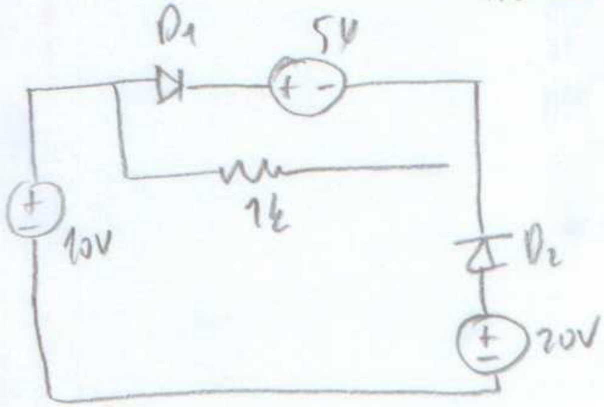
EE-282

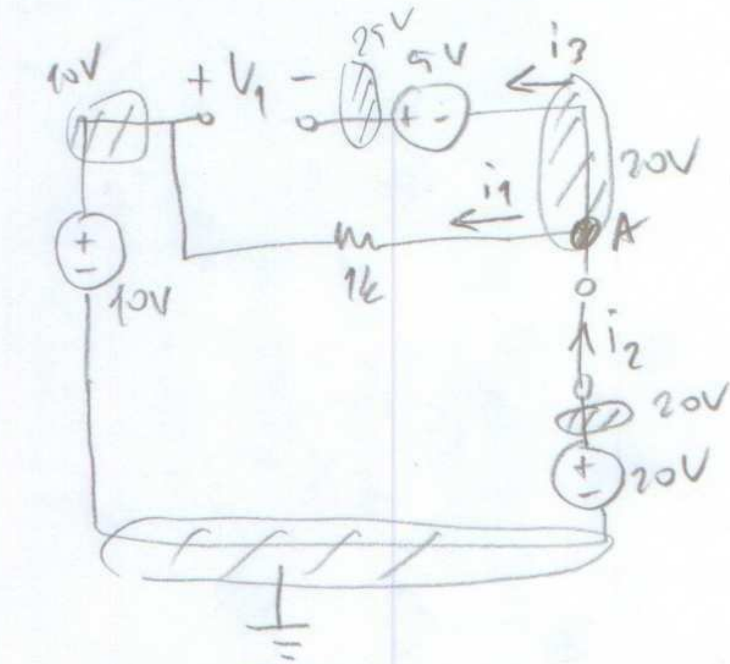
Homework #1

1-/



assume that $D_1 = OFF$

$D_2 = ON$



$V_1 < 0$, $i_1 > 0$ should satisfy

$\boxed{V_1 = 10-25 = -15V < 0}$ ✓

KCL at A

$\boxed{i_1 + i_3 = i_2}$

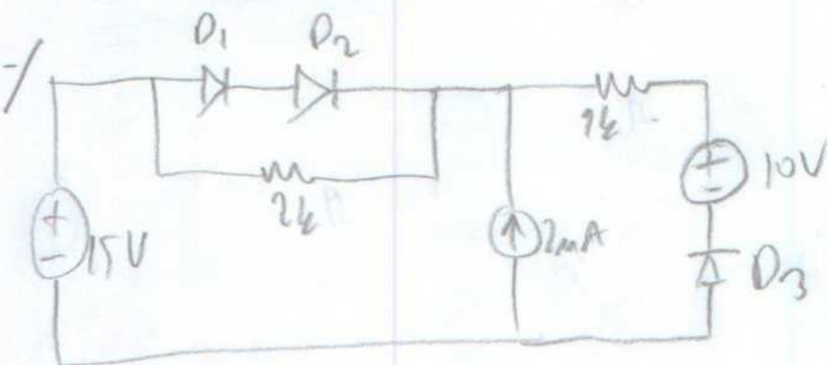
