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.

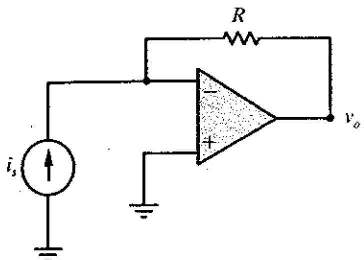

Fig. P2.27

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

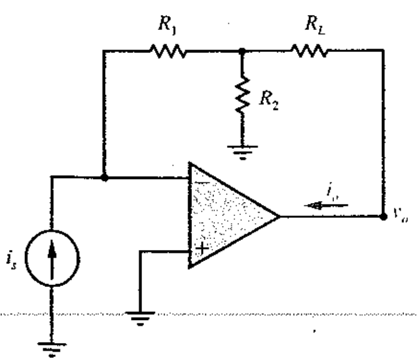

Fig. P2.28

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

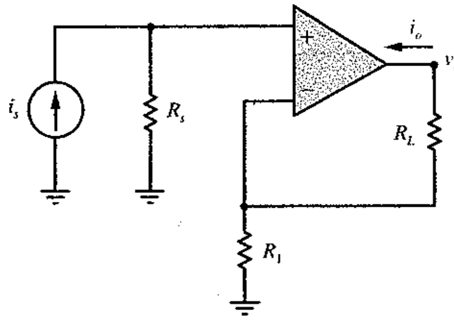

Fig. P2.29

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.

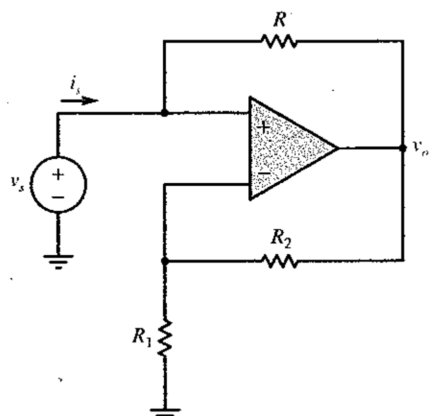

Fig. P2.30

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.)

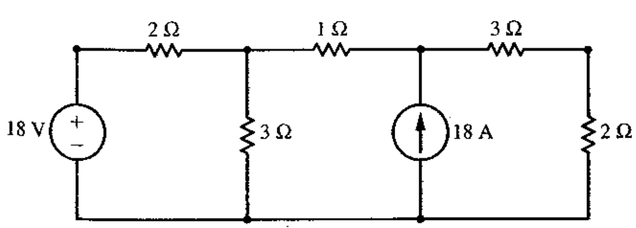

Fig. P2.26

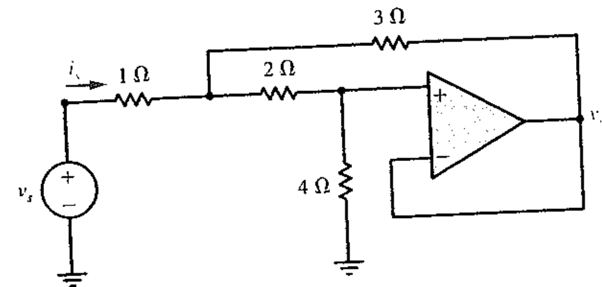

Fig. P2.31

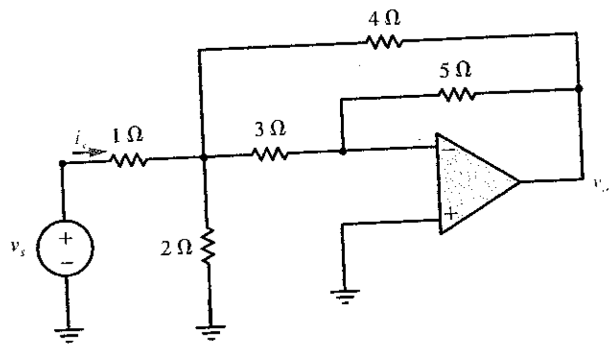

Fig. P2.33

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.

