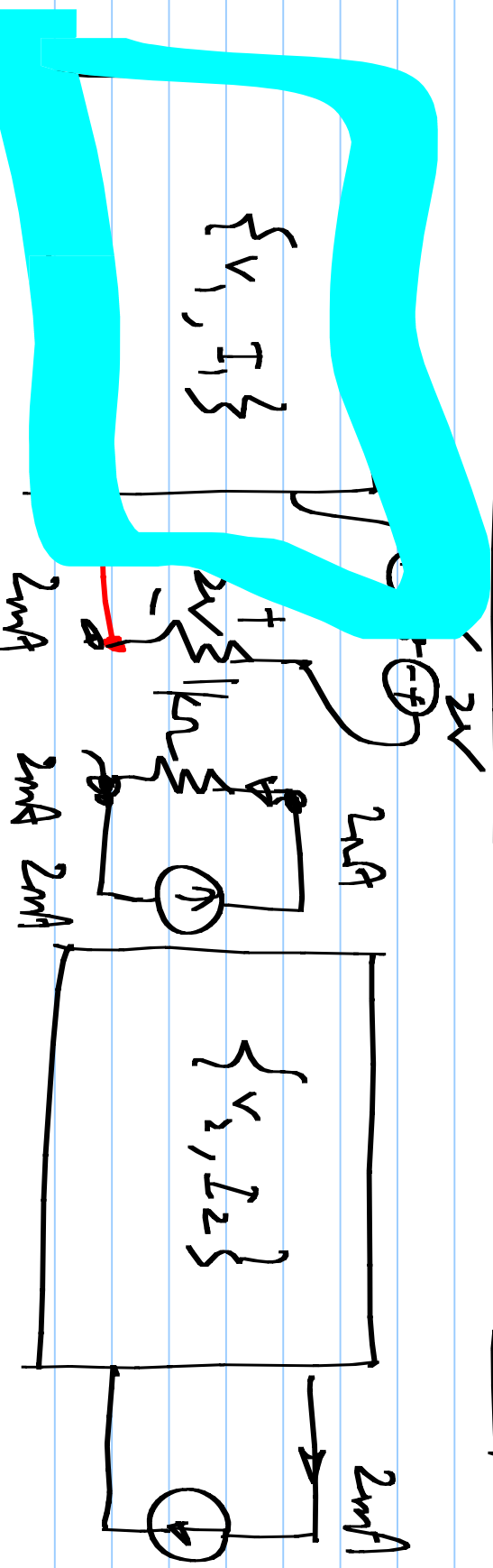


ECE 2015

Circuit theorems

22/8/2017



Substitution theorem: A two-terminal element with voltage  $V_o$  across it

