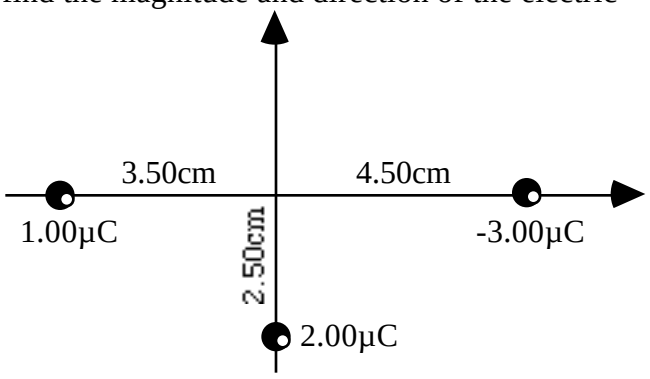
Name:_____

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 20 points. You must show your work in a logical fashion starting with the correctly applied physical principles which are on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded. **For full credit you must explain clearly what you are doing especially if your solution involves symmetry arguments or uses Gauss's Law.**

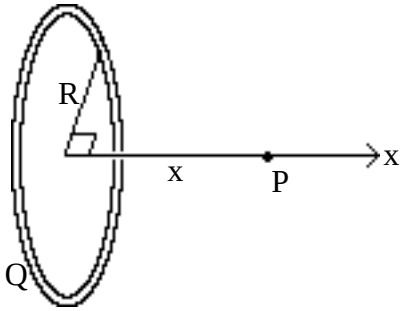
1. For the three charges shown at the right, find the magnitude and direction of the electric field at the origin.



2. For the charge distribution of problem 1, find the total number of electric field lines that leave a sphere centered at the origin that has a radius of (a)2.00cm, (b)3.00cm, (c)4.00cm, and (d)5.00cm

3. A spherical cloud of interstellar dust has a radius 4.00×10^{10}m and an approximately uniform charge density of $3.00 \times 10^{-9} \frac{C}{m^3}$. Find the electric field at a distance of 2.00×10^{10}m from the center of the cloud.

4. Find the potential due to a ring of total charge Q and radius R at the point P a distance x from the center of the ring along the axis as shown at the right.



5. An electron is accelerated from rest with a set of parallel plates as shown at the right. The plate at the far right has a hole so that the electron can escape. Find the potential difference required on the plates if the electron leaves the accelerator with a speed of 1.00×10^6 m/s. Indicate in the drawing which plate is positive.