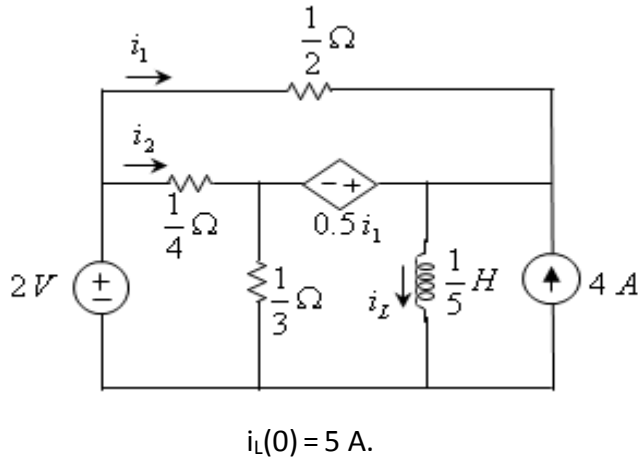


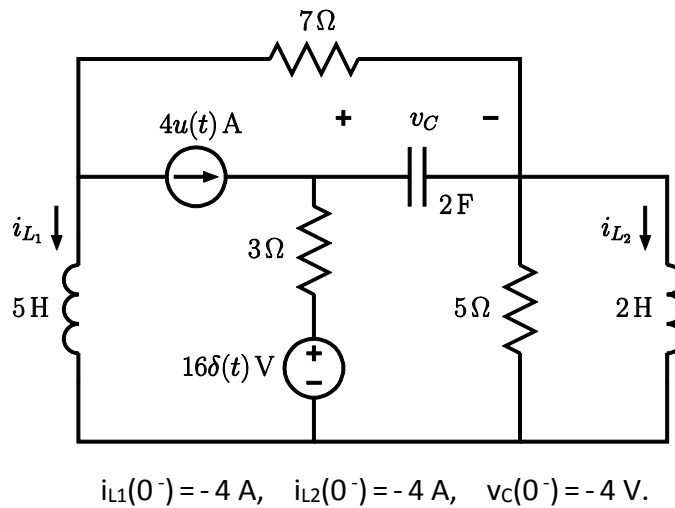
HOMEWORK VIII

Question 1 Consider the circuit below. Find $i_2(t)$ for $t \geq 0$.



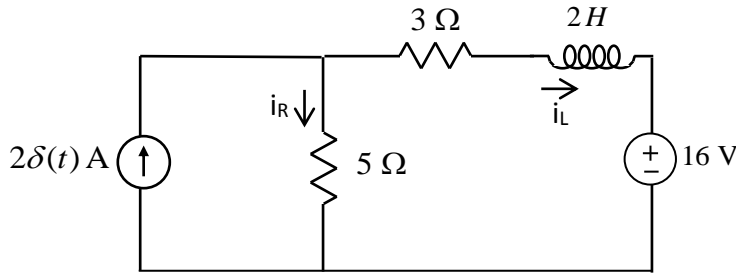
Answer $i_2(t) = 16 - 12.5e^{-5t/16} \text{ A, } t \geq 0.$

Question 2 In the circuit below, find the inductor and capacitor currents and voltages at $t = 0^+$ and $t = \infty$.



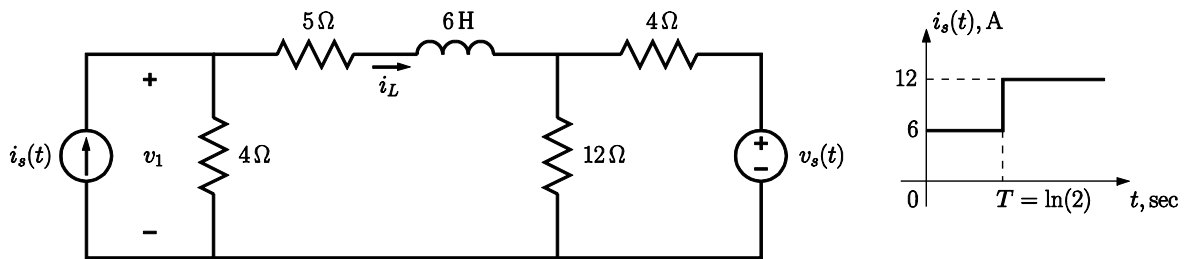
Answer $i_{L1}(0^+) = -2 \text{ A, } i_{L2}(0^+) = 1 \text{ A, } v_C(0^+) = -3 \text{ V};$
 $v_{L1}(0^+) = -10.25 \text{ V, } v_{L2}(0^+) = 3.75 \text{ V, } i_C(0^+) = 3.75 \text{ A};$
 $i_{L1}(\infty) = -4 \text{ A, } i_{L2}(\infty) = 0, v_C(\infty) = 12 \text{ V.}$

Question 3 In the circuit below, $i_L(0^-) = 2$ A. Find and sketch $i_R(t)$ for $t > 0^-$.



