

EELE 250: Circuits, Devices, and Motors

Lecture 2

Assignment

- Read 1.1 through 1.7
- Read 2.1 through 2.3
- Practice problems (complete before M 9/9/2013):
 - Chapter 1:
1.6, 1.7, 1.9, 1.11, 1.17
1.25, 1.32, 1.38, 1.42, 1.43
 - Chapter 2:
2.1, 2.4, 2.16, 2.25, 2.32, 2.40
2.67, 2.71, 2.77, 2.83, 2.85, 2.97
- TAKE D2L QUIZ this week 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
- It is not “wrong” to have a negative current or a negative voltage, just like it is not wrong to have the value of “x” be negative in an algebraic solution. It’s mathematics!

Resistance

- Electrical current generally indicates the flow of electrons. BUT the convention for current is positive for a positive movement of charge (*opposite* of electron motion).
- 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

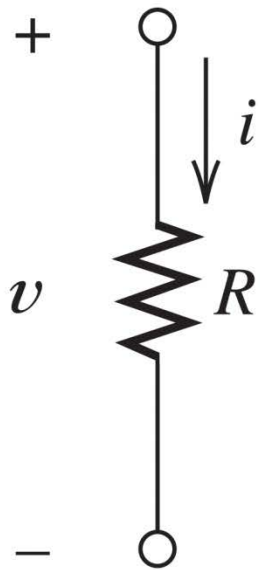
Or

- Voltage = Current * Resistance ("V = I R")

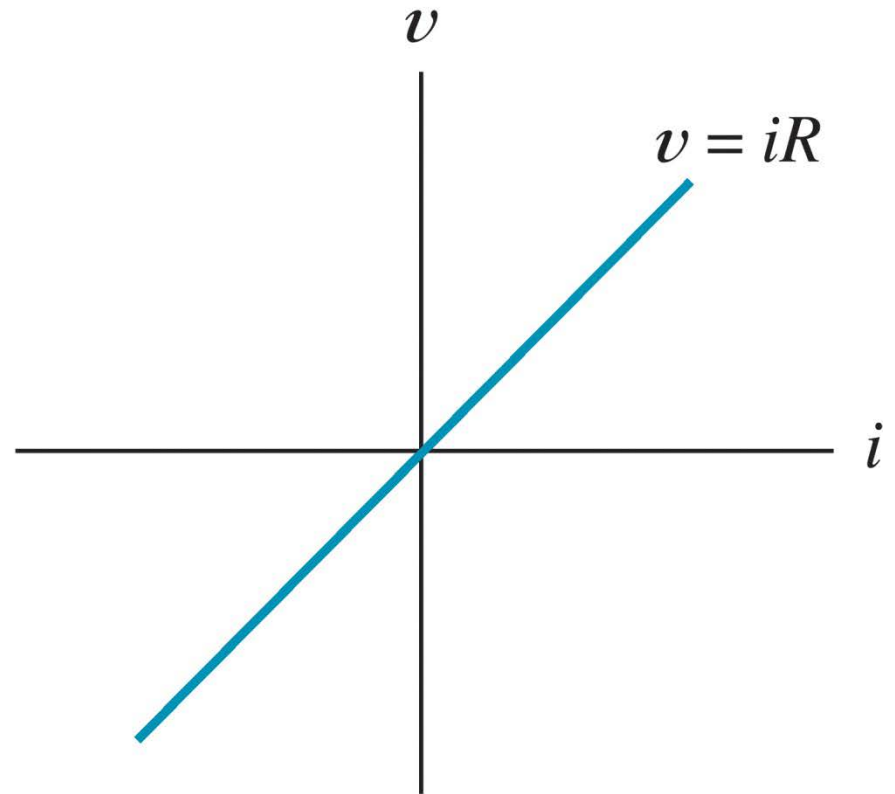
Or

- Current = Voltage / Resistance

Ohm's Law (cont.)