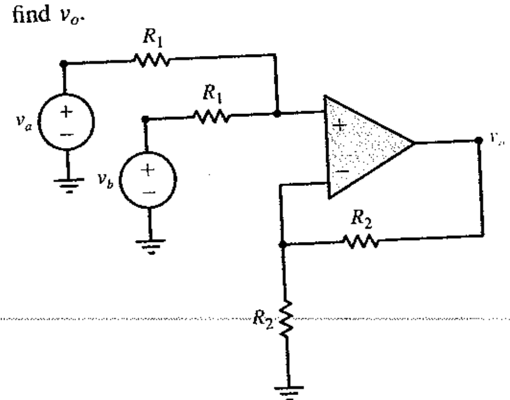

Fig. P2.35

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.

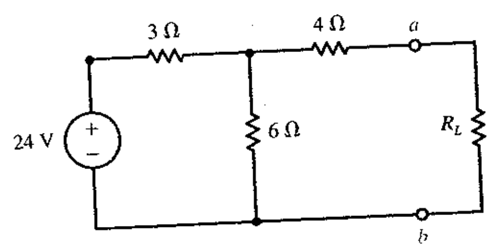

Fig. P2.37

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-

2.45 Find the Thévenin equivalent of the op-amp circuit shown in Fig. P2.45. (*Hint:* To find R_o, apply a current source i_o and calculate the resulting voltage v_o.)

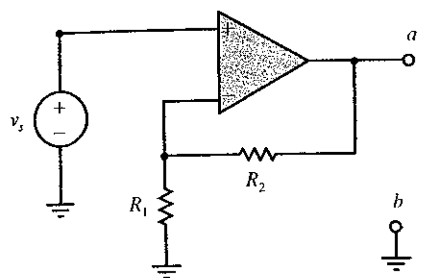

Fig. P2.45

2.46 Find the Thévenin equivalent of the op-amp circuit shown in Fig. P2.46. (*Hint:* To find R_o, apply a current source i_o and calculate the resulting voltage v_o.)

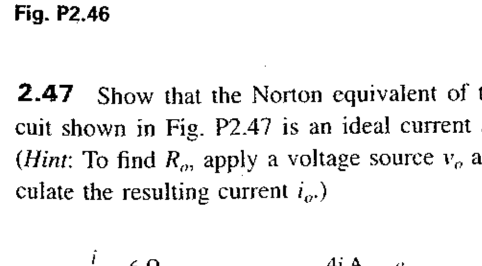

Fig. P2.46

2.47 Show that the Norton equivalent of the circuit shown in Fig. P2.47 is an ideal current source. (*Hint:* To find R_o, apply a voltage source v_o and calculate the resulting current i_o.)

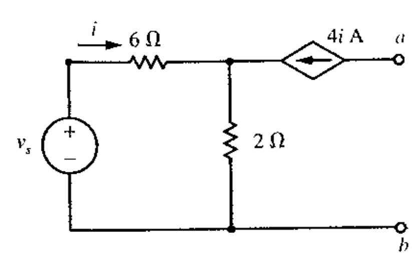

Fig. P2.47

2.48 For the circuit shown in Fig. P2.48, find (a) the Norton-equivalent circuit, and (b) the Thévenin-equivalent circuit.

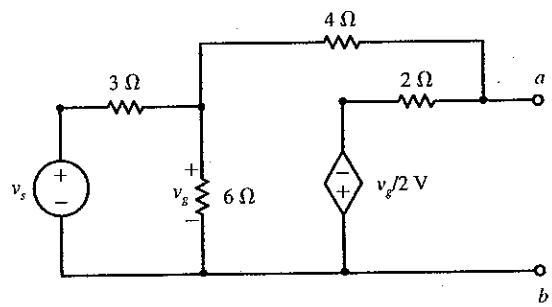

Fig. P2.48

2.49 Figure P2.49 demonstrates the concept of a **source transformation.** Specifically, the voltage source v_s connected in series with a resistance R_s is equivalent to a current source v_s/R_s connected in parallel with R_s. Without using Thévenin's or Norton's theorem, confirm the equivalence of Fig. P2.49*a* and *b* by writing expressions relating i and v.

