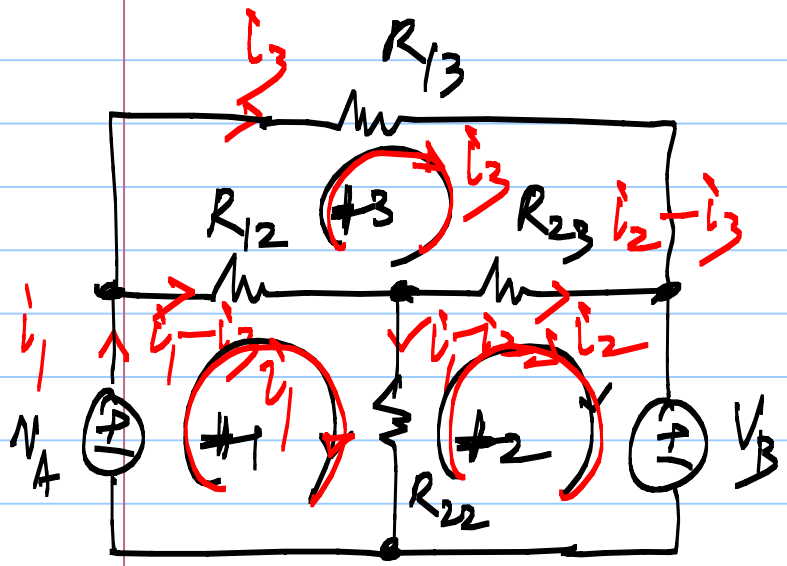
Lecture 9

Mesh analysis:

* Based on KVL around each mesh
* Applicable to planar circuits
* Mesh currents (Clockwise direction)



#1: $R_{12}(i_1 - i_3) + R_{22}(i_1 - i_2) = V_A$

#2: $R_{23}(i_2 - i_3) + R_{22}(i_2 - i_1) = -V_B$

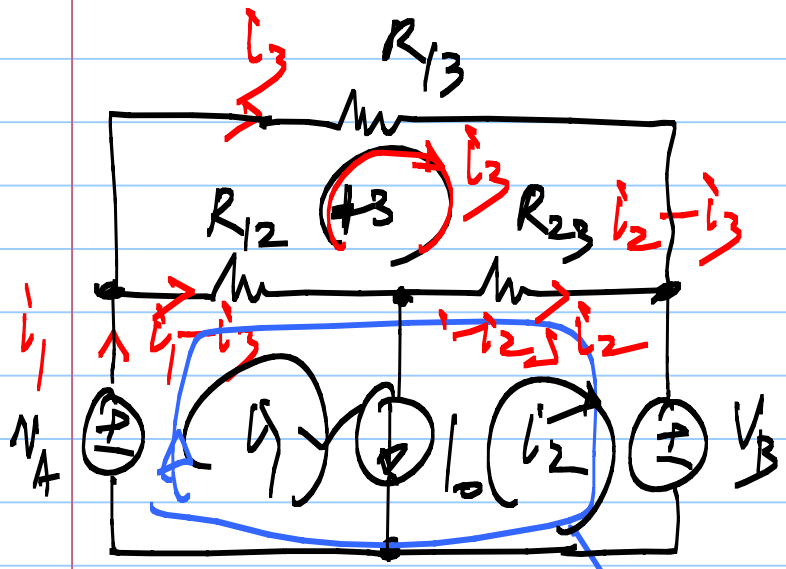
#3: $R_{13} \cdot i_3 + R_{12}(i_3 - i_1) + R_{23}(i_3 - i_2) = 0$

