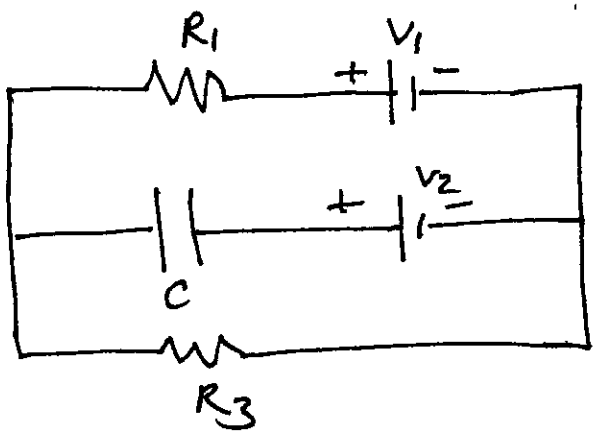
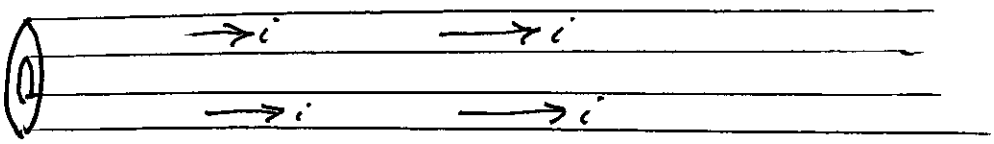
/. (25 points)In the circuit below the voltage of the battery, the capacitance, and the values of the resistances are known. The circuit was put together a long time ago so that the steady state can be assumed. Find all currents and the charges on the capacitor plates.



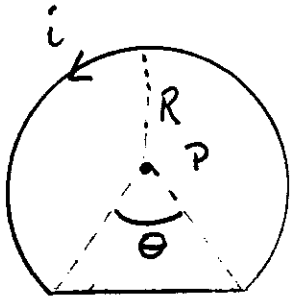
2. (25 points)An infinitely long, hollow cylindrical wire carries a current i.The wire has outer radius b and the cylindrical hole at its center has radius a.



a. Find the force on a charged particle, q, if it had a velocity of magnitude v_0 and was moving along the axis of the cylinder.

b. Find the force on a charged particle,q, if it was moving outside of the cylinder, with a velocity that had a component v_1 parallel to the cylinder and a component v_2 perpendicular to the axis of the cylinder.

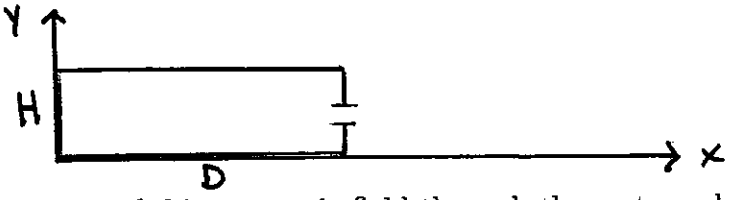
3. (25 points)A very thin circular loop of wire has a flat section as shown. A current i flows around the loop. Find the magnetic field at the point P, the center of the circular part.



4. (25 points)The two plates of a capacitor are a distance W apart and have area A. They are connected by a rectangular loop of wire with no resistance. The dimensions of the rectangle are H by D. The left corner of the rectangle is at the origin, as shown. There is a $\vec{B}$ field pointed into the page, perpendicular to the loop. It has a magnitude that is a function of x, but is constant in y. It is given by

$$B(x) = \alpha + \beta x$$

where α and β are not functions of x or y.



a. Find the flux of this magnetic field through the rectangular loop.

b. Find the equation for the charges on the plates as a functions of time if the self inductance of the loop is L and if $\alpha = c_1 t$ and $\beta = c_2$ where c_1 and c_2 are independent of time.

c. Solve the equation for the charges on the plates as a functions of time if L is ignored.