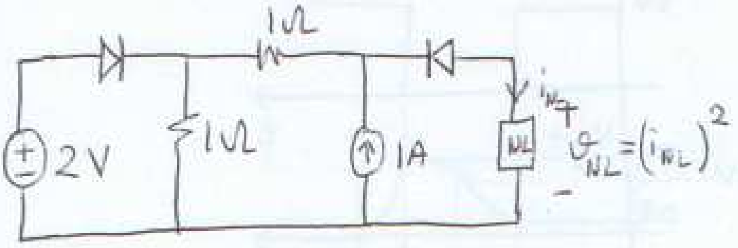
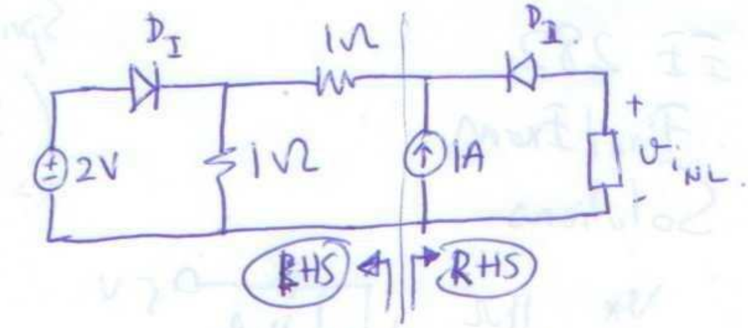
(2)



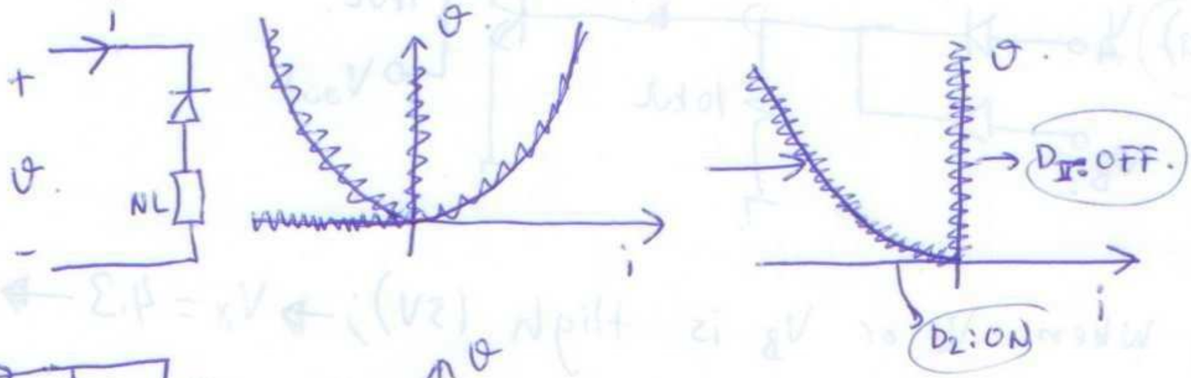
The block shown with NL indicates a non-linear load with transfer function $v_{NL} = (i_{NL})^2$. Find v_{NL}.

(2)

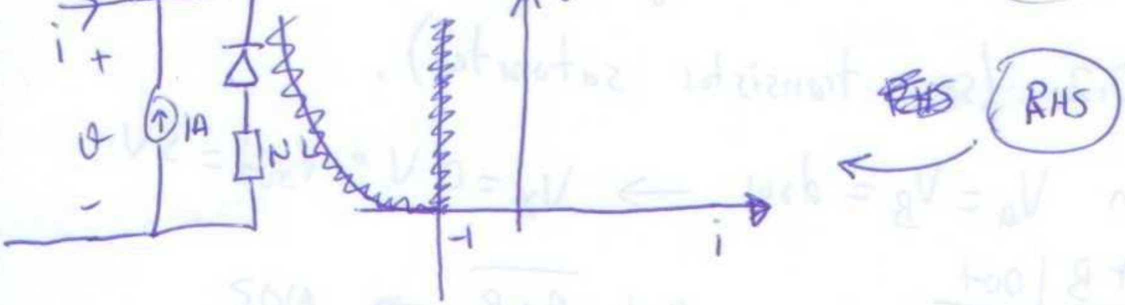
+20



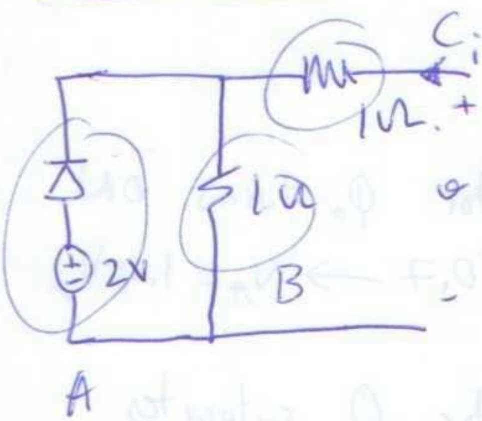
D_I
1Ω
D_{II}
2V
1Ω
1A
$v_{i_{NL}}$
RHS
RHS



