Exam #4 → Thursday, March 28

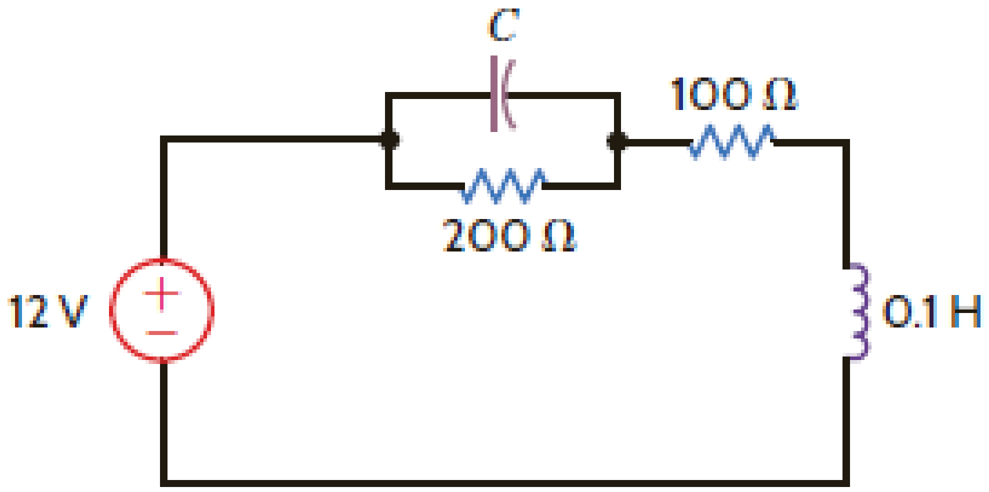
Concepts Chapter #4 & #6:

1) Op-Amp
   - Model
   - Circuit Analysis
     - Ideal behavior
     - Non-ideal behavior
2) Capacitor / Inductor
   - Model / Behavior
   - DC Analysis
   - Series / Parallel Combination

***** "Bate": bring your own set of equations (no problems, photocopies, solutions, etc)… subject to approval by the professor**

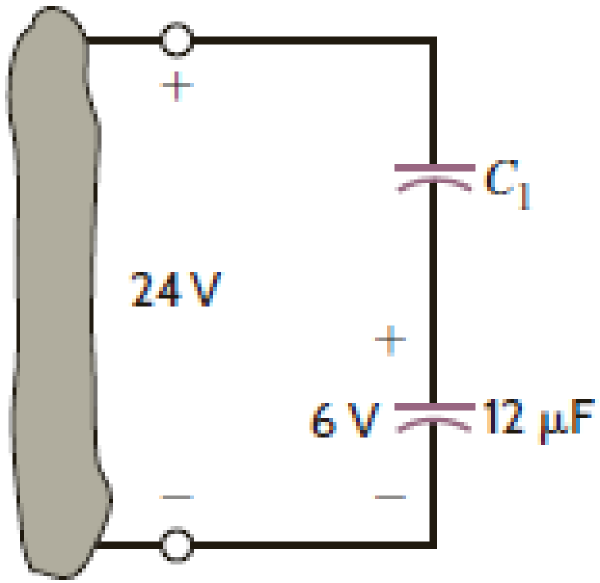
Problem 6.38

Find the value of C if the energy stored in the capacitor equals the energy stored in the inductor.



