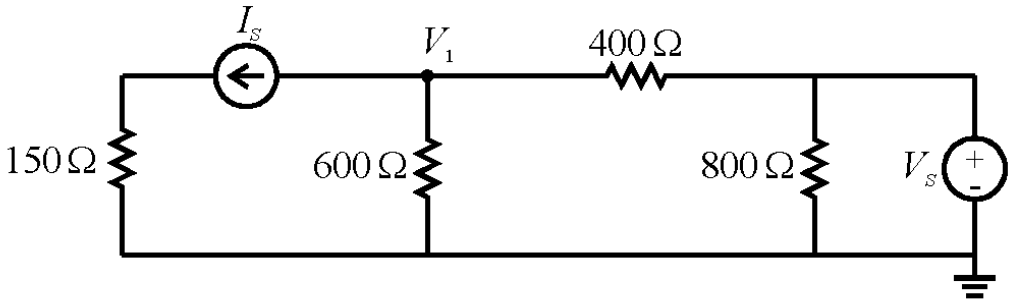
EE 220/220L Circuits I (Spring 2011) Examination 2

Name Example

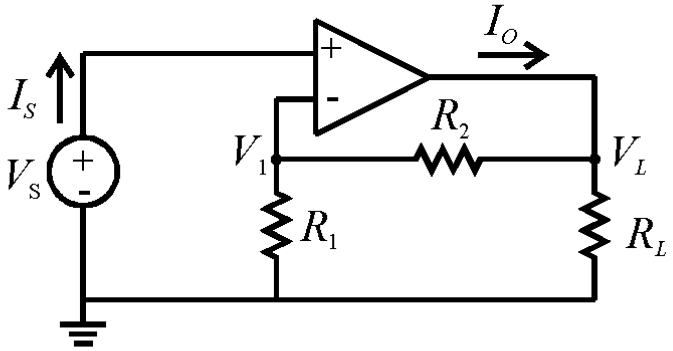
Instructions: Show all work for full credit. Write answers in indicated places. Attach equation sheet.

1) For the circuit shown, determine the node voltage V_1 due to each source and overall using the **Principle of Superposition** when $I_S = 44$ mA and $V_S = 14$ V.



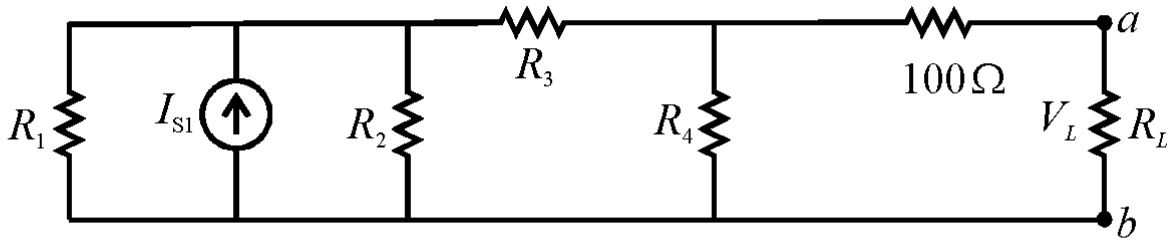
$V_{1,IS} =$ -10.56 V $V_{1,VS} =$ 8.4 V $V_1 =$ -2.16 V

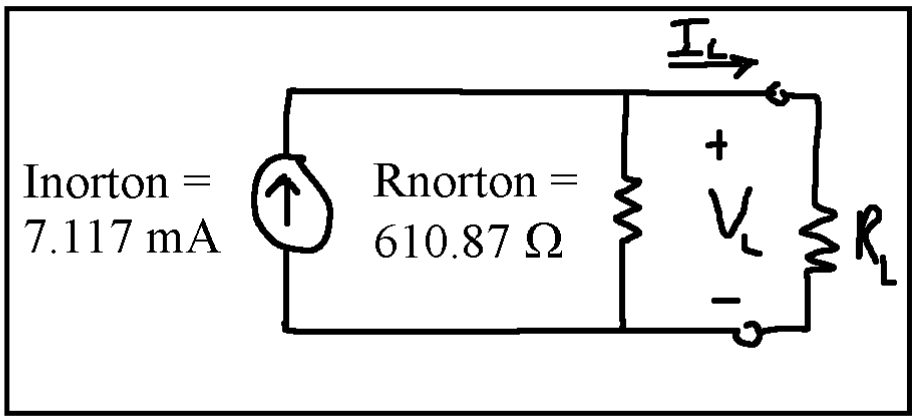
2) For the circuit, the operational amplifier has an open-loop gain of $4*10^4$, input resistance of 1 MΩ, and output resistance of 100 Ω. When V_S = 2 V, R_1 = 10 kΩ, R_2 = 20 kΩ, and R_L = 5 kΩ, find I_S, V_1, V_L, and I_O (keep at least 6 significant figures). Show clearly labeled work for partial credit!



