2.26 Assume clockwise mesh currents for the circuit shown in Fig. P2.26 (below). Use mesh analysis to find these mesh currents.

2.27 For the circuit shown in Fig. P2.27, find v_o when the ideal amplifier (a) is an op amp, and (b) has finite gain A.

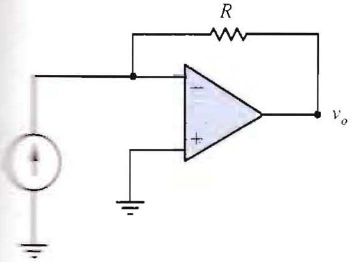

Fig. P2.27

2.28 For the op-amp circuit shown in Fig. P2.28, find (a) v_o, and (b) i_o.

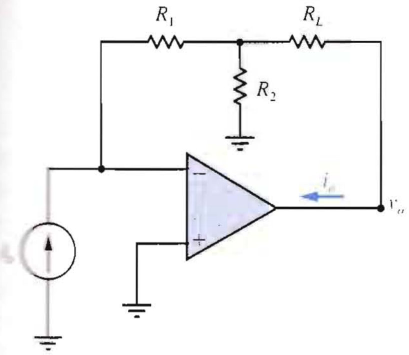

Fig. P2.28

2.29 For the op-amp circuit shown in Fig. P2.29, find (a) v_o, and (b) i_o.

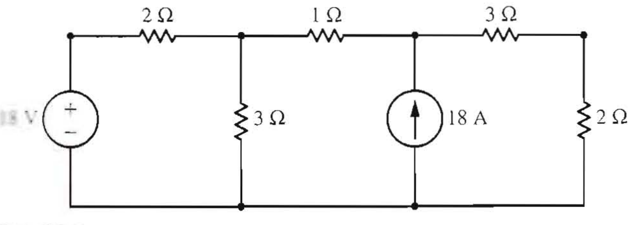

Fig. P2.26

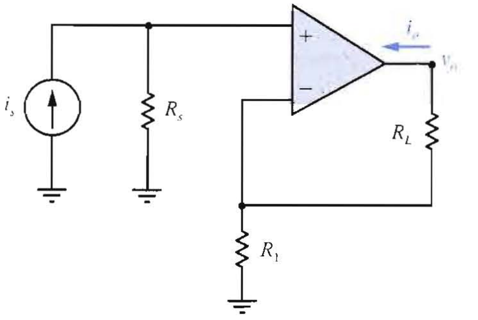

Fig. P2.29

2.30 The op-amp circuit shown in Fig. P2.30 is known as a **negative-impedance converter.** For this circuit, find (a) v_o, and (b) the resistance v_s/i_s.

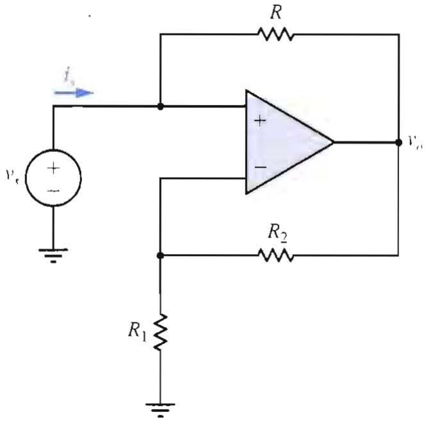

Fig. P2.30

2.31 For the op-amp circuit shown in Fig. P2.31, find (a) v_o, and (b) the resistance v_s/i_s. (See p. 104.)

2.32 For the op-amp circuit shown in Fig. P2.31, interchange the 1-Ω and 2-Ω resistors, and find (a) v_o, and (b) the resistance v_s/i_s. (See p. 104.)

