Tutorial

(Q1) Find out the L.T of each of the time domain functions.

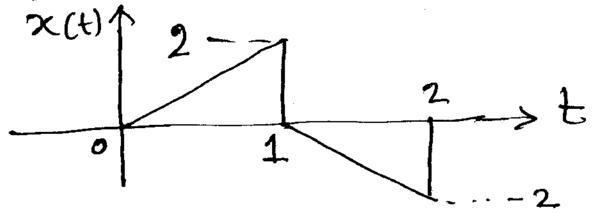
(a) $t \cos t \, u(t)$ (b) $t \sin t \, u(t)$ (c) $e^{-t} t \cos t \, u(t)$ (d) $e^{-t} t \sin t \, u(t)$

(Q2) The L.T of the time domain function $x(t)$ shown in the following figure has the form:

$$X(s) = X_1(s) + X_2(s) e^{-s} + X_3(s) e^{-2s}$$

where $X_1(s)$, $X_2(s)$ and $X_3(s)$ are rational functions.
Obtain $X_1(s)$, $X_2(s)$ and $X_3(s)$

Fig. for Q2 →



(Q3) Find the inverse L.T of each of the following functions.

(a) $\dfrac{s^3}{(s+2)(s+3)(s+4)}$ (b) $\dfrac{3s^2+2s+2}{(s+2)^2(s+3)}$

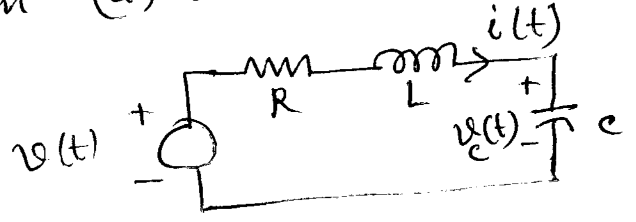
(c) $\dfrac{(4s^2-3s+5)}{s(s^2+2s+5)}$

(Q4) Find the inverse L.T of the following partial-fraction expansions

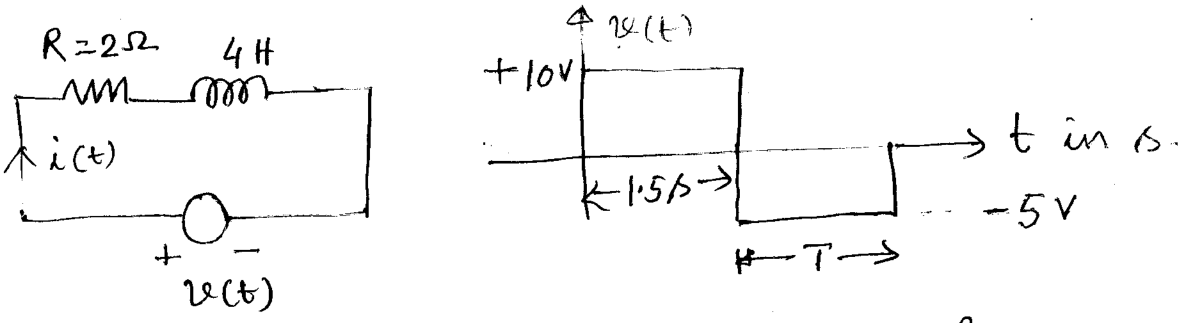
(a) $X(s) = \dfrac{j1}{s+1+j1} - \dfrac{j1}{s+1-j1} - \dfrac{1}{(s+1+j1)^2} - \dfrac{1}{(s+1-j1)^2}$

(b) $X(s) = \dfrac{jb}{(s-j)^2} - \dfrac{jb}{(s+j)^2}$

(Q5) For the R-L-C network with $R = 1\,\Omega$, $C = 1\,F$ & $L = \frac{1}{2}\,H$, Calculate $v_c(t)$ and $i(t)$ assuming all initial conditions relaxed.
When (a) $v(t) = u(t)$ volts (b) $v(t) = t\,u(t)$ volts.



