Week #2 Homework

1. Charging or discharging a capacitor goes like $e^{-t/RC}$ (see your Phys 2012 book, section 27-9). If you flip on the current to charge a capacitor, show that the resulting rise time of the voltage (defining "rise time" as the time it takes to go from 10% to 90% of the final voltage) is 2.2 RC.
2. Using the rules for adding impedances in parallel and series to derive the rules you already know for adding capacitors is series and in parallel.
3. Some complex algebra. Show that if **A**=**BC**, (boldface here means a complex number), then A=BC (where these are magnitudes). Hint: represent each complex number in polar form, *ie*, $\mathbf{A}=Ae^{i\theta}$.
4. Find the response (V_{out}/V_{in} vs. frequency) for a LC notch filter: ie, a voltage divider with "R" playing the role of R_1, and an L in series with a C playing the role of R_2, knowing what you know now about impedances and complex numbers.
5. Design a "rumble filter" for audio. It should pass frequencies greater than 20Hz (set the 3db point at 10Hz). Assume zero source impedance (perfect voltage source) and 10k (minimum) load impedance (that's important so you can choose R and C such that the load doesn't affect the filter operation significantly).