PROBLEMS

Sections 3.2 and 3.3   Nodal Analysis

3.1   Determine v_1, v_2, and the power dissipated in all the resistors in the circuit of Fig. 3.50.
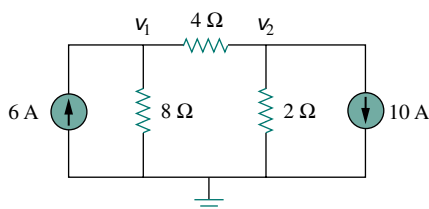

Figure 3.50   For Prob. 3.1.

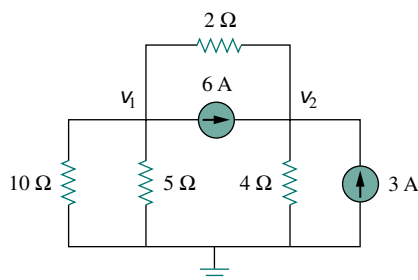**3.2**   For the circuit in Fig. 3.51, obtain v_1 and v_2.

Figure 3.51   For Prob. 3.2.

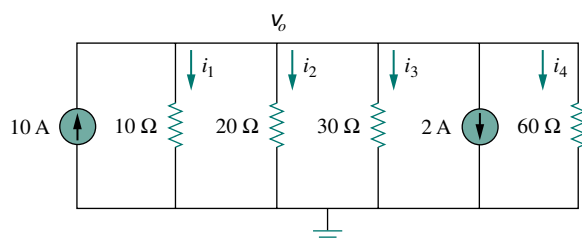**3.3**   Find the currents i_1 through i_4 and the voltage v_o in the circuit in Fig. 3.52.

Figure 3.52   For Prob. 3.3.

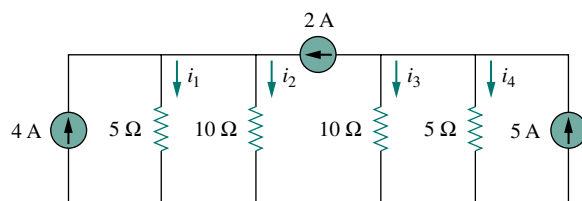**3.4**   Given the circuit in Fig. 3.53, calculate the currents i_1 through i_4.

Figure 3.53   For Prob. 3.4.
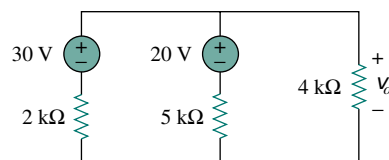
3.5   Obtain v_o in the circuit of Fig. 3.54.

Figure 3.54   For Prob. 3.5.

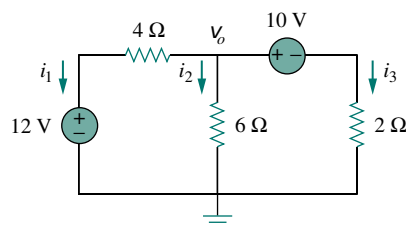**3.6**   Use nodal analysis to obtain v_o in the circuit in Fig. 3.55.

Figure 3.55   For Prob. 3.6.

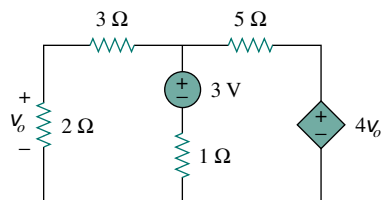**3.7**   Using nodal analysis, find v_o in the circuit of Fig. 3.56.

Figure 3.56   For Prob. 3.7.

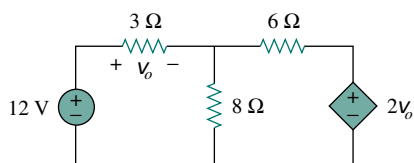**3.8**   Calculate v_o in the circuit in Fig. 3.57.

Figure 3.57   For Prob. 3.8.