Q6



Use L.T to find out i(t) for the following cases and sketch it. ~~for the foll~~

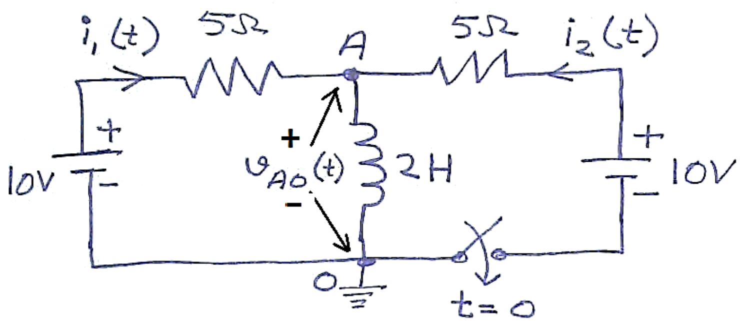
(a) T = 4 s & $i(0^-) = 0$

(b) T = 1 s & $i(0^-) = 0$

(c) T = 2 s & $i(0^-) = 1$ A

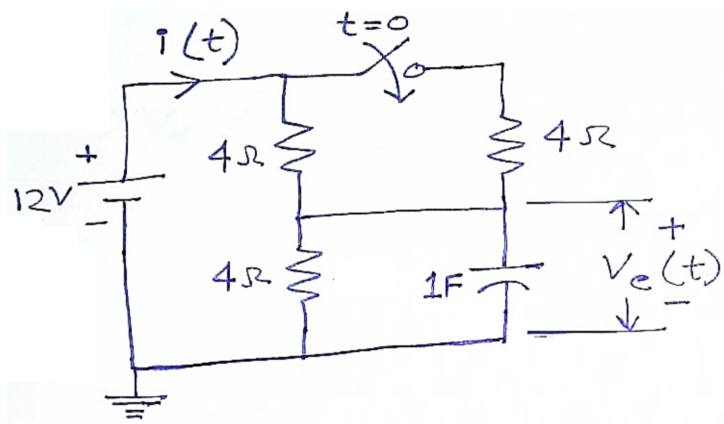
Q7 Repeat problem Q6 when R = 0.

QUESTION 8:



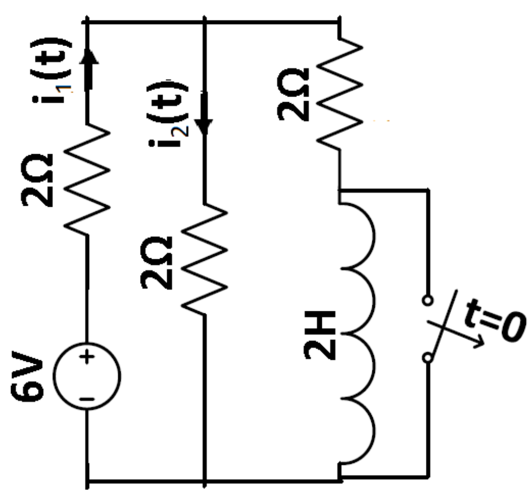
The switch was closed at $t = 0$. Before that the circuit was already in a steady state. Using circuit analysis in Laplace domain, find the expression for the voltage $v_{AO}(t)$ and current $i_2(t)$ for $t \geq 0$.

