Nodal

بكون عندي مقاومات و Current Source نطبق ا) مجموع التيارات الداخلة

Applying KCL

$\Sigma I_i = (\quad) V - V - V \quad$ ٢)

Self conduct — Mutual — Mutuall

المتصلة اتصال مباشر

أو : ١) $\Sigma I_{in} = \Sigma I_{out}$

٢) $I = \frac{V}{R}$

Suppernode

بكون عندي Independent Voltage Source = بين 2Node

١) نعمل $IVS = 0$ وبعد بنطبق KCL على كل الدائرة ونعمل

$I = \frac{V}{R}$

لازم تكون بين 2 nonreference node

Mesh:

لعند كم mesh عندي ونعمل KVL

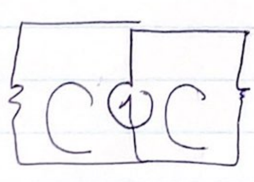
التيار طالع $\oplus$ +V

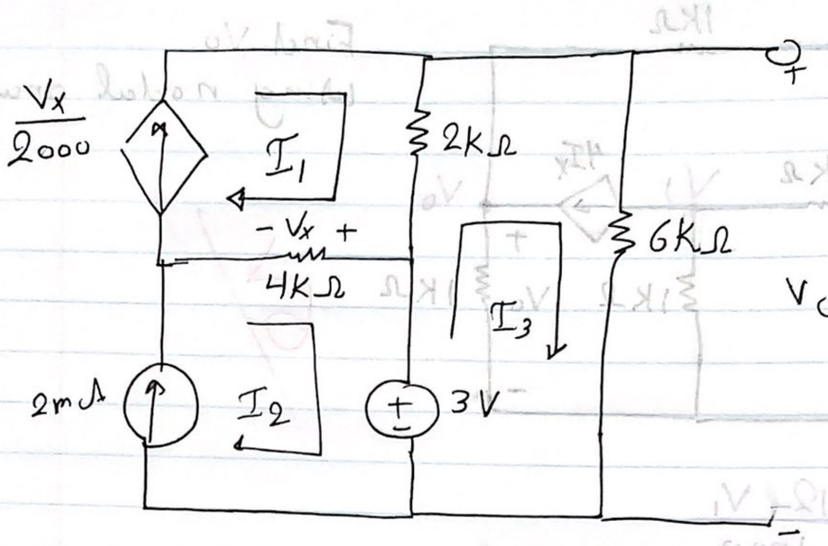
التيار نزل الحش داخل $\ominus$ -V

$\pm V = (SR) I_{mesh} - (MR) I$

Suppermesh

لما يكون عندي Current Source بين 2meshel





using mesh analysis Find I_2, V_o, I_3, I_1

$I_2 = 2\,mA$

$V_x = 4000(I_1 - I_2)$

$V_x = 4000\,I_1 - 8\,\cancel{I_2}$

$I_1 = \frac{V_x}{2000}$

$I_1 = \frac{4000\,I_1}{2000} - \frac{8}{2000}$

$-I_1 = -4 \times 10^{-3}$

$I_1 = 4\,mA$

To find I_3

mesh 3

$3 = 8000\, I_3 - 2000\, I_1$

$3 = 8000\, I_3 - 2000 \times 4 \times 10^{-3}$

$3 = 8000\, I_3 - 8$

