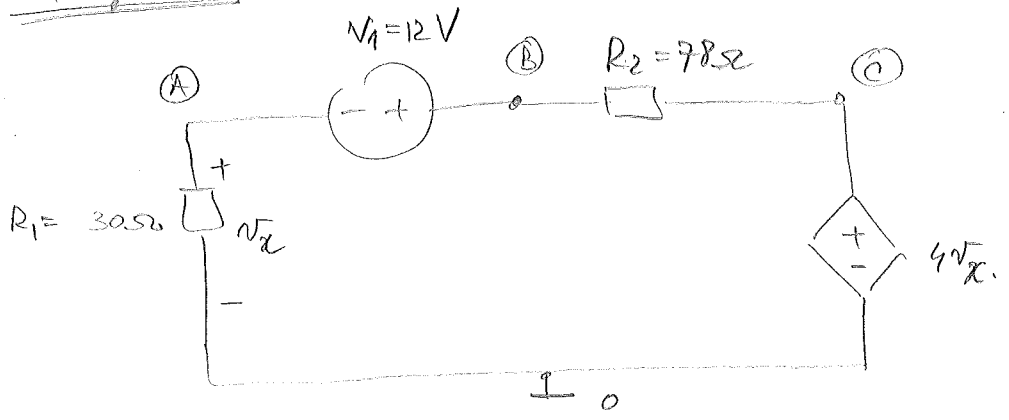
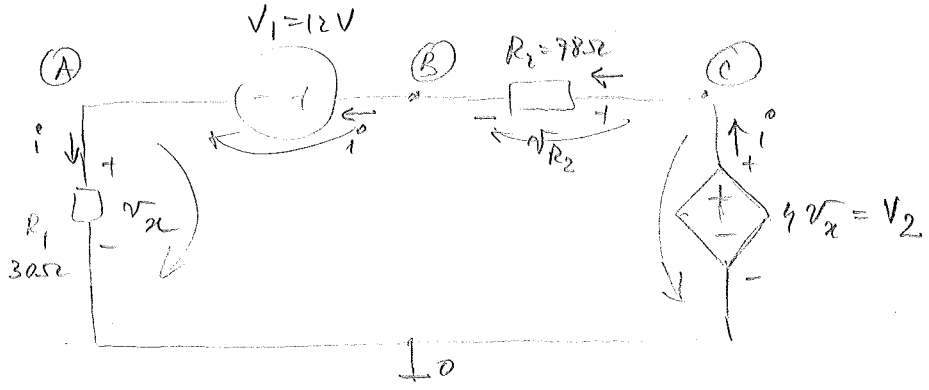
Example 2:



Find the power absorbed by each element in the circuit.



- KVL in the single loop: $v_x + V_1 + v_{R_2} = \underbrace{4v_x}_{=V_2}$

$$R_1 i + V_1 + R_2 i^\circ = 4R_1 i$$

$$V_1 = (3R_1 - R_2)\, i^\circ \Rightarrow \boxed{i^\circ = \frac{V_1}{3R_1 - R_2}} = \frac{12V}{(90-78)\Omega} = \frac{12V}{12\Omega} = 1A.$$

- Therefore the power absorbed by:

R_1: $P_{R_1} = v_x \cdot i = R_1 i^2 = 30\Omega \cdot (1A)^2 = 30\,W$

V_1: $P_{V_1} = V_1 \cdot i = 12V \cdot 1A = 12\,W$

R_2: $P_{R_2} = v_{R_2} \cdot i = R_2 \cdot i^2 = 78\Omega \times (1A)^2 = 78\,W$

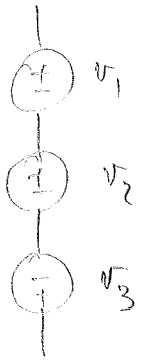
controlled voltage source: $P = (4v_x) \times (-i) = (4 \times 30V) \times (-1A) = -120\,W$: this is actually delivered!

Note: Sum of all power delivered equals the sum of all power absorbed!

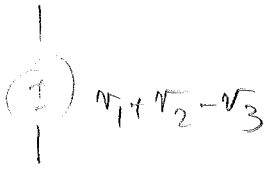
Sources connected in series and parallel

Series

(a) Voltage Sources:

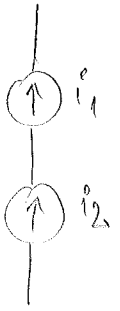


$\equiv$



: generalized to # number of series connected voltage sources.

(b) current sources:



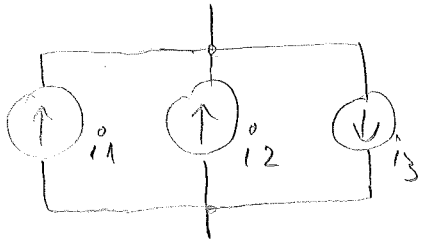
i_2 and i_1 must have the same direction & the same value.

Example:

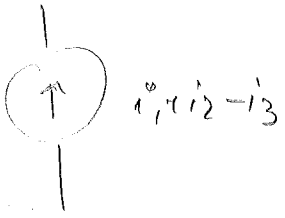
Not permissible!

