

WYE-delta transformation

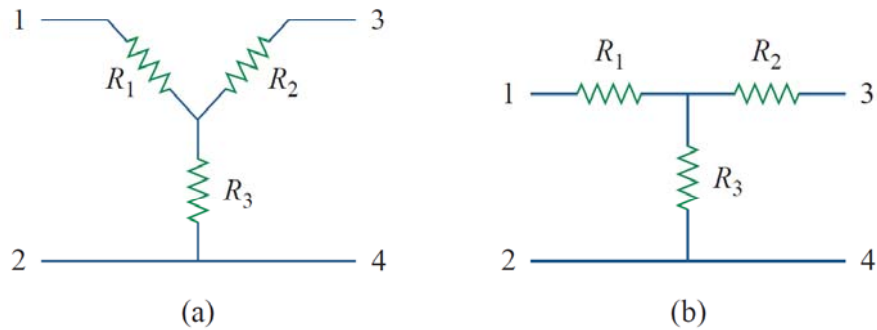


Figure 2.47

Two forms of the same network: (a) Y, (b) T.

The formulas for a wye-to-delta transformation are

$$R_a = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1}, \quad R_b = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2}$$

$$R_c = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3}$$

The formulas for a delta-to-wye transformation are

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}, \quad R_2 = \frac{R_c R_a}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$

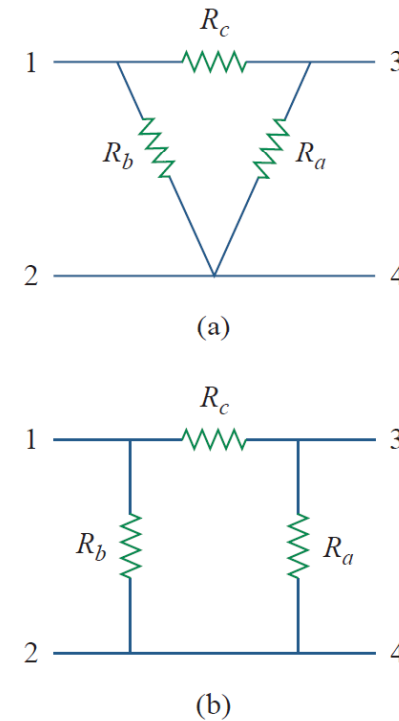


Figure 2.48

Two forms of the same network: (a) Δ , (b) Π .

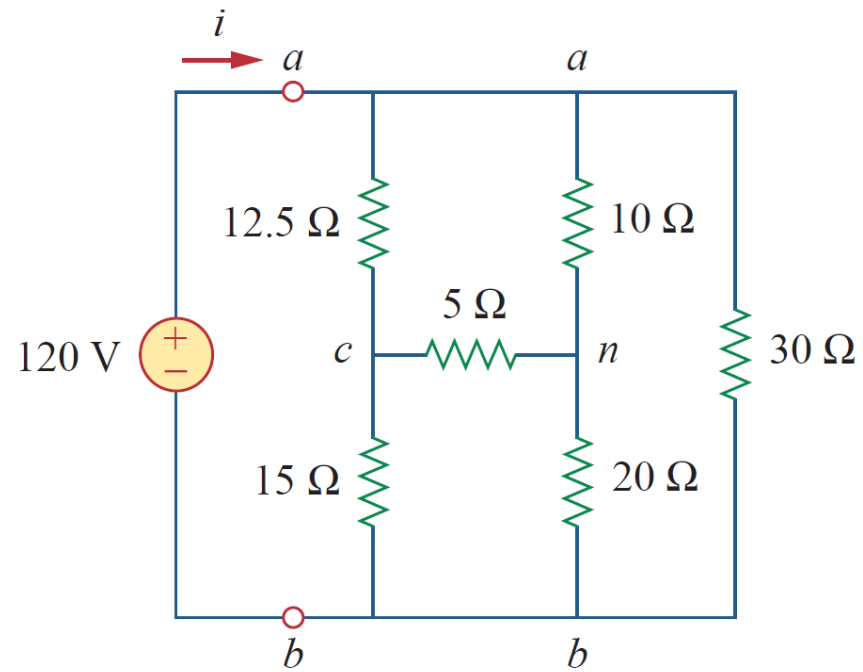


Figure 2.52
For Example 2.15.

