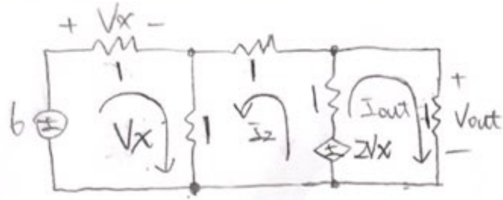
1.

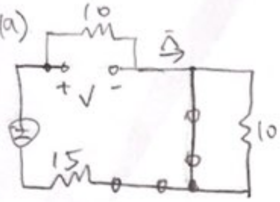


$$\begin{cases} 2 = 2V_x + I_2 \\ 2V_x = 3I_2 + V_x + I_{out} \\ 2V_x = 2I_{out} + I_2 \end{cases}$$ 代回

$$\Rightarrow \begin{cases} 2 = 2I_{out} + 2I_2 \Rightarrow 1 = I_{out} + I_2 \\ \cancel{I_{out}} + a5V_2 = 3I_2 + \cancel{I_{out}} \Rightarrow I_2 = 0 \end{cases}$$

$\therefore I_{out} = 1\ (A)$ ※ $V_{out} = 1\ (V)$ ※

2.(a)

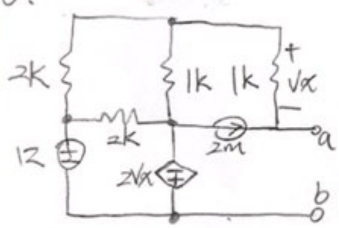


$\therefore V = 25 \times \frac{10}{10+15} = 10\ (V)$, $i = \frac{25}{10+15} = 1\ (A)$

$\therefore W_C = \frac{1}{2} \cdot 10 \cdot 10^2 = 500\ (J)$ ※ $\quad W_L = \frac{1}{2} \cdot 20 \cdot 1^2 = 10\ (J)$ ※

(b) ∵電容兩極板形成電場而產生相等之電壓，∴可視為開路；電感線圈中電流無變化，不會產生反應電動勢，∴可視為短路。※

3.



a-b open → $\pm V_{oc}$

$$\frac{V_x}{1k} + \frac{V_{oc}+V_x-(-2V_x)}{1k} + \frac{V_{oc}+V_x-12}{2k} = 0$$

$\Rightarrow V_{oc} = 4 - 3V_x$

$\frac{V_x}{1k} = -2m \Rightarrow V_x = -2$

$\therefore V_{oc} = 10\ (V)$

a-b short → ↓ I_{sc}

$I_{sc} = (2 + V_x)\ m$

$$\frac{V_x - 0}{1k} + \frac{V_x - (-2V_x)}{1k} + \frac{V_x - 12}{1k} = 0$$

$\Rightarrow V_x = \frac{4}{3}$

$\therefore I_{sc} = \frac{10}{3} m(A)$

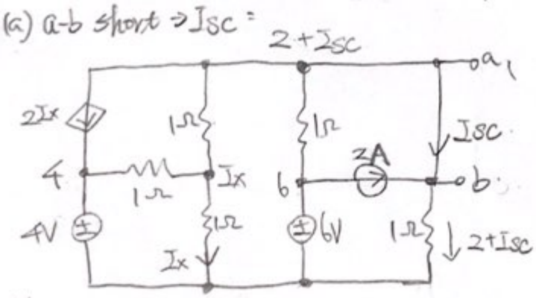
$\Rightarrow R_{th} = \frac{V_{oc}}{I_{sc}} = \frac{10}{10/3} = 3k(\Omega)$

$\therefore R_L = 3k(\Omega)$, P_{R_L} is maxixum ※

⇒

$P_{R_L}(max) = \frac{10^2}{4 \cdot 3k} = \frac{25}{3} m(W)$ ※

4.(a) a-b short ⇒ I_{sc} :



Node a : $I_{sc} + (2 + I_{sc} - 6) + (2 + I_{sc} - I_x) + 2I_x = 0$

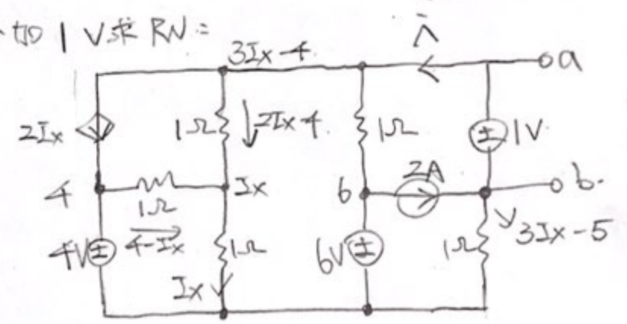
$\Rightarrow 3I_{sc} + I_x = 2$ — ①

Node I_x : $(2 + I_{sc} - I_x) + (4 - I_x) = I_x$

$\Rightarrow I_{sc} - 3I_x = -6$ — ②

$$I_{sc} = \frac{\begin{vmatrix} 2 & 1 \\ -6 & -3 \end{vmatrix}}{\begin{vmatrix} 3 & 1 \\ 1 & -3 \end{vmatrix}} = 0\ (A)$$

