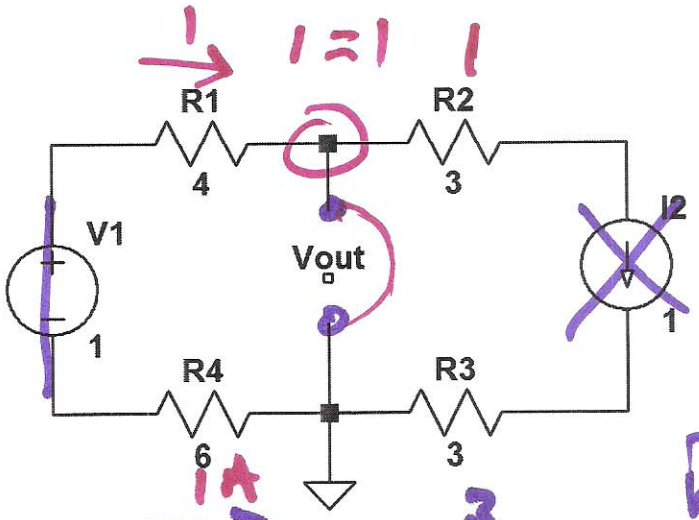
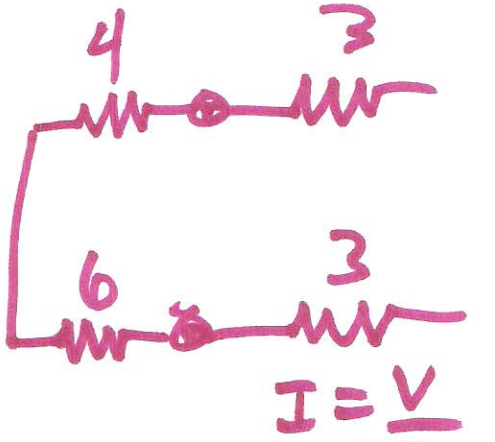
Lecture 13 June 25, 2014

Quiz #11 EE 220 Summer 2014 Name:_____
Closed book and notes.
Show your work for credit!

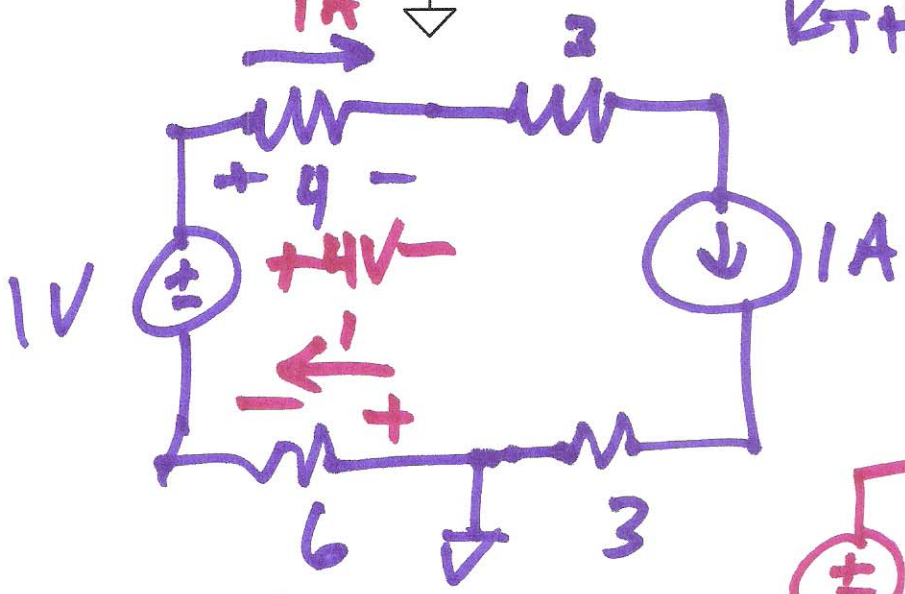
1. Find the Thevenin and Norton equivalents at the terminals adjacent to Vout in the following circuit. Again, show your work for credit.

