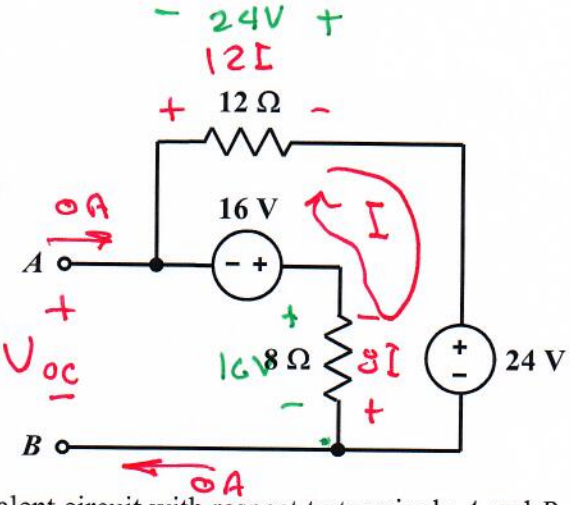
EE/EET 2240

Homework Problem #027



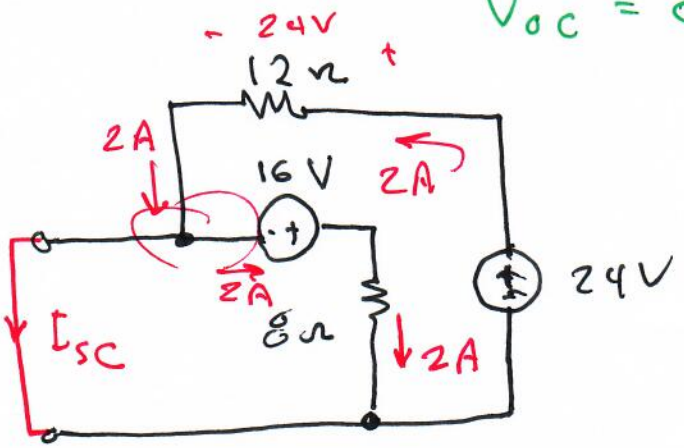
Find the Thévenin equivalent circuit with respect to terminals *A* and *B*.