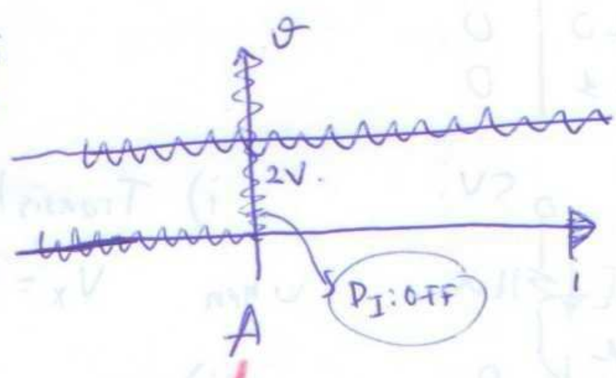
i
v
NL
D_{II}: OFF
D_2: ON



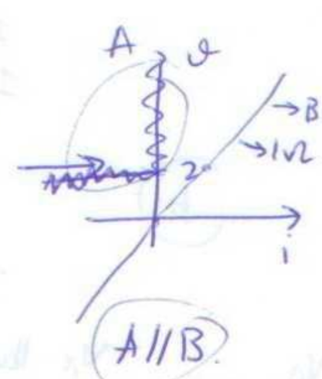
i
v
1A
NL
-1
RHS



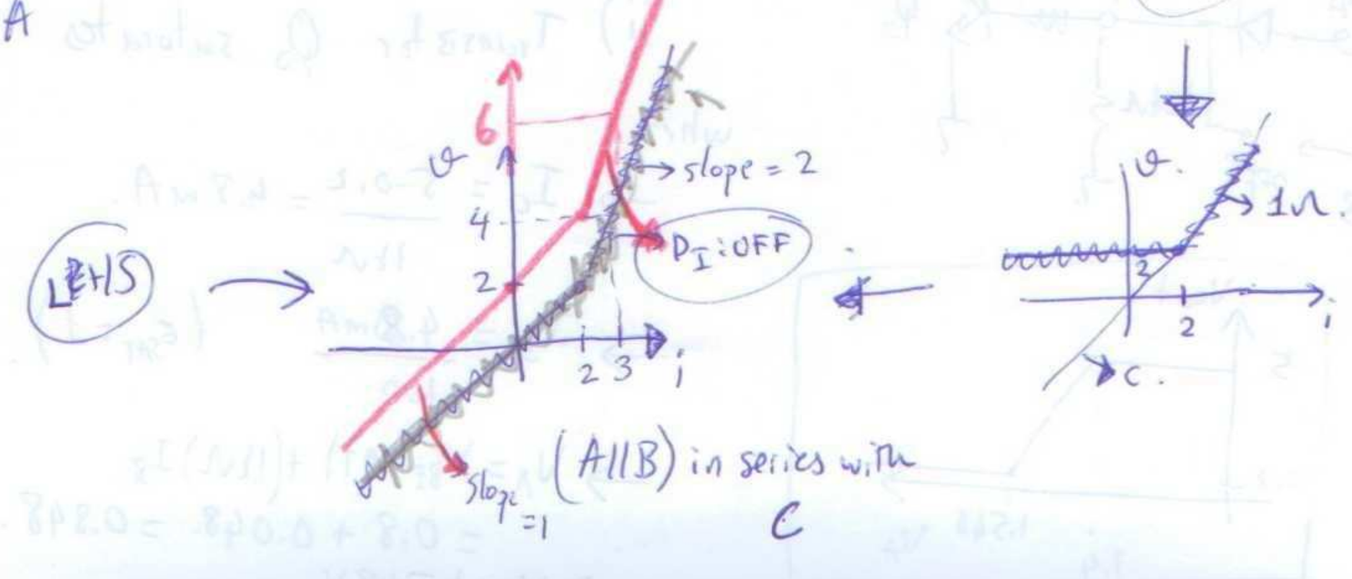
C
i
1Ω
1Ω
2V
B
A
v



v
2V
i
D_I: OFF
A

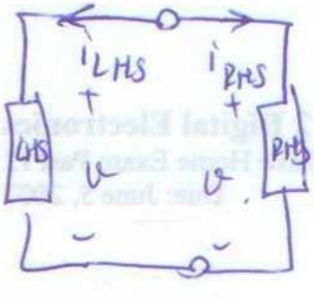


A
v
→B.
$\to 1\Omega$.
2
i
A//B

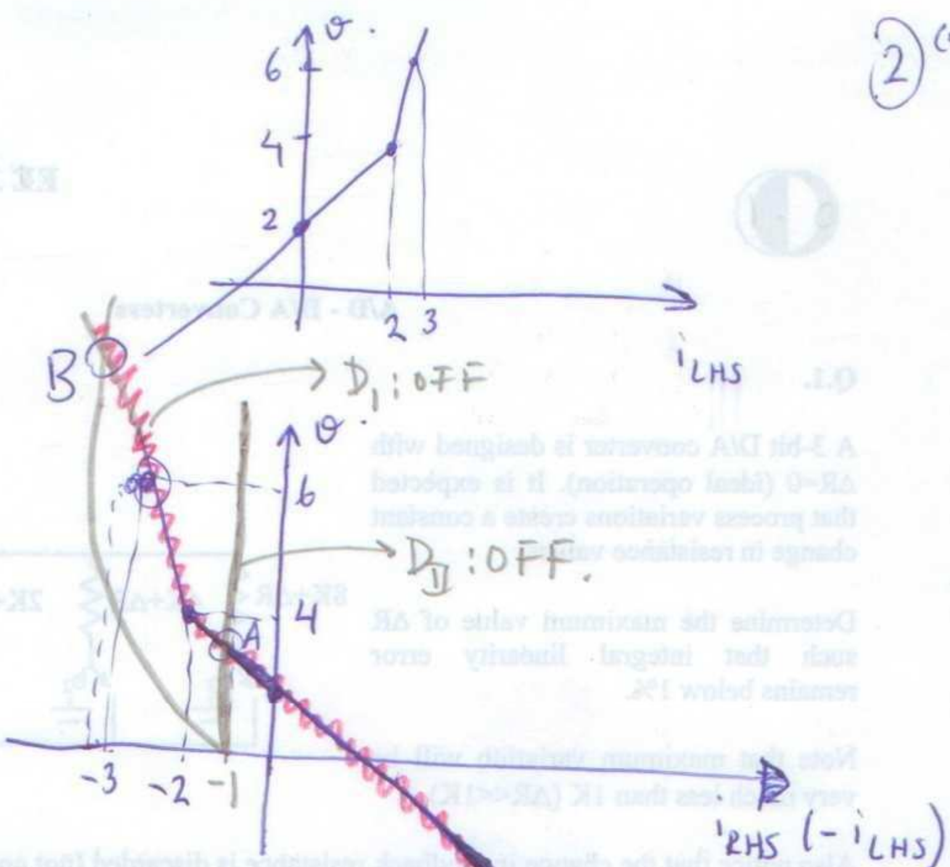


LHS
6
v
slope = 2
4
D_I: OFF
2
2 3
i
slope =1
(A//B) in series with C
v.
1Ω.
2
2
i
C.

(2) cont.



$i_{RHS} = -i_{LHS}$



Two Solution;

(A) D_1 : ON ; D_2 : OFF → (point A).

$v = 3$ Volt. ; $i = -1$ A.

then.

$\boxed{v_{NL} = 0\ V}$;

(B) D_1 : OFF ; D_2 : ON (point B).

→ $v = (i_{RHS}+1)^2$ intersects. $v = -2\, i_{RHS}$

$(i_{RHS}+1)^2 = -2\, i_{RHS} \rightarrow i_{RHS}^2 + 4 i_{RHS} + 1 = 0$

$i_{RHS} = -\frac{4 \mp \sqrt{12}}{2}$

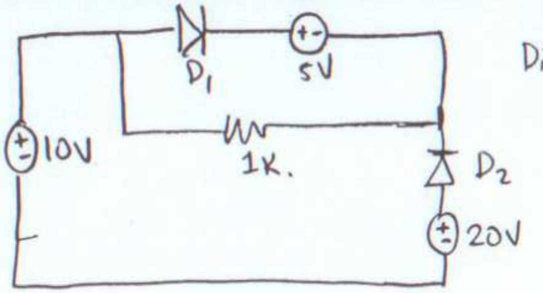
then $i_{RHS} = -2 - \frac{\sqrt{12}}{2}$ $\boxed{v_{NL} = +4 + \sqrt{12}}$