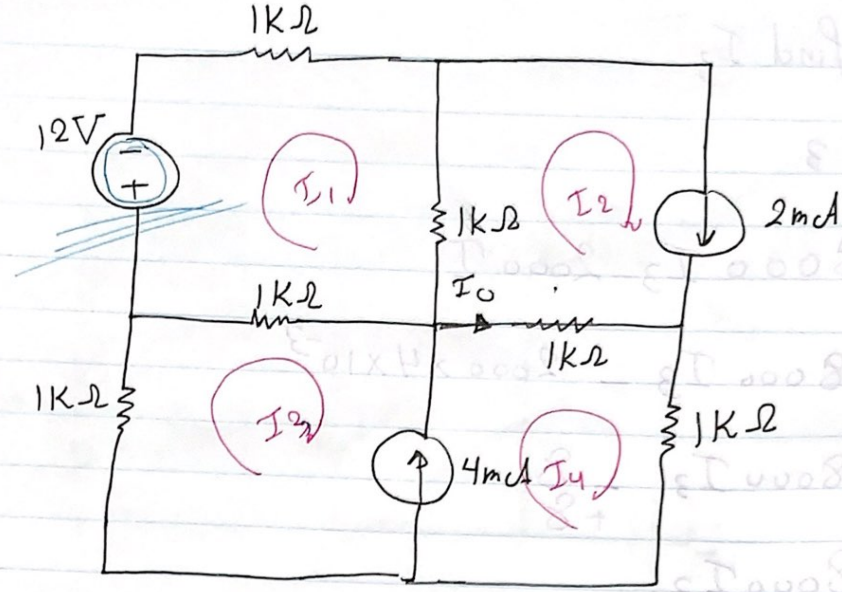
$+8 \qquad\qquad +8$

$11 = 8000\, I_3$

$I_3 = 1.375\, mA$

$V_o = 6\, I_3$

$= 8.25$



Find I_o a) 1.45 b) -0.55 c) -2.55 d) -4.2

$I_2 = 2mA$

$12 + 1K I_1 + 1K(I_1 - I_2) + 1K(I_1 - I_3) = 0$

Substitute $I_2 = 2mA$

$12 + 3K\, I_1 - 2 - 1K I_3 = 0$

$3I_1 - I_3 = -0.01 \longrightarrow (2)$

Supermesh

$1K\, I_3 + 1K(I_3 - I_1) + 1K(I_4 - I_2) + 1K I_4$

$2I_3 - I_1 + 2I_4 = 2mA$

$I_4 - I_3 = 4mA$

$$\begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & 2 \\ 0 & -1 & 1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} -0.1 \\ 2\,mA \\ 4\,mA \end{bmatrix}$$

$I_1 = -4.18\,mA$

$I_3 = -2.545\,mA$

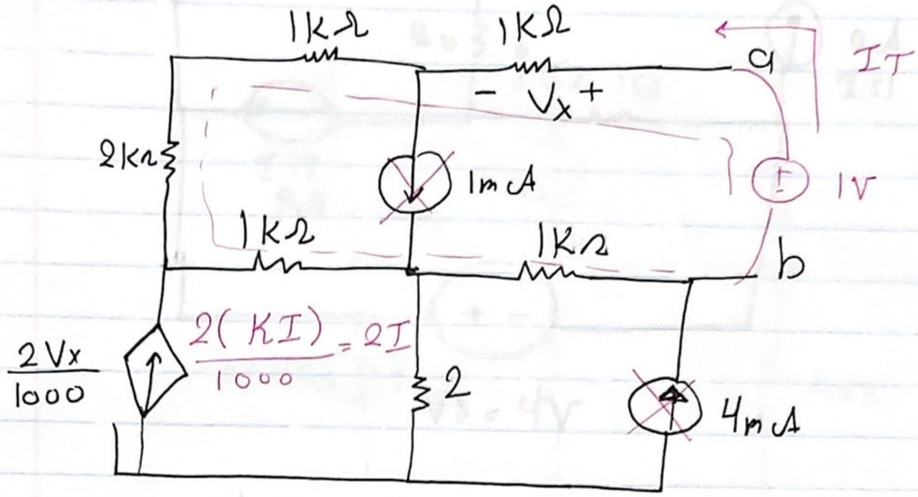
$I_4 = 1.45\,mA$

$I_o = I_4 - I_2$

$= 1.45\,mA - 2\,mA$

$I_o = -0.55\,mA$

Find Thevenin's equivalent Circuit



dep + ind sources

$V_x = I\,1K$

Connect 1V

KVL

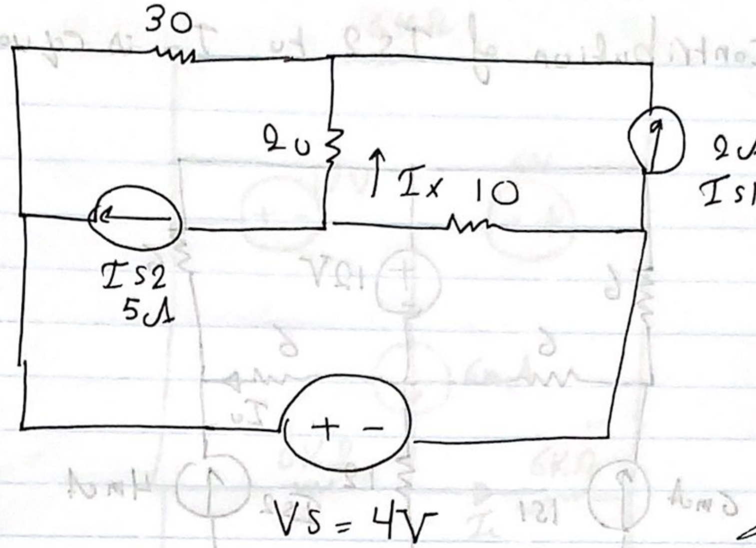
$-1 + 1KI + 1KI + 2KI + (3I)1K + 1K(I) = 0$

$1 = 8KI$

$I = \frac{1}{8K}$

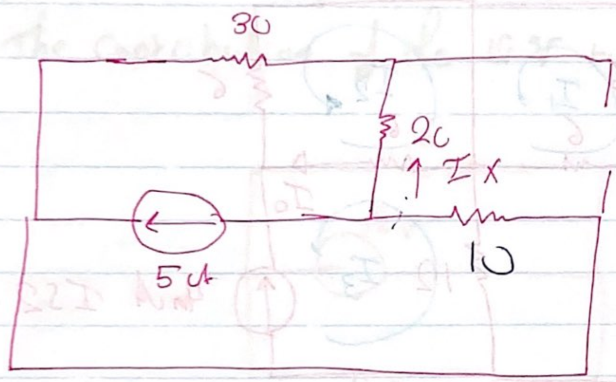
$R_{th} = \frac{1}{\frac{1}{8}} = 8K\Omega$

