

# EELE 250: Circuits, Devices, and Motors

## Lecture 2

# Assignment

- Read 1.1 through 1.7
- Read 2.1 through 2.3
- Practice problems:
- P1.12, P1.14, P1.36, P1.37, P1.41, P1.42
- P2.1, P2.6, P2.23, P2.24, P2.27

Then

- TAKE D2L QUIZ before Friday, 5PM

# Polarity

- Voltage and current have *polarity*: positive or negative
- Treat indicated labels like mathematical variables or vectors: result may turn out to be a positive or negative number

# Resistance

- Electrical current generally indicates the flow of electrons.
- Materials conduct electrical current to a greater or lesser degree depending upon their physical properties, including composition, size, and temperature.
  - Easy charge flow: conductors (low resistance)
  - Moderate charge flow: resistors
  - Poor or no charge flow: insulators

# Ohm's Law

- The fundamental relationship between the voltage applied across a resistor and the resulting current through the resistor is known as

Ohm's Law:

- Resistance = Voltage / Current

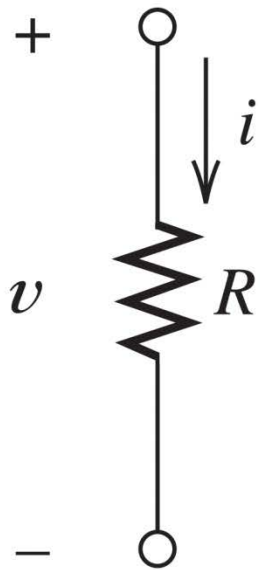
Or

- Voltage = Current \* Resistance

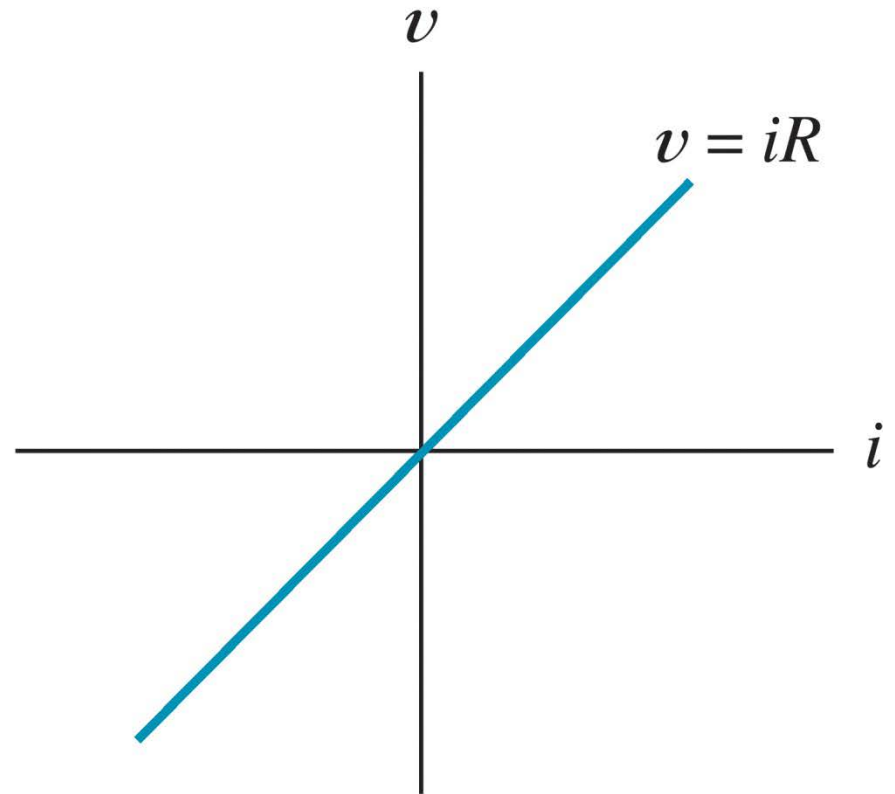
Or

- Current = Voltage / Resistance

# Ohm's Law (cont.)



(a) Resistance symbol