$i_3 = 0$, $i_1 = \dfrac{20-10}{1}$

$i_1 = 10\ mA$

$\boxed{i_2 = 10\ mA > 0}$ ✓

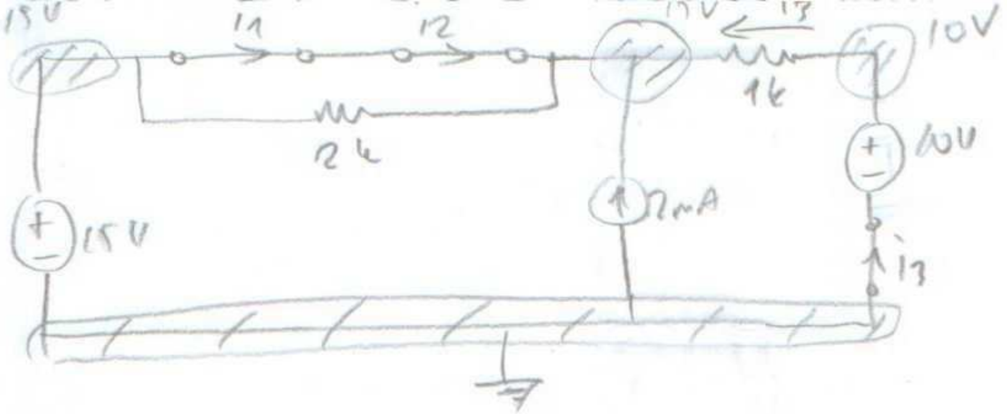
the assumption is correct

2-/



assume (1) $D_1: ON$, $D_2: ON$, $D_3: ON$

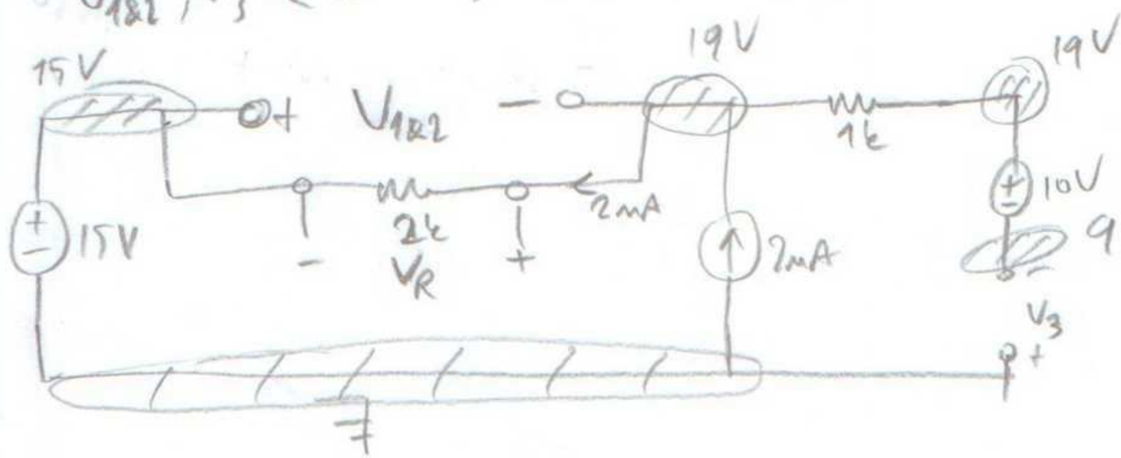
$i_1, i_2, i_3 > 0$ should satisfy according to our assumption



