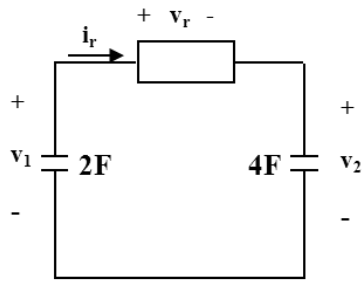
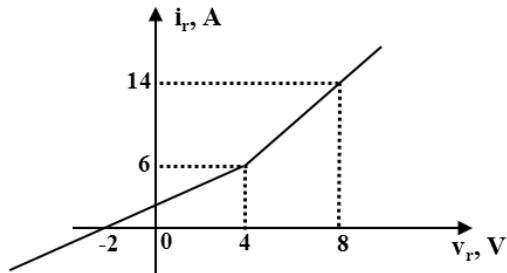


HOMEWORK IX

Question 1 Consider the circuit below.



$v_1(0) = 14V, \quad v_2(0) = 3V$



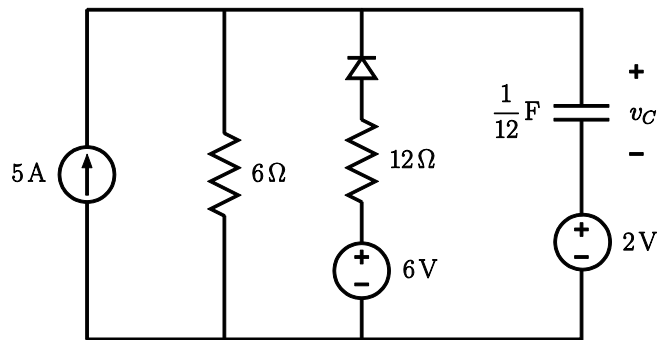
- a) Find and sketch $v_r(t)$ and $v_1(t)$.
- b) Find the energy delivered to the resistor on the interval $[0, \infty)$.

Answer a) $i_r(t) = 20e^{-1.5t}$ A, $v_1(t) = (22/3) + (20/3)e^{-1.5t}$ V, $0 \leq t \leq T$ where $T = (2/3)\ln(10/3)$ sec.

$i_r(t) = 6e^{-0.75(t-T)}$ A, $v_1(t) = (16/3) + 4e^{-0.75(t-T)}$ V, $t \geq T$.

b) $W_r = 78$ J.

Question 2 In the following circuit, find and sketch $v_c(t)$ for $t \geq 0$.

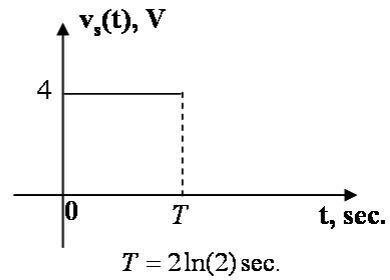
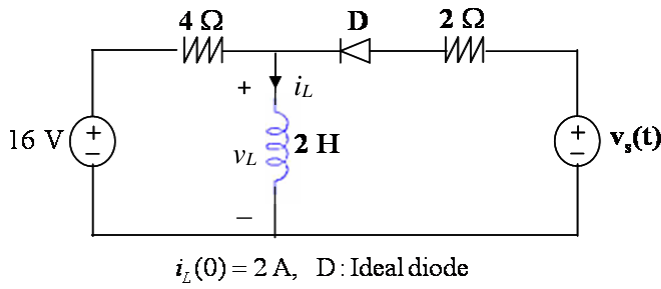


$v_c(0) = -4V$

Answer $v_c(t) = 20 - 24e^{-3t}$ V, $0 \leq t \leq T$ where $T = (1/3)\ln(1.5)$ sec;

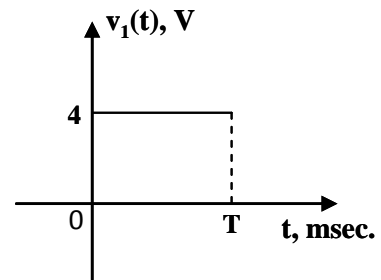
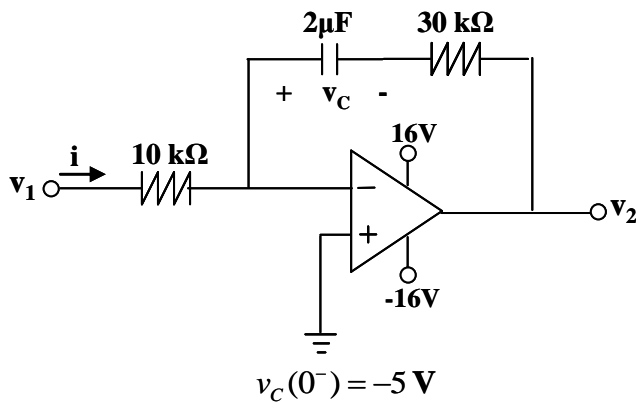
$v_c(t) = 28 - 24e^{-2(t-T)}$ V, $t \geq T$.

Question 3 In the following circuit, find and sketch $i_L(t)$ and $v_L(t)$ for $t \geq 0$.



Answer $i_L(t) = 4 - 2e^{-2t} \text{ A}$, $0 \leq t \leq T_1$ where $T_1 = 0.5\ln(2) \text{ sec}$;
 $i_L(t) = 6 - 3e^{-(2/3)(t-T_1)} \text{ A}$, $T_1 \leq t \leq T$;
 $i_L(t) = 4 + 0.5e^{-(2/3)(t-T)} \text{ A}$, $t \geq T$.

Question 4 Consider the following circuit.



- Find and sketch $v_c(t)$ and $i(t)$ for $t \geq 0$ given $v_c(T^-) = 18 \text{ V}$.
- Find and sketch $v_2(t)$ given $v_c(T^-) = 12 \text{ V}$.

Answer a) $v_c(t) = -5 + 200t \text{ V}$, $0 \leq t \leq T_1$ where $T_1 = 45 \text{ msec}$;
 $v_c(t) = 20 - 16e^{-12.5(t-T_1)} \text{ V}$, $T_1 \leq t \leq T$ where $T = 45 + 240\ln(2) \text{ msec}$;
 $v_c(t) = 16 + 2e^{-12.5(t-T)} \text{ V}$, $t \geq T$.

b) $v_2(t) = -7 - 200t \text{ V}$, $0 \leq t \leq T_1$;
 $v_2(t) = -16 \text{ V}$, $T_1 \leq t \leq T$ where $T = 45 + 80\ln(2) \text{ msec}$;
 $v_2(t) = -12 \text{ V}$, $t \geq T$.