外加 1V 求 R_N :



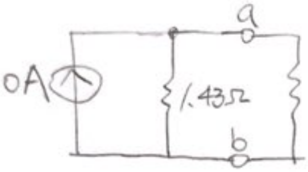
$2 = i + 3I_x - 5 \Rightarrow i = 7 - 3I_x$

$i = 7 - 3I_x = (3I_x - 4 - 6) + (2I_x - 4) + 2I_x$

$\Rightarrow I_x = 2.1$

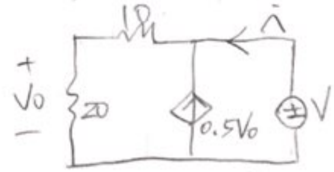
$\therefore i = 7 - 3 \times 2.1 = 0.7$

$\therefore R_N = \frac{1}{0.7} = \frac{10}{7} = 1.43\ (\Omega)$

∴ 

※

(b) 外加 V 求 R_N：



$V = V_0 + \frac{V_0}{20}\times 10 = 1.5V_0$

$i + 0.5V_0 = -\frac{V_0}{20}$

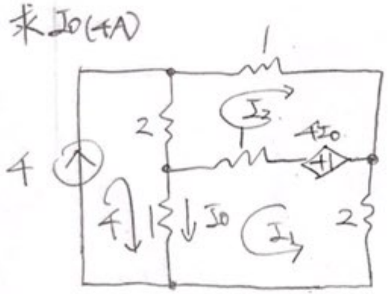
$\Rightarrow i = -0.45V_0$

$\therefore R_N = \frac{V}{i} = \frac{1.5V_0}{-0.45V_0} = \frac{-10}{3} = -3.33(\Omega)$ ※

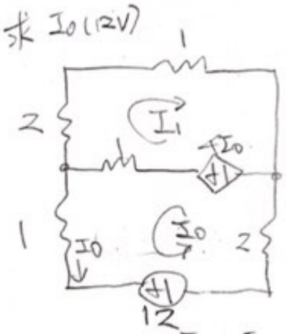
5. (a) $R_{ab} = 0.9 + [(\frac{1}{5})^{-1} + (\frac{1}{3})^{-1} + (\frac{1}{2})^{-1}]^{-1} = 0.9 + 0.1 = 1\ (\Omega)$ ※

(b) $I_0 = I_0(4A) + I_0(12V)$.

求 $I_0(4A)$



求 $I_0(12V)$



$$\begin{cases} 4I_0 = 4I_1 + I_2 + 4 \\ 4I_0 = 4I_2 + I_1 - 8 \\ I_0 = 4 + I_1 \Rightarrow I_1 = I_0 - 4 \end{cases}$$ 代回

$\Rightarrow I_2 = 12,\ I_0 = 12 = I_0(4A)$

$$\begin{cases} 4I_0 = 4I_1 + I_0 \\ 4I_0 = 4I_0 + 12 + I_1 \end{cases}$$

$\Rightarrow I_0 = -16 = I_0(12V)$

$\therefore I_0 = I_0(4A) + I_0(12V)$

$= 12 - 16$

$= -4\ (A)$ ※

6. (a) 設 5H 之电流為 i_1

$\therefore V = L_{eq}\frac{di}{dt} = 4\frac{di}{dt} + 5\frac{di_1}{dt}$， $5\frac{di_1}{dt} = \frac{di}{dt} + 3\frac{d(i-i_1)}{dt} \Rightarrow \frac{di_1}{dt} = \frac{1}{2}\frac{di}{dt}$.

$= (4 + 5\cdot\frac{1}{2})\frac{di}{dt} = 6.5\frac{di}{dt}$ $\therefore L_{eq} = 6.5\ (H)$ ※

(b) $Q = it = CV \Rightarrow i\Delta t = C(t)V(t) \Rightarrow i = \frac{C(t)V(t)}{\Delta t} \approx \frac{d[C(t)V(t)]}{dt}$

$\therefore I(t) = \frac{d}{dt}[4\cos(2t) + 2\sin(2t)\cos(2t)] = \frac{d}{dt}[4\cos(2t) + \sin(4t)] = 4\cos(4t) - 8\sin(2t)$

令 $I(t) = 0 \Rightarrow 4\cos(4t) = 8\sin(2t)$.