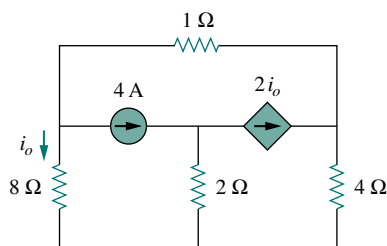**3.9**   Find i_o in the circuit in Fig. 3.58.

Figure 3.58   For Prob. 3.9.

3.10   Solve for i_1 and i_2 in the circuit in Fig. 3.22 (Section 3.5) using nodal analysis.

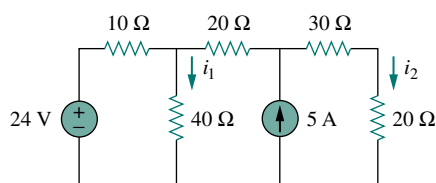**3.11**   Use nodal analysis to find currents i_1 and i_2 in the circuit of Fig. 3.59.

Figure 3.59   For Prob. 3.11.

3.12   Calculate v_1 and v_2 in the circuit in Fig. 3.60 using nodal analysis.
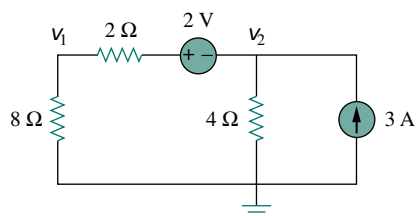

Figure 3.60   For Prob. 3.12.

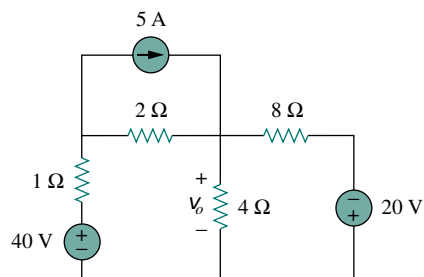**3.13**   Using nodal analysis, find v_o in the circuit of Fig. 3.61.

Figure 3.61   For Prob. 3.13.

3.14   Apply nodal analysis to find i_o and the power dissipated in each resistor in the circuit of Fig. 3.62.
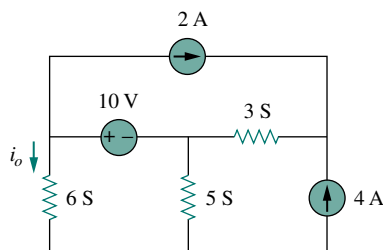

Figure 3.62   For Prob. 3.14.

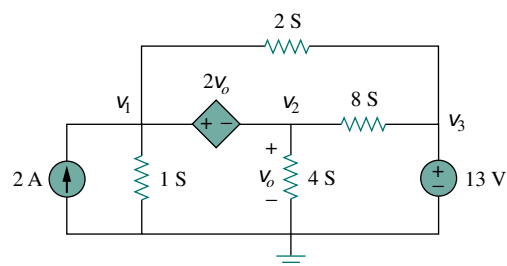**3.15**   Determine voltages v_1 through v_3 in the circuit of Fig. 3.63 using nodal analysis.

Figure 3.63   For Prob. 3.15.

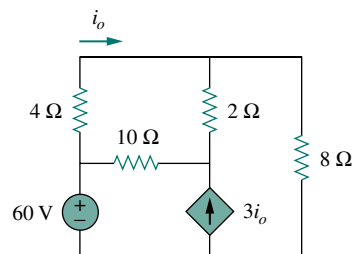**3.16**   Using nodal analysis, find current i_o in the circuit of Fig. 3.64.

Figure 3.64   For Prob. 3.16.

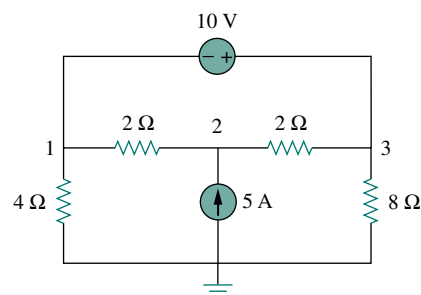**3.17**   Determine the node voltages in the circuit in Fig. 3.65 using nodal analysis.

