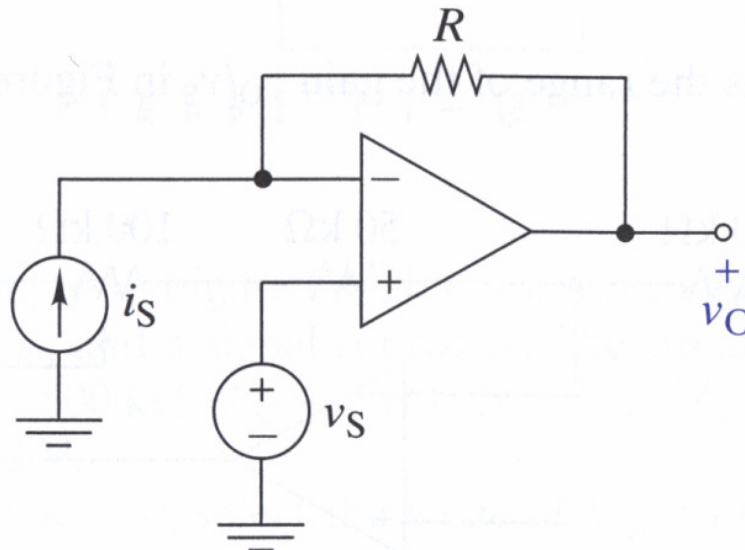


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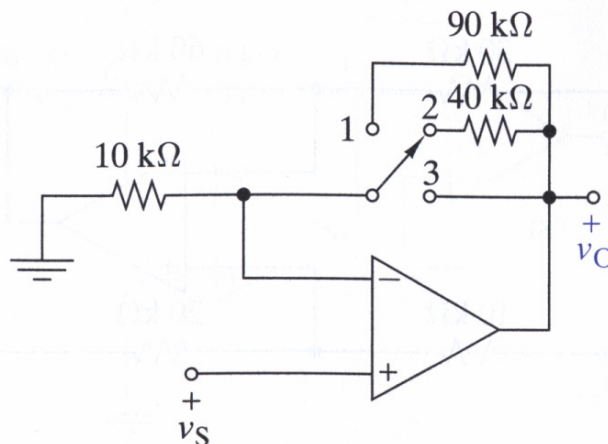
Homework #4

Due Date: May 9, 2008 (by 5pm)

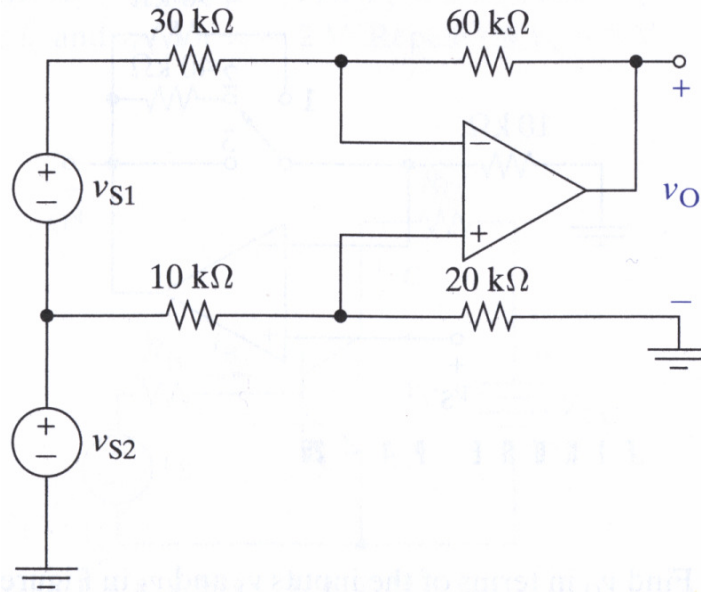
1. The inputs to the circuit below a current source i_S and a voltage source v_S . When the Op Amp in its linear range, the output voltage has the form $v_O = K_1 v_S + K_2 i_S$. Find K_1 and K_2 .