$i_3 = \frac{10-15}{1} = -5\ mA < 0$ X assumption is not satisfied

assume ② D_1 : OFF , D_2 : OFF , D_3 : OFF

$V_{1\&2}^*, V_3 < 0$ should satisfy



* D_1 and D_2 behaves like just one diode

$V_3 = 0 - 9 = -9V < 0$ ✓

$V_{1\&2} = 15 - 19 = -4V < 0$ ✓

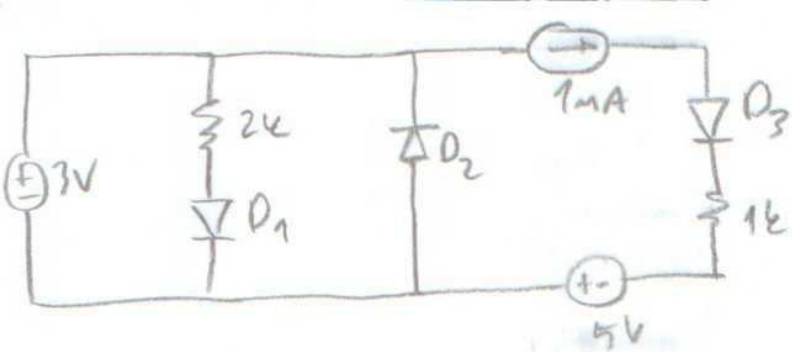
So our assumption is correct

D_1 & D_2 combination should have an open circuit btw 15V & 19V nodes

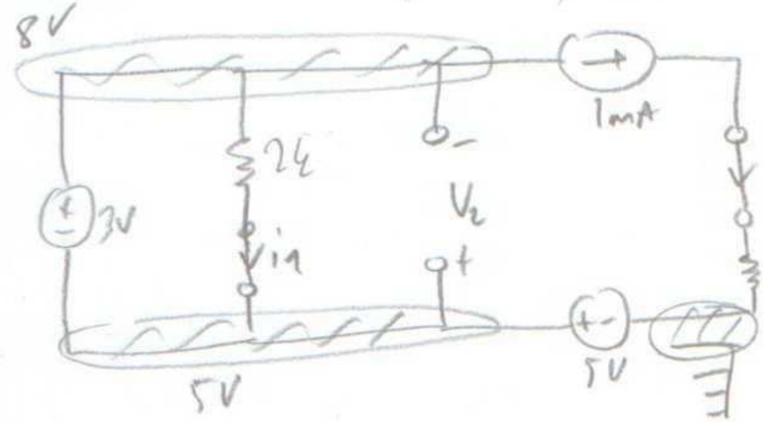
D_1 & D_2 : OFF

D_3 = OFF

3-/



assume that D_1 : ON , D_2 : OFF , D_3 : ON



$i_1, i_3 > 0$

$V_2 < 0$

should satisfy

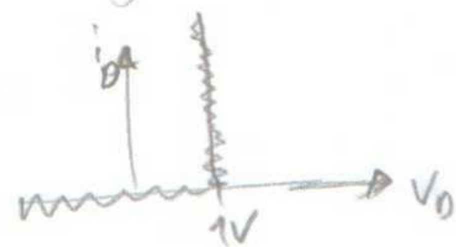
$i_1 = \dfrac{8-5}{2} = 1{,}5 \text{ mA} > 0$ ✓

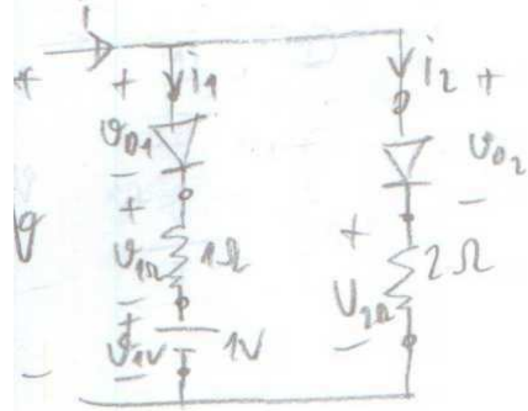
$V_2 = 5-8 = -3\text{ V} < 0$ ✓

$i_3 = 1\text{mA} > 0$ ✓

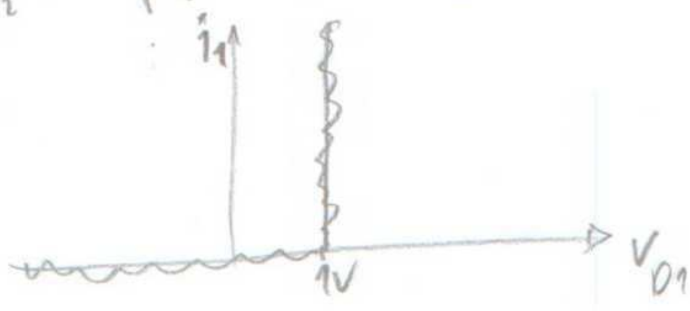
our assumption is correct

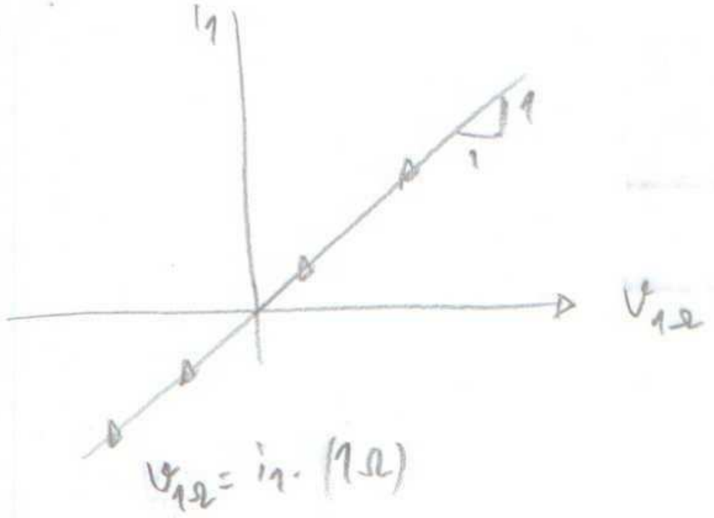
4-/ for each diode:

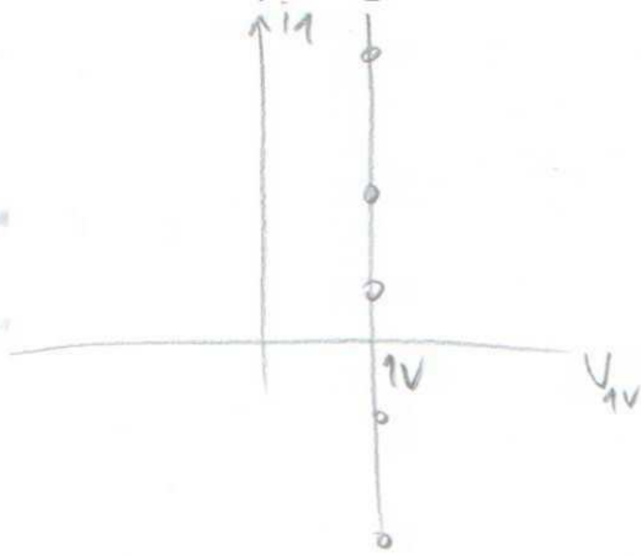




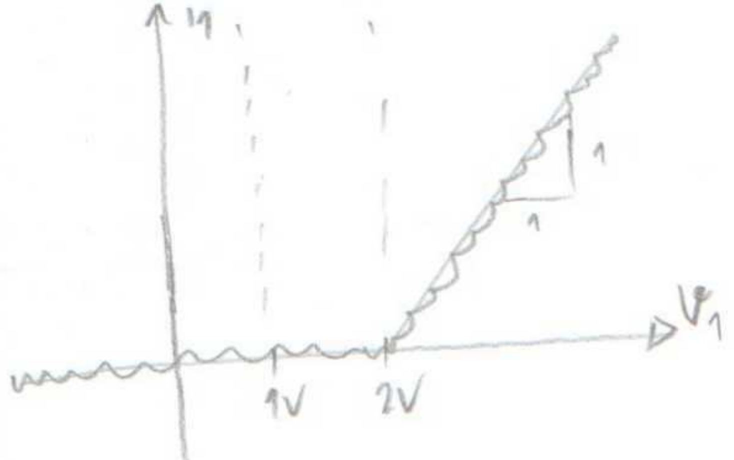
for branch ①:



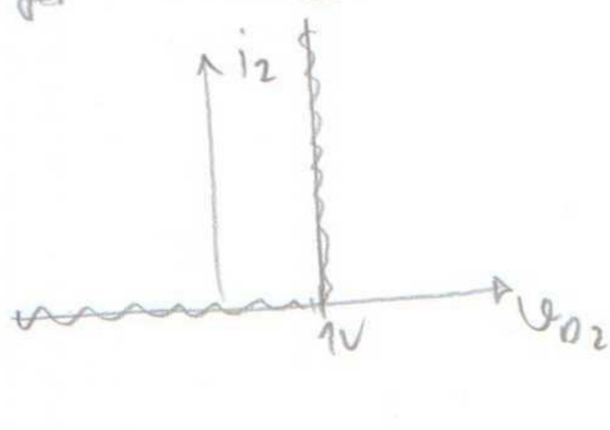


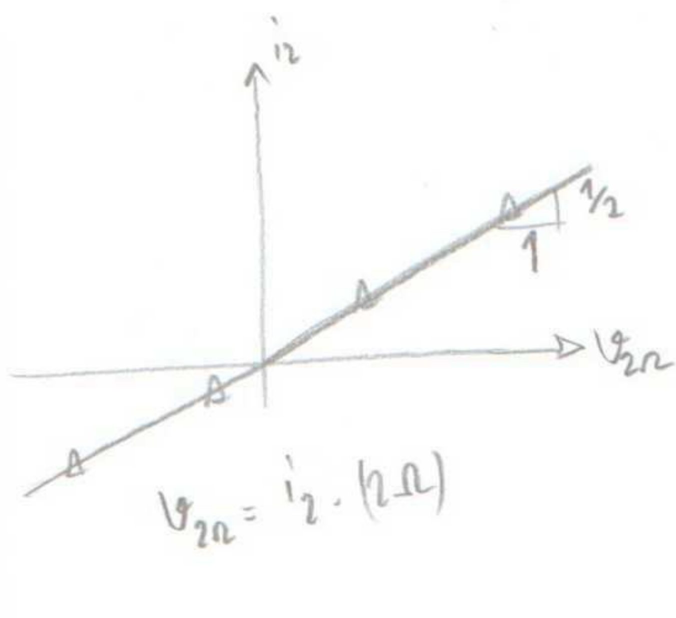


add v_{D1} , $v_{1\Omega}$, v_{1V} for all i_1 values st



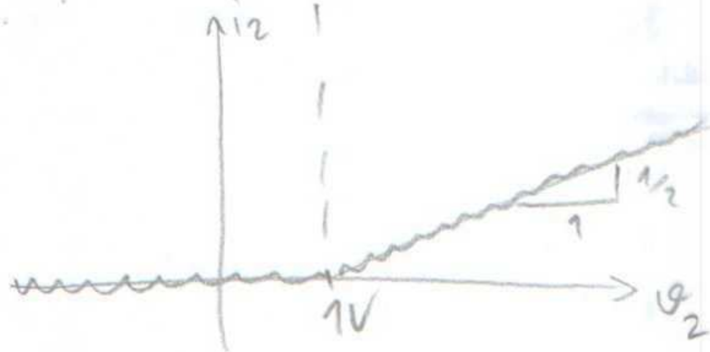
for branch (2) :





