Chapter 6, Solution 62.

Consider the circuit in Fig. 6.84. Given that $v(t) = 12e^{-3t}$ mV for $t > 0$ and $i_1(0) = -10$ mA, find: (a) $i_2(0)$, (b) $i_1(t)$ and $i_2(t)$.

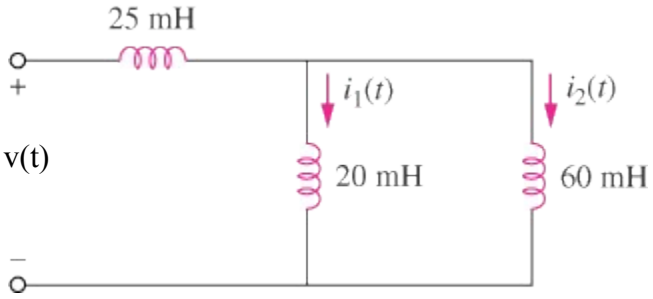

Figure 6.84
For Prob. 6.62.

Solution

(a)
$$L_{eq} = 25 + 20 // 60 = 25 + \frac{20x60}{80} = 40 \text{ mH}$$

$$v = L_{eq}\frac{di}{dt} \longrightarrow i = \frac{1}{L_{eq}}\int v(t)dt + i(0) = \frac{10^{-3}}{40x10^{-3}}\int_0^t 12e^{-3t}dt + i(0) = -0.1(e^{-3t} - 1) + i(0)$$

Using current division and the fact that all the currents were zero when the circuit was put together, we get,

$$i_1 = \frac{60}{80}i = \frac{3}{4}i, \quad i_2 = \frac{1}{4}i$$

$$i_1(0) = \frac{3}{4}i(0) \longrightarrow 0.75i(0) = -0.01 \longrightarrow i(0) = -0.01333$$

$$i_2 = \frac{1}{4}(-0.1e^{-3t} + 0.08667)\text{ A} = -25e^{-3t} + 21.67 \text{ mA}$$

$$\boldsymbol{i_2(0) = -25 + 21.67 = \underline{-3.33 \text{ mA}}}$$

(b)
$$\boldsymbol{i_1 = \frac{3}{4}(-0.1e^{-3t} + 0.08667)\text{ A} = \underline{-75e^{-3t} + 65 \text{ mA}}}$$

$$\boldsymbol{i_2 = \underline{-25e^{-3t} + 21.67 \text{ mA}}}$$