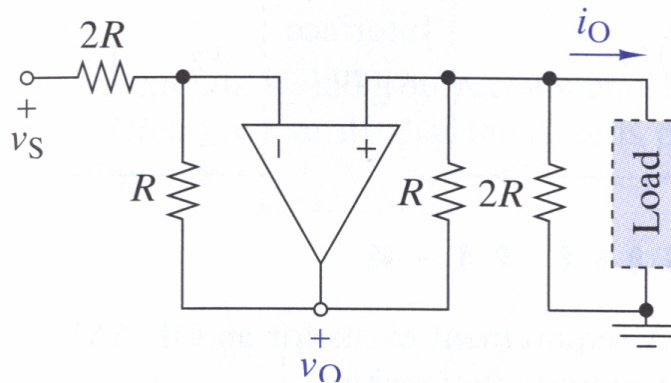
2. The op amp in the circuit below is ideal. What is the gain v_O/v_S in the circuit when the switch in position 1? Repeat for positions 2 and 3. Compare the results.



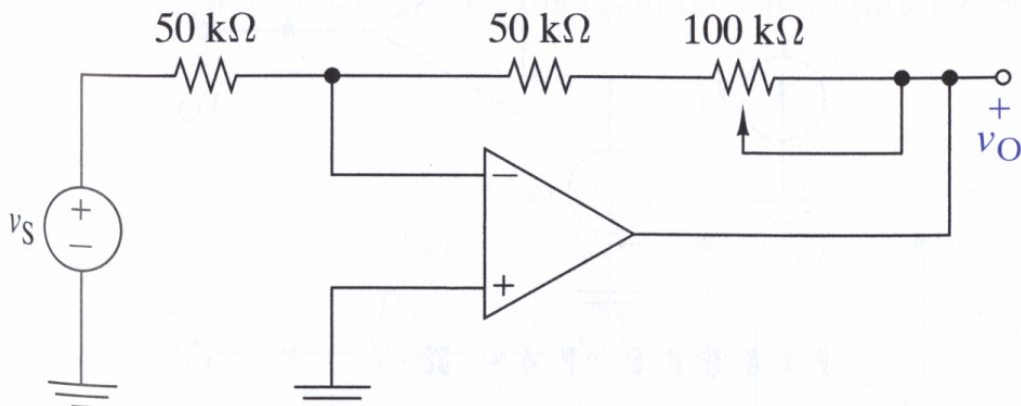
3. Find v_O in terms of the inputs v_{S1} and v_{S2} . Assume the Op Amp is ideal.



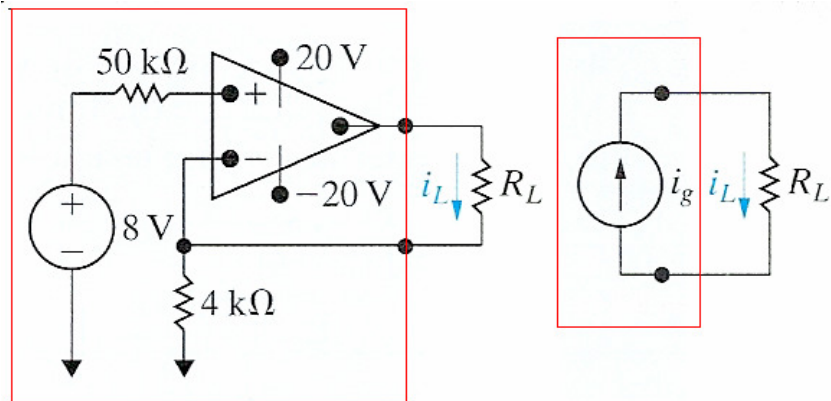
4. Use node-voltage analysis in the circuit below to show that the circuit is a voltage controlled current source. (Hint: show that $i_O = -v_S/2R$ regardless of the load) Assume the op amp is ideal.