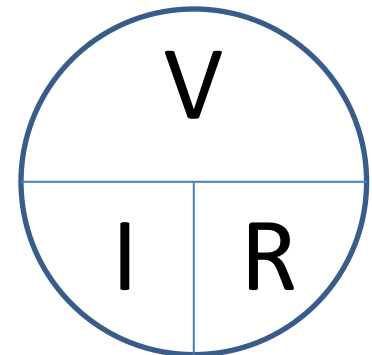
(b) Ohm's law

# Ohm's Law (cont.)

- Voltage is often shown with the letter “V”
- Current is often shown with the letter “I”
- Resistance is often indicated with “R”
- So Ohm's Law can be expressed symbolically:

$$V = I R \quad \text{or} \quad R = V/I \quad \text{or} \quad I = V/R$$

- Resistance is measured in Ohms (symbol  $\Omega$ )



# Kirchhoff's Current Law

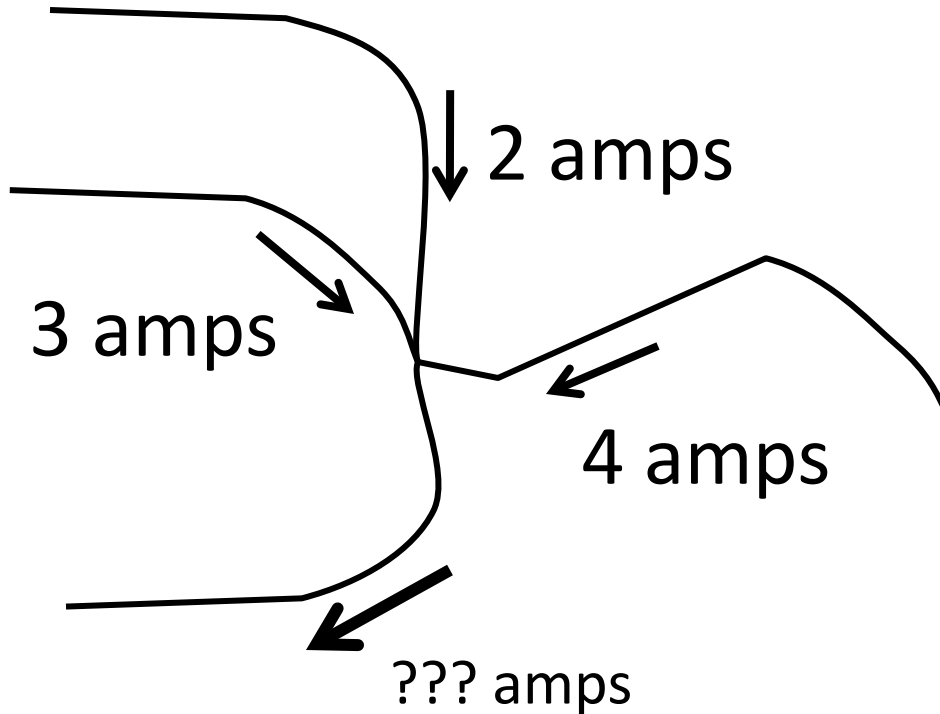
- Circuit junctions are called *nodes*
- Current entering a circuit junction must equal the current exiting the junction
- KCL: what goes in must equal what goes out!
  - Ex/ The number of cars entering an intersection must equal the number of cars leaving the intersection
  - Ex/ The amount of water in a river is equal to the total amount entering from the tributaries



# Kirchhoff's Voltage Law

- When observing a circuit *loop*, the sum of the increases in voltage must equal the sum of the decreases in voltage.
- KVL: the element (branch) voltages around a loop must total to zero.
  - Ex/ If we hike on a loop trail, we end up at the same elevation as we started, no matter how much up and down there may be on the trail

