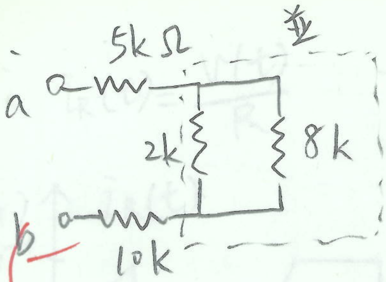
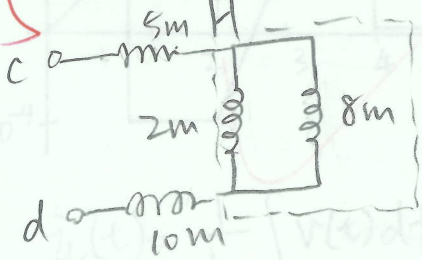
1.



$$\frac{2\times 8}{2+8}=\frac{16}{10}=1.6\,k\Omega$$

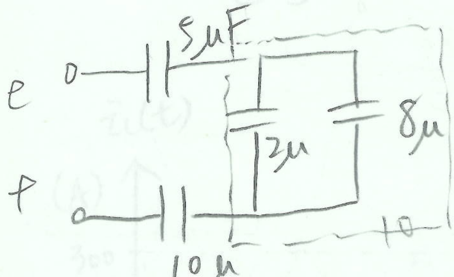
$$R_{ab}=1.6+5+10=16.6\,k\Omega \ \#$$

1



$$\frac{2\times 8}{2+8}=1.6\,mH$$

$$L_{cd}=1.6+5+10=16.6\,mH \ \#$$



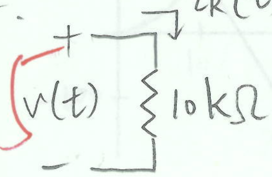
$$2+8=10\,\mu F$$

$$\frac{10\times 10}{10+10}=5\,\mu F$$

$$\frac{5\times 5}{5+5}=2.5\,\mu F$$

$$C_{ef}=2.5\,\mu F \ \#$$

2.

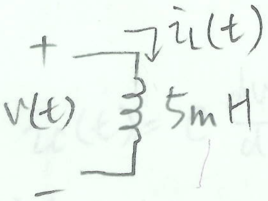


1

$$v(t)=100\sin(100t)+10$$

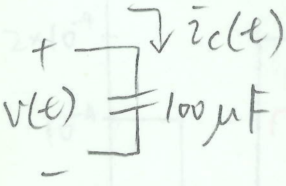
$$i_R(t)=\frac{v(t)}{R}=\frac{100}{10000}\sin(100t)+\frac{10}{10000}$$

$$=0.01\sin(100t)+0.001\ A \ \#$$



$$i_L(t)=\frac{1}{L}\int[100\sin(100t)+10]\,dt$$

$$=\frac{-\cos(100t)+10t}{5\times 10^{-3}}=-200\cos(100t)+2000t\ A \ \#$$

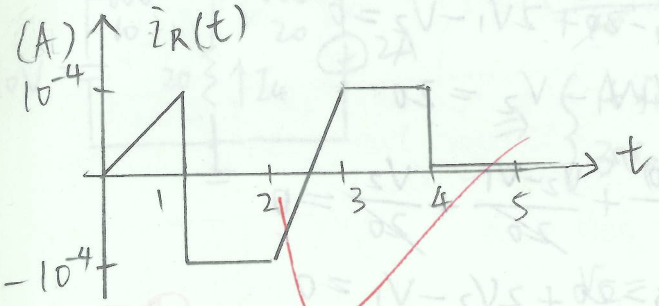


$$i_C(t)=C\frac{dv(t)}{dt}=100\times 10^{-6}\times[100\times 100\cos(100t)+0]$$

$$=\cos(100t)\ A \ \#$$

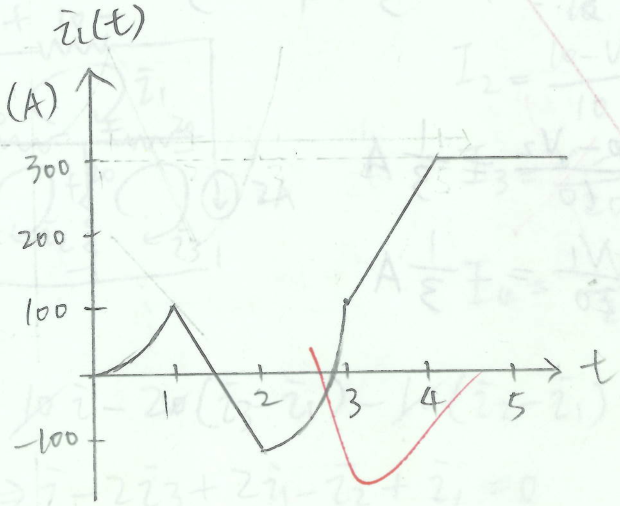
3.