2.50 Figure P2.50 also demonstrates the concept of a **source transformation.** Specifically, the current source i_g connected in parallel with R_g is equivalent to a voltage source $R_g i_g$ connected in series with a resistance R_g. Without using Thévenin's or Norton's theorem, confirm the equivalence of Fig. P2.50*a* and *b* by writing expressions relating i and v.

2.51 Use source transformations as described in Problems 2.49 and 2.50 to reduce the circuit given in Fig. P2.8 to a circuit having one mesh. Calculate v_3 from this reduced circuit.

2.52 Use source transformations as described in Problems 2.49 and 2.50 to reduce the circuit given in Fig. P2.9 to a circuit having one mesh. Calculate v_3 from this reduced circuit.

2.53 Use source transformations as described in Problems 2.49 and 2.50 and combine independent sources to reduce the circuit given in Fig. P2.39 to a circuit having one mesh. Calculate i from this reduced circuit when $R_L = 6\ \Omega$.

Problems

3.1 For the circuit shown in Fig. P3.1a, suppose that $i(t)$ is described by the function given in Fig. P3.1b. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

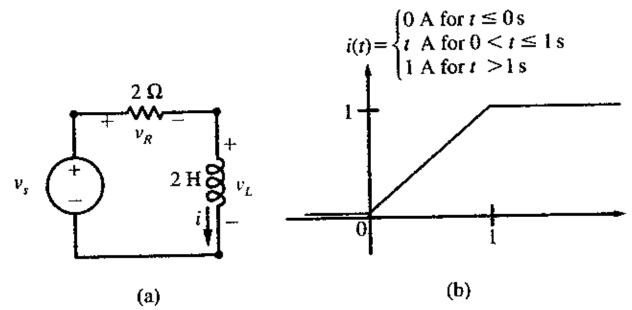

Fig. P3.1

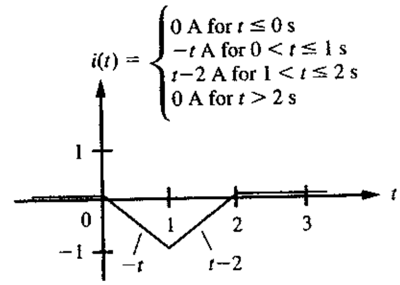

Fig. P3.2

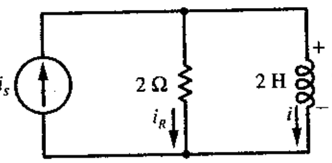

Fig. P3.3

3.2 For the circuit shown in Fig. P3.1a, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

3.3 For the circuit shown in Fig. P3.3, suppose that $i(t)$ is described by the function given in Fig. P3.1b. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $i_R(t)$, and (e) $i_s(t)$.

3.4 For the circuit shown in Fig. P3.3, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $i_R(t)$, and (e) $i_s(t)$.

3.5 For the circuit shown in Fig. P3.5, suppose that $i(t)$ is described by the function given in Fig. P3.1b. Sketch (a) $v_R(t)$, (b) $v_L(t)$, and (c) $v(t)$.

3.6 For the circuit shown in Fig. P3.5, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v_R(t)$, (b) $v_L(t)$, and (c) $v(t)$.

3.7 For the circuit shown in Fig. P3.7a, suppose that $v(t)$ is described by the function given in Fig. P3.7b. Sketch (a) $i(t)$, (b) $w_C(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

