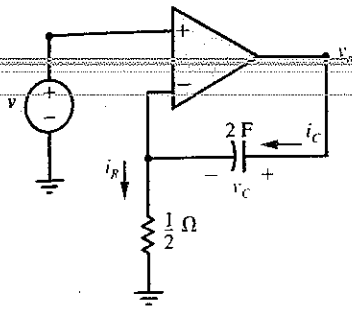


Fig. P3.18

3.19 For the circuit shown in Fig. P3.7*a*, suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $v_R(t)$, and (c) $v_s(t)$.

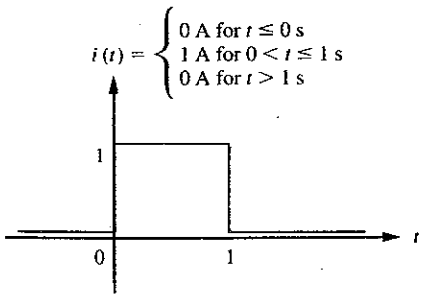


Fig. P3.19

3.20 For the circuit shown in Fig. P3.8, suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $i_R(t)$, and (c) $i_s(t)$.

3.21 For the op-amp circuit shown in Fig. P3.9, suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $v_R(t)$, (c) $v_s(t)$, and (d) $v_o(t)$.

3.22 For the op-amp circuit shown in Fig. P3.9, interchange the resistor and the capacitor. Suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $v_C(t)$, (c) $v_s(t)$, and (d) $v_o(t)$.

3.23 For the op-amp circuit shown in Fig. P3.11, suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $v_R(t)$, (c) $v_s(t)$, and (d) $v_o(t)$.

3.24 For the op-amp circuit shown in Fig. P3.13, suppose that $i(t)$ is described by the function given in Fig. P3.19. Sketch (a) $v(t)$, (b) $v_R(t)$, (c) $v_s(t)$, and (d) $v_o(t)$.

3.25 Find the dual of the circuit given in Fig. P3.25.

3.26 Find the dual of the circuit given in Fig. P3.26. (See p. 180.)

3.27 Find the dual of the circuit given in Fig. P3.27. (See p. 180.)

3.28 For the circuit shown in Fig. P3.28, the switch opens at time $t = 0$ s. Write a differential equation in $v(t)$ for ≥ 0 s. Find $v(t)$ and $i(t)$ for all time and sketch these functions.