Parallel

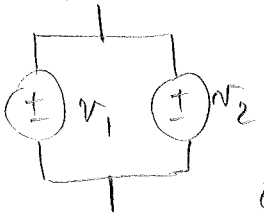
(c) current sources:



$\equiv$

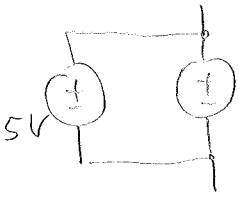


(d) voltage sources:



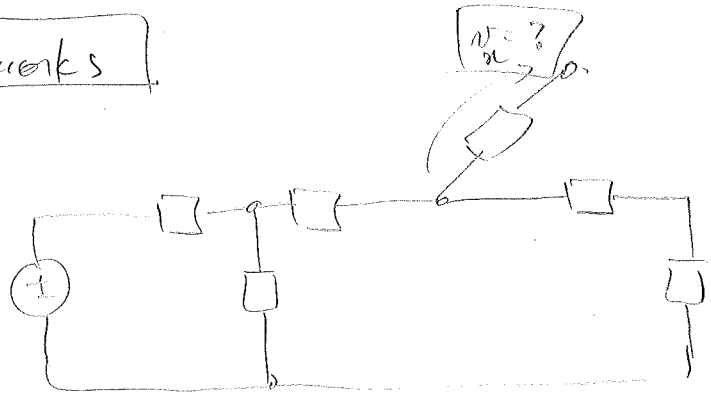
v_1 and v_2 must have the same value and polarities.

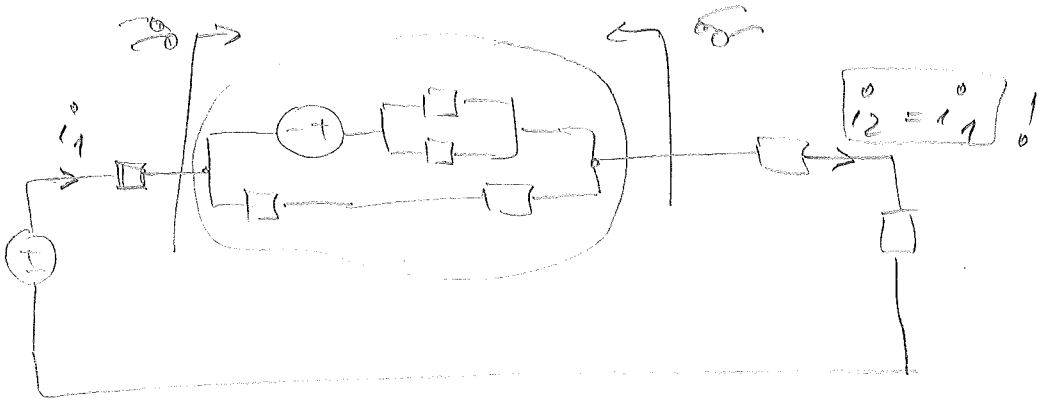
Example:

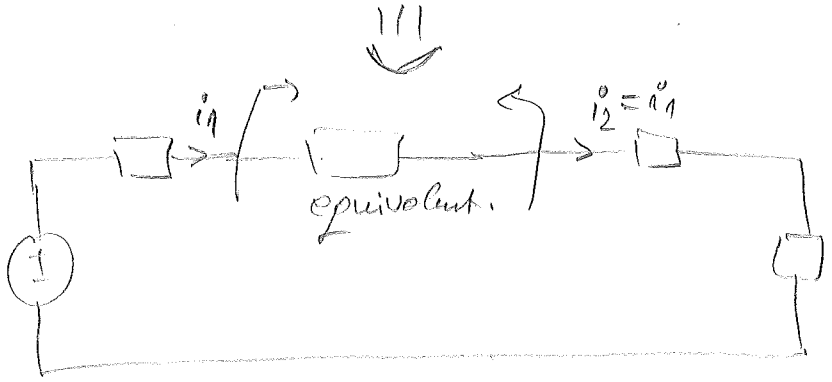


not permissible!

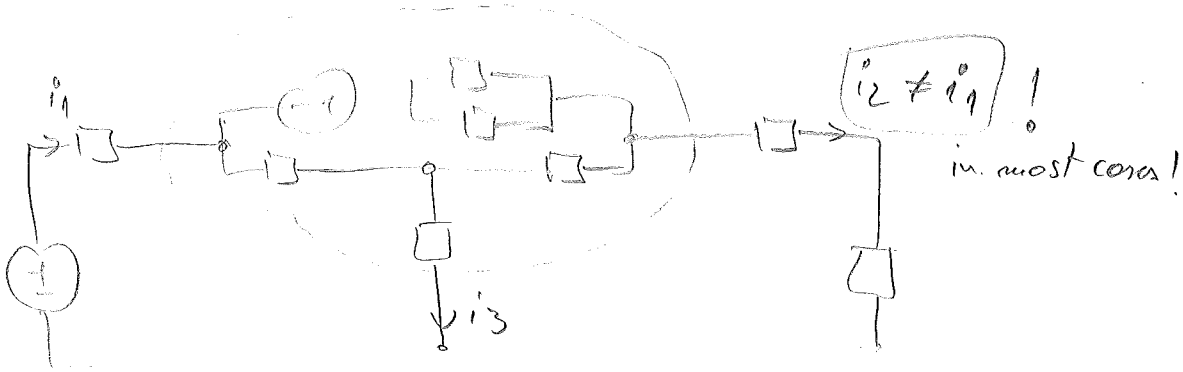
Remarks







But:



$i_1 = i_2 + i_3$ (!) Think about it!