Boise State University
Electrical Engineering Department

EE 210: Circuits I

Solution 1

(a) Before t = 0, $i = \frac{25}{3+2} = \mathbf{5\ A}$

After t = 0, $i(t) = i(0)e^{-t/\tau}$

$$\tau = \frac{L}{R} = \frac{4}{2} = 2, \qquad i(0) = 5$$

$$i(t) = \underline{5e^{-t/2}\ u(t)A}$$

(b) Before t = 0, the inductor acts as a short circuit so that the 2 Ω and 4 Ω resistors are short-circuited.

$$i(t) = \mathbf{6\ A}$$

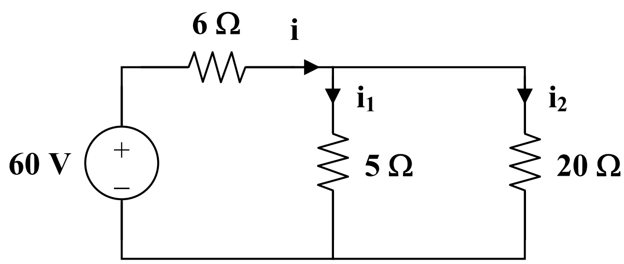
After t = 0, we have an RL circuit.

$$i(t) = i(0)e^{-t/\tau}, \qquad \tau = \frac{L}{R} = \frac{3}{2}$$

$$i(t) = \underline{6e^{-2t/3}\ u(t)A}$$

Solution 2

At $t = 0^-$, the circuit has reached steady state so that the inductors act like short circuits.



$$i = \frac{60}{6 + 5 \| 20} = \frac{60}{10} = 6, \qquad i_1 = \frac{20}{25}(6) = 4.8, \qquad i_2 = 1.2$$

$$i_1(0) = 4.8 \text{ A}, \qquad i_2(0) = 1.2 \text{ A}$$

For t > 0, the switch is closed so that the energies in L_1 and L_2 flow through the closed switch and become dissipated in the 5 Ω and 20 Ω resistors.

$$i_1(t) = i_1(0)e^{-t/\tau_1}, \qquad \tau_1 = \frac{L_1}{R_1} = \frac{2.5}{5} = \frac{1}{2}$$

$$i_1(t) = \underline{4.8e^{-2t}\ u(t)\text{A}}$$

$$i_2(t) = i_2(0)e^{-t/\tau_2}, \qquad \tau_2 = \frac{L_2}{R_2} = \frac{4}{20} = \frac{1}{5}$$

$$i_2(t) = \underline{1.2e^{-5t}\ u(t)\text{A}}$$