$$R_1 = 10 \, \Omega, \quad R_2 = 20 \, \Omega, \quad R_3 = 5 \, \Omega$$

Thus from Eqs. (2.53) to (2.55) we have

$$R_a = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1} = \frac{10 \times 20 + 20 \times 5 + 5 \times 10}{10}$$

$$= \frac{350}{10} = 35 \, \Omega$$

$$R_b = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2} = \frac{350}{20} = 17.5 \, \Omega$$

$$R_c = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3} = \frac{350}{5} = 70 \, \Omega$$

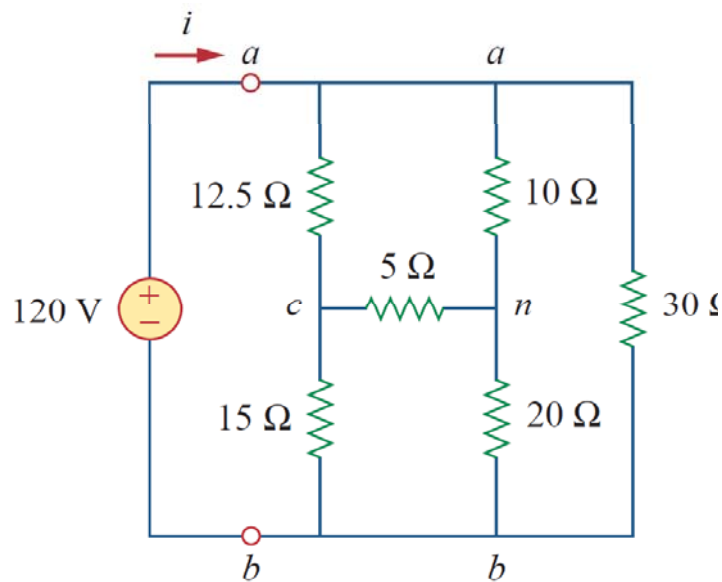
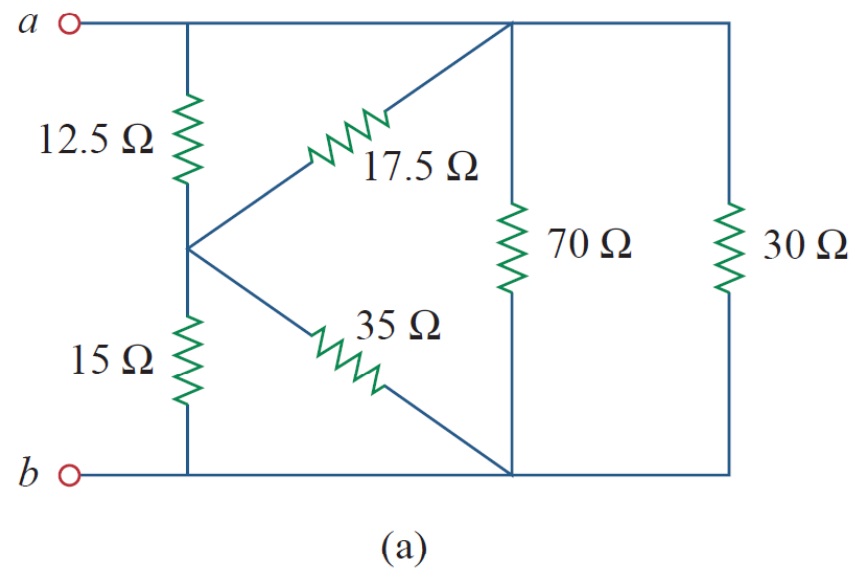


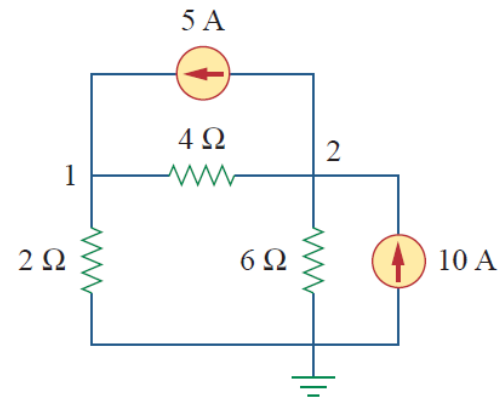
Figure 2.52
For Example 2.15.