$\Rightarrow 1 - 2\sin^2(2t) = 2\sin(2t)$，令 $u = \sin(2t)$

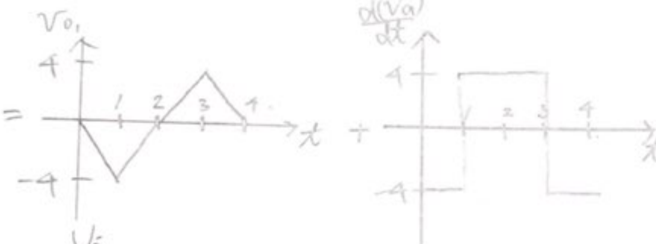
$2u^2 + 2u - 1 = 0$.

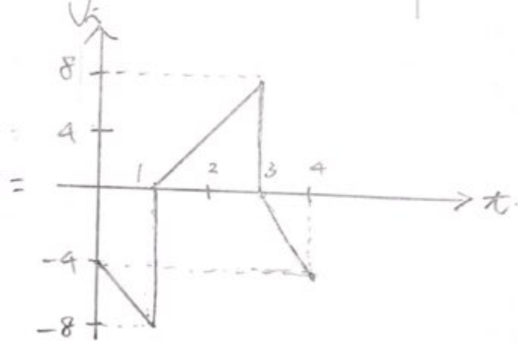
$u = \sin(2t) = \frac{-2\pm 2\sqrt{3}}{4} = \frac{-1\pm\sqrt{3}}{2}$ (負不合)

$\therefore \sin(2t) = \frac{-1+\sqrt{3}}{2}$

$t = \frac{1}{2}\arcsin(\frac{-1\pm\sqrt{3}}{2})\ (s)$ ※

7. $\frac{V_i}{1} = \frac{0-V_{o1}}{1} + 1\cdot\frac{d(0-V_{o1})}{dt} \Rightarrow V_i = -\left[V_{o1} + \frac{d(V_{o1})}{dt}\right]$

$=$ 

$=$ 

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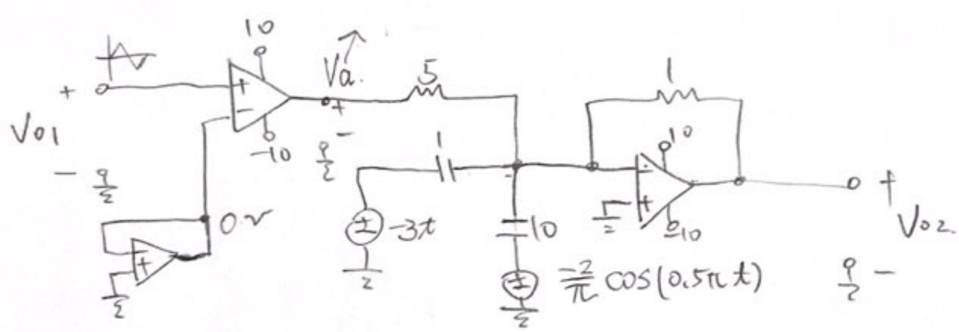
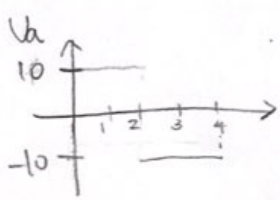
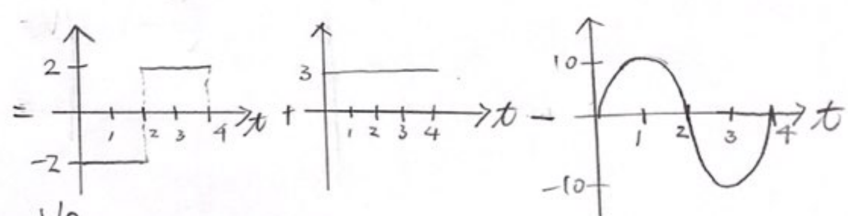
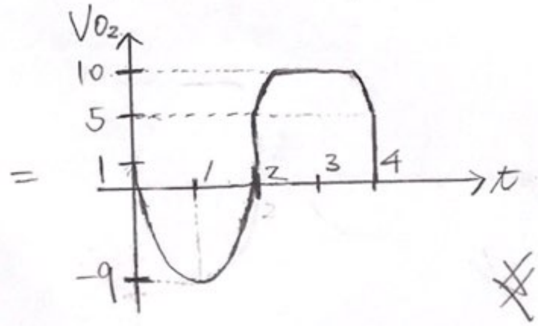




$\frac{V_a-0}{5} + 1\cdot\frac{d(-3t-0)}{dt} + 10\cdot\frac{d\left[\frac{-2}{\pi}\cos(0.5\pi t)\right]}{dt} = \frac{0-V_o}{1}$

$\Rightarrow V_o = -\frac{V_a}{5} + 3 - 10\sin(0.5\pi t)$

$=$ 

$=$ 

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