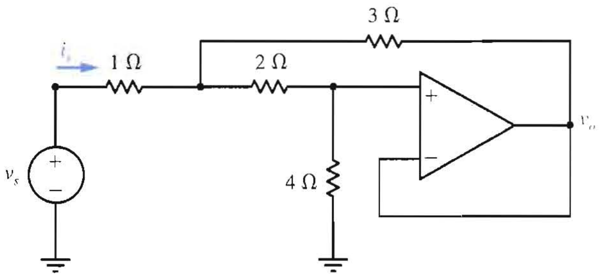

Fig. P2.31

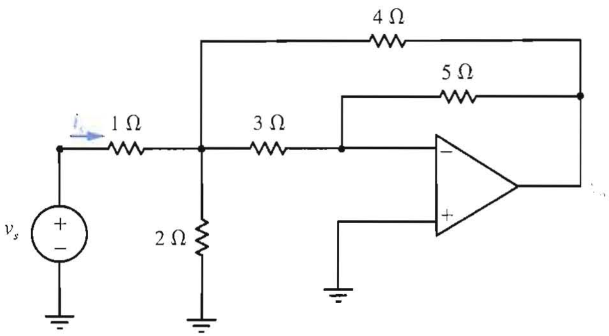

Fig. P2.33

2.33 For the op-amp circuit shown in Fig. P2.33, find (a) v_o, and (b) the resistance v_s/i_s.

2.34 For the op-amp circuit shown in Fig. P2.34, find (a) v_o, and (b) the resistance v_s/i_s. (See p. 105.)

2.35 For the op-amp circuit shown in Fig. P2.35, find v_o.

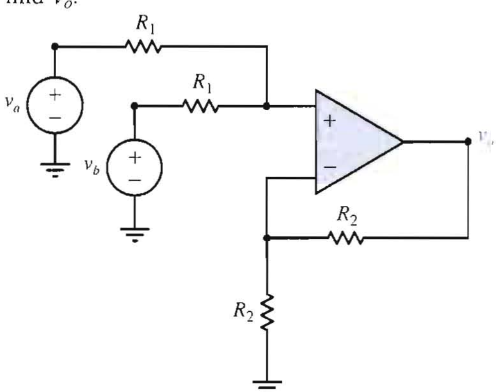

Fig. P2.35

2.36 For the op-amp circuit shown in Fig. P2.36, find v_o. (See p. 105.)

2.37 Consider the circuit shown in Fig. P2.37. (a) Find the Thévenin equivalent of the circuit to the left of terminals a and b. (b) Use the Thévenin-equivalent circuit to find the power absorbed by $R_L = 2\ \Omega$. (c) Determine the value of R_L, which absorbs the maximum amount of power, and find this power.

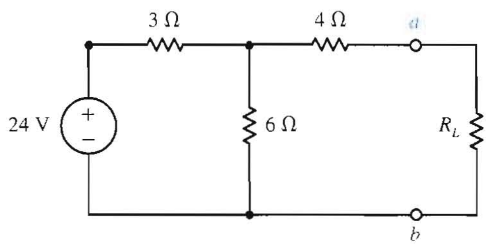

Fig. P2.37

2.38 For the circuit shown in Fig. P2.37, connect a 12-Ω resistor between terminal a and the positive terminal of the voltage source. (a) Find the Thévenin equivalent of the resulting circuit to the left of ter-

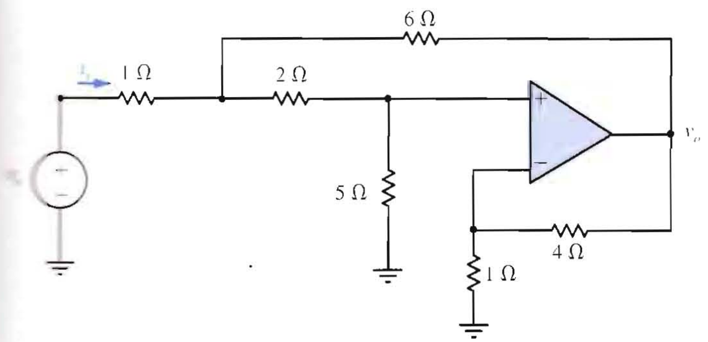

Fig. P2.34

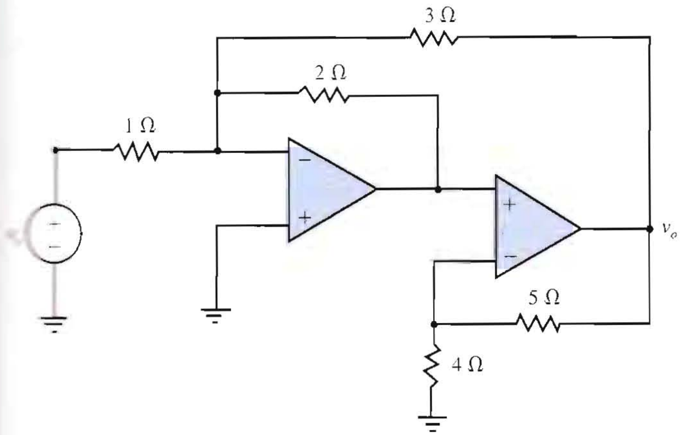

Fig. P2.36

minals a and b. (b) Use the Thévenin-equivalent circuit to find the power absorbed by R_L = 2 Ω. (c) Determine the value of R_L which absorbs the maximum amount of power, and find this power.

