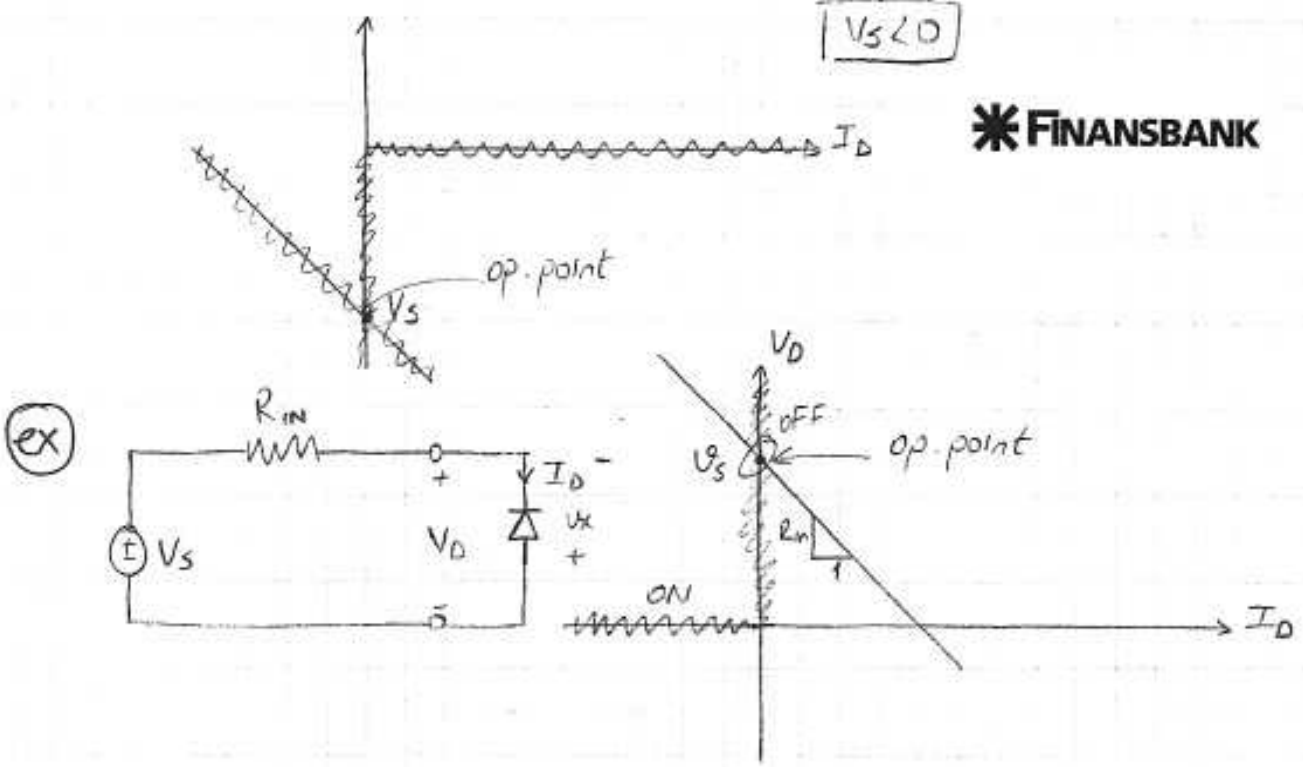
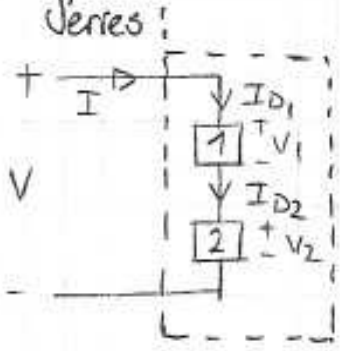


Series & Parallel Combinations Of Circuit Components



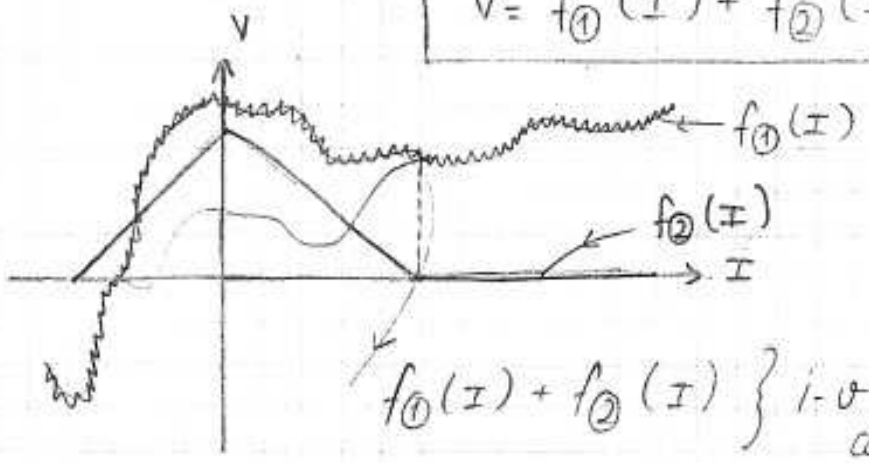
$I_1 = I_2 = I$ } Due to Series connection

