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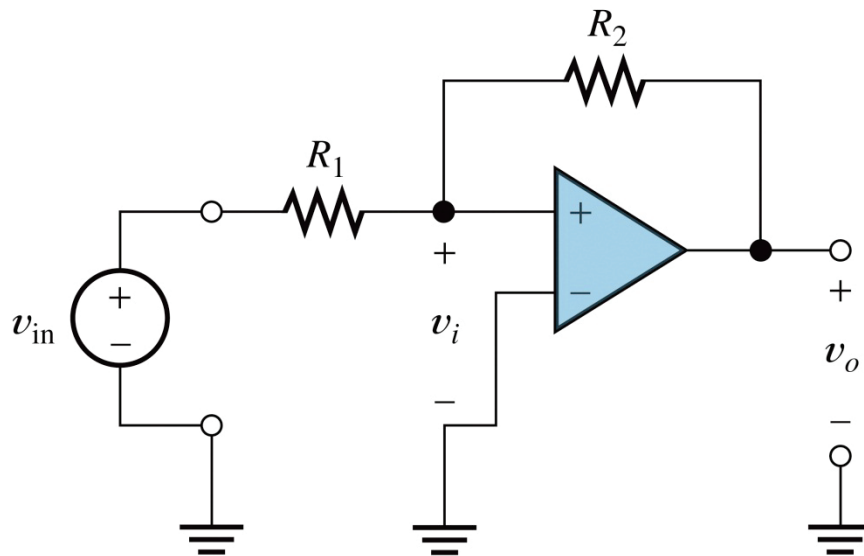
SHOW YOUR WORK: Correct answer with no work shown may not receive credit.  
Wrong answer with work shown may receive partial credit.

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1. (10 points) The circuit shown here demonstrates:

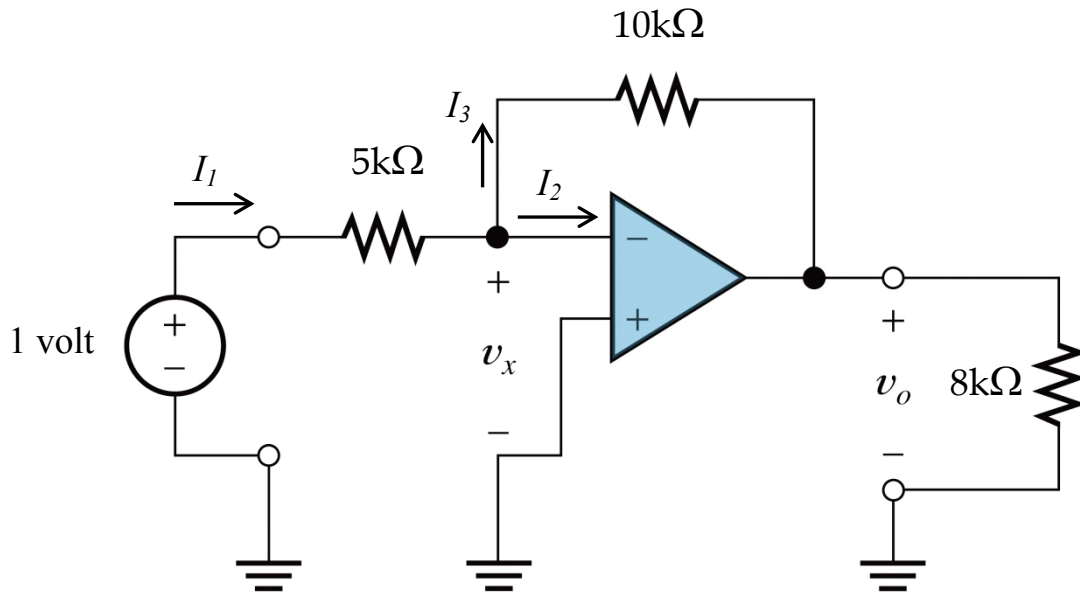
- Negative feedback
- Positive feedback
- Open loop conditions



2. (10 points) The “ideal” model for an op amp has:

- Zero input impedance
- Infinite input impedance
- Unity input impedance

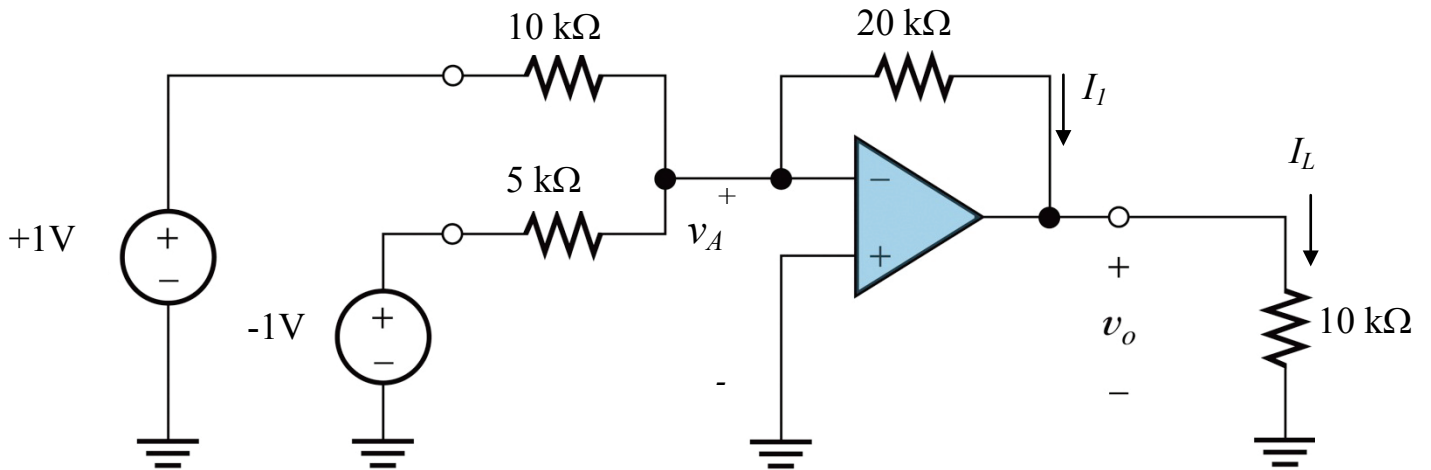
3. (20 points) Use the ideal op amp model to answer the following questions.



What is $v_x$ ? (5 points)	What is $v_o$ ? (5 points)	What is $I_1$ ? (5 points)	What is $I_2$ ? (5 points)
<input type="checkbox"/> -2 volts	<input type="checkbox"/> -2 volts	<input type="checkbox"/> -0.5 mA	<input type="checkbox"/> -0.5 mA
<input type="checkbox"/> -1 volt	<input type="checkbox"/> -1 volt	<input type="checkbox"/> -0.2 mA	<input type="checkbox"/> -0.2 mA
<input type="checkbox"/> 0 volts	<input type="checkbox"/> 0 volts	<input type="checkbox"/> 0 mA	<input type="checkbox"/> 0 mA
<input type="checkbox"/> +1 volt	<input type="checkbox"/> +1 volt	<input type="checkbox"/> +0.2 mA	<input type="checkbox"/> +0.2 mA
<input type="checkbox"/> +2 volts	<input type="checkbox"/> +2 volts	<input type="checkbox"/> +0.5 mA	<input type="checkbox"/> +0.5 mA

Explain your reasoning:

4. (20 points) Use the ideal op amp model to determine the voltages and currents. Be careful to observe the proper polarity.



What is $v_A$ ? (5 points)	What is $v_o$ ? (5 points)	What is $I_1$ ? (5 points)	What is $I_L$ ? (5 points)
<input type="checkbox"/> -2 volts	<input type="checkbox"/> -2 volts	<input type="checkbox"/> -0.2 mA	<input type="checkbox"/> -0.2 mA
<input type="checkbox"/> -1 volt	<input type="checkbox"/> -1 volt	<input type="checkbox"/> -0.1 mA	<input type="checkbox"/> -0.1 mA
<input type="checkbox"/> 0 volts	<input type="checkbox"/> 0 volts	<input type="checkbox"/> 0 mA	<input type="checkbox"/> 0 mA
<input type="checkbox"/> +1 volt	<input type="checkbox"/> +1 volt	<input type="checkbox"/> +0.1 mA	<input type="checkbox"/> +0.1 mA
<input type="checkbox"/> +2 volts	<input type="checkbox"/> +2 volts	<input type="checkbox"/> +0.2 mA	<input type="checkbox"/> +0.2 mA

5. (20 points) Use the ideal op amp model to determine the current  $i_o$ . SHOW AND EXPLAIN YOUR WORK.