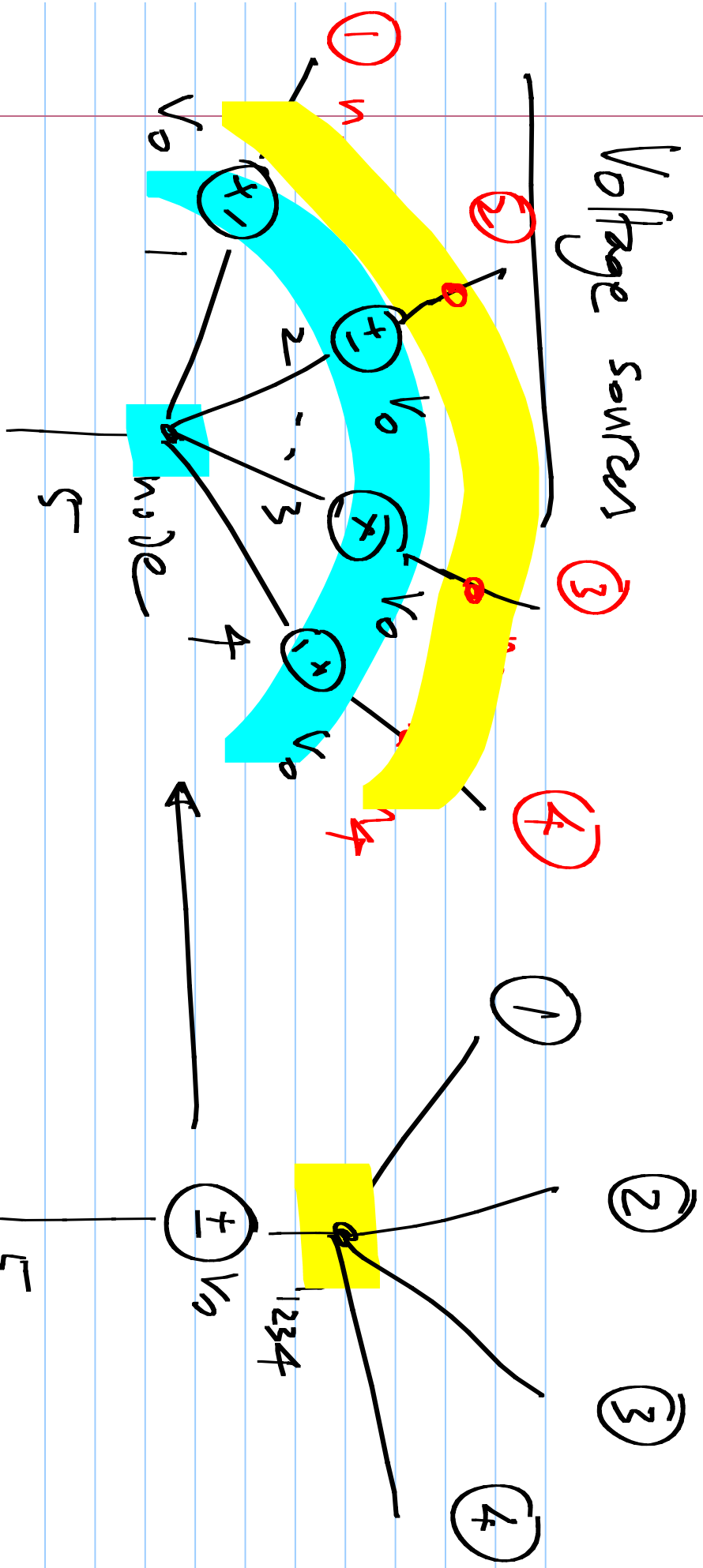
with a current  $I_o$  or a voltage source  $V_o$  can be replaced by a current source  $I_o$  or a voltage source  $V_o$  without changing  $\{V, I\}$

