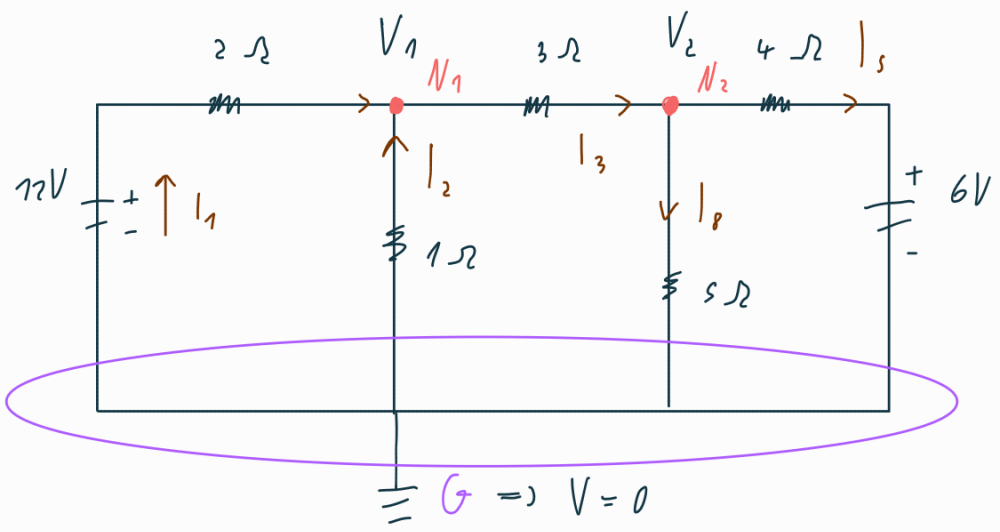
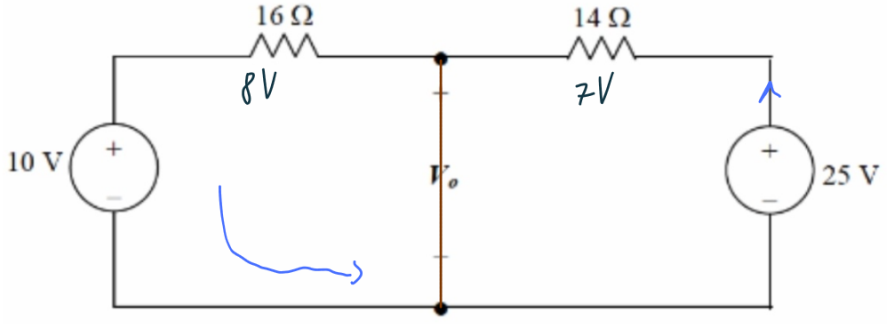


$N_1: \; I_1 + I_2 = I_3 \quad (=) \quad \frac{12 - V_1}{2} + \frac{0 - V_1}{1} = \frac{V_1 - V_2}{3}$

$N_2: \; I_3 = I_8 + I_5 \quad (=) \quad \frac{V_1 - V_2}{3} = \frac{V_2 - 0}{5} + \frac{V_2 - 6}{4}$