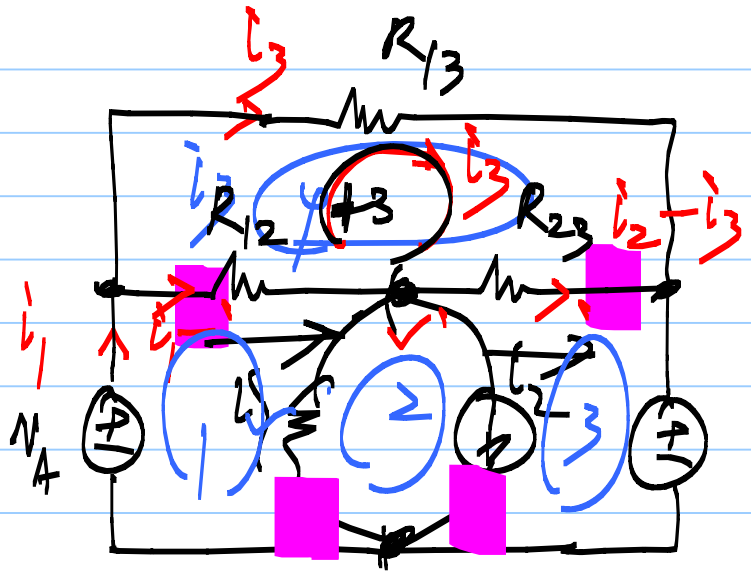
$$\begin{bmatrix} R_{12}+R_{22} & -R_{22} & -R_{12} \\ -R_{22} & R_{22}+R_{23} & -R_{23} \\ -R_{12} & -R_{23} & R_{12}+R_{23}+R_{13} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} V_A \\ -V_B \\ 0 \end{bmatrix}$$

