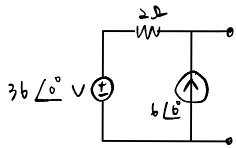
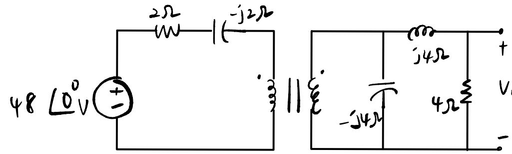
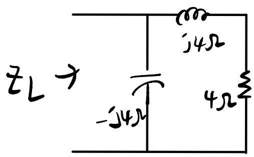
1.



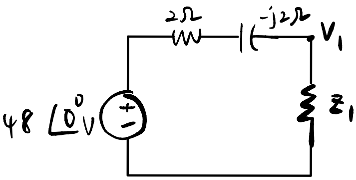
$\leftarrow \begin{cases} V_{oc} = 48\angle 0^\circ \text{ V} \\ Z_{th} = 2\,\Omega \end{cases}$



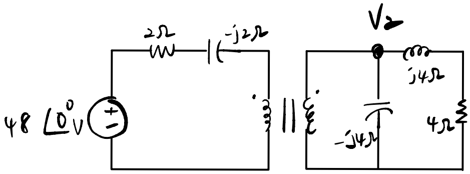
$n = \frac{1}{3}$



$$Z_L = (-j4) \,//\, (4 + j4) = 4 - j4$$



$$Z_1 = \frac{Z_L}{n^2} = \frac{4 - j4}{(\frac{1}{3})^2} = 36 - j36, \quad V_1 = 48 \times \frac{36 - j36}{(2 - j2) + (36 - j36)} = \frac{864}{19}$$



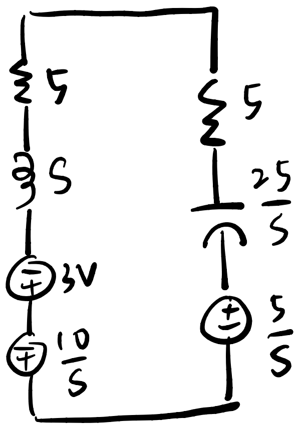
$$V_2 = \frac{1}{3} \times V_1 = \frac{288}{19}$$

$$V_o = V_2 \times \frac{4}{4 + j4} = 7.579 - j7.579 = 10.718\angle -45^\circ \text{ V}$$

2、

$t<0$: $i(0^-) = \frac{30}{10} = 3A$, $V_c(0^-) = 5\times 3 - 10 = 5V$

$t \geqslant 0$:



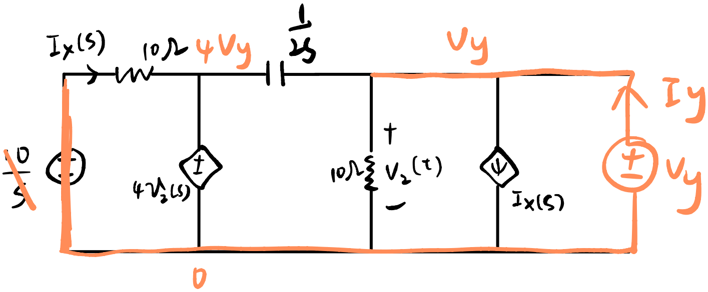
$$\left(3+\frac{10}{s}+\frac{5}{s}\right) = I(s)\left(10+s+\frac{25}{s}\right)$$

$$\Rightarrow (3s+15) = I(s)(10s+s^2+25)$$

$$I(s) = \frac{3(s+5)}{(s+5)^2} = \frac{3}{(s+5)}$$

$$\Rightarrow \mathcal{L}^{-1}\{I(s)\} = i(t) = 3e^{-5t}u(t)\ A$$

3.