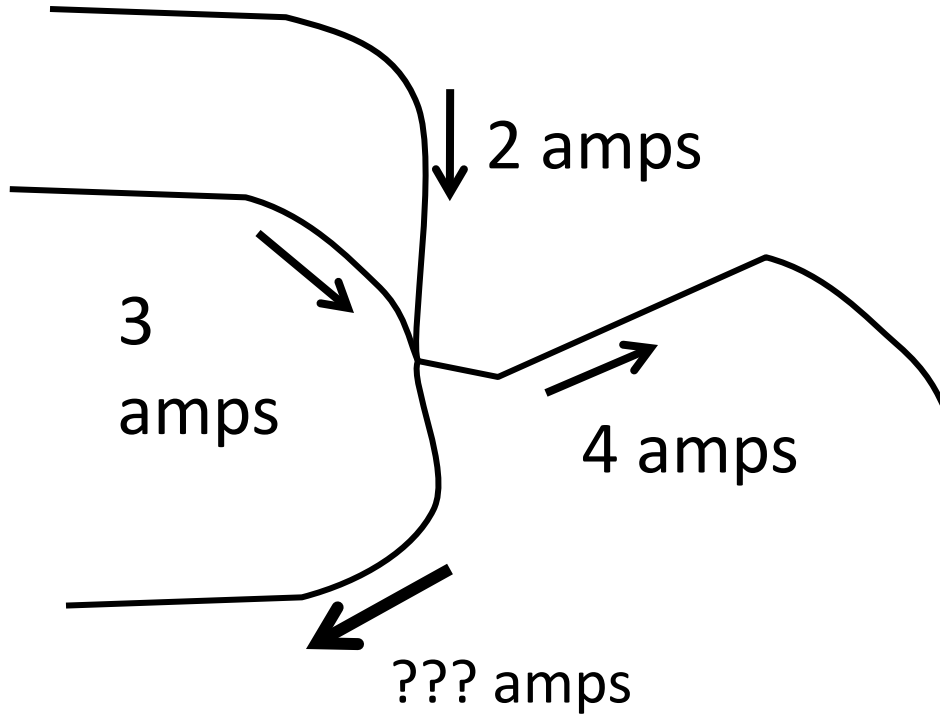
# Question



Is it:

- (A) 4 amps
- (B) 6 amps
- (C) 7 amps
- (D) 9 amps

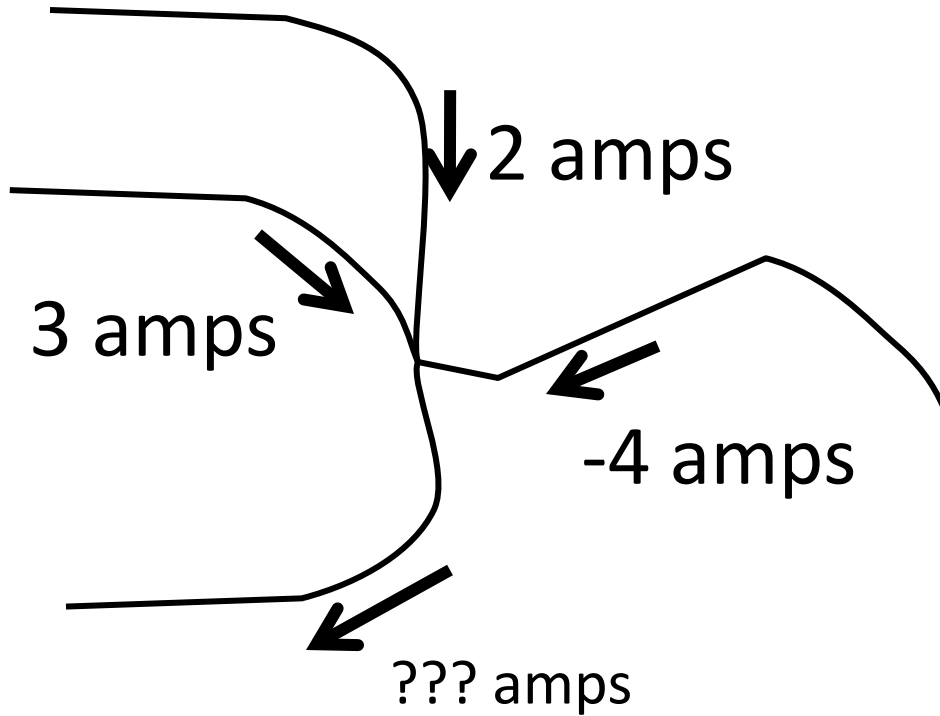
# Question 2



Is it:

- (A) -4 amps
- (B) 0 amps
- (C) 1 amps
- (D) 5 amps

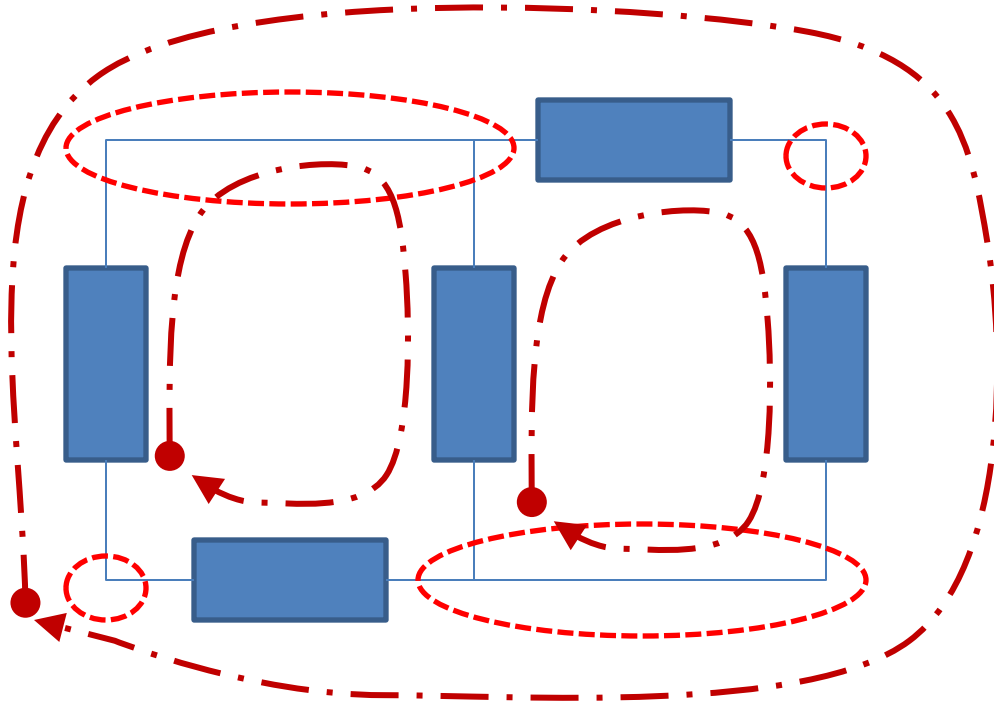
# Question 3



Is it:

- (A) -4 amps
- (B) -1 amps
- (C) 1 amps
- (D) 9 amps

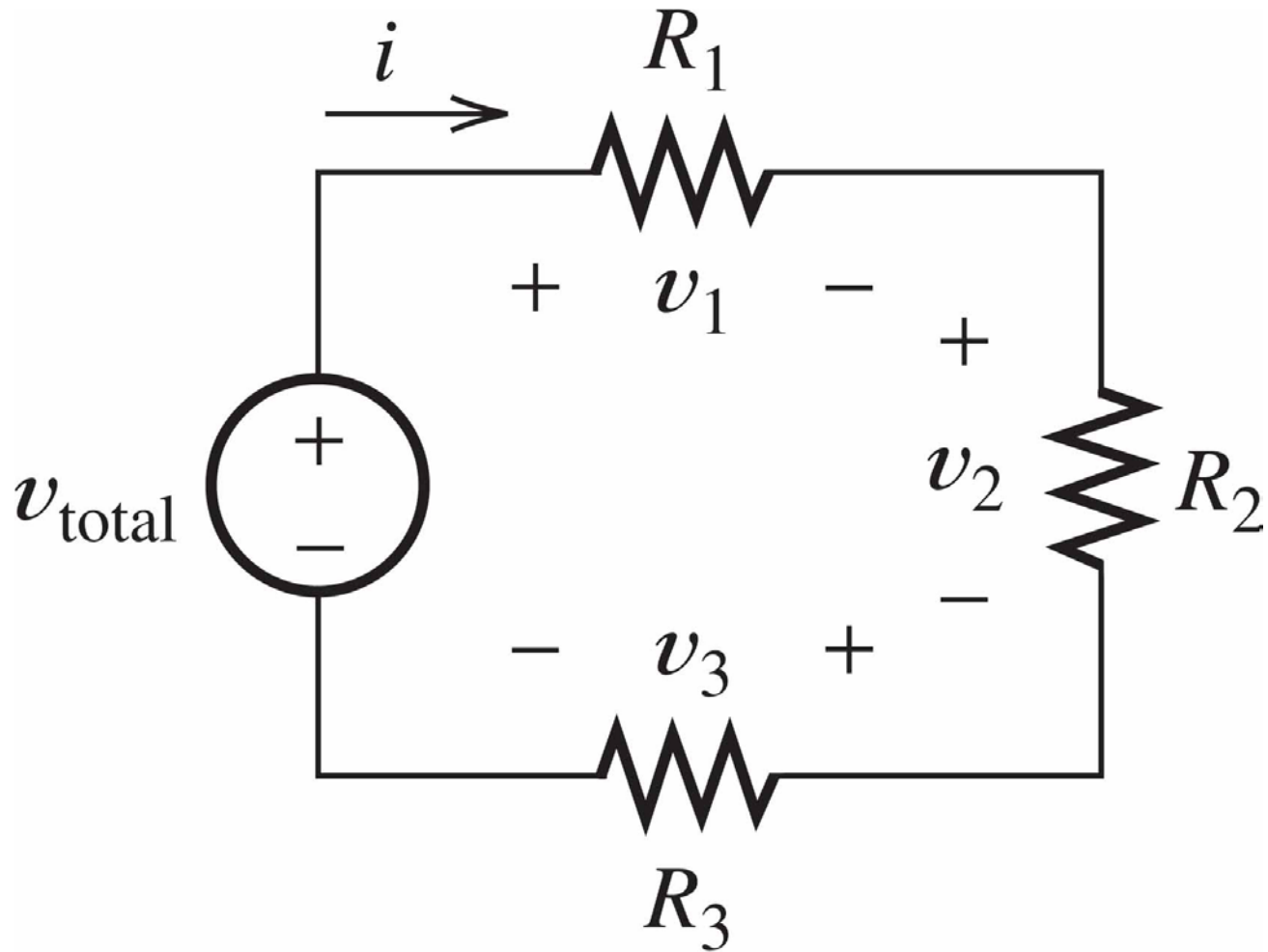
# Circuits: how many loops and nodes?



