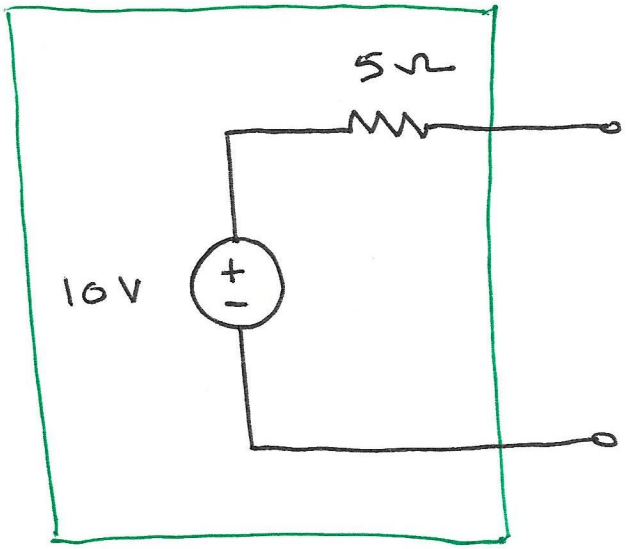
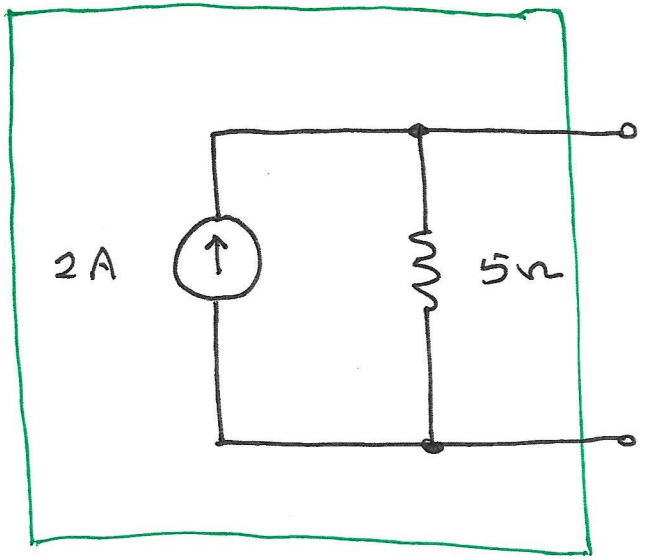
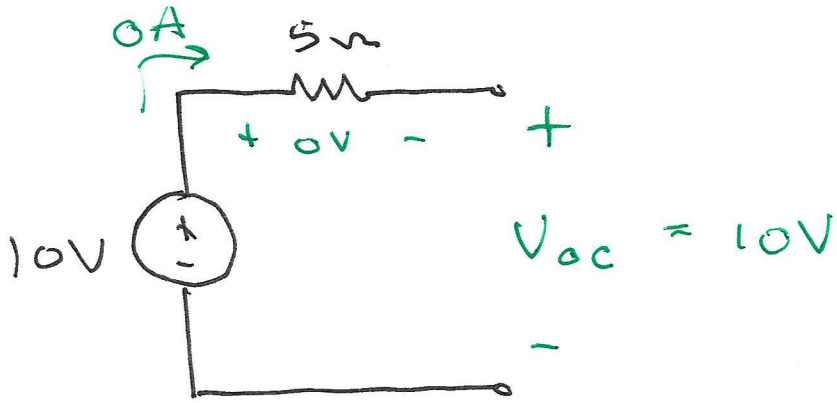
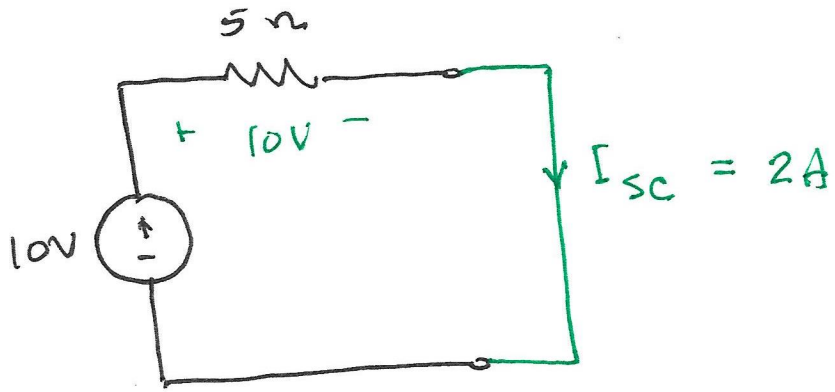