I_S = 0.153488 nA V_1 = 1.99985 V V_L = 5.99954 V I_O = 1.399835 mA

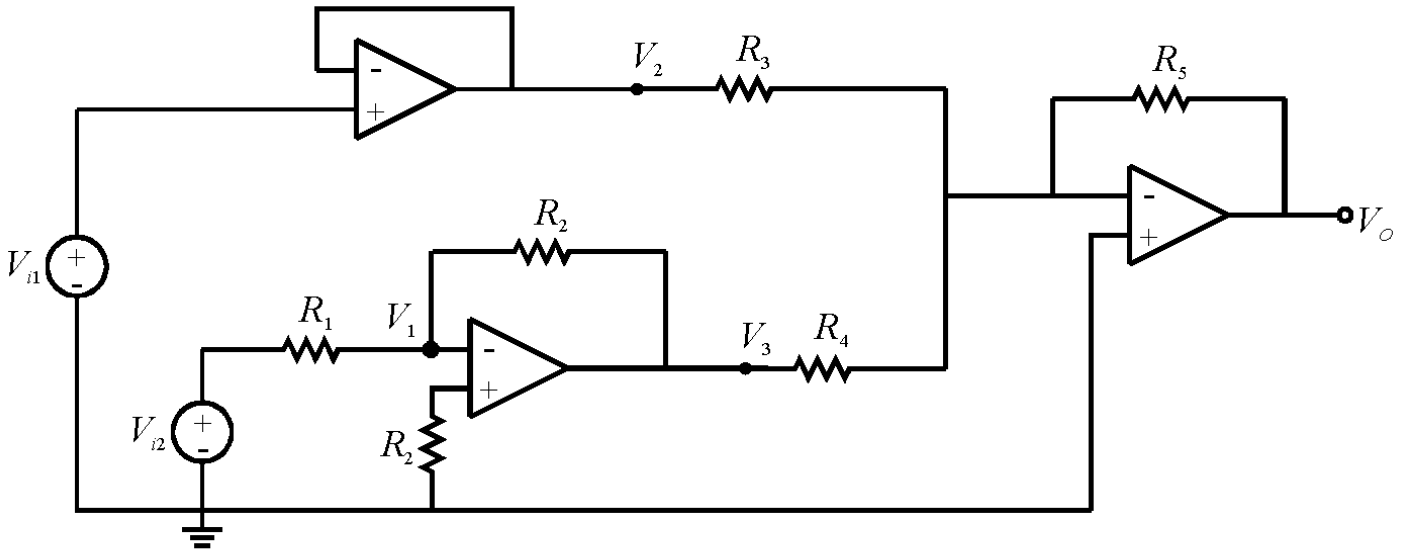
3) For the circuit shown, find and sketch a fully-labeled Norton equivalent circuit at terminals *a*-*b* when $I_{S1} = 20$ mA, $R_1 = R_4 = 1$ kΩ, $R_2 = 800$ Ω, and $R_3 = 600$ Ω. Then, determine the resistance R_L for maximum power transfer, and find the load voltage V_L and load voltage P_L.





$R_L =$ 610.87 Ω $\quad V_L =$ 2.1739 V $\quad P_L =$ 7.736 mW

4) Determine the voltages V_1, V_2, V_3, and V_O in the ideal operational amplifier circuit shown below when V_{i1} = 2 V, V_{i2} = -4 V, R_1 = 10 kΩ, R_2 = 20 kΩ, R_3 = 4 kΩ, R_4 = 8 kΩ, and R_5 = 16 kΩ.



V_1 = 0 V V_2 = 2 V V_3 = 8 V V_O = -24 V