Chapter 7, Solution 4.

For $t<0$, $v(0^-)=40$ V.

For t >0. we have a source-free RC circuit.

$$\tau = RC = 2x10^3 x10x10^{-6} = 0.02$$

$$v(t) = v(0)e^{-t/\tau} = \underline{40e^{-50t} \text{ V}}$$

Chapter 7, Solution 13.

(a) $\tau = \frac{1}{10^3} = \underline{1ms}$

$v = iR \longrightarrow 20e^{-1000t} = Rx4e^{-1000t}x10^{-3}$

From this, R = 20/4 kΩ= $\underline{5\ k\Omega}$

But $\tau = \frac{L}{R} = {}^{1}\!/_{10^3} \qquad \longrightarrow \qquad L = \frac{5x1000}{1000} = \underline{5H}$

(b) The energy dissipated in the resistor is

$$w = \int_0^t pdt = \int_0^t 80x10^{-3}e^{-2x10^3}dt = -\frac{80x10^{-3}}{2x10^3}e^{-2x10^3 t}\Bigg|_0^{0.5x10^{-3}}$$

$$= 40(1-e^{-1})\mu J = \underline{25.28\mu J}$$

Chapter 7, Solution 17.

$$i(t) = i(0)\, e^{-t/\tau}, \qquad \tau = \frac{L}{R_{eq}} = \frac{1/4}{4} = \frac{1}{16}$$

$$i(t) = 2\, e^{-16t}$$

$$v_o(t) = 3i + L\frac{di}{dt} = 6\, e^{-16t} + (1/4)(-16)\, 2\, e^{-16t}$$

$$v_o(t) = \underline{-2\, e^{-16t}\ u(t) V}$$

Chapter 7, Solution 44.

$$R_{eq} = 6 \,||\, 3 = 2\,\Omega, \qquad \tau = RC = 4$$
$$v(t) = v(\infty) + \left[\, v(0) - v(\infty)\right] e^{-t/\tau}$$

Using voltage division,

$$v(0) = \frac{3}{3+6}(30) = 10\text{ V}, \qquad v(\infty) = \frac{3}{3+6}(12) = 4\text{ V}$$

Thus,

$$v(t) = 4 + (10 - 4)\, e^{-t/4} = 4 + 6\, e^{-t/4}$$
$$i(t) = C\frac{dv}{dt} = (2)(6)\left(\frac{-1}{4}\right)e^{-t/4} = \underline{\mathbf{-3\,e^{-0.25t}\ A}}$$

Chapter 7, Solution 54.

(a) Before t = 0, i is obtained by current division or

$$i(t) = \frac{4}{4+4}(2) = \underline{\mathbf{1\ A}}$$

After t = 0,

$$i(t) = i(\infty) + \left[i(0) - i(\infty)\right] e^{-t/\tau}$$

$$\tau = \frac{L}{R_{eq}}, \qquad R_{eq} = 4 + 4 \,\|\, 12 = 7\,\Omega$$

$$\tau = \frac{3.5}{7} = \frac{1}{2}$$

$$i(0) = 1, \qquad i(\infty) = \frac{4\,\|\,12}{4 + 4\,\|\,12}(2) = \frac{3}{4+3}(2) = \frac{6}{7}$$

$$i(t) = \frac{6}{7} + \left(1 - \frac{6}{7}\right)e^{-2t}$$

$$i(t) = \underline{\mathbf{\frac{1}{7}\left(6 - e^{-2t}\right)\ A}}$$

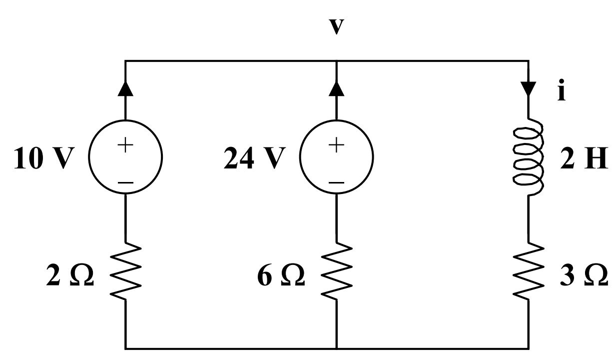
(b) Before t = 0, $i(t) = \frac{10}{2+3} = \underline{\mathbf{2\ A}}$

After t = 0, $R_{eq} = 3 + 6\,\|\,2 = 4.5$

$$\tau = \frac{L}{R_{eq}} = \frac{2}{4.5} = \frac{4}{9}$$

$$i(0) = 2$$

To find $i(\infty)$, consider the circuit below, at t = when the inductor becomes a short circuit,



$$\frac{10 - v}{2} + \frac{24 - v}{6} = \frac{v}{3} \longrightarrow v = 9$$

$$i(\infty) = \frac{v}{3} = 3\ A$$

$$i(t) = 3 + (2 - 3)\,e^{-9t/4}$$

$$i(t) = \underline{\mathbf{3 - e^{-9t/4}\ A}}$$