— EE 282 HW#1 —

Due Date: 13, March, 2009

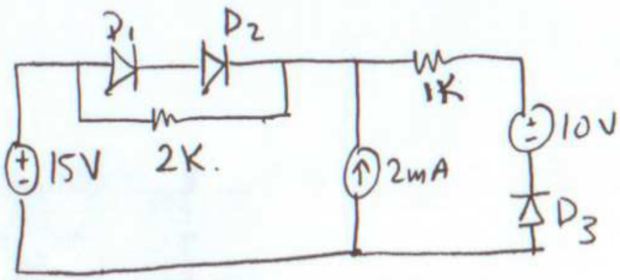
Find the states of the diodes,

1)



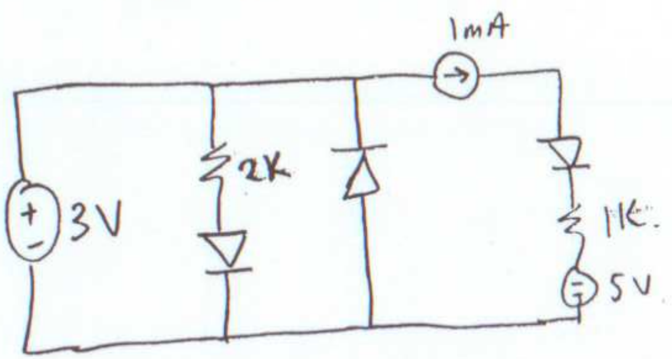
Diodes are ideal.

2)

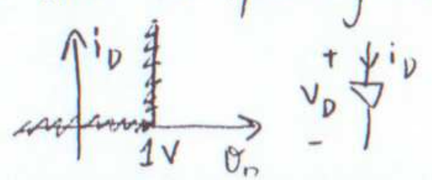


Diodes are ideal.

3)

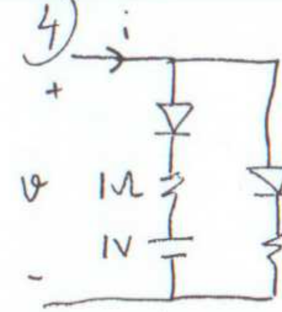


Diodes have the following i-v char.

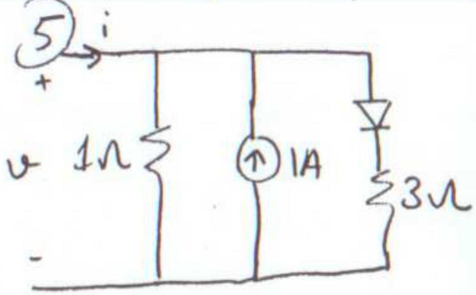


Find i-v characteristics of the following.

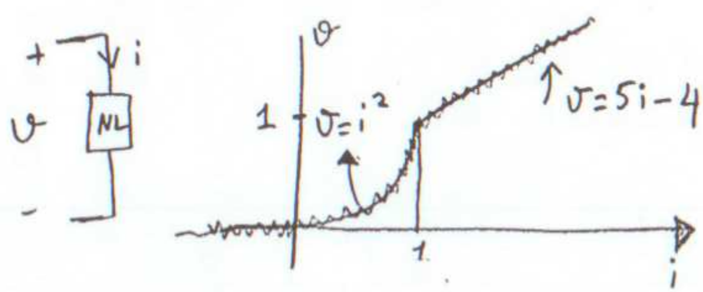
4)

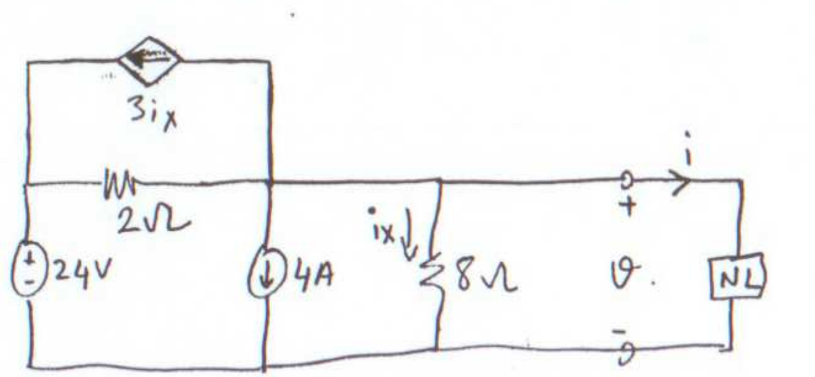


5)



6) The following Non-linear component has the i-v characteristic as follows.





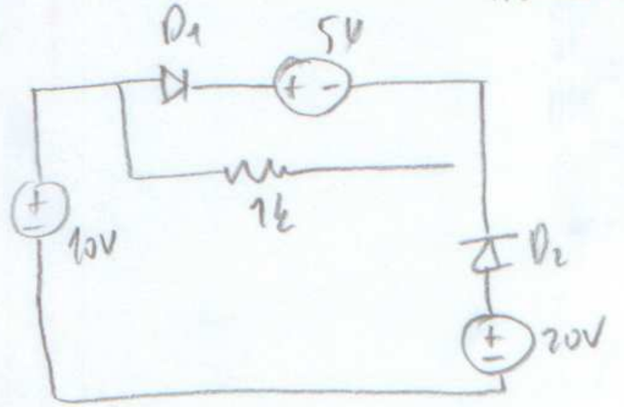
Find v.

