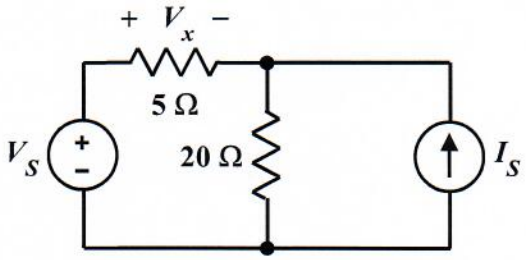
EE/EET 2240

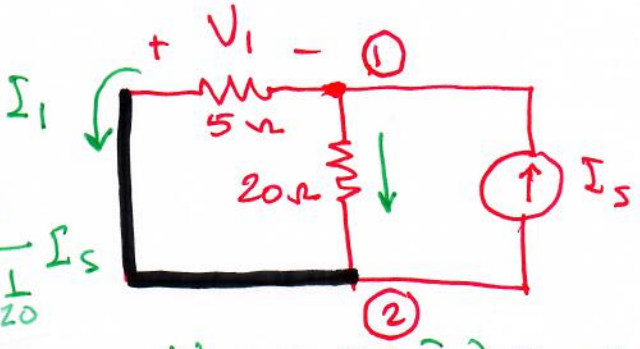
Homework Problem #020



The voltage V_x can be described by the equation

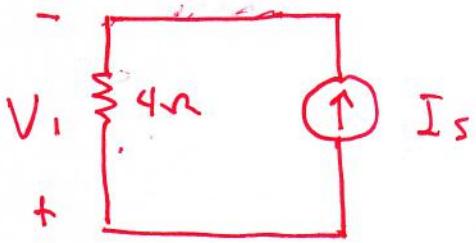
$$V_x = K_1 I_S + K_2 V_S$$

where I_S and V_S are the values of the two independent sources. Determine the numerical value of each of the coefficients, K_1 and K_2.

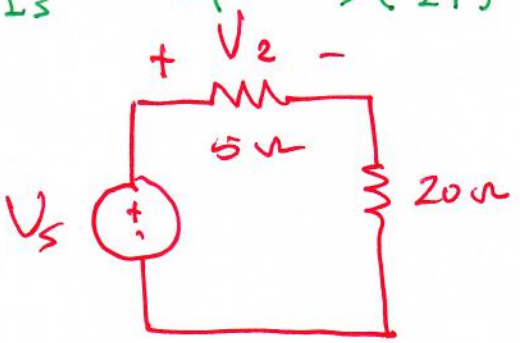


$$I_1 = \frac{\frac{1}{5}}{\frac{1}{5}+\frac{1}{20}} I_S = \frac{4}{5} I_S$$

$$V_1 = -5(I_1) = -4 I_S$$



$$V_1 = -4 I_S$$



$$V_2 = \frac{5}{25} V_S = \frac{1}{5} V_S$$

$$V_x = V_1 + V_2 = -4 I_S + \frac{1}{5} V_S$$

$$K_1 = -4, \quad K_2 = \frac{1}{5}$$

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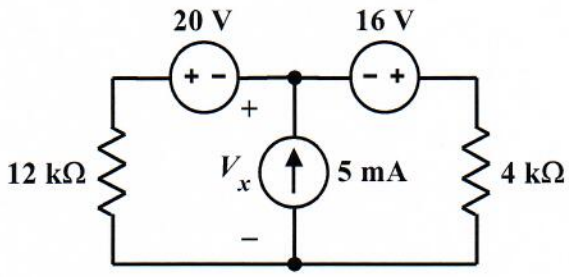
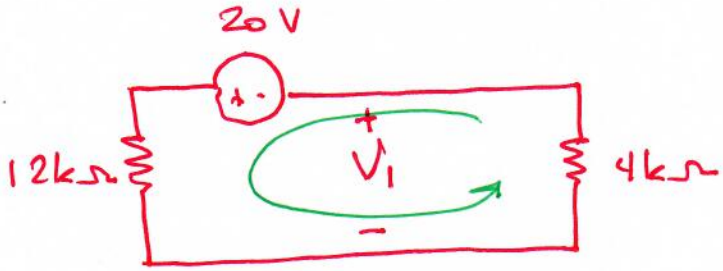
Homework Problem #021