add V_{D2} & $V_{2\Omega}$

for all i_2 values

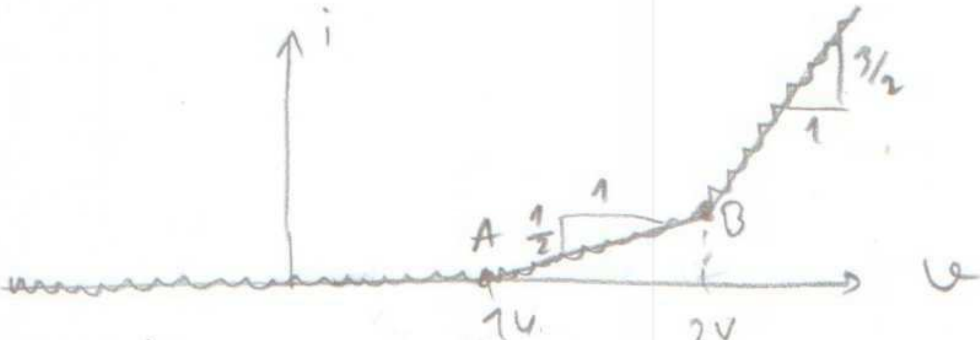


Now, we need to combine branch ① & ②.

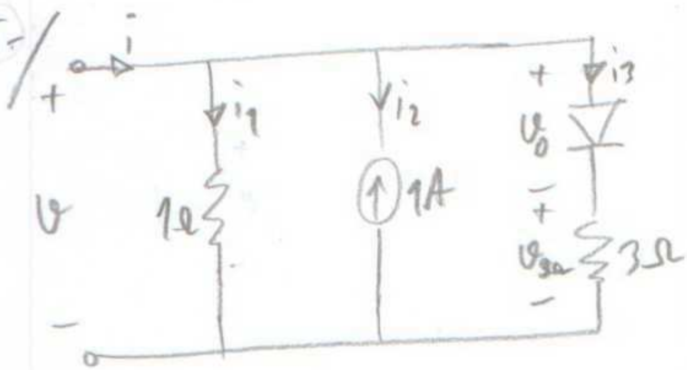
$$v = v_1 = v_2$$

$$i = i_1 + i_2$$

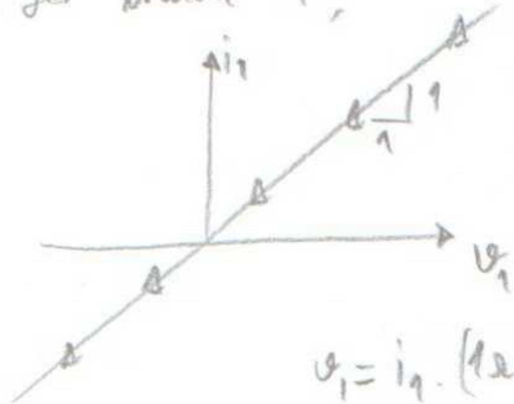
add i_1 & i_2 for each $v = v_1 = v_2$ value st;



A (1,0)
B (2,0,5)

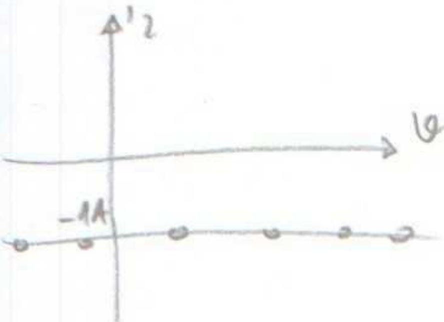


for branch 1;

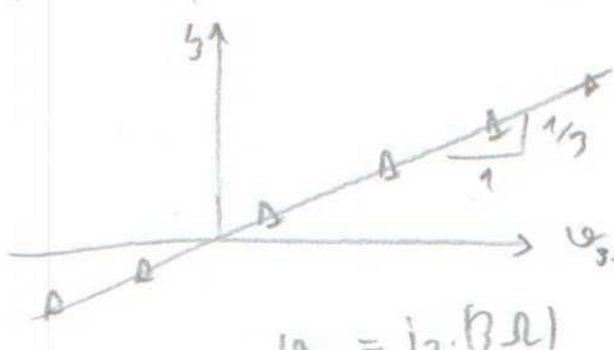


$v_1 = i_1 \cdot (1Ω)$

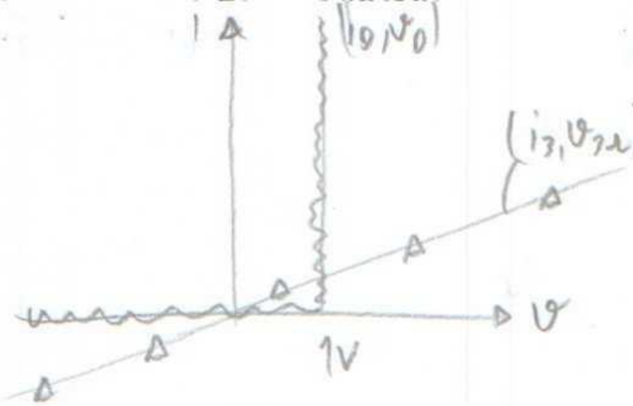
for branch 2;



for branch 3;