2.39 Consider the circuit shown in Fig. P2.39. (a) Find the Thévenin equivalent of the circuit to the left of terminals a and b. (b) Use the Thévenin-equivalent circuit to find i and the power absorbed by R_L when R_L = 6 Ω. (c) Determine the value of R_L, which absorbs the maximum amount of power, and find this power. (See p. 106.)

2.40 Consider the circuit shown in Fig. P2.40. (a) Find the Thévenin equivalent of the circuit to the left of terminals a and b. (b) Use the Thévenin-equivalent circuit to find v and the power absorbed by R_L when R_L = 3 Ω. (c) Determine the value of R_L, which absorbs the maximum amount of power, and find this power. (See p. 106.)

2.41 For the circuit given in Fig. P2.41, determine the value of R_L, which absorbs the maximum amount of power, and find this power when v_1 = 20 V.

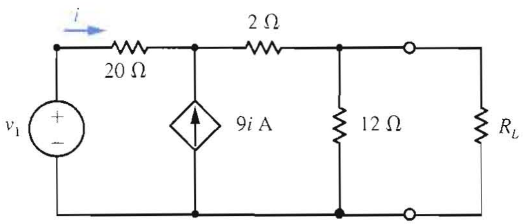

Fig. P2.41

2.42 Find the Norton equivalent of the circuit to the left of terminals a and b for the circuit shown in Fig. P2.42. Use this result to find i.

and $v_s(t) = 12u(t)$ V. Find the step responses $v(t)$ and $i(t)$.

3.73 For the *RLC* circuit shown in Fig. 3.43 on p. 172, suppose that $R = \frac{1}{2}\ \Omega$, $L = \frac{1}{3}$ H, $C = \frac{1}{4}$ F, and $V = 1$ V. Find the unit step responses $i(t)$ and $v(t)$.

3.74 For the *RLC* circuit shown in Fig. 3.43 on p. 172, suppose that $R = \frac{1}{2}\ \Omega$, $L = \frac{1}{4}$ H, $C = \frac{1}{2}$ F, and $V = 1$ V. Find the unit step responses $i(t)$ and $v(t)$.

3.75 For the circuit shown in Fig. P3.66, suppose that $v_s(t) = 9u(t)$ V. Find the step response $v_2(t)$.

3.76 For the circuit shown in Fig. P3.67, suppose that $v_s(t) = 6u(t)$ V. Find the step responses $i(t)$ and $v(t)$.

3.77 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.77 when $C = \frac{1}{3}$ F and $v_s(t) = 4u(t)$ V.

3.78 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.77 when $C = \frac{1}{8}$ F and $v_s(t) = 8u(t)$ V.

3.79 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.77 when $C = \frac{1}{4}$ F and $v_s(t) = 6u(t)$ V.

3.80 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = \frac{4}{3}$ F and $v_s(t) = 4u(t)$ V.

3.81 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = 1$ F and $v_s(t) = 3u(t)$ V.

3.82 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = \frac{1}{5}$ F and $v_s(t) = 2u(t)$ V.

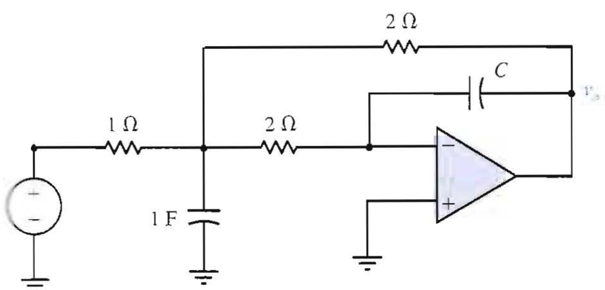

Fig. P3.77

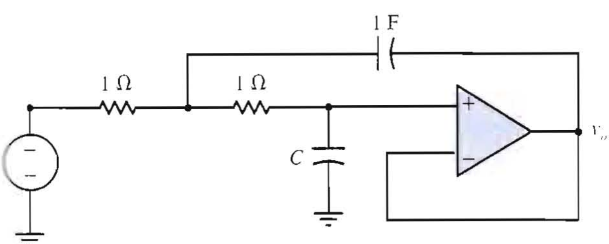

Fig. P3.80

4.18 For the circuit shown in Fig. P4.17, find the Thévenin equivalent of the circuit in the shaded box when $v_s(t) = 4\cos(2t - 60°)$ V. Use this to determine $v_o(t)$.

