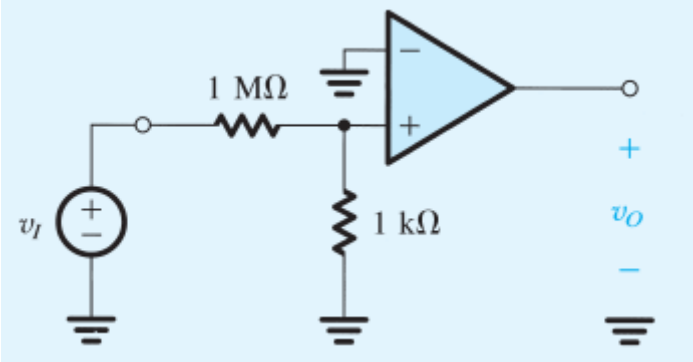
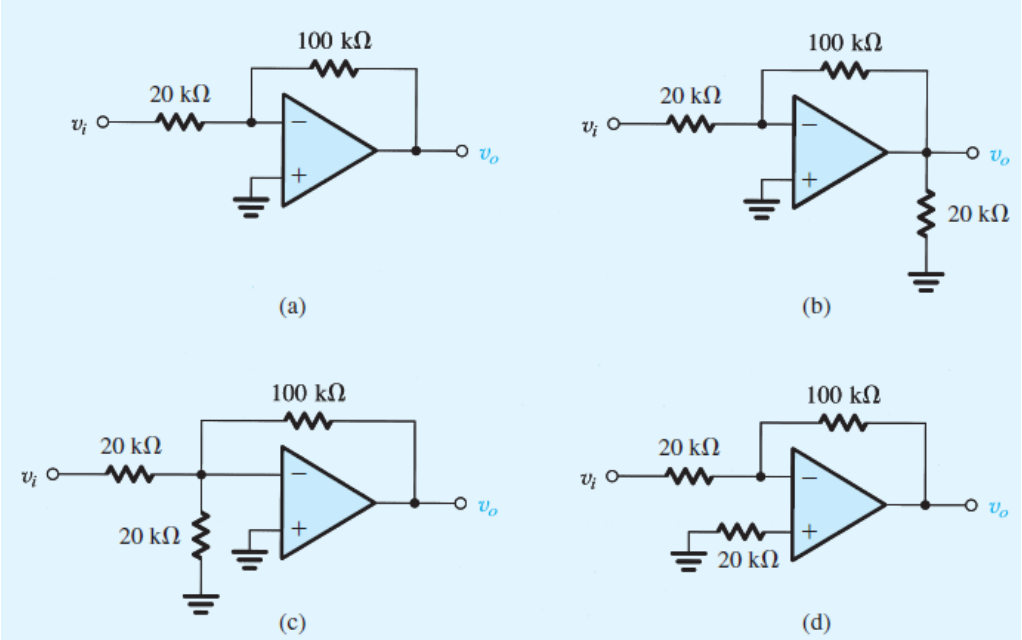
Homework 1

1. Problem 2.1 on Sedra & Smith 8th ed.
   The circuit of Fig. P2.1 uses an op amp that is ideal except for having a finite gain A. Measurements indicate v_O =4.0 V when v_I = 1.0 V. What is the op-amp gain A?

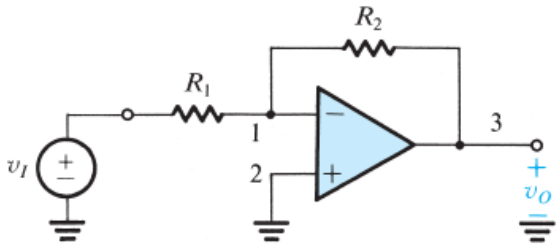


2. Problem 2.9 on Sedra & Smith 8th ed..
   Assuming ideal op amps, find the voltage gain *vo*/*vi* and input resistance *R*in of each of the circuits in Fig. P2.9.