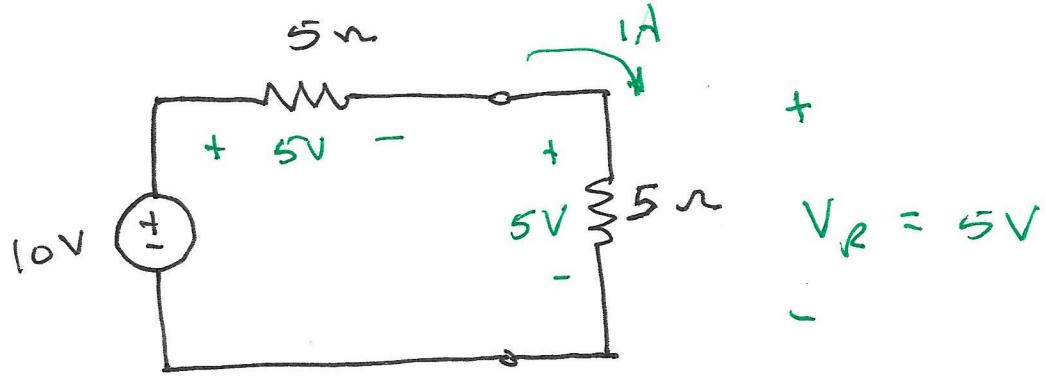
Circuit A

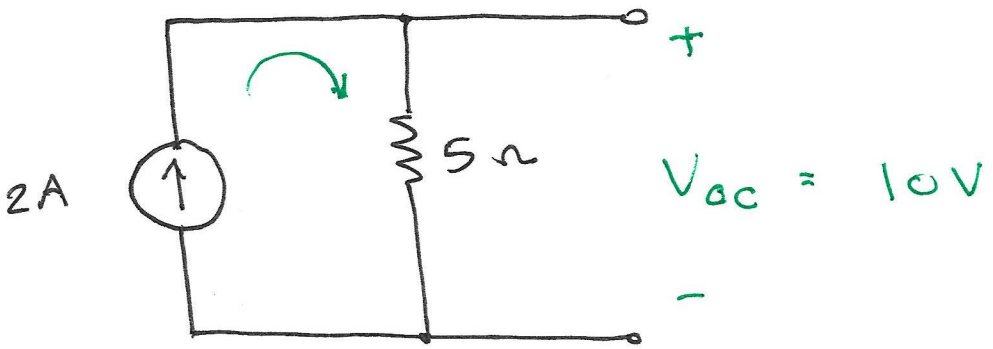


Circuit B

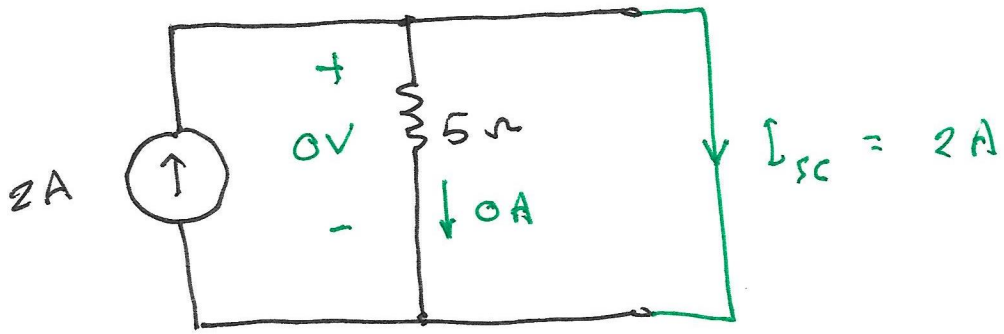

0A
5Ω
+ 0V −
+
10V
−
V_{oc} = 10V


5Ω
+ 10V −
I_{sc} = 2A
10V

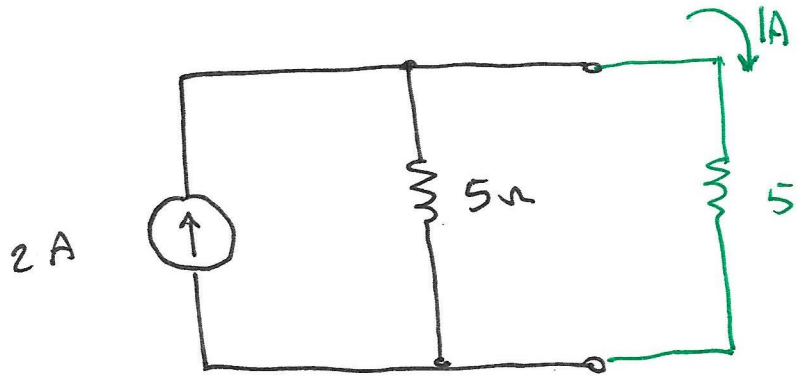

5Ω
1A
+ 5V −
+
5V
5Ω
−
10V
+
V_R = 5V
−



$V_{oc} = 10V$



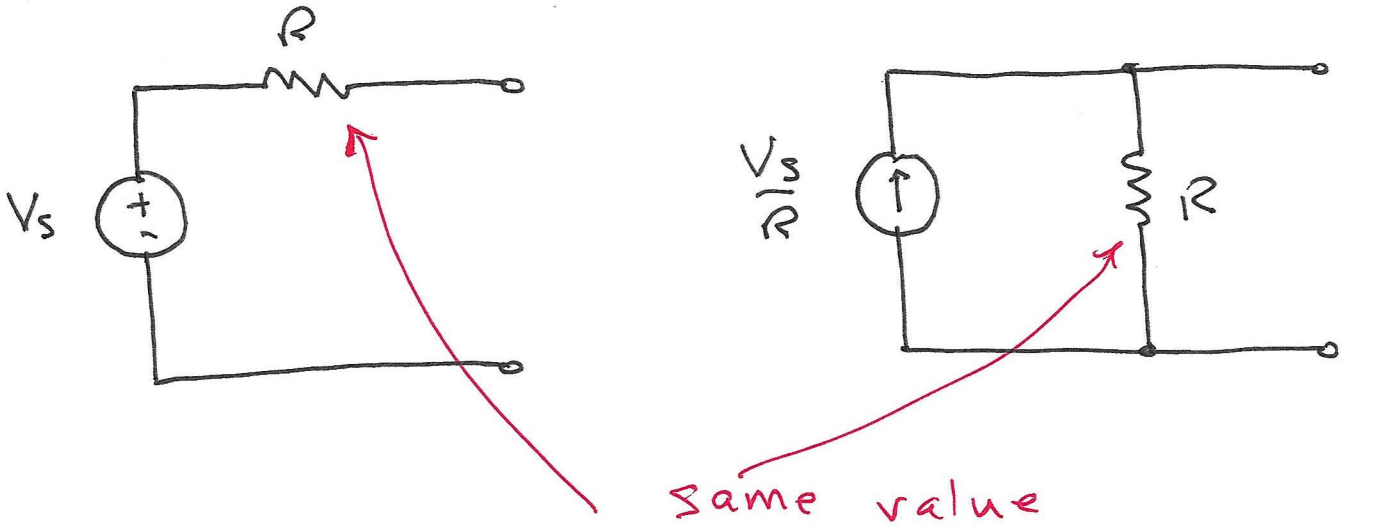