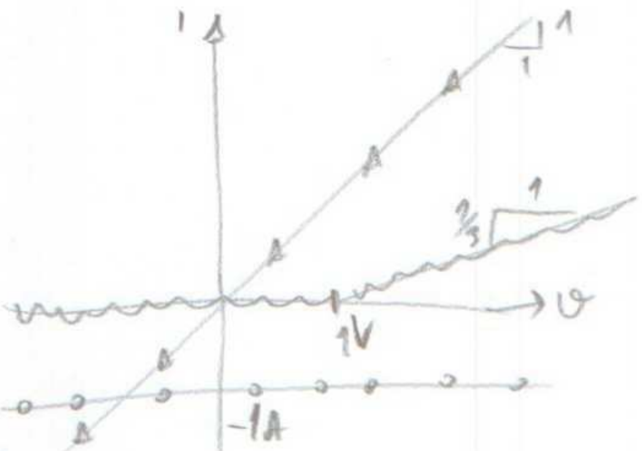
$v_{3Ω} = i_3 \cdot (3Ω)$

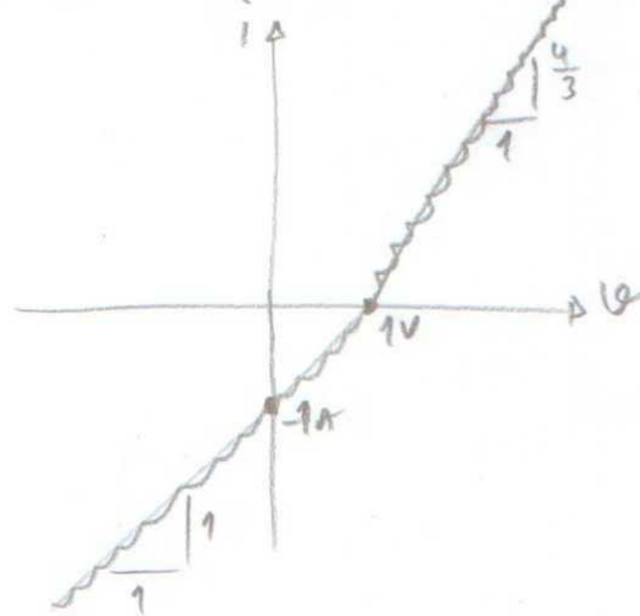


for each i value
add v_0 & $v_{1\Omega}$

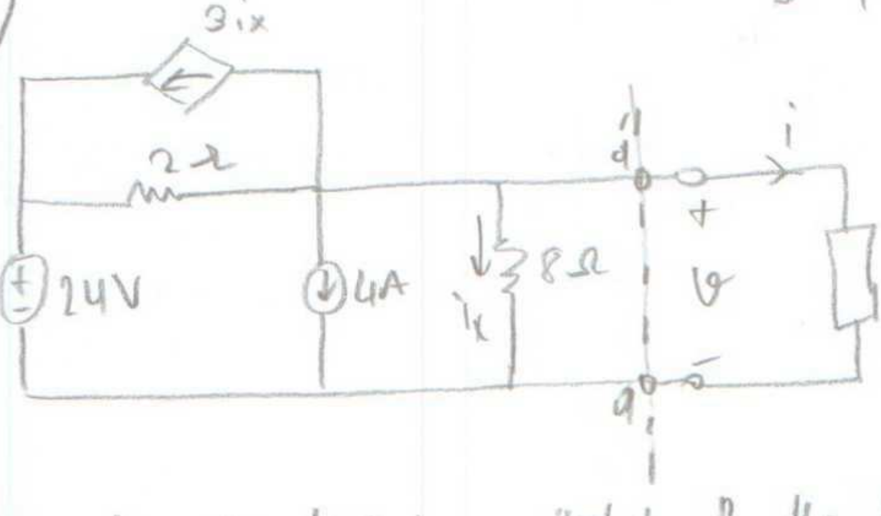
for each branches $\quad v = v_1 = v_2 = v_3 \quad ; \quad i = i_1 + i_2 + i_3$