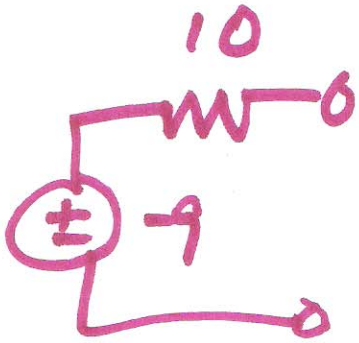




$I = \frac{V}{R_{THV}}$

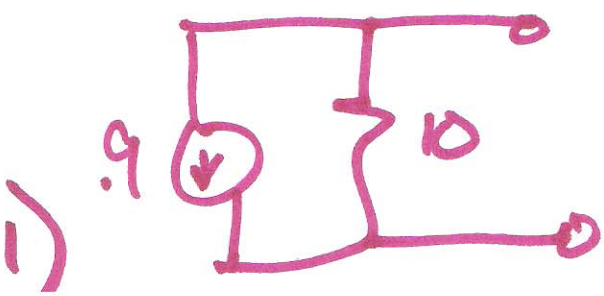
$R_{TH} = 10$

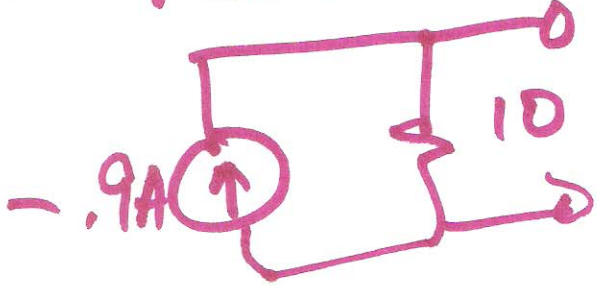




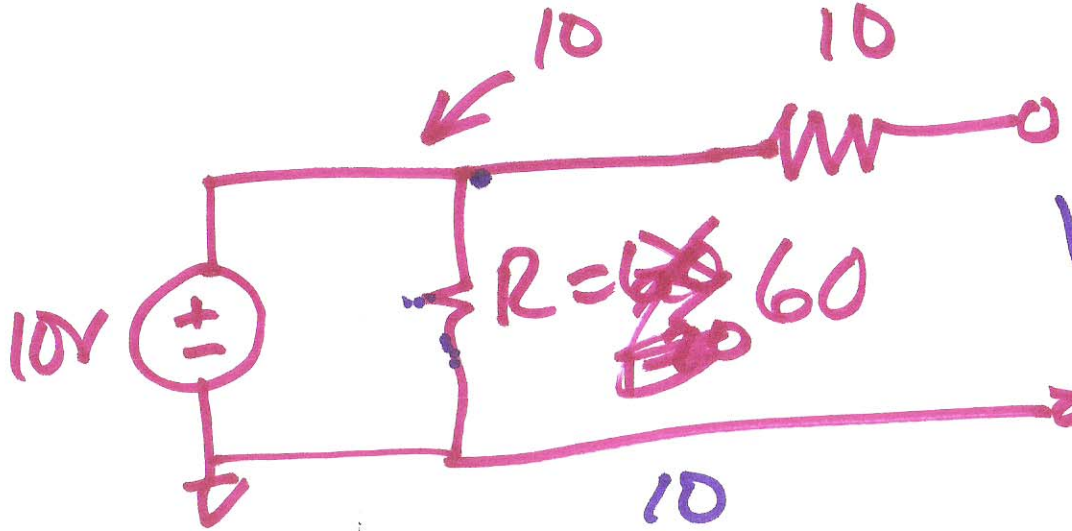
$-6V+$

$-6+1-4 = V_{Thv} = -9V$

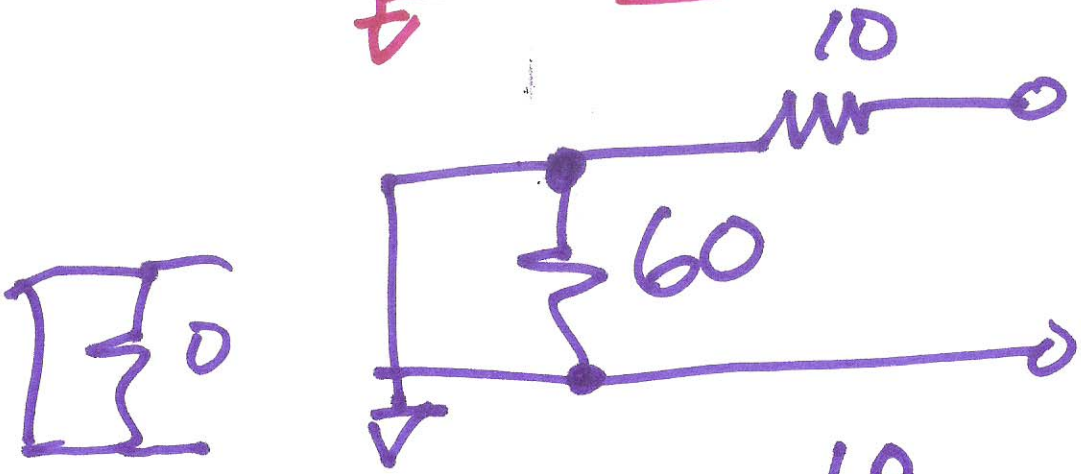




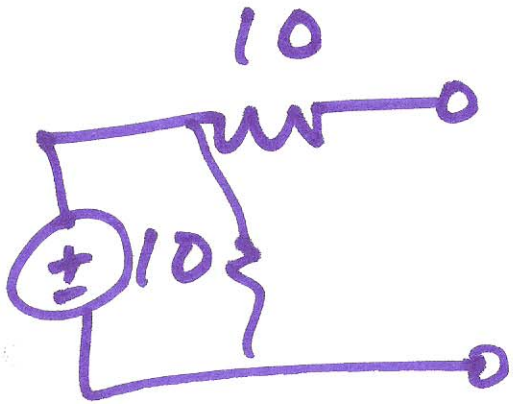
1)

