Chapter 7, Solution 80.

In the circuit of Fig. 7.144, assume that the switch has been in position A for a long time, find:

(a) $i_1(0)$, $i_2(0)$, and $v_0(0)$
(b) $i_L(t)$
(c) $i_1(\infty)$, $i_2(\infty)$, and $v_0(\infty)$

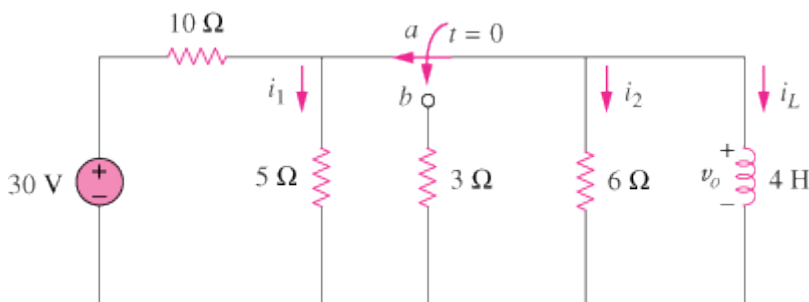Figure 7.144
For Prob. 7.80.

Solution

(a) When the switch is in position A, the 5-ohm and 6-ohm resistors are short-circuited so that

$$i_1(0) = \quad i_2(0) = v_o(0) = 0$$

but the current through the 4-H inductor is $i_L(0) = 30/10 = 3A$.

(b) When the switch is in position B,

$$R_{Th} = 3 // 6 = 2\Omega, \qquad \tau = \frac{L}{R_{Th}} = 4/2 = 2 \sec$$

$$i_L(t) = i_L(\infty) + [i_L(0) - i_L(\infty)]e^{-t/\tau} = 0 + 3e^{-t/2} = 3e^{-t/2} \text{ A}$$

(c) $i_1(\infty) = \frac{30}{10+5} = 2 \text{ A}, \qquad i_2(\infty) = -\frac{3}{9}i_L(\infty) = 0 \text{ A}$

$$v_o(t) = L\frac{di_L}{dt} \qquad \longrightarrow \qquad v_o(\infty) = 0 \text{ V}$$