$I = \frac{U}{R} = \frac{V_i - V_f}{R}$

3. Given circuit below. Use KVL to determine V_0 in the circuit

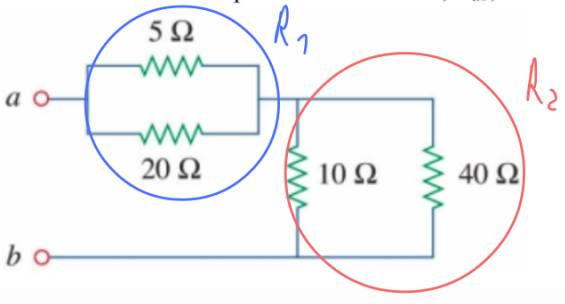


$I = \frac{25 - 10}{30} = \frac{1}{2} = 0.5 \; A$

$V = I \cdot R$

$V_0 = 25 - 7 = 10 + 8 = 18$

5. Calculate the equivalent resistance, R_{ab}, at terminals a-b for the circuit below

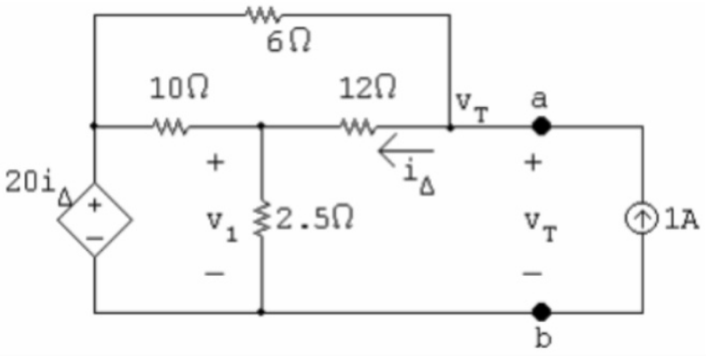


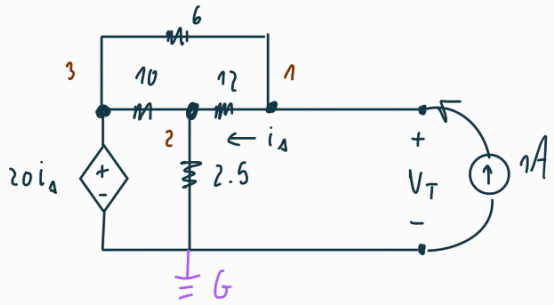
$\frac{1}{R_1} = \frac{1}{5} + \frac{1}{20} = \frac{5}{20} \Rightarrow R_1 = 4$

$\frac{1}{R_2} = \frac{1}{10} + \frac{1}{40} = \frac{5}{40} \Rightarrow R_2 = 8$

$R_{eq} = R_1 + R_2 = 12$

6. The current controlled voltage source is $20i_\Delta$. Find the Thévenin equivalent with respect to the terminals a, b for the circuit