$I_{sc} = 2A$

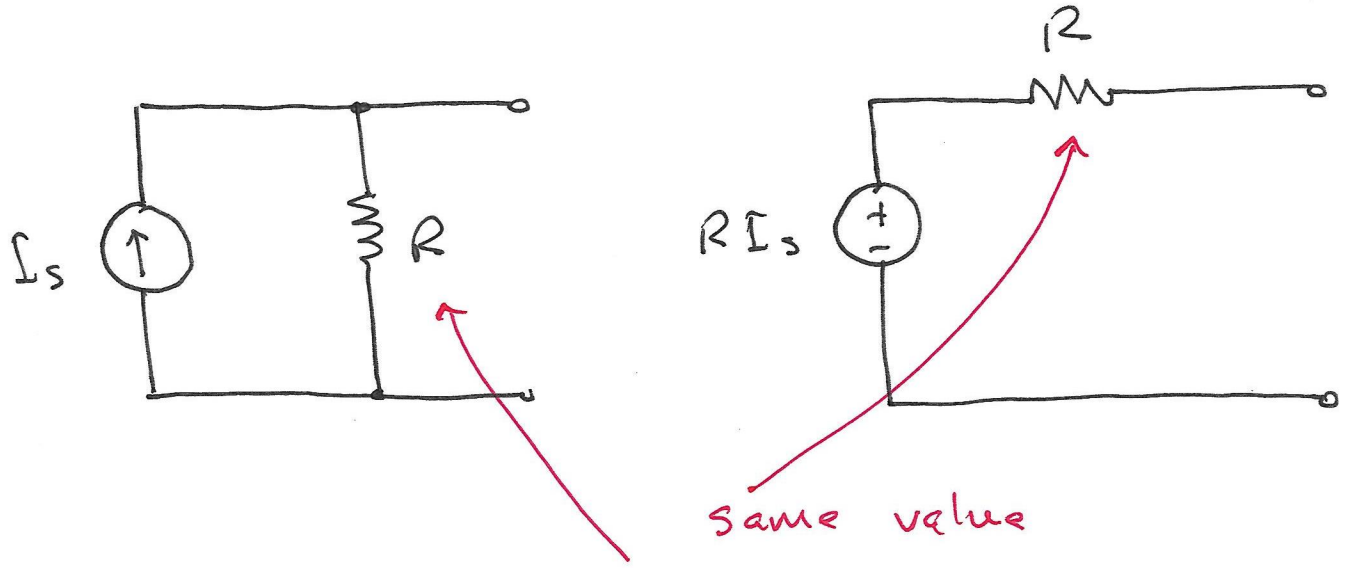


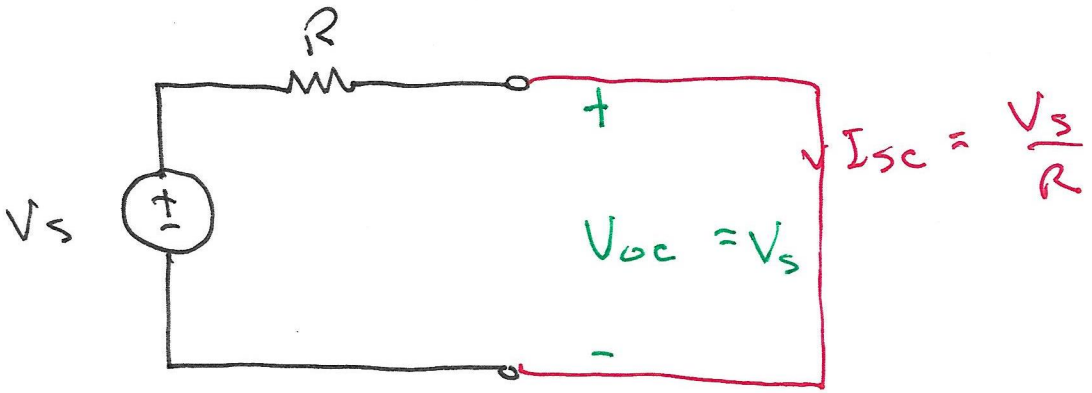
$+$

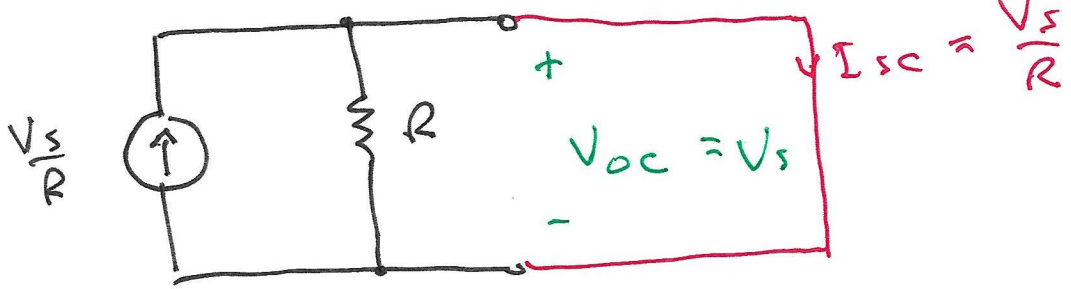
$V_R = 5V$

$-$

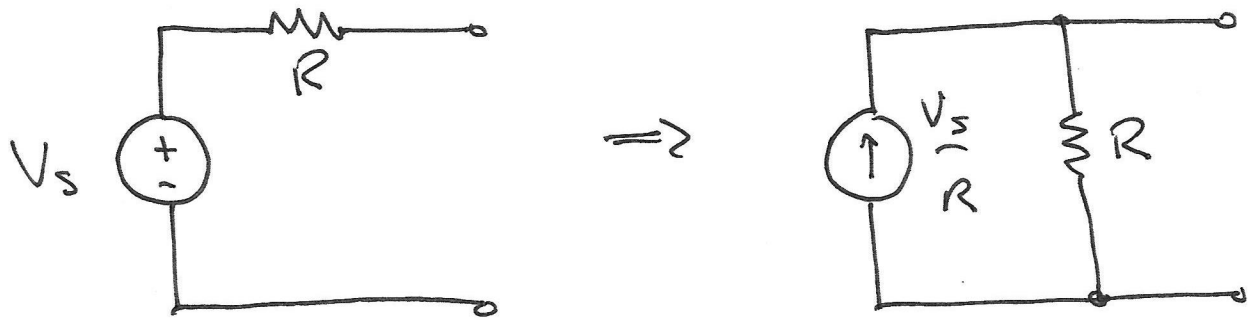

R
Vs
+
-
Vs/R
R
same value


Is
R
R
RIs
+
-
same value

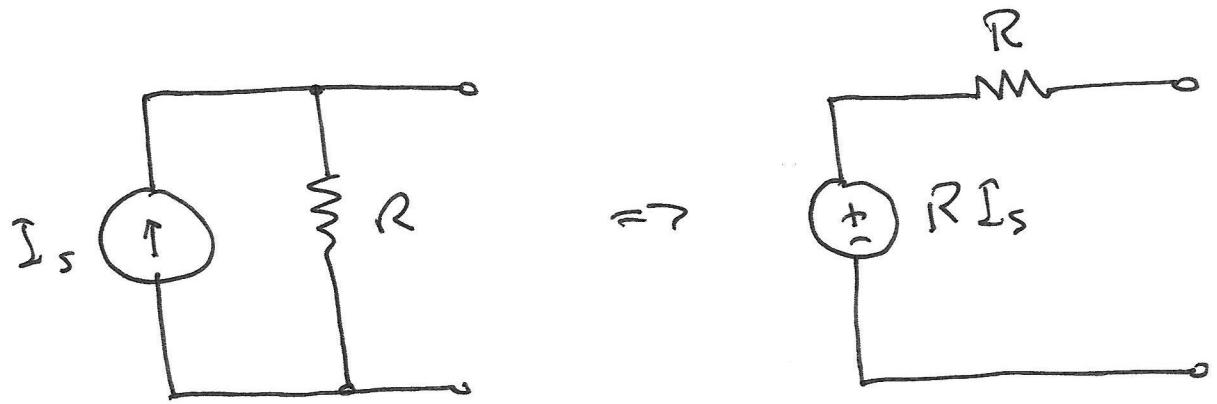

R
Vs
+
-
Voc = Vs
Isc = Vs/R


Vs/R