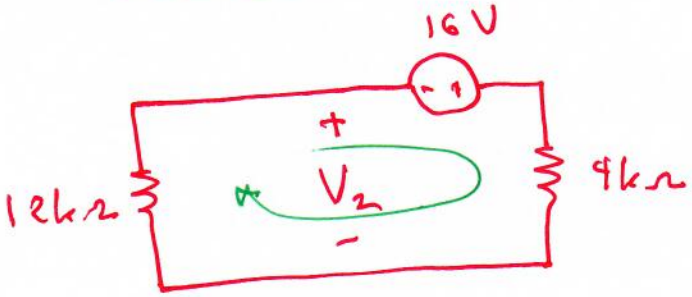


Use the superposition method to determine the value of V_x.



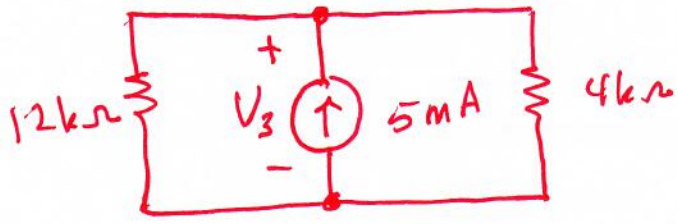
$$V_1 = -\left(\frac{4k\Omega}{12k\Omega + 4k\Omega}\right) \cdot 20V$$

