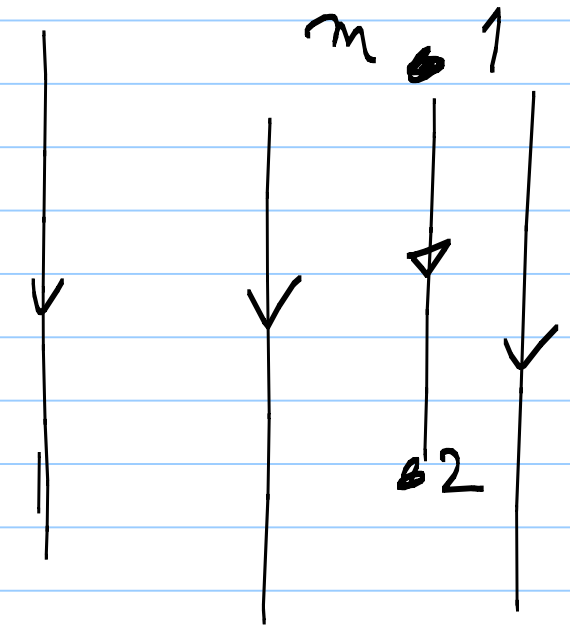
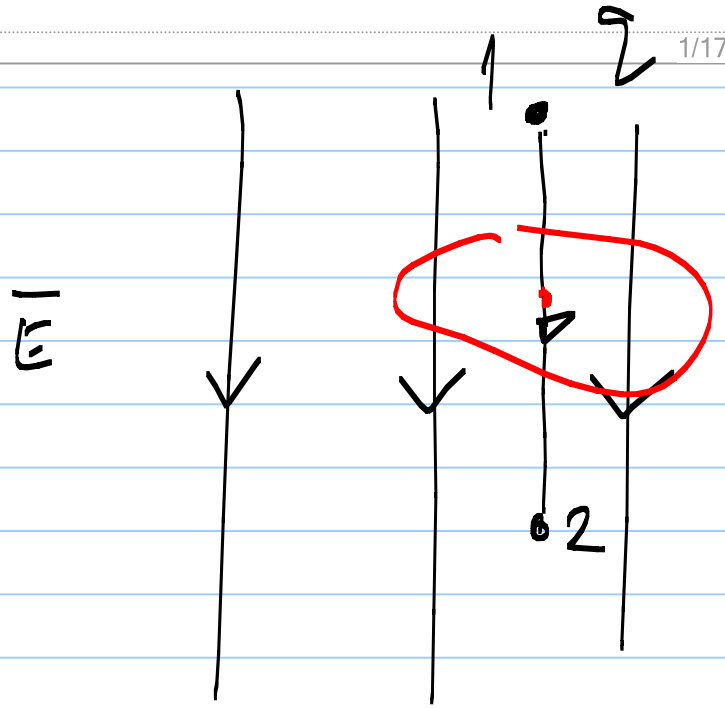
Lecture #2