R
+
-
Voc = Vs
Isc = Vs/R

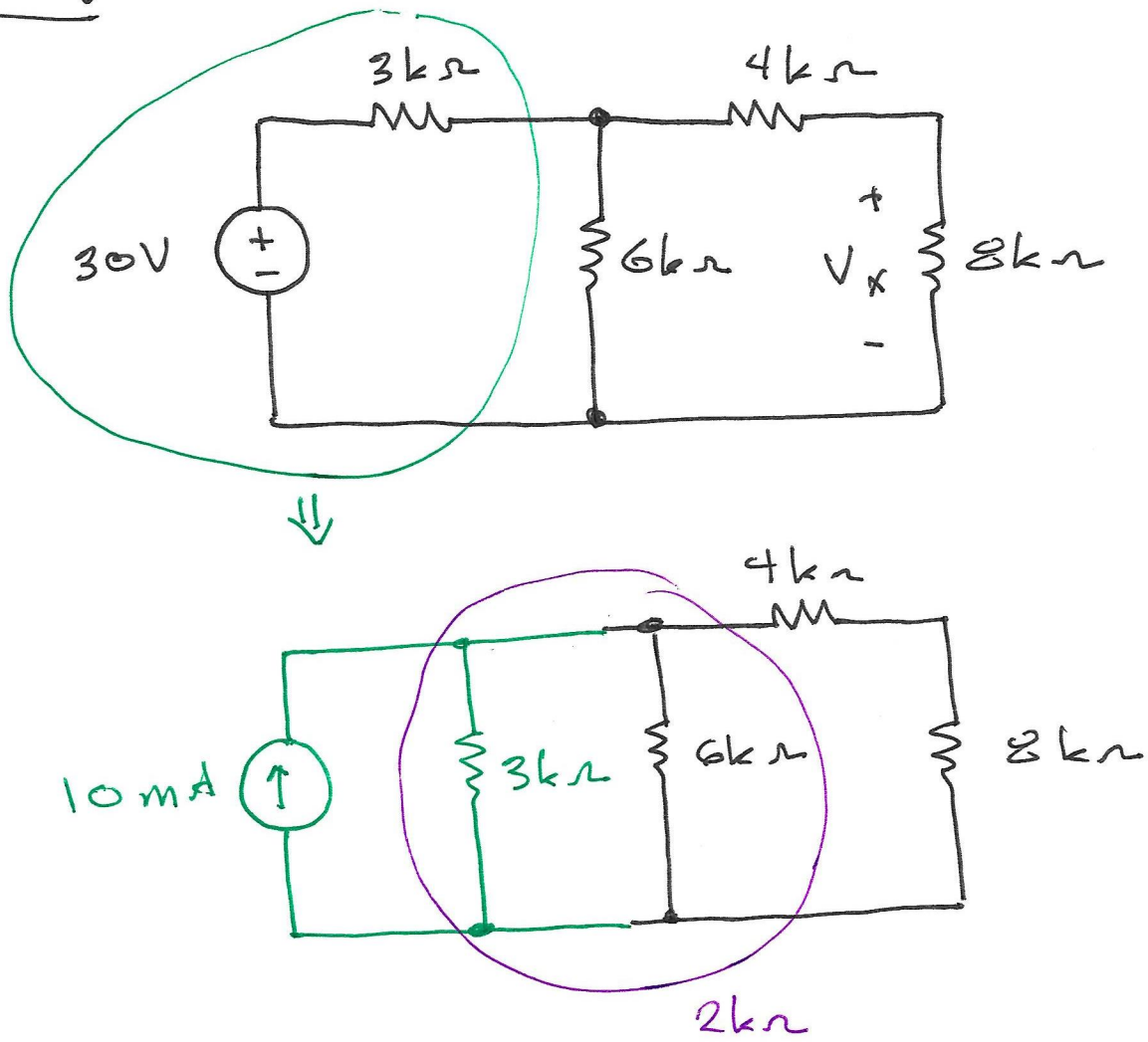
Source Transformation

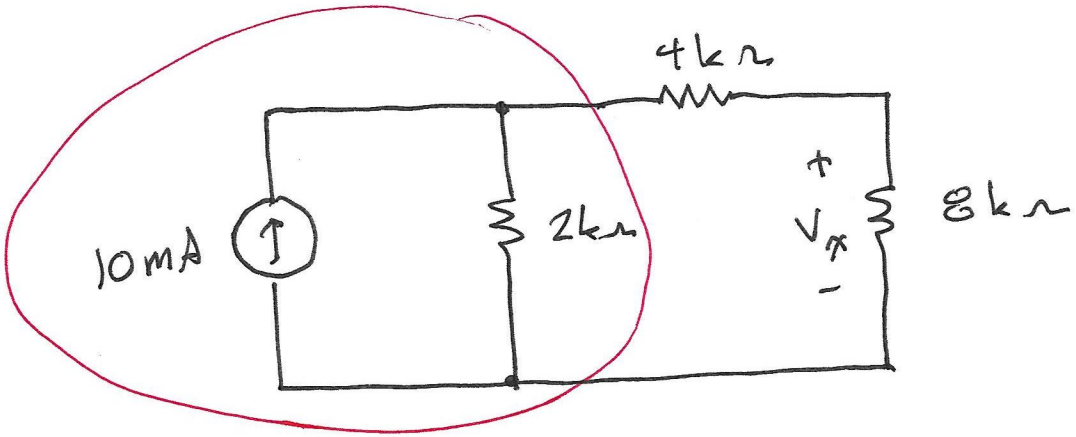


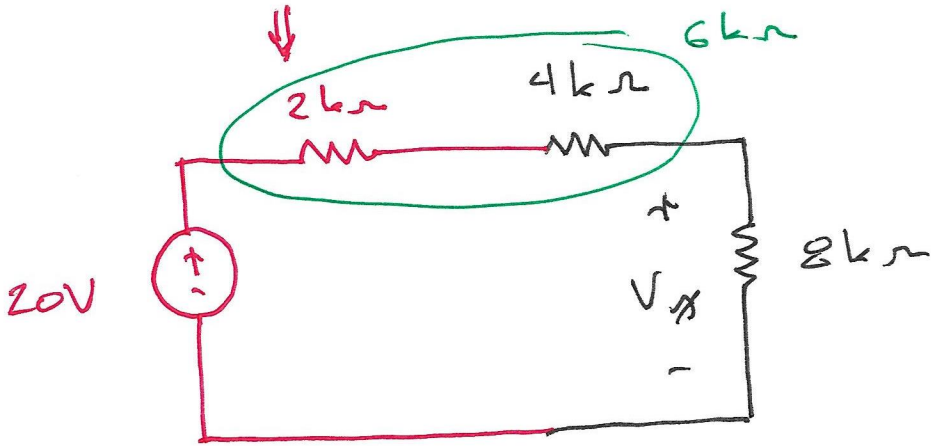
Or

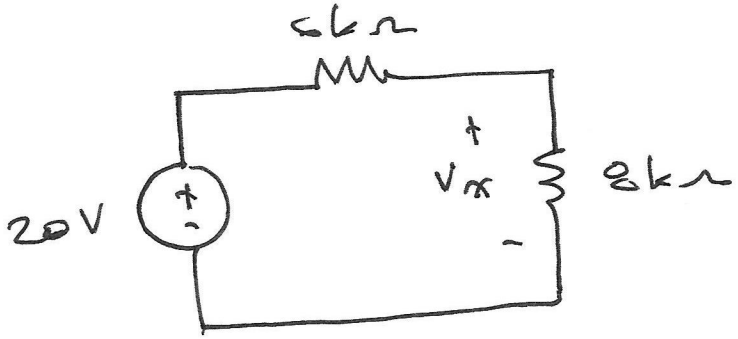


Example









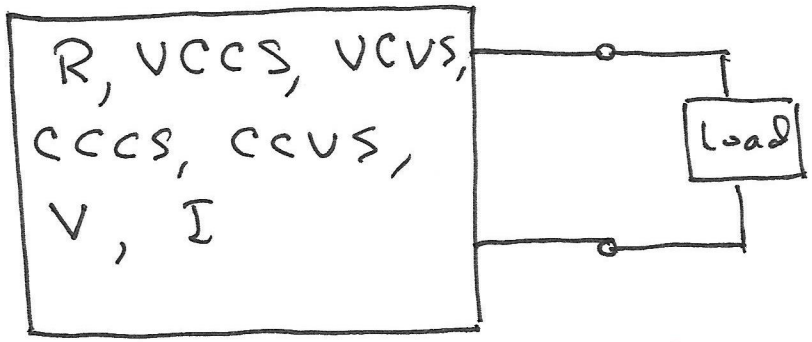
$$V_x = \frac{8}{6+8} \cdot 20$$

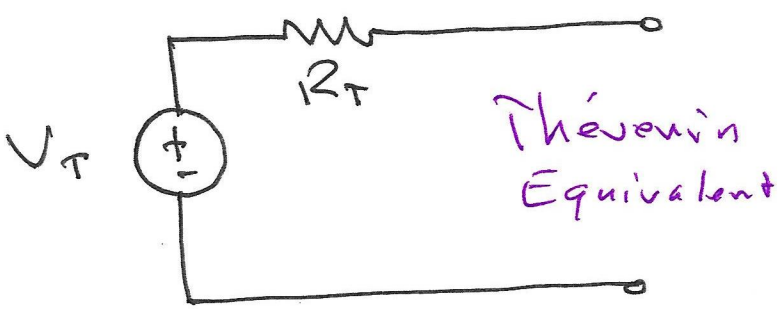