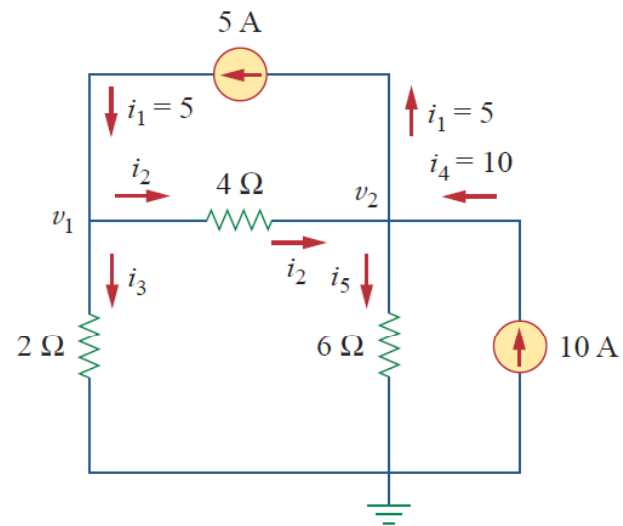
Chapter 3 Methods of Analysis

Steps to Determine Node Voltages:

1. Select a node as the reference node. Assign voltages $v_1, v_2, \dots, v_{n-1}$ to the remaining $n - 1$ nodes. The voltages are referenced with respect to the reference node.
2. Apply KCL to each of the $n - 1$ nonreference nodes. Use Ohm's law to express the branch currents in terms of node voltages.
3. Solve the resulting simultaneous equations to obtain the unknown node voltages.



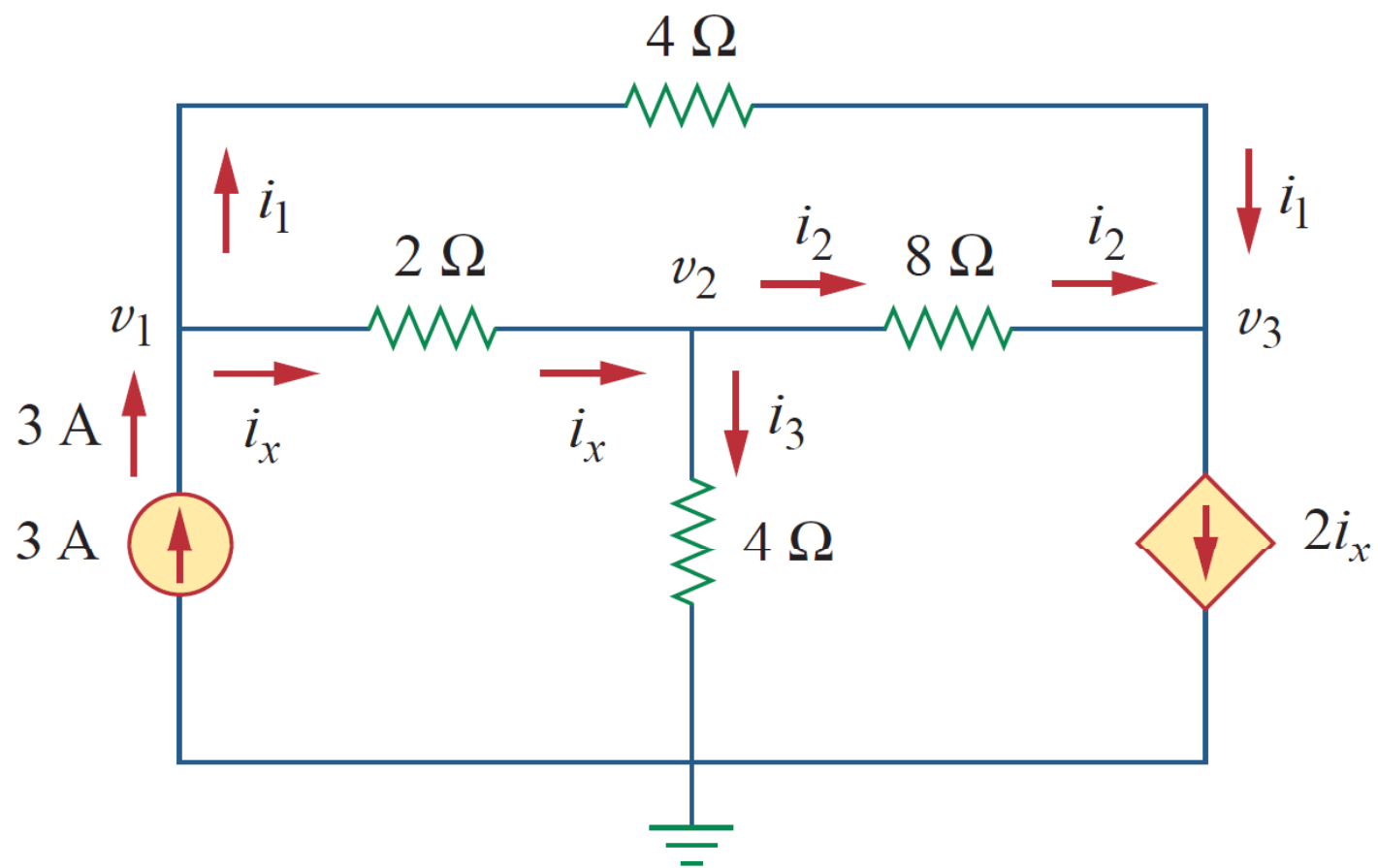
(a)