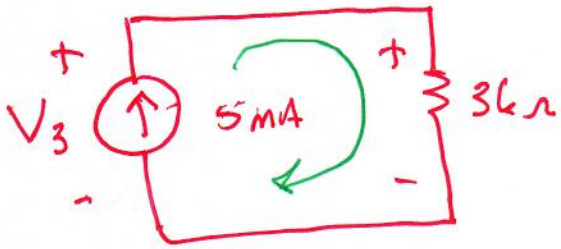
$$= -5\,V$$



$$V_2 = -\left(\frac{12k\Omega}{12k\Omega + 4k\Omega}\right) \cdot 16V$$

$$= -12V$$

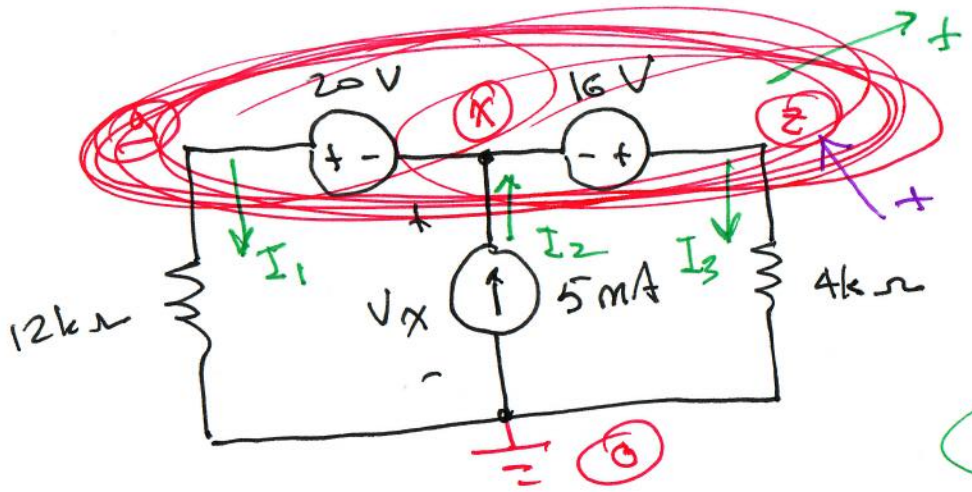




$$V_3 = (3k\Omega)(5mA)$$

$$= 15V$$

$$V_x = V_1 + V_2 + V_3 = -5 - 12 + 15 = -2V$$



$$I_1 + I_3 - I_2 = 0$$

$$I_2 = I_1 + I_3$$

$$I_2 - I_1 - I_3 = 0$$

[1] $V_y - V_x = 20$

[2] $V_z - V_x = 16$

$$\frac{V_y}{12k\Omega} + \frac{V_z}{4k\Omega} - \frac{\Sigma}{1000} = 0$$

[3] $\Rightarrow$ $V_y + 3V_z - 60 = 0$

[1] - [2] $\Rightarrow$ $V_y - V_z = 4$

[3] $\Rightarrow$ $V_y + 3V_z = 60$

$4V_z = 56 \Rightarrow V_z = 14V$

$V_x = V_z - 16 = 14 - 16 = -2V$

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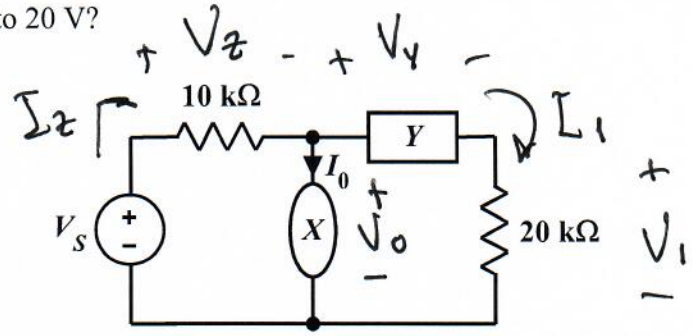
Homework Problem #019

X and Y are linear components. If $I_0 = 15$ mA when $V_S = 60$ V, what will be the new value of I_0 if V_S is decreased to 20 V?