4.19 Find the frequency-domain Thévenin equivalent (to the left of terminals a and b) of the circuit shown in Fig. 4.20 on p. 211. (*Hint:* Use the fact that $\mathbf{Z}_o = \mathbf{V}_{oc}/\mathbf{I}_{sc}$.)

4.20 The frequency-domain Thévenin equivalent of a circuit having $\omega = 5$ rad/s has $\mathbf{V}_{oc} = 3.71\underline{/-15.9°}$ V and $\mathbf{Z}_o = 2.38 - j0.667\ \Omega$. Determine a corresponding time-domain Thévenin-equivalent circuit.

4.21 For the op-amp circuit shown in Fig. P4.21, find $v_o(t)$ when $v_s(t) = 6 \sin 2t$ V.

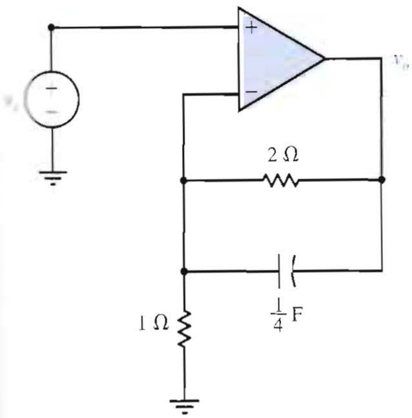

Fig. P4.21

4.22 For the op-amp circuit given in Fig. P4.22, find $v_o(t)$ when $v_s(t) = 3\cos 2t$ V.

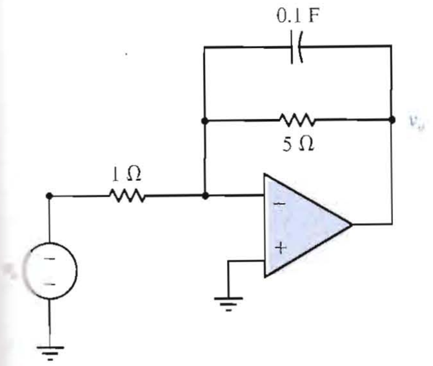

Fig. P4.22

4.23 For the op-amp circuit shown in Fig. P4.23, find $v_o(t)$ when $v_s(t) = 4\cos(2t - 30°)$ V. (See p. 258.)

4.24 For the circuit shown in Fig. P4.24, find the currents $\mathbf{I}_1$ and $\mathbf{I}_2$ when $\mathbf{V}_{s1} = 250\sqrt{2}\underline{/-30°}$ V, $\mathbf{V}_{s2} = 250\sqrt{2}\underline{/-90°}$ V, and $\mathbf{Z} = 78 - j45\ \Omega$.

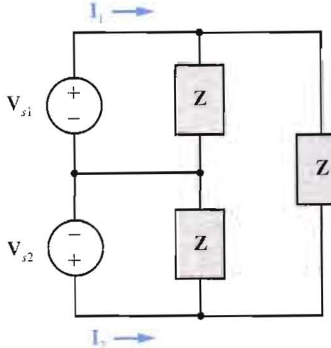

Fig. P4.24

4.25 Use mesh analysis to find $\mathbf{I}_1$ and $\mathbf{I}_2$ for the circuit given in Fig. P4.25 when $\mathbf{V}_{s1} = 250\sqrt{2}\underline{/-30°}$ V, $\mathbf{V}_{s2} = 250\sqrt{2}\underline{/-90°}$ V, and $\mathbf{Z} = 26 - j15\ \Omega$.

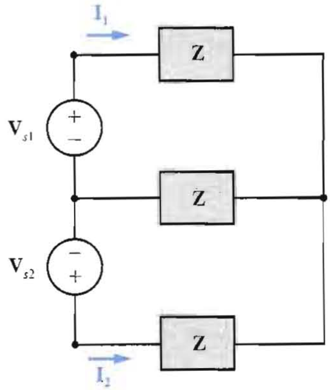

Fig. P4.25

4.26 For the circuit shown in Fig. P4.9, when $i_s(t) = 5\cos 3t$ A then $v_o(t) = 4.47\cos(3t + 26.6°)$ V. Find the average power absorbed by each element in the circuit.

4.27 For the circuit shown in Fig. P4.17, when $v_s(t) = 10\cos 4t$ V, then the Thévenin equivalent of the portion of the circuit in the shaded box is $\mathbf{V}_{oc} =$