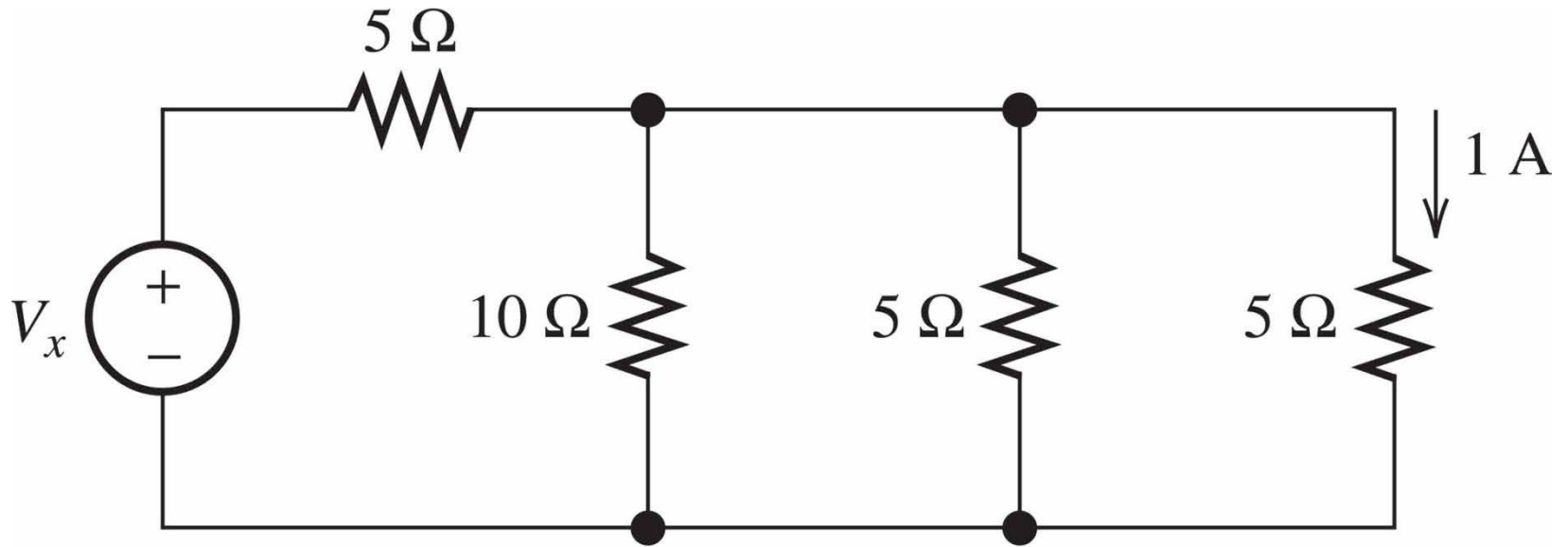
4 Nodes

3 Loops

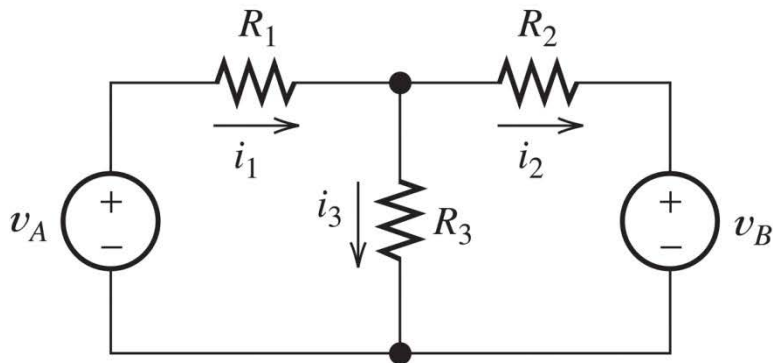
# KVL – Loop Equations



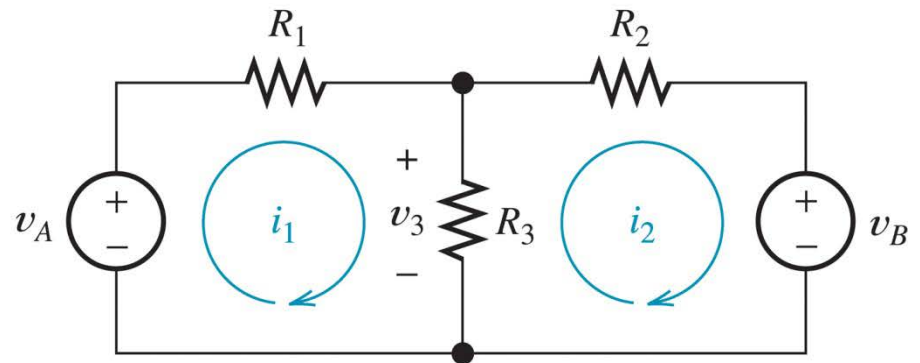
# Circuit Interpretation



# Mesh Current Method



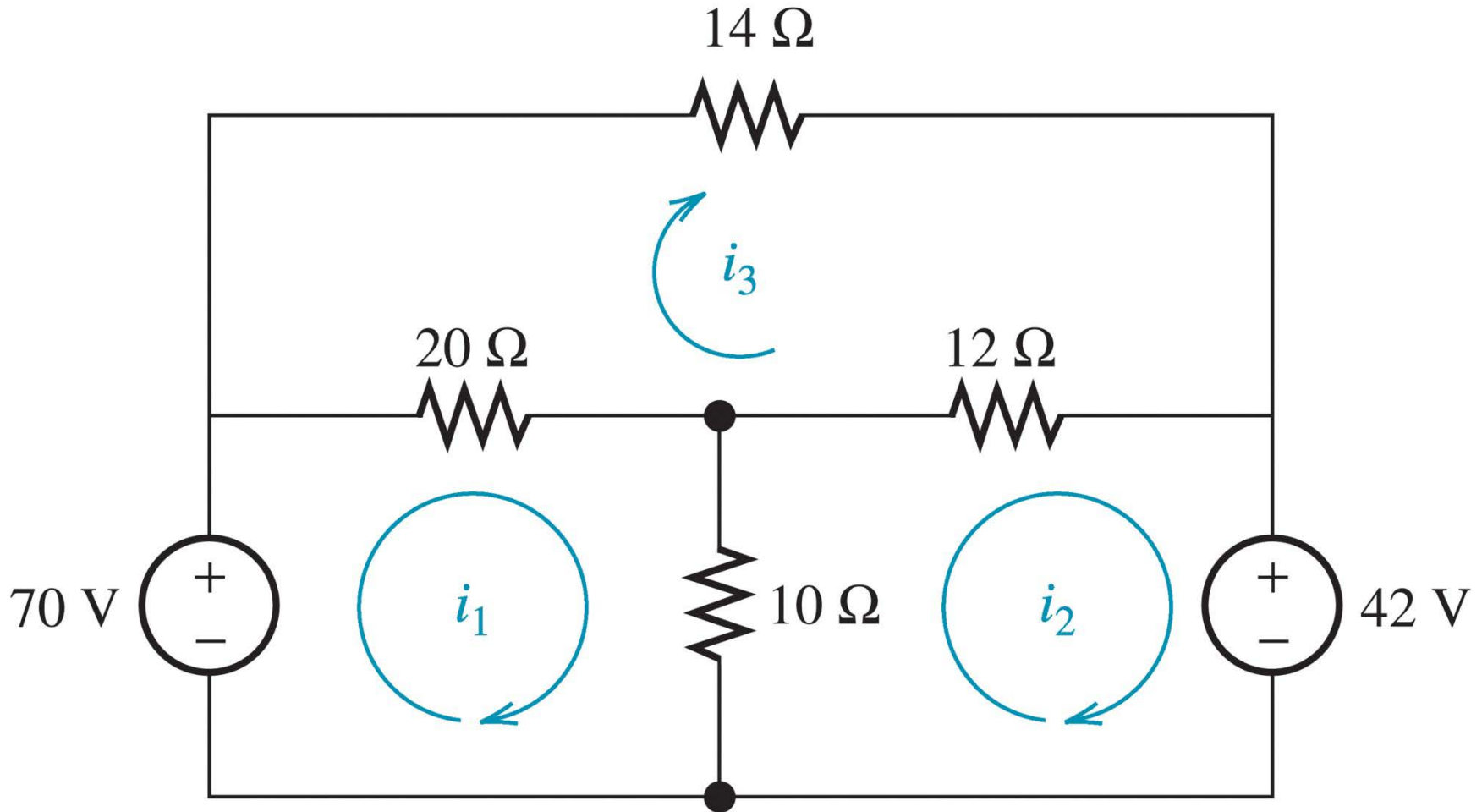
(a) Circuit with branch currents



(b) Circuit with mesh currents



# Mesh Current Method (cont.)



# Summary and Review

- Charge, Current, Voltage
- Circuit Elements, Branches, Loops
- Ohm's Law:  $V=IR$
- KCL
- KVL

# Assignment reminder

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