Answer $i_R(t) = 2\delta(t) + (2 - 9e^{-4t})u(t)$ A.

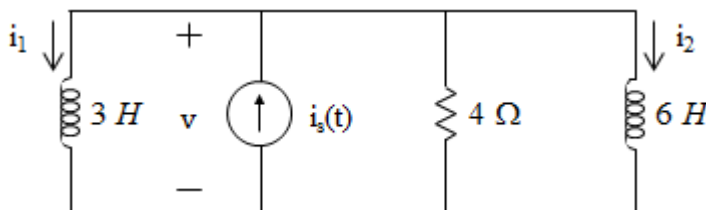
Question 4 Consider the circuit given below. Find and sketch $v_1(t)$ for $t \geq 0$.



$i_L(0^-) = 6$ A; $v_s(t) = 24\delta(t - 2T)$ V.

Answer $v_1(t) = 32 + 4e^{-2(t-T)}$ V, $T \leq t < 2T$; $v_1(2T^+) = 45$ V.

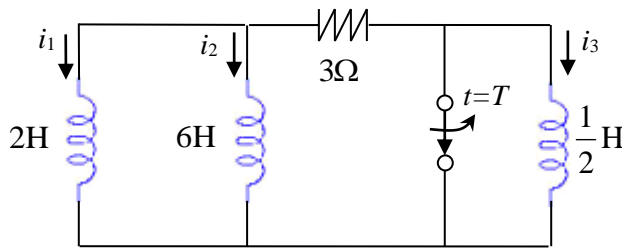
Question 5 Consider the circuit given below. Find and sketch $i_2(t)$ and $v(t)$ for $t \geq 0$. Find the stored energy in the 6 H inductor at $t = \infty$.



$i_s(t) = 15u(t) - 9\delta(t - T)$ A
 $i_1(0^-) = 5$ A, $i_2(0^-) = -2$ A
 $T = \ln(2)$ sec.

Answer $i_1(t) = 13 - 8e^{-2t}$ A, $v(t) = 48e^{-2t}$ V, $0 \leq t < T$; $i_1(T^+) = -1$ A; $e_{6H}(\infty) = 12$ J.

Question 6 Consider the following circuit. The switch is opened at $t = T$.

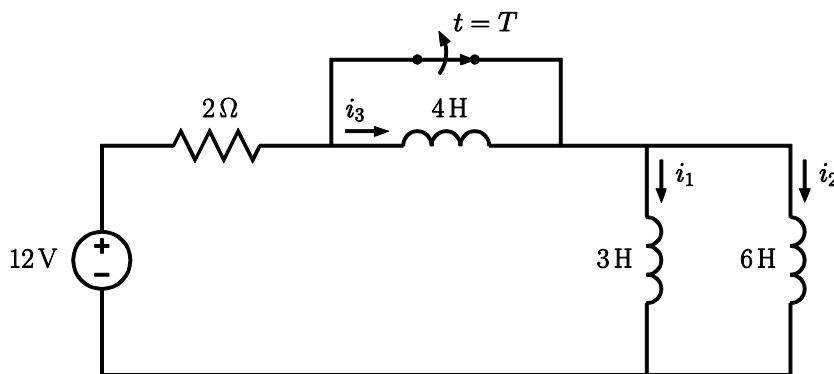


$$\begin{aligned} i_1(0) &= 10 \text{ A}, \\ i_2(0) &= 2 \text{ A}, \\ i_3(0) &= 4 \text{ A}; \\ i_2(T^-) &= 0. \end{aligned}$$

- Find and sketch $i_1(t)$ and $i_3(t)$ for $t \geq 0$.
- Find the energy delivered to the resistor on the interval $0 \leq t < T$.

Answer a) $i_1(t) = 1 + 9e^{-2t}$ A, $0 \leq t < T$; $T = 0.5 \ln(3)$ sec; $i_3(t) = -2e^{-1.5(t-T)}$ A, $t > T$.
 b) $W_R = 96$ J.

Question 7 In the circuit shown below, the switch is closed during $0 \leq t < T$, and it is opened at $t = T$.



$$i_1(0) = 5 \text{ A}, \quad i_2(0) = -2 \text{ A}, \quad i_3(0) = -1.5 \text{ A}; \quad i_1(T^-) = 6 \text{ A},$$

- Find $i_1(t)$ and $i_3(t)$ for $t \geq 0$.
- Find the energy supplied by the battery and the energy delivered to the resistor on the interval $0 \leq t < T$. Find the stored energies in the inductors at $t = 0$ and $t = T^-$. Verify that the energy is conserved.

Answer a) $i_1(t) = 7 - 2e^{-t}$ A, $0 \leq t < T$; $T = \ln(2)$ sec; $i_3(t) = 6 - 5.5e^{-(t-T)/3}$ A, $t > T$.
 b) $W_{IS} = 72T - 18$ J, $W_R = 72T - 29.25$ J, $E_2(T^-) = 6.75$ J.