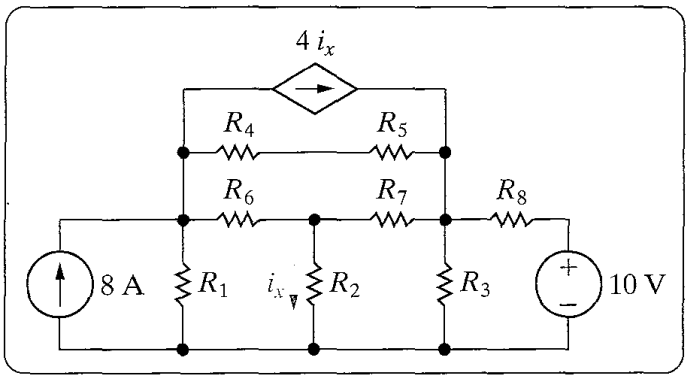
4.1 For the circuit shown in Fig. P4.1, state the numerical value of the number of (a) branches, (b) branches where the current is unknown, (c) essential branches, (d) essential branches where the current is unknown, (e) nodes, (f) essential nodes, and (g) meshes.

Figure P4.1



4.4 Assume the current i_g in the circuit in Fig. P4.4 is known. The resistors R_1–R_5 are also known.

a) How many unknown currents are there?

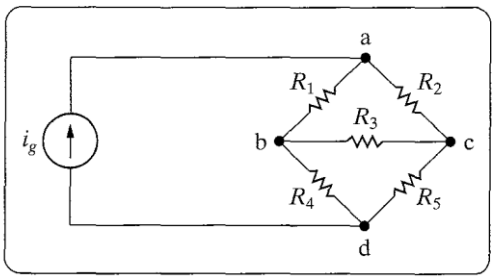
b) How many independent equations can be written using Kirchhoff's current law (KCL)?

c) Write an independent set of KCL equations.

d) How many independent equations can be derived from Kirchhoff's voltage law (KVL)?

e) Write a set of independent KVL equations.

Figure P4.4



P A 100 Ω resistor is connected in series with the 40 mA current source in the circuit in Fig. P4.6.

a) Find v_o.

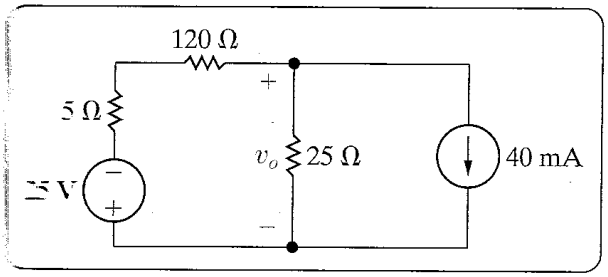
b) Find the power developed by the 40 mA current source.

c) Find the power developed by the 25 V voltage source.

d) Verify that the total power developed equals the total power dissipated.

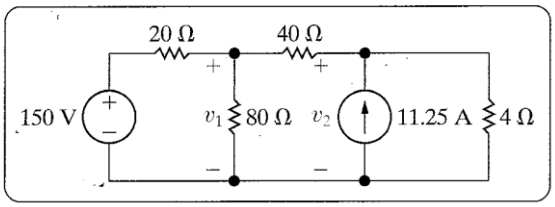
e) What effect will any finite resistance connected in series with the 40 mA current source have on the value of v_o?

Figure P4.6



4.12 **P** Use the node-voltage method to find v_1 and v_2 in the circuit in Fig. P4.12.

Figure P4.12



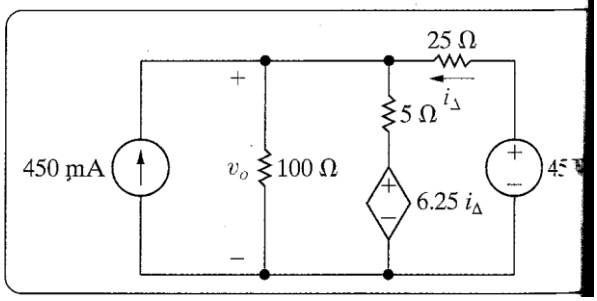
4.17 P

a) Use the node-voltage method to find v_o in the circuit in Fig. P4.17.

b) Find the power absorbed by the dependent source.

c) Find the total power developed by the independent sources.

Figure P4.17

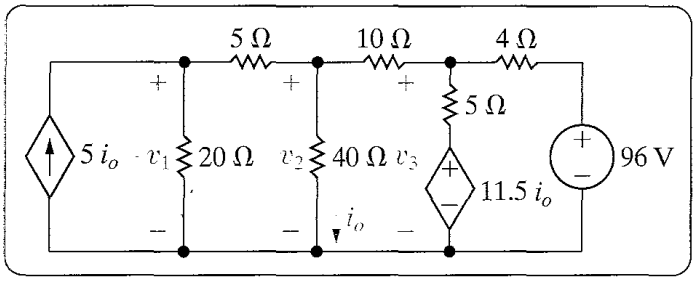


4.18 P

a) Find the node voltages v_1, v_2, and v_3 in the circuit in Fig. P4.18.

b) Find the total power dissipated in the circuit.

