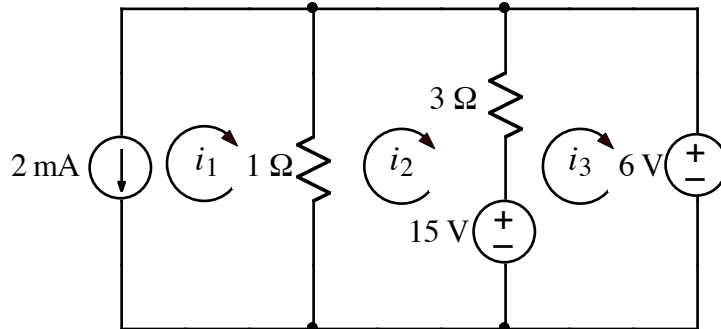
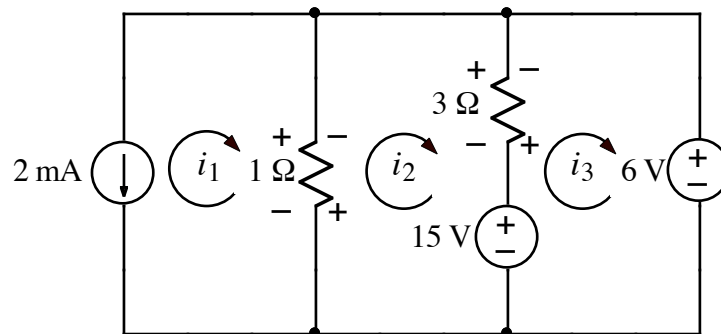


Ex:



Use the mesh-current method to find i_1 , i_2 , and i_3 .

SOL'N: The mesh-current method is based on the idea of calculating voltage loops in terms of mesh currents in inner loops that add up to give the total current through components that are shared by loops. The diagram below shows the polarities of voltage drops for mesh currents. These voltage drops follow the passive sign convention for their respective mesh current.



The current through the 1Ω resistor (measured with an arrow pointing down) is $i_1 - i_2$. The current through the 3Ω resistor (measured with an arrow pointing down) is $i_2 - i_3$.

On the left side, we have a current source on the outside edge of the loop. It follows that mesh current i_1 is determined by the current of the source:

$$i_1 = -2 \text{ mA}$$

The voltage loop for mesh current i_2 is as follows:

$$-i_2 \cdot 1\Omega + i_1 \cdot 1\Omega - i_2 \cdot 3\Omega + i_3 \cdot 3\Omega - 15\text{V} = 0\text{V} \quad (1)$$

The voltage loop for mesh current i_3 is as follows:

$$15\text{V} - i_3 \cdot 3\Omega + i_2 \cdot 3\Omega - 6\text{V} = 0\text{V} \quad (2)$$

We substitute $i_1 = -2 \text{ mA}$ and solve the simultaneous equations by first combining terms multiplying i 's and moving constant terms to the right side.

$$-i_2(1\Omega + 3\Omega) + i_3 \cdot 3\Omega = 15\text{V} + 2\text{mA} \cdot 1\Omega \quad (1')$$

$$-i_3 \cdot 3\Omega + i_2 \cdot 3\Omega = 6\text{V} - 15\text{V} = -9\text{V} \quad (2')$$

Summing the two equations eliminates the i_3 term.

$$-i_2(1\Omega + 3\Omega) + i_2 \cdot 3\Omega = 15\text{V} + 2\text{mA} \cdot 1\Omega - 9\text{V} = 6\text{V} + 2\text{mV} \quad (3)$$

or

$$i_2 = -6.002\text{A}$$

Using equation 2' and the value of i_2 , we find the value of i_3 :

$$-i_3 + i_2 = -3\text{A}$$

or

$$i_3 = i_2 + 3\text{A} = -6.002\text{A} + 3\text{A} = -3.002\text{A}$$