Figure 3.65   For Prob. 3.17.

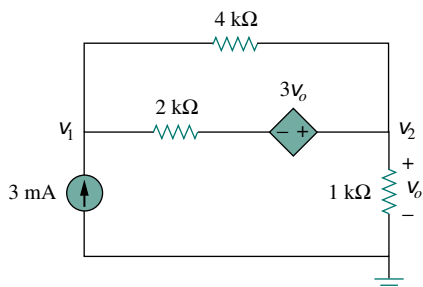**3.18** For the circuit in Fig. 3.66, find v_1 and v_2 using nodal analysis.

Figure 3.66   For Prob. 3.18.

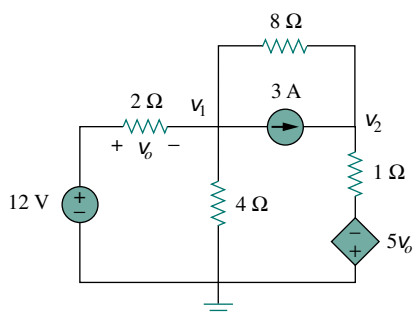**3.19** Determine v_1 and v_2 in the circuit in Fig. 3.67.

Figure 3.67   For Prob. 3.19.

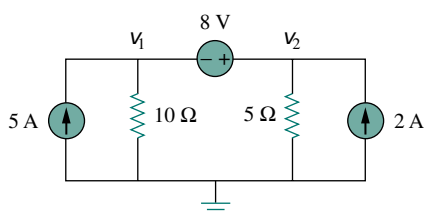**3.20** Obtain v_1 and v_2 in the circuit of Fig. 3.68.

Figure 3.68   For Prob. 3.20.

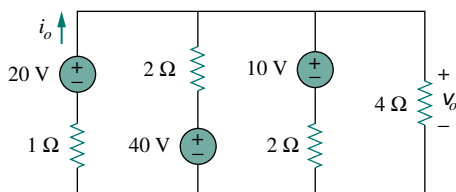**3.21** Find v_o and i_o in the circuit in Fig. 3.69.

Figure 3.69   For Prob. 3.21.

*An asterisk indicates a challenging problem.

*3.22 Use nodal analysis to determine voltages v_1, v_2, and v_3 in the circuit in Fig. 3.70.
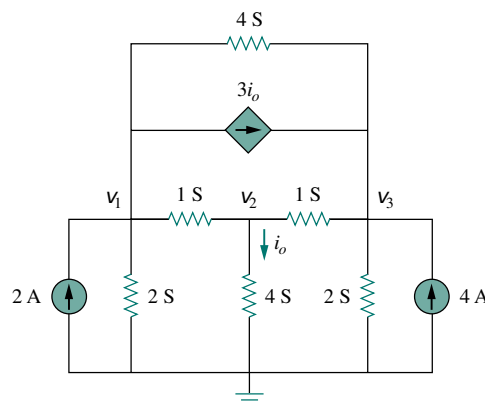

Figure 3.70   For Prob. 3.22.

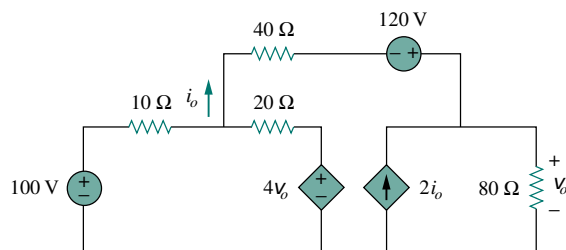**3.23** Using nodal analysis, find v_o and i_o in the circuit of Fig. 3.71.

Figure 3.71   For Prob. 3.23.

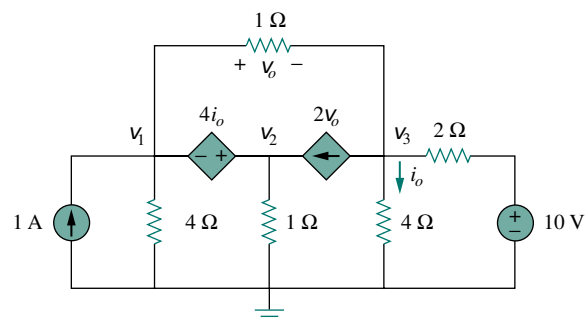**3.24** Find the node voltages for the circuit in Fig. 3.72.