Mustafa Sait Altan
1692842 - 01

EE-282

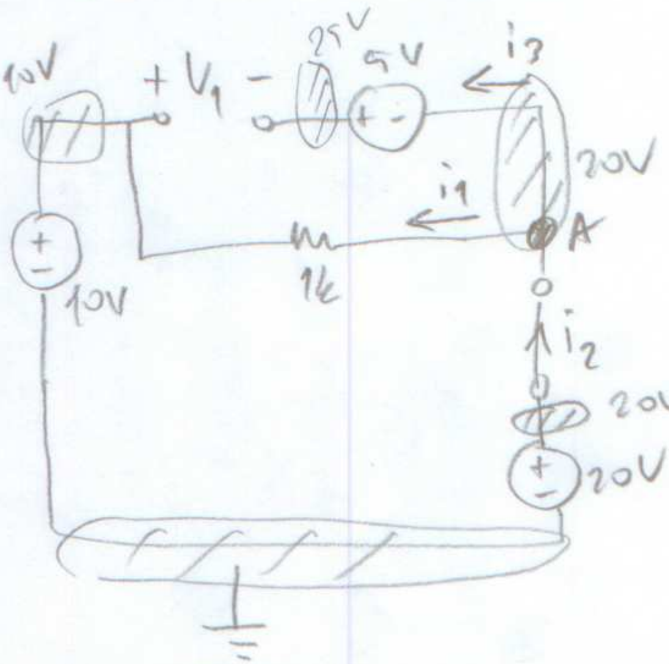
Homework #1

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

$$\boxed{i_1 + i_3 = i_2}$$

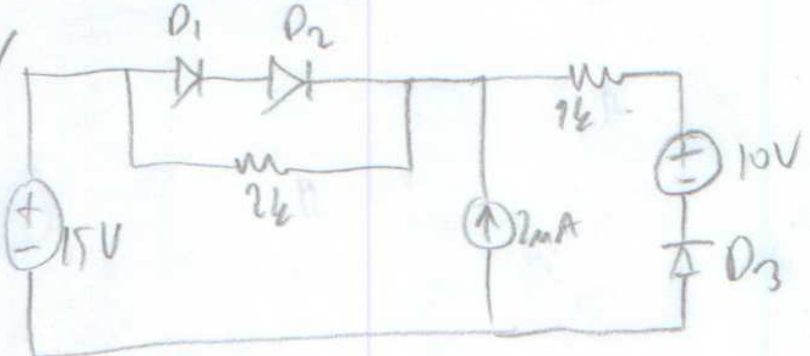
$i_3 = 0$, $i_1 = \dfrac{20-10}{1}$

$i_1 = 10\ mA$

$$\boxed{i_2 = 10\ mA > 0}$$ ✓

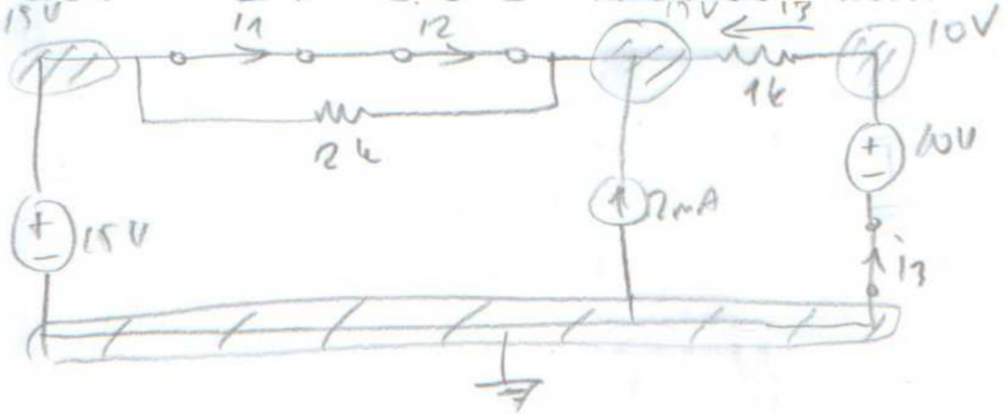
the assumption is correct

2-/



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

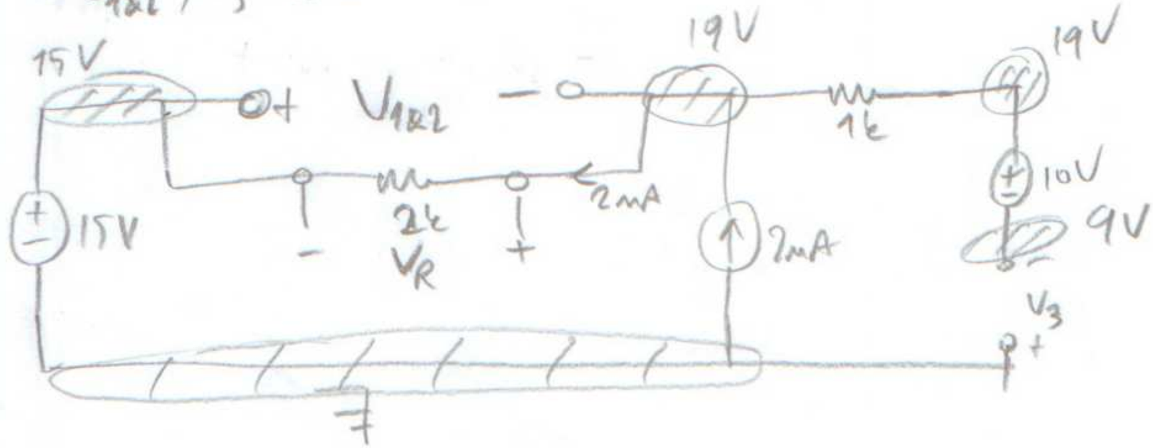
$i_1, i_2, i_3 > 0$ should satisfy according to our assumption



$i_3 = \frac{10-15}{1} = -5\ mA < 0$ ✗ 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

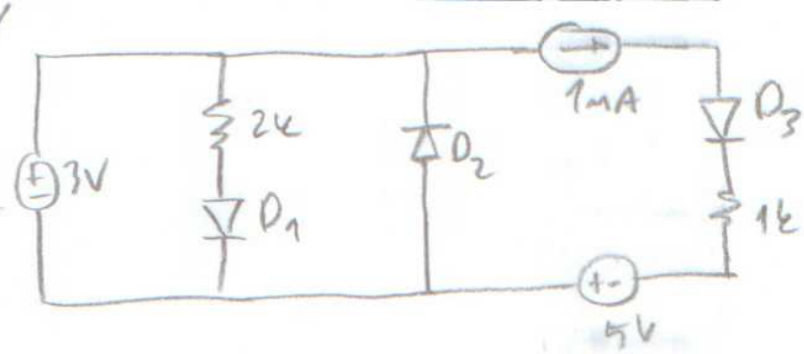
$V_3 = 0 - 9 = -9V < 0$ ✓
$V_{1\&2} = 15 - 19 = -4V < 0$ ✓
so our assumption is correct

