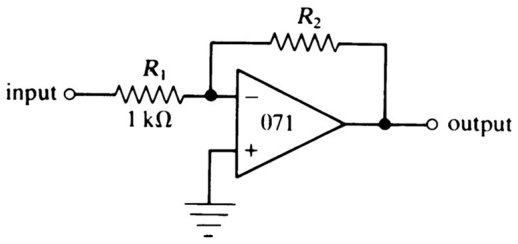
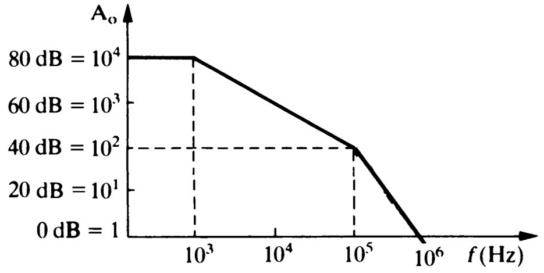
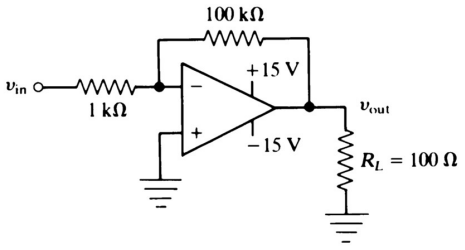
Physics 4700 HOMEWORK VI
Due November 13

1. **Simpson: problem 13, page 409.** The inverting amplifier referred to here is the one in problem 11, page 408. The open loop gain versus frequency for an uncompensated op amp is shown below. Would the inverting amplifier be stable for
   a. $R_2 = 10$ kΩ?
   b. $R_2 = 100$ kΩ?





2. **Simpson: problem 18, page 410.** Although the output resistance of most op amps is extremely low when negative feedback is used, a typical inexpensive op amp can supply only a maximum current of approximately 25 mA. Calculate the maximum amplitude sinusoidal input (at low frequencies ~ 1 kHz) that will produce a non-distorted output across $R_L = 100\ \Omega$. Repeat it for $R_L = 1\ k\Omega$.



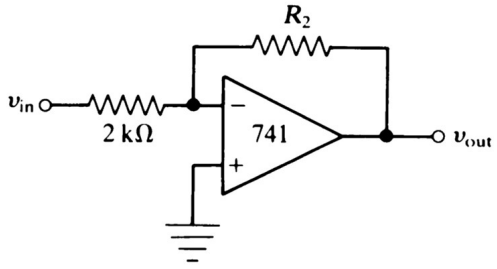
3. **Simpson: problem 7, page 466.** Design a summing amplifier circuit to sum from inputs v_A, v_B, v_C, v_D and to produce an output of $v_o = v_A + 2v_B + 4v_C + 8v_D$.

4. **Simpson: problem 9, page 466.** Design a voltage-to-current converter to convert a 1 mV input voltage to a 1 mA current through a 1 kΩ load resistor.

5. **Simpson: problem 18, page 467.** Design an op-amp differentiator whose output is,

$$v_{out} = -(10^{-6})\frac{dV_{in}}{dt}$$

6. **Simpson: problem 14, page 409.** For a 741 op-amp with a slew rate of 0.5 V/μs, for $R_2 = 20$ kΩ, what is the maximum input sinusoidal frequency to avoid slew rate distortion in the output? The input peak-to-peak amplitude is 10 mV. Repeat for $R_2 = 200$ kΩ.



7. **Simpson: problem 20, page 467.** The comparator is bipolar.
   a. Sketch the output waveform if V_{bb} = +5 V.
   b. Repeat for V_{bb} = –5 V
   c. How would you change the circuit to produce output voltages of +5 V and –0.6 V?