b) Assume that you have solved these and now know the current in the right-most branch. Use its symbol as a known quantity and determine an expression for $V_A - V_B$.