$V = V_1 + V_2$

$\downarrow$

$V = f_{①}(I_1) + f_{②}(I_2)$

$\boxed{V = f_{①}(I) + f_{②}(I)}$



$f_{①}(I) + f_{②}(I)$ } i-v characteristic of combined component

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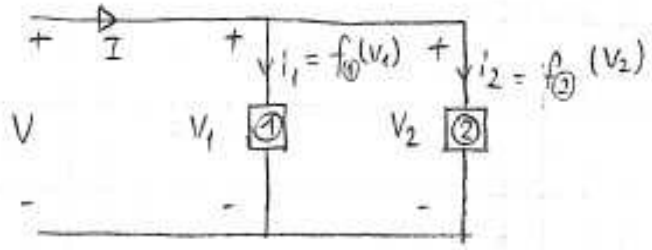
Parallel:

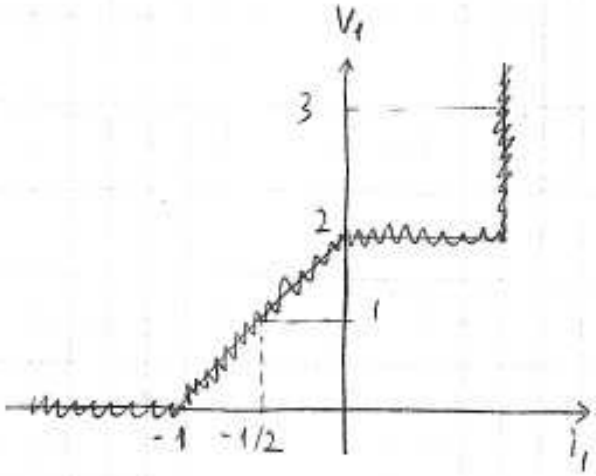


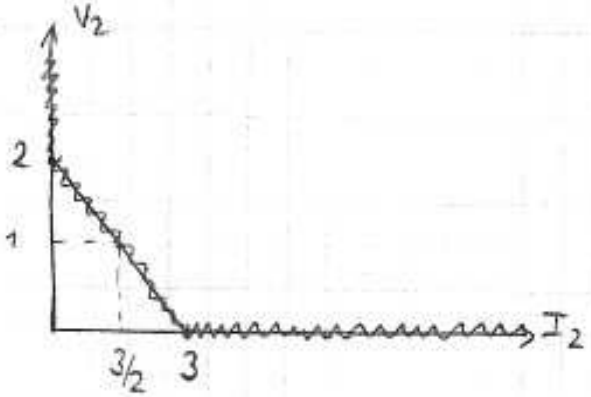
$V_1 = V_2 = V$