$I_0 = K V_S$

$15\text{mA} = K(60\text{V})$

$K = \frac{15\text{mA}}{60} = .25\text{ mS}$

$I_0' = K(20\text{V}) = 5\text{ mA}$

$V_0 = K_1 V_S$

$I_1 = K_2 V_S$

$V_1 = K_3 V_S$

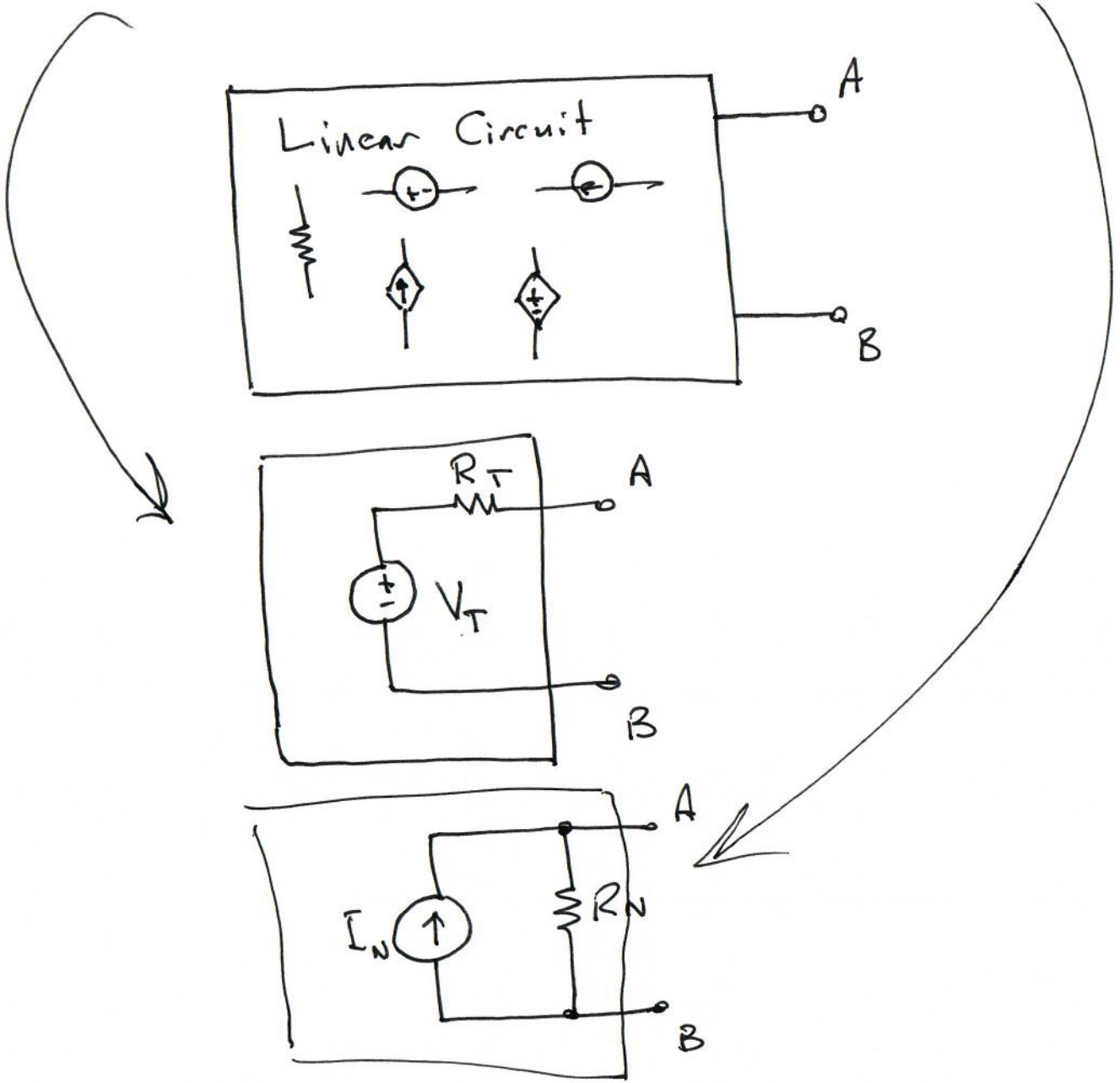
$V_Y = K_4 V_S$

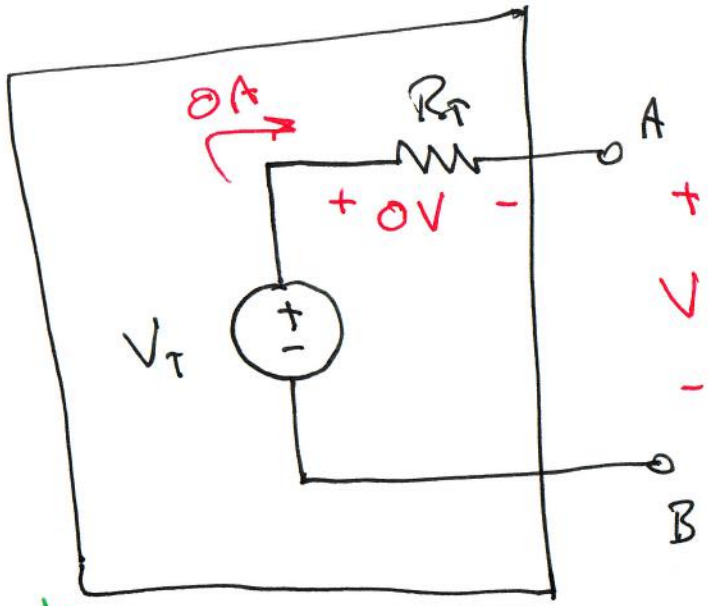
$V_Z = K_5 V_S$

$I_2 = K_6 V_S$

Thévenin's Theorem