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

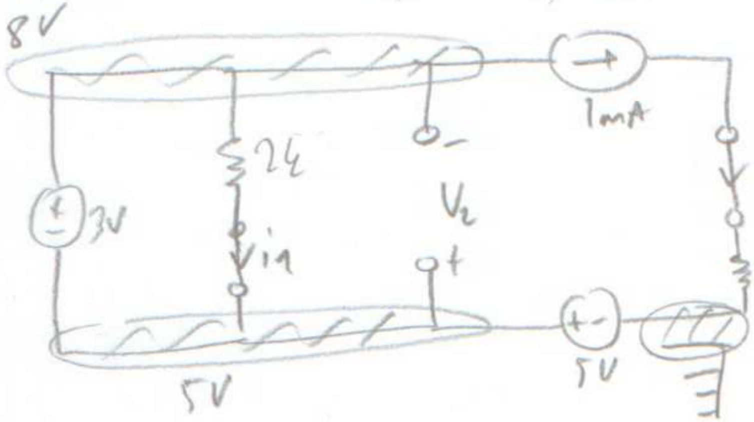
D_1 & D_2 : OFF

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

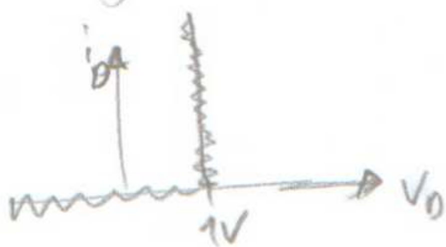
$i_1 = \frac{8-5}{2} = 1{,}5$ mA > 0 ✓

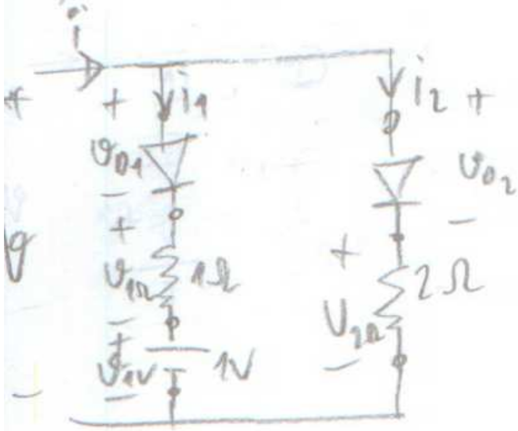
$V_2 = 5 - 8 = -3V < 0$ ✓

$i_3 = 1mA > 0$ ✓

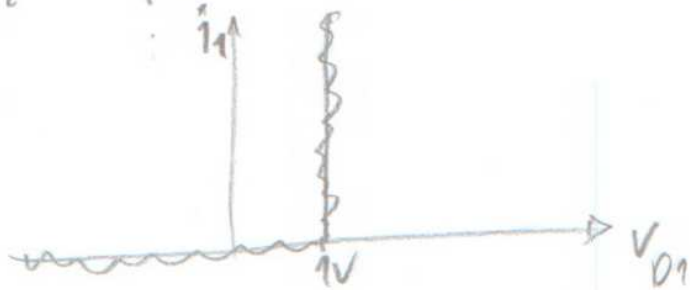
our assumption is correct

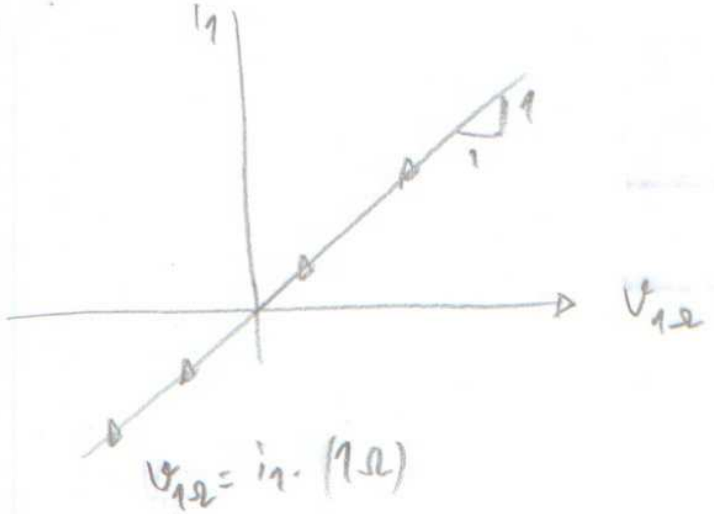
4-/ for each diode:

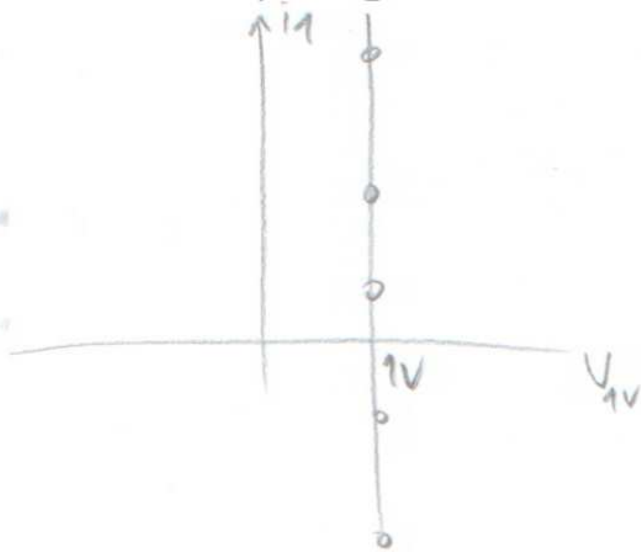




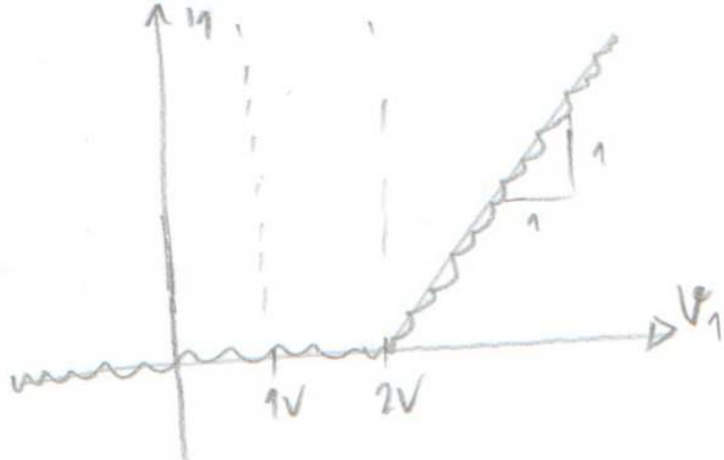
for branch ①:



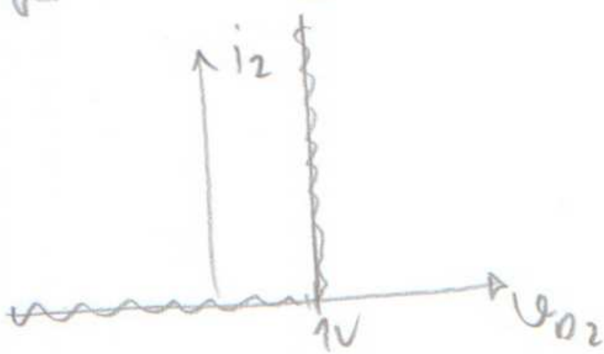


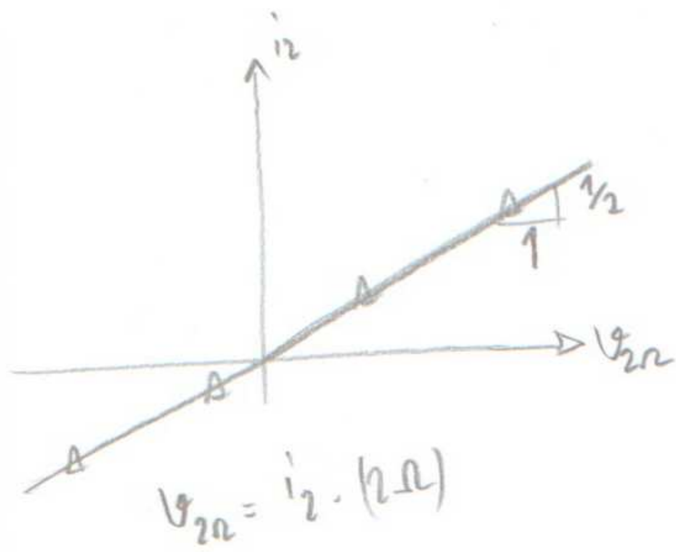


add v_{D1} , $v_{1\Omega}$, v_{1V} for all i_1 values   st



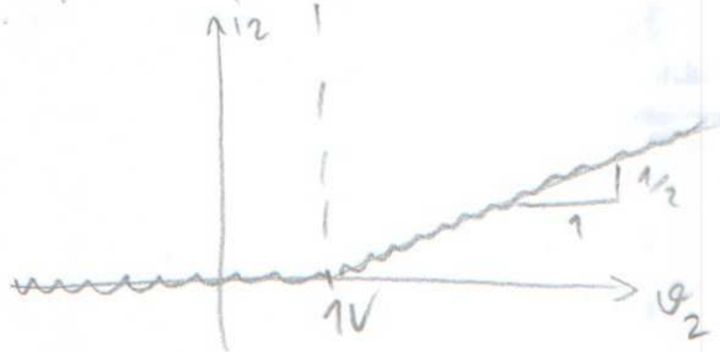
for branch (2) :





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

for all i_2 values

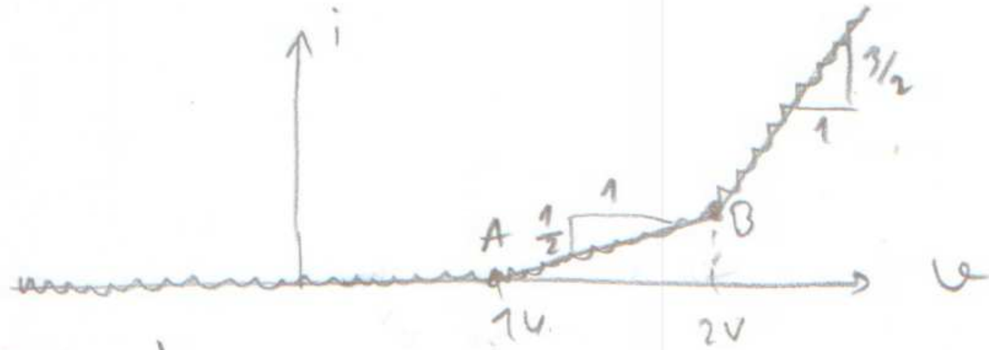


Now, we need to combine branch ① & ②.

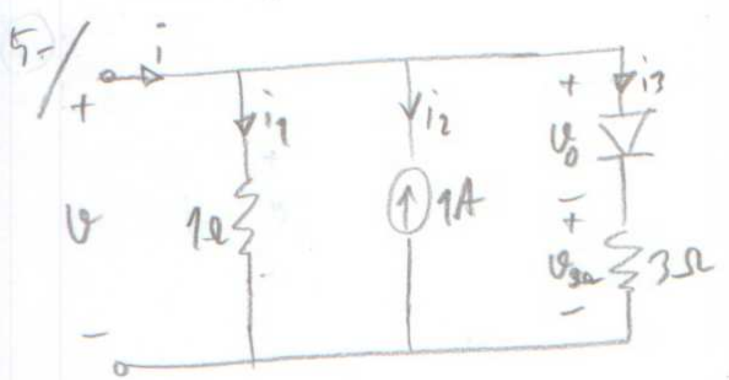
$$v = v_1 = v_2$$

$$i = i_1 + i_2$$

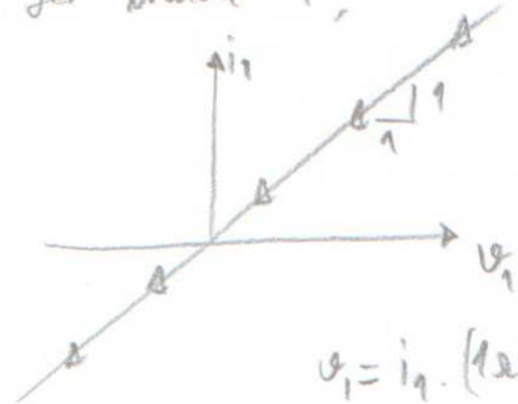
add i_1 & i_2 for each $v = v_1 = v_2$ value st;



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

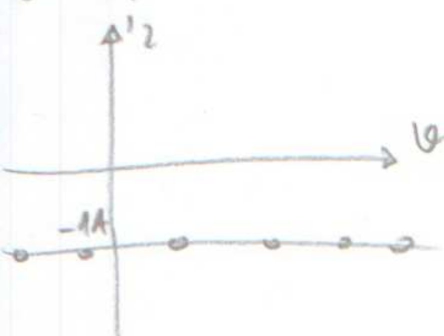


for branch 1;

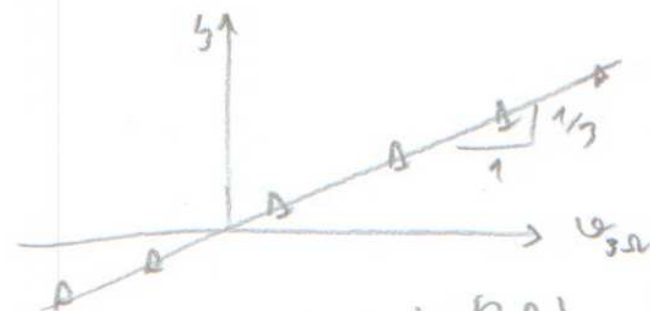


$v_1 = i_1 \cdot (1\Omega)$

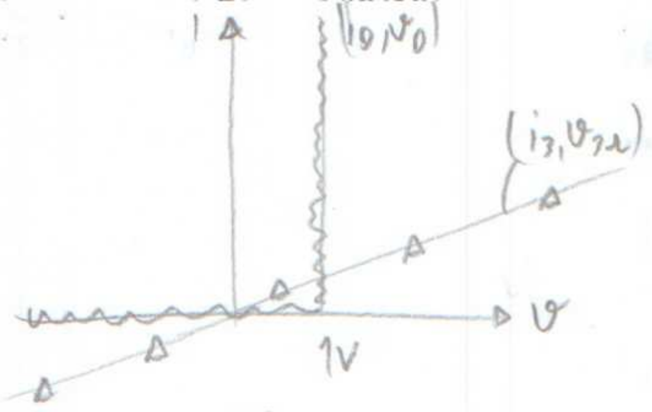
for branch 2;