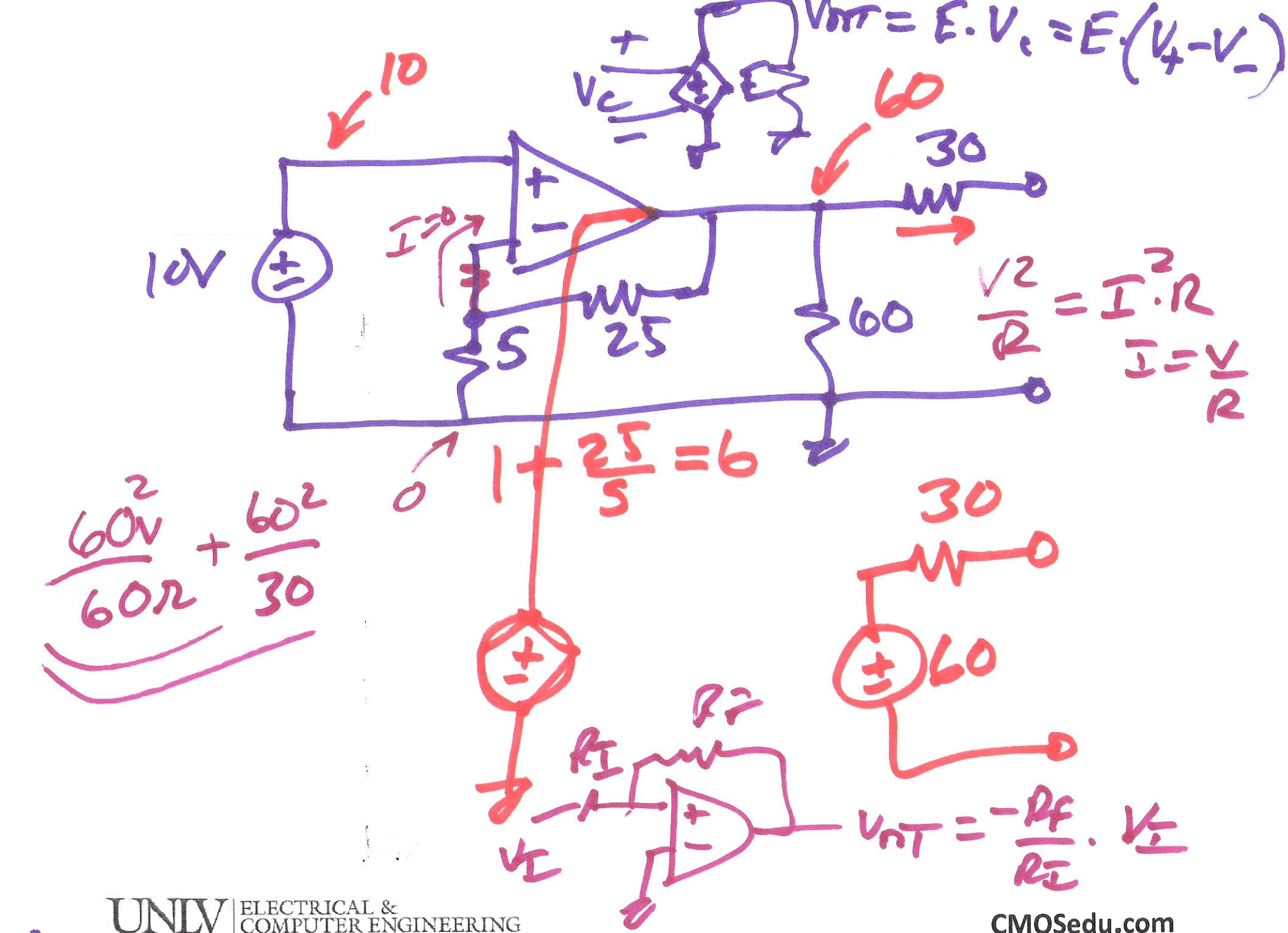


$V_{OC} = 10V = V_{THN}$

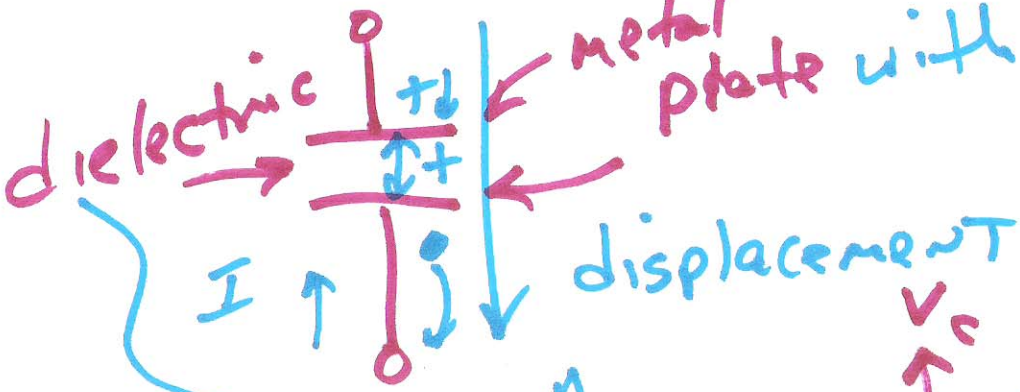


$R_{THN} = 10$




$V_{out} = E \cdot V_i = E(V_+ - V_-)$
10
60
30
10V
I=0
5
25
60
$\frac{V^2}{R} = I^2 \cdot R$
$I = \frac{V}{R}$
0
$1 + \frac{25}{5} = 6$
$\frac{60^2}{60\Omega} + \frac{60^2}{30}$
30
60
R_f
R_I
V_I
$V_{OT} = -\frac{R_f}{R_I} \cdot V_I$