$V_{th} = -8V$



Huda AbuZayed

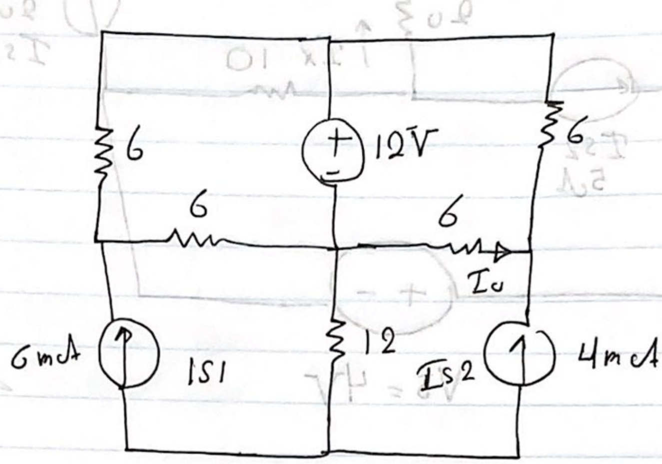
Contribution Is2 to Ix

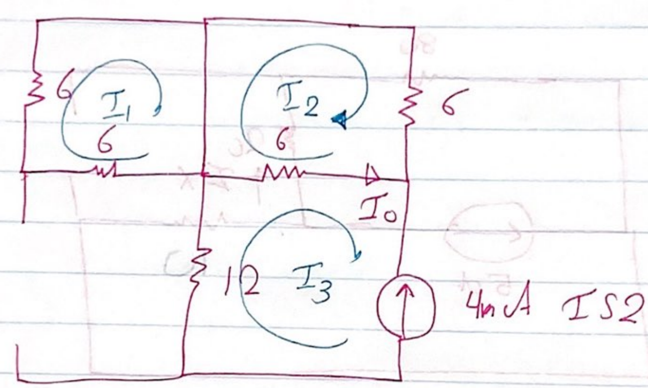


Current divider Rule

$$-\frac{5\times10}{20+30+10} = -0.833\ A$$

The contribution of I_{S2} to I_o is equal





$I_3 = -4mA$ $\qquad$ $I_3 = -4mA$

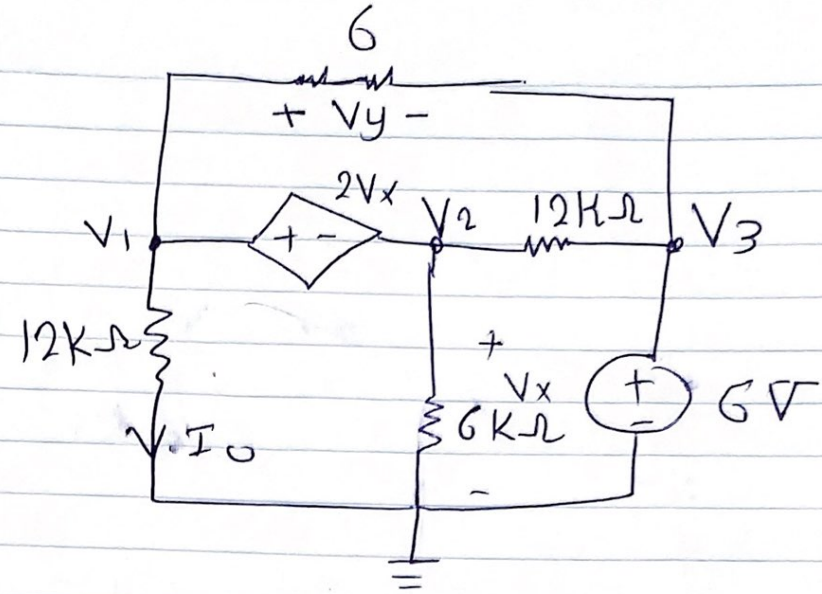
$I_o = I_3 - I_2$

$= -4 - I_2 \quad = -4 + 2 = -2mA$

mesh 1 $\quad 12 I_1 = 0$

mesh 2 $\quad 12 I_2 - 6 I_3 = 0$

$12 I_2 + 24 = 0 \qquad 12 I_2 = -24 \quad I_2 = -2$



Suppernode

$V_1 - V_2 = 2V_x \qquad V_x = V_2$

$V_1 - V_2 = 2V_2$
$+V_2 \quad +V_2 \qquad V_1 = 3V_2$

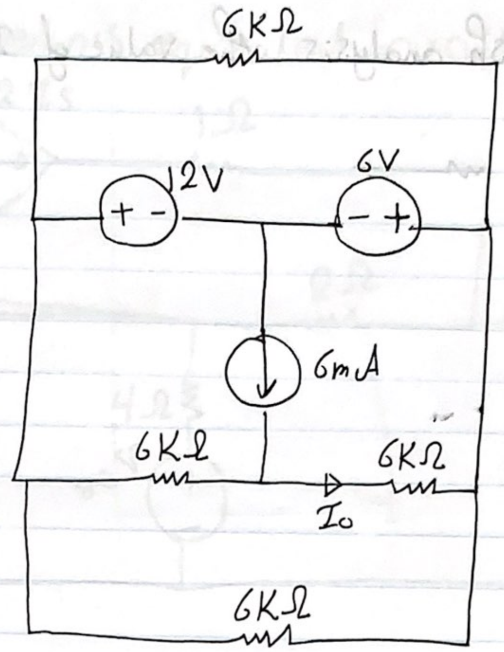
$\left(\frac{1}{6} + \frac{1}{12}\right) V_1 + \left(\frac{1}{12} + \frac{1}{6}\right) V_2 - \frac{1}{12K} V_3 - \frac{1}{6} V_3 = 0$

$0.25 V_1 + 0.25 V_2 - 1.5\times10^{-3} = 0$
$\times10^{-3}$

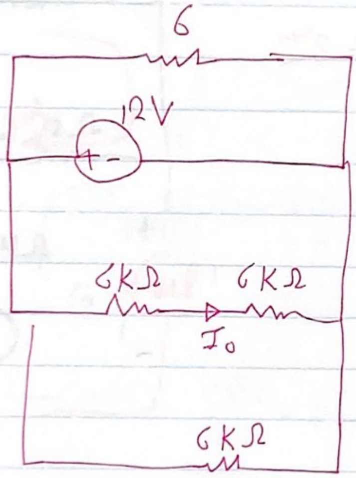
$0.25\times10^{-3} V_1 + 0.25\times10^{-3} V_2 = 1.5\times10^{-3}$

$0.75\times10^{-3} V_2 + 0.25\times10^{-3} V_2 = 1.5\times10^{-3}$

$1\times10^{-3} V_2 = 1.5\times10^{-3} \qquad V = 1.5V$



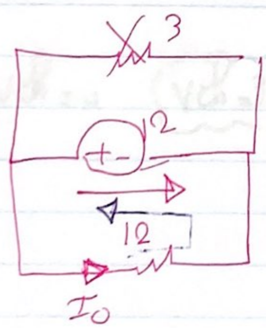
The contribution of the 12 V to I_o.