$$V_2 = V_y$$

$$I_x(s) = \frac{0-4V_y}{10}$$

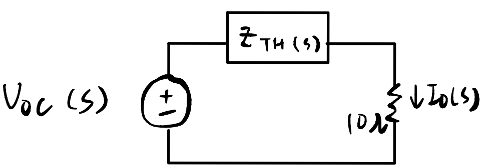
$$\Rightarrow V_y = -\frac{10}{4} I_x(s)$$

$$I_y = I_x(s) + \frac{V_y}{10} + \frac{V_y - 4V_y}{\frac{1}{2s}} = I_x(s) + \frac{V_y}{10} - 6s\,V_y$$

$$= I_x(s) + \frac{1}{10}\left(-\frac{10}{4} I_x(s)\right) - 6s\left(-\frac{10}{4} I_x(s)\right)$$

$$\Rightarrow 4I_y = 3I_x(s) + 60s\,I_x(s) = (3+60s) I_x(s)$$

$$\Rightarrow Z_{TH} = \frac{V_y}{I_y} = \frac{-\frac{10}{4} I_x(s)}{\frac{(3+60s)}{4} I_x(s)} = \frac{-10}{60s+3}$$

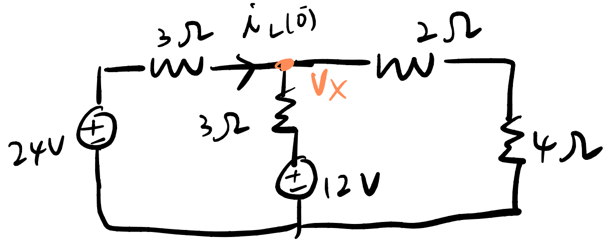


$$I_o(s) = \frac{\frac{10}{s(60s+3)}}{\frac{-10}{60s+3} + 10} = \frac{1}{s(60s+2)} = \frac{1}{s(s+\frac{1}{30})}$$

$$I_o(s) = \frac{1}{s(s+\frac{1}{30})} = \frac{\frac{1}{2}}{s} - \frac{\frac{1}{2}}{s+\frac{1}{30}}$$

$$\boxed{i_o(t) = \left(\frac{1}{2} - \frac{1}{2}e^{-\frac{1}{30}}\right) u(t)\ A}$$

4. $t < 0$

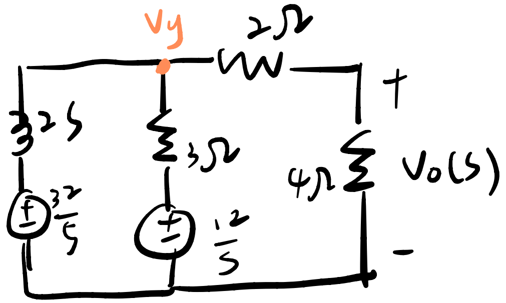


$$V_x = \left(\frac{24}{3} + \frac{12}{3}\right) \times (3 \parallel 3 \parallel 6) = 12 \times 1.2 = 14.4V$$

$$i_L(0^-) = \frac{24 - 14.4}{3} = 3.2\,A$$

$$L i_L = \frac{32}{5}\,V$$

$t > 0$:



$$\frac{V_y - \frac{32}{5}}{2s} + \frac{V_y - \frac{12}{s}}{3} + \frac{V_y}{6} = 0$$

$$V_y\left(\frac{1}{2s} + \frac{1}{2}\right) = \frac{16}{5s} + \frac{4}{s}$$

$$V_y(s+1) = \frac{72}{5}$$

$$V_y = \frac{\frac{72}{5}}{s+1},$$

$$V_o = \frac{2}{3} V_y = \frac{\frac{48}{5}}{s+1} = \left(\frac{48}{5} e^{-t}\right) u(t)\,V$$

5.

$$20\left[\log 0.1 + \log\left|1+\frac{j\omega}{0.5}\right| - \log|j\omega| - \log\left|1+\frac{j\omega}{10}\right| - \log\left|1+\frac{j\omega}{100}\right|\right]$$