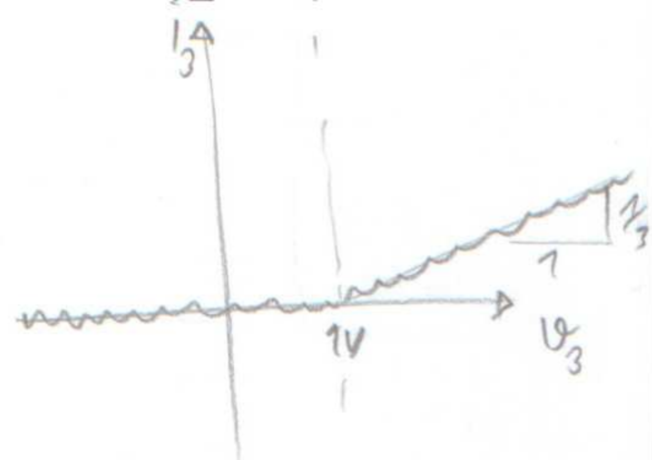


for branch 3;



$v_{3\Omega} = i_3 \cdot (3\Omega)$

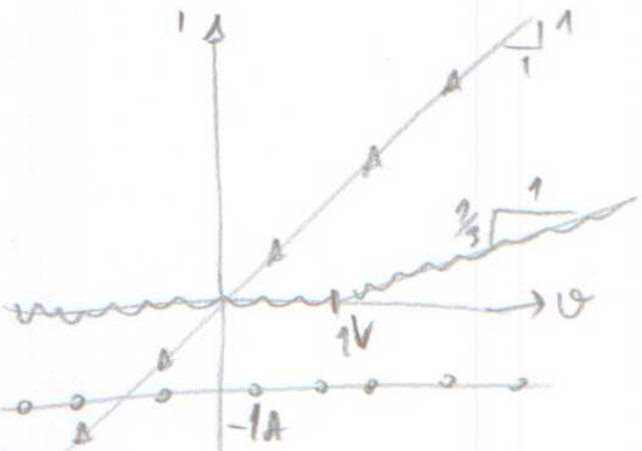


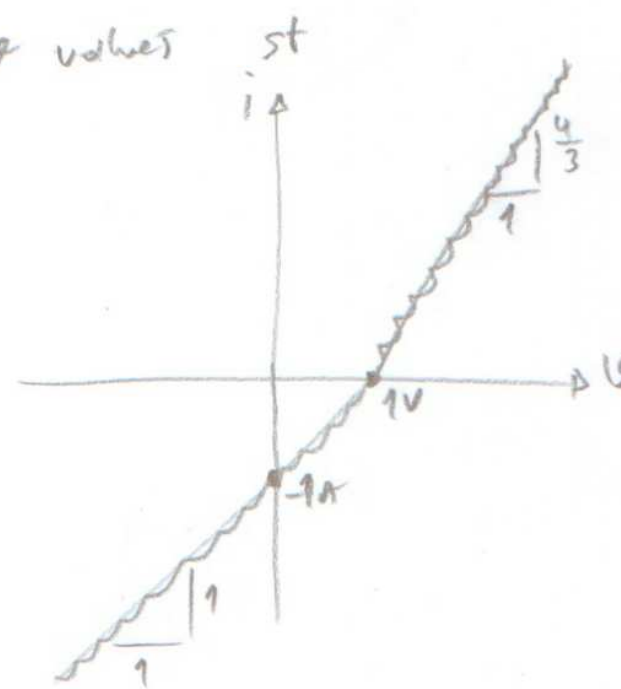


for each i value
add v_0 & $v_{1\Omega}$

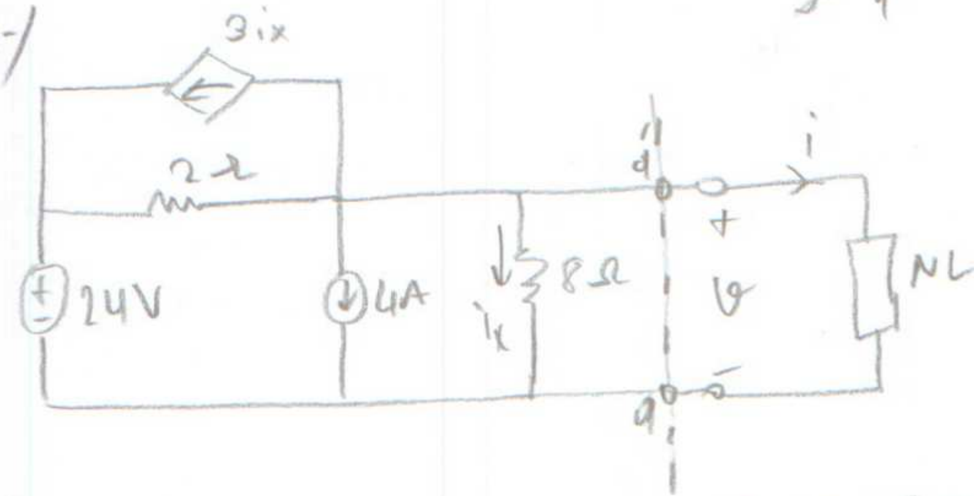
for each branches $v = v_1 = v_2 = v_3$; $i = i_1 + i_2 + i_3$