Norton's Theorem

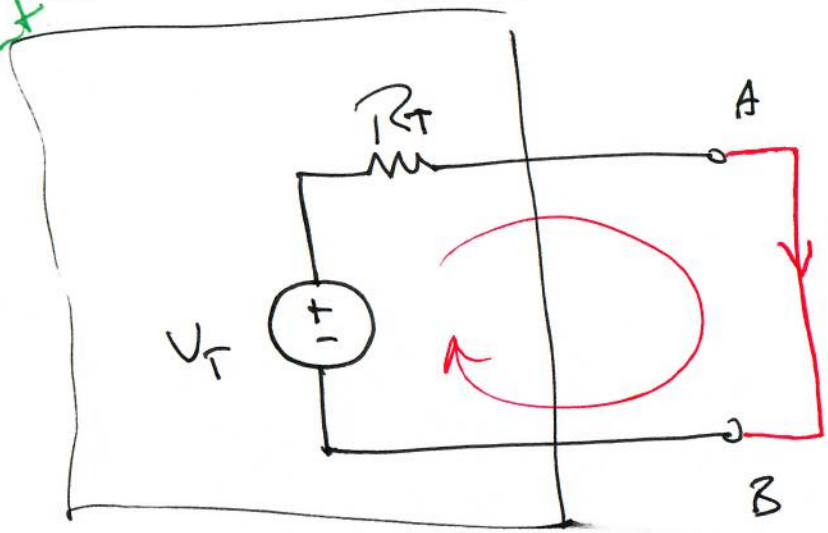




$V_{OC} = V_T$

measure or calculate

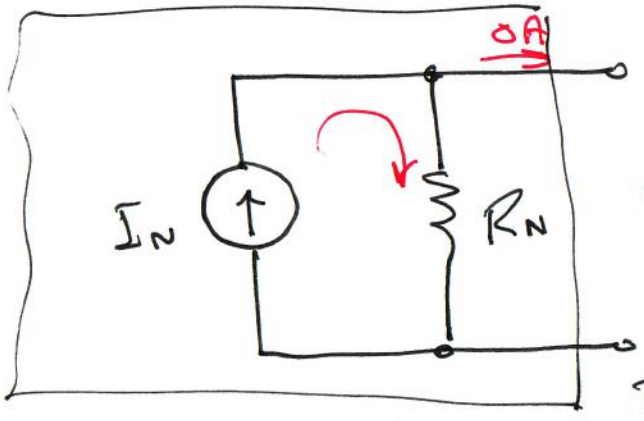
Thévenin Equivalent



$I_{SC} = \frac{V_T}{R_T}$

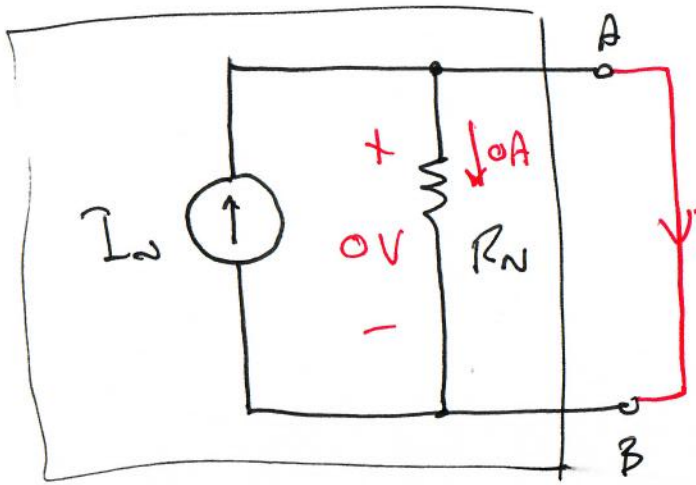
measure or calculate

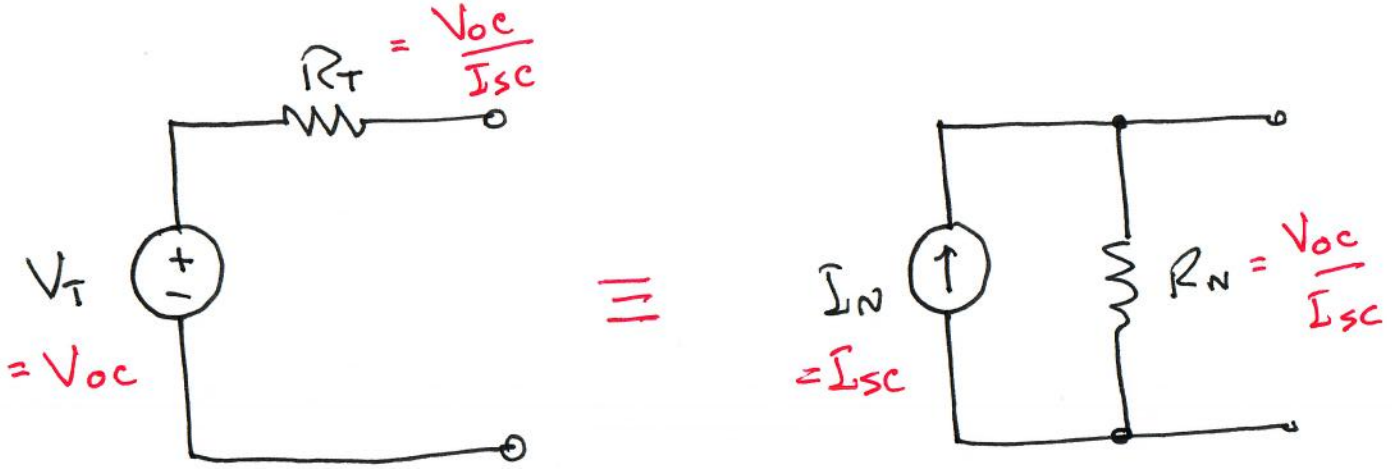
$$R_T = \frac{V_T}{I_{SC}} = \frac{V_{OC}}{I_{SC}}$$