Figure 3.72   For Prob. 3.24.

*3.25 Obtain the node voltages v_1, v_2, and v_3 in the circuit of Fig. 3.73.
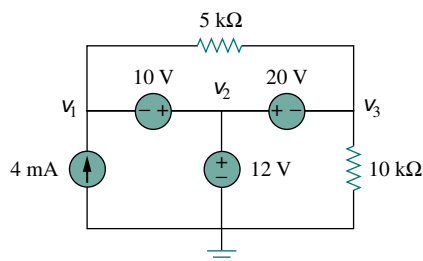

Figure 3.73   For Prob. 3.25.

Sections 3.4 and 3.5   Mesh Analysis

3.26 Which of the circuits in Fig. 3.74 is planar? For the planar circuit, redraw the circuits with no crossing branches.
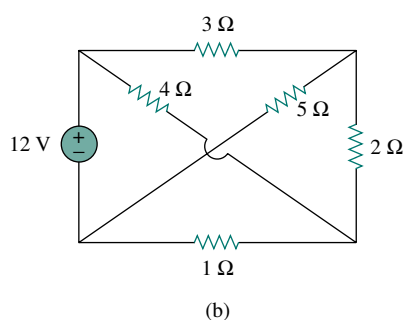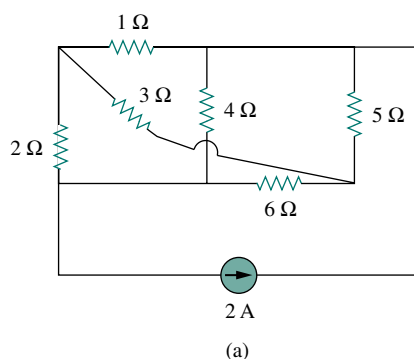

(a)

(b)

Figure 3.74   For Prob. 3.26.

3.27 Determine which of the circuits in Fig. 3.75 is planar and redraw it with no crossing branches.

(a)

(b)

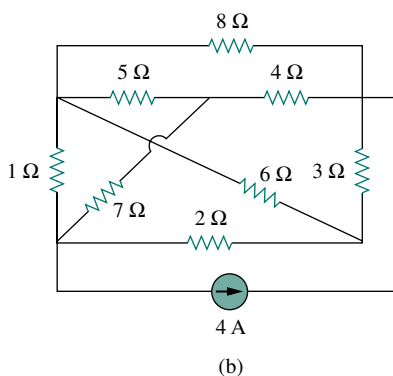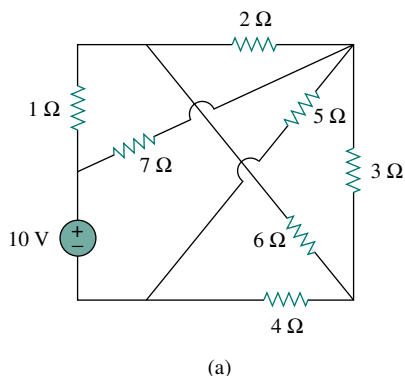**Figure 3.75**   For Prob. 3.27.

3.28 Rework Prob. 3.5 using mesh analysis.

3.29 Rework Prob. 3.6 using mesh analysis.

3.30 Solve Prob. 3.7 using mesh analysis.

3.31 Solve Prob. 3.8 using mesh analysis.

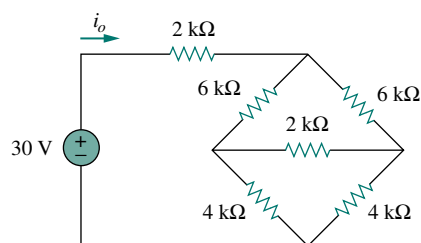3.32 For the bridge network in Fig. 3.76, find i_o using mesh analysis.

