

# ECE 2100

## Circuit Analysis

### Lesson 4

### Chapter 2

### Kirchhoff's

### Current and Voltage Laws

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# ECE 2100

## Circuit Analysis

**REVIEW:**  
Lesson 3; Chapter 2  
Ohm's Law  
Network Topology:  
nodes, branches, and loops

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A decorative graphic on the left side of the slide features three balloons: a light green one at the top, a light blue one in the middle, and a light purple one at the bottom. Each balloon is attached to a string and has several small yellow triangular shapes radiating from it, resembling sunbeams or confetti. The balloons are positioned vertically along the left edge of the slide.

# ECE 2100

## Circuit Analysis

### Lesson 4

### Chapter 2

### Kirchhoff's

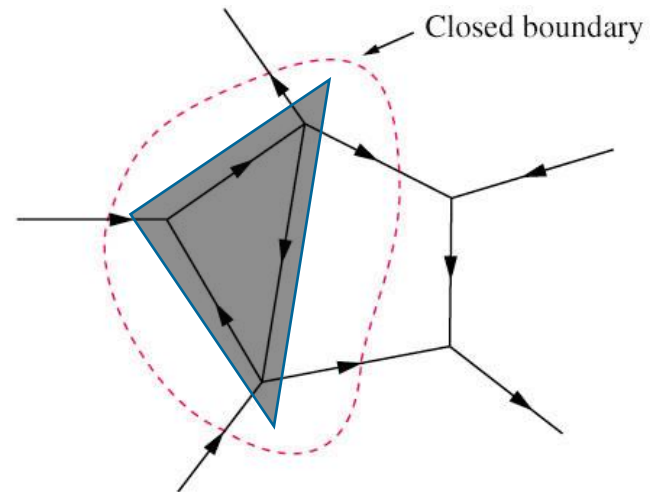
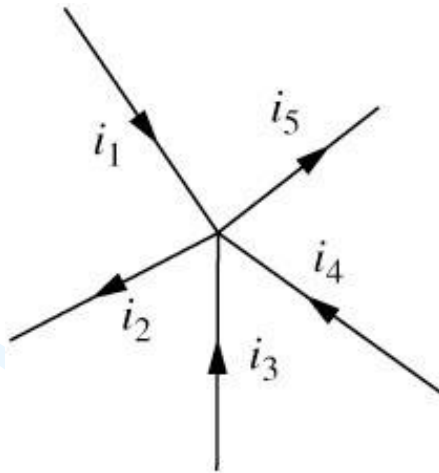
### Current and Voltage Laws

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## 2.3 Kirchhoff's Laws (1)

- Kirchhoff's current law (KCL) states that the algebraic sum of currents entering a node (or a closed boundary) is zero.

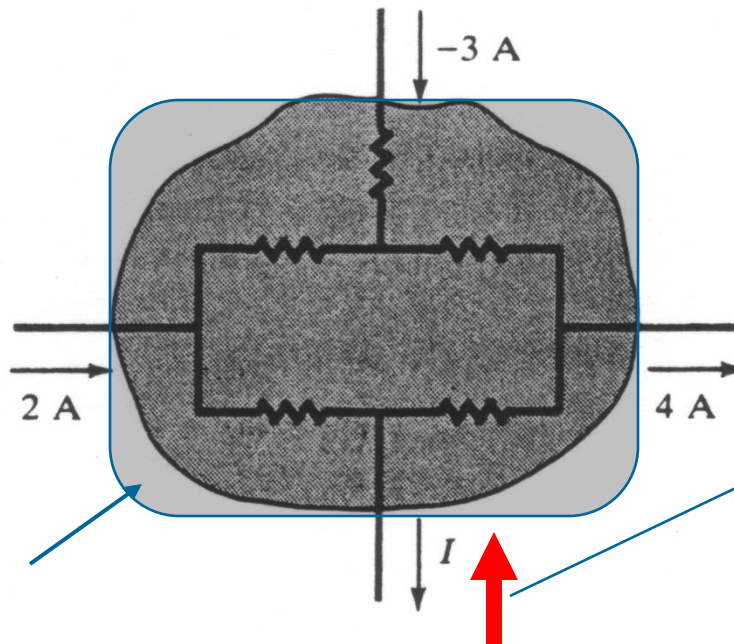


$$\sum_{n=1}^N i_n = 0$$

## 2.3 Kirchhoff's Laws (2)

### Example 4

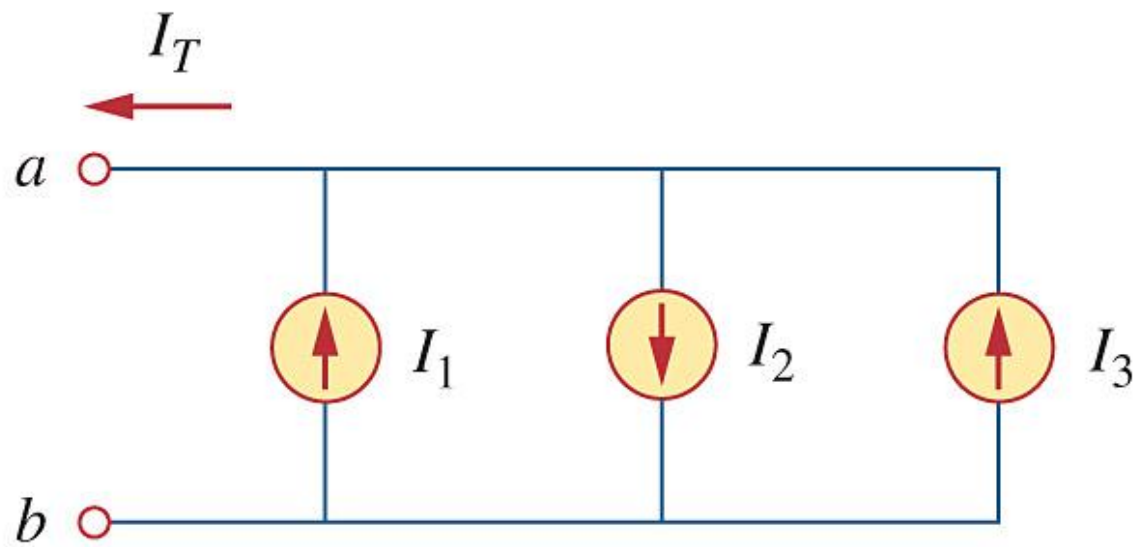
- Determine the current  $I$  for the circuit shown in the figure below.