$i_R(t)=\frac{v(t)}{R}$ $\qquad \frac{1}{10^4}=10^{-4}$

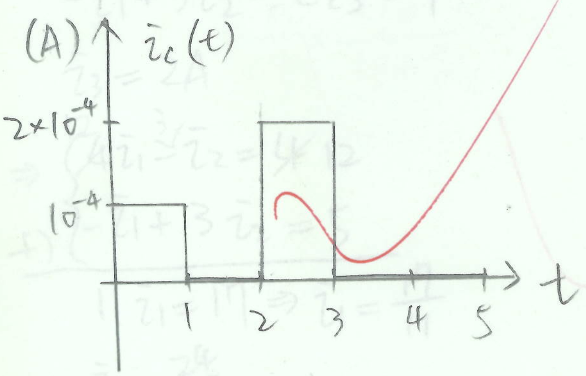


$i_L(t)=\frac{1}{L}\int v(t)dt$

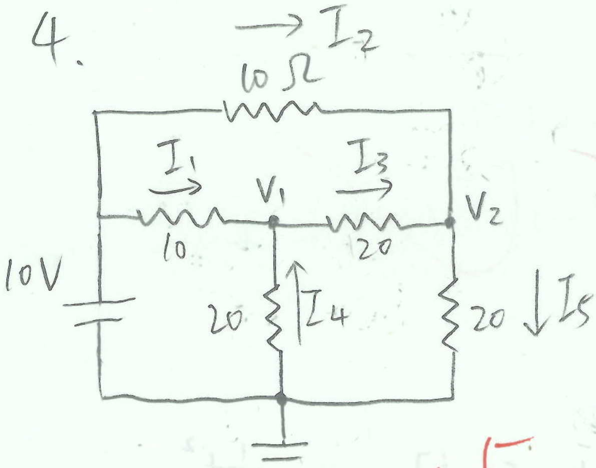
$$v=\begin{cases} t, & [0,1] \qquad \frac{1}{2}t^2 \\ -1, & [1,2] \qquad -t \\ -5+2t, & [2,3] \qquad -t+t^2 \quad 6-12 \\ 1, & [3,4] \qquad t \\ 0, & [4,\infty) \qquad C \end{cases}$$



$i_C(t)=C\frac{dv(t)}{dt}=10^{-4}\times\frac{dv}{dt}$



4.



15

$$\frac{(V_1-10)^{\times 2}}{\cancel{10}}+\frac{V_1}{\cancel{20}}+\frac{V_1-V_2}{\cancel{20}}=0$$

$$\Rightarrow 2V_1-20+2V_1-V_2=0$$

$$\Rightarrow 4V_1-V_2=20$$

$$\frac{(V_2-10)^{\times 2}}{\cancel{10}}+\frac{V_2-V_1}{\cancel{20}}+\frac{V_2}{\cancel{20}}=0$$

$$\Rightarrow 2V_2-20+2V_2-V_1=0$$

$$\overset{16}{\cancel{4}}V_2-\cancel{4}V_1=\cancel{20}\ 80$$

$$\begin{cases}4V_1-V_2=20\\ -4V_1+16V_2=80\end{cases}\quad (+)$$

$$15V_2=100 \Rightarrow V_2=\frac{\overset{20}{\cancel{100}}}{\underset{3}{\cancel{15}}}=\frac{20}{3}, \quad V_1=\frac{80}{3}\times\frac{1}{4}=\frac{20}{3}$$

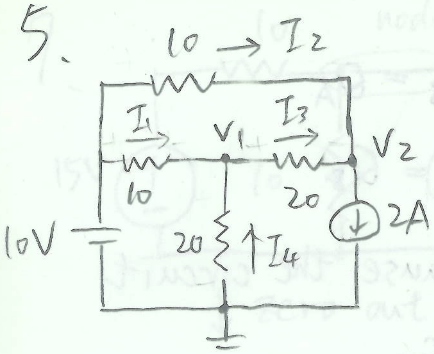
$$V_1=V_2=\frac{20}{3}\ \text{V}$$

$$I_1=\frac{10-V_1}{10}=\frac{1}{3}\ \text{A}, \quad I_2=\frac{10-V_2}{10}=\frac{1}{3}\ \text{A}$$

$$I_3=\frac{V_1-V_2}{20}=0\ \text{A}, \quad I_4=\frac{-V_1}{20}=-\frac{1}{3}\ \text{A}$$

$$I_5=\frac{V_2}{20}=\frac{1}{3}\ \text{A}$$

5.