\* Zero current branch can be open circuited

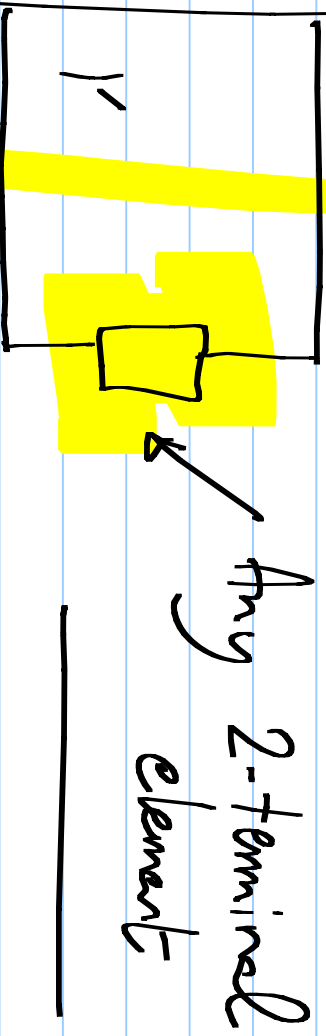
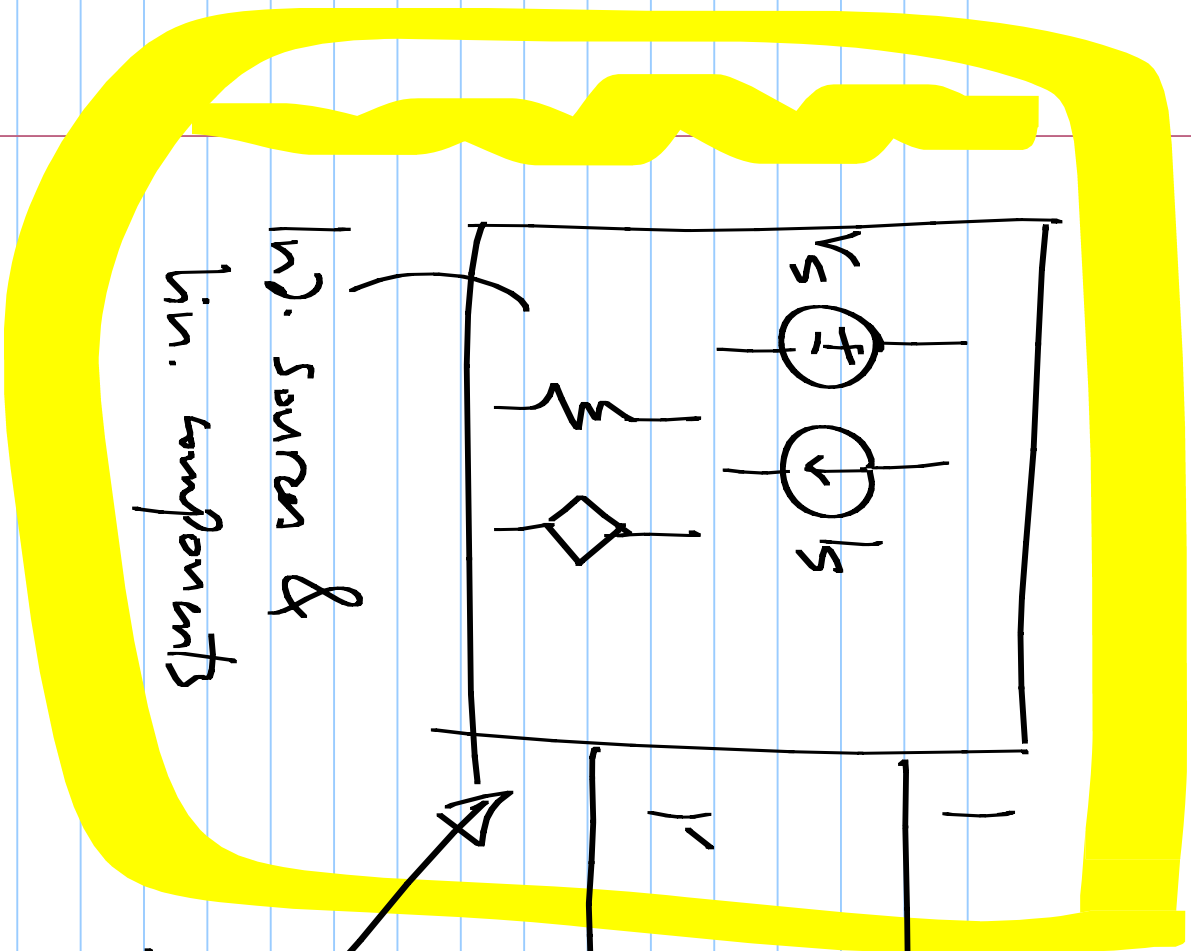
\* Nodes with zero voltage difference can be shorted.