(a) Resistance symbol



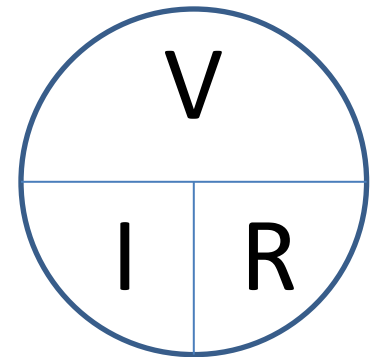
(b) Ohm's law

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 Ω)



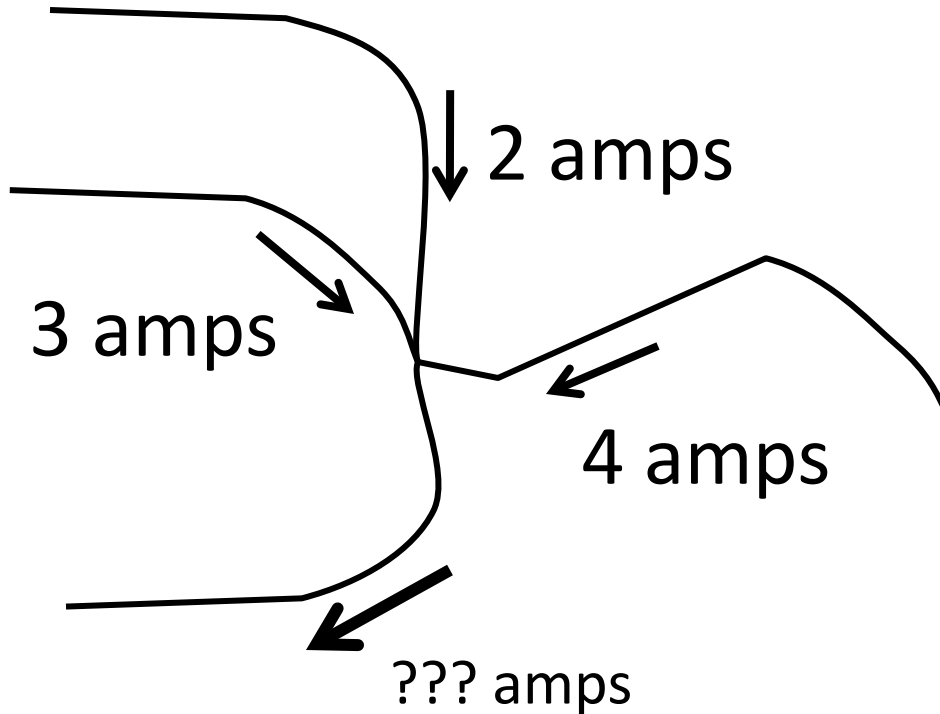
Kirchhoff's Current Law (KCL)

- 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 (KVL)

- When observing a circuit *loop*, the sum of the increases in voltage must equal the sum of the decreases in voltage traversing around the loop.
- 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

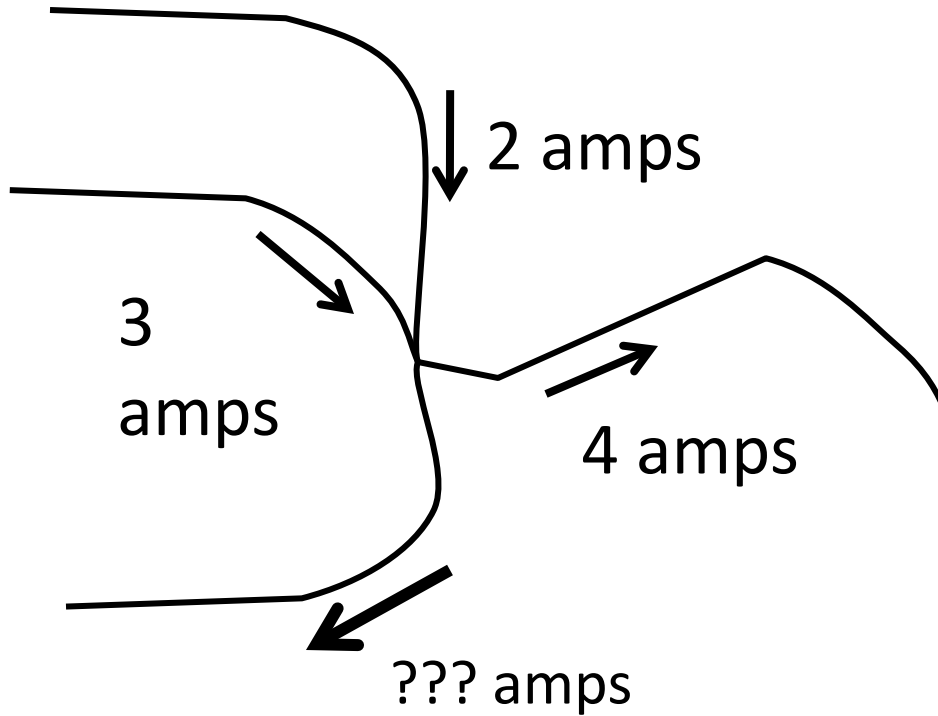
Question



Is it:

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

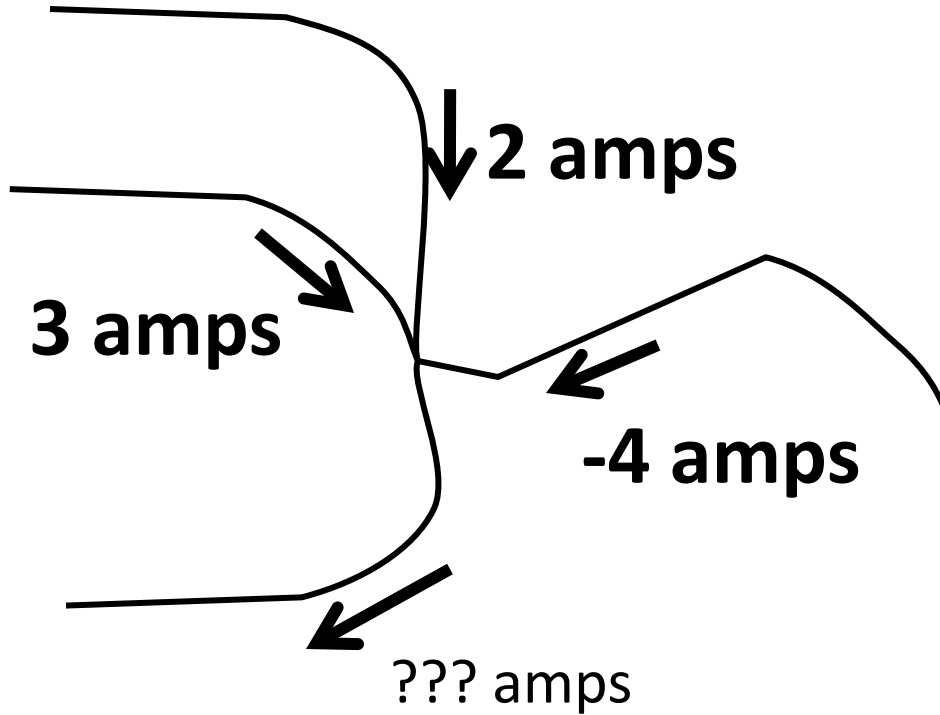
Question 2



Is it:

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

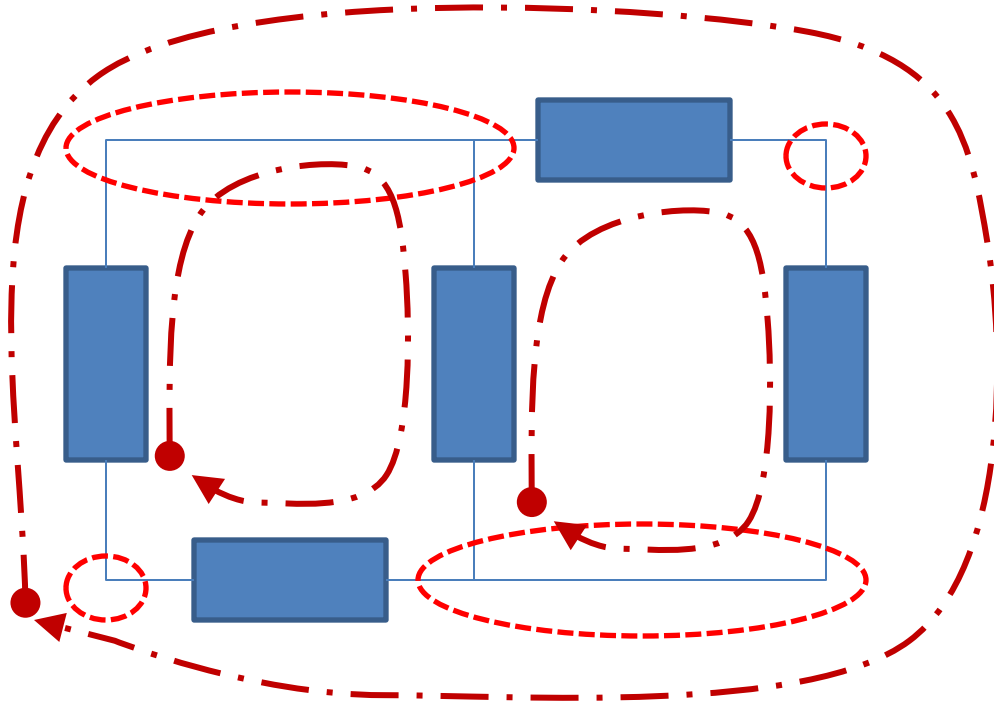
Question 3



Is it:

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

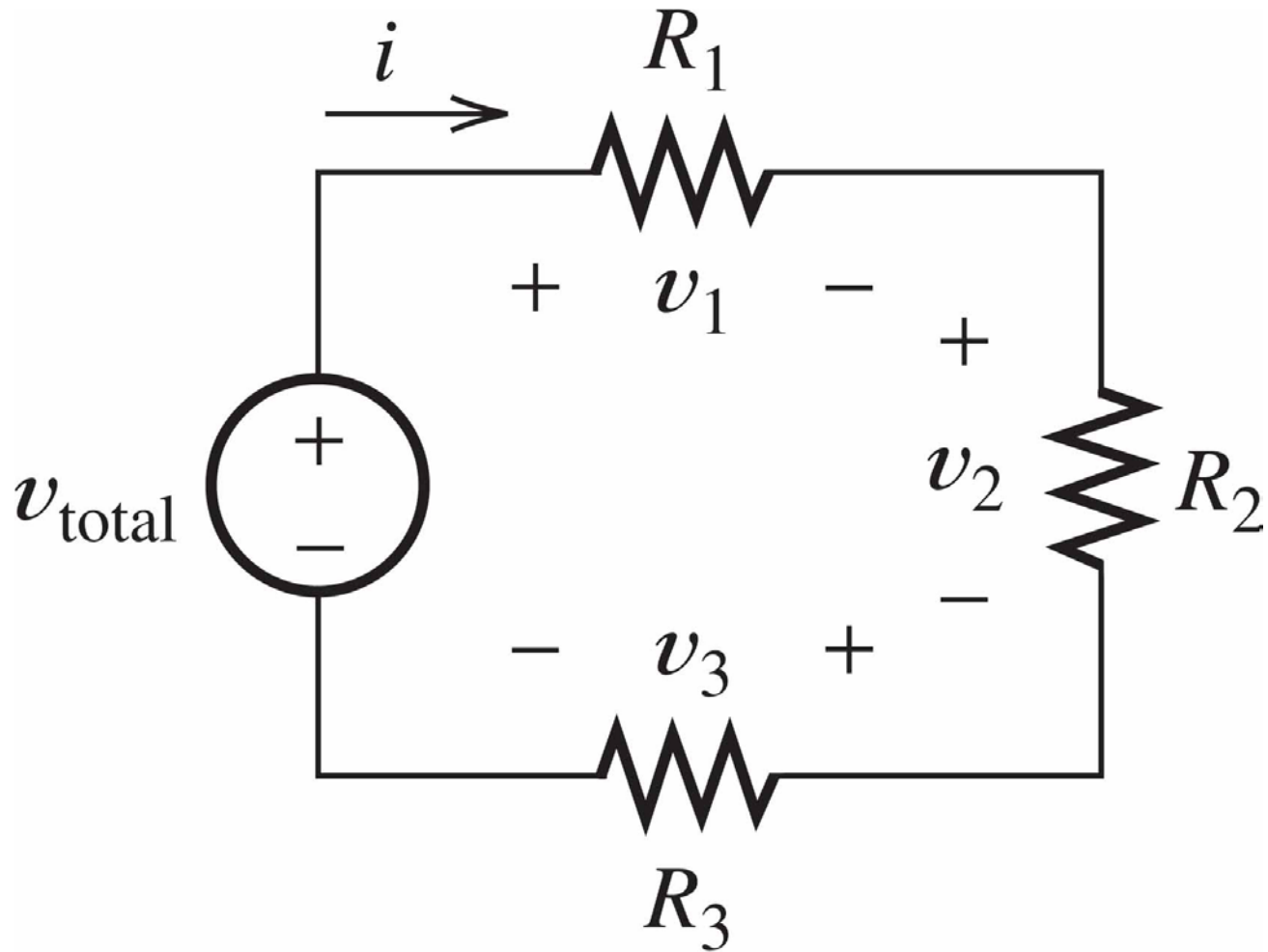
Circuits: how many loops and nodes?