Figure 3.76   For Prob. 3.32.

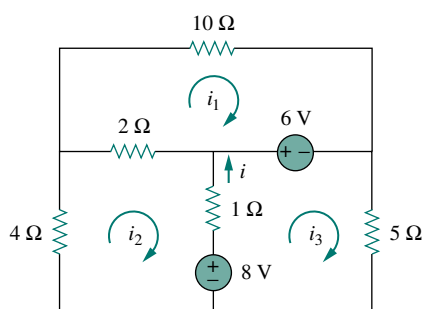3.33 Apply mesh analysis to find i in Fig. 3.77.

Figure 3.77   For Prob. 3.33.

3.34   Use mesh analysis to find v_{ab} and i_o in the circuit in Fig. 3.78.
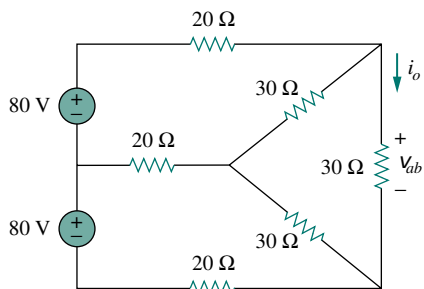

Figure 3.78   For Prob. 3.34.

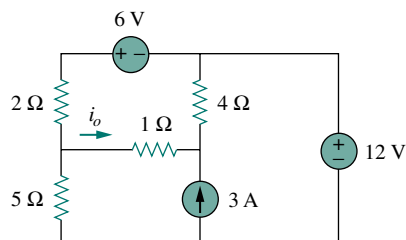**3.35**   Use mesh analysis to obtain i_o in the circuit of Fig. 3.79.

Figure 3.79   For Prob. 3.35.
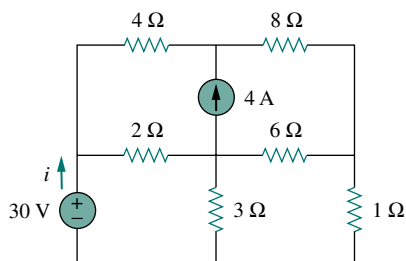
3.36   Find current i in the circuit in Fig. 3.80.

Figure 3.80   For Prob. 3.36.

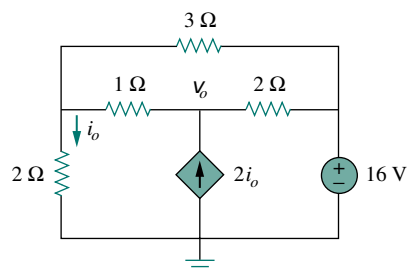**3.37**   Find v_o and i_o in the circuit of Fig. 3.81.

Figure 3.81   For Prob. 3.37.

3.38   Use mesh analysis to find the current i_o in the circuit in Fig. 3.82.
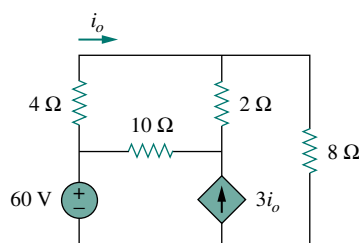

Figure 3.82   For Prob. 3.38.

3.39   Apply mesh analysis to find v_o in the circuit in Fig. 3.83.
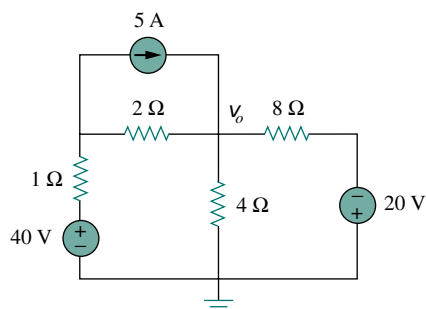

Figure 3.83   For Prob. 3.39.

