13.48 In the network in Fig. P13.48, the switch opens at $t = 0$. Use Laplace transforms to find $v_o(t)$ for $t > 0$.

CS

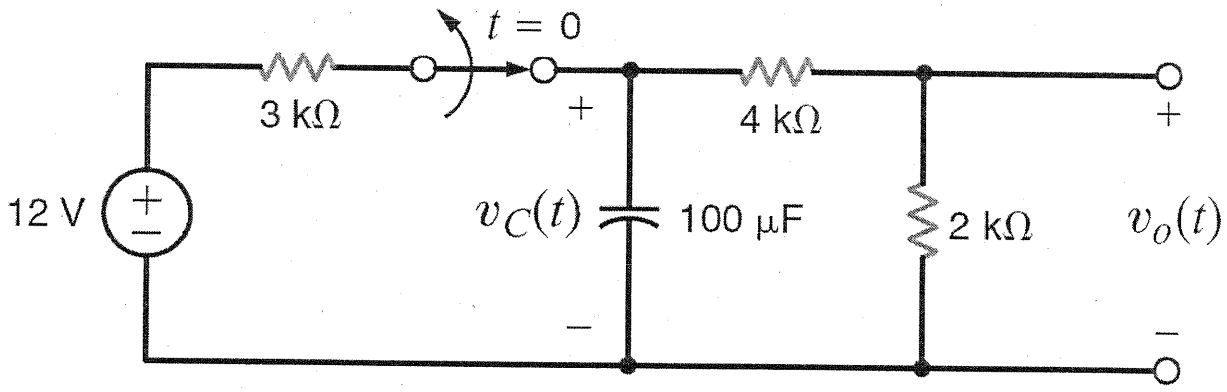


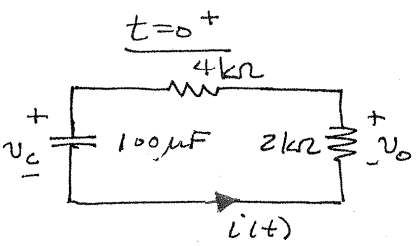
Figure P13.48

SOLUTION:

$t=0^-$

$$v_c(0^-) = \frac{12(6000)}{6000+3000} = 8\text{ V}$$

$t=0^+$



$$6000\,i(t) + 10^4 \int i(t) = 0 \quad \text{or,} \quad 10^{-4}\frac{dv_c}{dt} + \frac{v_c(t)}{6000} = 0$$

$$0.6\left[sV_c(s) - v_c(0^-)\right] + V_c(s) = 0 \Rightarrow V_c(s)\left[0.6s+1\right] = 4.8$$

$$\text{But} \quad \frac{V_o(s)}{V_c(s)} = \frac{2000}{2000+4000} = \frac{1}{3} \Rightarrow V_o(s) = \frac{V_c(s)}{3}$$

$$3V_o(s)\left[0.6s+1\right] = 4.8 \Rightarrow V_o(s)\left[s+1.67\right] = 2.67$$

$$V_o(s) = \frac{2.67}{s+1.67}$$

$$v_o(t) = 2.67\,e^{-1.67t}\,u(t)$$