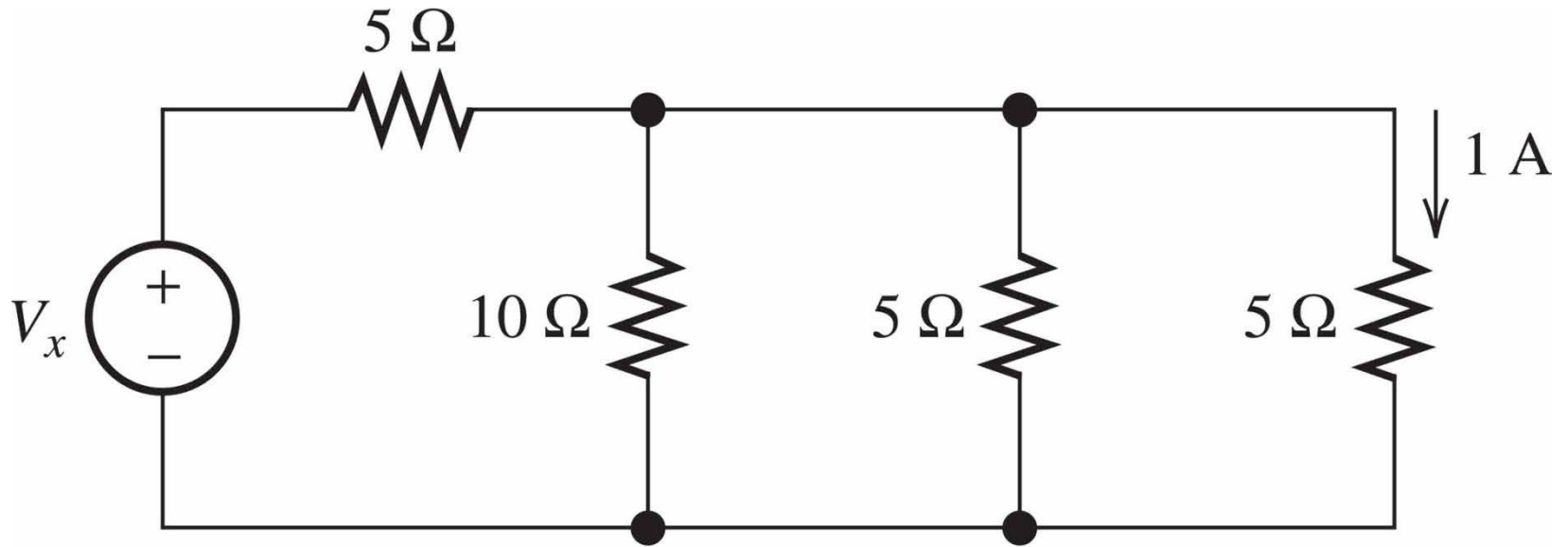
4 Nodes

3 Loops

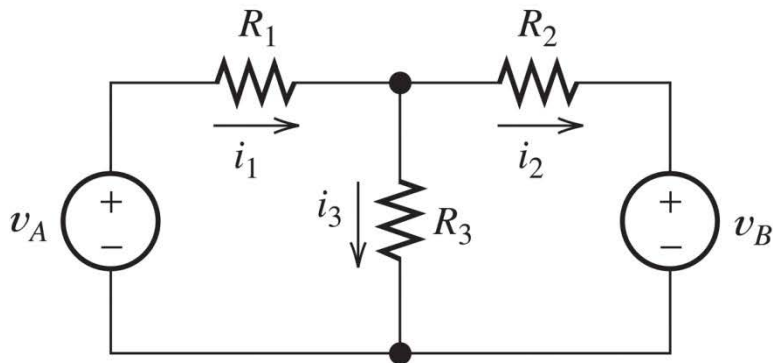
KVL – Loop Equations



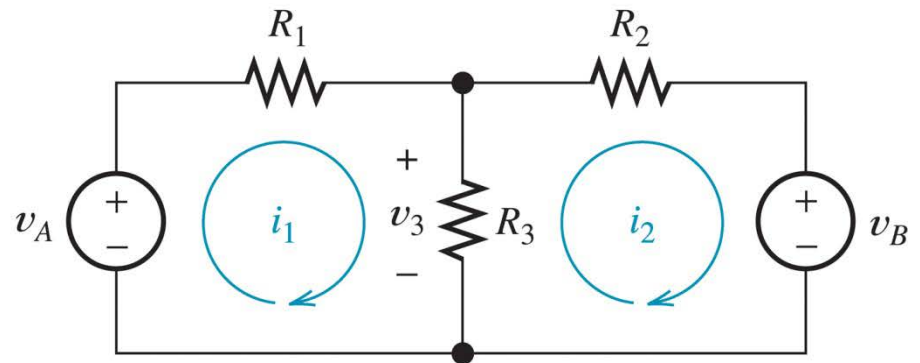
Circuit Interpretation