(b)

Figure 3.3

For Example 3.1: (a) original circuit,
(b) circuit for analysis.



(b)

Nodal Analysis with Voltage Sources

A supernode is formed by enclosing a (dependent or independent) voltage source connected between two nonreference nodes and any elements connected in parallel with it.

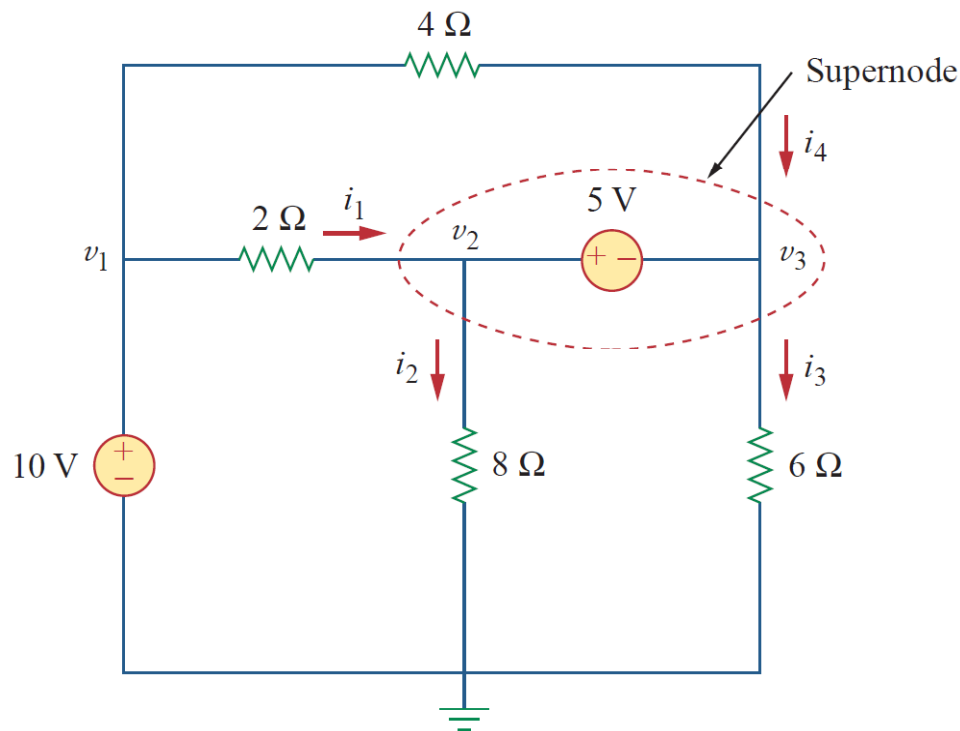


Figure 3.7

A circuit with a supernode.