3.40   Use mesh analysis to find i_1, i_2, and i_3 in the circuit of Fig. 3.84.
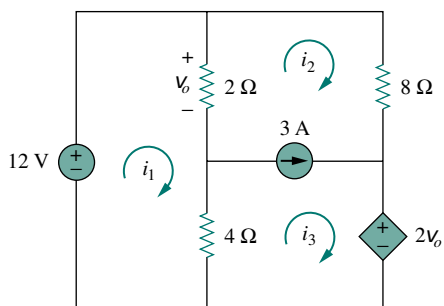
Figure 3.84   For Prob. 3.40.

3.41   Rework Prob. 3.11 using mesh analysis.

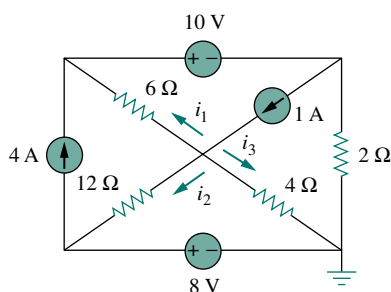*3.42*   In the circuit of Fig. 3.85, solve for i_1, i_2, and i_3.

Figure 3.85   For Prob. 3.42.

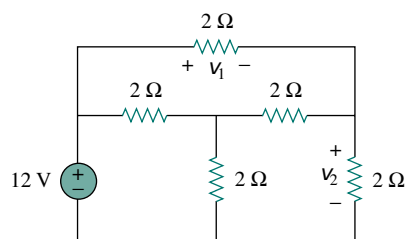**3.43**   Determine v_1 and v_2 in the circuit of Fig. 3.86.

Figure 3.86   For Prob. 3.43.

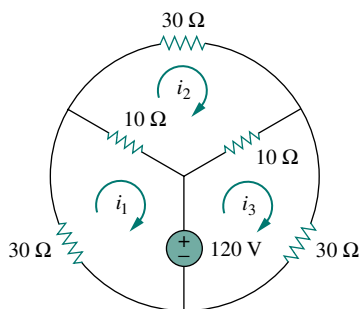**3.44**   Find i_1, i_2, and i_3 in the circuit in Fig. 3.87.

Figure 3.87   For Prob. 3.44.

3.45   Rework Prob. 3.23 using mesh analysis.

3.46   Calculate the power dissipated in each resistor in the circuit in Fig. 3.88.
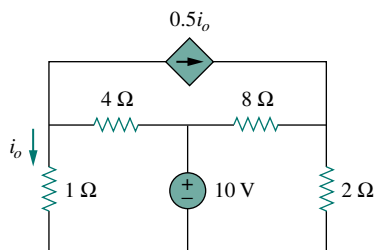

Figure 3.88   For Prob. 3.46.

3.47   Calculate the current gain i_o/i_s in the circuit of Fig. 3.89.
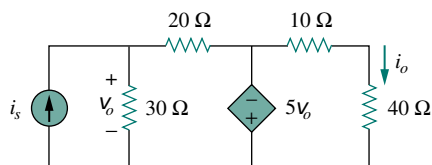

Figure 3.89   For Prob. 3.47.

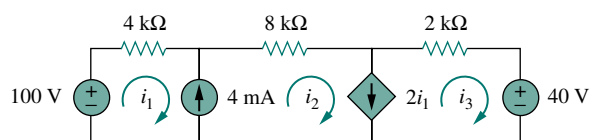**3.48**   Find the mesh currents i_1, i_2, and i_3 in the network of Fig. 3.90.

Figure 3.90   For Prob. 3.48.

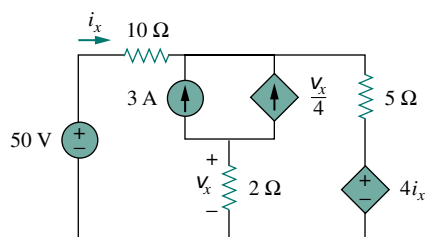**3.49**   Find v_x and i_x in the circuit shown in Fig. 3.91.

Figure 3.91   For Prob. 3.49.

3.50 Find v_o and i_o in the circuit of Fig. 3.92.

Figure 3.92   For Prob. 3.50.