5. What is the range of the gain v_O/v_S in the circuit below. Assume the Op Amp is ideal.



6. The circuit inside the red box in the figure below is a constant current source for a limited range of values of R_L .
- Find the value of i_L for $R_L = 4\text{k}\Omega$.
 - Find the maximum value for R_L for which i_L will have the value in (a).
 - Assume that $R_L = 16\text{k}\Omega$. Explain the operation of the circuit. You can assume that $i_n = i_p \approx 0$ under all operating conditions.
 - Sketch i_L versus R_L for $0 \leq R_L \leq 16\text{k}\Omega$.

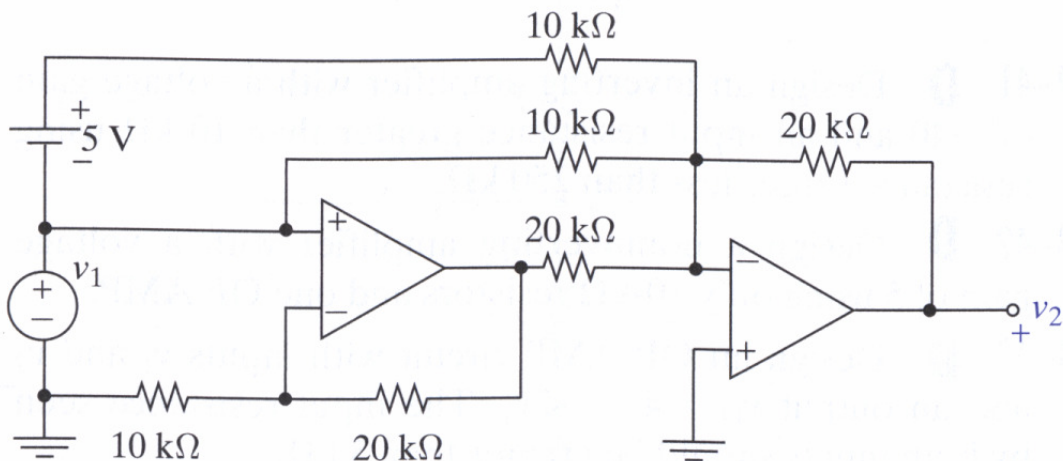


7. Design an inverting summing amplifier so that:

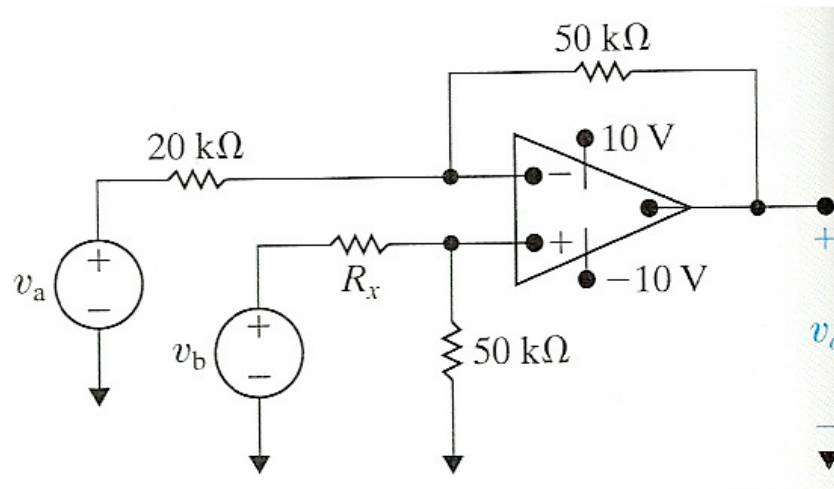
$$v_0 = -(2v_a + 4v_b + 6v_c + 8v_d)$$

If the feedback resistor (R_f) is chosen to be $56\text{k}\Omega$, draw a circuit diagram of the amplifier and specify the values of R_a , R_b , R_c , and R_d .

8. The op amps in the circuit shown are ideal. Find the output v_2 in terms of v_1 .



9. In the difference amplifier shown below, what range of values of R_x yields a $CMRR \geq 1000$?



10. Find the output v_2 in terms of the input v_1 in the circuit below. Assume the Op Amps are ideal.