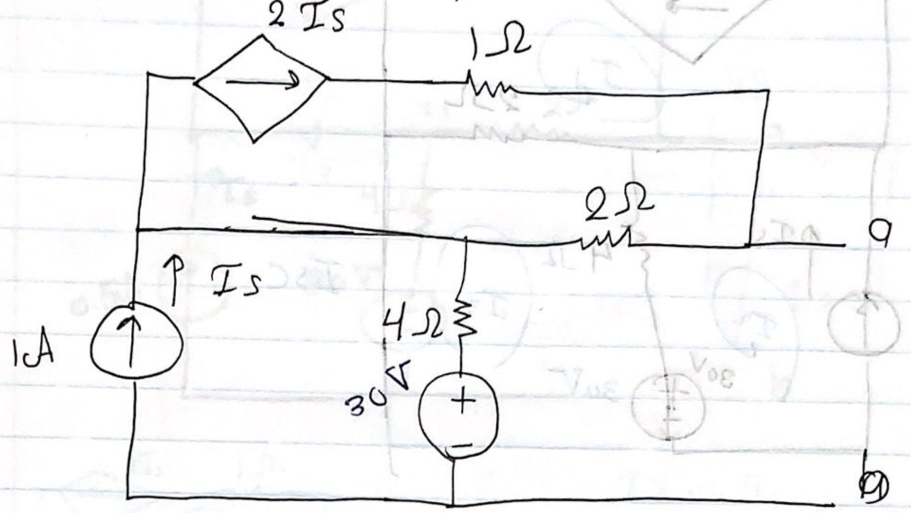
$6 // 6 = 3$

Kill مابلزمني

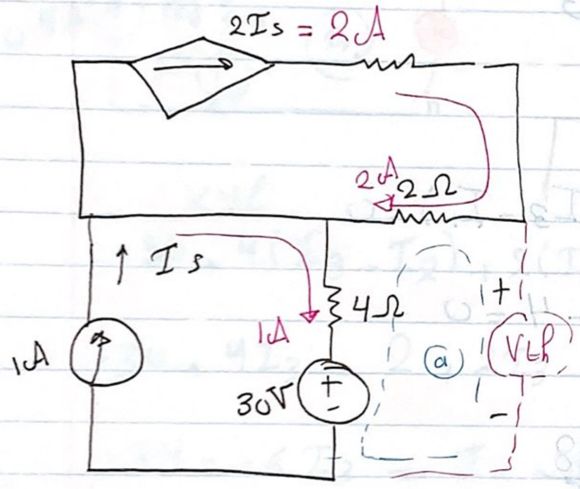
$I_o = \frac{V}{R} = \frac{12}{12} = 1$



Find Thevenin's equivalent circuit a, b



S1) $R_{th} = \frac{V_{th}}{I_{sc}}$

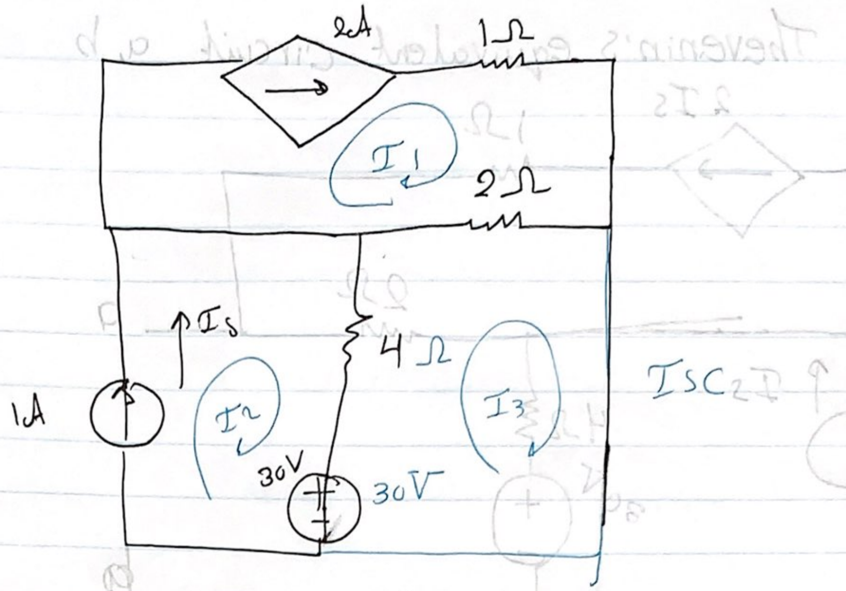


$R_{th} = \frac{V_{th}}{I_{sc}}$

$I_s = 1A$

KVL

$-30 - 4 - 4 + V_{th} = 0$ $V_{th} = 38$



$I_1 = 2A$

$I_2 = 1A$ $I_{SC} = -I_3$

at mesh 3

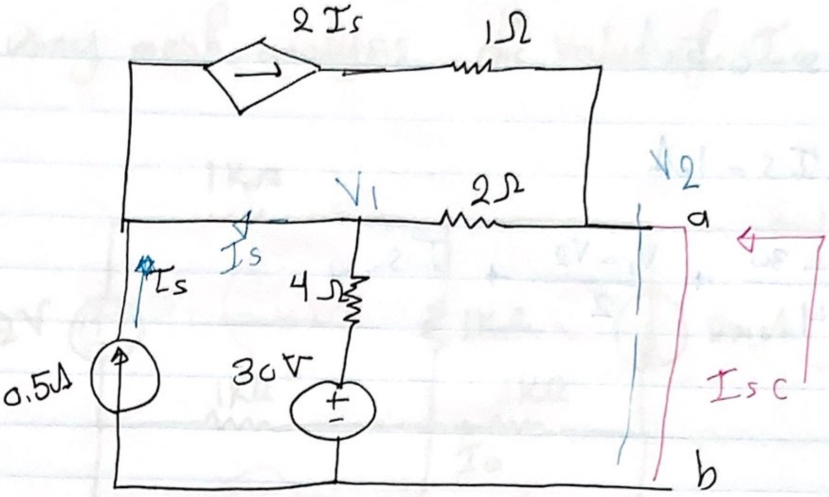
$-30 + 4(I_3 - I_2) + 2(I_3 - I_1) = 0$

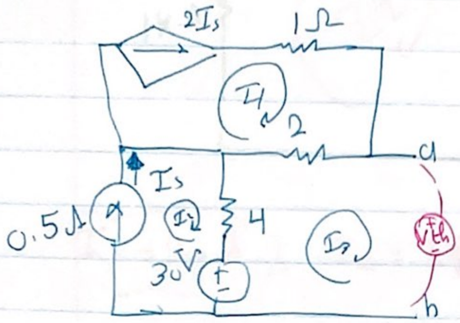
$-30 + 4I_3 - 4 + 2I_3 - 4 = 0$

$-38 = -6I_3$ $I_3 = -\frac{38}{6}$

$R_{th} = \frac{V_{th}}{R_{th}} = \frac{38}{\frac{38}{6}} = 6\Omega$

$V_{th} = 38V$ & $R_{th} = 6\Omega$