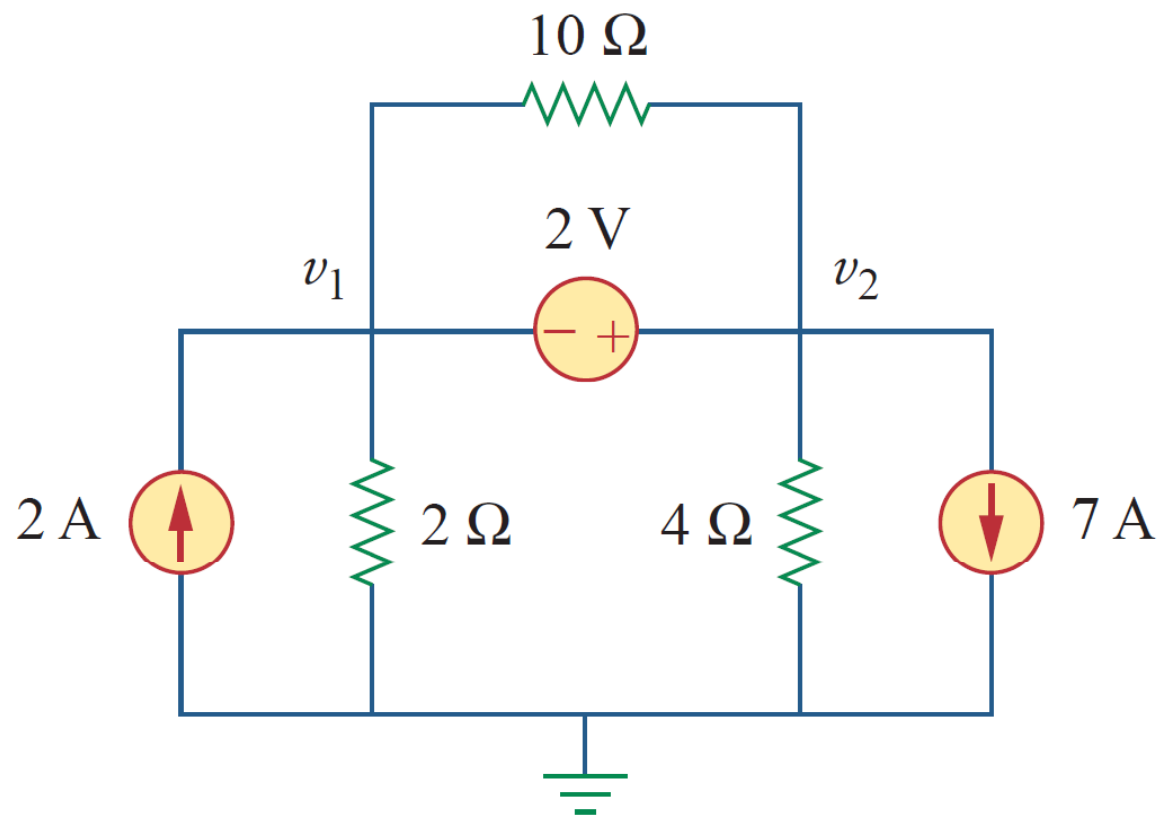


Figure 3.9
For Example 3.3.