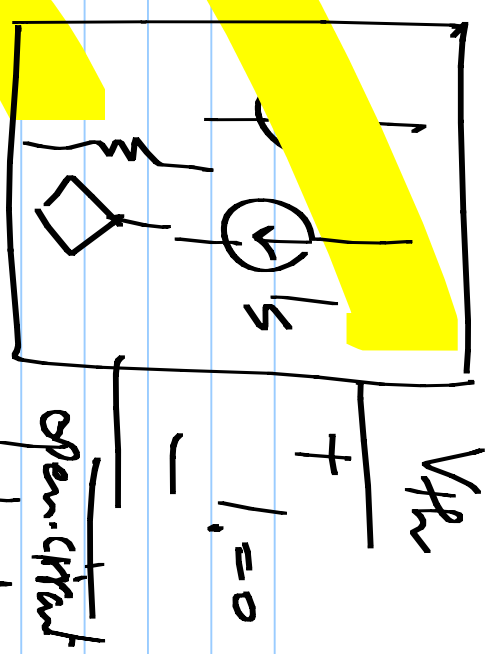
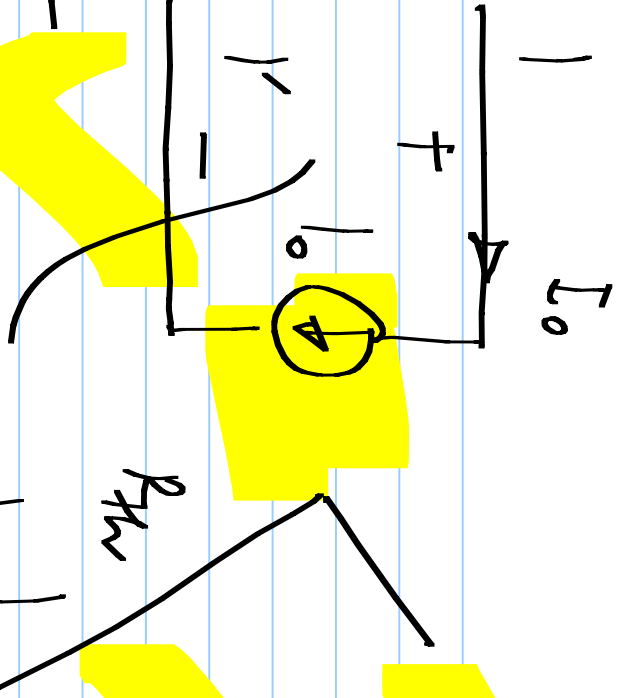
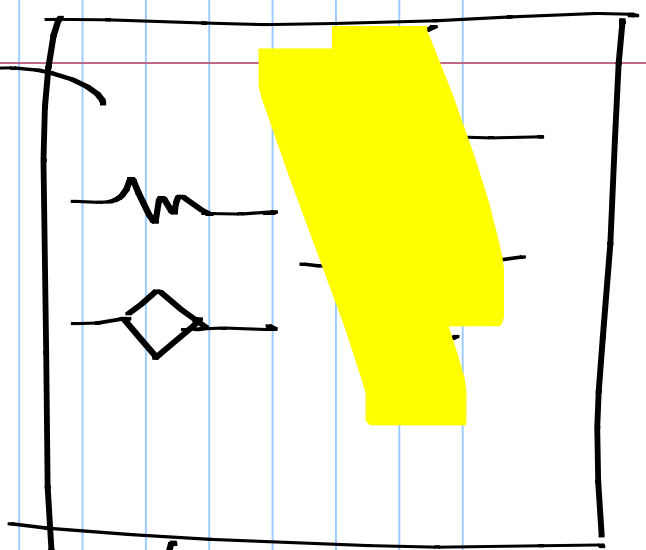
Voltage sources



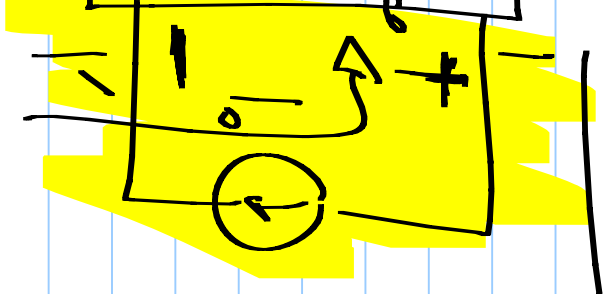
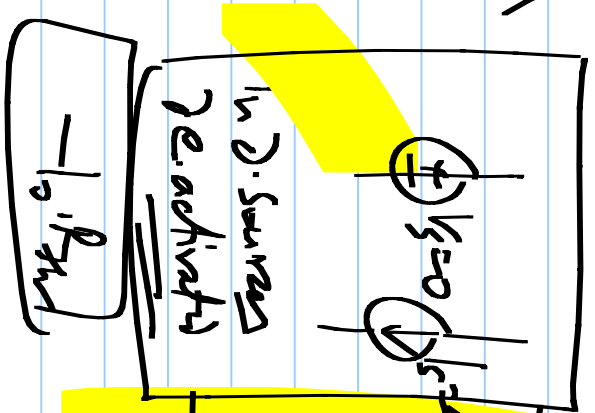
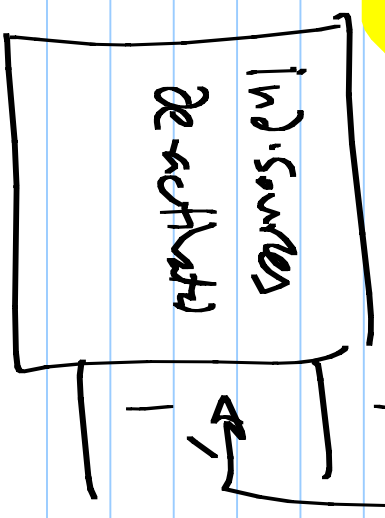
A voltage source in a branch can be "pushed" into all other branches connected to the same node.

