

EELE 250: Circuits, Devices, and Motors

Lecture 4

Assignment Reminder

- Read 2.4 - 2.7
- Practice problems:
 - P2.34, P2.36, P2.37, P2.48, P2.49, P2.53
 - P2.67, P2.68, P2.71
- D2L Quiz #2 by 5PM on Friday. NOTE that the quiz requires equation solving, so be ready to do linear algebra!

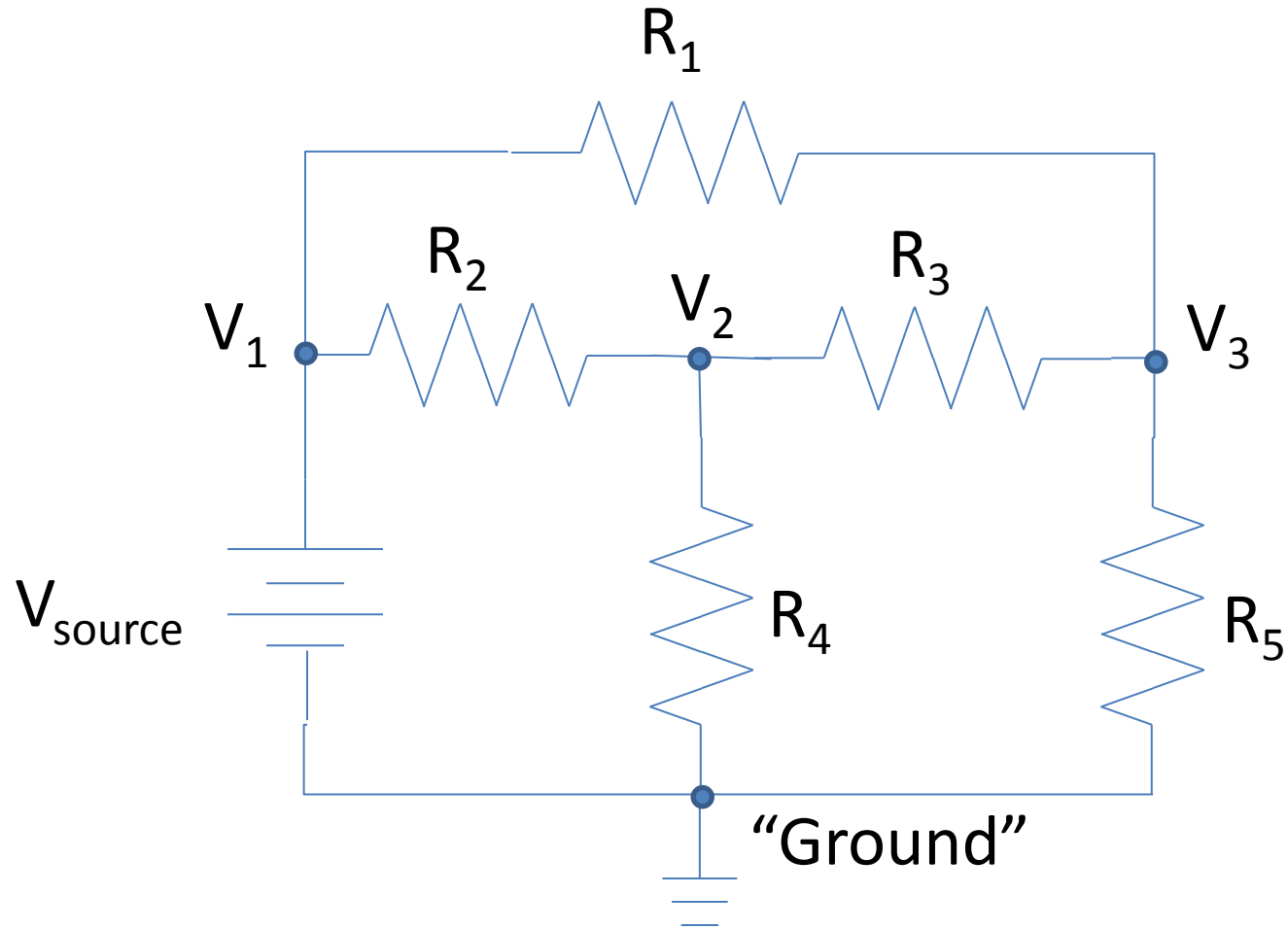
Circuit Analysis

- General techniques to find currents and voltages in electrical networks
- Use KVL, KCL, and Ohm's Law
- Remember: voltages and currents can be positive or negative, so be meticulous with the math!