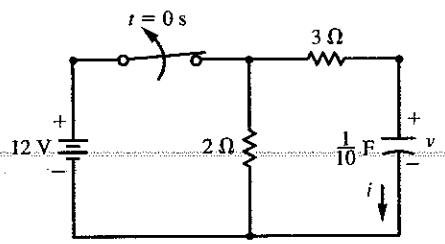


Fig. P3.28

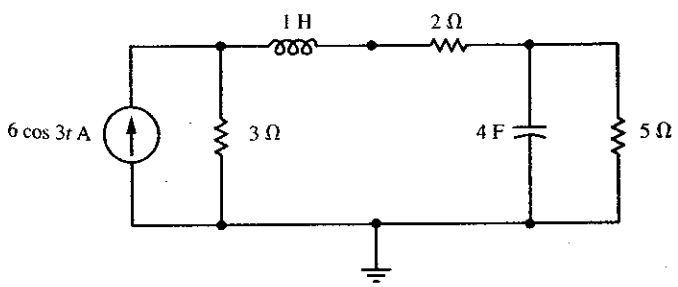


Fig. P3.25

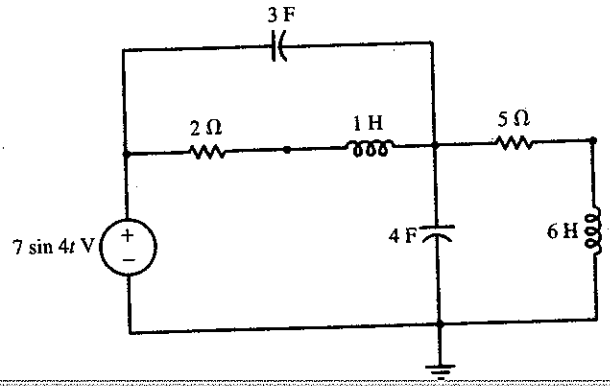


Fig. P3.26

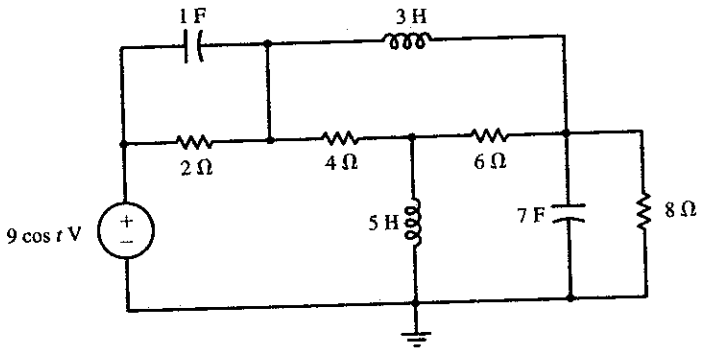


Fig. P3.27

3.29 For the circuit shown in Fig. P3.28, replace the capacitor with a 5-H inductor. For the resulting circuit, the switch opens at time $t = 0$ s. Write a differential equation in $i(t)$ for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time and sketch these functions.

3.30 For the circuit shown in Fig. P3.30, suppose that $i_s(t) = 10$ A for $t < 0$ s and $i_s(t) = 0$ A for $t \geq 0$ s. Write a differential equation in $i(t)$ for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time and sketch these functions.

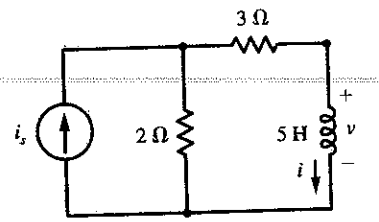


Fig. P3.30

3.31 For the circuit shown in Fig. P3.30, replace the inductor with a 0.1-F capacitor. Suppose that $i_s(t) = 10$ A for $t < 0$ s and $i_s(t) = 0$ A for $t \geq 0$ s. Write a differential equation in $v(t)$ for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time and sketch these functions.

3.32 For the circuit shown in Fig. P3.32, suppose that $v_s(t) = 18$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Write a differential equation in $i(t)$ for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time and sketch these functions.

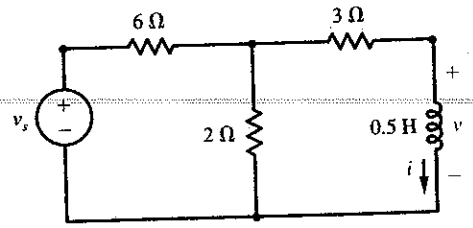


Fig. P3.32

3.33 For the circuit shown in Fig. P3.32, replace the inductor with a $\frac{1}{9}$-F capacitor. Suppose that $v_s(t) = 18$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Write a differential equation in $v(t)$ for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time and sketch these functions.

3.34 For the circuit shown in Fig. P3.34, suppose that $v_s(t) = 12$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Write a differential equation in $v(t)$ for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time and sketch these functions.

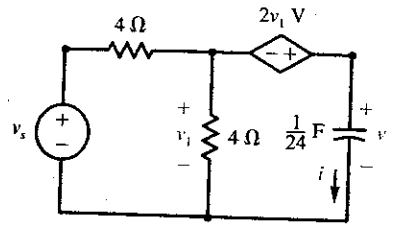


Fig. P3.34

3.35 For the circuit shown in Fig. P3.34, replace the capacitor with a 3-H inductor. Suppose that $v_s(t) = 12$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Write a differential equation in $i(t)$ for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time and sketch these functions.

3.36 For the circuit shown in Fig. P3.36, the switch opens at time $t = 0$ s. Write a differential equation in $i(t)$ for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time and sketch these functions.

3.37 For the circuit shown in Fig. P3.36, replace the inductor with a $\frac{1}{8}$-F capacitor. For the resulting circuit, the switch opens at time $t = 0$ s. Write a differential equation in $v(t)$ for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time and sketch these functions.

3.38 For the circuit shown in Fig. P3.38, the switch opens at time $t = 0$ s. Find $v_1(t)$, $v_2(t)$, $i_1(t)$, $i_2(t)$, and $v(t)$ for all time.

3.39 For the circuit shown in Fig. P3.38, change the value of the 2-Ω resistor to 1 Ω. The switch in the circuit opens at time $t = 0$ s. Find $v_1(t)$, $v_2(t)$, $i_1(t)$, $i_2(t)$, and $v(t)$ for all time.