KVL: $12I + 24 + 8I + 16 = 0$

$20I = -40$

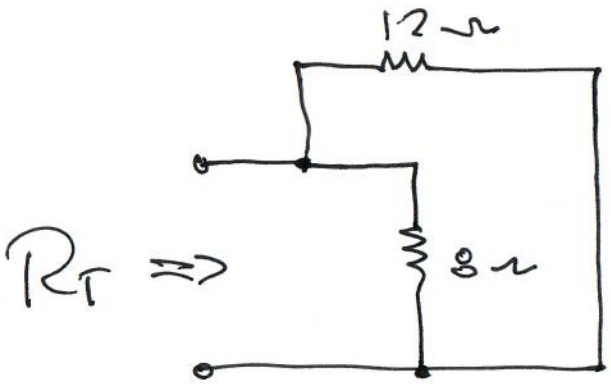
$I = -2\ A$

$V_{OC} = 0\ V = V_T$

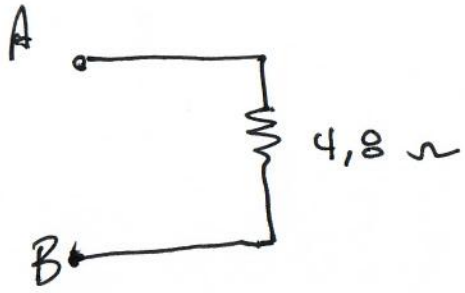


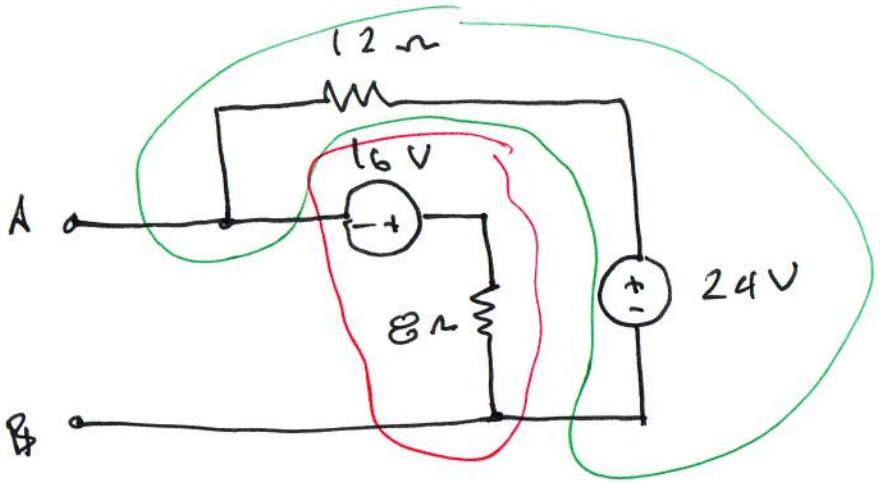
$I_{SC} = 0\ A$

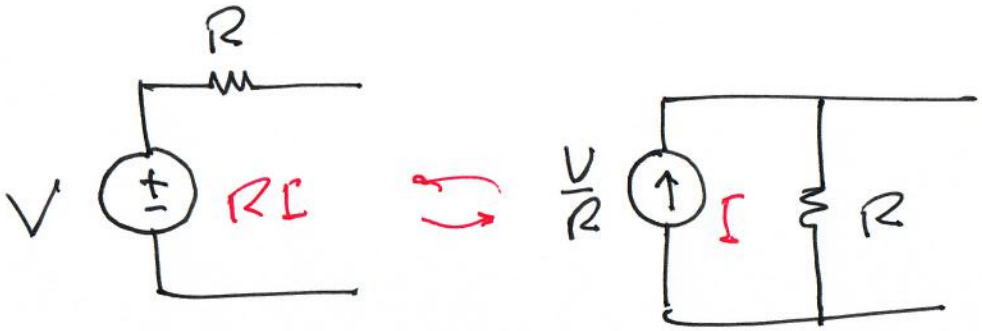
$R_T = \frac{V_{OC}}{I_{SC}} = \frac{0}{0} = ?$



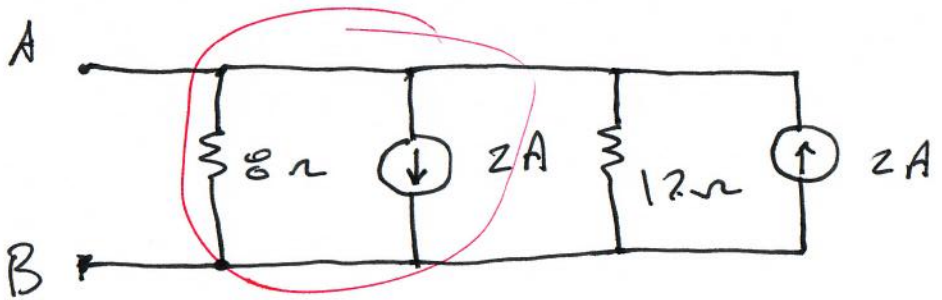
$$R_T = 8\,\Omega \,||\, 12\,\Omega = 4.8\,\Omega$$