Capacitors & Inductors



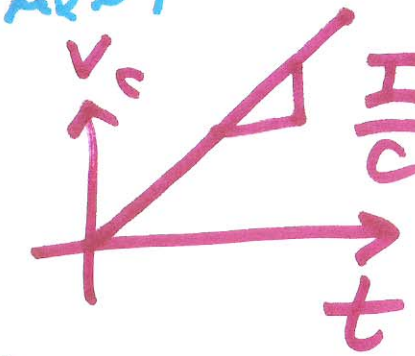
$$C = \epsilon_D \cdot \frac{A}{t}$$

FARADS

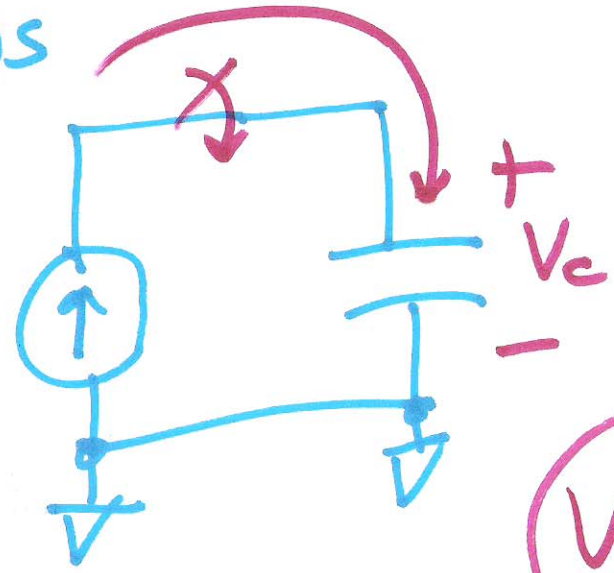
$$Q = C \cdot V_c$$

$$\mathcal{E} = \frac{1}{2} C V_c^2$$

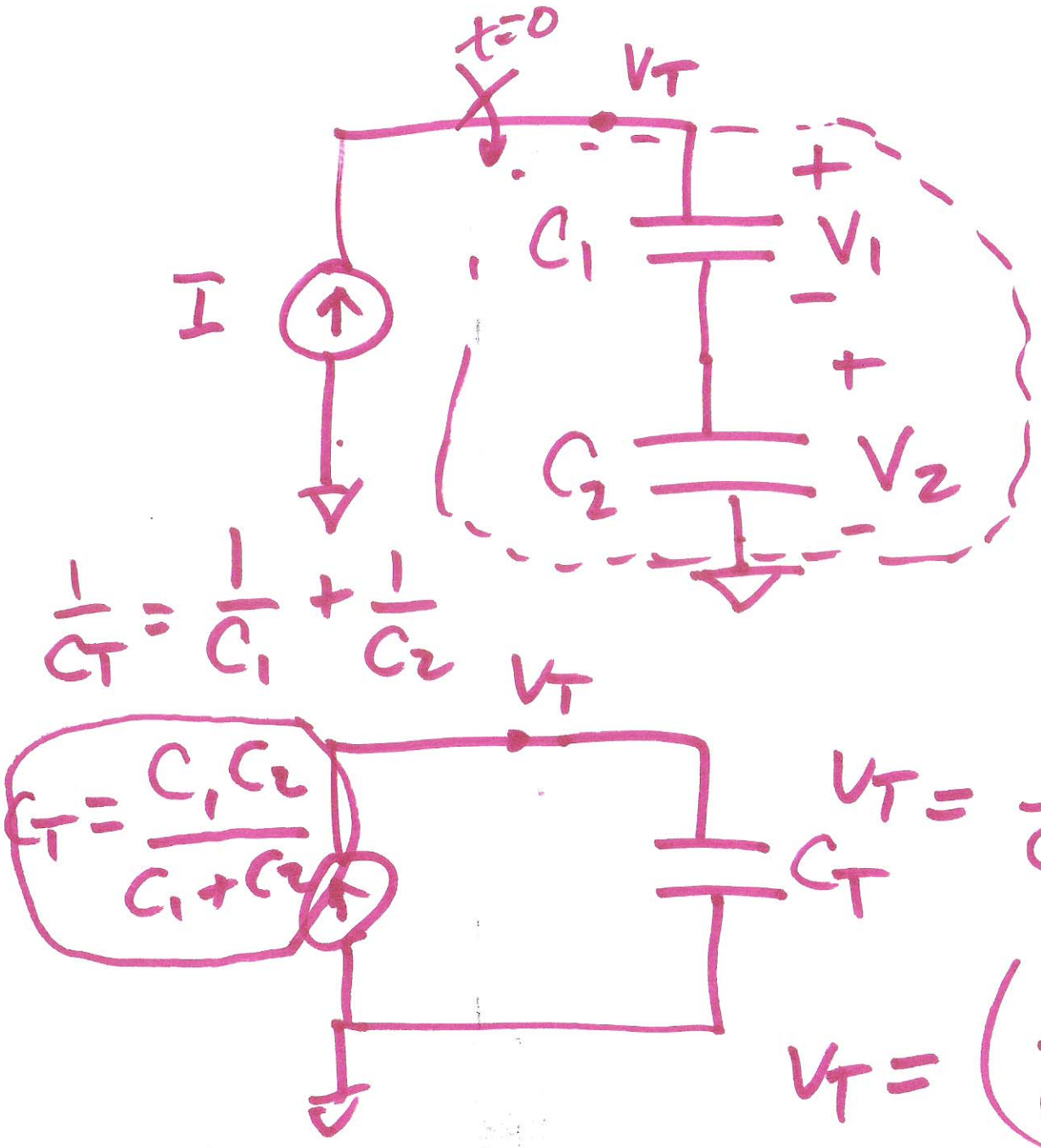
$$I = C \frac{dV_c}{dT}$$



$$\frac{I}{C} = \frac{dV_c}{dt}$$



$$V_c = \frac{1}{C} \int_0^t I \cdot dt$$



$$I = C\frac{dV}{dt}$$

$$V = \frac{1}{C}\int I \cdot dt$$

$$CV = Q$$

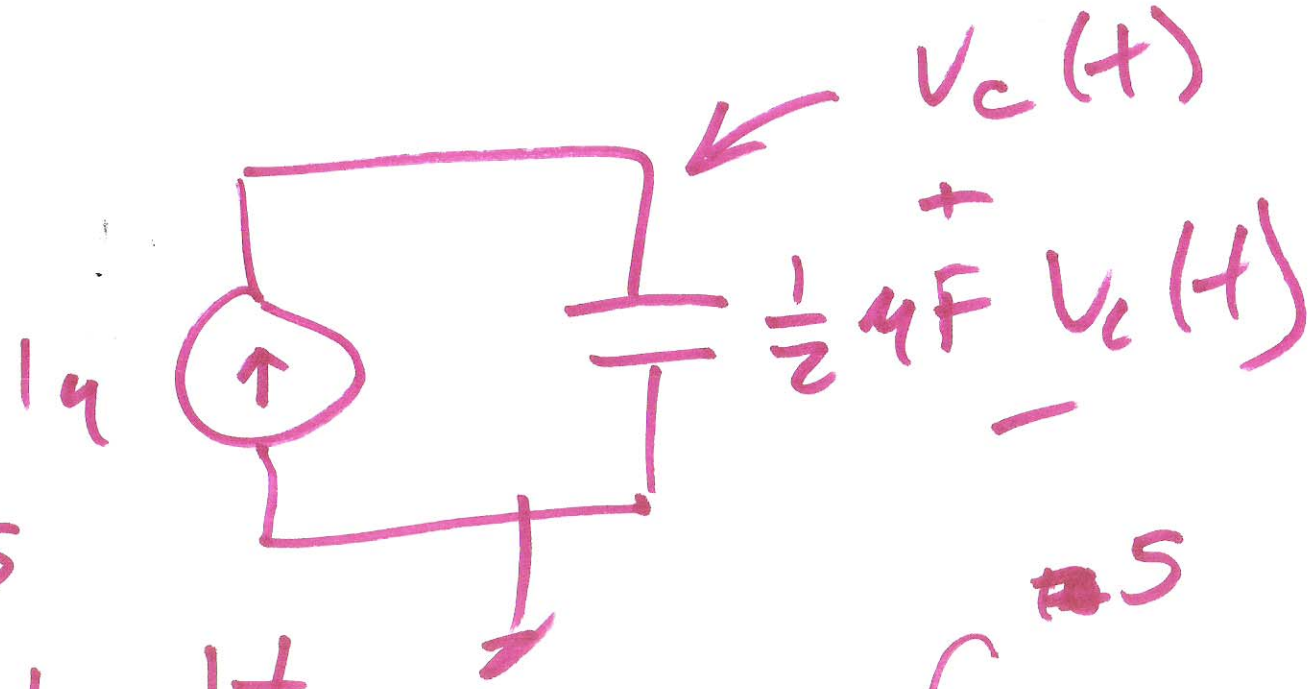
$$Q_1 = C_1 V_1 = Q_2 = C_2 V_2$$

$$V_T = V_1 + V_2$$

$$V_T = \frac{1}{C_1}\int I \cdot dt + \frac{1}{C_2}\int I \cdot dt$$

