Chapter 7, Solution 44.

The switch in Fig. 7.111 has been in position a for a long time. At $t = 0$, it moves to position b. Calculate $i(t)$ for all $t > 0$.
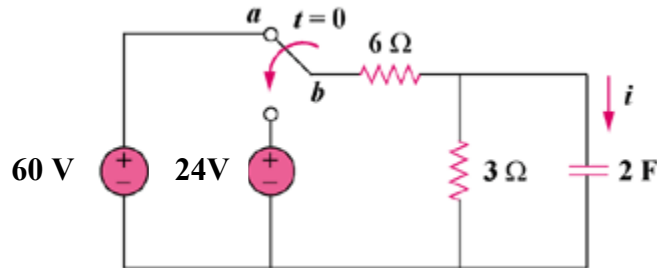

Figure 7.111
For Prob. 7.44.

Solution

$$R_{eq} = 6 \| 3 = 2\,\Omega, \qquad \tau = RC = 4$$

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

Using voltage division,

$$v(0) = \frac{3}{3+6}(60) = 20\,V \qquad v(\infty) = \frac{3}{3+6}(24) = 8\,V$$

Thus,

$$v(t) = 8 + (20 - 8)\, e^{-t/4} = 8 + 12\, e^{-t/4}$$

$$i(t) = C\frac{dv}{dt} = (2)(12)\left(\frac{-1}{4}\right) e^{-t/4} = -6\, e^{-0.25t}\ A$$