Section 3.6   Nodal and Mesh Analyses by Inspection

3.51 Obtain the node-voltage equations for the circuit in Fig. 3.93 by inspection. Determine the node voltages v_1 and v_2.

Figure 3.93   For Prob. 3.51.

3.52 By inspection, write the node-voltage equations for the circuit in Fig. 3.94 and obtain the node voltages.
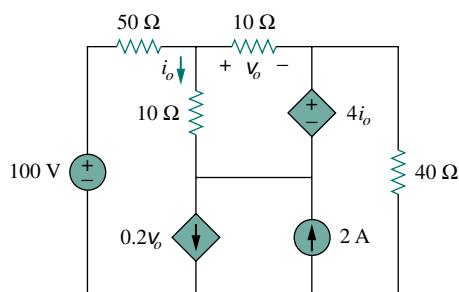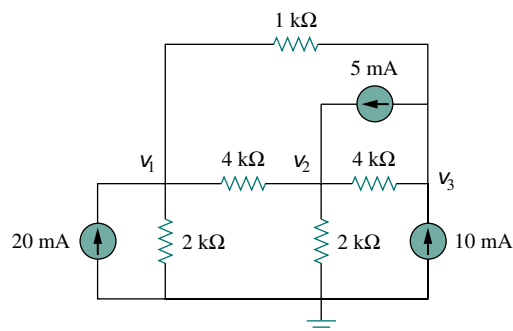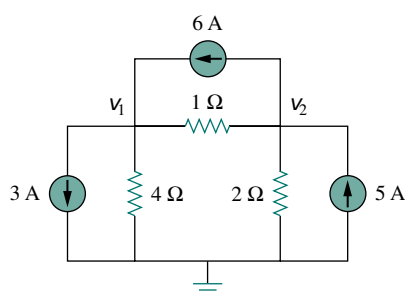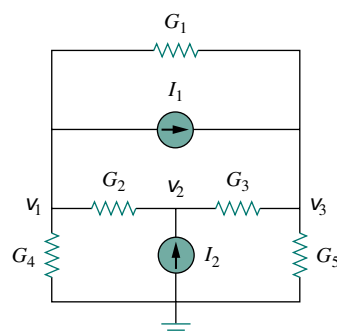

Figure 3.94   For Prob. 3.52.

3.53 For the circuit shown in Fig. 3.95, write the node-voltage equations by inspection.

Figure 3.95   For Prob. 3.53.

3.54 Write the node-voltage equations of the circuit in Fig. 3.96 by inspection.
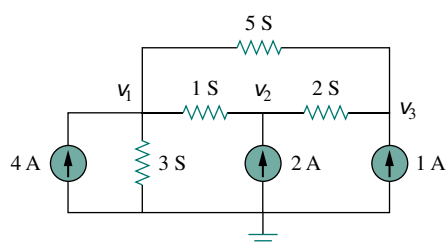

Figure 3.96   For Prob. 3.54.

3.55 Obtain the mesh-current equations for the circuit in Fig. 3.97 by inspection. Calculate the power absorbed by the 8-Ω resistor.
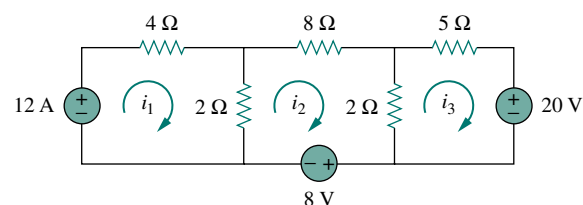

Figure 3.97   For Prob. 3.55.

3.56 By inspection, write the mesh-current equations for the circuit in Fig. 3.98.
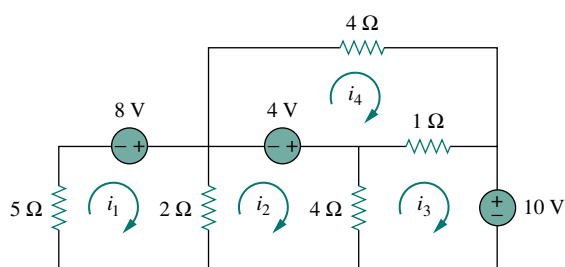
Figure 3.98   For Prob. 3.56.