add i_1, i_2, i_3 for all v values st

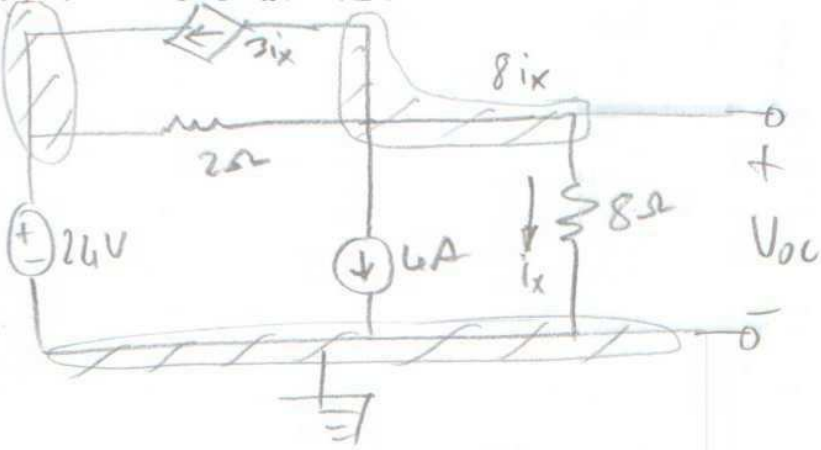




6-/



First, find the Thevenin equivalent of the left hand side of terminals a-a'.



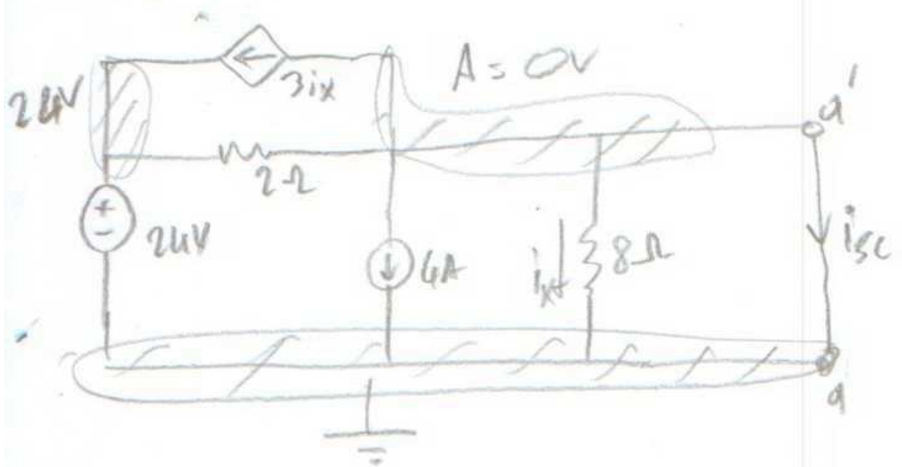
for Node $8i_x$, apply for KCL;

$$3i_x + \frac{8i_x - 24}{2} + 4 + i_x = 0$$

$$3i_x + 4i_x - 12 + 4 + i_x = 0 \rightarrow 8i_x = 8 \ , \ i_x = 1A$$

$$V_{oc} = 8i_x - 0 = 8V$$

$$i_x = \frac{0}{8} = 0A$$

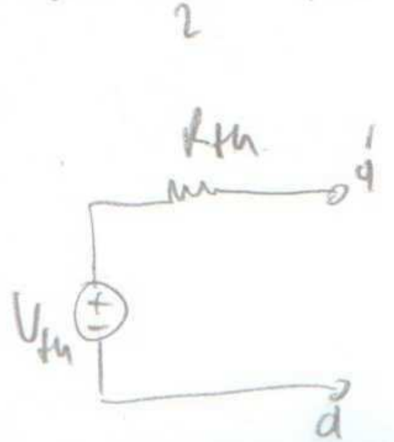


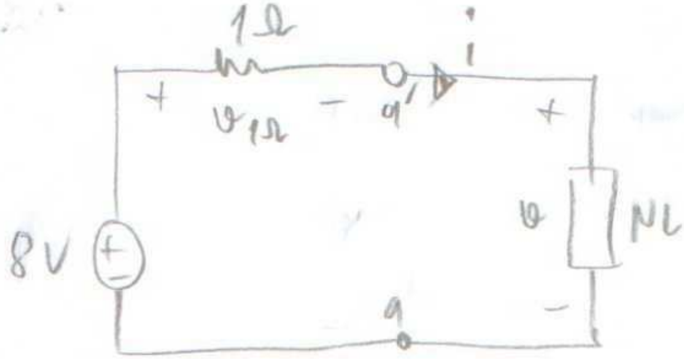
KCL for A = 0V node.