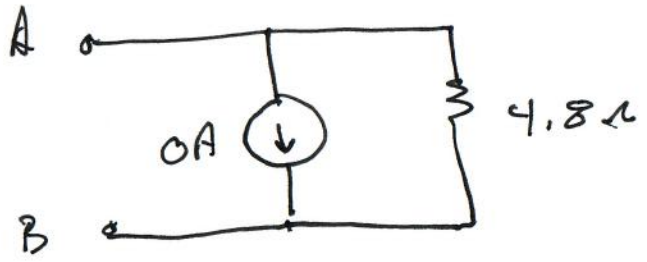


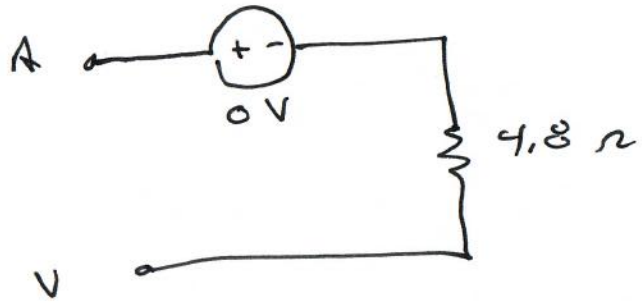


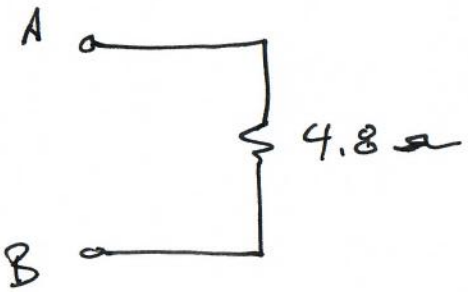


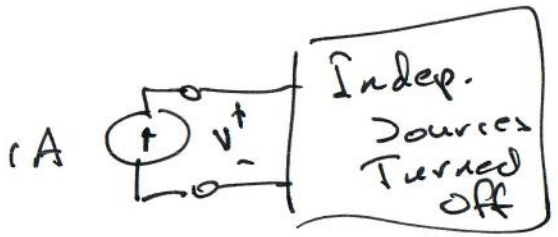
Source Transformation




A
0A
4.8Ω
B


A
+ -
0 V
4.8 Ω
V


A
4.8Ω
B



$$V \equiv R_T = R_N$$

SC => Short Circuit

OC => Open Circuit

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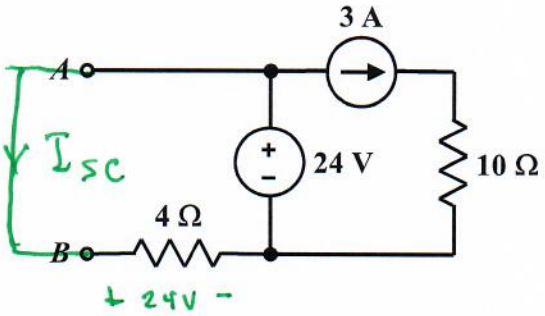
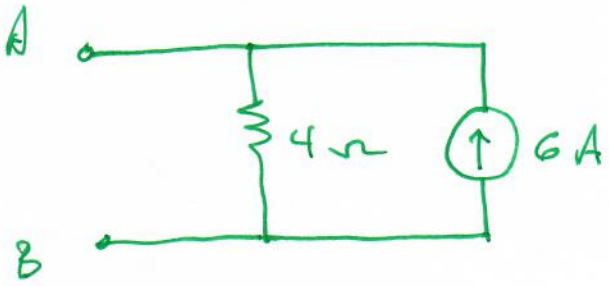
Homework Problem #026



Find the Norton equivalent circuit with respect to terminals *A* and *B*.