$$V_T = \left(\frac{1}{C_1} + \frac{1}{C_2}\right)\int I \cdot dt$$

$$= \frac{1}{C_T}\int I \cdot dt$$



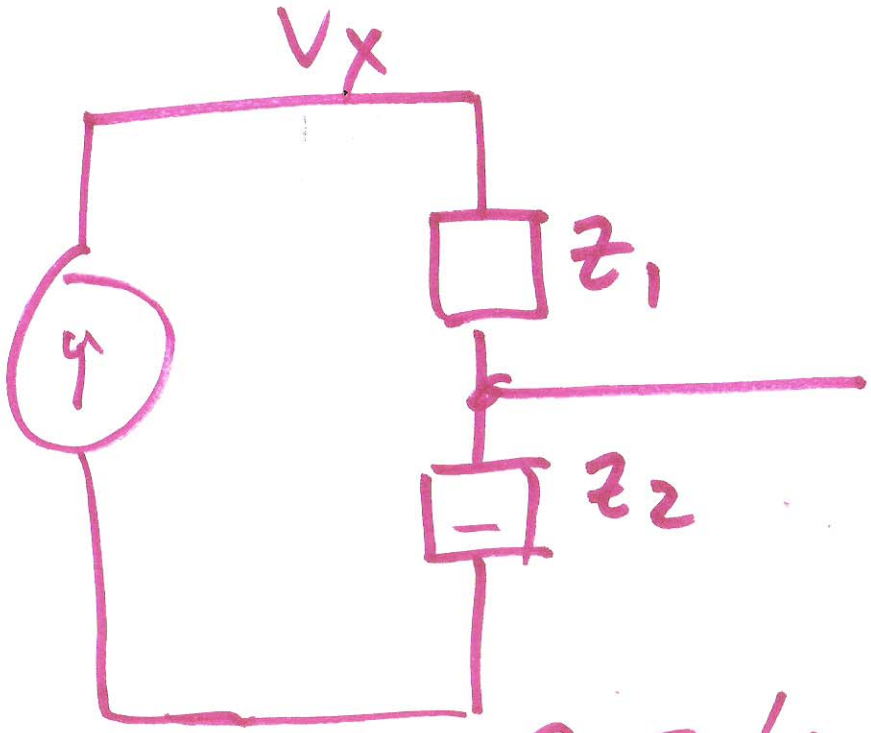
$$= \frac{1}{.8\mu}\int_0^5 1\mu \cdot dt$$

$$= \frac{5\mu}{.8\mu} = \underline{6.25V}$$

$$V_c(t) = \frac{1}{\frac{1}{2}\mu}\int_0^{=5} 1\mu \cdot dt$$

$$= \frac{5\,\cancel{1\mu}}{\frac{1}{2}\mu} = 10\,\cancel{\text{sec}}\ V$$

6)



$$\frac{1}{C_1} \\ \frac{1}{C_2} \Rightarrow \frac{1}{C_T} = \frac{C_1 C_2}{C_1 + C_2}$$

$$V_y = V_x \cdot \frac{Z_2}{Z_2 + Z_1}$$

$$= V_x \cdot \frac{\frac{1}{j\omega C_2}}{\frac{j\omega C_1 C_2}{j\omega C_1 C_2}\left(\frac{1}{j\omega C_2} + \frac{1}{j\omega C_1}\right)}$$

