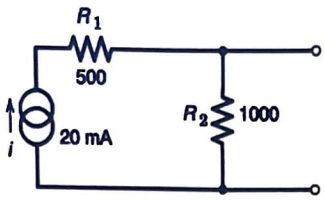

FIGURE 6-18 The circuit for Problem 6-5.

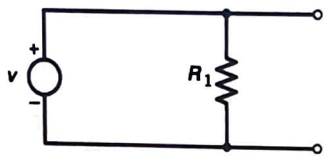

FIGURE 6-19 The circuit for Problem 6-6.

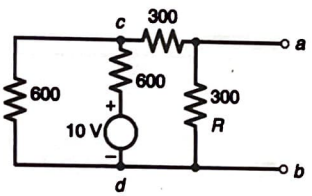

FIGURE 6-20 The circuit for Problem 6-7.

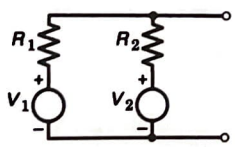

FIGURE 6-21 The circuit for Problem 6-8.

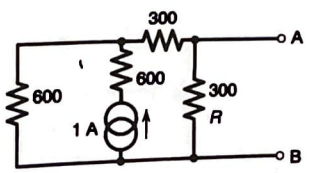

FIGURE 6-22 The circuit for Problem 6-9.

Evaluating this determinant and setting it equal to zero gives

$$V[-R_1(R_3 + R_4) + R_4(R_1 + R_2)] = 0$$

or

$$R_2R_4 = R_1R_3 \tag{6-13}$$

which is the same result as before, Equation 6-11. This was much easier, but not the easiest way.

Finally, the problem is solved by using Thevenin's theorem. To find the Thevenin equivalent circuit, first replace R_5 with an open circuit and find V_{Th}. The resulting circuit is shown in Figure 6-13.

It can be seen that V_{Th} is simply the difference between two voltage dividers. This can be written down directly:

$$V_{Th} = V\left(\frac{R_2}{R_1 + R_2} - \frac{R_3}{R_3 + R_4}\right)$$

The current will be zero when $V_{Th} = 0$ or when

$$\frac{R_2}{R_1 + R_2} = \frac{R_3}{R_3 + R_4}$$

or

$$R_2R_4 = R_1R_3 \tag{6-14}$$

This is the same result as Equation 6-13, but this time it took practically no effort.

PROBLEMS

6-1 Find the unknown current i in the circuit of Figure 6-14.

6-2 Find the unknown voltage v and current i in the circuit of Figure 6-15.

6-3 What is the voltage across and the current through each of the circuit elements in the circuit of Figure 6-16?

6-4 What is the voltage across and the current through each of the elements in the circuit of Figure 6-17?

6-5 Find the Thevenin equivalent circuit for the circuit of Figure 6-18.

6-6 Find the Thevenin equivalent circuit for the circuit of Figure 6-19.

6-7 Find the Thevenin equivalent circuit for the circuit of Figure 6-20.

6-8 Find the Norton equivalent circuit for the circuit of Figure 6-21.

6-9 Find the Norton equivalent circuit for the circuit of Fi

ANSWERS TO ODD-NUMBERED PROBLEMS

6-1 $i = -3\text{A}$

6-3

Element	Voltage	Current
Current source	8 V top positive	3 A upward
R	3 V left positive	3 A to right
Voltage source	5 V as shown	3 A downward.

6-5 $V_{\text{Th}} = 20$ V; $R_{\text{Th}} = 1000\Omega$.

6-7 $V_{\text{Th}} = \frac{5}{3}$ V; $R_{\text{Th}} = 200\Omega$

6-9 $I_{\text{Nor}} = \frac{2}{3}$ A; $R_{\text{Nor}} = 225\ \Omega$