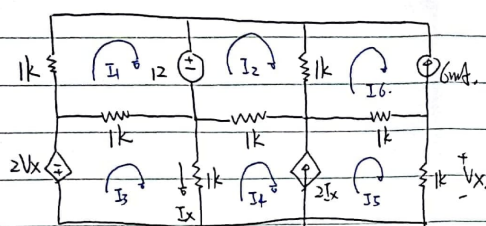


1.



1: $V_x = I_5$

$\begin{cases} I_x = I_3 - I_4 \\ 2I_x = I_5 - I_4 \end{cases} = -2I_3 - I_4 - I_5$ 利用网孔未知

五个网孔方程

$\begin{cases} I_1: 2I_1 - I_3 = -12 \\ I_2: 2I_2 - I_4 = 6 \\ I_3: 2I_3 - I_1 - I_4 + 2I_5 = 0 \\ I_4, I_5: 2I_4 + 2I_5 - I_2 - I_3 = -6 \end{cases}$

$\Delta = \begin{vmatrix} 2 & 0 & -1 \\ 0 & -1 & 3 \\ -1 & -6 & 6 \end{vmatrix} = 25$

克拉姆法则

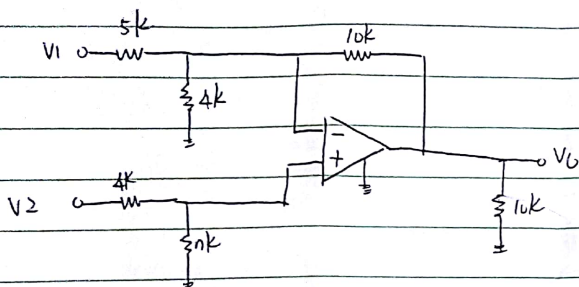
四个方程未知

$\begin{cases} I_1: 2I_1 - I_3 = -12 \\ I_2: 2I_2 - I_4 = 6 \\ I_3: -I_1 + 6I_3 - 3I_4 = 0 \\ I_4, I_5: -I_2 + 3I_3 = -6 \end{cases}$

$\begin{cases} I_4 = 2I_2 - 6 \\ -I_1 - 6I_2 + 6I_3 = -18 \end{cases}$

$\Delta I_2 = \begin{vmatrix} 2 & -12 & -1 \\ 0 & -6 & 3 \\ -1 & -18 & 6 \end{vmatrix} = 78$

$\begin{aligned} I_1 &= -6.48 \\ I_2 &= 3.12 \\ I_3 &= -0.96 \\ I_4 &= 0.24 \\ I_5 &= -2.16 \end{aligned}$



$$a) V^+ = V^- = V_2 \times \frac{7}{11}$$

$$-\frac{V_1 + V^+}{5k} + \frac{V^+}{4k} + \frac{V^+ - V_0}{10k} = 0$$

$$-4V_1 + 4V^+ + 5V^+ + 2V^+ - 2V_0 = 0$$

$$-4V_1 + 11V^+ = 2V_0$$

$$V_0 = -2V_1 + \frac{11V^+}{2}, \quad V^+ = \frac{7V_2}{11}$$

$$V_0 = -2V_1 + \frac{7}{2}V_2 \quad \text{✗}$$

$$b) V_1 = V_2 = 4$$

$$V_0 = -8 + 14 = 6V \quad \text{✗}$$

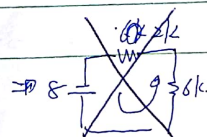
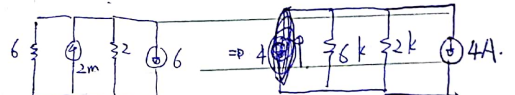
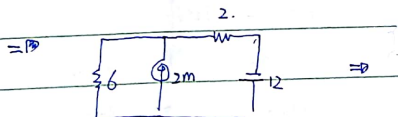
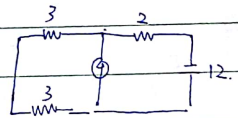
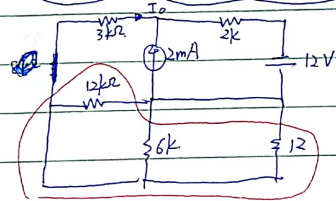
$$c) |-2V_1 + 7| \leq 15$$

$$-15 \leq -2V_1 + 7 \leq 15$$

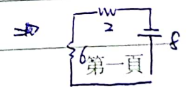
$$-22 \leq -2V_1 \leq 8$$

$$11 \geq V_1 \geq -4 \quad \text{✗}$$

6:

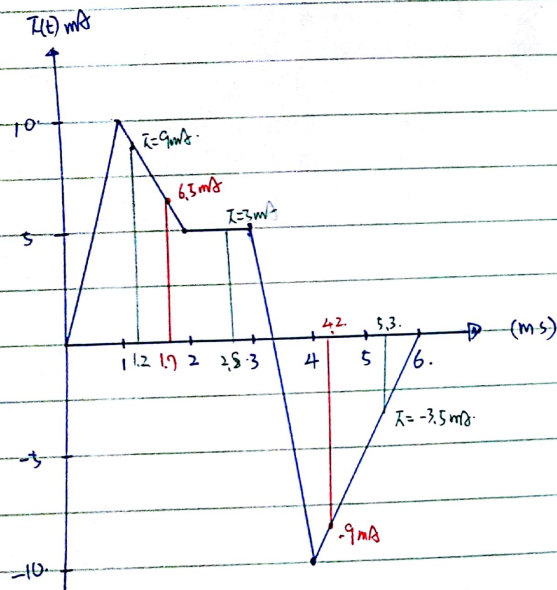


$$\Rightarrow I_0 = 1 \text{ mA} \quad \text{✗}$$



可轉頁再寫。

寫起。



① $w_L = \frac{1}{2} L I^2 < 1.7 \text{ ms} >$

$= \frac{1}{2} \times 0.5 \times (10)^2 = 10.5625 \text{ mJ}$

② $w_L = \frac{1}{2} L I^2 < 4.2 \text{ ms} >$

$= \frac{1}{2} \times 0.5 \times (-9)^2 = 20.25 \text{ mJ}$

③ $P = I \times V$

$V = L \frac{di}{dt} = 0.5 \times (-8) = -2.5 \text{ V} \quad (1 \sim 2)$

$= 0.5 \times (0) = 0 \quad (2 \sim 3)$

$= 0.5 \times (5) = 2.5 \text{ V} \quad (4 \sim 6)$

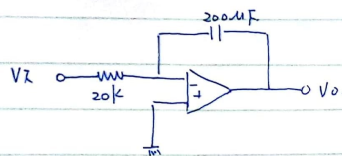
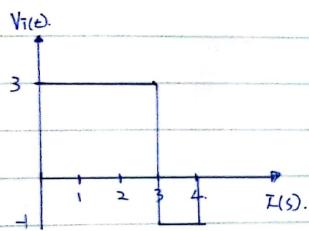
$= 9 \text{ mA} \times -2.5 \text{ V} = -22.5 \text{ mW} \quad (1.2 \text{ ms})$

$= 5 \text{ mA} \times 0 \text{ V} = 0 \text{ mW} \quad (2.8 \text{ ms})$

$= -3.5 \text{ mA} \times 2.5 \text{ V} = -8.75 \text{ mW} \quad (5.3 \text{ ms})$

注意吸的跟提了

④

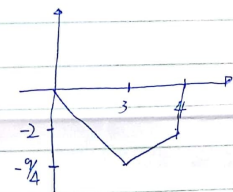


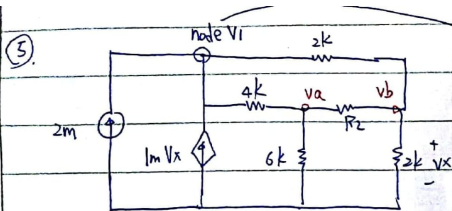
sol: $V_o = -\frac{1}{Rc} \int_0^t V_i(t) dt + V_o(t)$

$$V_o = -\frac{1}{4} \int_0^3 3 dt + 0 = -\frac{3}{4} t \Big|_0^3$$

$$V_o(t) = -\frac{1}{4} \int_3^4 -1 dt + -\frac{9}{4} = \frac{1}{4} t \Big|_3^4 - \frac{9}{4}$$

$$\frac{1}{4}(t-3) - \frac{9}{4} \Big|_{[3,4]} \quad [0,3]$$





$V_{th} = \text{node } V1$

$$\begin{cases} -2\text{mA} - 1\text{mA} V_x + \frac{V1}{4+6} + \frac{V1}{2+2} = 0 \\ V_x = \frac{1}{2} V1 \end{cases}$$

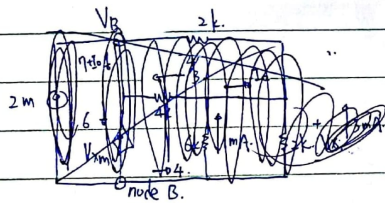
$V_{oc} = V_a - V_b$

$$\begin{cases} V_a = \frac{6}{4+6} V1 \\ V_b = \frac{1}{2} V1 \end{cases}$$

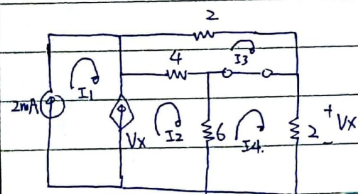
$$\begin{aligned} -2 - \frac{1}{2} V1 + 0.1 V1 + 0.25 V1 &= 0 \\ -0.15 V1 &= 2 \quad V1 = -13.3 \end{aligned}$$

$V_{oc} = 0.1 V1 = -1.33\text{V}$

$R_{th} =$ 有相依 \Rightarrow 诺顿



~~Handwritten scribbles and crossed-out equations.~~



$$\begin{aligned} V_x &= 2 I_4 \\ I_1 &= 2\text{mA} \quad I_2 - I_1 = V_x \\ I_2 &= I_1 + V_x = 2\text{mA} + 2 I_4 \text{mA} \end{aligned}$$

~~Handwritten scribbles and crossed-out equations.~~

$\boxed{\text{KVL } I_3}$

$$\begin{aligned} 6 I_3 - 4 I_2 &= 0 \\ 6 I_3 &= -16 \\ I_3 &= -2.67\text{mA} \end{aligned}$$

$\boxed{\text{KVL } I_4}$

$$\begin{aligned} 6 I_4 + 2 I_4 - I_2 \cdot 6 &= 0 \\ 8 I_4 &= 6 I_2 = 12 + 12 I_4 \\ -4 I_4 &= 12 \quad I_4 = -3\text{mA}, I_2 = -4\text{mA} \\ I_0 &= I_4 - I_3 = -3 - (-2.67) = -0.33\text{mA} \end{aligned}$$

$\boxed{R_{th} = \frac{V_{oc}}{I_{sc}} = 4\text{k}\Omega}$

$\boxed{P_{max} = \frac{V^2}{4R} = \frac{1}{9} \text{W}}$