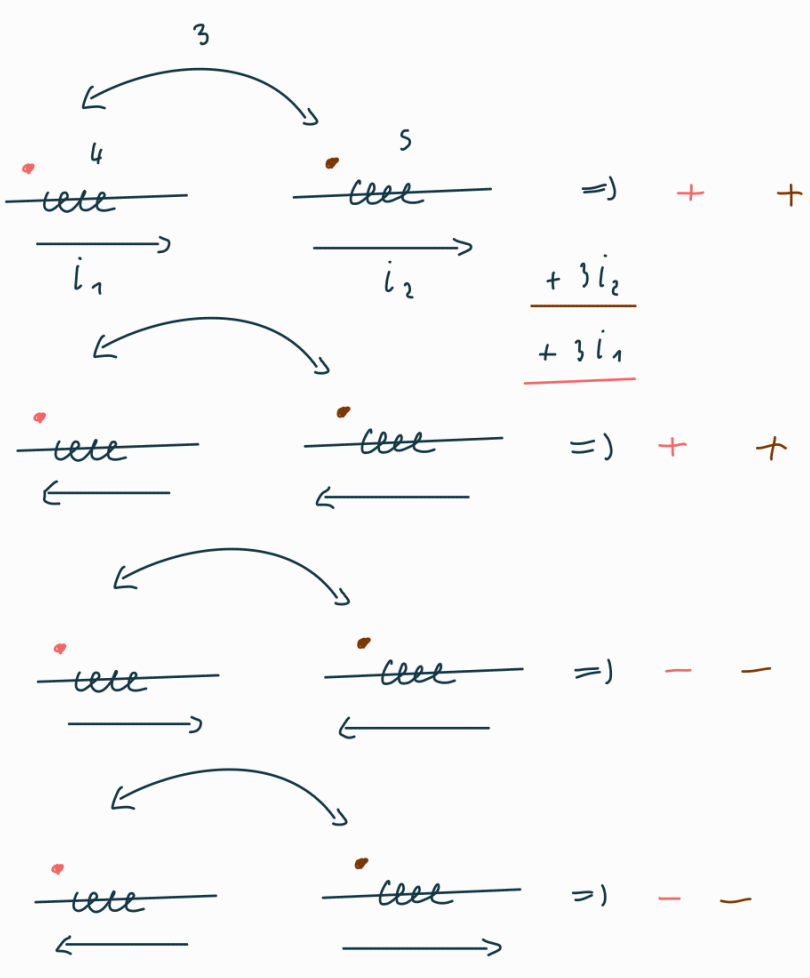


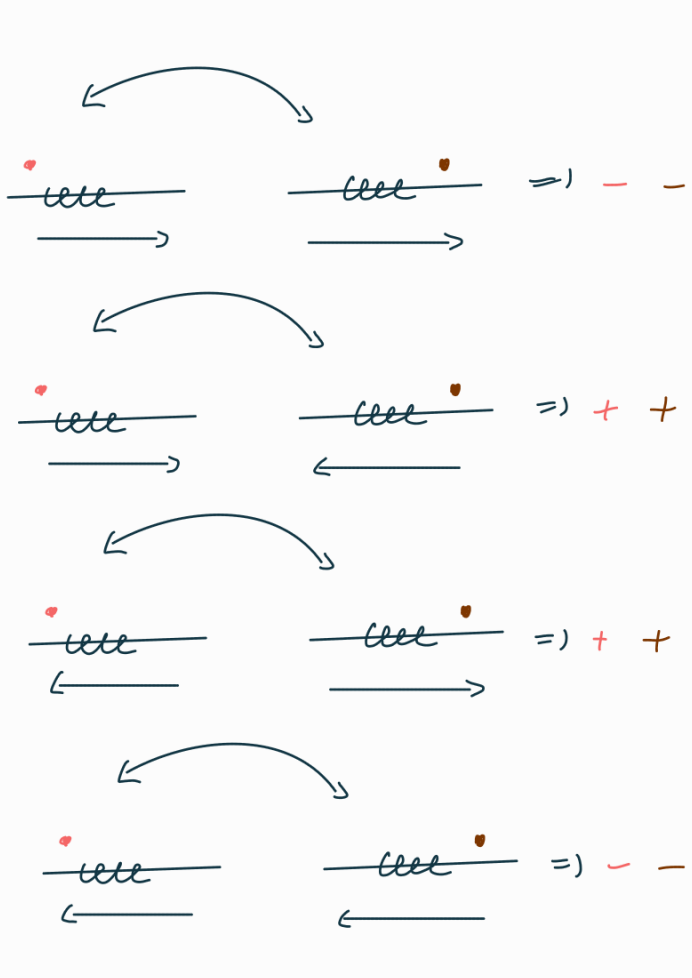
$$1: \quad 1 - \frac{V_1 - 20i_\Delta}{6} - \frac{V_1 - V_2}{12} = 0$$

$$2: \quad \frac{V_1 - V_2}{12} - \frac{V_2 - 20i_\Delta}{10} - \frac{V_2}{2.5} = 0$$

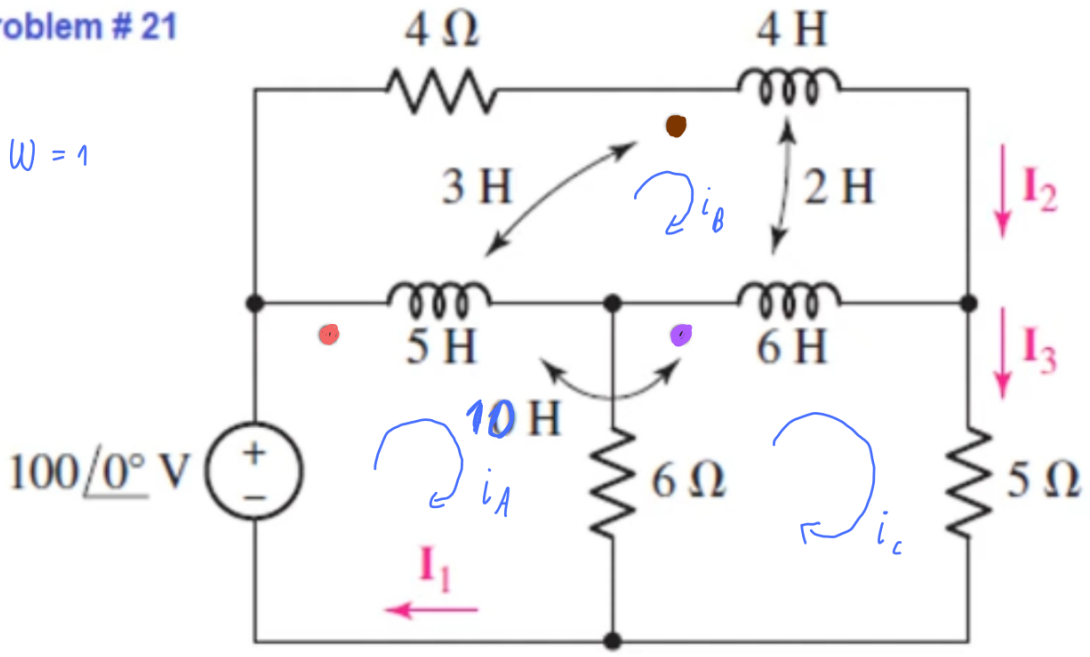
$$i_\Delta = \frac{V_1 - V_2}{12} \qquad V_3 = 20 i_\Delta$$