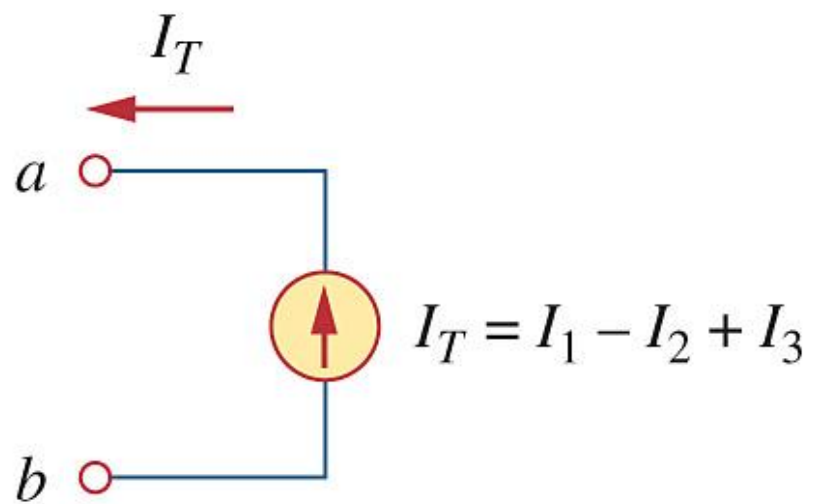
$$I + 4 - (-3) - 2 = 0$$

$$\Rightarrow I = -5\text{ A}$$

This indicates that the actual current for  $I$  is flowing in the opposite direction.

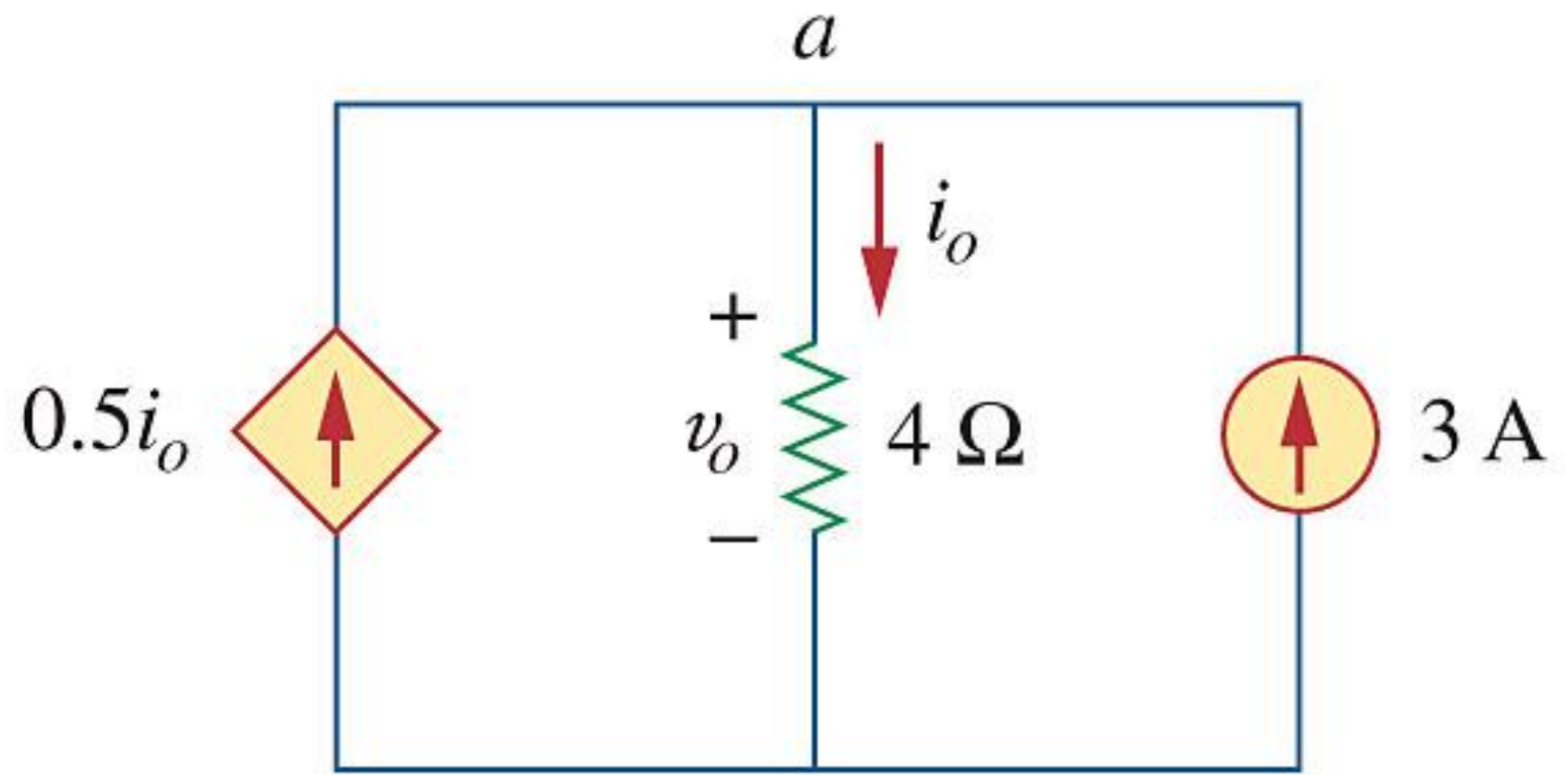


(a)

