Example:
The input to the circuit shown in Figure 1 is the voltage of the voltage source, $v_s$. The output is the current measured by the meter, $i_m$.

a. Suppose $v_s = 15 \text{ V}$. Determine the value of the resistance $R$ that causes the value of the current measured by the meter to be $i_m = 5 \text{ A}$.

b. Suppose $v_s = 15 \text{ V}$ and $R = 24 \Omega$. Determine the current measured by the ammeter.

c. Suppose $R = 24 \Omega$. Determine the value input voltage, $v_s$, that causes the value of the current measured by the meter to be $i_m = 3 \text{ A}$.

![Diagram of the circuit considered in this example.](image)

**Figure 1** The circuit considered in this example.

**Solution:** Use voltage division in the left part of the circuit to get

$$v_a = \left( \frac{12}{12+18} \right) (-v_s) = -\frac{2}{5} v_s$$

Next, use current division in the right part of the circuit to get

$$i_m = -\left( \frac{16}{16+R} \right) \left( 5 v_a \right) = -\frac{80}{16+R} v_a$$

Combining these equations gives:

$$i_m = -\left( \frac{80}{16+R} \right) \left( -\frac{2}{5} v_s \right) = \frac{32}{16+R} v_s$$
a. When $v_s = 15$ V and $i_m = 5$ A

$$5 = \left( \frac{32}{16 + R} \right)_{15} \Rightarrow 80 + 5R = 480 \Rightarrow R = \frac{400}{5} = 80 \ \Omega$$

b. When $v_s = 15$ V and $R = 24$ $\Omega$

$$i_m = \left( \frac{32}{16 + 24} \right)_{15} = 12 \ \text{A}$$

c. When $i_m = 3$ A and $R = 24$ $\Omega$

$$3 = \left( \frac{32}{16 + 24} \right)_{v_s} = \frac{4}{5}v_s \Rightarrow v_s = \frac{15}{4} = 3.75 \ \text{V}$$