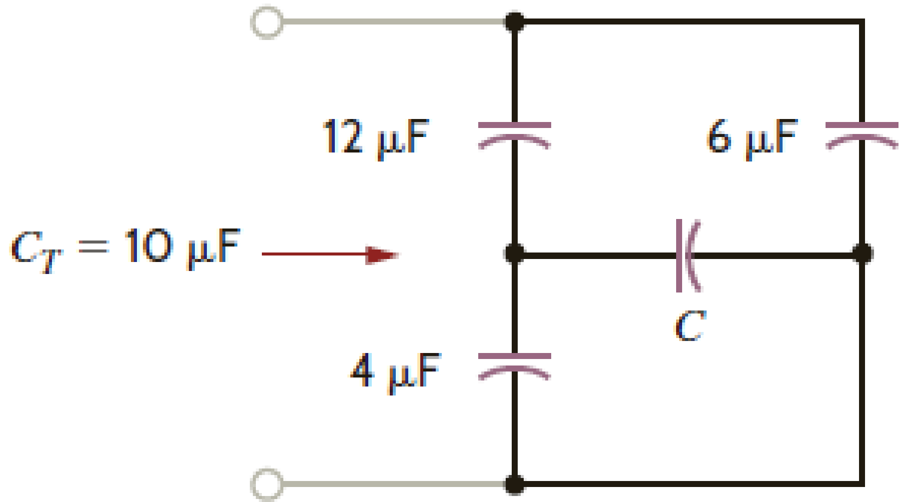
Learning Assessment E6.11

Two initially uncharged capacitors are connected as shown in the circuit below. After a period of time, the voltage reaches the value shown. Determine the value of C_1.



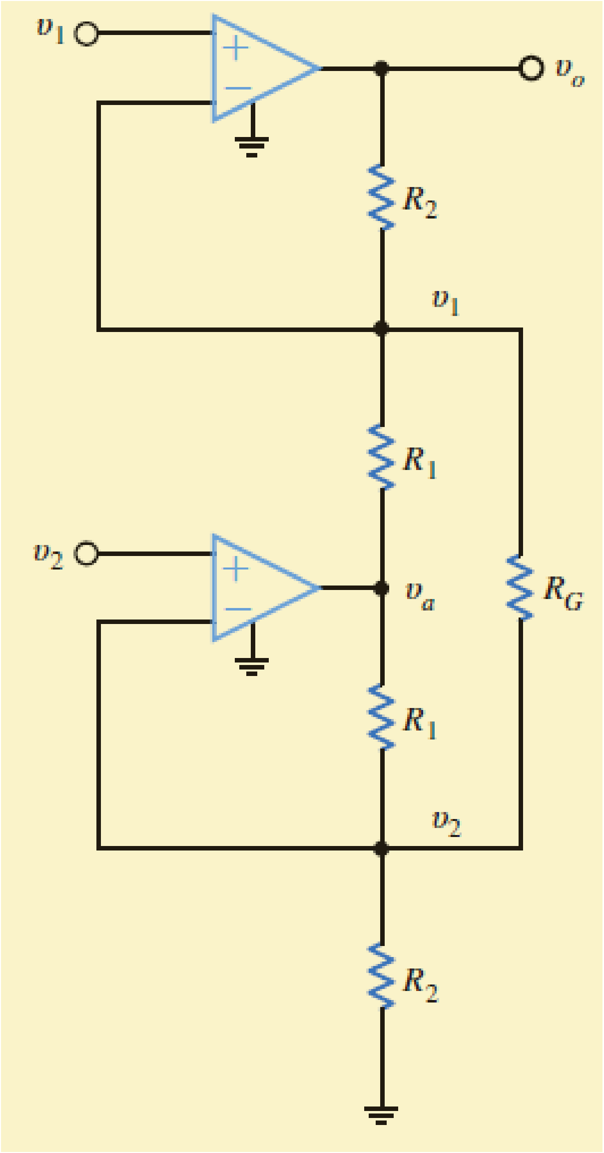
Problem 6.57

If the total capacitance of the provided network is 10μF, find the value of C.