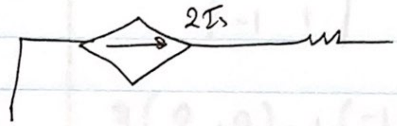


$I_s = 0.5$

$I_1 = 1$

$-30 \quad I_2 = 0.5$

$I_3 = -I_{ss} \Rightarrow I_{sc} = -I_3$



KVL

$$-30 + 4(I_3 - I_2) + 2(I_3 - I_1) = 0$$

$$-30 + 4I_3 - 2 + 2I_3 - 2\cancel{I_1} = 0$$

$$-34 = -6I_3 \Rightarrow I_3 = \frac{34}{6} \Rightarrow I_{sc} = -\frac{34}{6}$$

$$V_{th} \Rightarrow -30 + 4I_2 - 2I_1 + V_{th} = 0$$

$$-30 - 2 - 2 + V_{th} = 0$$

$$+34 = V_t$$

$$R_{th} = \frac{V_{th}}{I_{sc}} = \frac{34}{\frac{34}{6}} = 6\Omega$$

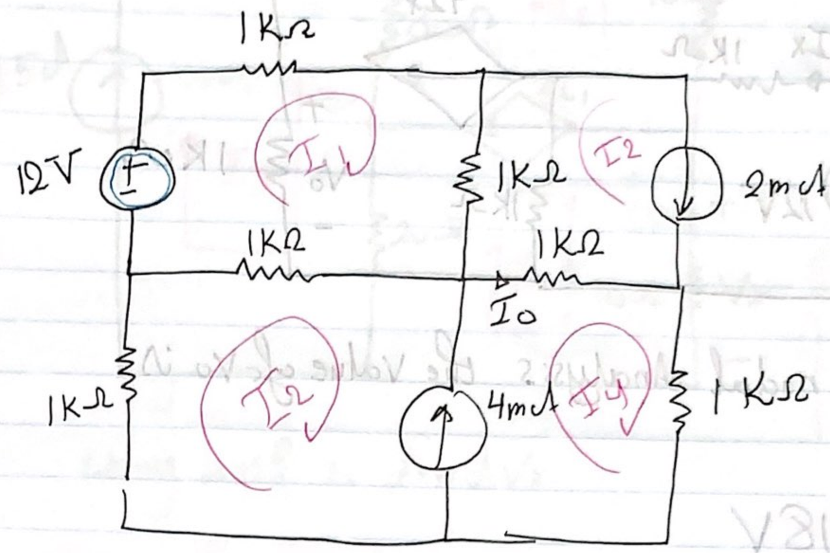
$V_{th} = 34\,V$

$I_s = 0.5A$

$2I_s = 1A$

$$\frac{V_1 - 36}{4} + \frac{V_1 - V_2}{2} + I_s = 0$$

using mesh analysis the value of I_o is equal



$I_1 = 2mA$ $I_o = I_4 - I_2$

Mesh 1

$-12 + 3KI_1 - 2 - 1KI_3 = 0$