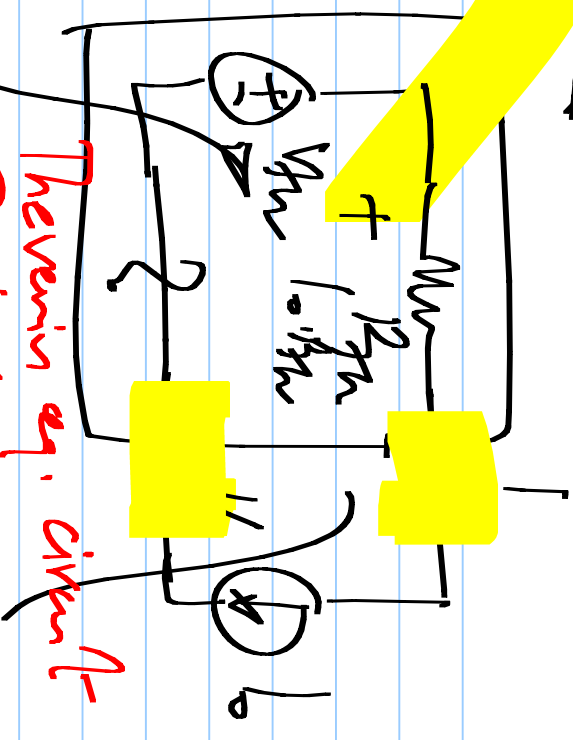
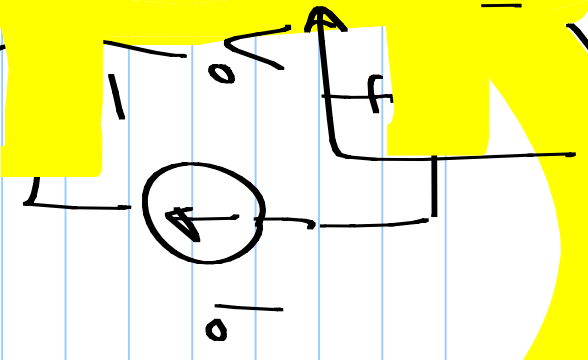
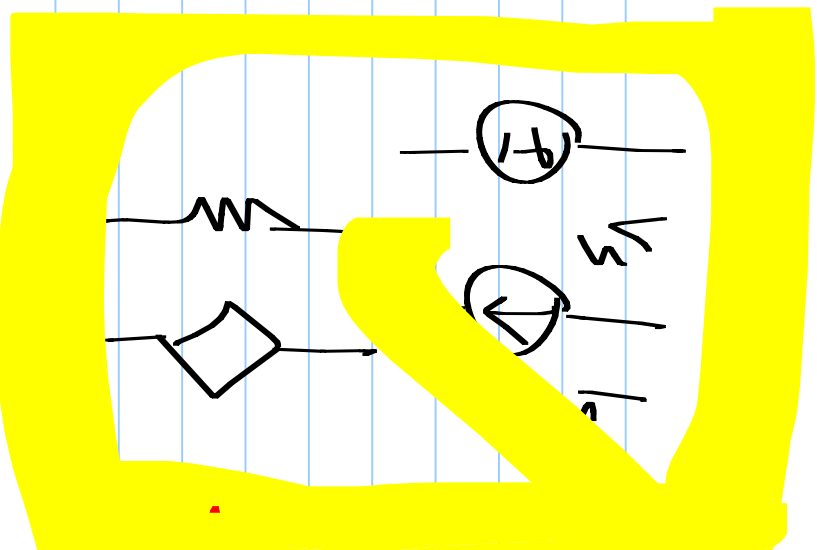


Suppler  
pg.