Figure P4.18

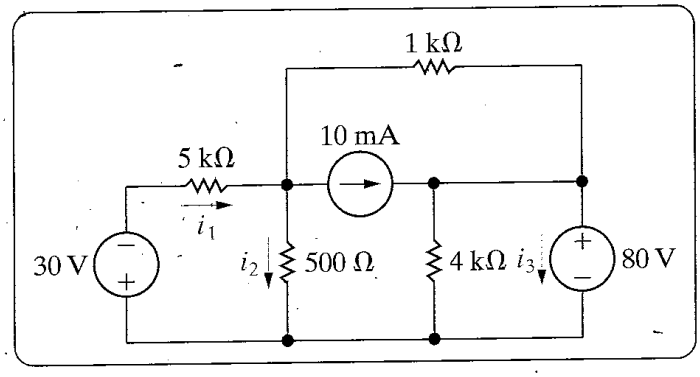


4.24 P

a) Use the node-voltage method to find the branch currents i_1, i_2, and i_3 in the circuit in Fig. P4.24.

b) Check your solution for i_1, i_2, and i_3 by showing that the power dissipated in the circuit equals the power developed.

Figure P4.24

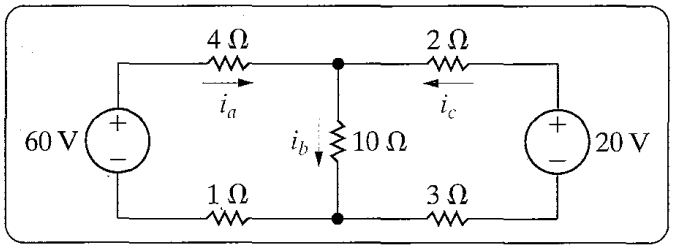


4.31 P

a) Use the mesh-current method to find the branch currents i_a, i_b, and i_c in the circuit in Fig. P4.31.

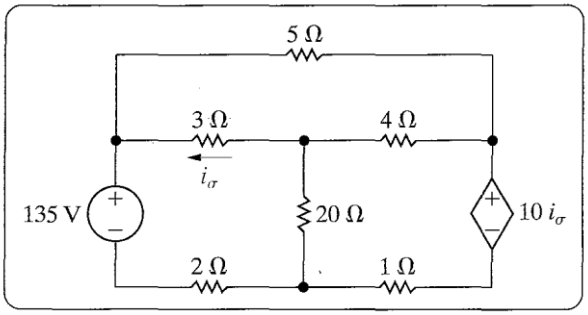
b) Repeat (a) if the polarity of the 60 V source is reversed.

Figure P4.31



4.33 P Use the mesh-current method to find the power dissipated in the 20 Ω resistor in the circuit in Fig. P4.33.

Figure P4.33

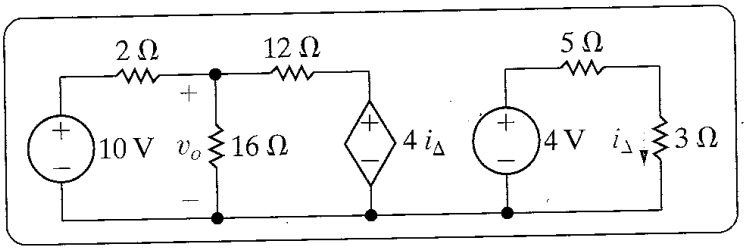


4.36 P

a) Use the mesh-current method to find v_o in the circuit in Fig. P4.36.

b) Find the power delivered by the dependent source.

Figure P4.36

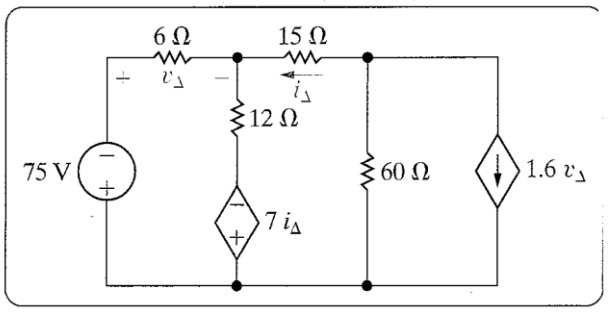


4.42 P

a) Use the mesh-current method to determine which sources in the circuit in Fig. P4.42 are generating power.

b) Find the total power dissipated in the circuit.

Figure P4.42



4.43 P Use the mesh-current method to find the total power dissipated in the circuit in Fig. P4.43.

Figure P4.43