3.8 For the circuit shown in Fig. P3.8, suppose that $v(t)$ is described by the function given in Fig. P3.7b.

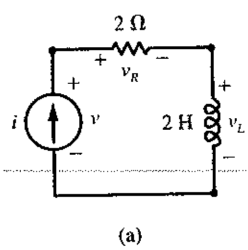

Fig. P3.5

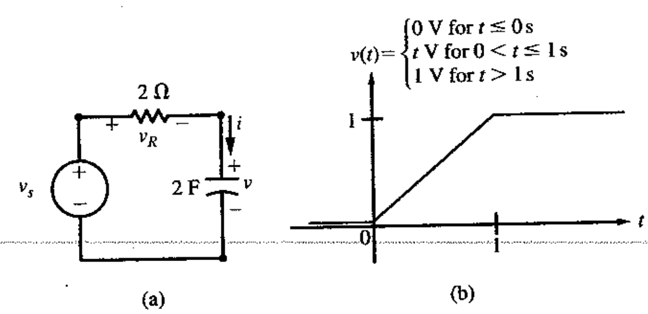

Fig. P3.7

Sketch (a) $i(t)$, (b) $w_C(t)$, (c) $p_R(t)$, (d) $i_R(t)$, and (e) $i_s(t)$.

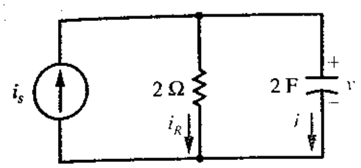

Fig. P3.8

3.9 For the op-amp circuit shown in Fig. P3.9, suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

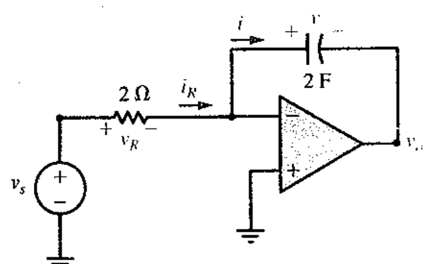

Fig. P3.9

3.10 For the op-amp circuit shown in Fig. P3.9, connect an additional 2-Ω resistor in parallel with the capacitor. Suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

3.11 For the op-amp circuit shown in Fig. P3.11, suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

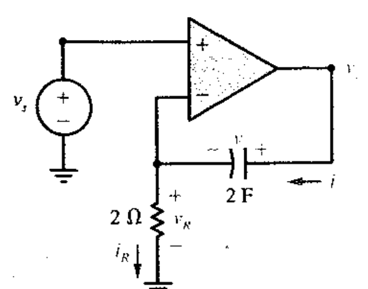

Fig. P3.11

3.12 For the op-amp circuit given in Fig. P3.11, connect an additional 2-Ω resistor in parallel with the capacitor. Suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

3.13 For the op-amp circuit shown in Fig. P3.13, suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

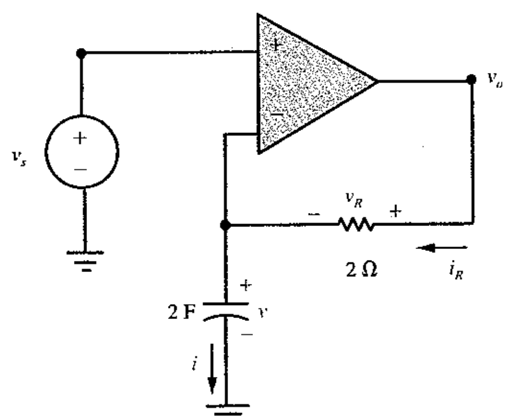

Fig. P3.13

3.14 For the op-amp circuit shown in Fig. P3.13, connect an additional 2-Ω resistor in parallel with the capacitor. Suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $i_R(t)$, (c) $v_R(t)$, (d) $v_s(t)$, and (e) $v_o(t)$.

3.15 Show the following: (See p. 178.)
(a) Inductors connected in series can be combined as depicted in Fig. P3.15*a*.
(b) Inductors connected in parallel can be combined as depicted in Fig. P3.15*b*.
(c) Capacitors connected in parallel can be combined as depicted in Fig. P3.15*c*.
(d) Capacitors connected in series can be combined as depicted in Fig. P3.15*d*.

3.16 For the circuit shown in Fig. P3.1*a*, suppose that $v(t)$ is described by the function given in Fig. P3.16. Sketch (a) $i(t)$, (b) $v_R(t)$, and (c) $v_s(t)$. (See p. 178.)