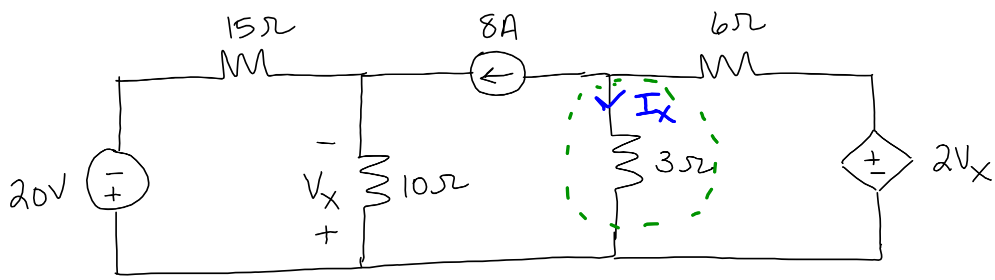
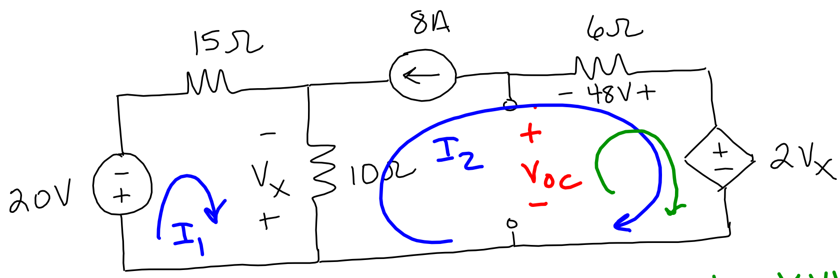



Find $I_x$ using a Thev Eq. ckt.

Find $V_{TH}$




Know

$$\boxed{\begin{aligned} I_2 &= -8A \\ V_x &= 10(I_2 - I_1) \end{aligned}}$$

m1: $-20 - 15I_1 - 10(I_1 - I_2) = 0$

$$-25I_1 = 20 - 10\cancel{I_2}^{-8}$$

$$-25I_1 = 100$$

$$\boxed{I_1 = -4A}$$

by KVL

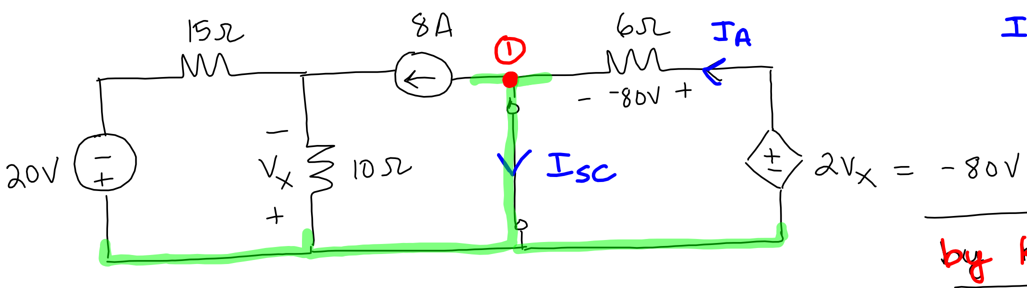
$$V_{oc} + 48 - 2V_x = 0$$

$$V_x = 10(-8+4)$$

$$= -40V$$

$$V_{oc} = 2V_x - 48$$

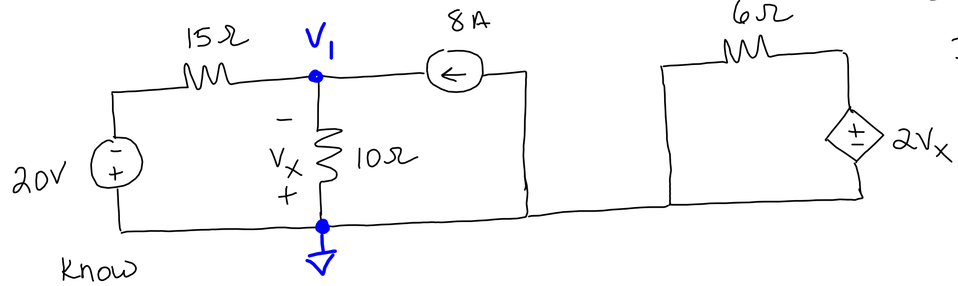
$$\boxed{V_{oc} = -128\ V}$$




$$I_A = \frac{-80}{6}$$
$$= -13.33\ A$$

by KCL @ ①

$$I_A = 8 + I_{sc}$$
$$I_{sc} = I_A - 8$$
$$= -21.33A$$

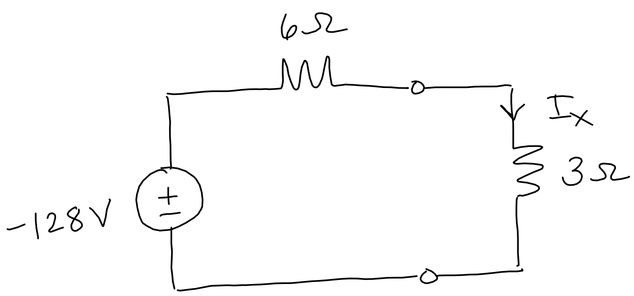



know

$$V_x = -V_1 \qquad \frac{V_1 + 20}{15} + \frac{V_1}{10} - 8 = 0 \Rightarrow V_1 = 40\ V$$
$$V_x = -40V$$