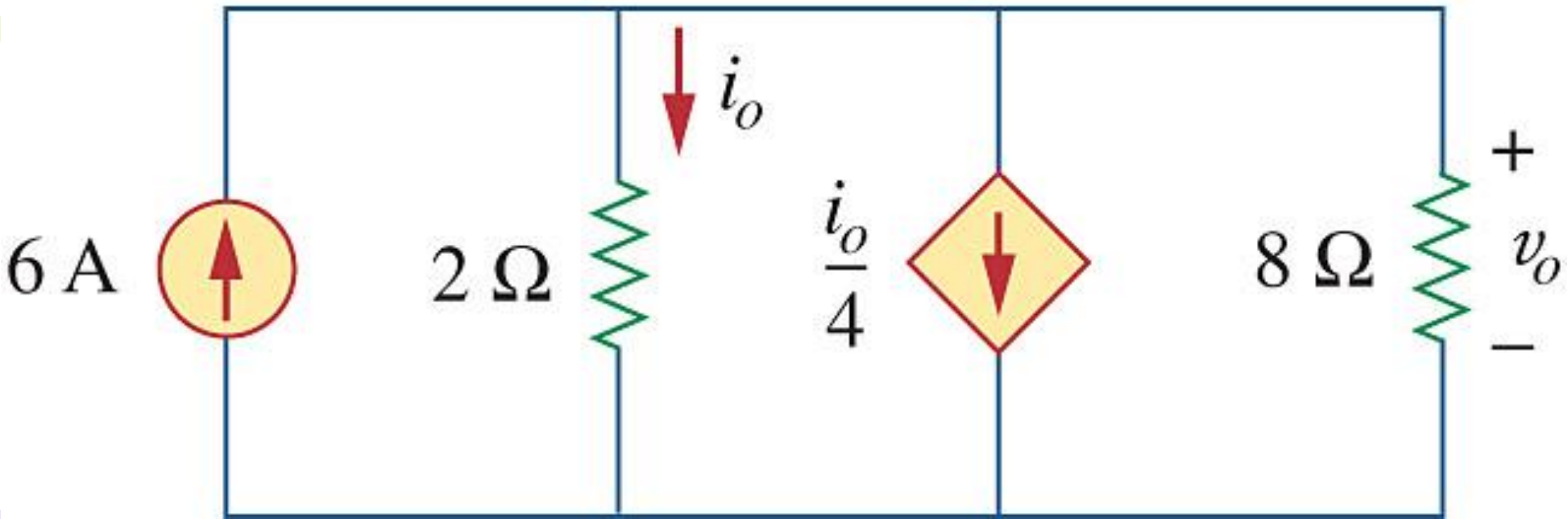


(b)

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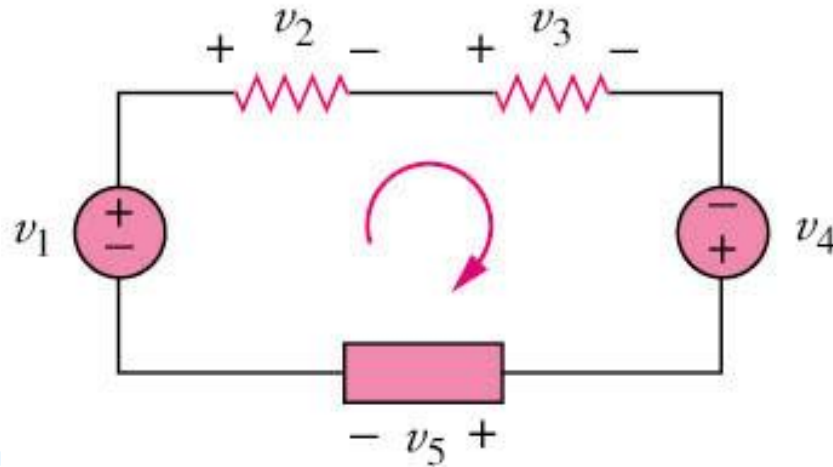


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## 2.3 Kirchhoff's Laws (3)

- Kirchhoff's voltage law (KVL) states that the algebraic sum of all voltages around a closed path (or loop) is zero.

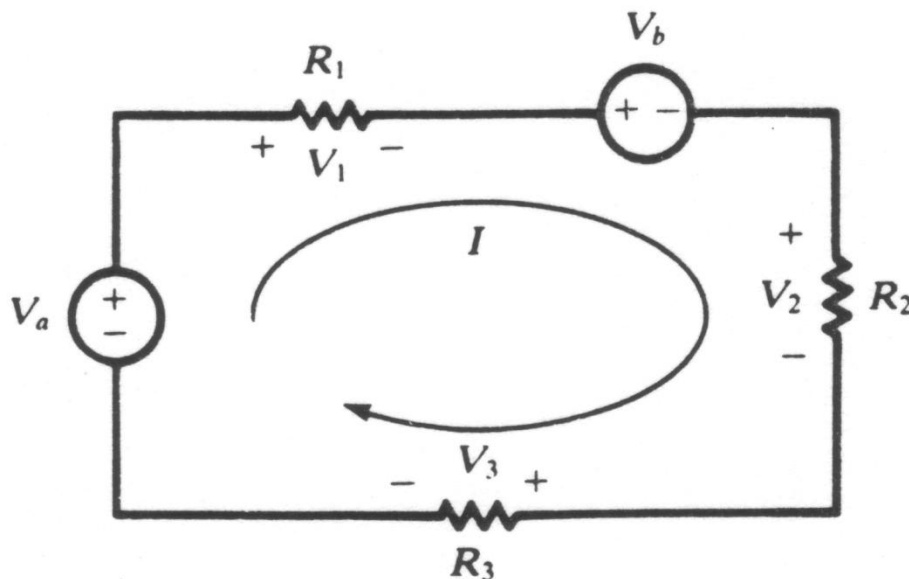


$$\sum_{m=1}^M v_n = 0$$

## 2.3 Kirchhoff's Laws (4)

### Example 5

- Applying the KVL equation for the circuit of the figure below.