$R_T = R_N = 4\,\Omega$

$I_{SC} = 6\,A$



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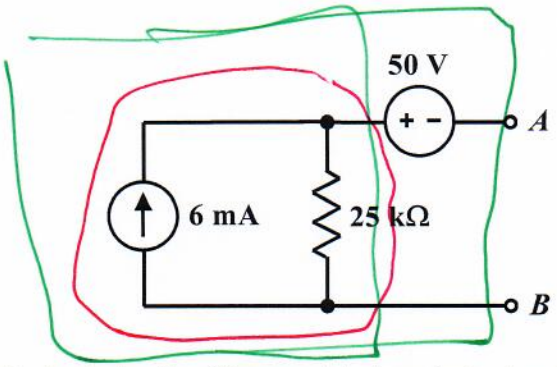
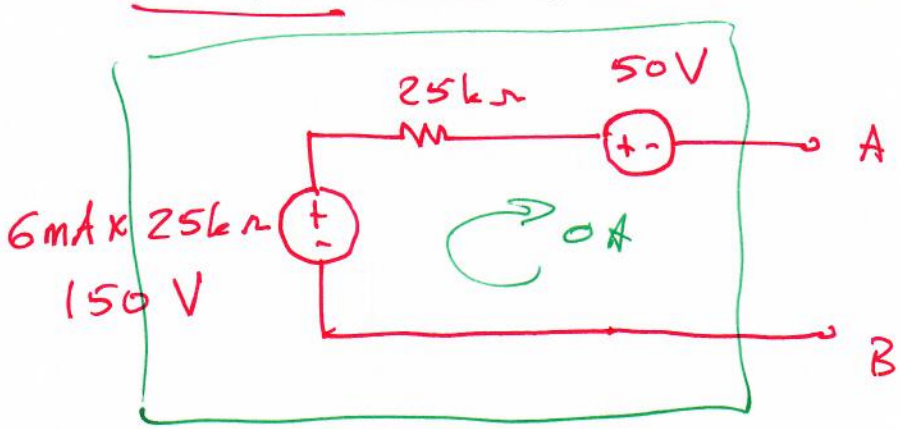
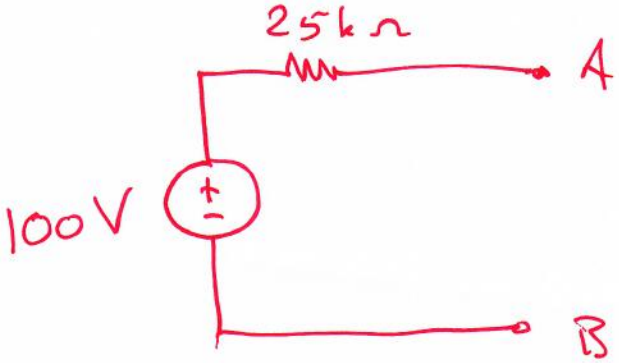
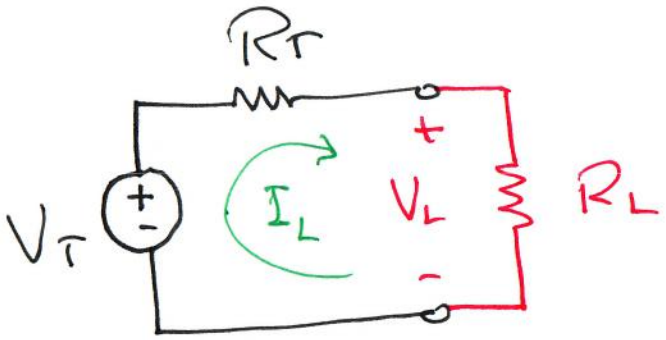
Homework Problem #025



Find the Thévenin equivalent circuit with respect to terminals *A* and *B*.







What value of R_L will absorb maximum power from the circuit?

$$V_L = \frac{R_L}{R_T + R_L} \cdot V_T$$

$$I_L = \frac{V_T}{R_T + R_L}$$

$$P_L = V_L I_L = \frac{R_L V_T^2}{(R_T + R_L)^2}$$

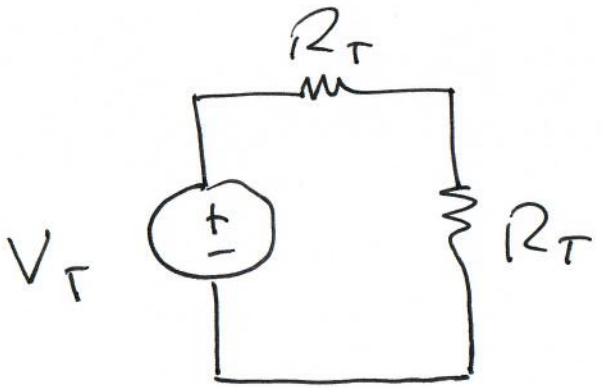
Maximize P_L w.r.t. R_L

$$\frac{dP_L}{dR_L} = \frac{(R_T + R_L)^2 V_T^2 - R_L V_T^2 \, 2(R_T + R_L)}{(R_T + R_L)^2}$$

$$(R_T + R_L)^{\cancel{2}} \cancel{V_T^2} - R_L \cancel{V_T^2} \, 2(\cancel{R_T + R_L}) = 0$$