$$V_x \cdot \frac{C_1}{C_1 + C_2}$$

$$V_x \cdot \frac{1}{5}$$

$$1.25 = \frac{6.25}{5}$$

$C_1 = 1\mu$

$C_2 = 4\mu$

$$V_y = \frac{1}{C_2}\int I \cdot dt$$

$$V_x - V_y = \frac{1}{C_1}\int I \cdot dt$$

$$V_x = \frac{1}{C_T}\int I \cdot dt$$

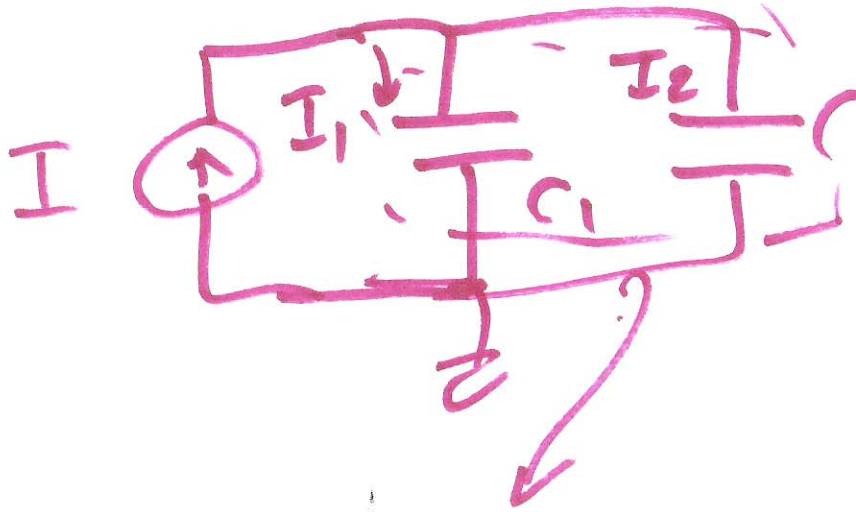
$$V_y = \frac{1}{C_2}\int I \cdot dt$$

$$V_x \cdot C_T = \int I \cdot dt$$

$$V_y \cdot C_2 = \int I \cdot dt \qquad C_T = \frac{C_1 \cdot C_2}{C_1 + C_2}$$

$$V_x \cdot C_T = V_y \cdot C_2$$

$$\boxed{V_x \cdot \frac{C_1}{C_1 + C_2} = V_y}$$

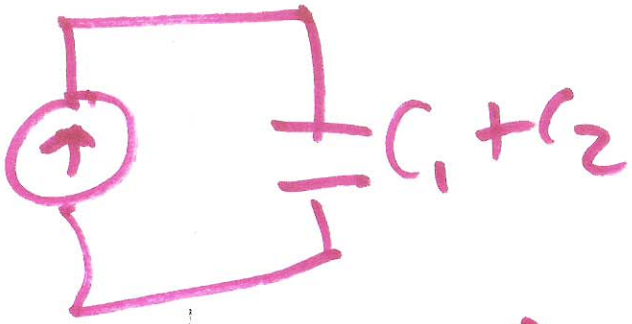


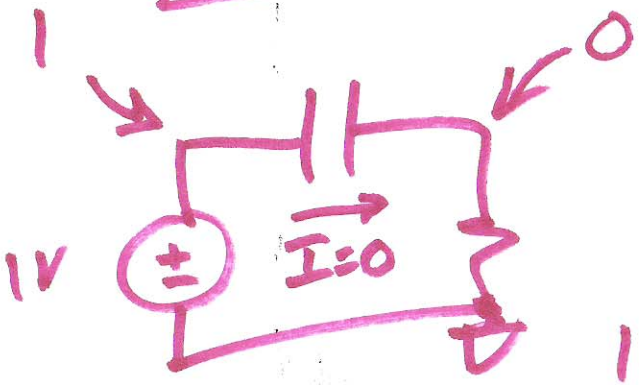
$$I = C\frac{dV}{dT}$$

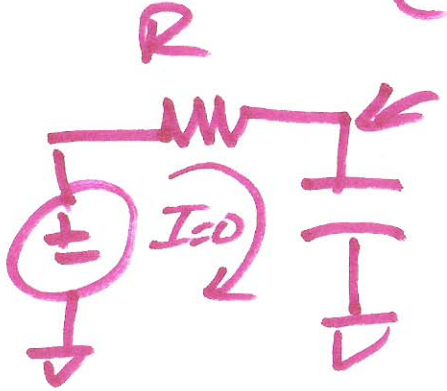
$$I = I_1 + I_2$$

$$= C_1 \cdot \frac{dv_c}{dt} + C_2 \cdot \frac{dv_c}{dT}$$

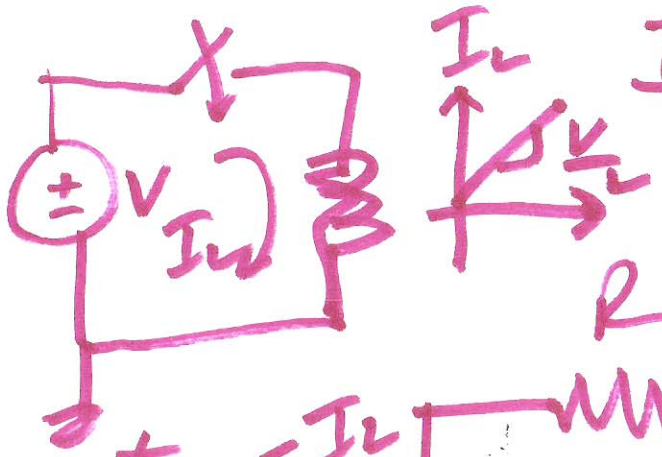
$$= \frac{(C_1 + C_2)}{C_T}\frac{dv_c}{dT}$$