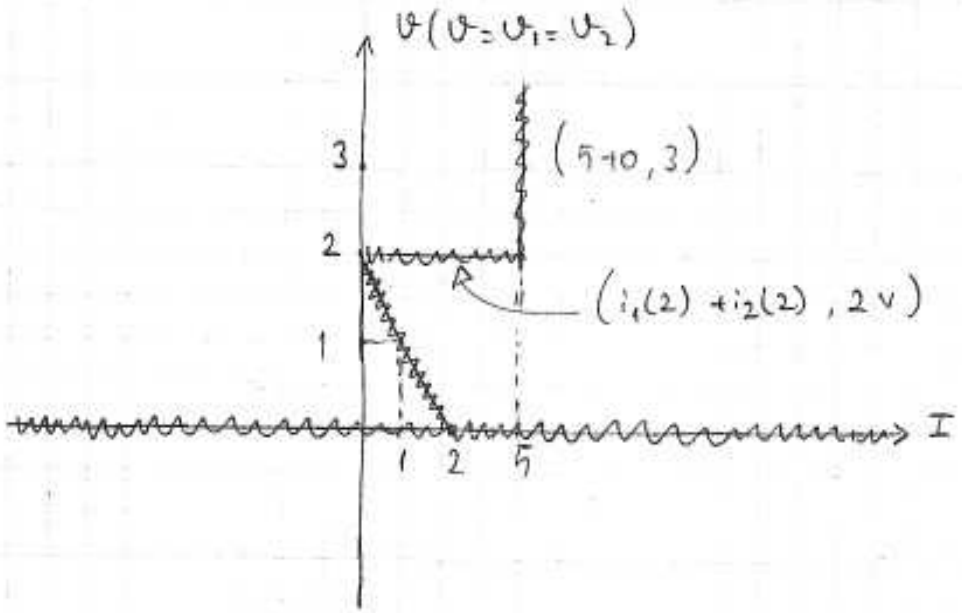
$I = i_1 + i_2$

$= f_①(V_1) + f_②(V_2)$

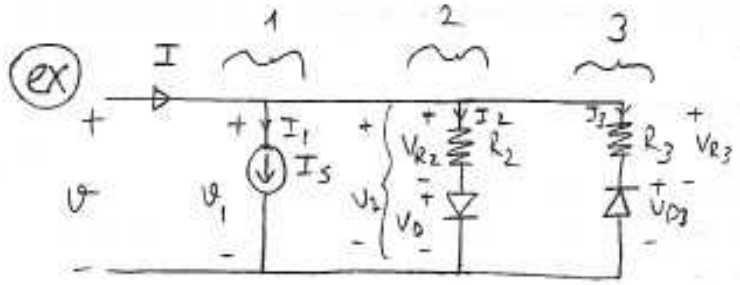
$$\boxed{I = f_①(V) + f_②(V)}$$



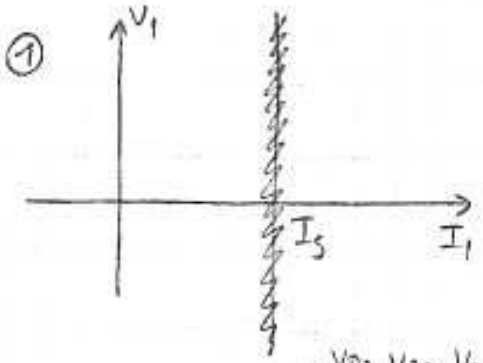


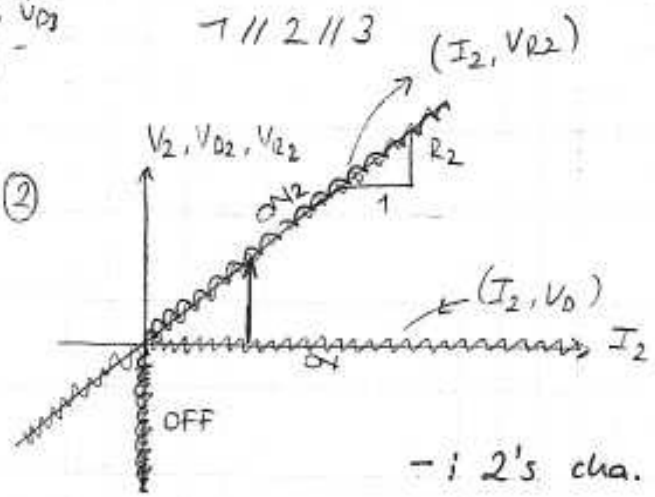


(ex)

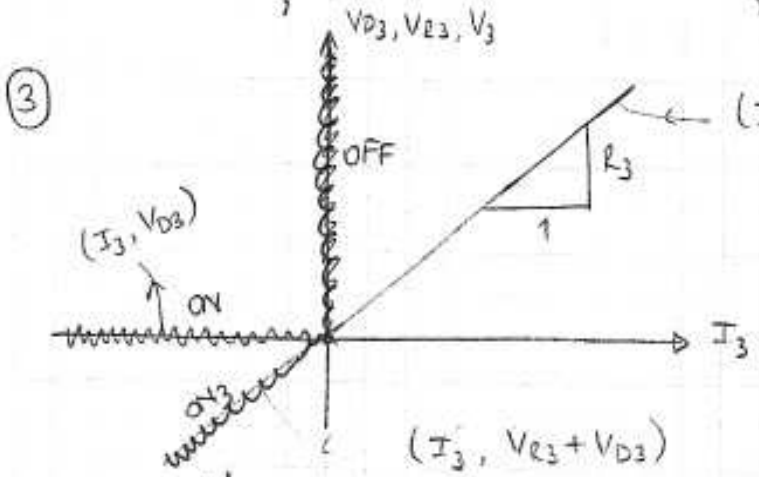


1 // 2 // 3

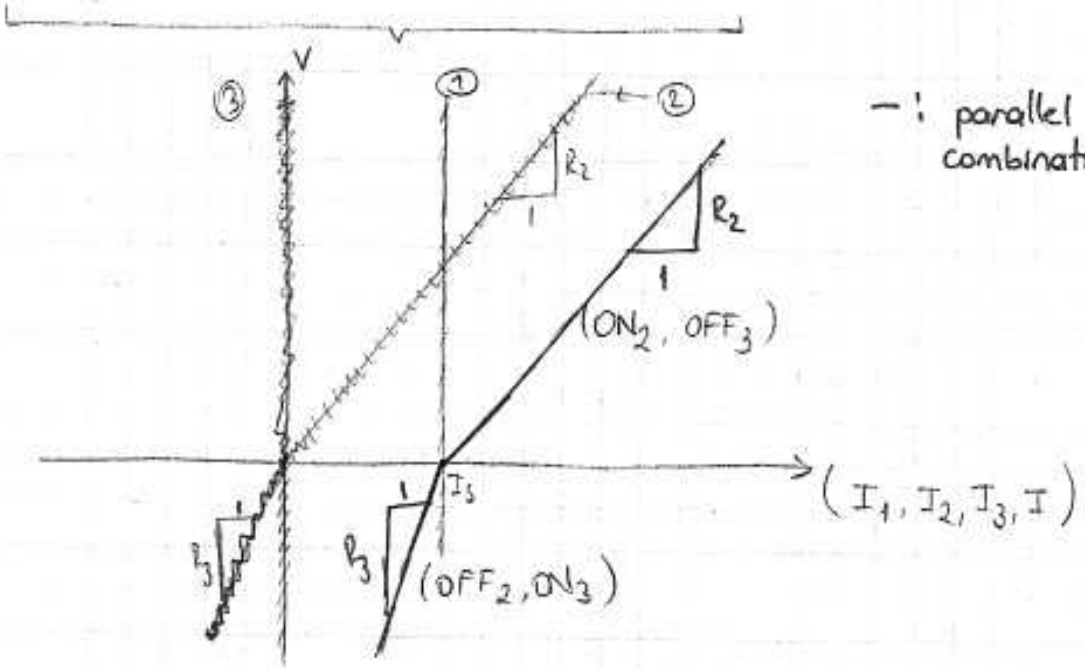




-: 2's cha.



-: 3'rds cha.