$$3i_x + \frac{0 - 24}{2} + 4 + i_x + i_{sc} = 0 \quad ; \quad i_{sc} = 12 - 4 = 8A$$

$$V_{th} = V_{oc} = 8V$$

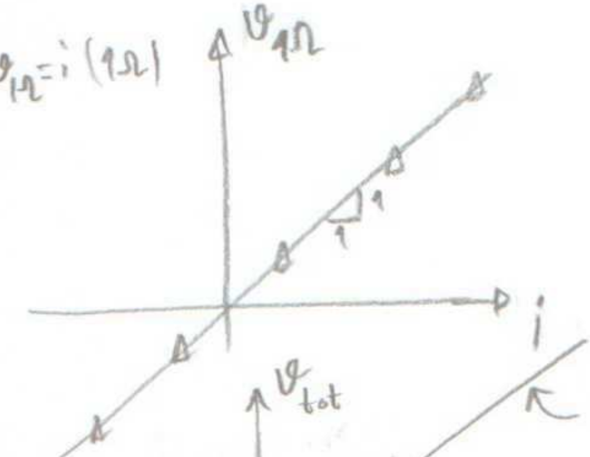
$$R_{th} = \frac{V_{oc}}{i_{sc}} = 1\Omega$$

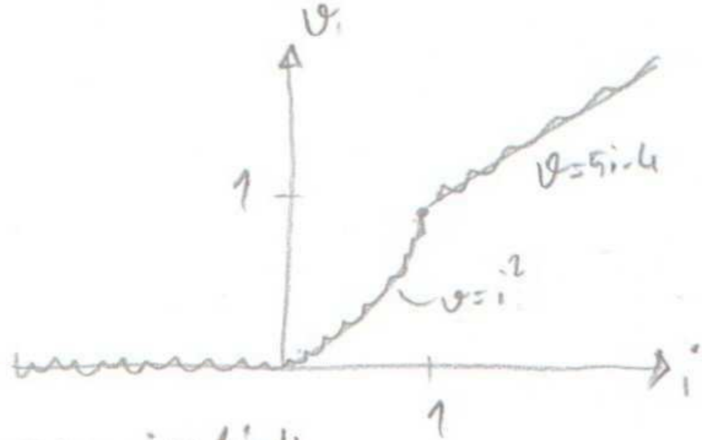


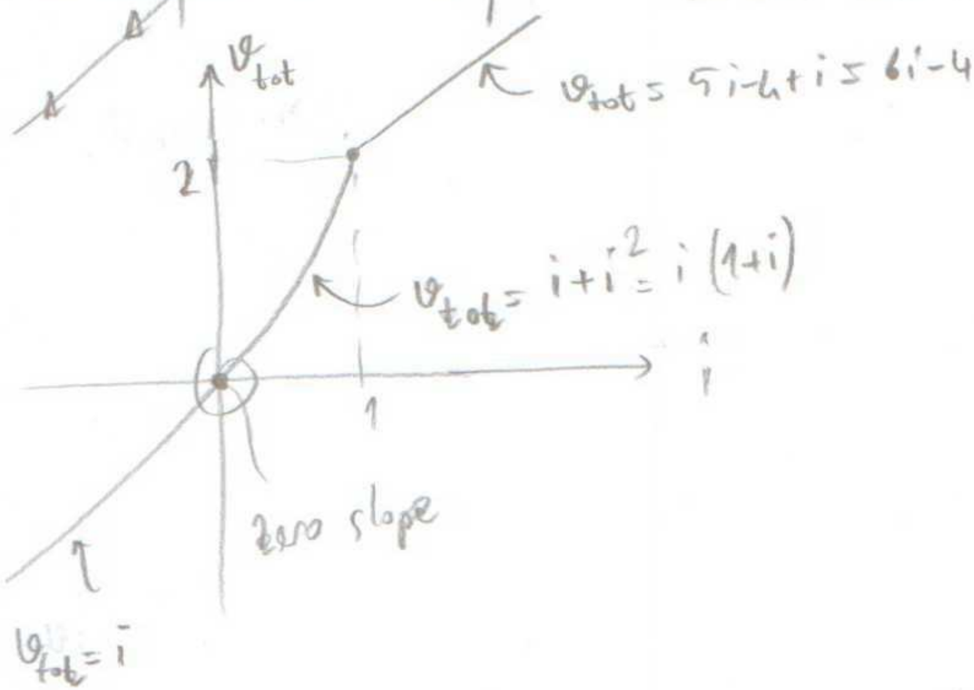


$v_{1\Omega} + v - 8 = 0$

$v_{tot} = v_{1\Omega} + v = 8$







at $v_{tot} = 8V$, $v_{tot} = 6i - 4$ line is valid ,

$8V = 6i - 4 \quad \rightarrow \quad i = 2\,A$

for $i = 2A$ $\quad v = 5i - 4$, $\underline{\underline{v = 6\,V}}$