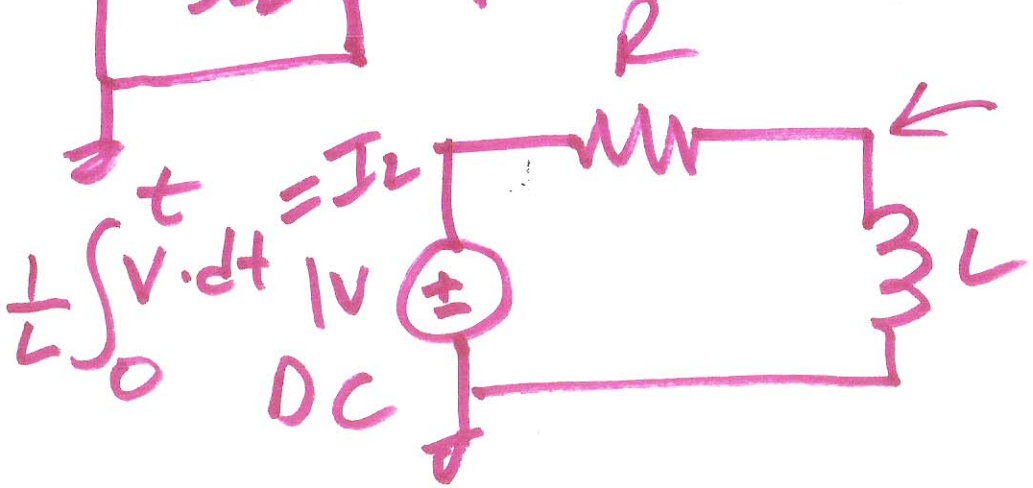


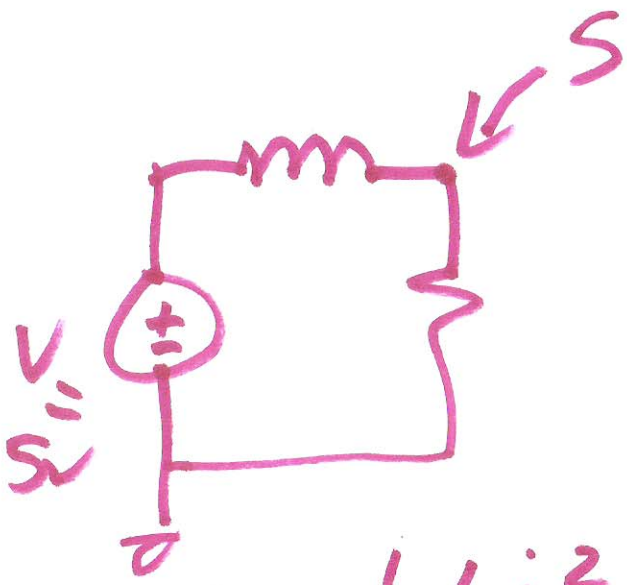
$\frac{1}{T}$ for DC is the open!

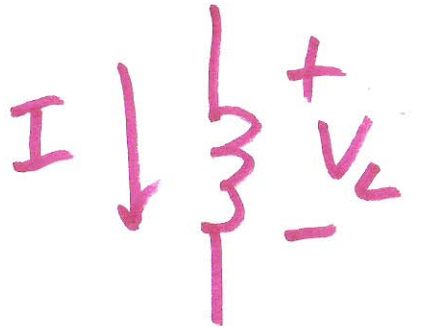


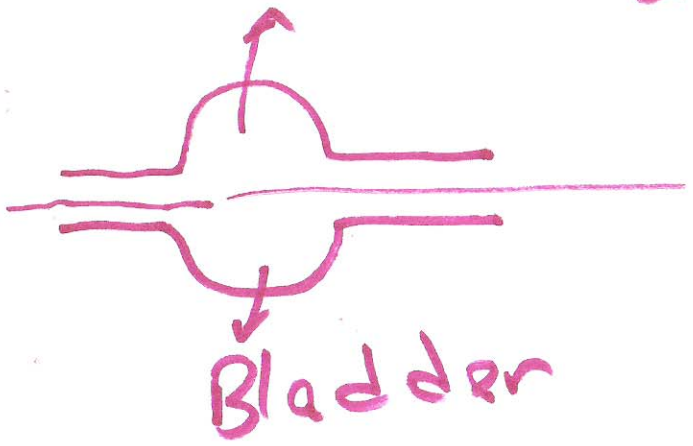
Inductors

for DC inductors are wires!