70

A:
$$\begin{cases} \dfrac{(V_1-10)}{\cancel{10}}^{\times 2} + \dfrac{V_1}{\cancel{20}} + \dfrac{V_1-V_2}{20} = 0 \\ \dfrac{(V_2-10)}{\cancel{10}}^{\times 2} + \dfrac{V_2-V_1}{\cancel{20}} + \cancel{2}^{40} = 0 \end{cases}$$

$$\Rightarrow \begin{cases} 4V_1 - V_2 = 20 \\ 3V_2 - V_1 = -20 \end{cases} \Rightarrow \begin{cases} -V_1 + 3V_2 = -20 \\ 12V_1 - 3V_2 = 60 \end{cases}$$

$+)$ $11V_1 = 40$

$\Rightarrow V_1 = \dfrac{40}{11}$ V #

$V_2 = \dfrac{160}{11} - \dfrac{\cancel{20}\,220}{11}$

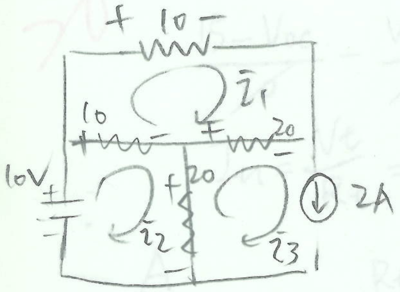
$= -\dfrac{60}{11}$ V #

$I_1 = \dfrac{10-V_1}{10} = \dfrac{70}{11} \times \dfrac{1}{10} = \dfrac{7}{11}$ A #

$I_2 = \dfrac{10-V_2}{10} = \dfrac{170}{11} \times \dfrac{1}{10} = \dfrac{17}{11}$ A #

$I_3 = \dfrac{V_1-V_2}{20} = \dfrac{100}{11} \times \dfrac{1}{20} = \dfrac{5}{11}$ A #

$I_4 = \dfrac{-V_1}{20} = -\dfrac{2}{11}$ A #



B: $\cancel{10}i - 2\cancel{0}(i_3 - i_1) - \cancel{10}(i_2 - i_1) = 0$

$\Rightarrow i - 2i_3 + 2i_1 - i_2 + i_1 = 0$

$\Rightarrow 4i_1 - 2i_3 - i_2 = 0$

$-1\cancel{0} + 1\cancel{0}(i_2 - i_1) + 2\cancel{0}(i_2 - i_3) = 0$

$-i_1 + 3i_2 - 2i_3 = 1$

$i_3 = 2$A

$$\Rightarrow \begin{cases} \overset{12}{4i_1} - \overset{3}{i_2} = \cancel{4}\ 12 \\ -i_1 + 3i_2 = 5 \end{cases}$$

$+)$ $11i_1 = 17 \Rightarrow i_1 = \dfrac{17}{11}$

$i_2 = \dfrac{24}{11}$

$I_1 = i_2 - i_1 = \dfrac{24}{11} - \dfrac{17}{11} = \dfrac{7}{11}$ A #

$I_2 = i_1 = \dfrac{17}{11}$ #

$I_3 = i_3 - i_1 = 2 - \dfrac{17}{11} = \dfrac{5}{11}$ A #

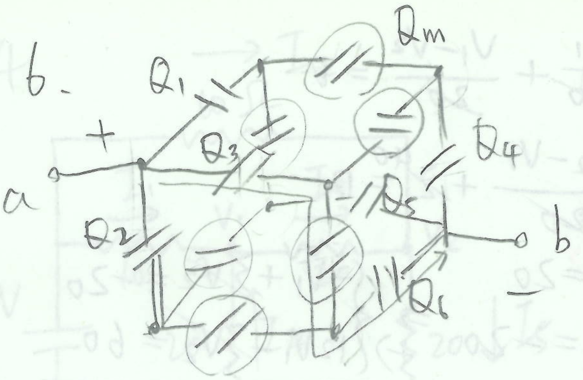
$I_4 = i_3 - i_2 = 2 - \dfrac{24}{11} = -\dfrac{2}{11}$ A #

$V_1 = -I_4 \times 20 = \dfrac{40}{11}$ V #

$V_2 = V_1 - I_3 \times 20$

$= \dfrac{40}{11} - \dfrac{100}{11} = \dfrac{-60}{11}$ V #

6.