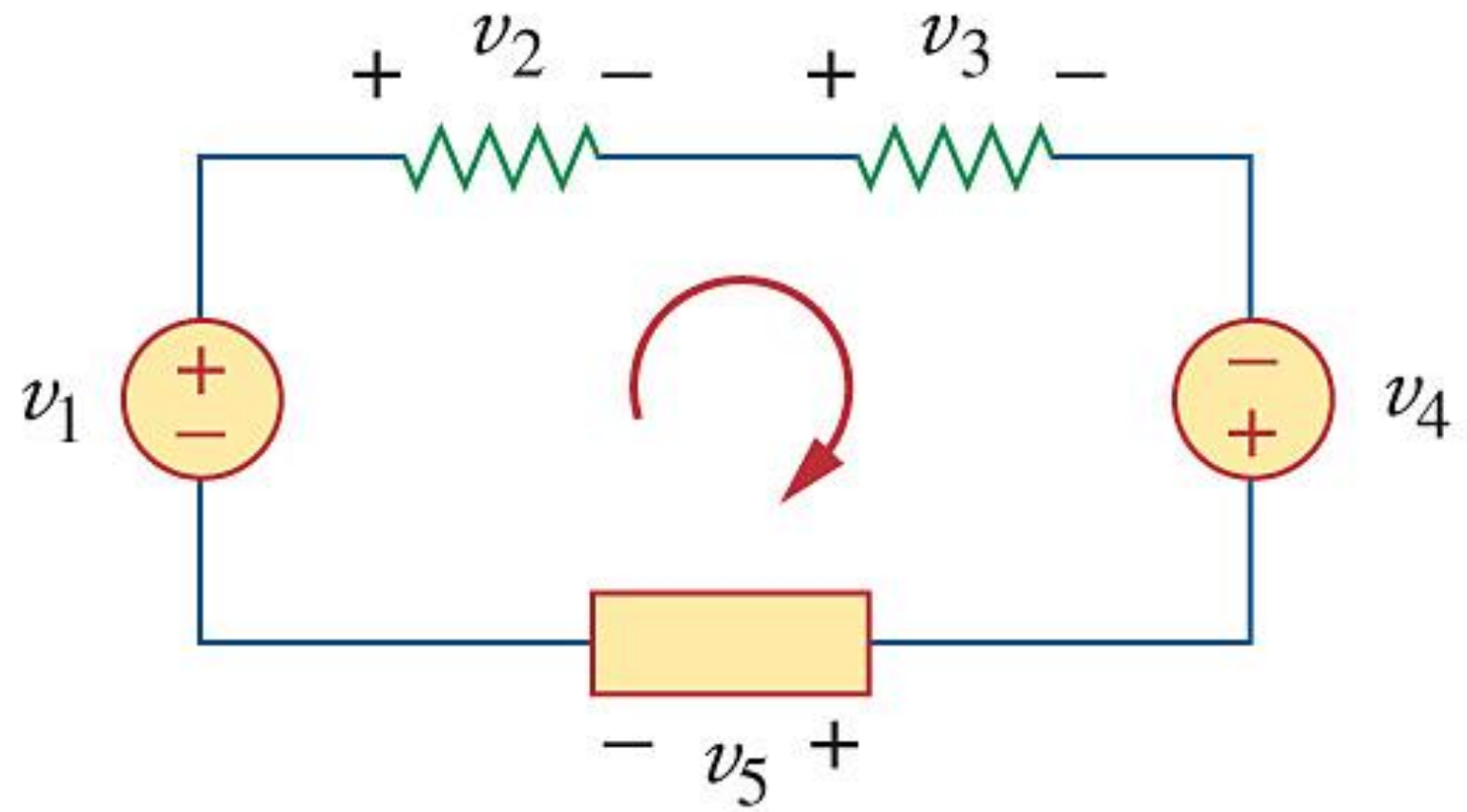
$$V_a - V_1 - V_b - V_2 - V_3 = 0$$

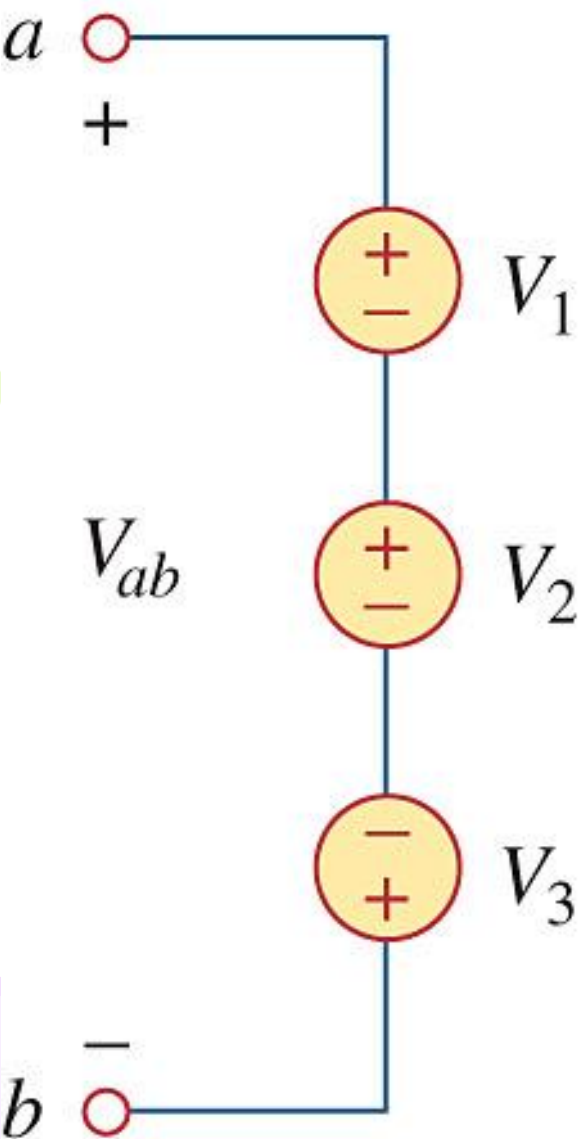
$$V_1 = IR_1 \quad V_2 = IR_2 \quad V_3 = IR_3$$

