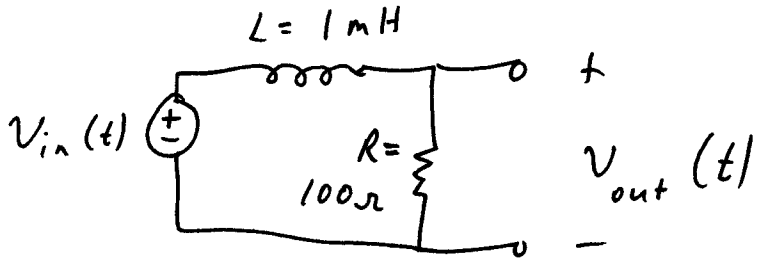
ELEC 320, Fall 2006
Prof. Rich Kozick

Homework 3

Date Assigned: Wednesday, August 30, 2006
Date Due: Monday, September 4, 2006

1. **Reading:** Please read Chapter 1 in the Lathi text for the week of September 6. The key concepts are in Chapter 1 are as follows: what is a signal, what is a system, continuous-time versus discrete-time, and what does it mean for a system to be *linear*, *time-invariant*, and *causal*.

2. Please construct Bode plots for the magnitude and phase response for the following circuit. On your magnitude plot, label the -3 dB cutoff frequency, the gain of the filter in the passband, and the slope of the "roll-off" in the stopband.

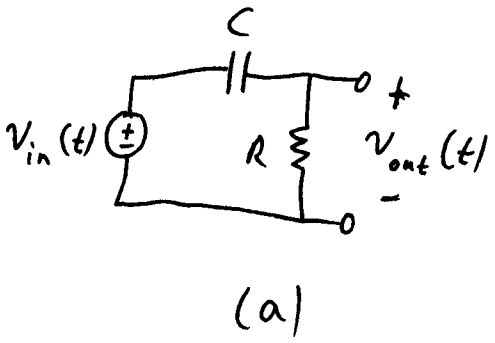


3. This exercise will provide practice converting between amplitude gain and decibels (dB). Consider a sine wave with amplitude 1 volt that is passed through 7 filters. The filter gains at the sine wave frequency are as follows:

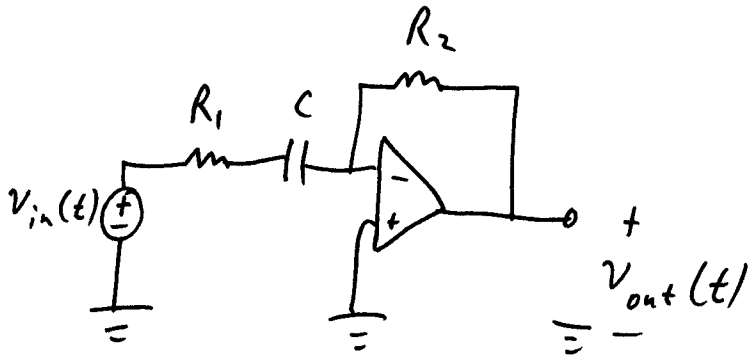
   0 dB, 3 dB, 6 dB -3 dB, 20 dB, -20 dB, and - 40 dB

   What is the amplitude (in volts) of the output sine wave from each filter?

4. Obtain Bode plots (magnitude and phase versus frequency) for the following circuits. What type of filter is each circuit?
   What is the formula for the cutoff frequency w_c in terms of the values of R and C?
   The frequency axis in your plots should span at least 4 orders of magnitude, including $w_c/100$, $w_c/10$, w_c, 10 w_c, and 100 w_c.
   Be sure to indicate the pass-band gain and the slope of the roll-off in the stop-band in your plots.



(a)



5. Classify each of the following filters as low-pass, high-pass, or band-pass. You can do this by looking at each filter as a voltage divider, and determining the behavior of each impedance in the circuit for low frequencies, middle frequencies, and high frequencies. Alternatively, you can write the equation for the frequency response and study its behavior as the frequency varies.

   For the low-pass filters: Is one of them "closer" to an ideal filter than the others? Please explain.