Node-Voltage Analysis

- Identify all the nodes in the circuit
- Assign one of the nodes to be the reference point, referred to as the “ground” node
- Label the other nodes as V_1 , V_2 , etc. These unknown voltages are with respect to the “ground” node.
- Write a KCL expression at each node, and solve for the unknown voltages

Node Voltage Example



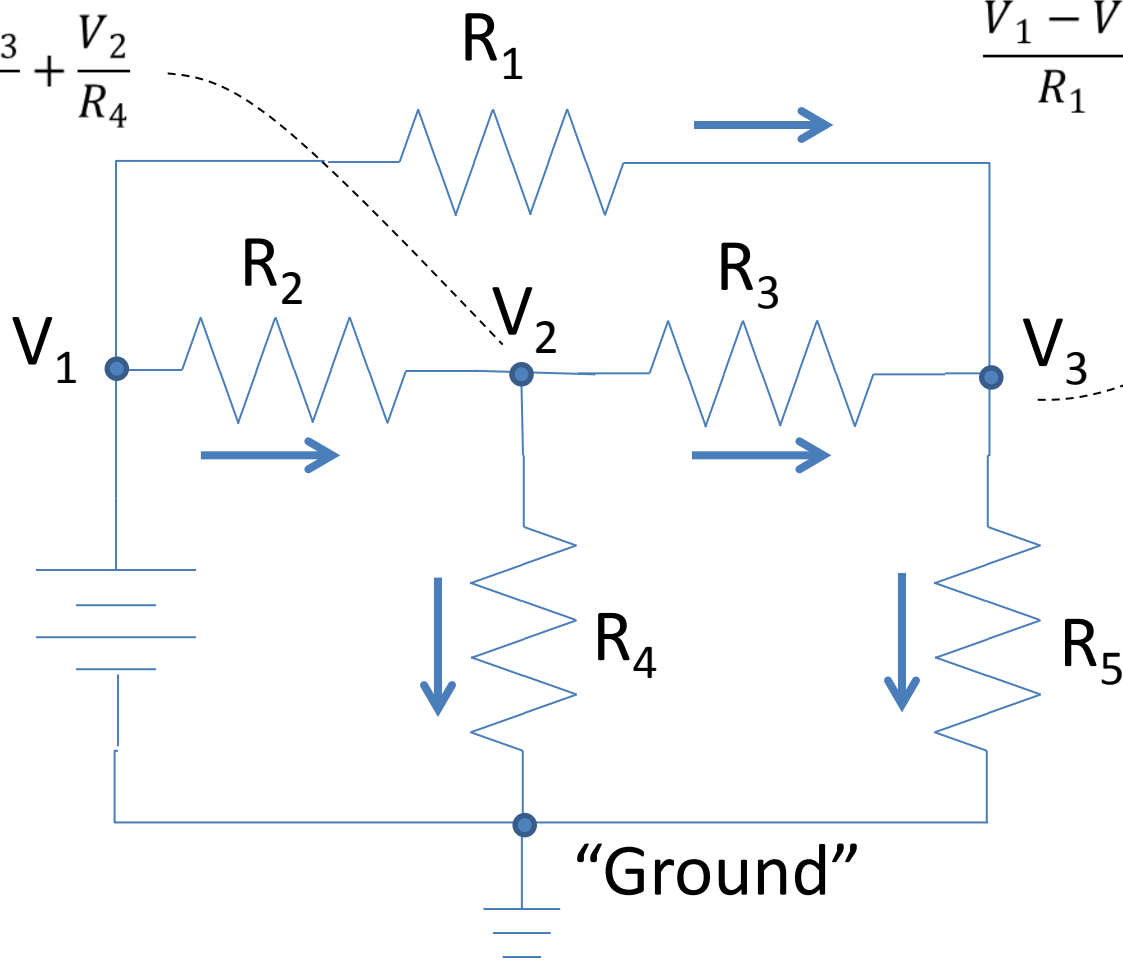
Node Voltage Example

$$\frac{V_1 - V_2}{R_2} = \frac{V_2 - V_3}{R_3} + \frac{V_2}{R_4}$$

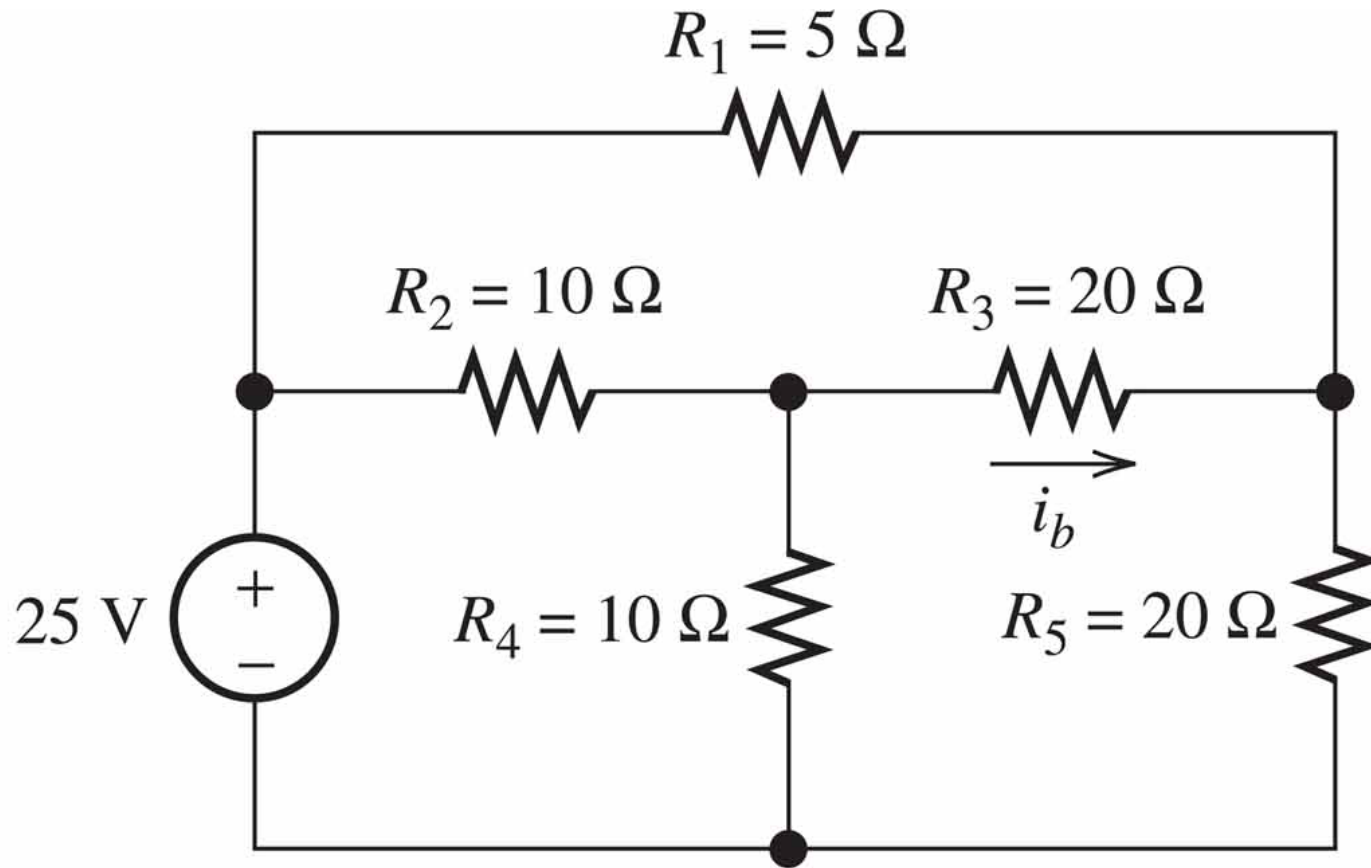
$$\frac{V_1 - V_3}{R_1} + \frac{V_2 - V_3}{R_3} = \frac{V_3}{R_5}$$