$$= \frac{160}{14}$$

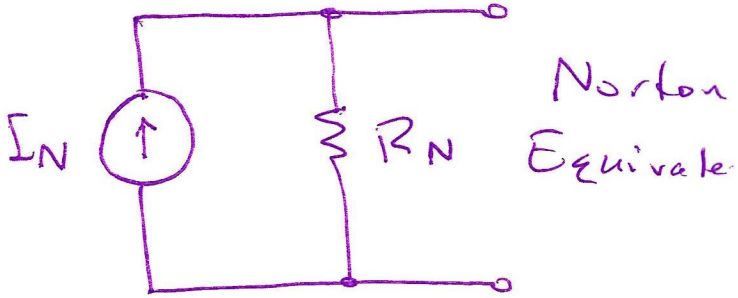
$$= \frac{80}{7}\ V$$

Thévenin's Theorem

Norton's Theorem

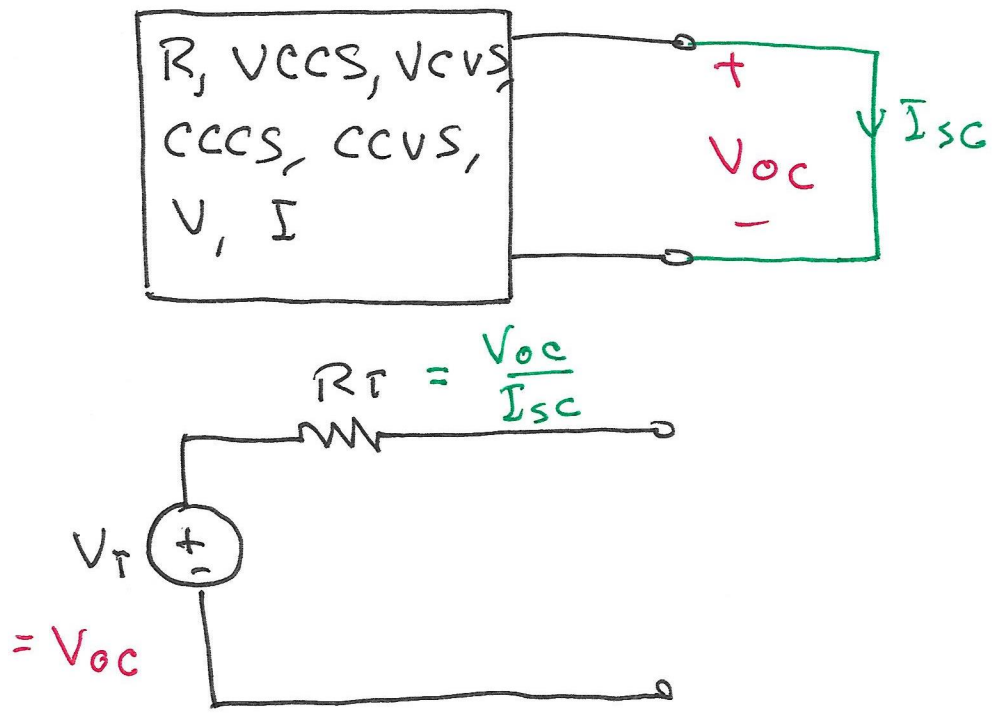


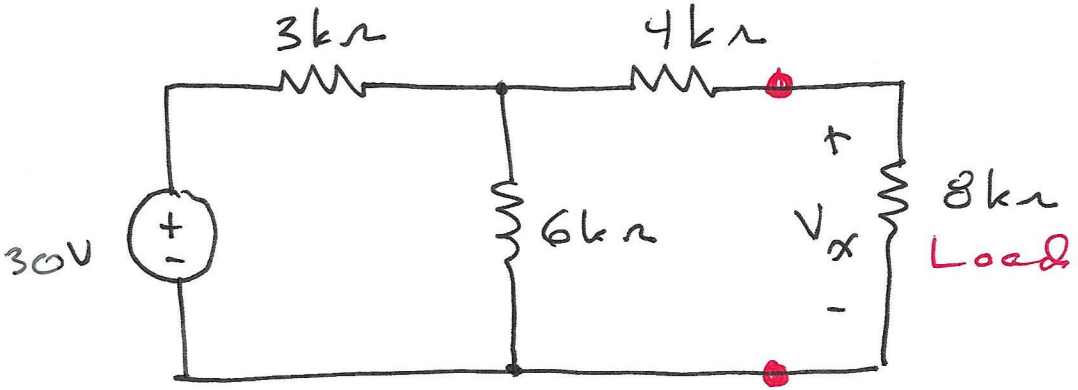


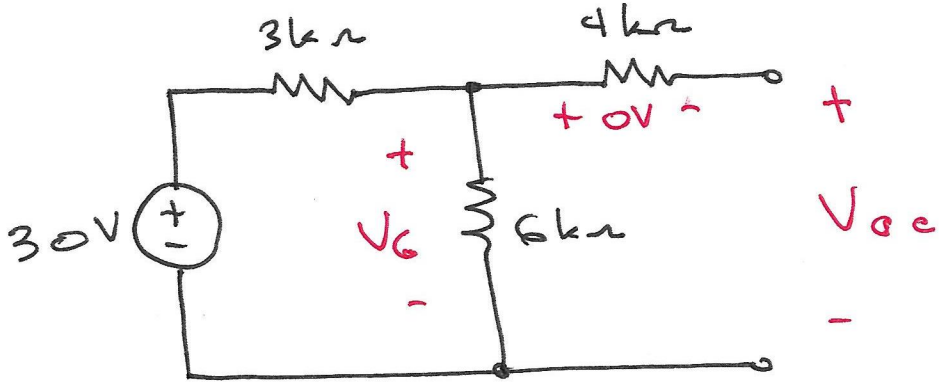


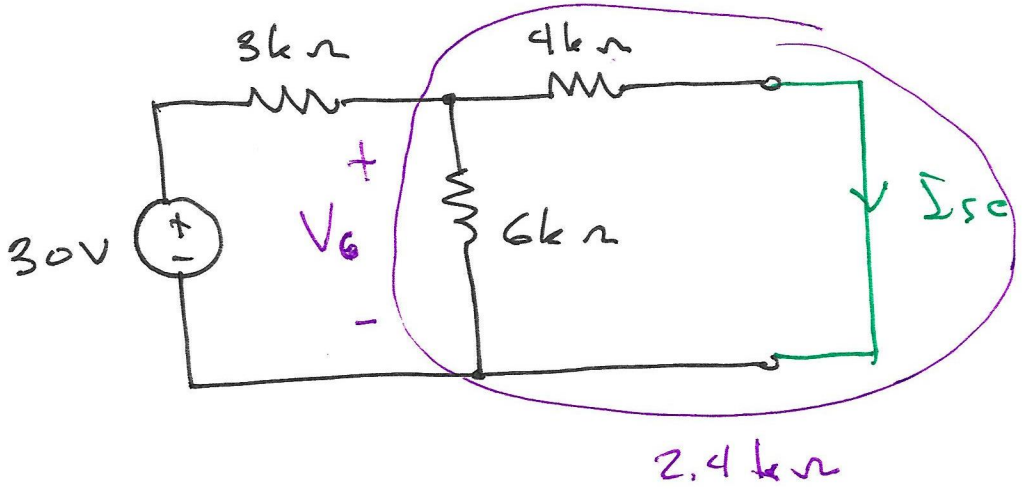
$$R_N = R_T$$