$$V_1 = V_T = 27 \quad \Rightarrow R_{TH} = \frac{V_T}{i_T} = 27\,\Omega$$





Problem # 21

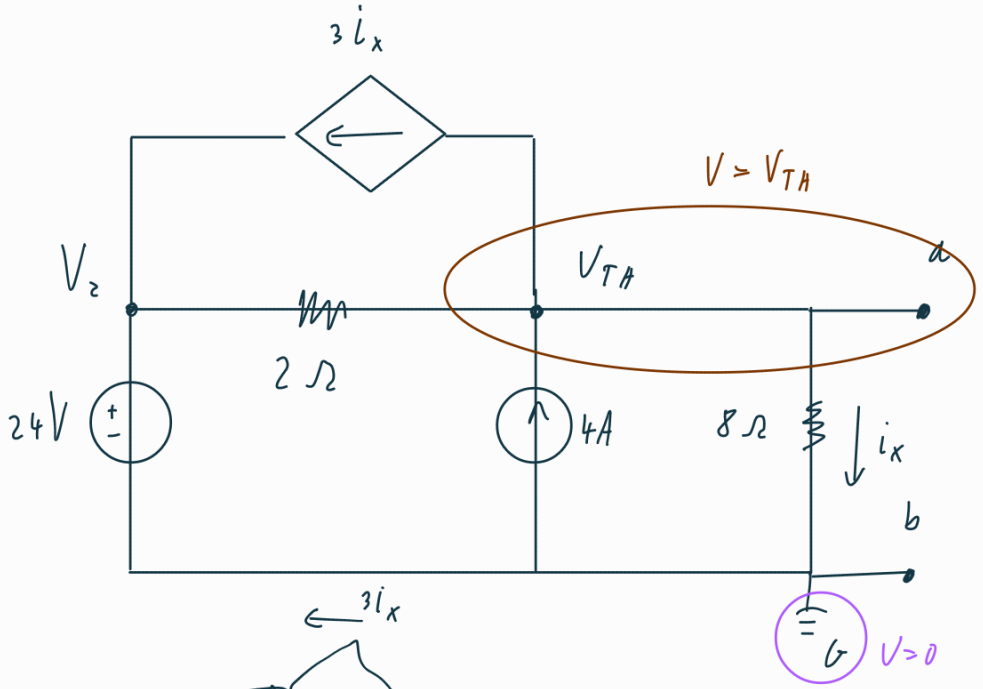


$\omega = 1$

$$5j(i_A - i_B) + 6(i_A - i_C) + 3j\,i_B + 10j(i_C - i_B) = 100$$

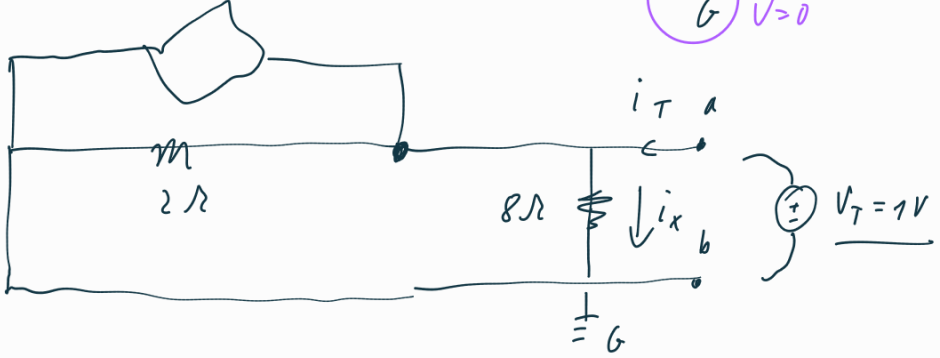
$$4\,i_B + 4j\,i_B + 6j(i_B - i_C) + 5j(i_B - i_A) + 2j(i_C - i_B) + 3j(i_A - i_B) - 2j\,i_B + 10j(i_B - i_A) + 10j(i_B - i_C) - 3j\,i_B = 0$$

$$5i_C + 6(i_C - i_A) + 6j(i_C - i_B) + 10j(i_A - i_B) + 2j\,i_B = 0$$



$$\frac{V_{TH}}{8} + 4 - \frac{V_{TH} - V_2}{2} - \frac{3V_{TH}}{8} = 0$$

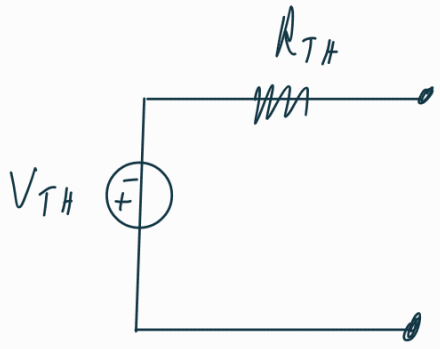
$$\frac{3V_{TH}}{8} + 24 + \frac{V_{TH} - V_2}{2} = 0$$



$$R_{TH} = \frac{V_T}{i_T}$$

NVM: $i_T - \frac{V_T}{8} - \frac{3V_T}{8} - \frac{V_T}{2} = 0 \Rightarrow i_T = \frac{V_T + 3V_T + 4V_T}{8} = \frac{1+3+4}{8} = 1\,A$