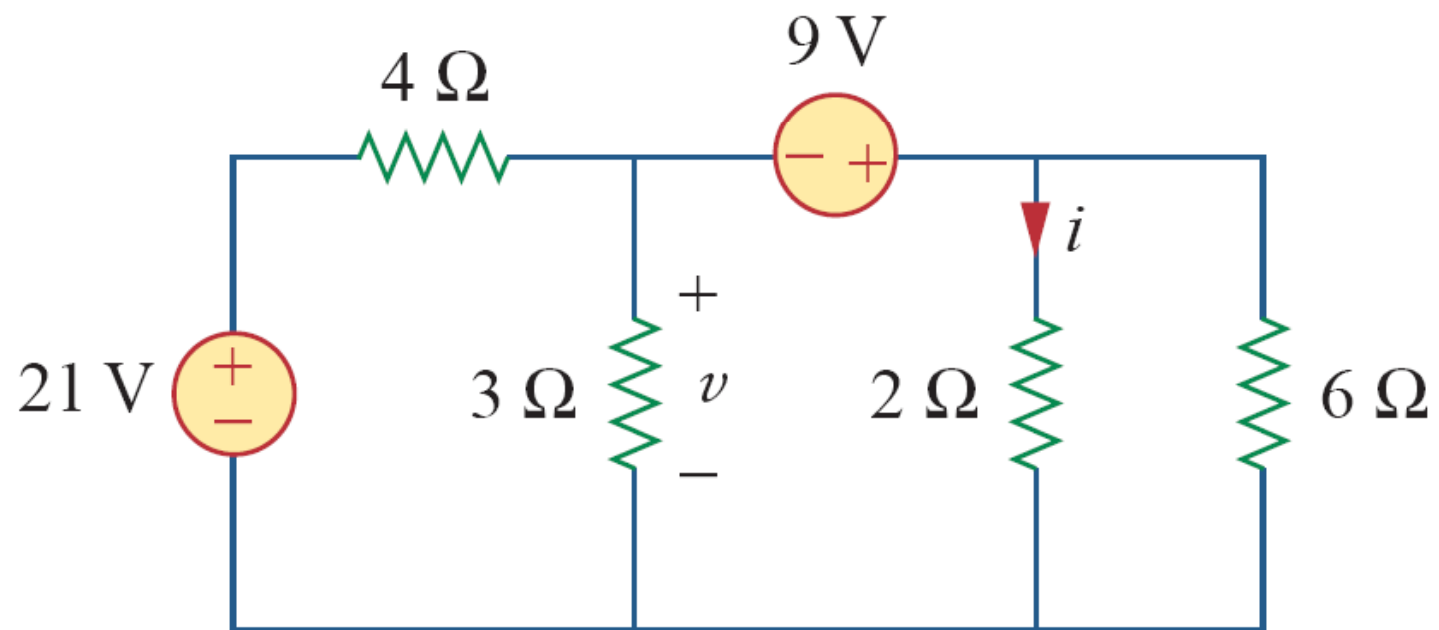


Figure 3.11

For Practice Prob. 3.3.