$$V_T = R_N I_N \quad \text{or} \quad I_N = \frac{V_T}{R_T}$$


R, VCCS, VCVS,
CCCS, CCVS,
V, I
+
Voc
−
Isc
RT = Voc / Isc
VT
+
−
= Voc







$$V_6 = \frac{6}{3+6} \cdot 30V$$

$$= 20V$$

$$V_{oc} = V_6 = 20V$$

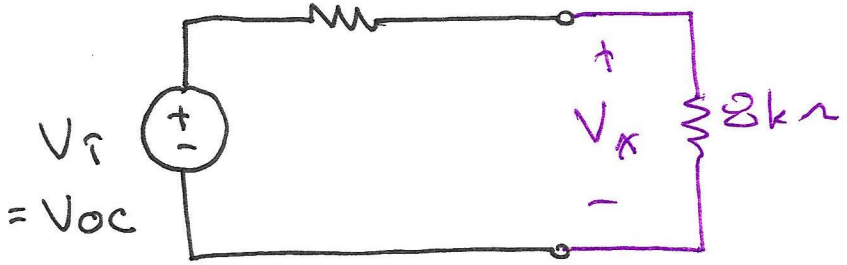
$$V_6 = \frac{2.4}{5.4} \cdot 30V$$

$$= \frac{12}{27} \cdot \frac{30}{10}$$

$$= \frac{120}{9} = \frac{40}{3} V$$