-: parallel combination

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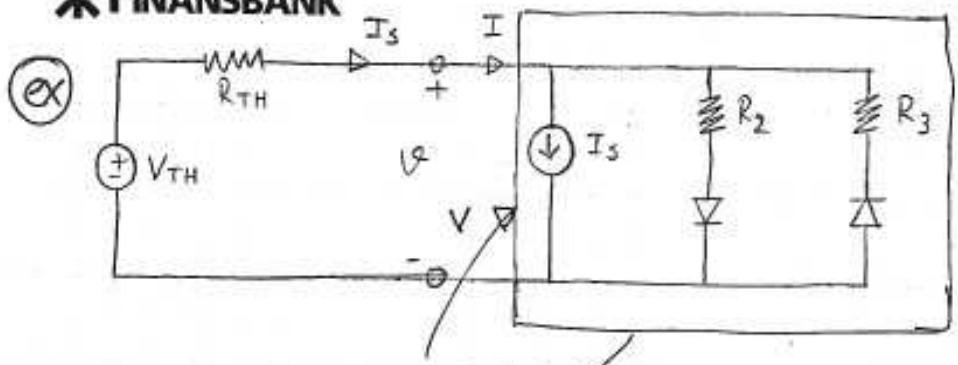
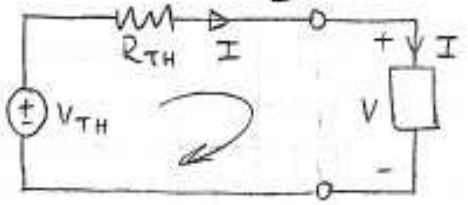
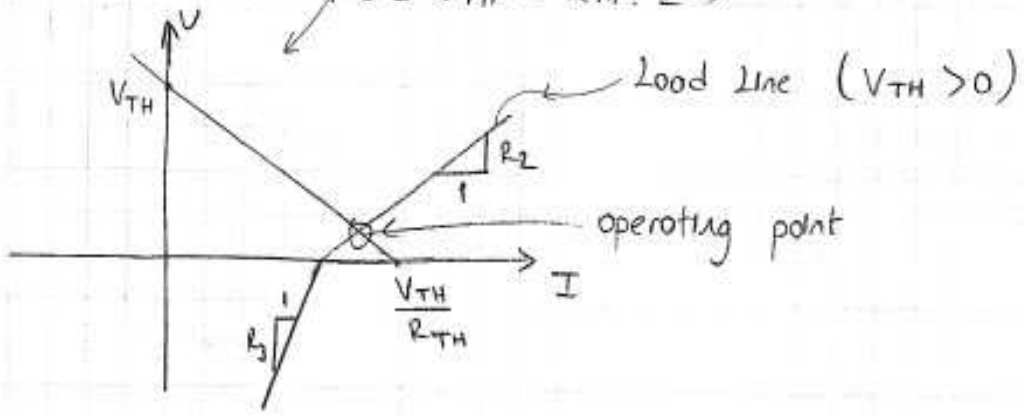
(a)



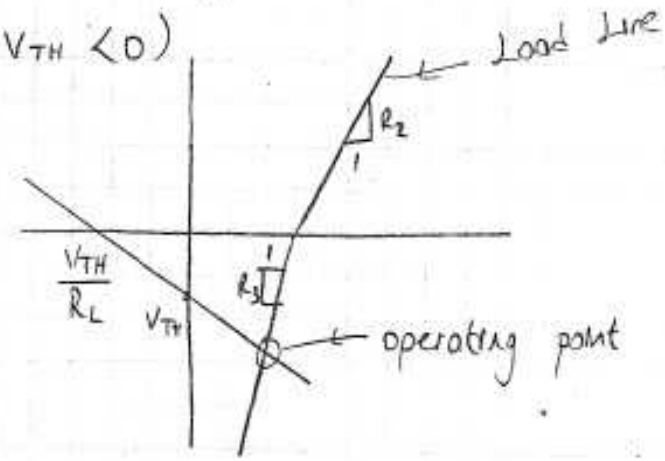


$$-V_{TH} + R_{TH}.I + V = 0$$

$$(\vartheta = V_{TH} - R_{TH}.I)$$

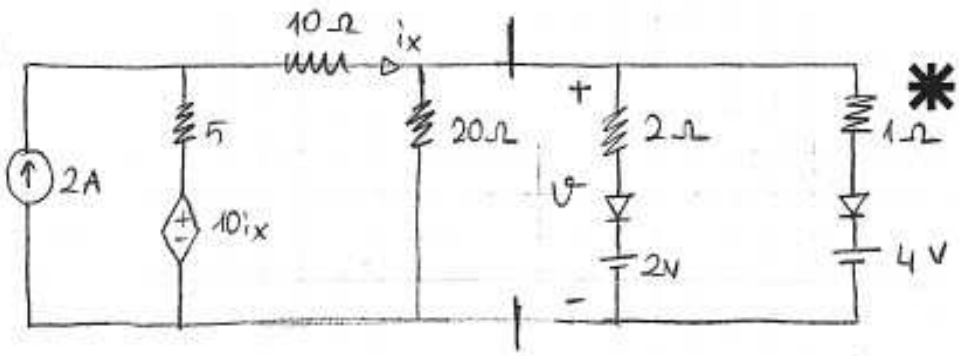


($V_{TH} < 0$)



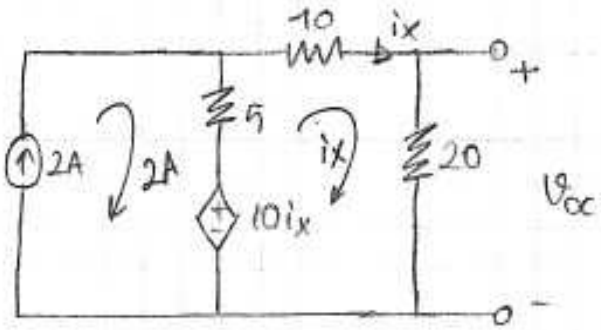
3/03/2010

(ex)



Find v. → State Guessing
→ Graphical Method

Let's find Thev. eq of left hand side of "v" branch.