$$\Rightarrow V_a - V_b = I(R_1 + R_2 + R_3)$$

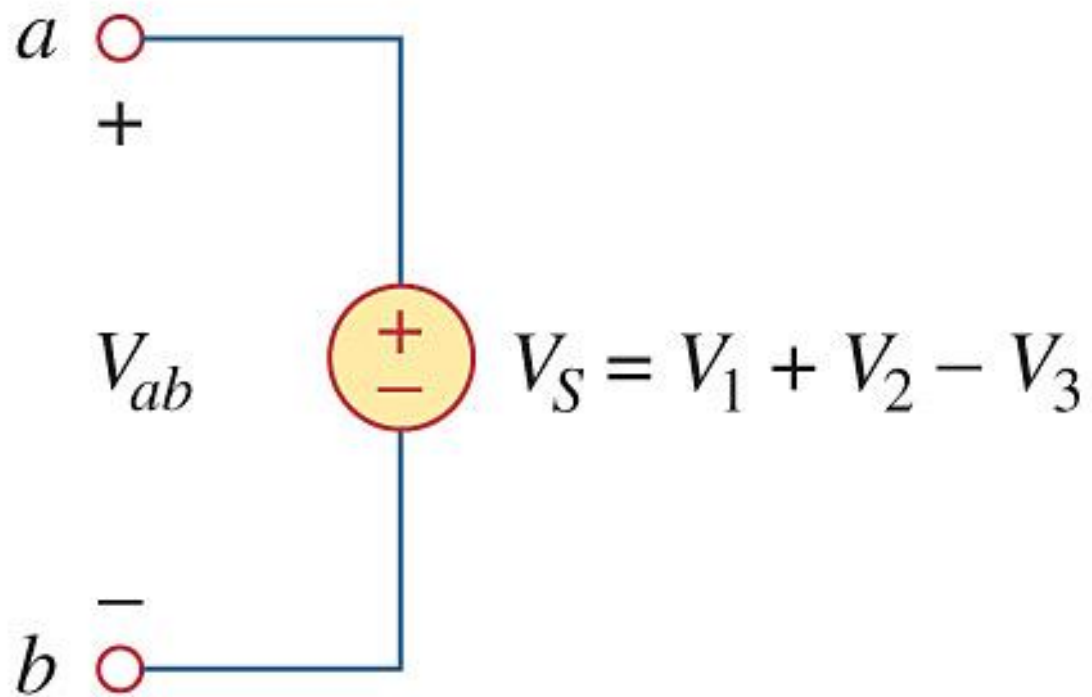
$$I = \frac{V_a - V_b}{R_1 + R_2 + R_3}$$

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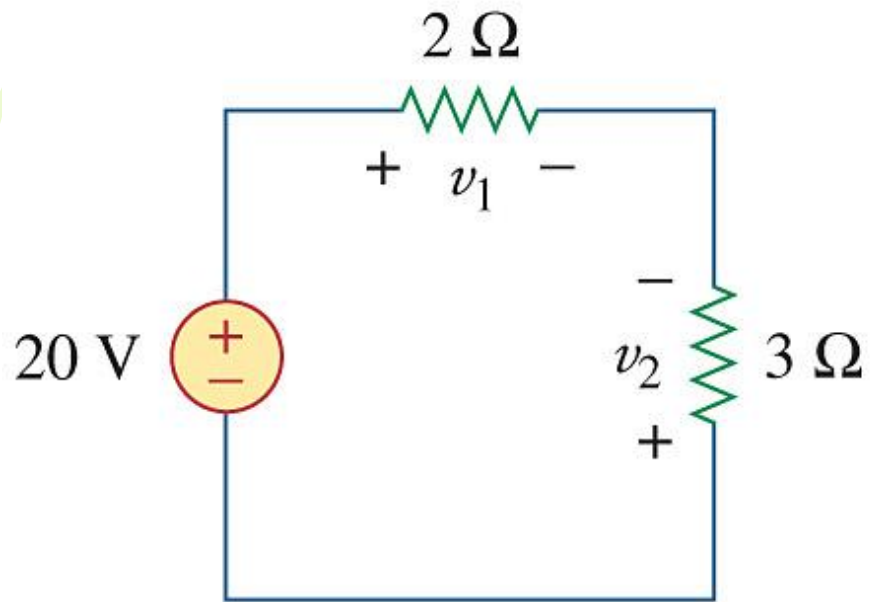


(a)

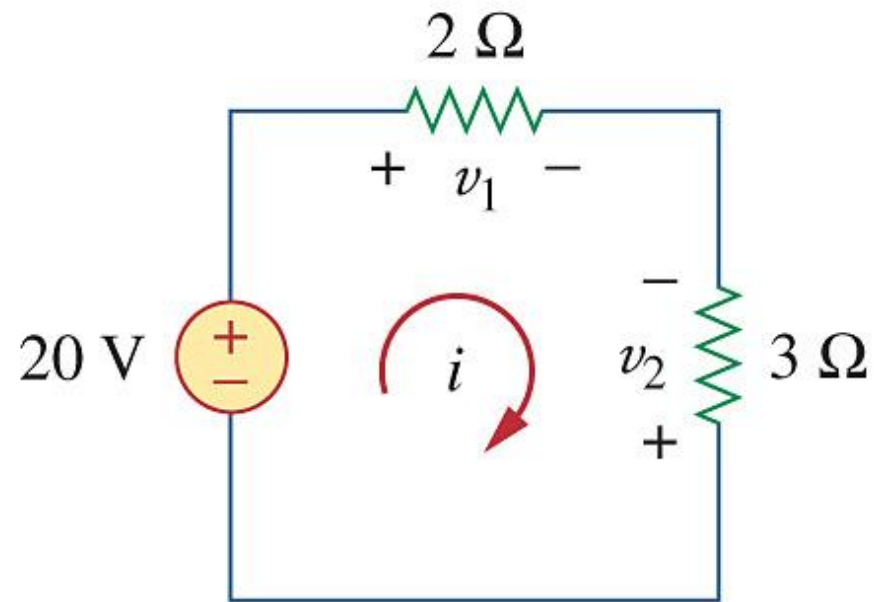


(b)