$$I_{sc} = \frac{\frac{40}{3}}{4k} = \frac{10}{3} mA$$

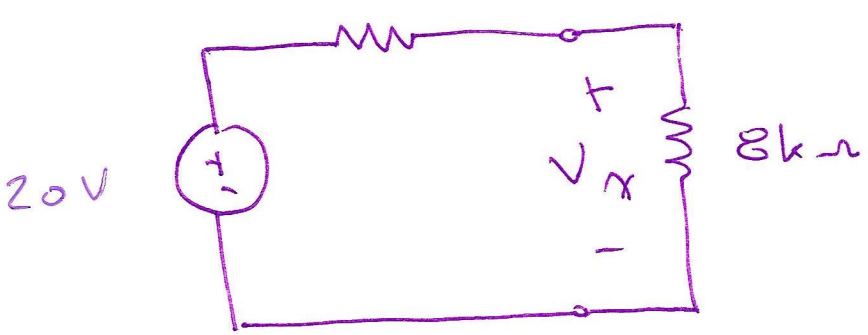
$$R_T = \frac{V_{oc}}{I_{sc}}$$



$$V_T = V_{oc} = 20V$$

$$R_T = \frac{20}{\frac{10}{3}\,mA}$$

$$= 6k\Omega$$

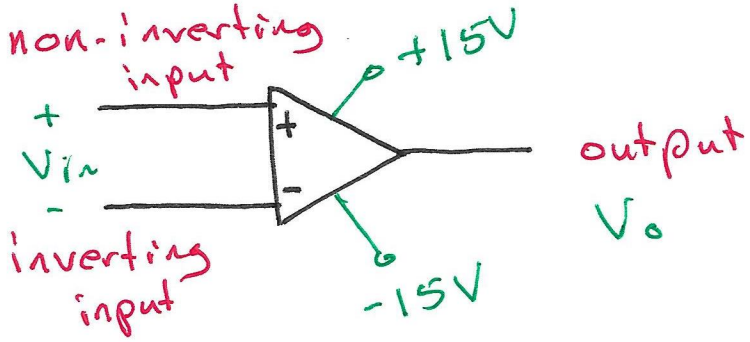


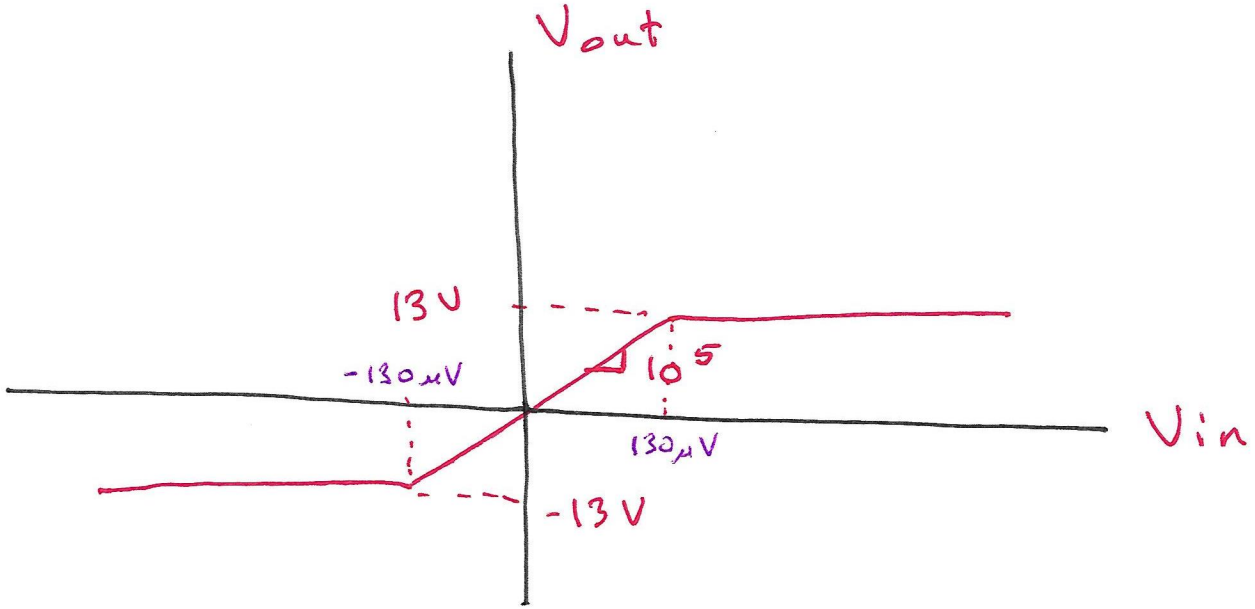
$$V_x = \frac{8}{6+8} \cdot 20$$

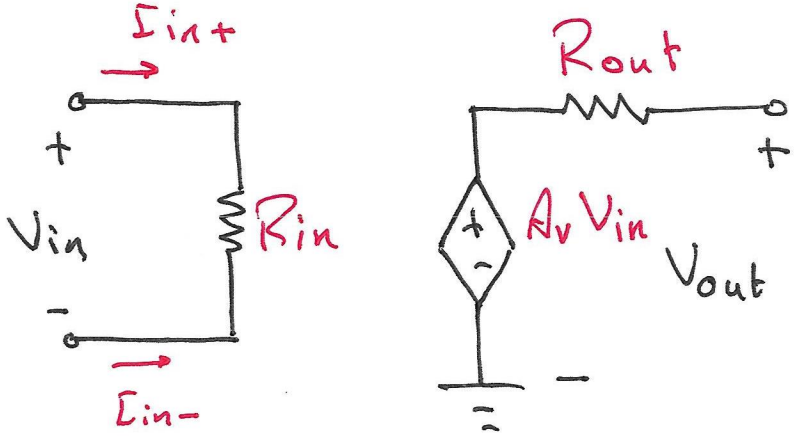