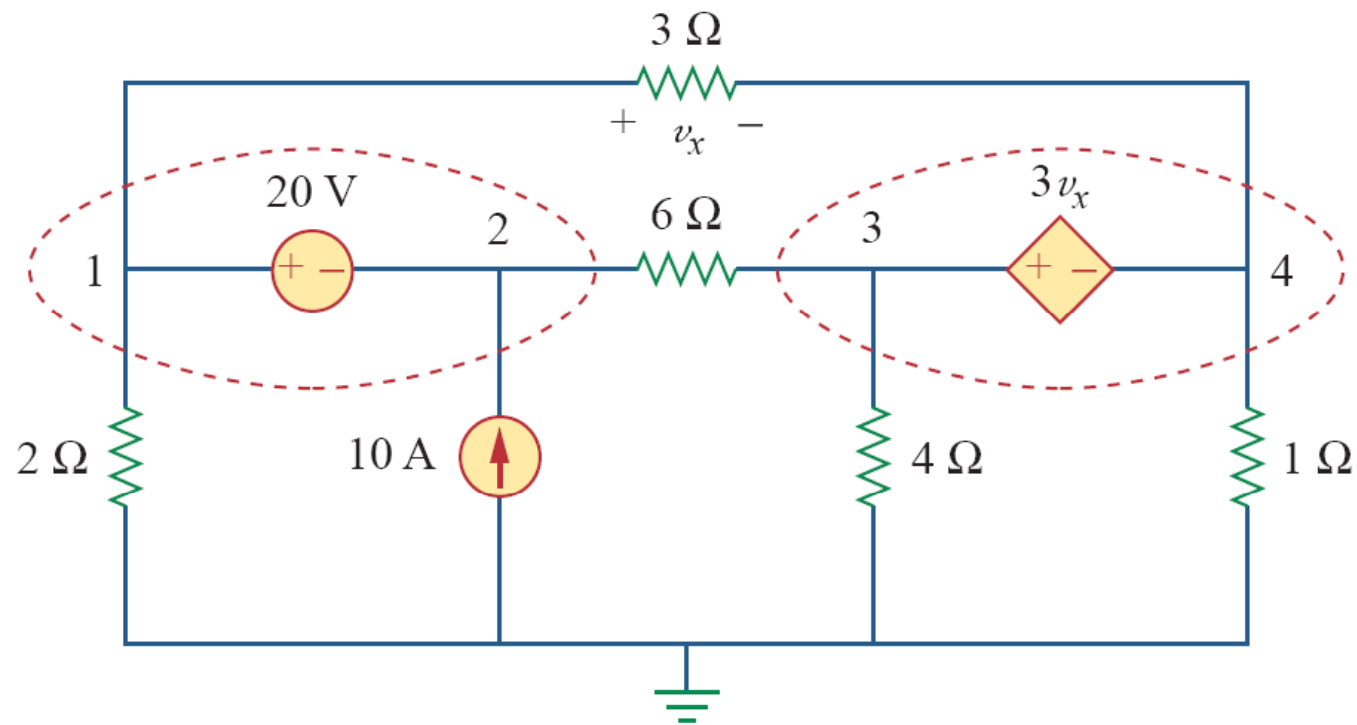


Figure 3.12
For Example 3.4.

MESH ANALYSIS

A mesh is a loop which does not contain any other loops within it.

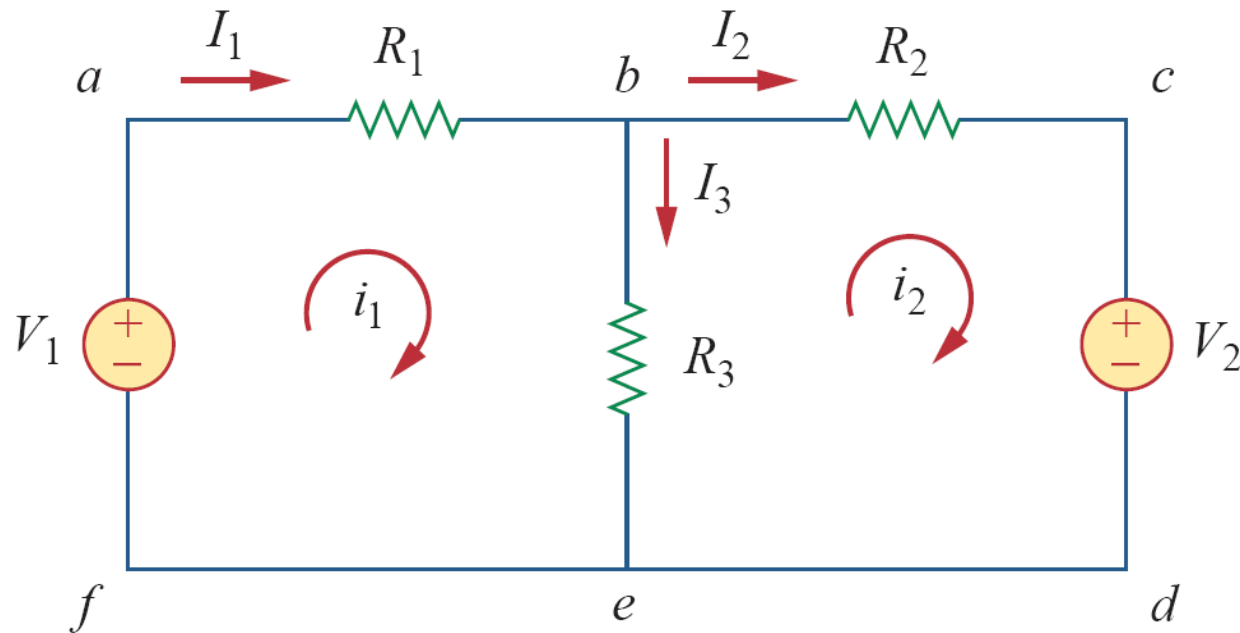


Figure 3.17

A circuit with two meshes.



Steps to Determine Mesh Currents:

1. Assign mesh currents $i_1, i_2, \dots, i_n$ to the n meshes.
2. Apply KVL to each of the n meshes. Use Ohm's law to express the voltages in terms of the mesh currents.
3. Solve the resulting n simultaneous equations to get the mesh currents.

