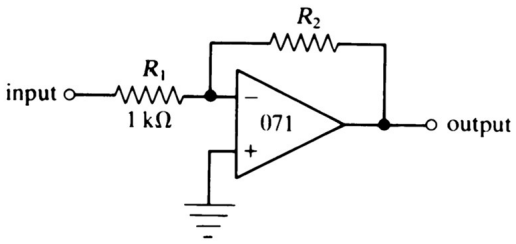
Physics 4700 HOMEWORK VI
Due November 23

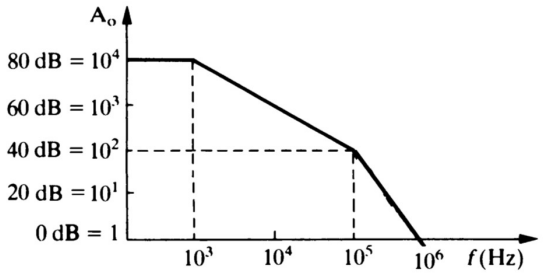
Note: Determine the gain roll-off vs. frequency for both parts a and b and compare it to the open loop gain roll-off vs. frequency for the op amp.

1. 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?

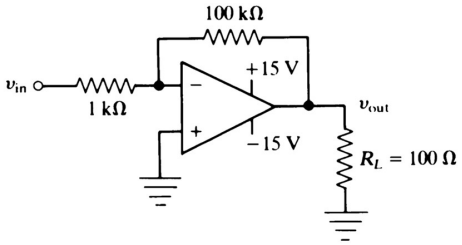
b. $R_2 = 100$ kΩ?





Note: The ±15 V power supply for the op amp restricts the output amplitude.

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 $R_L = 1\ k\Omega$.



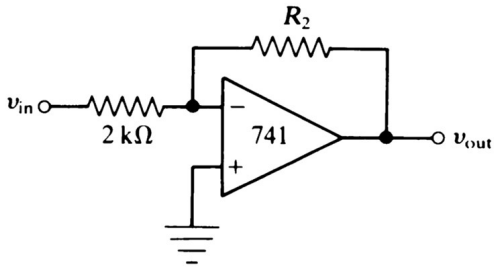
3. Design a summing amplifier circuit to sum from inputs v_A, v_B, v_C, v_D and to produce an output of $v_o = v_A + 2v_B + 4v_C + 8v_D$.

4. Design a voltage-to-current converter to convert a 1 mV input voltage to a 1 mA current through a 1 kΩ 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 $R_2 = 20$ 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.



Note: For part c, you cannot just lower the power supply input to the op amp

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?