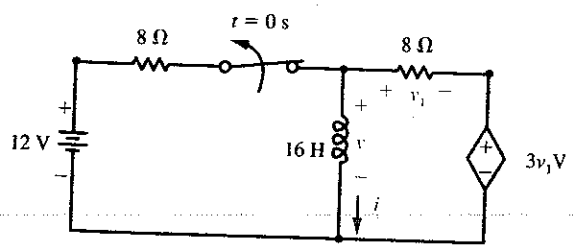


Fig. P3.36

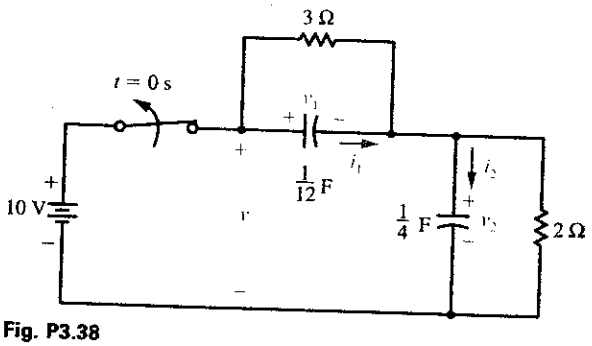


Fig. P3.38

3.40 For the parallel *RC* circuit given in Fig. P3.8, suppose that $i_s(t) = 6u(t)$ A. Find the step responses $v(t)$ and $i(t)$, and sketch these functions.

3.41 For the parallel *RL* circuit given in Fig. P3.17, find the unit step responses $i_L(t)$ and $v(t)$, and sketch these functions.

3.42 For the circuit shown in Fig. P3.42, find the step responses $v(t)$ and $i(t)$, and sketch these functions.

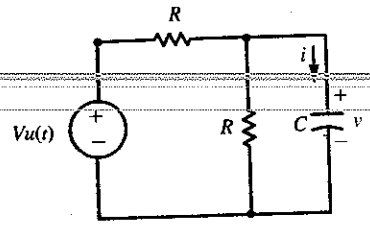


Fig. P3.42

3.43 For the circuit given in Fig. P3.30, suppose that $i_s(t) = 10u(t)$ A. Use Thévenin's theorem to find the step responses $i(t)$ and $v(t)$, and sketch these functions.

3.44 For the circuit given in Fig. P3.30, replace the inductor with a 0.1-F capacitor. Suppose that $i_s(t) = 10u(t)$ A. Use Thévenin's theorem to find the step responses $v(t)$ and $i(t)$, and sketch these functions.

3.45 For the circuit given in Fig. P3.34, suppose that $v_s(t) = 12u(t)$ V. Find the step responses $v(t)$ and $i(t)$, and sketch these functions.

3.46 For the circuit given in Fig. P3.34, replace the capacitor with a 3-H inductor. Suppose that $i_s(t) = 12u(t)$ V. Find the step responses $i(t)$ and $v(t)$, and sketch these functions.

3.47 The step responses $v_C(t)$ and $i(t)$ for the series *RC* circuit shown in Fig. P3.47*a* are given by Eq. 3.19 and Eq. 3.20, respectively. Use duality to determine the step responses $i_L(t)$ and $v(t)$ for the parallel *GL* circuit shown in Fig. P3.47*b*.

3.48 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.48.

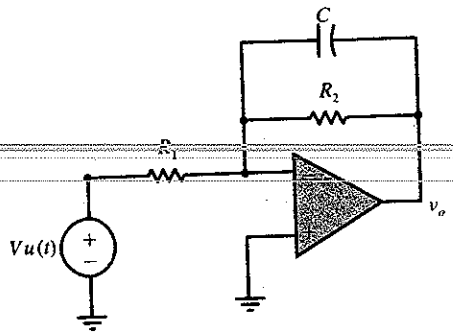


Fig. P3.48

3.49 Find the step responses $v(t)$ and $v_o(t)$ for the op-amp circuit shown in Fig. P3.49.

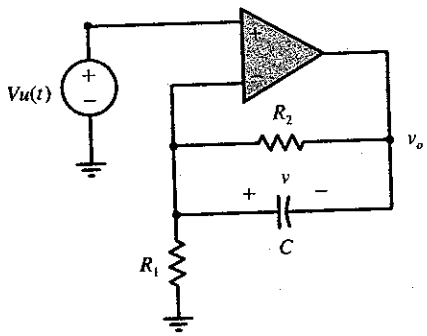
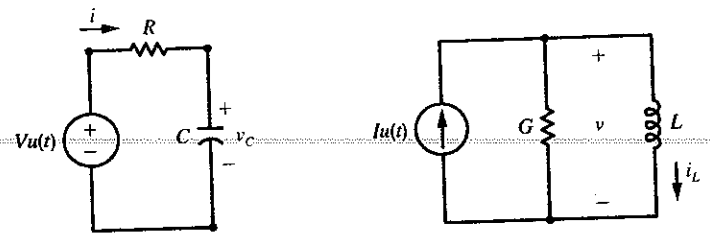


Fig. P3.49



(a) (b)

Fig. P3.47