3. Design an inverting amplifier using ideal opamp and the total resistance R_1+R_2=110 kΩ.
   (a) The gain V_O/V_I is −10 V/V.
   (b) The gain | V_O/V_I | is -20 dB.

(c) The gain | V_O/V_I | is 40 dB.



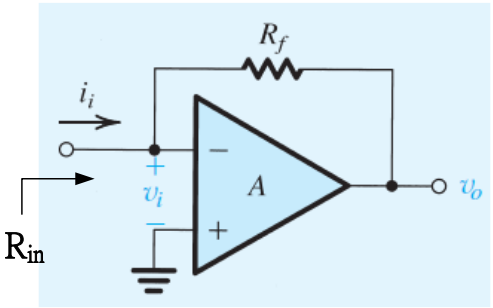
4. Problem 2.24, Sedra & Smith 8th ed. (2.22 on 7th ed.)

The circuit in Fig. P2.22 is frequently used to provide an output voltage $\boldsymbol{v_o}$ roportional to an input signal current $\boldsymbol{i_i}$.

Derive expressions for the transresistance $\boldsymbol{R_m \equiv v_o/i_i}$ and the input resistance $\boldsymbol{R_i \equiv v_i/i_i}$ for the following cases:

(a) A is infinite.

(b) A is finite.



5. Problem 2.51 on Sedra & Smith.

The circuit shown in Fig. P2.51 utilizes a 10-k potentiometer to realize an adjustable-gain amplifier. Derive an expression for the gain as a function of the potentiometer setting x. Assume the op amp to be ideal. What is the range of gains obtained? Show how to add a fixed resistor so that the gain range can be 1 to 11 V/V. What should the resistor value be?

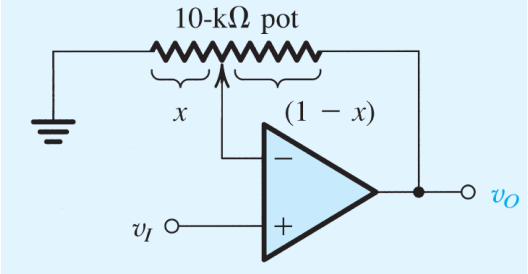


Figure P2.51

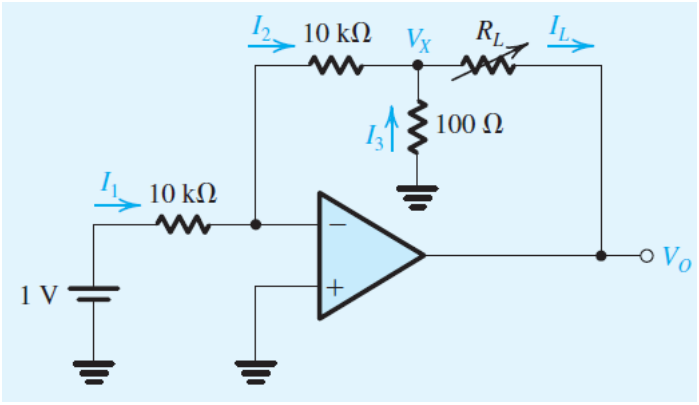
6. Problem P 2.30 on Sedra & Smith 8th ed. (P2.32 on 7th ed.).

The circuit in Fig. P2.30 utilizes an ideal op amp.

(a) Find I_1, I_2, I_3, I_L, and Vx.

(b) If V_O is not to be lower than −13 V, find the maximum allowed value for R_L.

(c) If R_L is varied in the range 100 Ω to 1 kΩ, what is the corresponding change in I_L and in V_O?



7. Problem 2.38 in Sedra & Smith 8th ed. (2.31 in 7th ed.)

(a) The circuit in Fig. P2.31 can be considered to be an extension of the circuit in Fig. 2.8.(a) Find the resistances looking into node 1, R_1; node 2, R_2; node 3, R_3; and node 4, R_4.

(b) Find the currents I_1, I_2, I_3, and I_4, in terms of the input current I.

(c) Find the voltages at nodes 1, 2, 3, and 4, that is, V_1, V_2, V_3, and V_4 in terms of (I_R).