$0.014 = 3I_1 - I_2$

$I_4 - I_3 = 4mA$

$3I_3 - I_1 + 2I_4 = 2mA$

$$\begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & 2 \\ 0 & -1 & 1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_3 \\ I_4 \end{bmatrix} = \begin{bmatrix} 0.014 \\ 2mA \\ 4mA \end{bmatrix}$$

$I_o = I_2 - I_4 = -1.63\times10^{-3}$

$$\Delta = 3\begin{vmatrix} 2 & 2 \\ -1 & 1 \end{vmatrix} + 1\begin{vmatrix} -1 & 0 \\ -1 & 1 \end{vmatrix} + 0$$

$3(2+2) + 1(-1)$

$12 - 1 = 11$

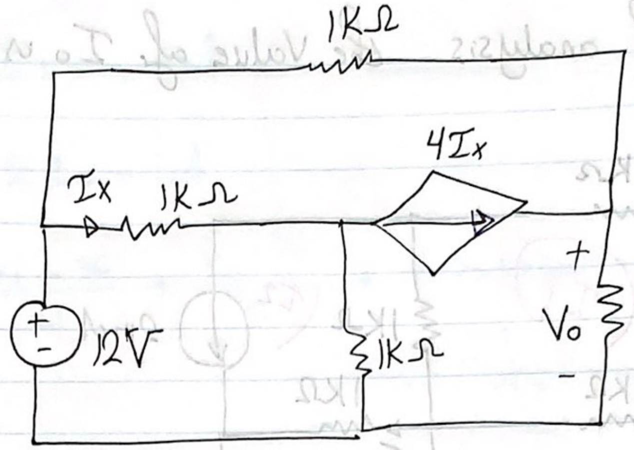
$$N_3 = \begin{vmatrix} 3 & -1 & 0.014 \\ -1 & 2 & 2mA \\ 0 & -1 & 4mA \end{vmatrix}$$

$$3\begin{pmatrix} 2 & 2\times10^{-3} \\ -1 & 4\times10^{-3} \end{pmatrix} + 1\begin{pmatrix} -1 & 0.014 \\ -1 & 4\times10^{-3} \end{pmatrix}$$