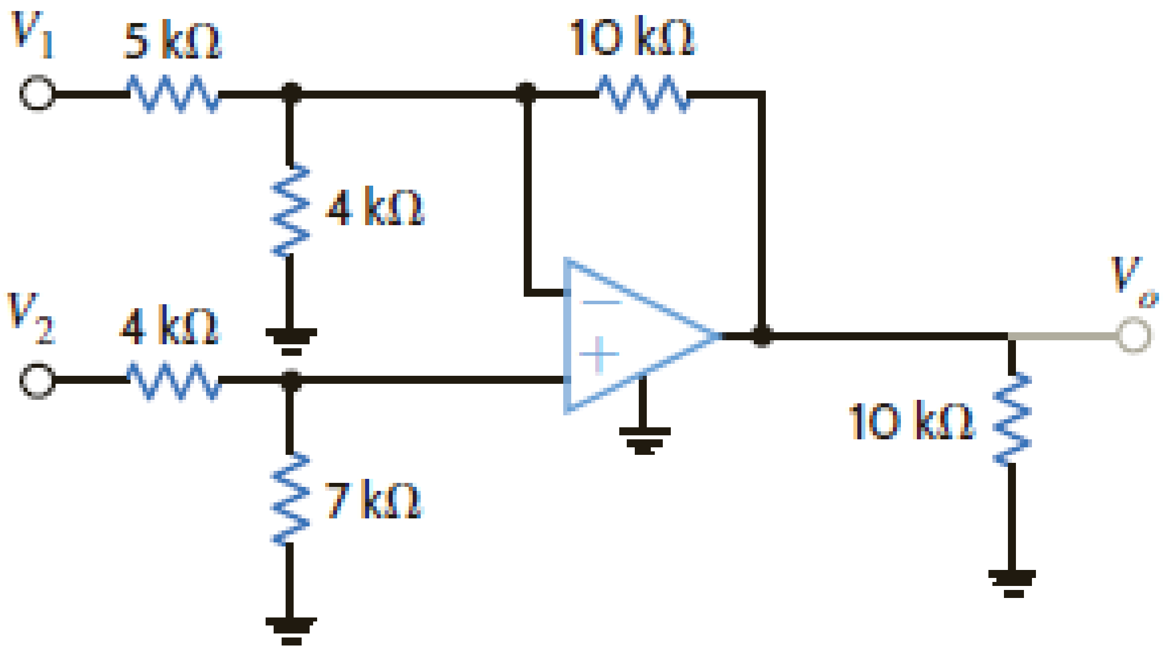
Example 4.5

The circuit shown is a precision differential voltage-gain device. It is used to provide a single-ended input for an analog-to-digital converter. Derive an expression for the output of the circuit in terms of the two inputs.



Learning Assessment – E4.5

Assuming ideal op-amp behavior find Vo in terms of V_1 and V_2. If $V_1=V_2=4$ find V_0. If the op-amp power supplies are ±15V and $V_2=2V$, what is the allowable range of V_1?