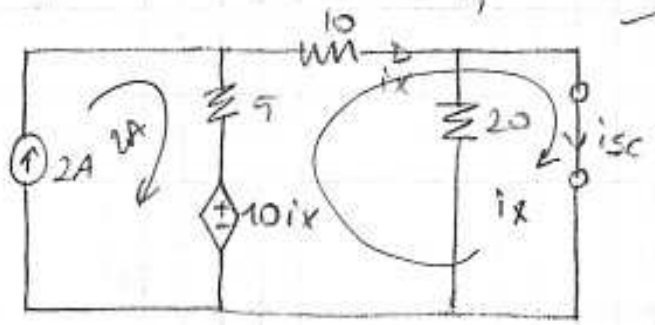
OC voltage

$$-10i_x + 5(i_x - 2) + 10i_x + 20i_x = 0$$

$$25 i_x = 10 \qquad i_x = \frac{2}{5} = 0.4\ A$$

$$v_{oc} = 20 i_x = 20 \cdot \frac{2}{5} = 8\ V$$

SC CURRENT



$$R_{TH} = \frac{V_T}{I_{sc}} = 4\Omega$$

$$-10i_x + 5(i_x - 2) + 10i_x = 0$$

$$i_x = 2\ A \qquad i_x = i_{sc} = 2A.$$

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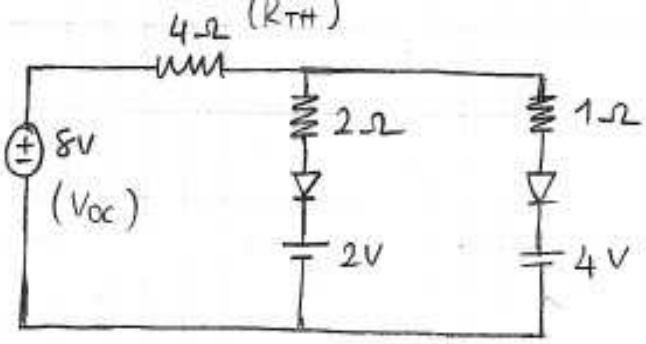
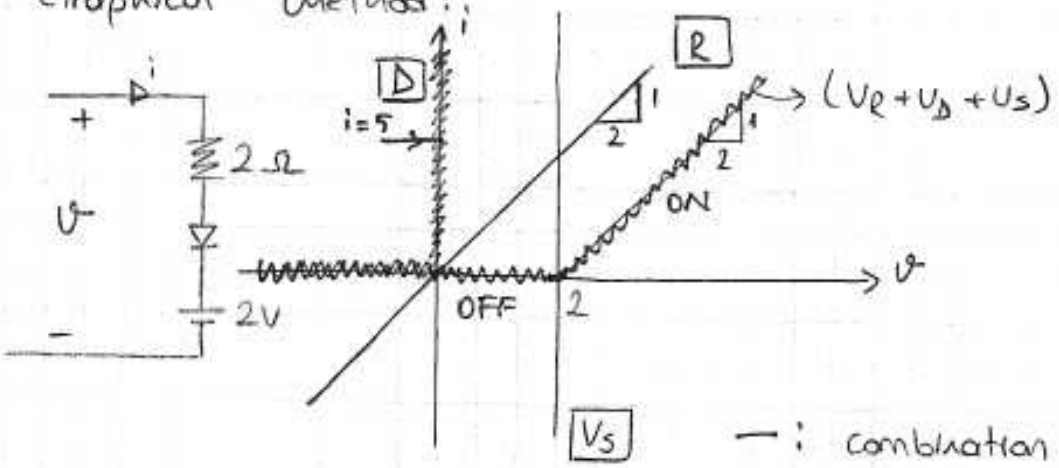
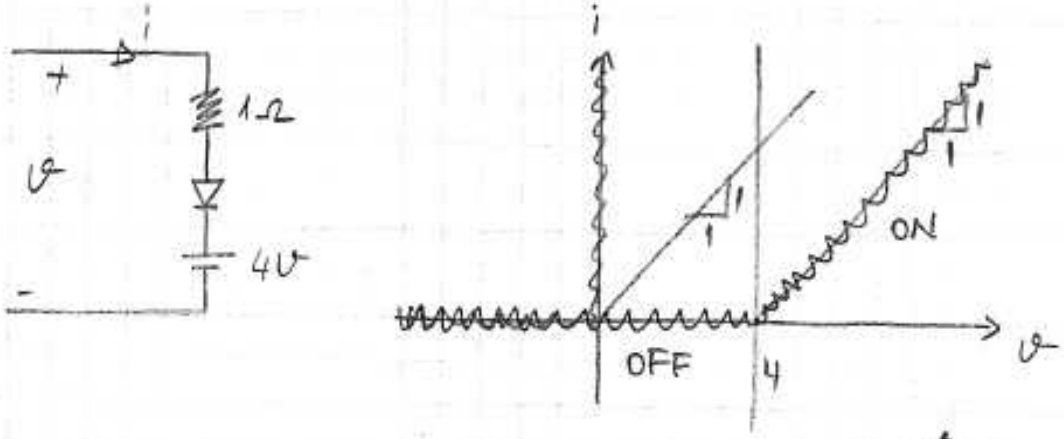