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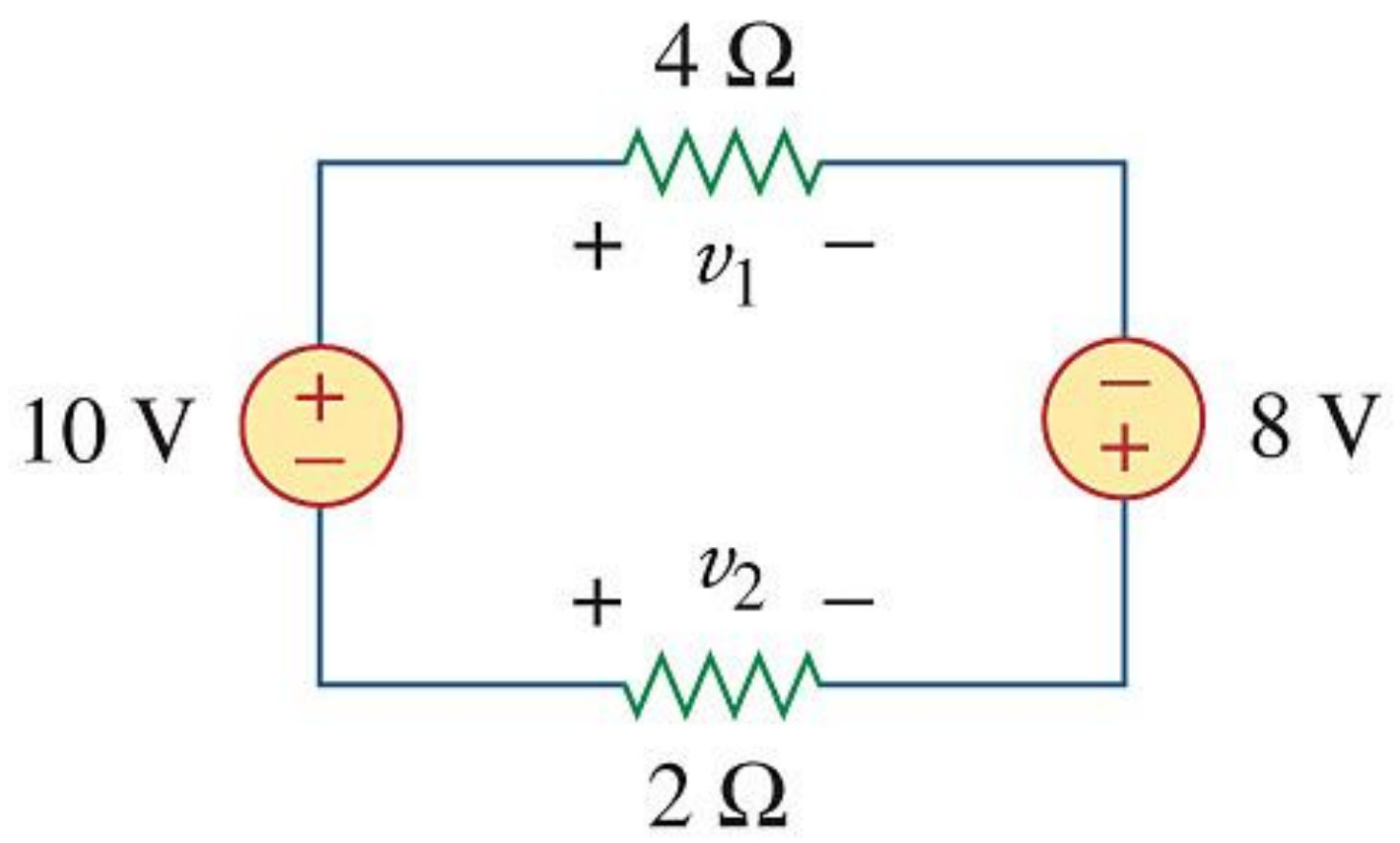
(a)



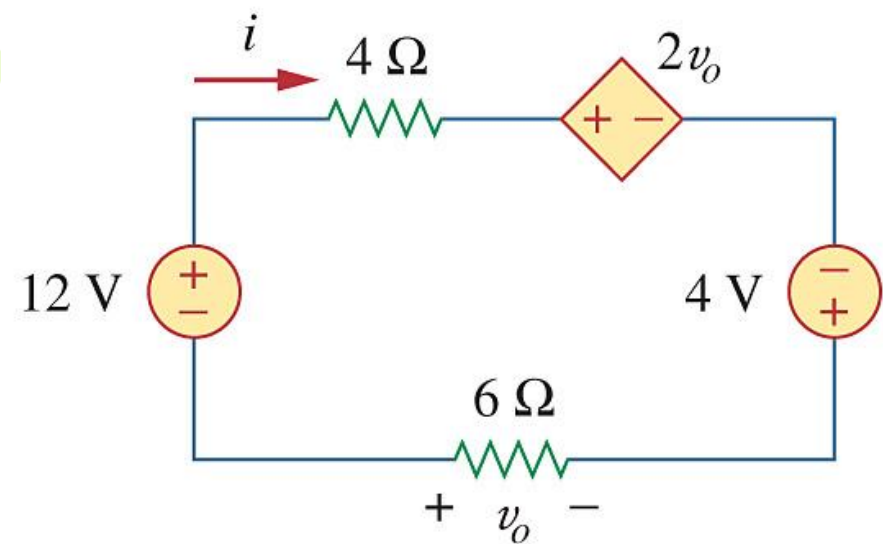
(b)