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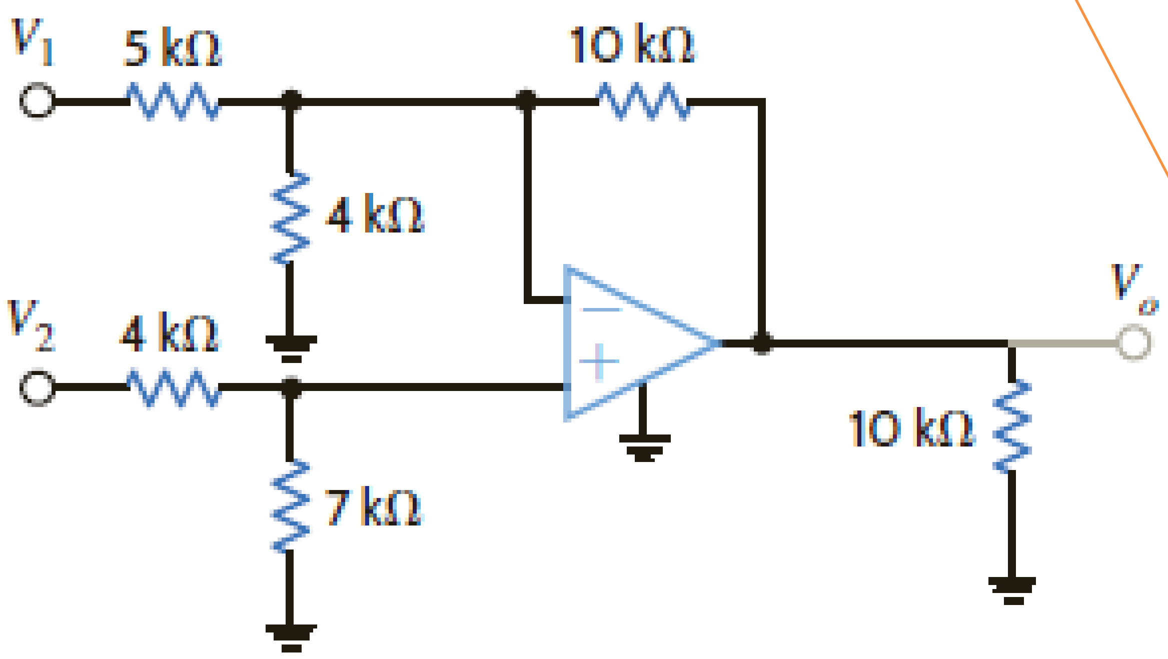


→ **Superposition: Inverting Amp. / Non-Inverting Amp.**

$$V_0' = -V_1\left[\frac{10k}{5k}\right] = -2\cdot V_1$$

$$V_0'' = V_2\left[\frac{7k}{11k}\right]\left[1+\frac{10k}{4k//5k}\right] = 3.5\cdot V_2$$