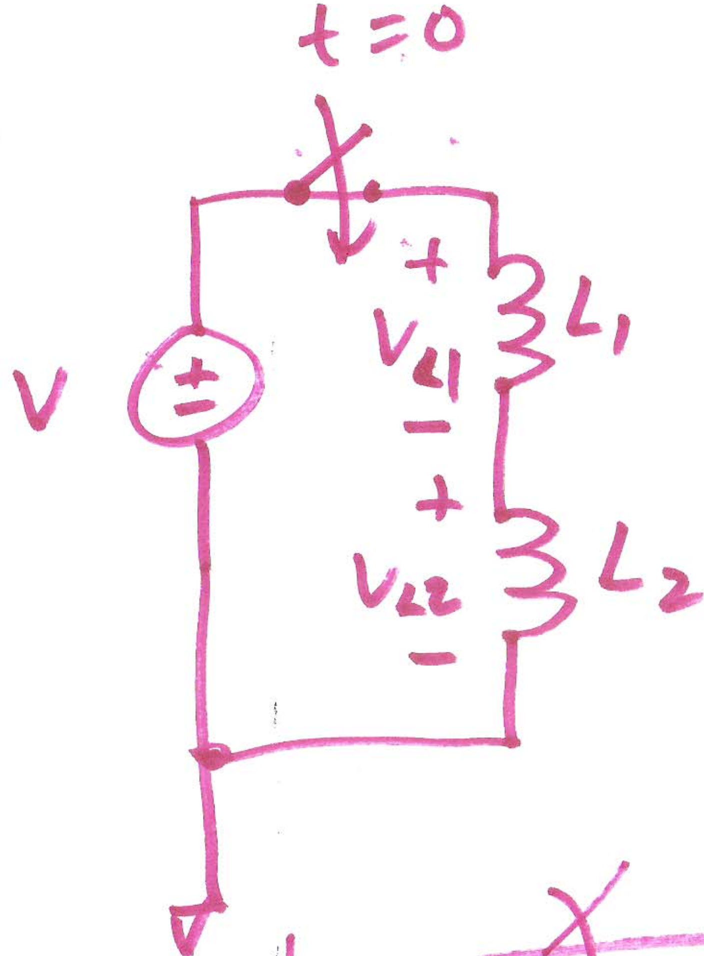




$$\mathcal{E} = \frac{1}{2} L i^2$$

$$V_L = L \cdot \frac{dI}{dT}$$

$$I = \frac{1}{L} \int V_L \cdot dt$$



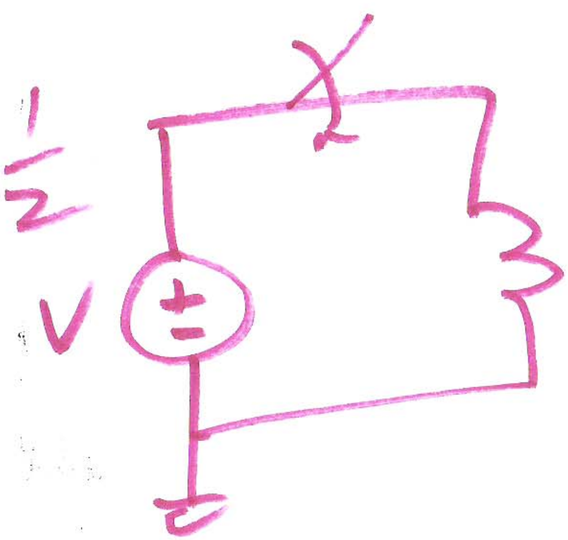
$$I = \frac{1}{L}\int v \cdot dt$$

$$V = V_{L1} + V_{L2}$$

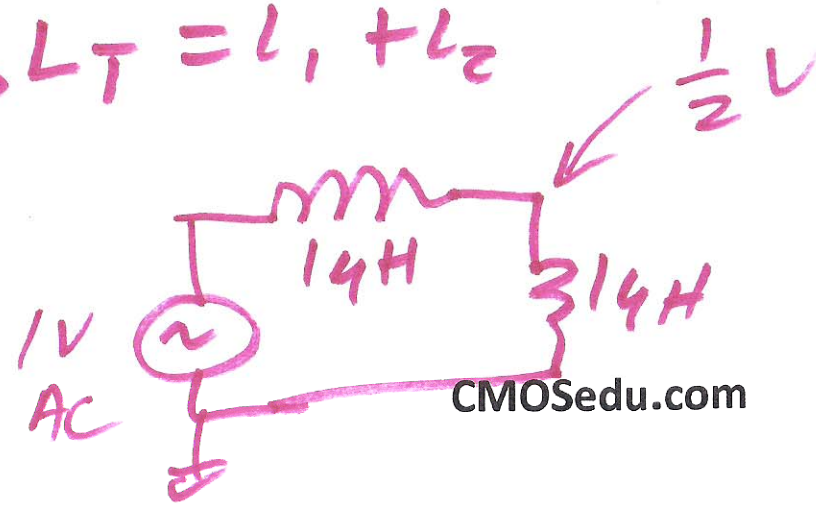
$$= L_1 \frac{dI}{dt} + L_2 \frac{dI}{dt}$$

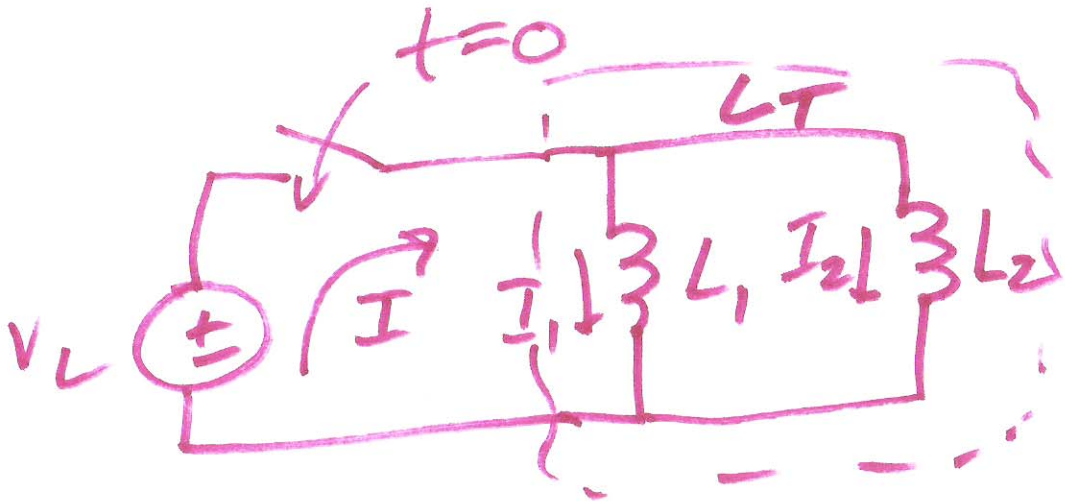
$$= \underbrace{(L_1 + L_2)}_{L_T} \frac{dI}{dT}$$

~~$1 \cdot \frac{j\omega 14}{j\omega 14 + j\omega 14} = \frac{1}{2}$~~



$L_T = L_1 + L_2$





$$I = \frac{1}{L}\int V \cdot dt$$

$$I = I_1 + I_2$$

$$V_L = L_1 \frac{dI_1}{dt}$$

$$\frac{1}{L_T}\int V \cdot dt = \frac{1}{L_1}\int V \cdot dt + \frac{1}{L_2}\int V \cdot dt$$

$$V = L_T \frac{dI}{dt} = L_1 \frac{dI_1}{dt} = L_2 \frac{dI_2}{dt}$$

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2}$$

$$L_T = \frac{L_1 L_2}{L_1 + L_2}$$