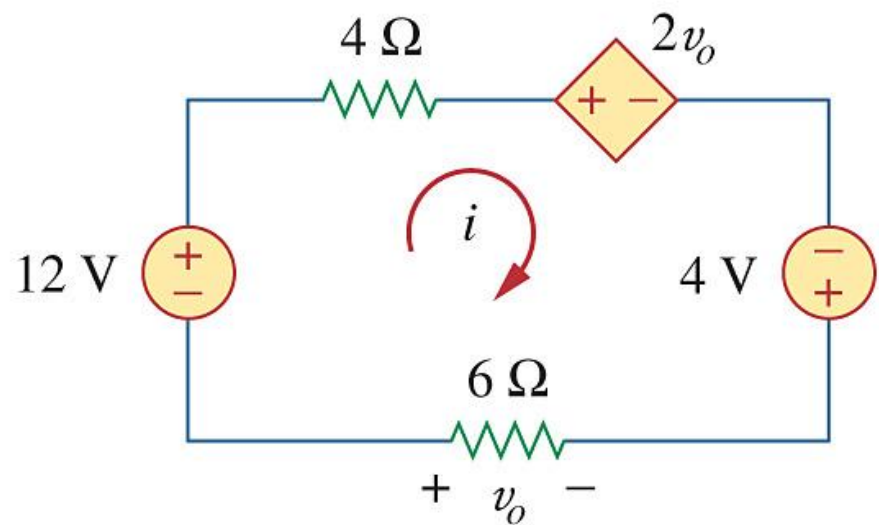
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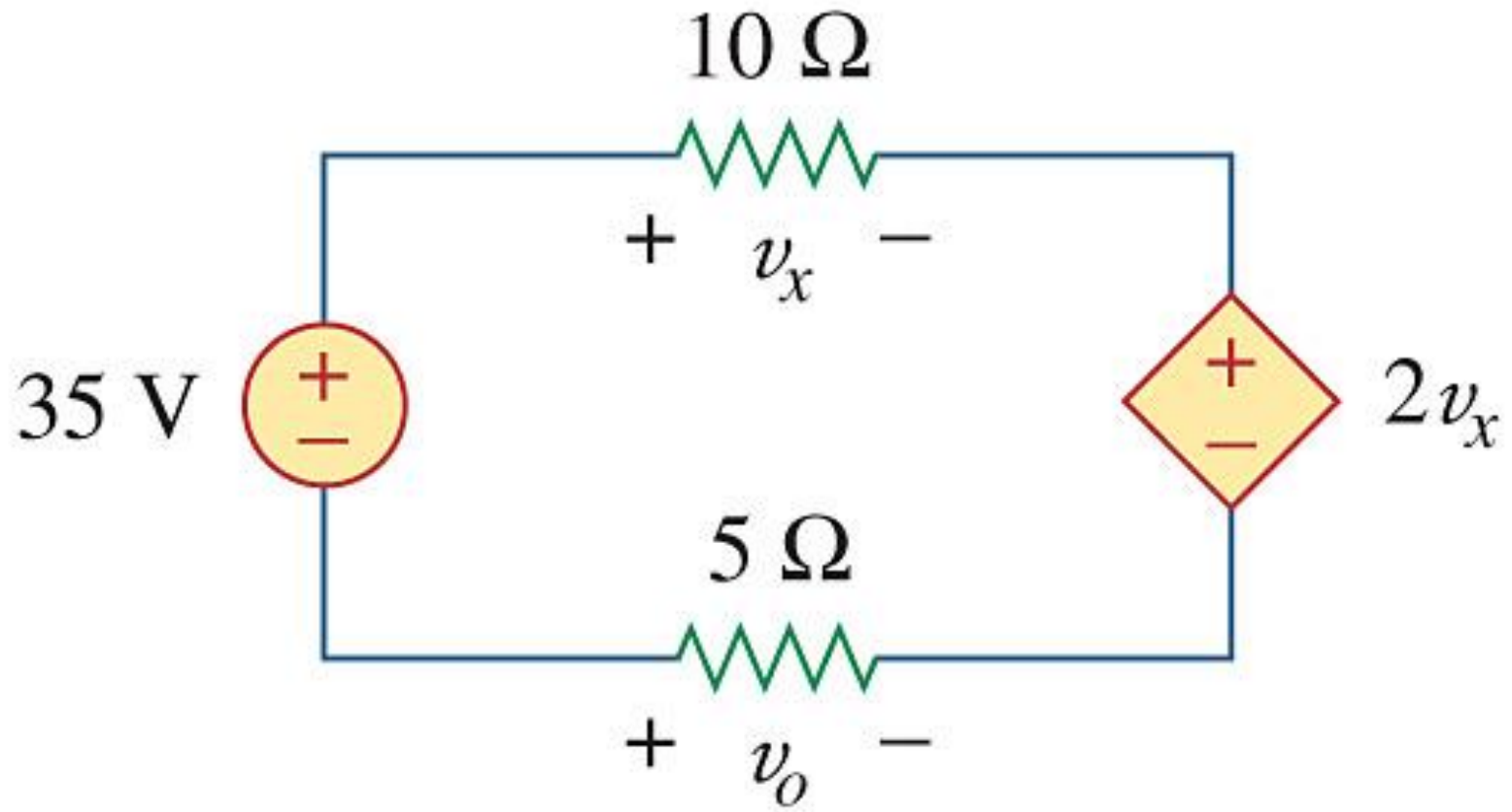


(a)

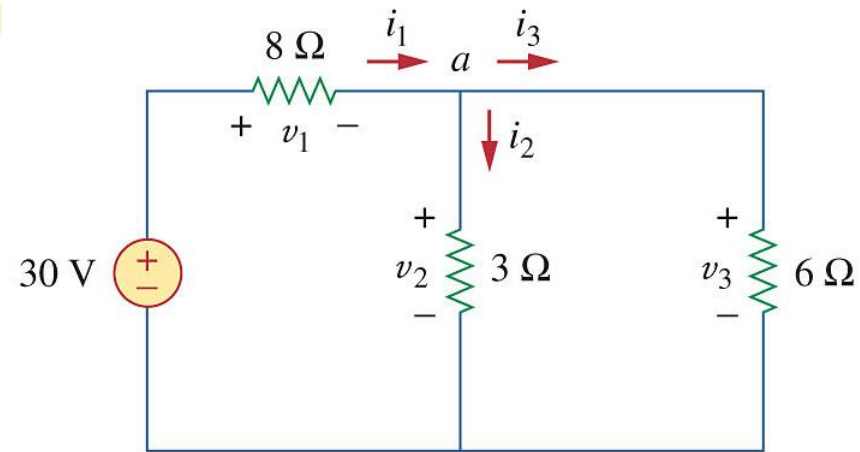


(b)