QUESTION 9:



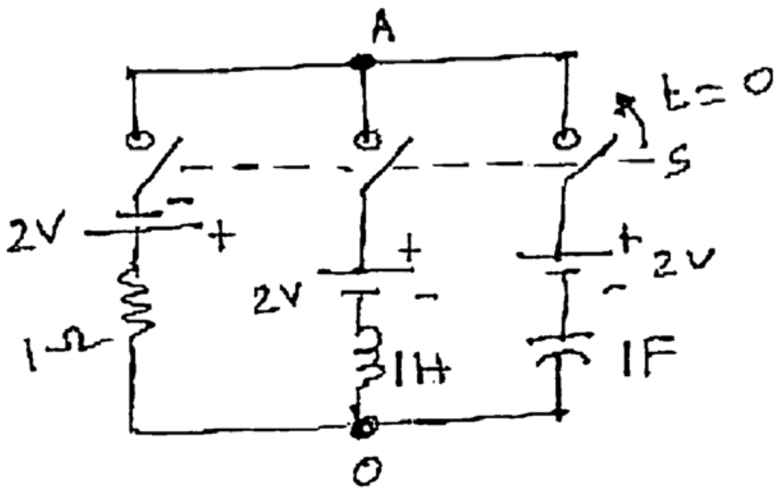
The switch was closed at $t = 0$. Before that the circuit was already in a steady state. Using circuit analysis in Laplace domain, find the expression for the capacitor voltage $v_c(t)$ and current $i(t)$ for $t \geq 0$.

QUESTION 10:



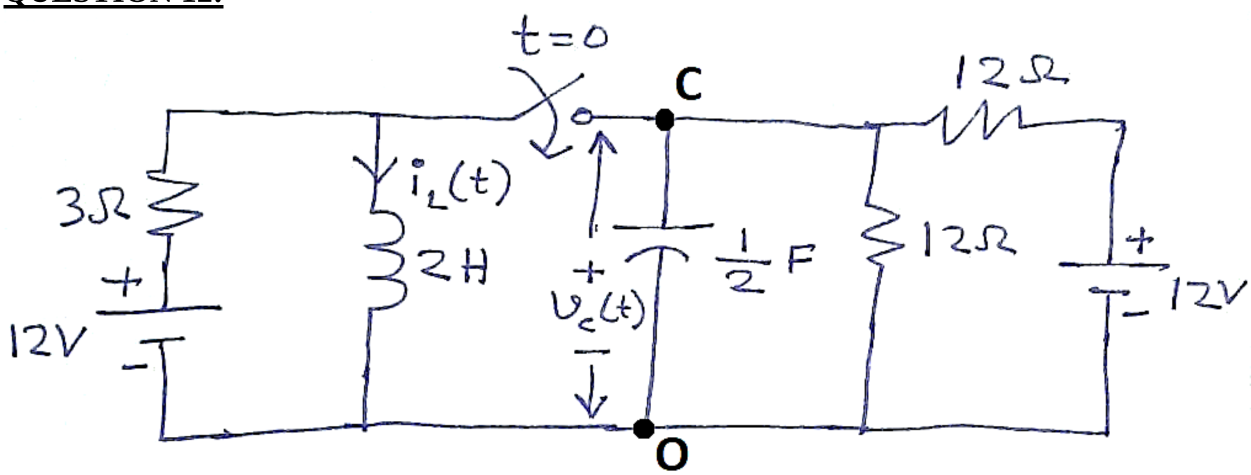
The switch was **opened** at $t = 0$. Before that the circuit was already in a steady state. (Assume the inductor has a very low amount of resistance but the switch has much lower resistance)
Using circuit analysis in Laplace domain, find the expression for the current $i_1(t)$ and $i_2(t)$ for $t \geq 0$.

<u>QUESTION 11:</u>



All switches were closed at $t = 0$ together. Before that the capacitor was uncharged.
Using circuit analysis in Laplace domain, find the expression for the voltage $v_{AO}(t)$and capacitor voltage $v_c(t)$ for $t \geq 0$.

<u>QUESTION 12:</u>



The switch was closed at $t = 0$. Before that the circuit was already in a steady state.
Using circuit analysis in Laplace domain, find the expression for the voltage $v_c(t)$ and current $i_L(t)$ for $t \geq 0$.
(Hint: You may use nodal analysis at node C in Laplace domain for ease of calculation)