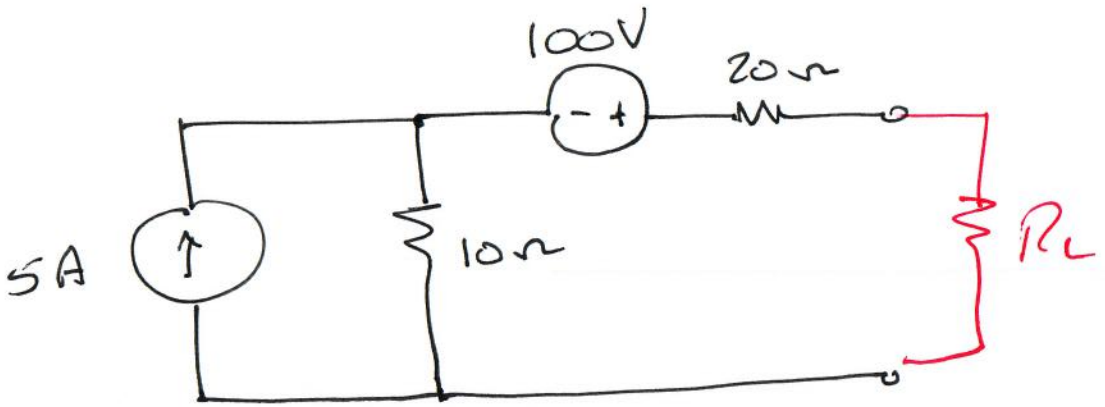
$$R_T + R_L - 2R_L = 0$$

$$R_L = R_T$$

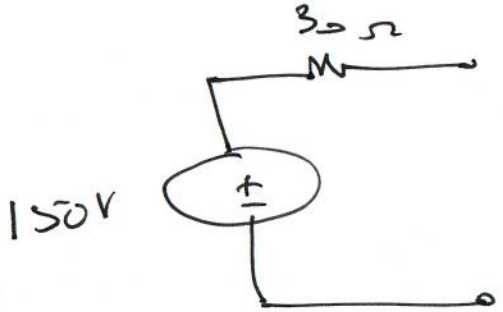


Maximum Power Transfer Theorem

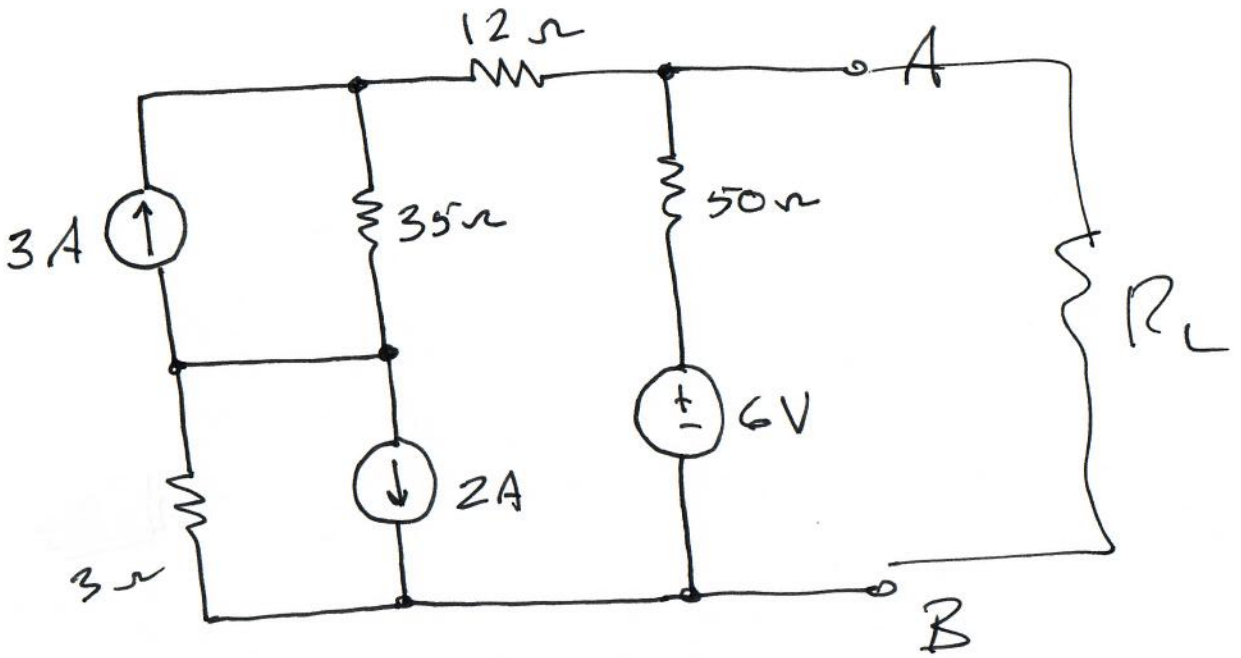
$R_L = R_T$ (or R_N)