$3(0.01) + 0.01$

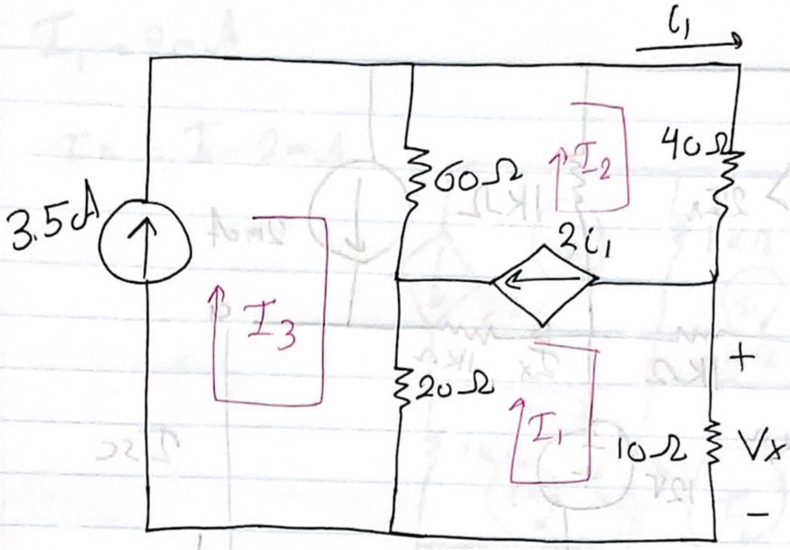
$= 0.04$

$I_4 = \frac{0.4}{11} = 3.63\times10^{-3}$



Using nodal Analysis the Value of Vo is

18V



using mesh to find Vx

$2i_1 = I_2 - I_1$

$i_1 = I_2$

$I_3 = 3.5$

$I_2 = -I_1$

Suppermesh 1 & 2

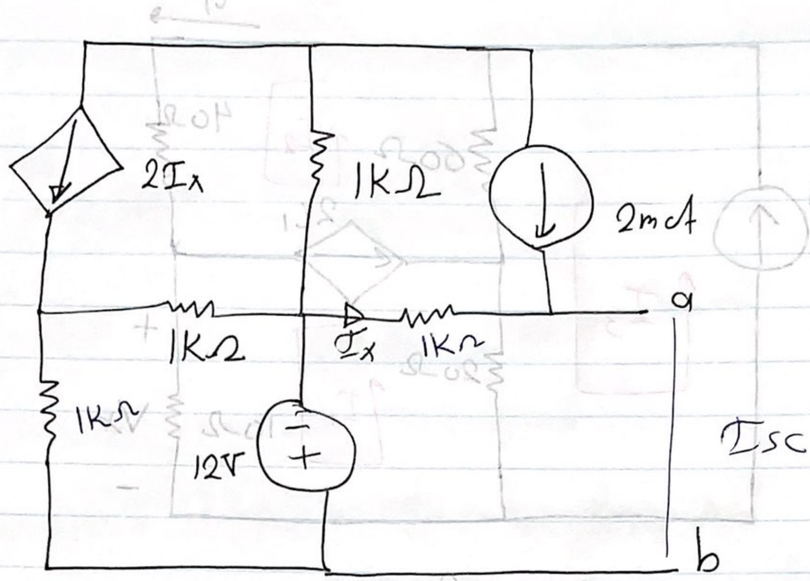
$0 = 30I_1 - 80I_3 + 10I_2$

$= 30I_1 - 280 + 100I_2$

$280 = 30I_1 - 100I_1$

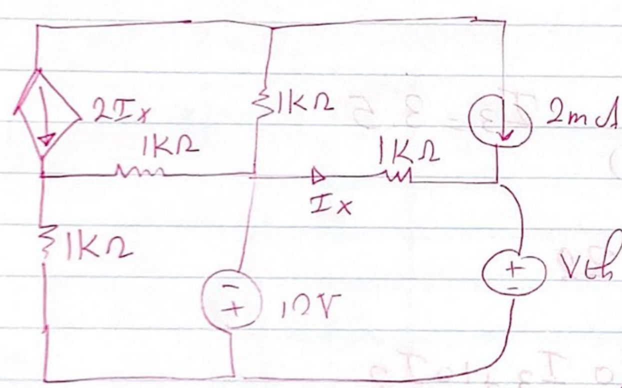
$\frac{280}{-70} = \frac{\cancel{-70}I_1}{\cancel{-70}}$

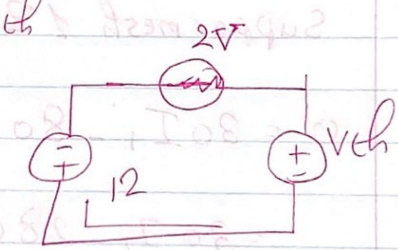
$-4 = I_1$ $\quad V_x = IR = -40V$



Vth = ??