$$V_1 = V_{\text{source}}$$

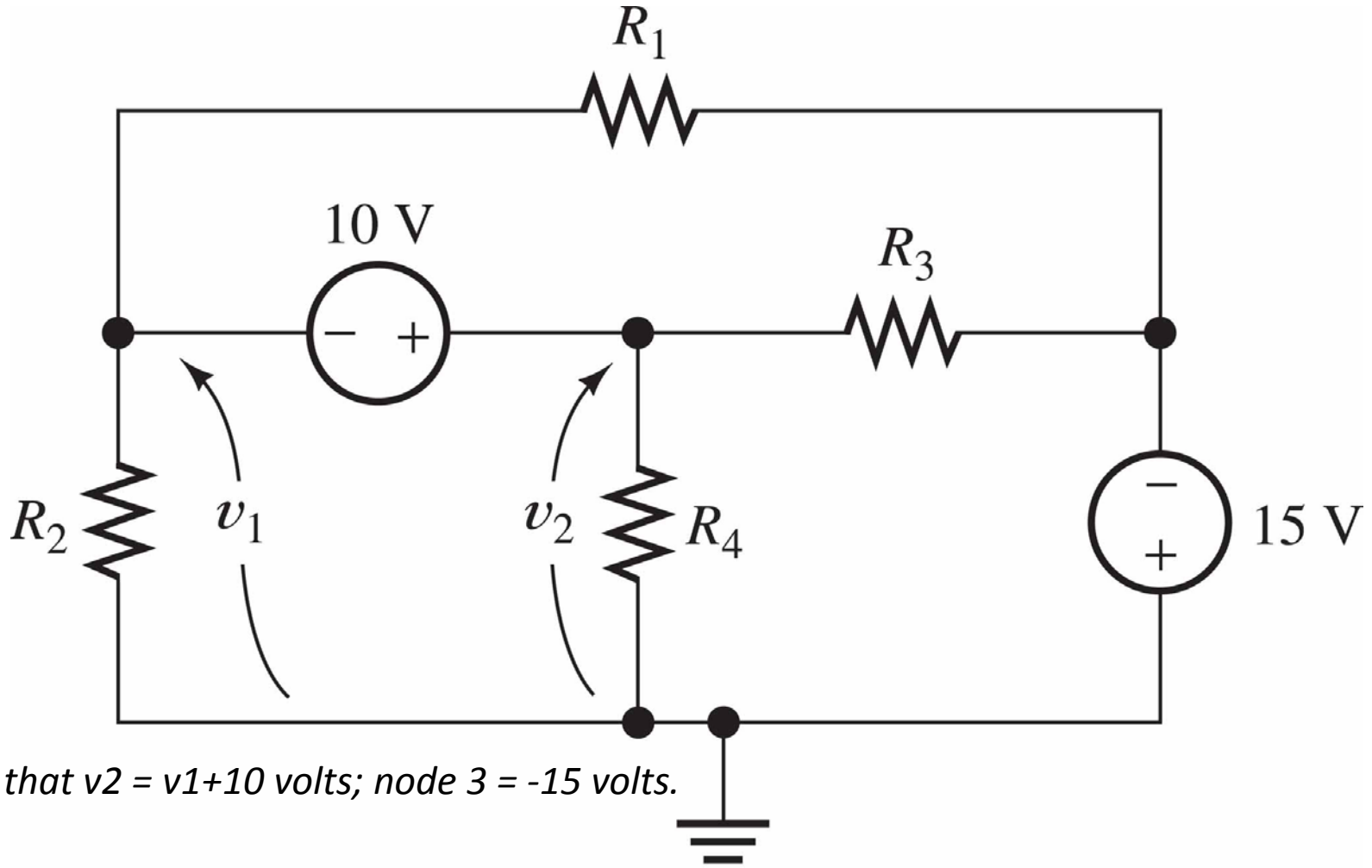
V_{source}



Node Voltage Example



Node Voltage Example



Note that $v_2 = v_1 + 10$ volts; node 3 = -15 volts.

Problem: voltage sources do not constrain current, so how do we write KCL? Need to use “supernode” concept.

Summary and Review

- Nodes
- Assign reference and unknown labels
- Identify any known node voltages
- Write KCL expressions
- Solve for the unknowns
- Remember to keep track of the signs (positive and negative)

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