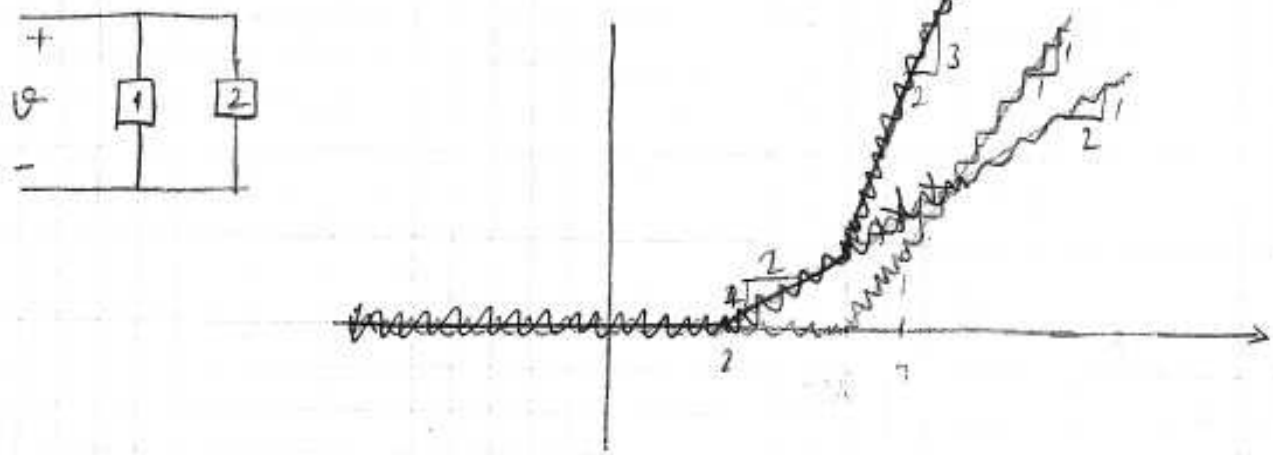
Graphical Method:



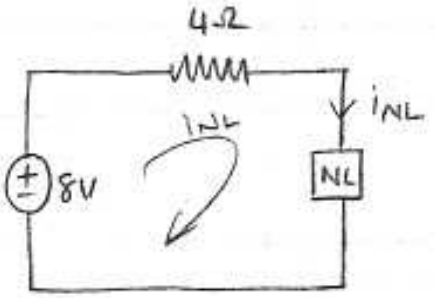
—: combination of three components

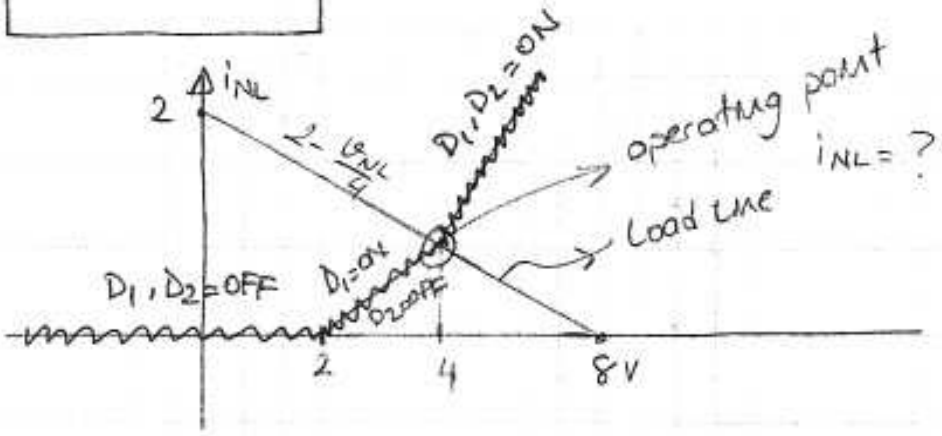
↙ Diode does not allow a negative current.





—: combination 1-2 ↙



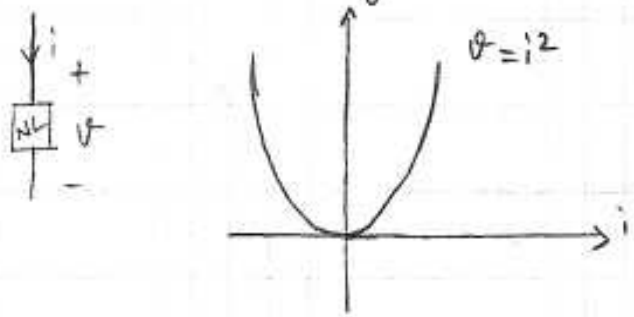


$$-8 + 4 \cdot i_{NL} + v_{NL} = 0$$

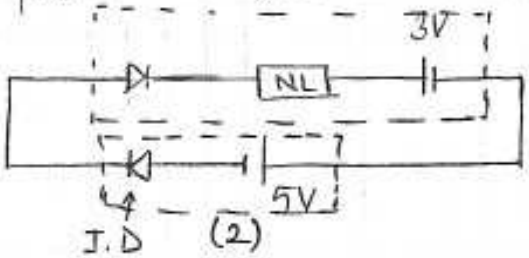
$$i_{NL} = 2 - \frac{v_{NL}}{4}$$ ← KVL constraint

5.03.2010

(ex)



Then find (1)