Mesh Current Method

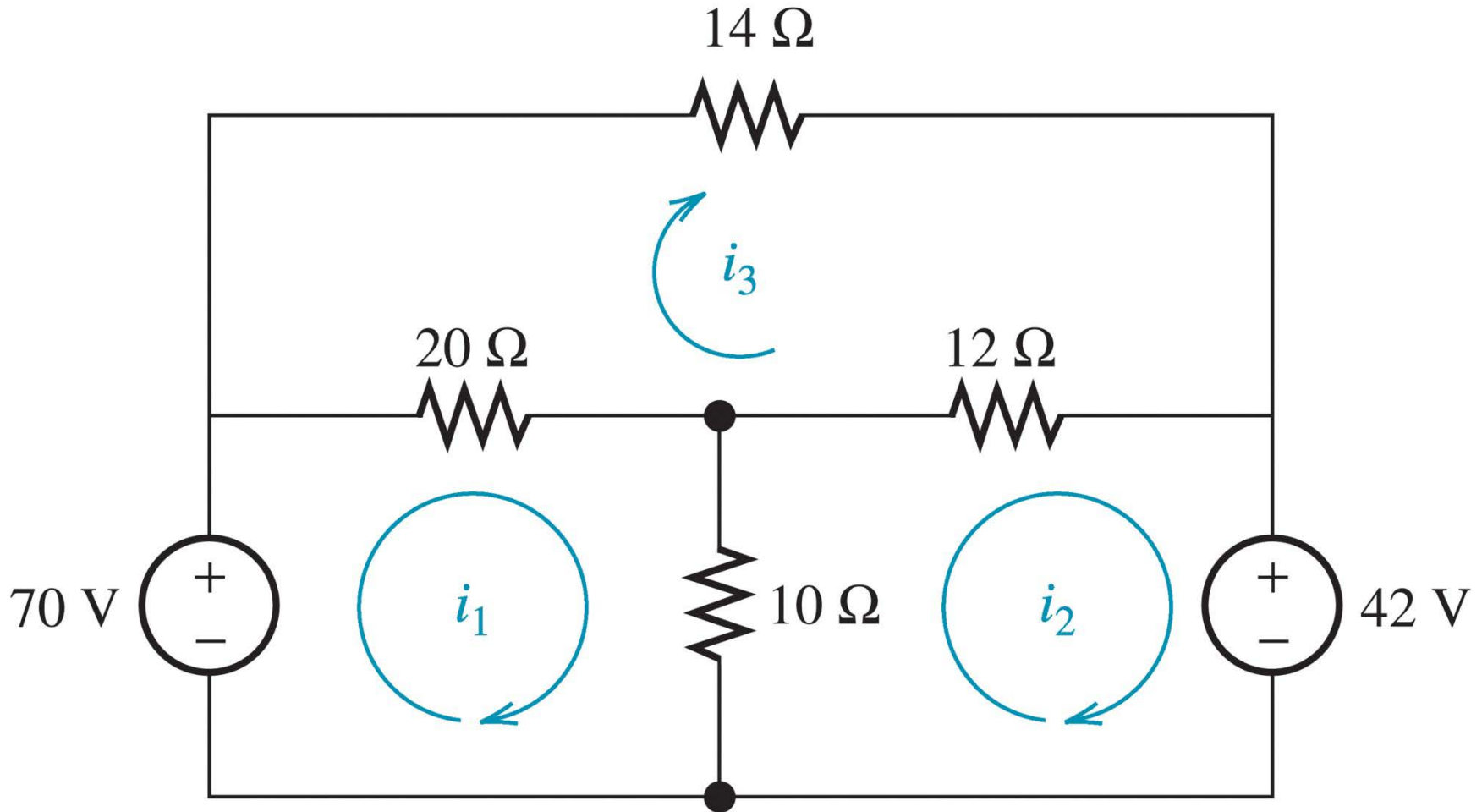


(a) Circuit with branch currents



(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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