$$R \cdot \underline{i} = \underline{V}$$

$$\sim$$

$$G \cdot \underline{V} = \underline{I}$$





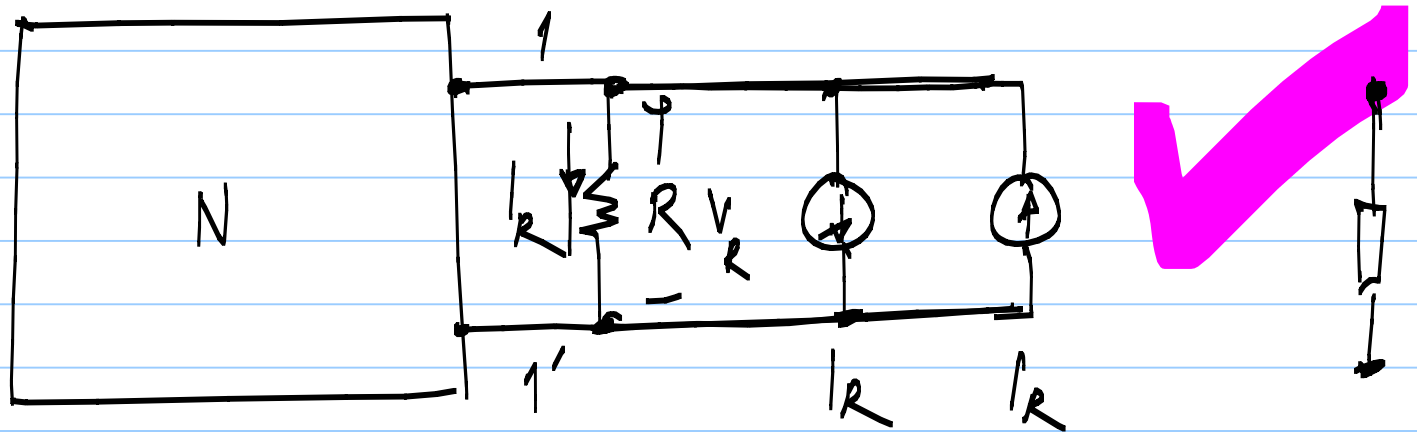
#11

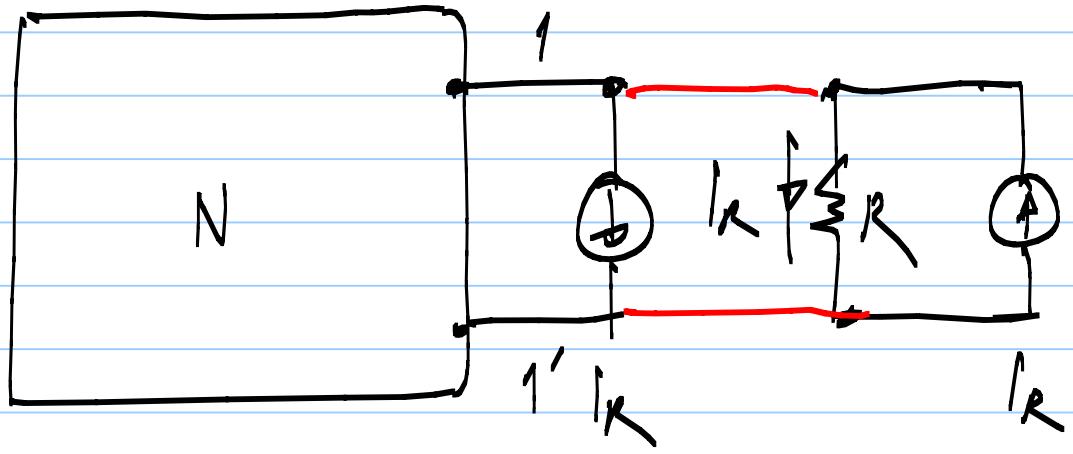
$i_1 - i_2 = I_0$

Supermesh

Circuit theorems:

Substitution theorem



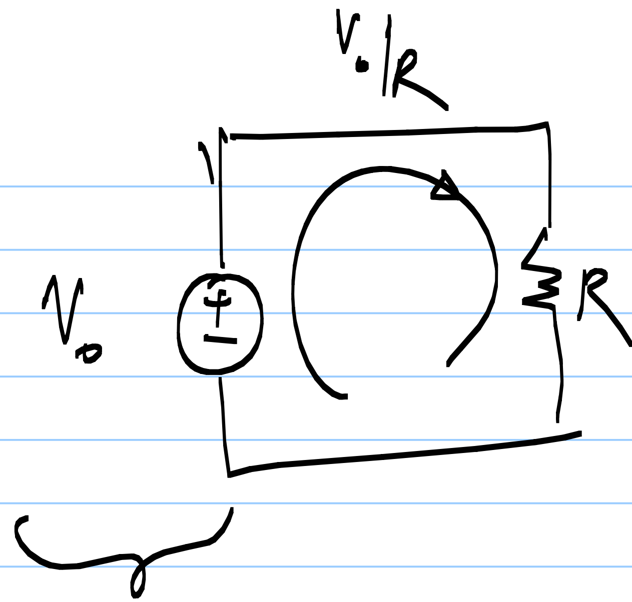


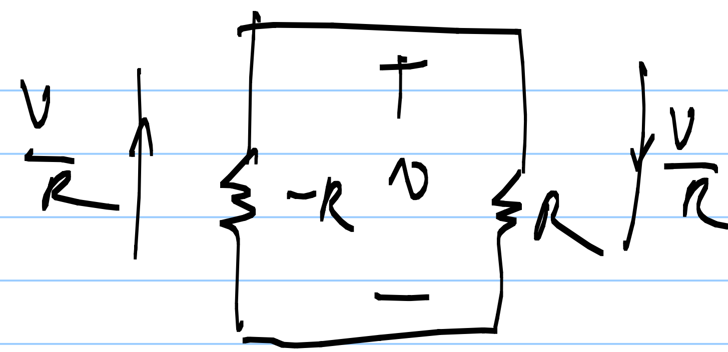
N
N

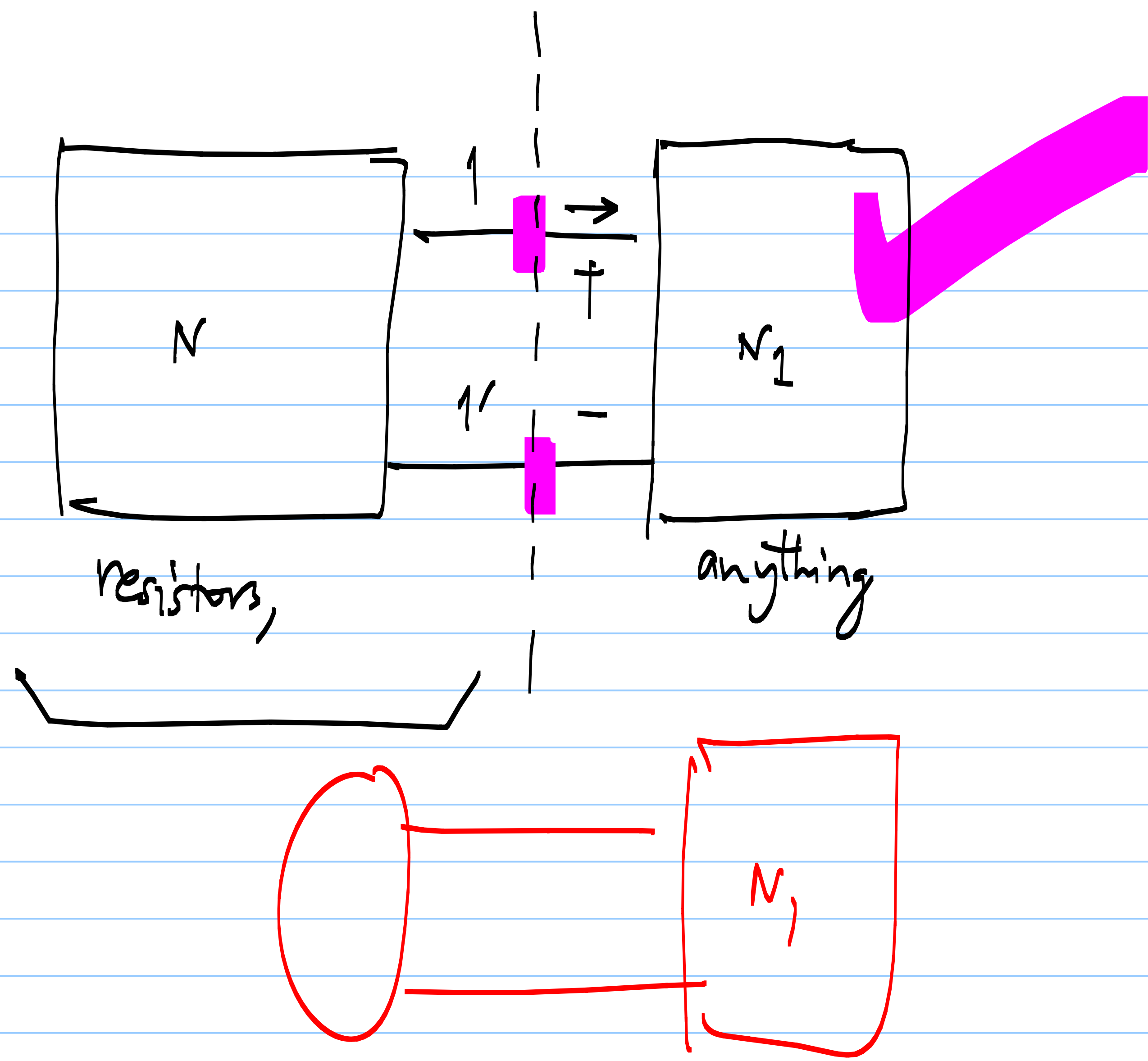
* Substitution theorem: any two terminal element

A resistor R with a voltage V_R across it and a current I_R through it can be replaced by a current source I_R OR a voltage source V_R without changing the solution

Voltage / current sources can be substituted by a resistor if they are dissipating power.


V_0/R
V_0
R


$\frac{v}{R}$
-R
+
v
−
R
$\frac{v}{R}$


N
1
1'
+
−
N_1
resistors,
anything
N_1