add i_1, i_2, i_3 for all v values st

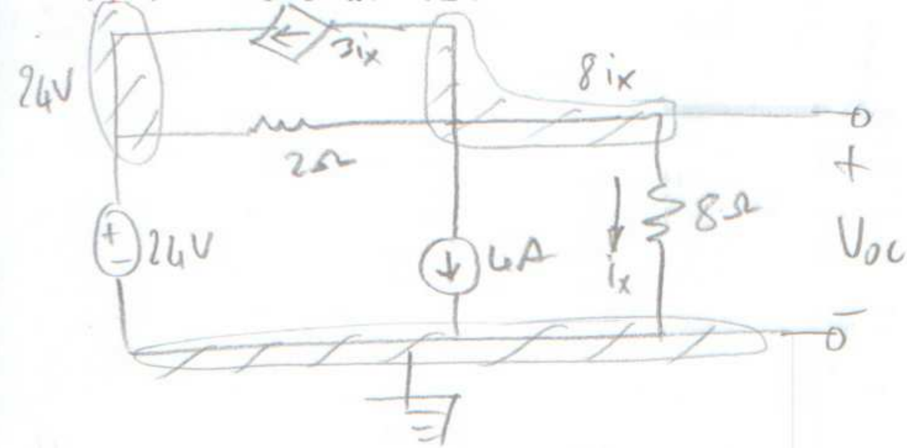




6-/



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



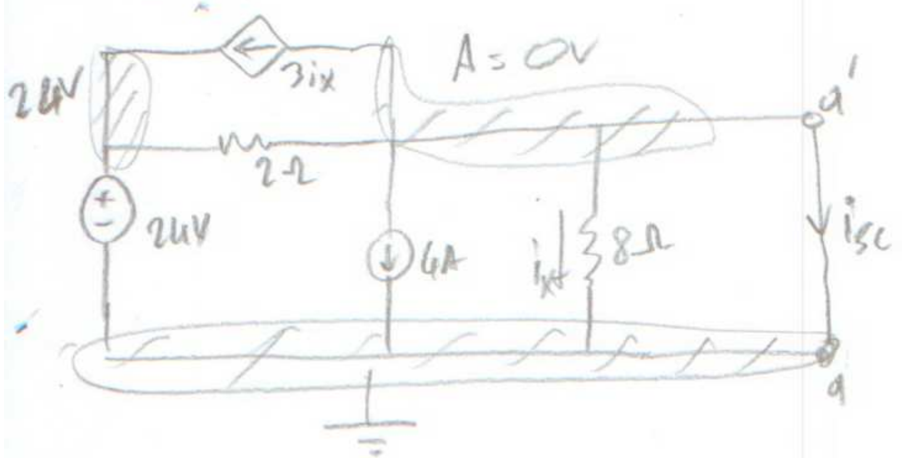
for Node $8i_x$, apply for KCL;

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

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

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

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

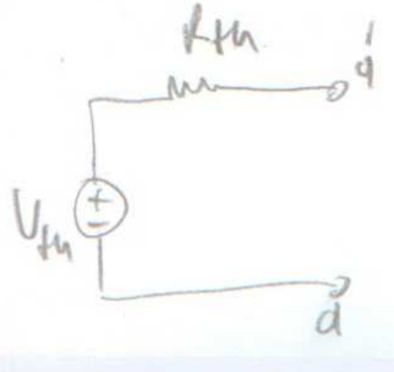


KCL for A = 0V node.

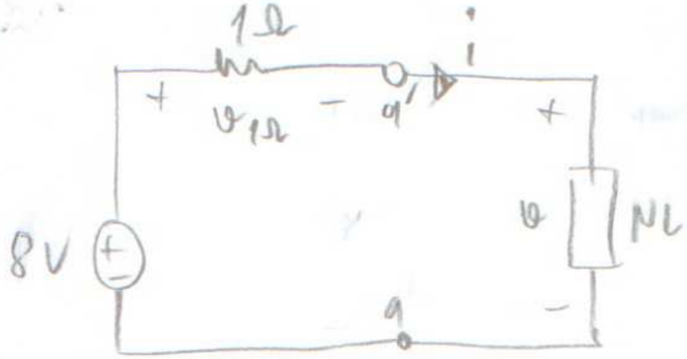
$$3i_x + \frac{0 - 24}{2} + 4 + i_x + i_{sc} = 0 \quad ; \quad i_{sc} = 12 - 4 = 8A$$

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

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

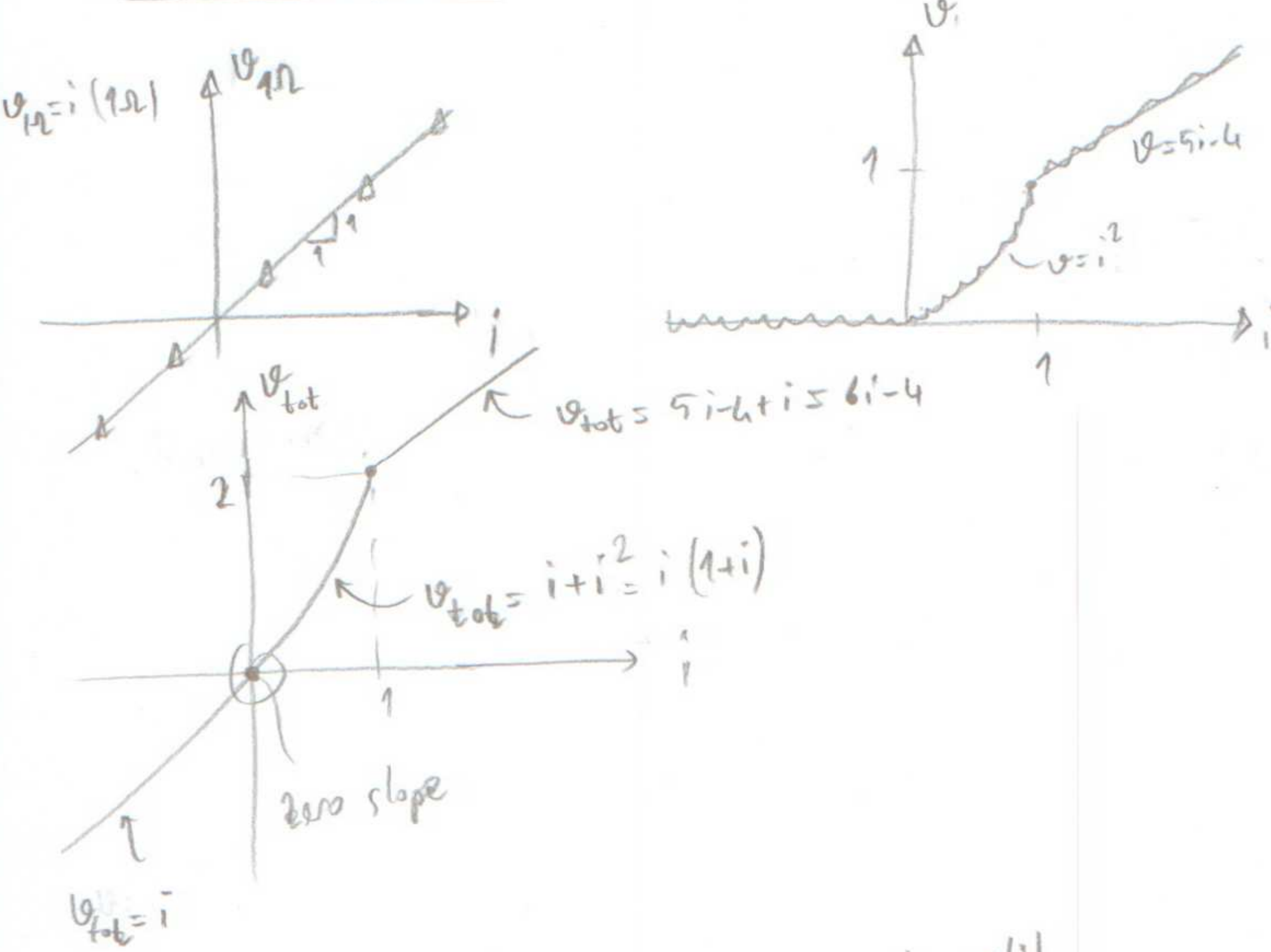


/7



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

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



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

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

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

/8