$\Rightarrow$

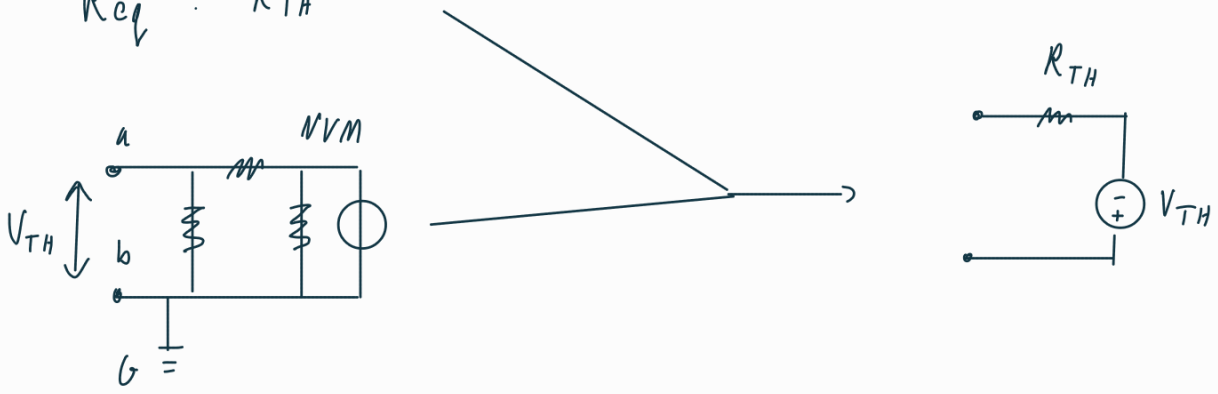


1) indep. sources:

- V src:

- C src:

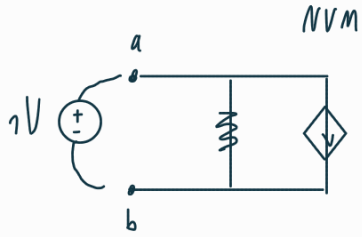
$R_{eq} - ? = R_{TH}$



2) otherwise

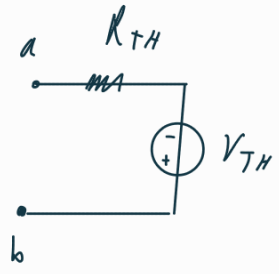
- deactivate indep. sources

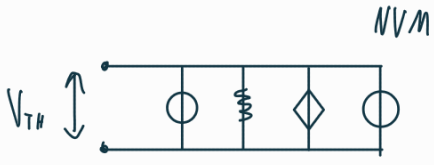
! only dep. sources $\rightarrow$ only R_{TH}



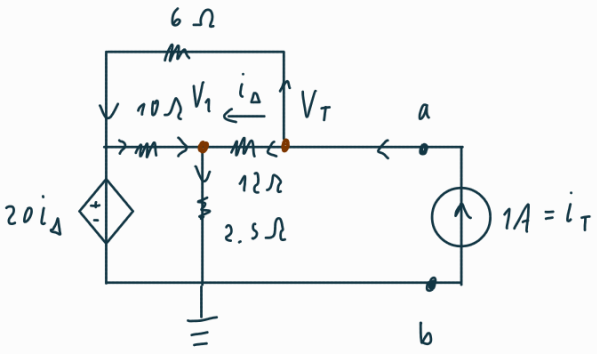
$i_T / V_T \longrightarrow V_T / i_T \Rightarrow R_{TH} = \frac{V_T}{i_T}$

$\Rightarrow$





6)



$V_T = ?$

$$\begin{cases} 1 - \dfrac{V_T - 20 i_\Delta}{6} - \dfrac{V_T - V_1}{12} = 0 \\ \dfrac{V_T - V_1}{12} + \dfrac{20 i_\Delta - V_1}{10} - \dfrac{V_1}{2.5} = 0 \\ i_\Delta = \dfrac{V_T - V_1}{12} \end{cases}$$

$\Rightarrow R_{TH} = \dfrac{V_T}{i_T}$ $\Rightarrow$