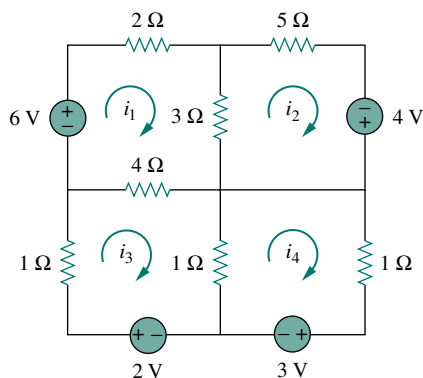**3.57** Write the mesh-current equations for the circuit in Fig. 3.99.

Figure 3.99   For Prob. 3.57.

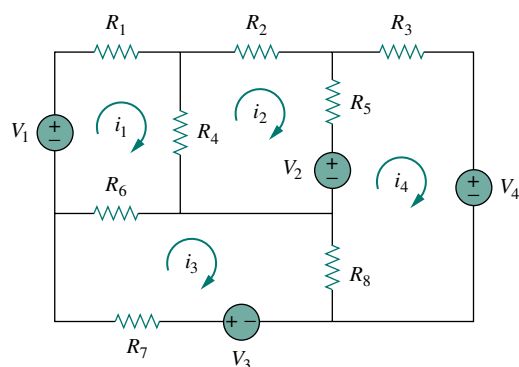**3.58** By inspection, obtain the mesh-current equations for the circuit in Fig. 3.100.

Figure 3.100   For Prob. 3.58.

Section 3.8   Circuit Analysis with *PSpice*

3.59 Use *PSpice* to solve Prob. 3.44.

3.60 Use *PSpice* to solve Prob. 3.22.

3.61 Rework Prob. 3.51 using *PSpice*.

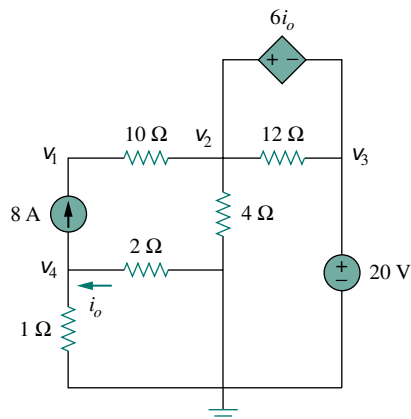**3.62** Find the nodal voltages v_1 through v_4 in the circuit in Fig. 3.101 using *PSpice*.

Figure 3.101   For Prob. 3.62.

3.63 Use *PSpice* to solve the problem in Example 3.4.

3.64 If the Schematics Netlist for a network is as follows, draw the network.

```
R_R1    1   2    2K
R_R2    2   0    4K
R_R3    3   0    8K
R_R4    3   4    6K
R_R5    1   3    3K
V_VS    4   0    DC       100
I_IS    0   1    DC       4
F_F1    1   3    VF_F1    2
VF_F1   5   0    0V
E_E1    3   2    1        3    3
```

3.65 The following program is the Schematics Netlist of a particular circuit. Draw the circuit and determine the voltage at node 2.

```
R_R1    1   2    20
R_R2    2   0    50
R_R3    2   3    70
R_R4    3   0    30
V_VS    1   0    20V
I_IS    2   0    DC    2A
```

Section 3.9   Applications

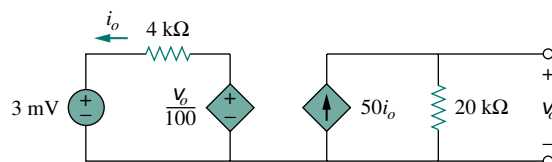**3.66** Calculate v_o and i_o in the circuit of Fig. 3.102.

Figure 3.102   For Prob. 3.66.

3.67 For the simplified transistor circuit of Fig. 3.103, calculate the voltage v_o.