## Physics 4700 HOMEWORK VI Due March 30

- 1. The open loop gain versus frequency for an uncompensated op amp is shown below (Simpson problems 11/13). Would the inverting amplifier be stable for
  - a.  $R_2 = 10 \text{ k}\Omega?$
  - b.  $R_2 = 100 \text{ k}\Omega?$



2. 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 an undistorted output across  $R_L = 100 \Omega$ . Repeat it for  $R_L = 1 k\Omega$ .



- 3. 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. Design a voltage-to-current converter to convert a 1 mV input voltage to a 1 mA current through a 1 k $\Omega$  load resistor.
- 5. Design an op-amp differentiator whose output is,

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

6. For a 741 op-amp with a slew rate of 0.5 V/µs, for  $R_2 = 20 \text{ k}\Omega$ , 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  $R_2 = 200 \text{ k}\Omega$ .



## 7. 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?