$$\therefore V_0 = -2\cdot V_1 + 3.5\cdot V_2$$

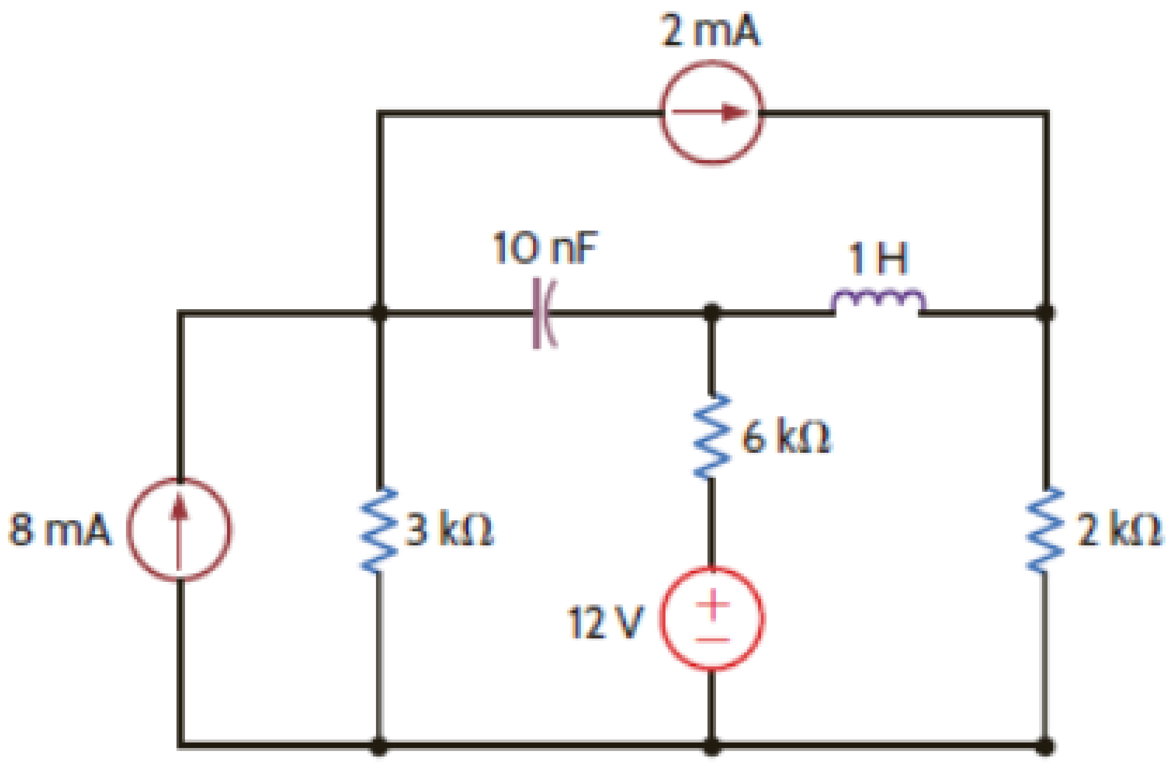
$$-15V \le V_0 \le 15V$$

$$\therefore V_0 = -2\cdot V_1 + 3.5\cdot V_2 \le 15$$

$$\therefore V_0 = -2\cdot V_1 + 3.5\cdot V_2 \ge -15$$

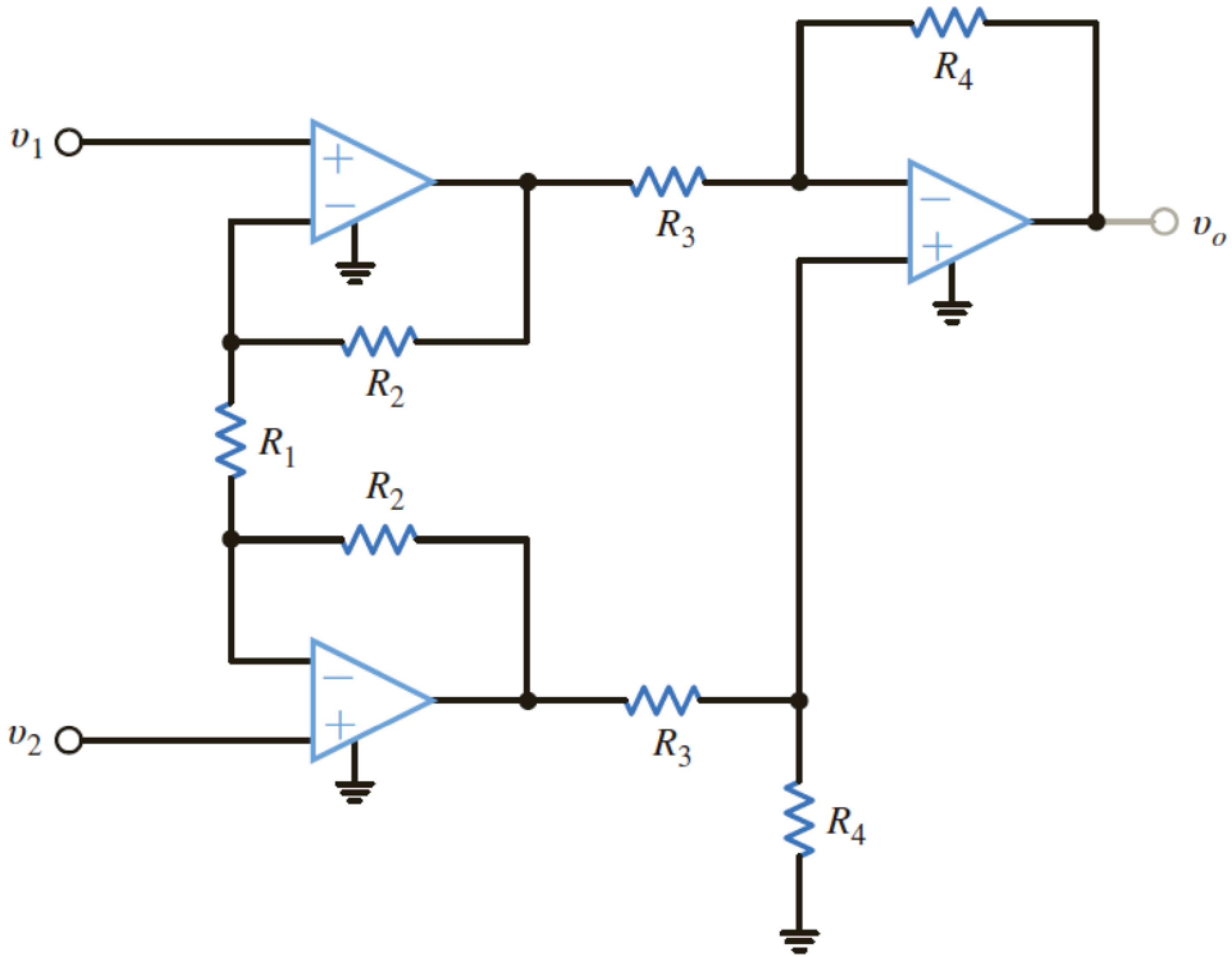
