Chapter 7, Solution 42.

(a) If the switch in Fig. 7.109 has been open for a long time and is closed at $t = 0$, find $v_o(t)$.

(b) Suppose that the switch has been closed for a long time and is opened at $t = 0$. Find $v_o(t)$.

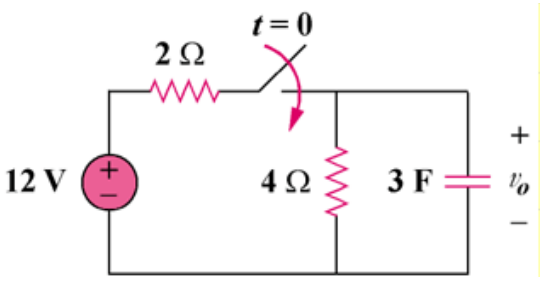

Figure 7.109
For Prob. 7.42.

Solution

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

$$v_o(0) = 0, \qquad v_o(\infty) = \frac{4}{4+2}(12) = 8$$

$$\tau = R_{eq} C_{eq}, \qquad R_{eq} = 2 \| 4 = \frac{4}{3}$$

$$\tau = \frac{4}{3}(3) = 4$$

$$v_o(t) = 8 - 8e^{-t/4}$$

$$\mathbf{v_o(t) = 8(1 - e^{-0.25t})\ V}$$

(b) For this case, $v_o(\infty) = 0$ so that

$$v_o(t) = v_o(0) e^{-t/\tau}$$

$$v_o(0) = \frac{4}{4+2}(12) = 8, \qquad \tau = RC = (4)(3) = 12$$

$$\mathbf{v_o(t) = 8e^{-t/12}\ V}$$