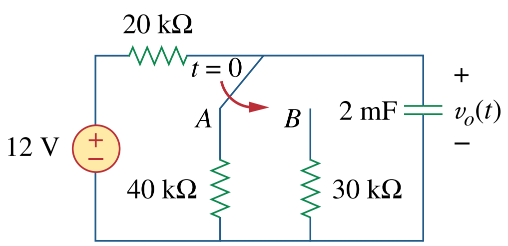
Spring, 2007

EECS70A / CSE 70A Network Analysis I
Prof. Peter Burke

Homework # 5 solution

Q1. Problem 7.7:



When the switch is at position A, the circuit reaches steady state. By voltage division,

$$v_o(0) = \frac{40}{40+20}(12V) = 8V$$

When the switch is at position B, the circuit reaches steady state. By voltage division,

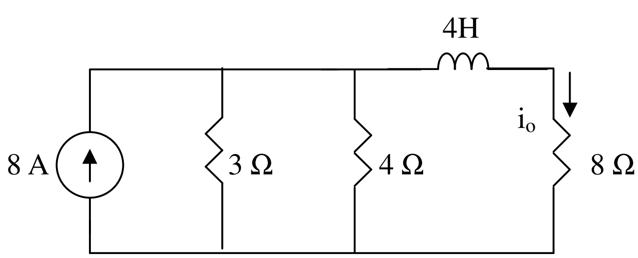
$$v_o(\infty) = \frac{30}{30+20}(12V) = 7.2V$$

$$R_{Th} = 20k // 30k = \frac{20x30}{50} = 12k\Omega$$

$$\tau = R_{Th}C = 12x10^3 x2x10^{-3} = 24s$$

$$v_o(t) = v_o(\infty) + [v_o(0) - v_o(\infty)]e^{-t/\tau} = 7.2 + (8-7.2)e^{-t/24} = \underline{7.2 + 0.8e^{-t/24} \quad V}$$

Q2. Problem 7.11



3Ω // 4Ω = 4x3/7 = 1.7143Ω

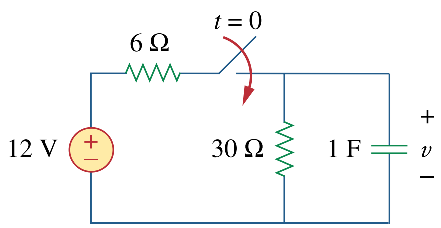
$$i_o(0^-) = \frac{1.7143}{1.7143+8}(8) = 1.4118 \text{ A}$$

For t >0, we have a source-free RL circuit.

$$\tau = \frac{L}{R} = \frac{4}{4+8} = 1/3$$

$$i_o(t) = i_o(0)e^{-t/\tau} = \underline{1.4118e^{-3t} \text{ A}}$$

Q3. Problem 7.41



$$v(0) = 0, \qquad v(\infty) = \frac{30}{36}(12) = 10$$

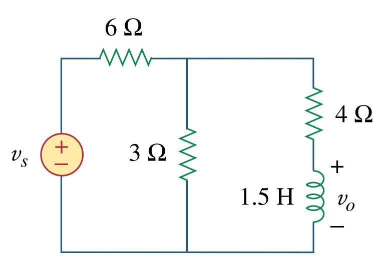
$$R_{eq}C = (6 \parallel 30)(1) = \frac{(6)(30)}{36} = 5$$

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

$$v(t) = 10 + (0 - 10)e^{-t/5}$$

$$v(t) = \underline{10(1 - e^{-0.2t})\, u(t) V}$$

Q4. Problem 7.59



Let I be the current through the inductor.

For $t < 0$, $\quad v_s = 0$, $\quad i(0) = 0$

For $t > 0$, $\quad R_{eq} = 4 + 6 \parallel 3 = 6$,

$$\tau = \frac{L}{R_{eq}} = \frac{1.5}{6} = 0.25$$

$$i(\infty) = \frac{2}{2+4}(3) = 1$$

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

$$i(t) = 1 - e^{-4t}$$

$$v_o(t) = L\frac{di}{dt} = (1.5)(-4)(-e^{-4t})$$

$$v_o(t) = \underline{6e^{-4t}u(t) \text{ V}}$$