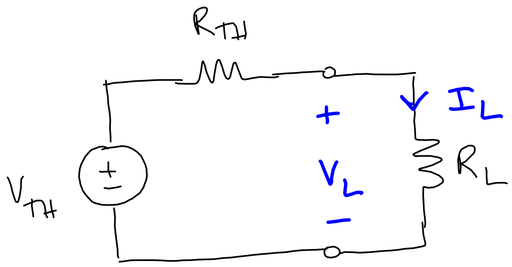
$R_{TH}$

$$R_{TH} = \frac{V_{oc}}{I_{sc}} = \frac{-128}{-21.33} = 6\Omega$$




$$I_x = \frac{-128}{9}$$

$$\boxed{I_x = -14.22\ A}$$




Design $R_L$ such that it will absorb maximum power.

$$I_L = \frac{V_{TH}}{R_{TH} + R_L}$$

$$P_L = I_L^2 \cdot R_L = \left(\frac{V_{TH}}{R_{TH} + R_L}\right)^2 \cdot R_L$$

$$\max P_L \Rightarrow \frac{dP_L}{dR_L} = 0 \Rightarrow \text{solve } R_L$$

$$\frac{Hi}{Ho} \Rightarrow \frac{Ho\,dHi - Hi\,dHo}{Ho\,Ho}$$

$$P_L = V_{TH}^2 \cdot \frac{R_L}{(R_{TH} + R_L)^2}$$

$$\frac{dP_L}{dR_L} = V_{TH}^2 \left( \frac{(R_{TH} + R_L)^2 (1) - R_L\left[2(R_{TH} + R_L)(1)\right]}{(R_{TH} + R_L)^4} \right)$$

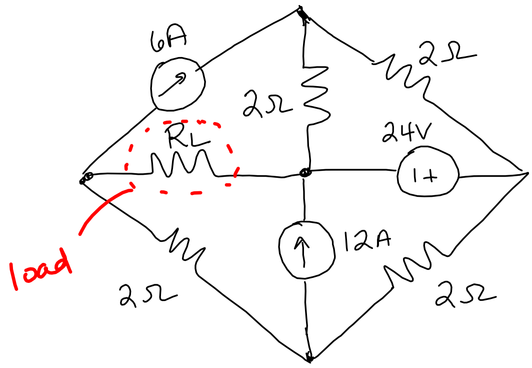
$$(R_{TH} + R_L)^2 - R_L\left(2(R_{TH} + R_L)\right) = 0$$

$$\cancel{(R_{TH} + R_L)}\left[(R_{TH} + R_L) - 2R_L\right] = 0$$

$$R_{TH} + R_L - 2R_L = 0$$

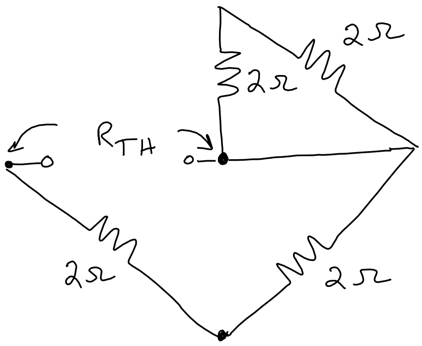
$$R_{TH} = R_L$$

$$\boxed{\text{for maximum power } R_L = R_{TH}}$$




Find $R_L$ for maximum power.

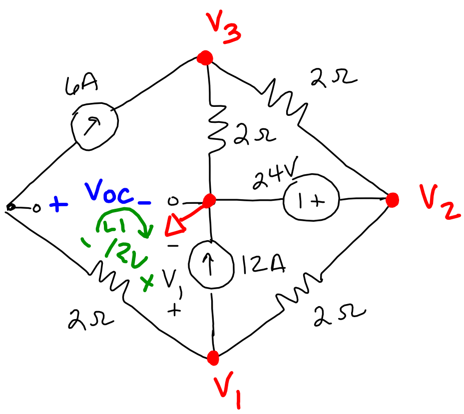
Find $R_{TH}$




$R_{TH} = 2 + 2$
$= 4\Omega$

$R_L = 4\Omega$

Find $V_{TH}$




Know
$V_2 = 24V$

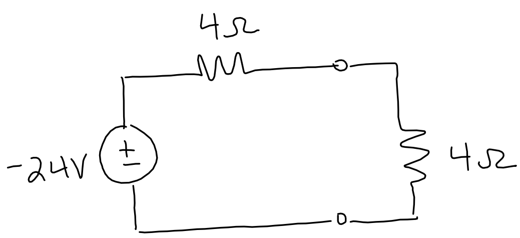
$$N1: \quad 6 + 12 + \frac{V_1 - V_2}{2} = 0$$

$V_1 = -12V$

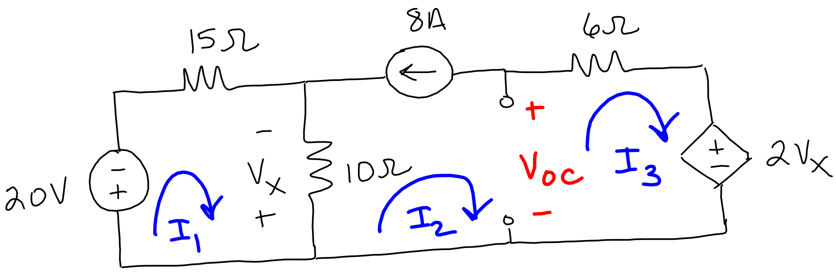
by KVL at L1:

$$-V_{oc} + V_1 - 12 = 0$$

$$V_{oc} = V_1 - 12 = -24V$$




$P_L = 36W$, Abs




Know

$I_2 - I_3 = 0$