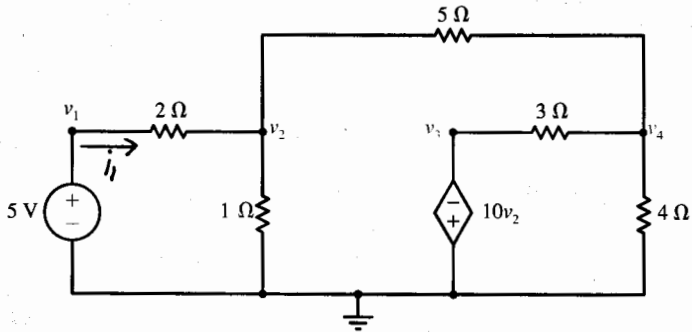**Fig. 2.8** Circuit with voltage source connected between two nonreference nodes.

Drill Exercise 2.2

For the circuit shown in Fig. 2.8, change the value of the 4-V source to 23 V. Use nodal analysis to find v_1, v_2, and v_3. Determine the currents for the circuit.

ANSWER 24 V, 15 V, −8 V, 4.5 A, −2.5 A, 2 A, −1 A

Fig. 2.9 Nodal analysis of a circuit with two voltage sources.

For the circuit shown in Fig. 2.9, replace the voltage-dependent voltage source with a current-dependent voltage source (having the same polarity) whose value is $5i_1$ V. Determine the resulting node voltage v_1, v_2, v_3, and v_4.

ANSWER 5 V, 1 V, -10 V, -4 V

Problems

2.1 For the circuit shown in Fig. P2.1, select node d as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.
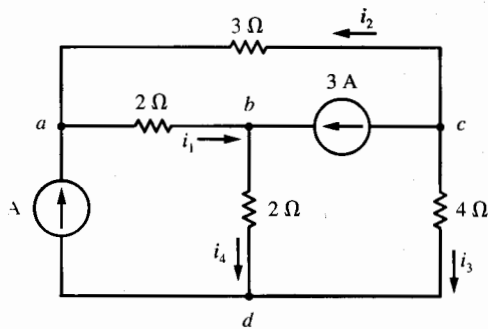

Fig. P2.1

2.2 For the circuit shown in Fig. P2.1, select node a as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

2.3 For the circuit shown in Fig. P2.1, select node b as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

2.4 For the circuit shown in Fig. P2.1, select node c as the reference node. (a) Use nodal analysis to find the node voltages. (b) Use the node voltages to determine i_1, i_2, i_3, and i_4.

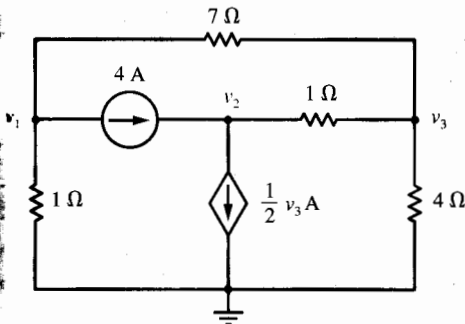**2.5** Find the node voltages for the circuit shown in Fig. P2.5.

Fig. P2.5

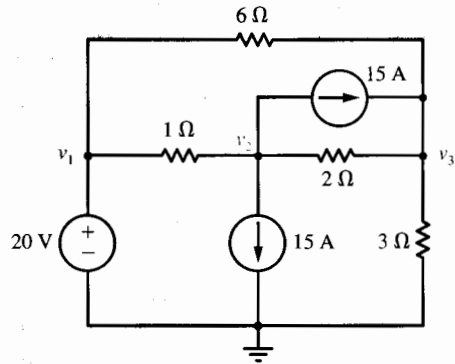**2.6** Find the node voltages for the circuit shown in Fig. P2.6.

Fig. P2.6

2.7 Find the node voltages for the circuit shown in Fig. P2.7. (See p. 100.)

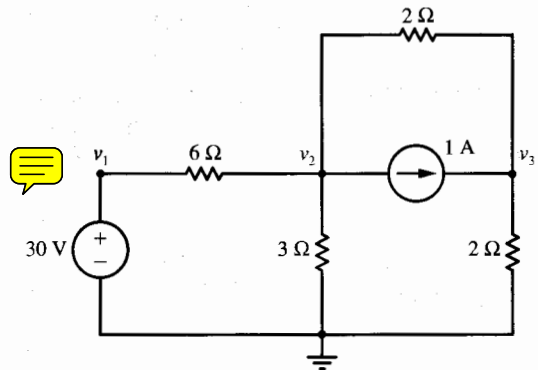**2.8** Find the node voltages for the circuit shown in Fig. P2.8.

Fig. P2.8

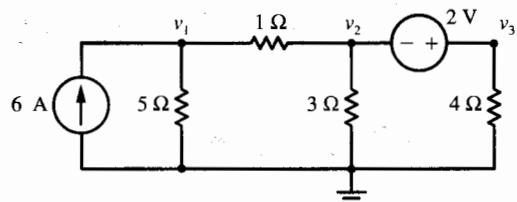**2.9** Find the node voltages for the circuit shown in Fig. P2.9.

Fig. P2.9