$Q_1 = Q_2 = Q_3 = Q_A$

$Q_4 = Q_5 = Q_6 = Q_B$

$Q_A = Q_B$ because the circuit is symmetric.

Let $Q_a = Q_B = Q_p$

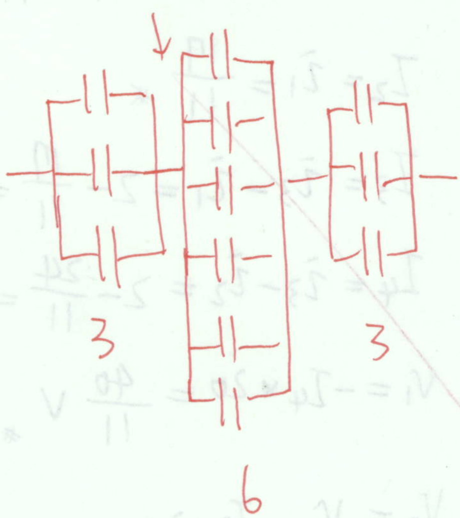
$Q_m = \frac{1}{2} Q_p$ $\qquad V = \frac{Q}{C}$ $\qquad$ O

choose one path for a to b :

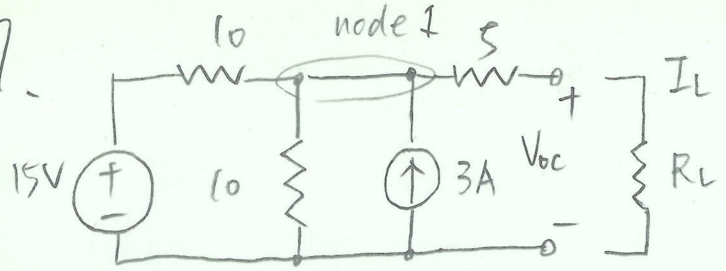
$$V_{ab} = \frac{Q_p}{1\mu F} + \frac{\frac{1}{2}Q_p}{1\mu F} + \frac{Q_p}{1\mu F} = \frac{\frac{5}{2}Q_p}{1\mu F}$$

$$C_{ab} = \frac{Q_{ab}}{V_{ab}} = 3\cancel{Q_p} \times \frac{1\mu F}{\frac{5}{2}Q_p} = \cancel{0.4}\ \frac{6}{5}\ \mu F \ *$$

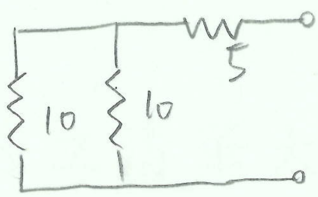
$$\frac{1}{\frac{1}{3}+\frac{1}{6}+\frac{1}{3}} = \frac{6}{5} \ *$$



7.



↓ zero out sources



$R_t = R_{eq} = \dfrac{10\times 10}{\cancel{10+10}_{\,20}} + 5 = 5+5 = 10$

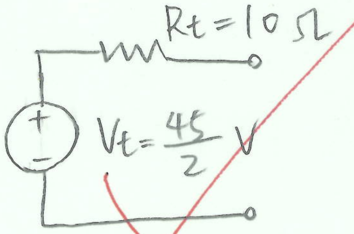
for node 1 :

20

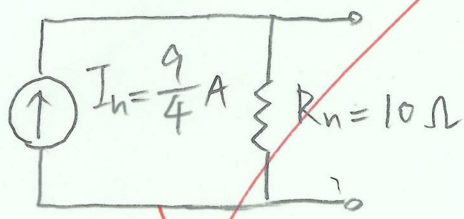
$\dfrac{15 - V_{oc}}{\cancel{10}} - \dfrac{V_{oc}}{\cancel{10}} + \overset{30}{\cancel{3}} = 0 \Rightarrow 2V_{oc} = 45 \Rightarrow V_{oc} = \dfrac{45}{2} = V_t$

$I_n = \dfrac{V_t}{R_t} = \dfrac{45}{20} = \dfrac{9}{4}$ A

A.



B.



C.

$I_L = I_n \times \dfrac{R_n}{R_n + R_L}$

$= \dfrac{9}{4} \times \dfrac{\cancel{10}\,2}{\cancel{10+5}\,3} = \dfrac{3}{2}$ A ※

D.

$I_L = \dfrac{V_t}{R_t + R_L} = \dfrac{\cancel{45}^{\,9}}{2} \times \dfrac{1}{\cancel{510}\,102}$

$= \dfrac{9}{204}$ A ※