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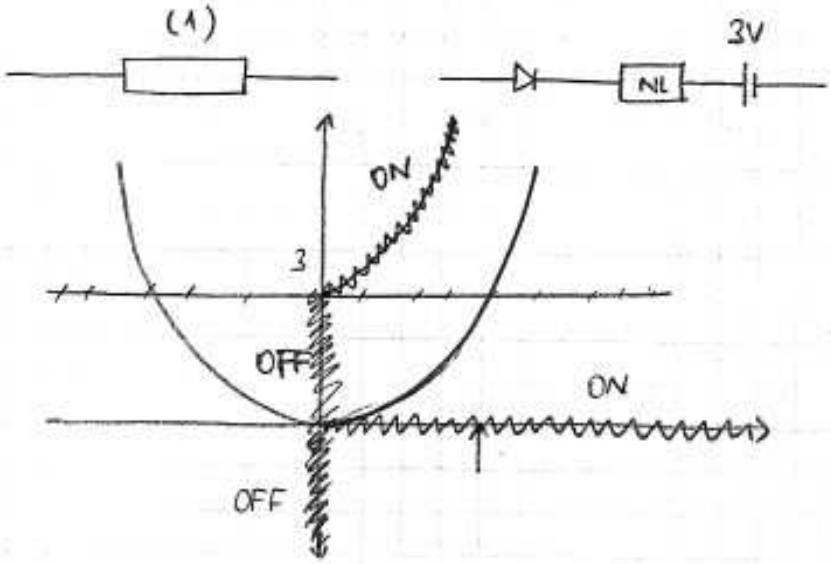
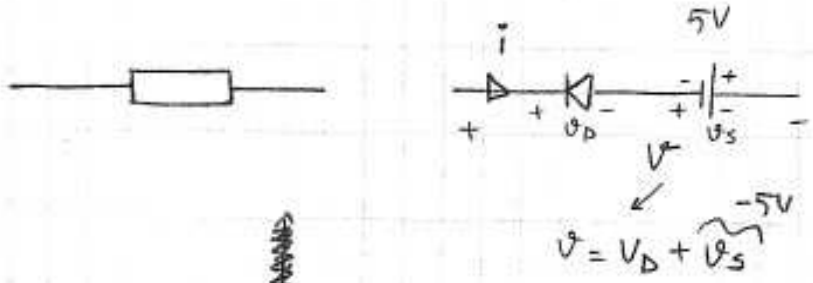
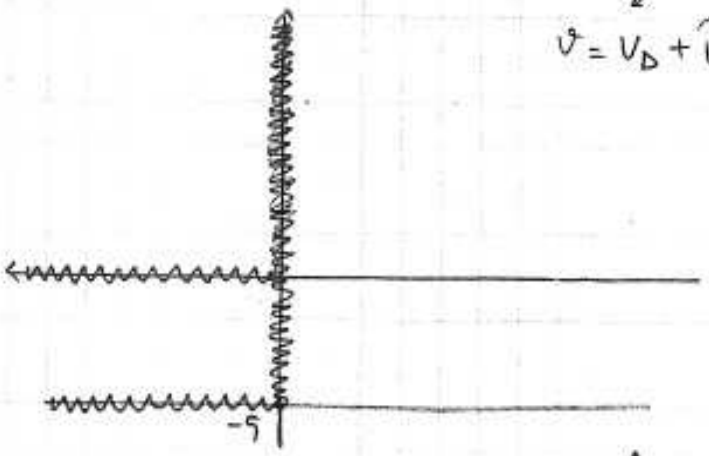
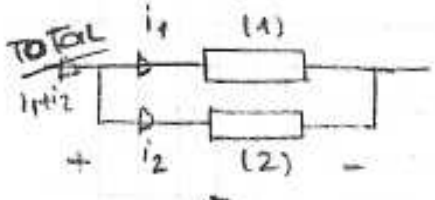
(1)

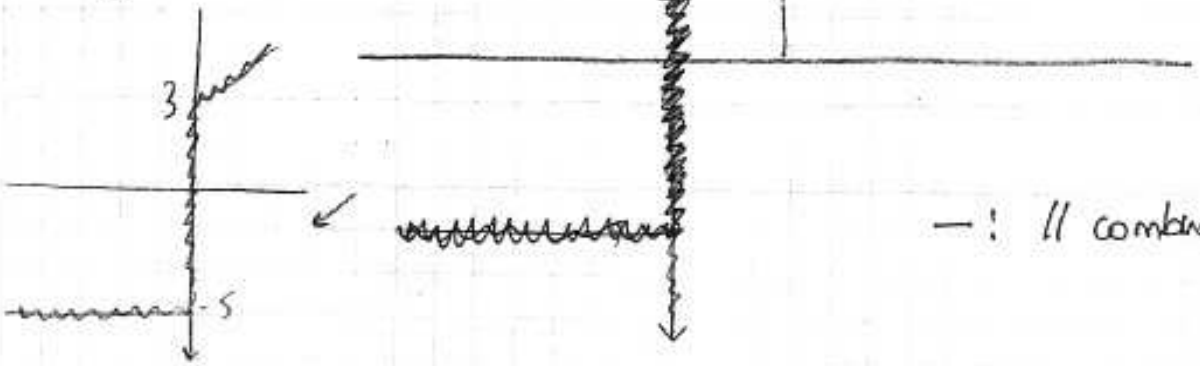


(2)