Learning Assessment E6.10

For the provided circuit find the energy stored in the capacitor and the inductor.



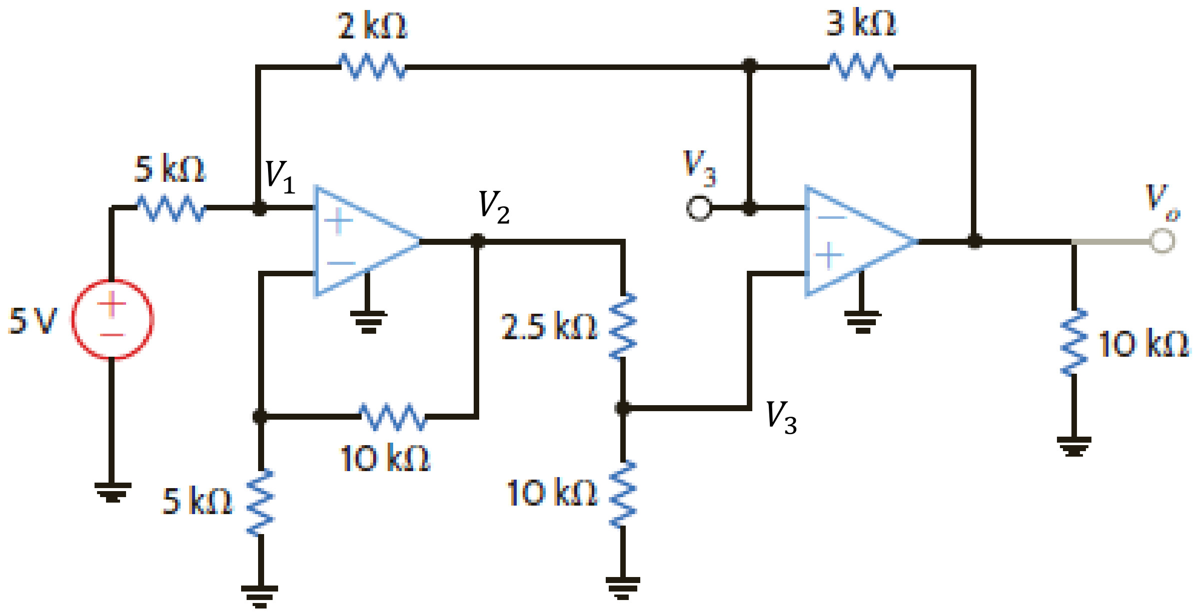
Problem 4.43

Assuming ideal op-amp behavior, find the expression for v_0 in terms of (v_2-v_1).