Source transformation





KVL

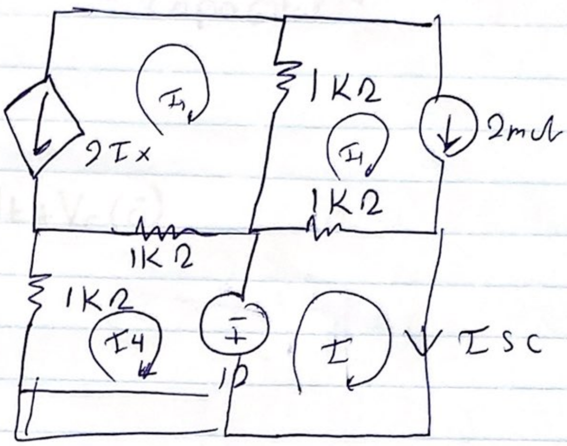
$12V - 2V + Vth = Zero$

$Vth = -10\ V$

T

$I_1 = 2mA$

$I_x = I - 2mA$



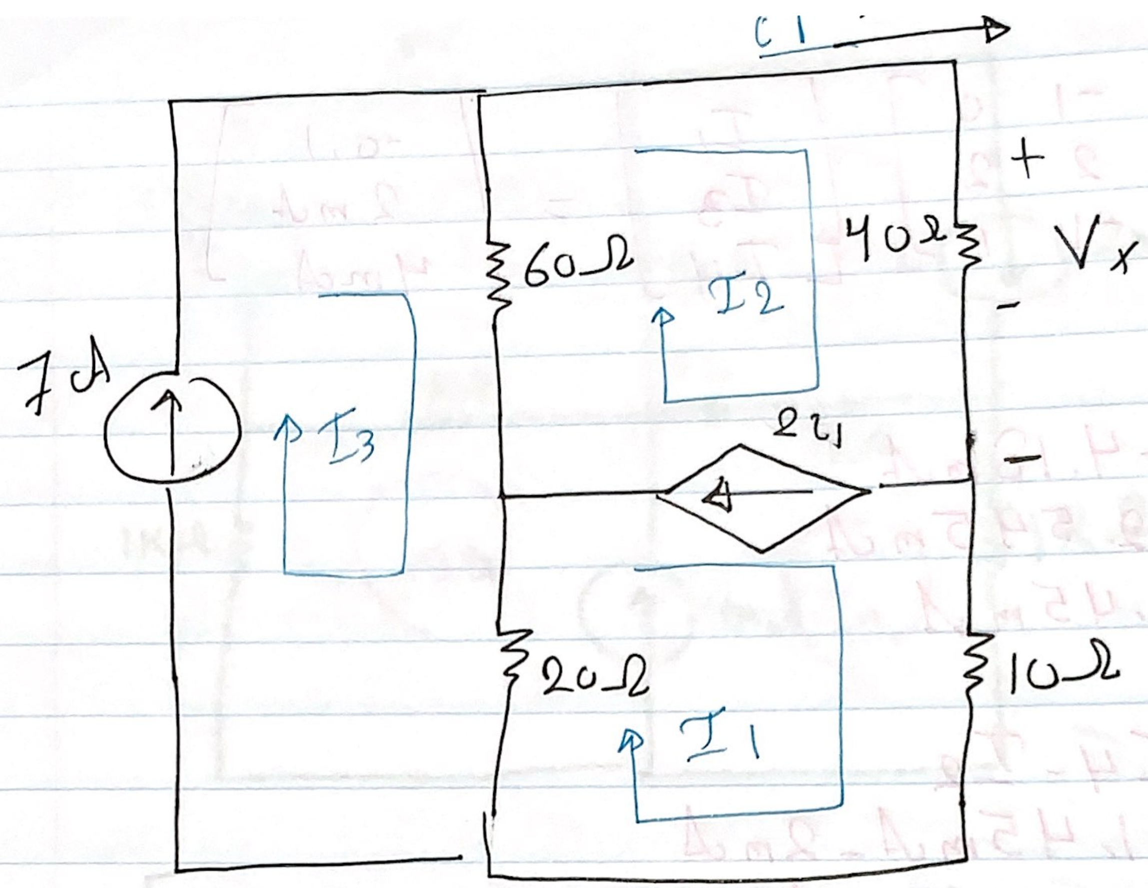
$$12 + 1K(I - 2mA) = 0$$

$$12 + 1KI - 2 = 0$$

$$10 + 1KI = 0$$

$$I = -10$$

$$R_{th} = \frac{V_{th}}{I_{sc}} = \frac{-10}{-10} = 1k\Omega$$



Find Vx using mesh analysis