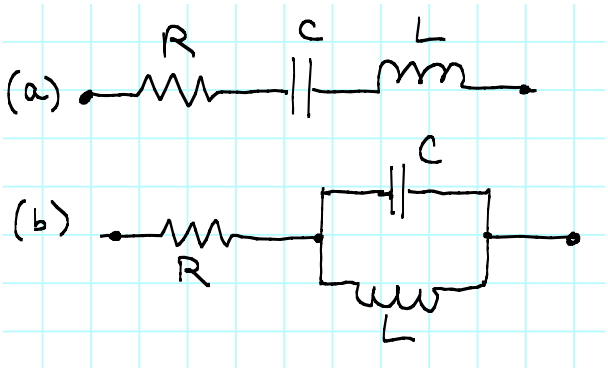
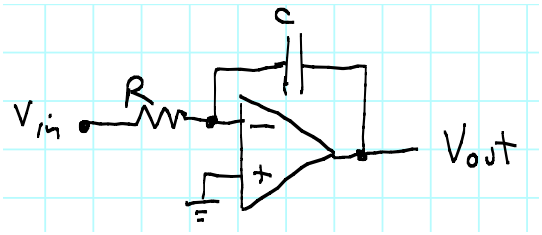
PHYS 5061 Homework 1
Due Wed. Feb. 13

1) The reciprocal of impedance is called admittance, often denoted by Y=1/Z. Instead of thinking V = IZ as the generalization of Ohm's law V=IR, the admittance is handy in expressing the current as being proportional to voltage. I = YV. Consider the two RLC circuits at right. Assume they are eachdriven by a voltage $V(t) = V_o e^{i\omega t}$. For (a) find the magnitude of the admittance $Y(\omega)$ as a function of frequency and. Sketch it qualitatively as a function of frequency. Where is the admittance a maximum and what is the maximum current that will flow? For circuit (b) find the magnitude of the impedance $Z(\omega)$. Sketch it. How does the current through this combination vary with frequency? At what frequency is it a minimum? What is the minimum current? What's the maximum current?



2) The op-amp circuit is connected to a time-dependent Vin(t). Applying the golden rules for op-amps show that the output voltage is proportional to the time integral of Vin(t): $V_{out}(t) = -(1/RC) \int V_{in}(t)\, dt$.



3) Apply the golden rules for op-amps to find an expression for Vout(t) in terms of Vin(t) for this circuit. Verify that for Vin(t) restricted to the range of -5 V to +5 V, the output will be between 0 and –5V.