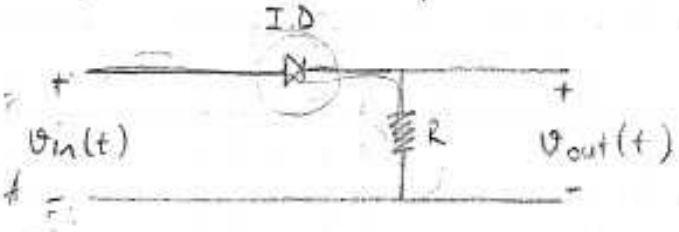




—: // combination

Diode Applications:

① Half-Wave Rectifier:

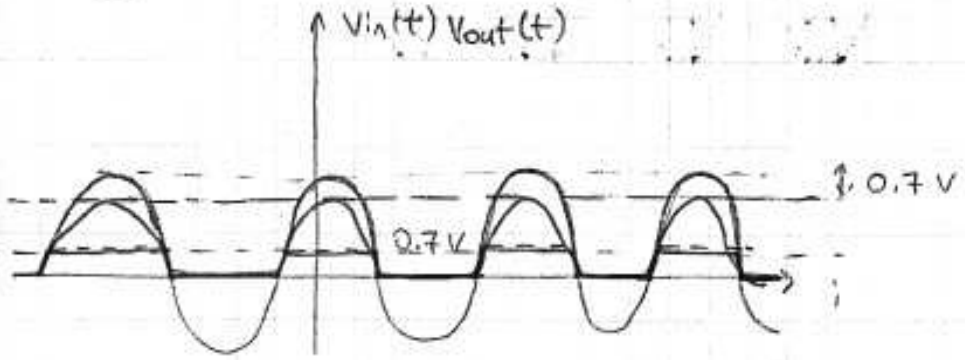


$$V_{out}(t) = \begin{cases} V_{in}(t) & V_{in}(t) > 0 \\ 0 & V_{in}(t) < 0 \end{cases}$$

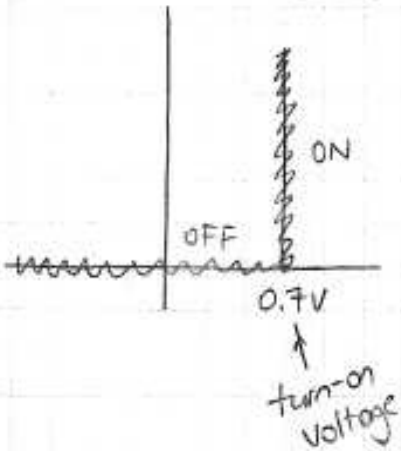
Check: $V_{in}(t) = A$

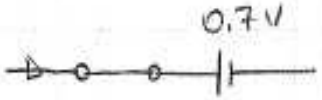
① $A > 0$, Diode ON, $V_{out}(t) = V_{in}(t)$

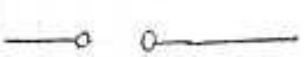
② $A < 0$, Diode OFF, $V_{out}(t) = 0$

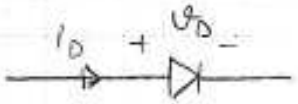


Not Ideal



ON →  , $i_D > 0$

OFF →  , $V_D < 0$



— : this model

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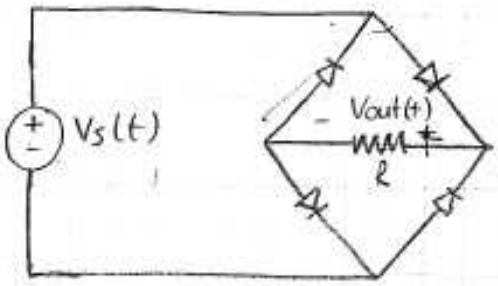
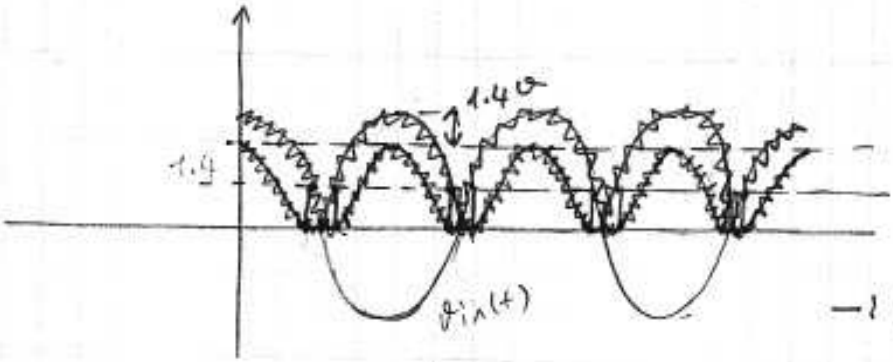
② Full - Wave Rectifier



Diodes are ideal

$V_{out}(t) = |V_{in}(t)|$



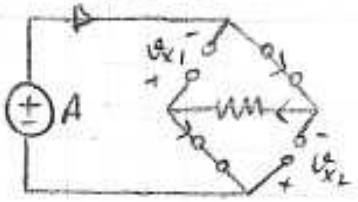
—: $v_{out}(t)$

—: not-ideal model $V_{out}(t)$

Check:

$V_S(t) = A$

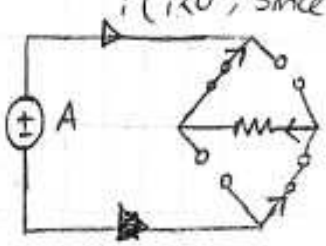
① $A > 0$



$V_{x1} = V_{x2} = -A$ OFF ✓

$v_{out}(t) = A$.

② $A < 0$



$v_{out} = i'R$

$= -A$