Learning Assessment – E4.6

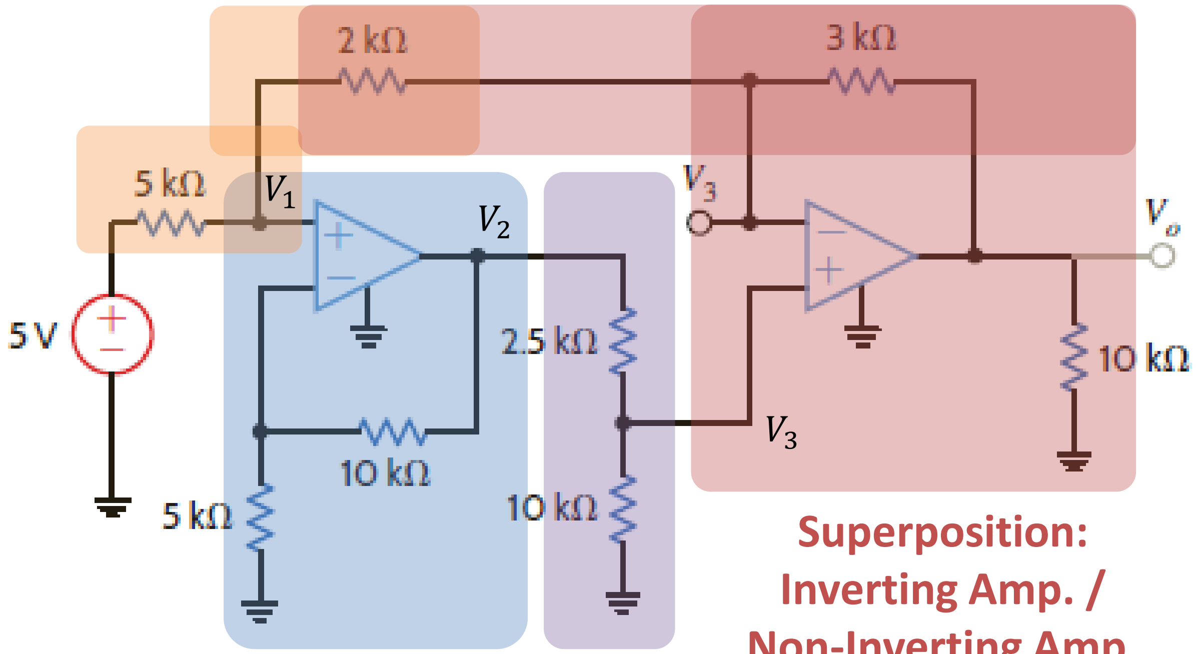
Assuming ideal op-amp behavior find V_0 and V_3 in the provided circuit.



Learning Assessment – E4.6

Assuming ideal op-amp behavior find V_0 and V_3 in the provided circuit.

Superposition: Voltage Divider



Superposition: Inverting Amp. / Non-Inverting Amp.

Non-Inverting Amp.

Voltage Divider

$$V_2 = \left[1 + \frac{10k}{5k}\right] V_1 = 3 \cdot V_1$$

$$V_3 = \left[\frac{10k}{10k + 2.5k}\right] V_2 = \frac{4}{5} \cdot V_2 = \frac{12}{5} \cdot V_1$$

$$V_0 = \left[1 + \frac{3k}{2k}\right] V_3 - \left[\frac{3k}{2k}\right] V_1$$

$$= \frac{5}{2} \cdot V_3 - \frac{3}{2} \cdot V_1 = 6 \cdot V_1 - \frac{3}{2} \cdot V_1 = \frac{9}{2} \cdot V_1$$

$$V_1 = \left[\frac{2k}{7k}\right] 5 + \left[\frac{5k}{7k}\right] V_3 = \frac{10}{7} + \frac{12}{7} \cdot V_1$$

$$\therefore V_1 = -2V$$

$$\therefore V_0 = -9V$$

$$\therefore V_3 = -4.8V$$