Ind. sources &  
lin. components  
 $V_o = V_{th} - I_o R_{th}$





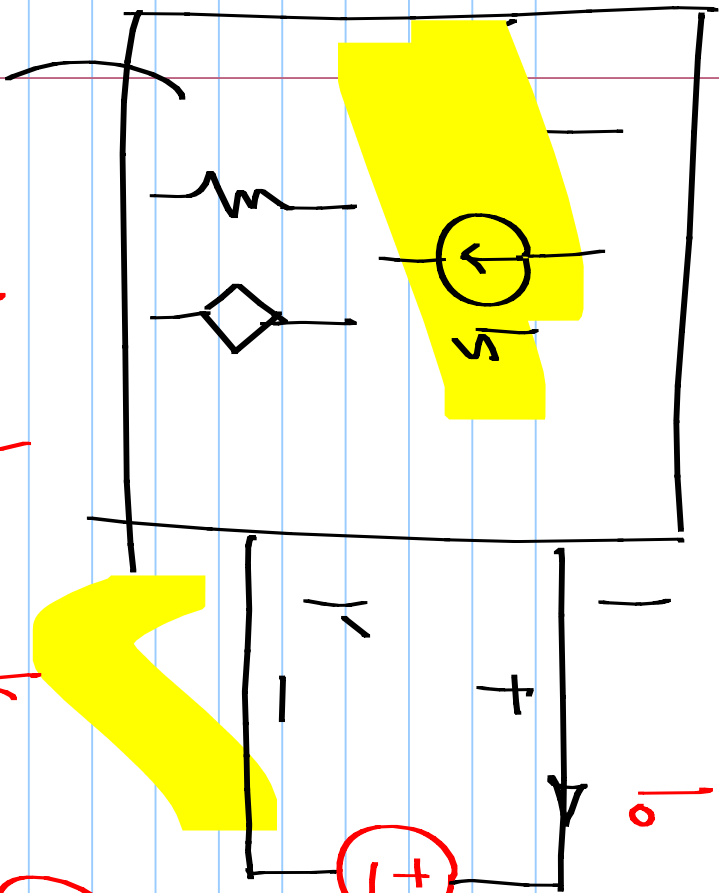
→ Thevenin's theorem

Thevenin eq. circuit -  
 @ 1-1'  
 $V_{th} = I_o R_{th}$

Thevenin open circuit voltage

Resistance with Ind. sources de-activated

Thevenin resistance



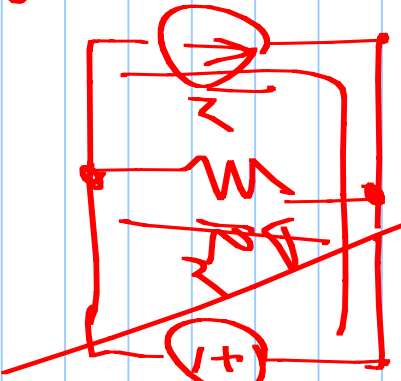
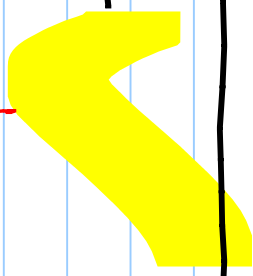
Short circuit -  
(Norton)

Current -

$$I_o = I_N$$

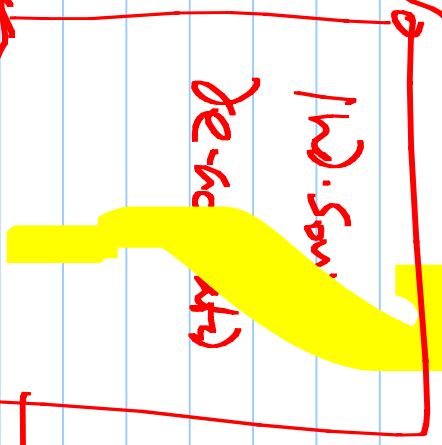
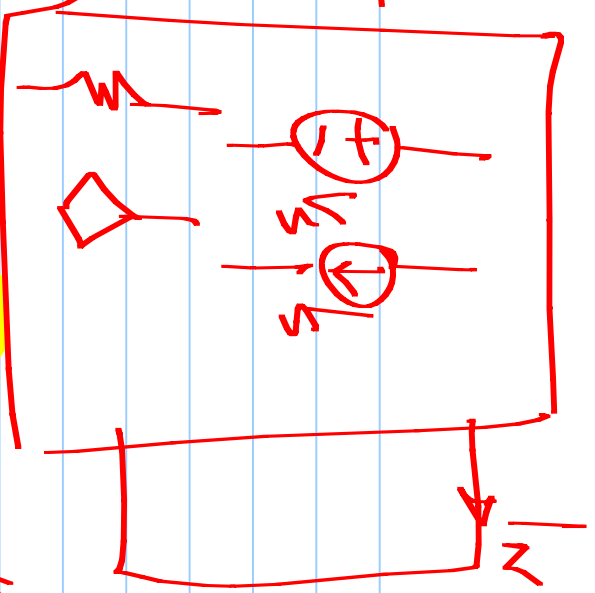
$$R_N = R_{th}$$

Norton Resistance



Thermin

$$V_o$$



Ind. Source  
de-activate

$$V_o$$