$$= \frac{4}{7} \cdot 20$$

$$= \frac{80}{7}\ V$$

Operational Amplifiers







Op Amp

$A_v \approx 10^5$

$R_{in} \approx 2M\Omega$

$R_{out} \approx 75\Omega$

} LM741

For an ideal OpAmp:

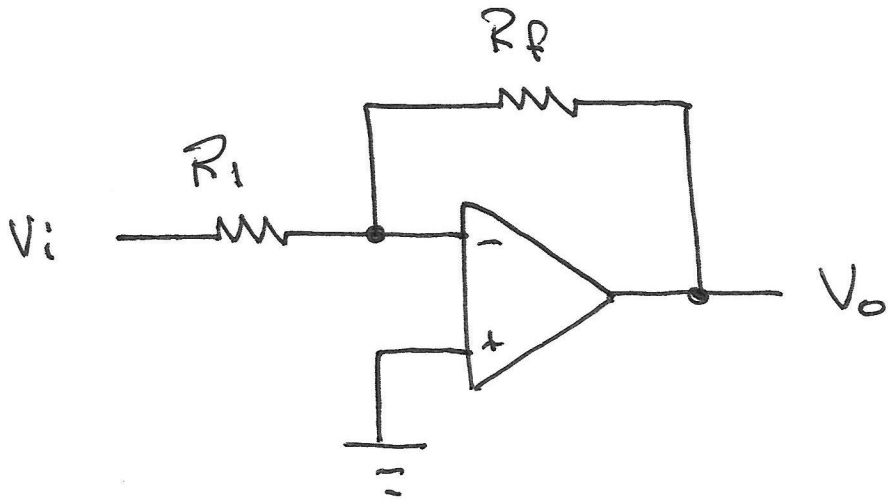
$V_{in} = 0$

$R_{in} = \infty$

$R_{out} = 0$

$A_v = \infty$

$I_{in} = 0$


Rf
R1
Vi
−
+
Vo