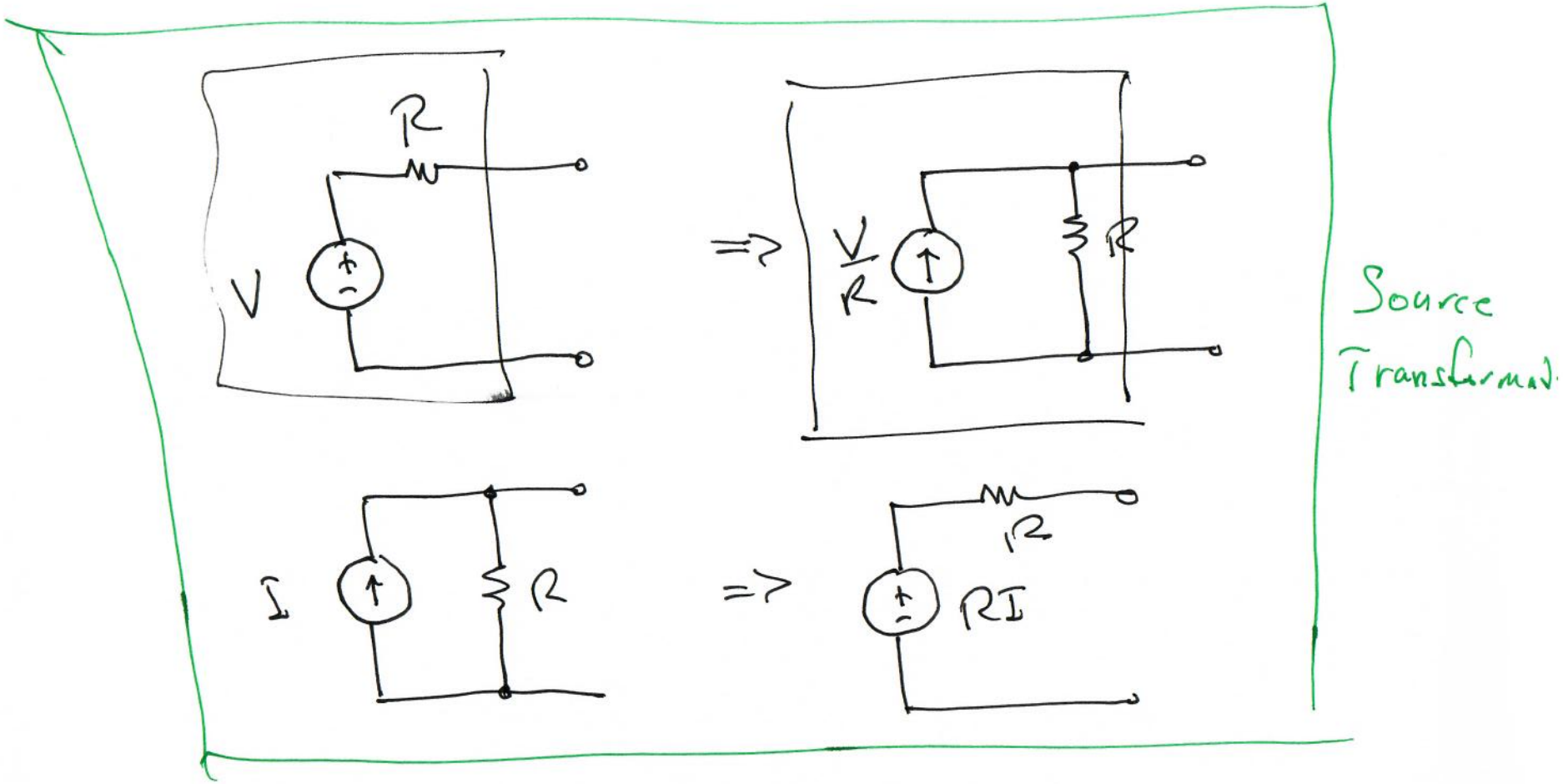


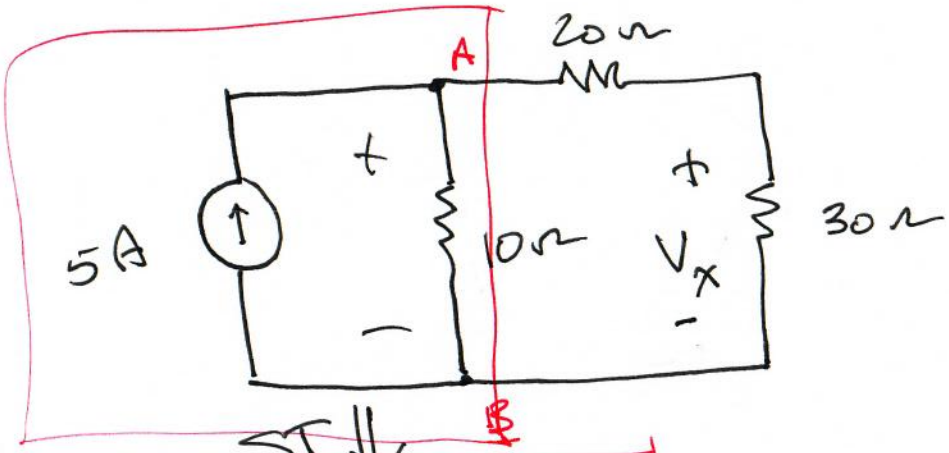
$$V_{OC} = R_N I_N = R_N I_{SC}$$

$$R_N = \frac{V_{OC}}{I_{SC}}$$

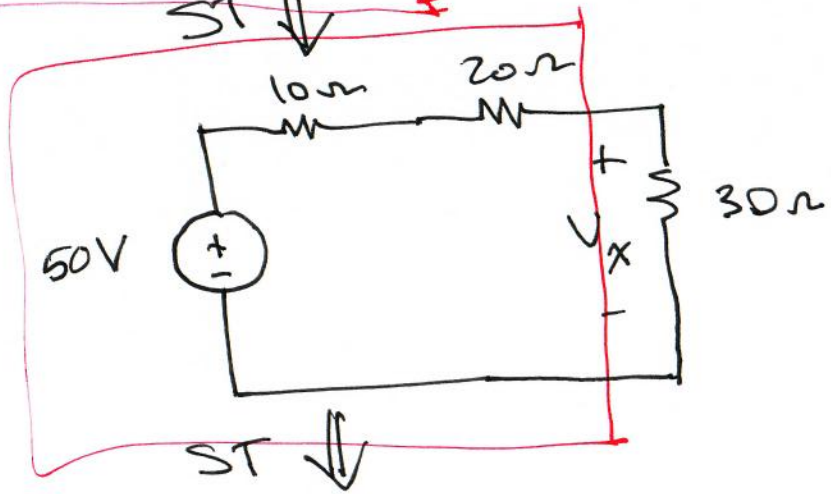



$R_T = \frac{V_{oc}}{I_{sc}}$
V_T
$= V_{oc}$
$\equiv$
I_N
$= I_{sc}$
$R_N = \frac{V_{oc}}{I_{sc}}$

