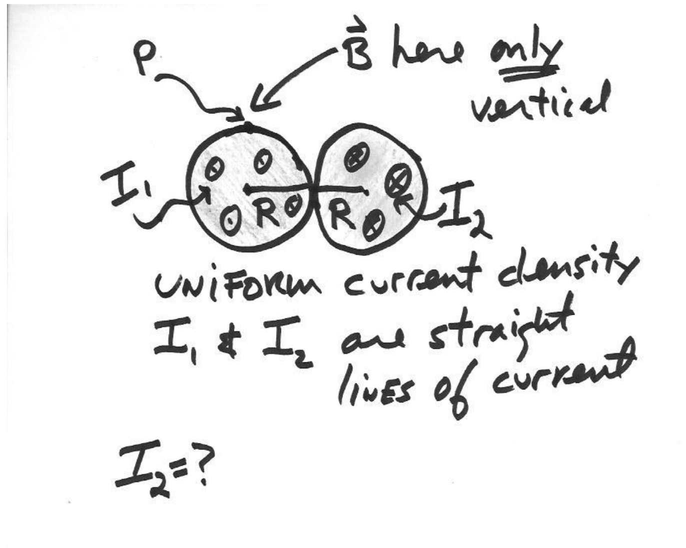
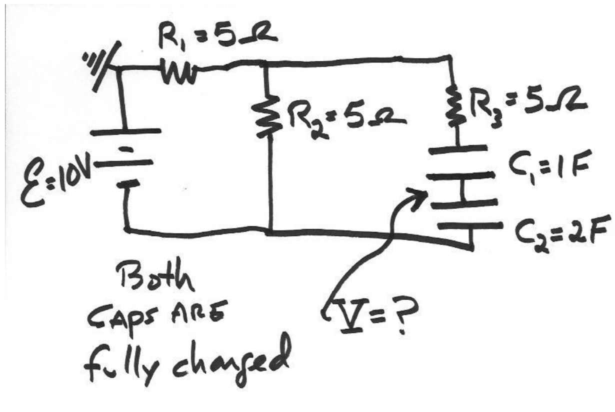
Physics 4B Exam 2 Spring 2012 Name______________________________

1. (25 points) A conducting elastic ring forms a circle that can expand radially in a symmetric manner. As the radius of the ring's circle changes, its resistance, given as R, does not change. The ring is in an external uniform magnetic field B that is perpendicular to the circle's area directed into the page. The rate at which the elastic ring's radius increases is given by $r(t) = Kt+R_o$ (where K is a constant with units of meters/second and R_o is the initial radius of the band at time t= 0. **Find the induced current, magnitude <u>and sense</u>, in the elastic ring as it expands.** How the ring is expanding is irrelevant to this problem.

2. (25 points) Two straight conductors each of radius R are adjacent as shown in the diagram. One conductor has a current I_1 out of the page. The other conductor has a current into the page, I_2. **Find the value of I_2 (in terms of I_1) such that the magnetic field from both currents at the point shown in the diagram has *no* horizontal component. Also, find the resultant magnitude of the vertical magnetic field at the same point.**



3. (25 points) Refer to the diagram. Both capacitors are fully charged. **Find the potential of the conducting surface indicated in the diagram** (which is the conducting surface between the two capacitors, the bottom of the top capacitor and the top of the bottom capacitor). It is not okay to use some formula you memorized for two capacitors in series, but here is a hint: think about what the net charge would have to be on that conducting surface between the two capacitors.



4. (25 points) A spinning disk of charge (spinning about its axis) of radius R is so arranged in its charge distribution that it has a zero magnetic moment so that it won't experience a torque in an external magnetic field. That means some of its charge must be negative and some must be positive. Let the charge density be uniform whether it is positive or negative in some part of the disk. Say that closer to the axis of rotation the charge of the disk is positive. **Find at what distance from the center of the disk the charge must become negative (and then remain negative to the outside edge of the disk) such that the total magnetic moment of the disk as it spins is zero.** Recall the magnetic moment's magnitude for a single loop of circular current is $\mu = IA$.