Note Title 1/17/2013



Earth

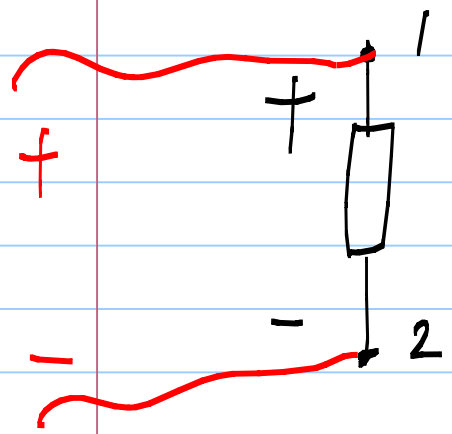
$mg(h_1 - h_2)$



$q(V_1 - V_2)$

Potential diff. / Voltage

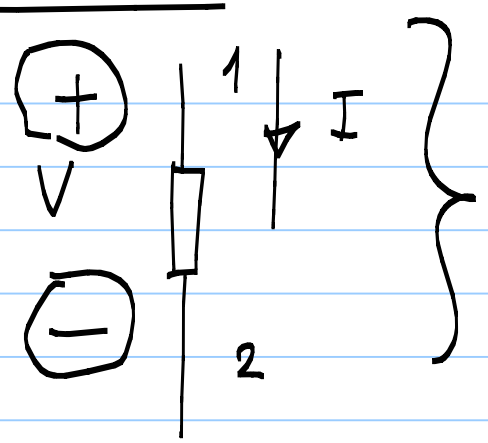
Current: Rate of flow of charge across a surface



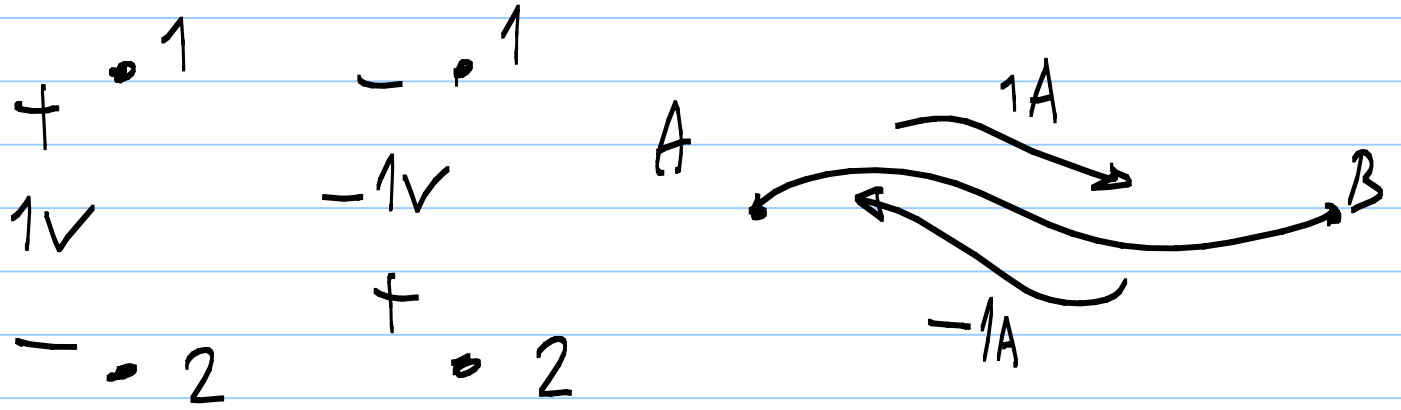
Elements:

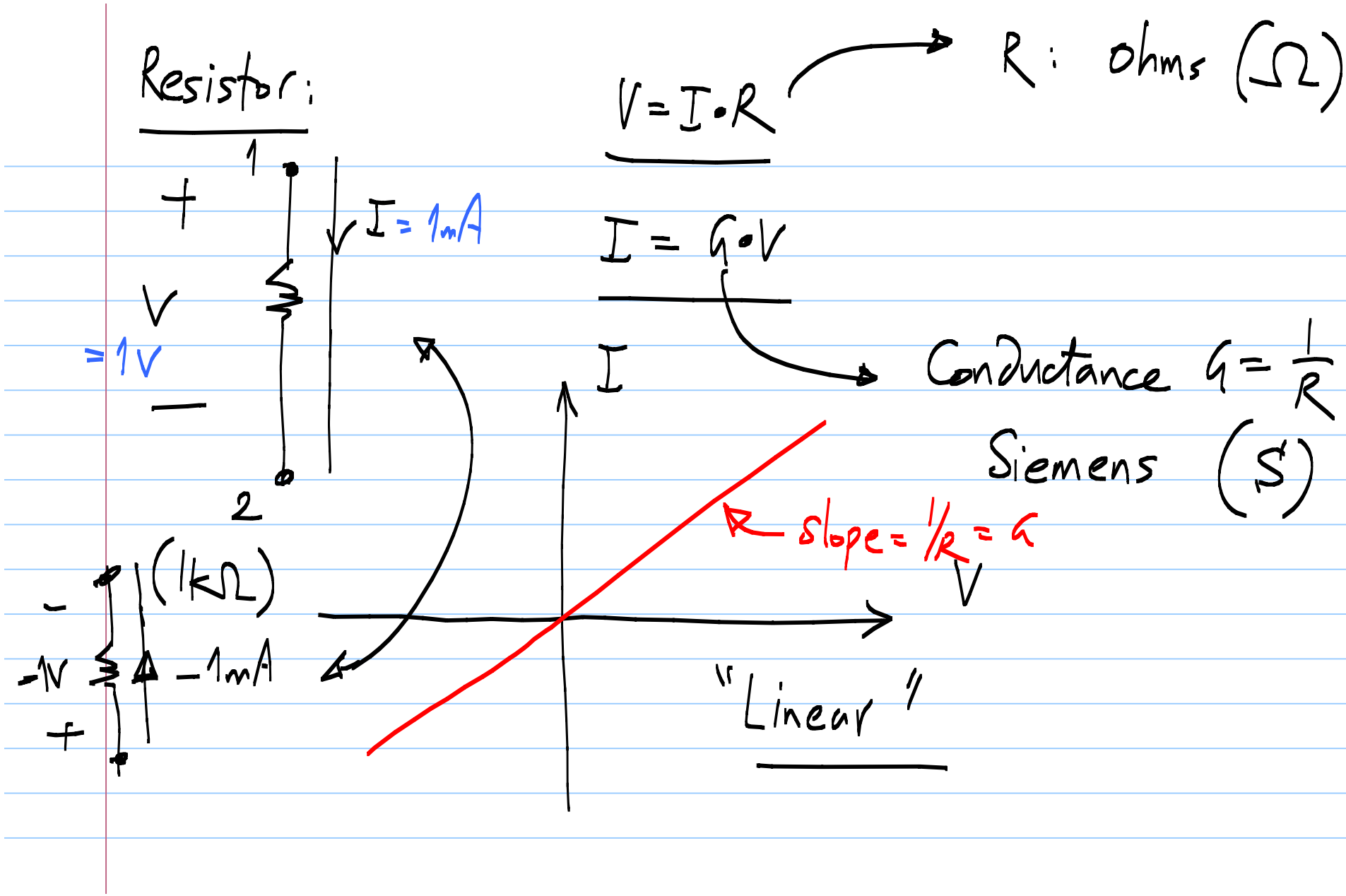
- At least two terminals

Elements:

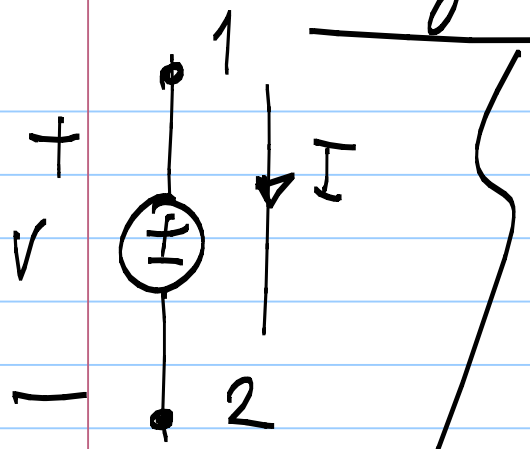


Defining the element characteristics



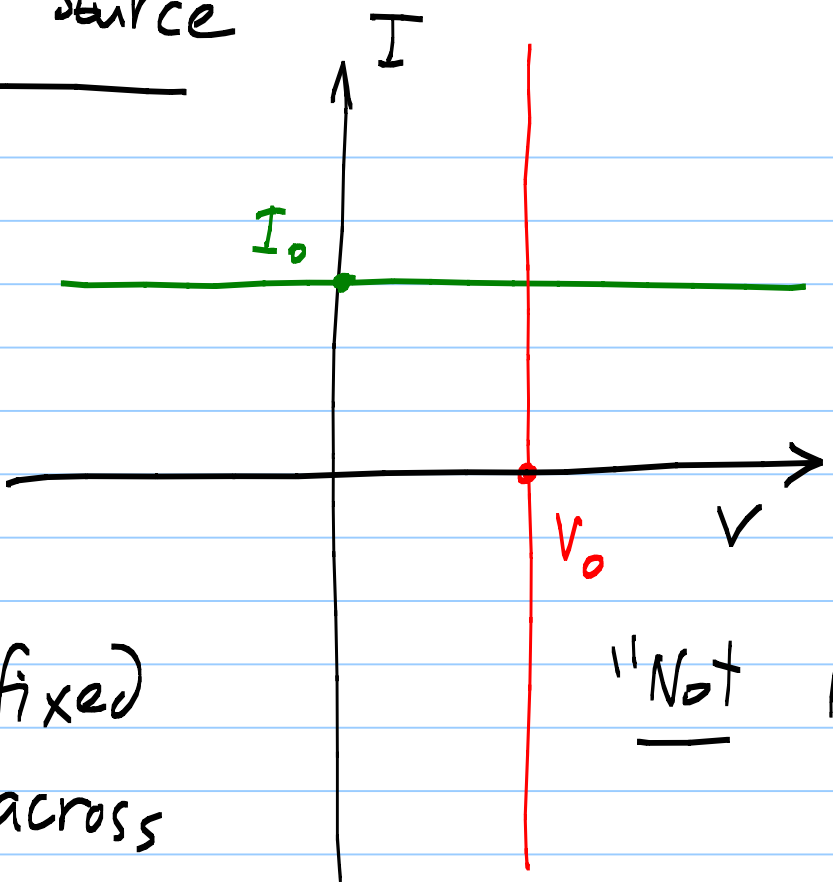

Resistor:
1
+
V
= 1V
—
2
I = 1mA
(1kΩ)
-
-1V
+
-1mA
V = I · R
R: ohms (Ω)
I = G · V
I
V
Conductance G = 1/R
Siemens (S)
slope = 1/R = G
"Linear"

Voltage source

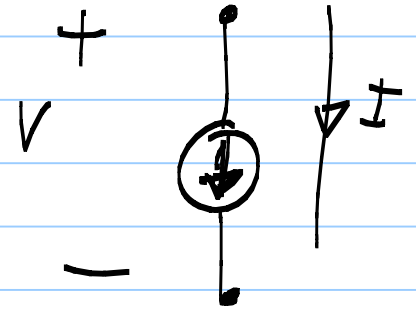


Establishes a fixed p. difference across 1-2

$V = V_0$



Current source



$I = I_0$

"Not linear"

Linearity:

response $\propto$ stimulus

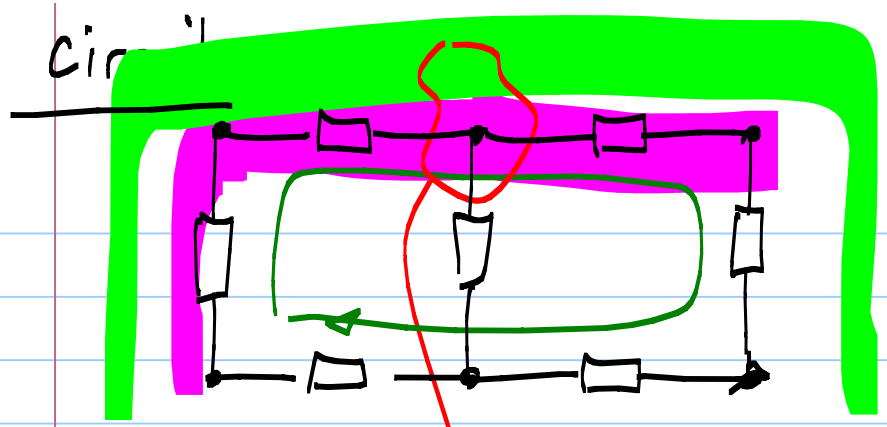
output $\propto$ input

$output_1 \leftarrow input_1$

$output_2 \leftarrow input_2$

$output_1 + output_2 \leftarrow input_1 + input_2$

$\alpha \cdot output_1 + \beta \cdot output_2 \leftarrow \alpha \cdot input_1 + \beta \cdot input_2$



Circuit: Interconnection of elements w/ atleast 1 closed loop.

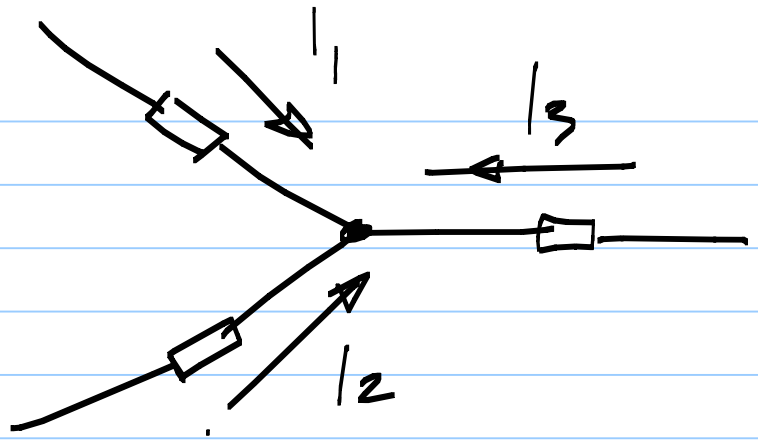
→ **nodes:** point of connection of multiple elements (terminals)

path: Elements + nodes (contignous)

Loop: Closed path

Branch: Element connected between two nodes

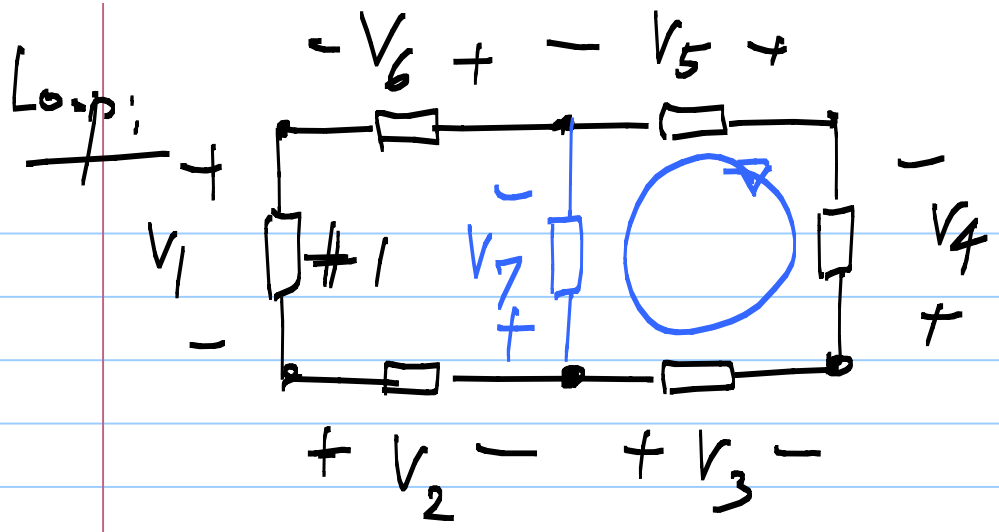
② Node:



Kirchhoff's current law (KCL)

$$I_1 + I_2 + I_3 = 0$$

$\sum$ currents flowing into a node $= 0$

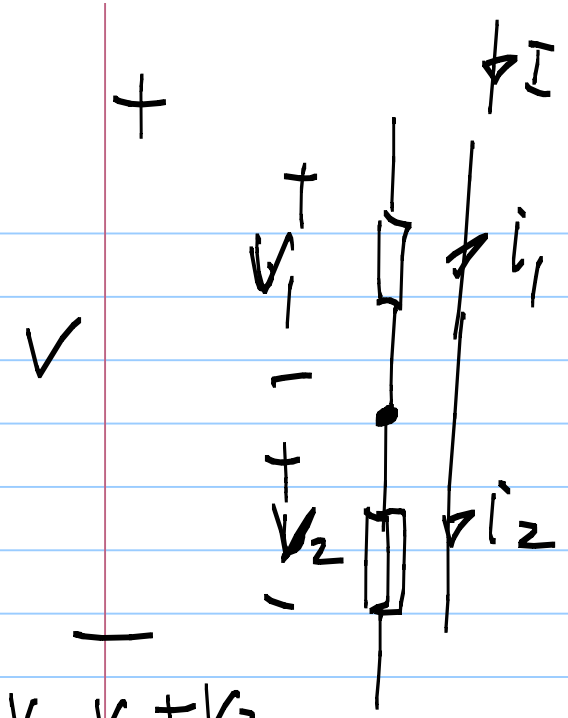


$$\sum_{k=1}^{6} V_k = 0$$

Kirchhoff's voltage law (KVL)

$$V_1 + V_2 + V_7 + V_6 = 0$$

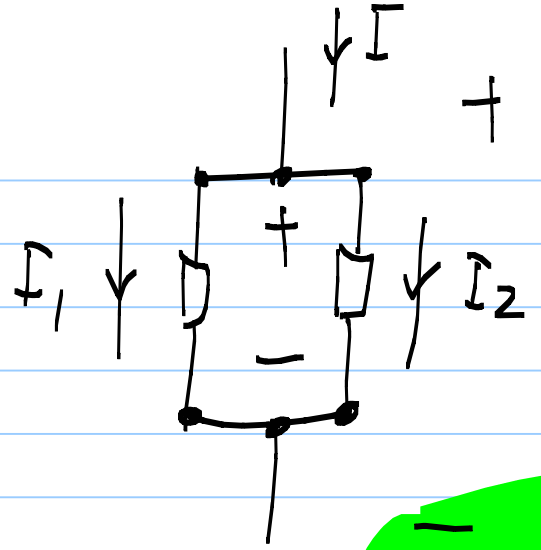
$$V_5 + V_4 + V_3 - V_7 = 0$$



$V = V_1 + V_2$

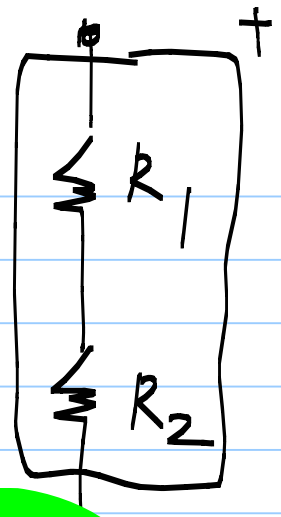
$I = I_1 = I_2$ Series Connection

(identical currents)



Parallel Connection

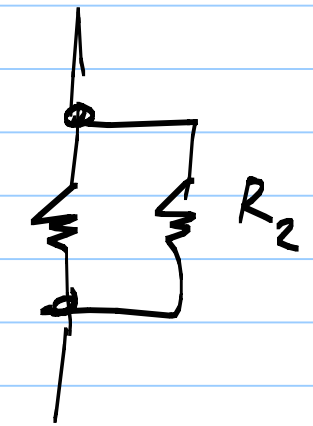
(identical Voltages)



$V = (R_1 + R_2) I$

$V = V_1 = V_2$

$I = I_1 + I_2$



$V = \frac{R_1 R_2}{R_1 + R_2} \cdot I$