**Example 1:**
Consider the circuit shown in Figure 1. Find the value of the resistance, $R$. Find the value of the power *supplied by* the voltage source and the power *absorbed by* the resistor.

**Solution:** Figure 2 shows the circuit from Figure 1 after replacing the ammeter by an equivalent short circuit and labeling the current measured by the ammeter.

Label the element currents and voltages as shown in Figure 3. In anticipation of using Ohm’s law, the reference directions of the resistor current and voltage have been chosen to adhere to the passive convention. Consequently, the product of the resistor current and voltage is the power *absorbed by* the resistor, as required.

The reference direction for the voltage source current has been selected so that the voltage source current and voltage do not adhere to the passive convention. Consequently, the product of the voltage source current and voltage is the power *supplied by* the voltage source, as required.

**Figure 1** The circuit considered in Example 1.

**Figure 2** The circuit from Figure 1 after replacing the ammeter by a short circuit.
Figure 3 The circuit from Figure 2 after labeling the element currents and voltages.

Apply KVL to the mesh consisting of the voltage source, the resistor and the short circuit that replaced to ammeter to get

\[ v_R + 0 + 48 = 0 \Rightarrow v_R = -48 \text{ V} \]

Apply KCL at the right node of the resistor to get

\[ i_R = -6 \Rightarrow i_R = -6 \text{ A} \]

Next, Ohm’s law gives

\[ R = \frac{v_R}{i_R} = \frac{-48}{-6} = 8 \text{ \Omega} \]

The power **absorbed by** the resistor is

\[ i_R v_R = (-6)(-48) = 288 \text{ W} \]

Apply KCL at the node that connects the voltage source and resistor to get

\[ 0 = i_a + i_R \Rightarrow i_a = -i_R = 6 \text{ A} \]

The power **supplied by** the voltage source is

\[ i_a (48) = (6)(48) = 288 \text{ W} \]

As expected, the power absorbed by the resistor is equal the power delivered by the voltage source.
Example 2:
Consider the circuit shown in Figure 4. Find the value of the resistance, $R$. Find the value of the power supplied by the current source and the power absorbed by the resistor.

![Figure 4](image)

**Figure 4** The circuit considered in Example 2.

Solution: Figure 5 shows the circuit from Figure 4 after replacing the voltmeter by an equivalent open circuit and labeling the voltage measured by the voltmeter.

Label the element currents and voltages as shown in Figure 6. In anticipation of using Ohm’s law, the reference directions of the resistor current and voltage have been chosen to adhere to the passive convention. Consequently, the product of the resistor current and voltage is the power absorbed by the resistor, as required.

The reference direction for the current source voltage has been selected so that the current source current and voltage do not adhere to the passive convention. Consequently, the product of the current source current and voltage is the power supplied by the current source, as required.

![Figure 5](image)

**Figure 5** The circuit from Figure 4 after replacing the voltmeter by an open circuit.
Figure 6 The circuit from Figure 5 after labeling the element currents and voltages.

Apply KVL to the mesh consisting of the resistor and the open circuit that replaced the voltmeter to get

\[-48 - v_R = 0 \quad \Rightarrow \quad v_R = -48 \text{ V}\]

Apply KCL at the top node of the resistor to get

\[0 + i_R + 4 = 0 \quad \Rightarrow \quad i_R = -4 \text{ A}\]

Next, Ohm’s law gives

\[R = \frac{v_R}{i_R} = \frac{-48}{-4} = 12 \text{ } \Omega\]

The power absorbed by the resistor is

\[v_R i_R = (-4)(-48) = 192 \text{ W}\]

Apply KVL to the mesh consisting of the current source and the resistor to get

\[v_R + v_a = 0 \quad \Rightarrow \quad v_a = -v_R = 48 \text{ V}\]

The power supplied by the voltage source is

\[(4) v_a = (4)(48) = 192 \text{ W}\]

As expected, the power absorbed by the resistor is equal to the power delivered by the current source.