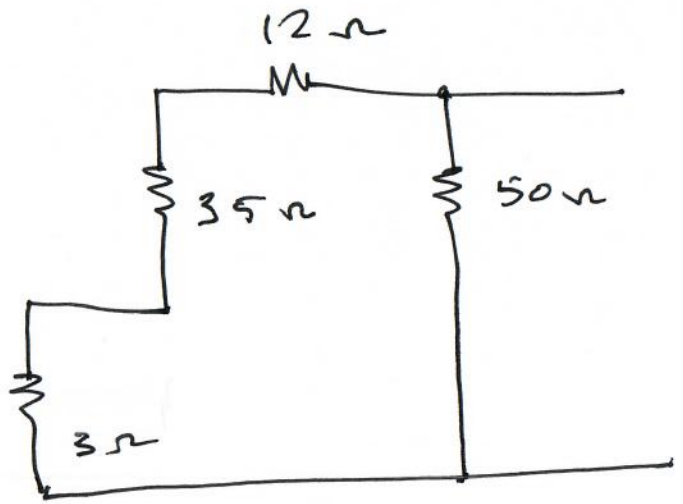


What R_L will absorb max. power?



Choose $R_L = 30\Omega$ for max. power.

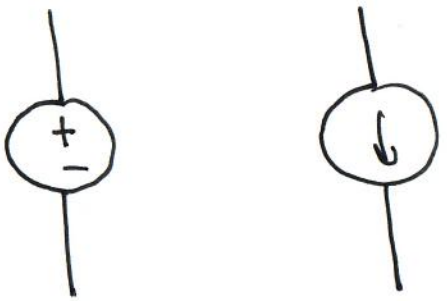




$\Leftarrow R_{eq}$

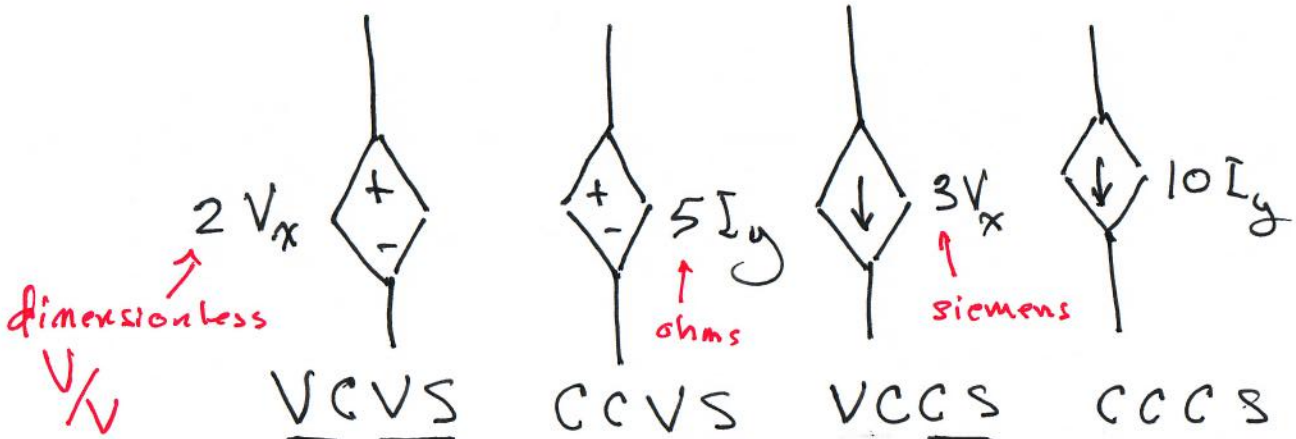