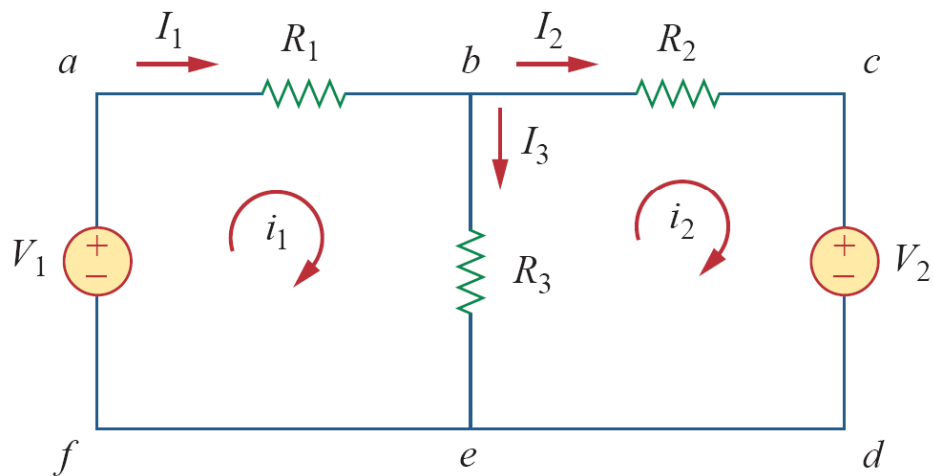


Figure 3.17
A circuit with two meshes.

$$\begin{bmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ -V_2 \end{bmatrix} \quad (3.15)$$

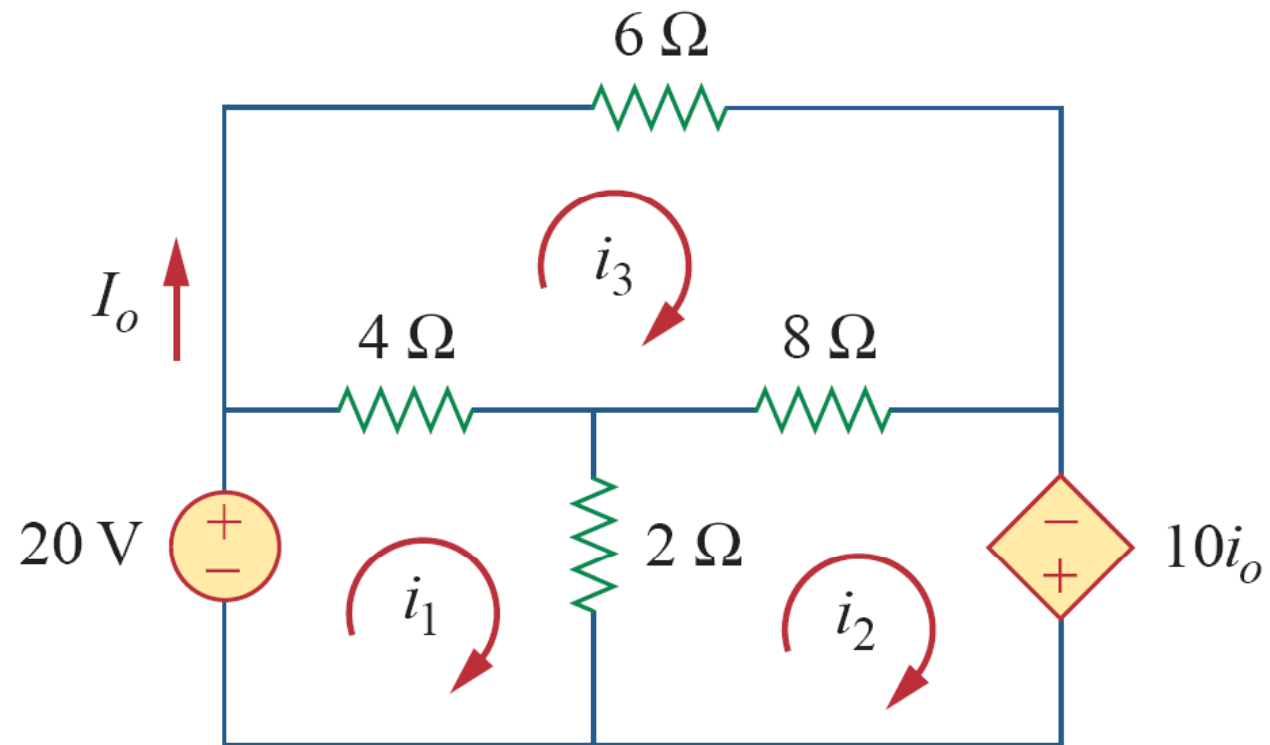


Figure 3.21

For Practice Prob. 3.6.