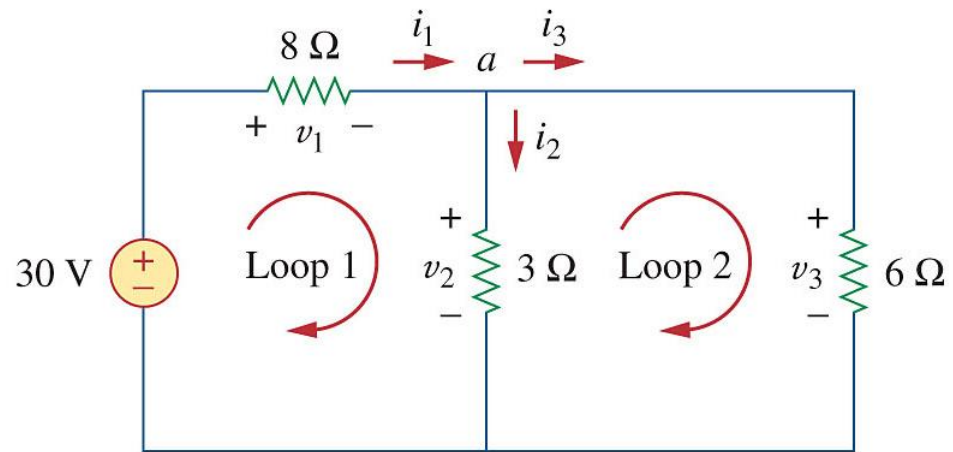
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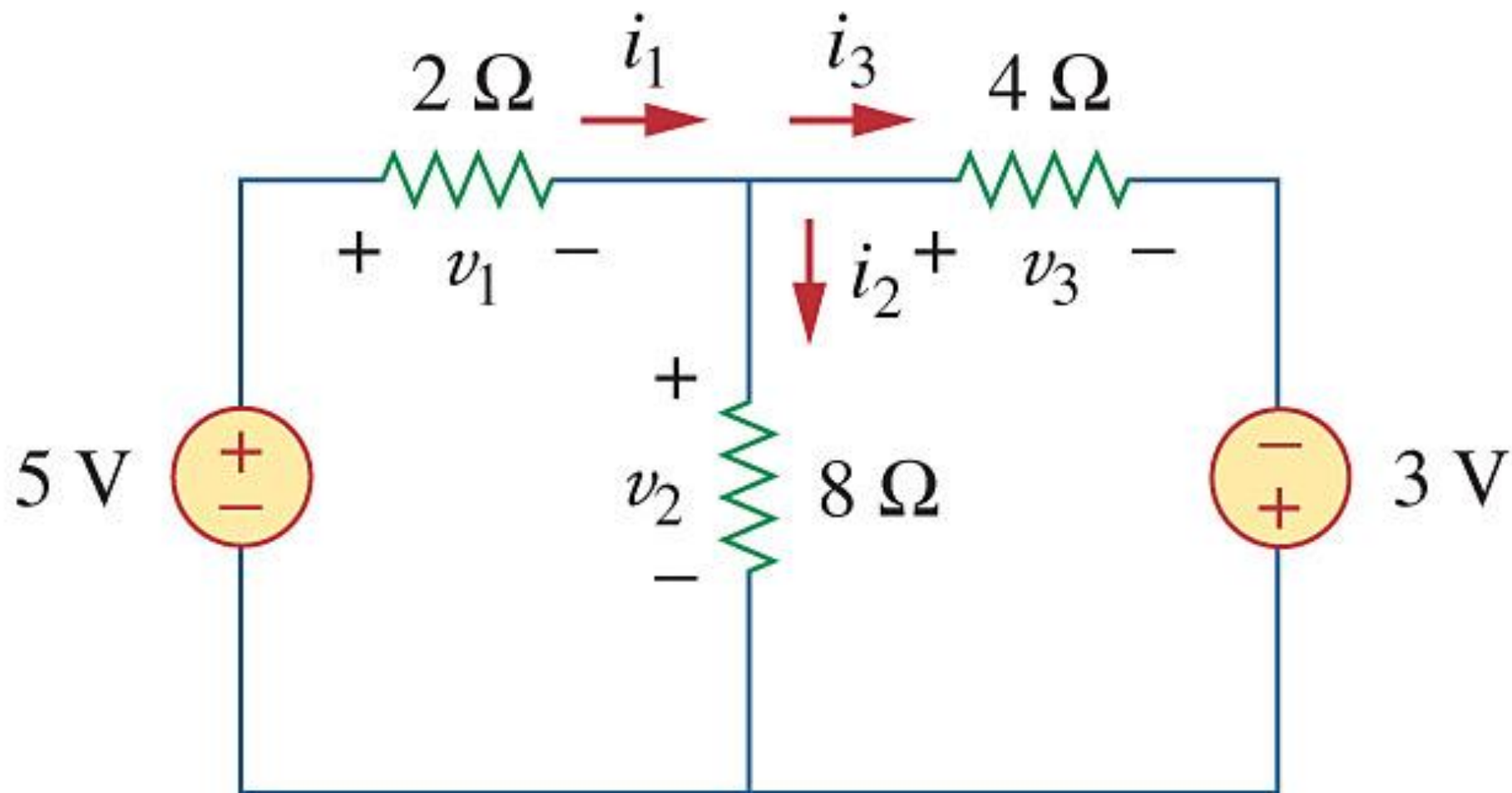



(a)



(b)

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