$R_{eq} = 25\Omega$

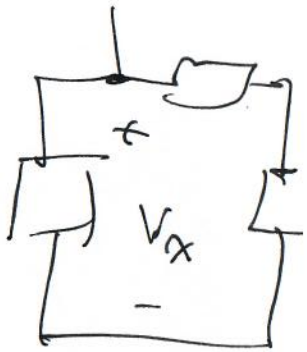
Independent Sources

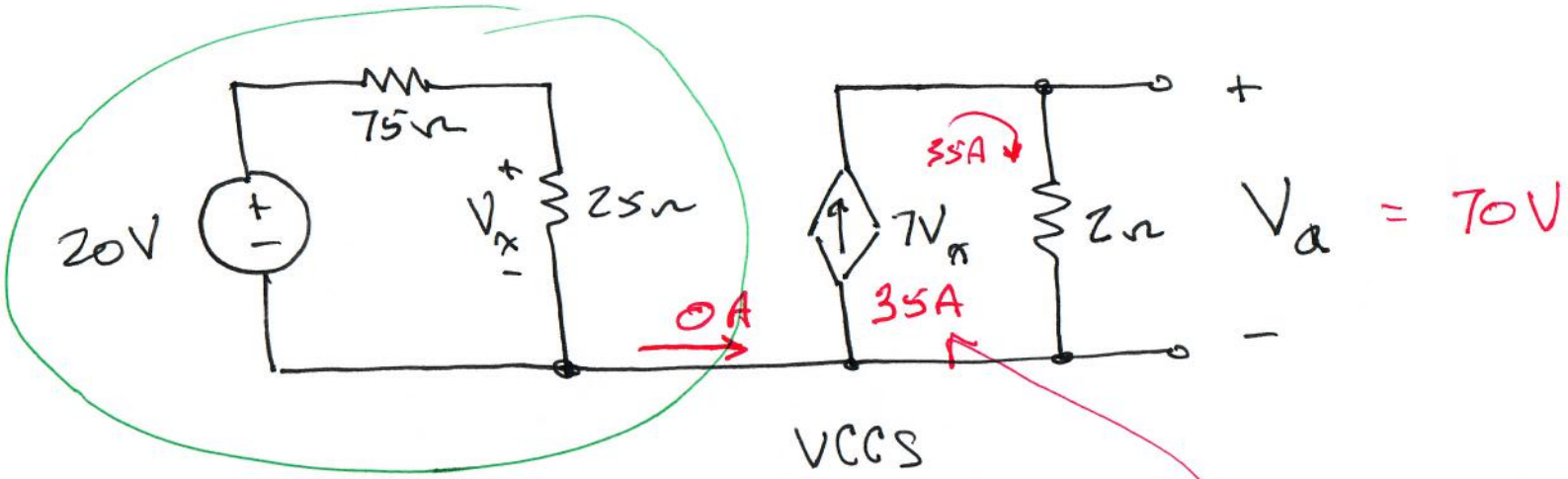


Dependent Sources (Controlled Sources)

E







$V_o = 70V$

$$V_x = \frac{25}{100} \cdot 20 = 5\,V$$