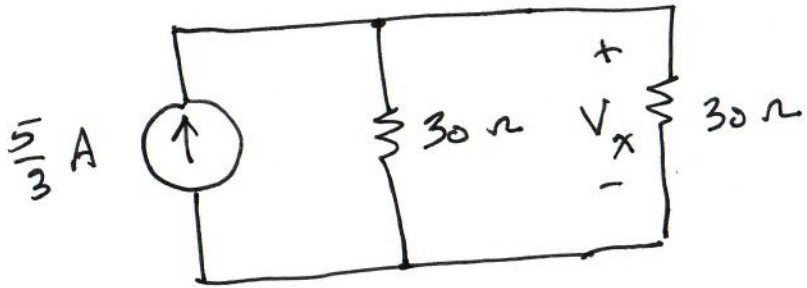

R
V
$\Rightarrow$
$\frac{V}{R}$
R
I
R
=>
R
RI
Source Transformat



ST



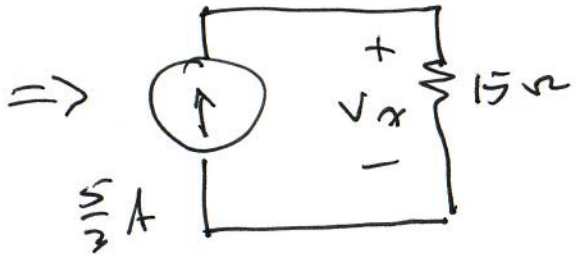
ST



$$V_x = \frac{30}{60} \cdot 50$$

$$= 25\,V$$

$\Rightarrow$



$$V_x = \frac{5}{3} \cdot 15$$

$$= 25\,V$$