Name: Md Raihanul Islam Bhuiyan

Id: 2010239

Section: CSE 10

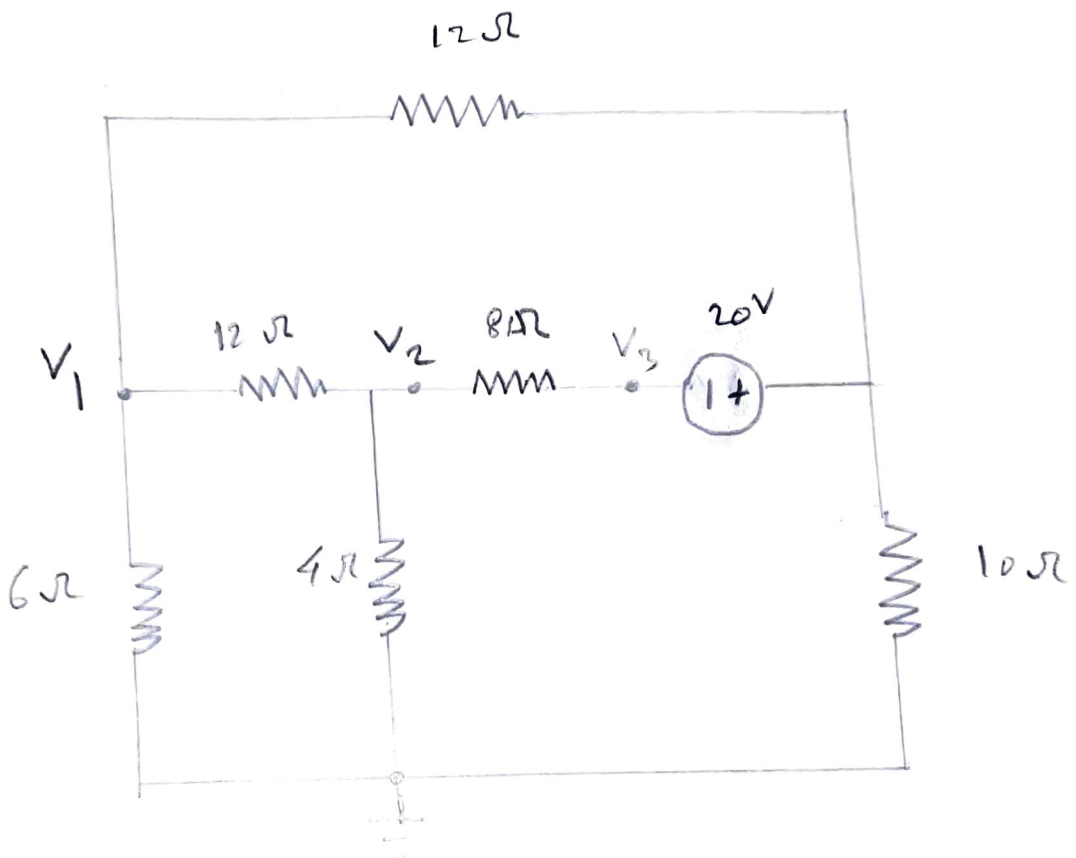
Course: CSE 250

Assignment: 2

CSE - 250

Assignment - 2

Ans to the Q^s N: 1



Equation for Node 1:

$$V_1\left(\frac{1}{12}+\frac{1}{6}+\frac{1}{12}\right)-\frac{V_2}{12}-\frac{0}{6}-\frac{V_4}{12}=0$$

. . . . . (i)

Equation for Node 2:

$$V_2\left(\frac{1}{8}+\frac{1}{12}+\frac{1}{4}\right)-\frac{V_1}{12}-\frac{V_3}{8}-\frac{0}{4}=0$$

. . . . . (ii)

Equation for Node 3 and 4:

$$V_3\left(\frac{1}{8}\right)-\frac{V_2}{8}+\frac{V_4}{0}\left(\frac{1}{10}+\frac{1}{12}\right)-\frac{V_1}{12}-\frac{0}{10}=0$$

. . . . . (iii)

~~Eqn $V_3 - V_4 = 20$ . . . . (iv)~~

$$V_4 - V_3 = 20 \quad . \; . \; . \; (iv)$$

By solving the 4 equations,

$v_1 = 0.899701\ V$

$v_2 = -3.3887\ V$

$v_3 = -13.02\ V$

$v_4 = 6.997624\ V$

Current in battery,

$$I_v = \frac{V_3 - V_2}{8}$$

$$= \frac{-13.02 + 3.3887}{8}$$

$$= -1.204 \text{ A}$$

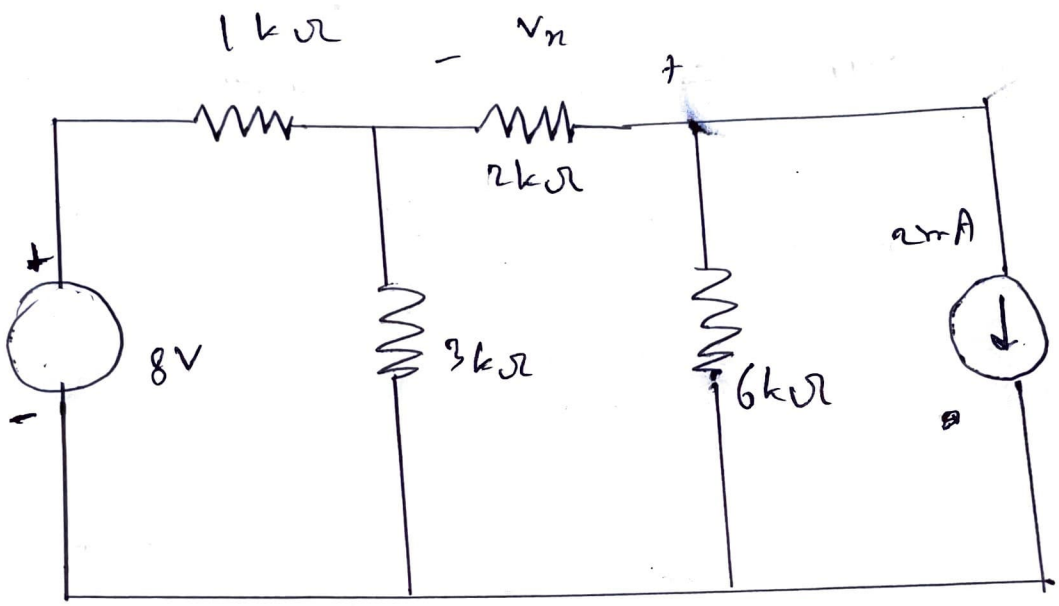
∴ Power of the voltage source,

$$P = I_v (V_4 - V_3)$$

$$= -1.204 \times 20$$

$$= -24.08 \text{ Watt}$$

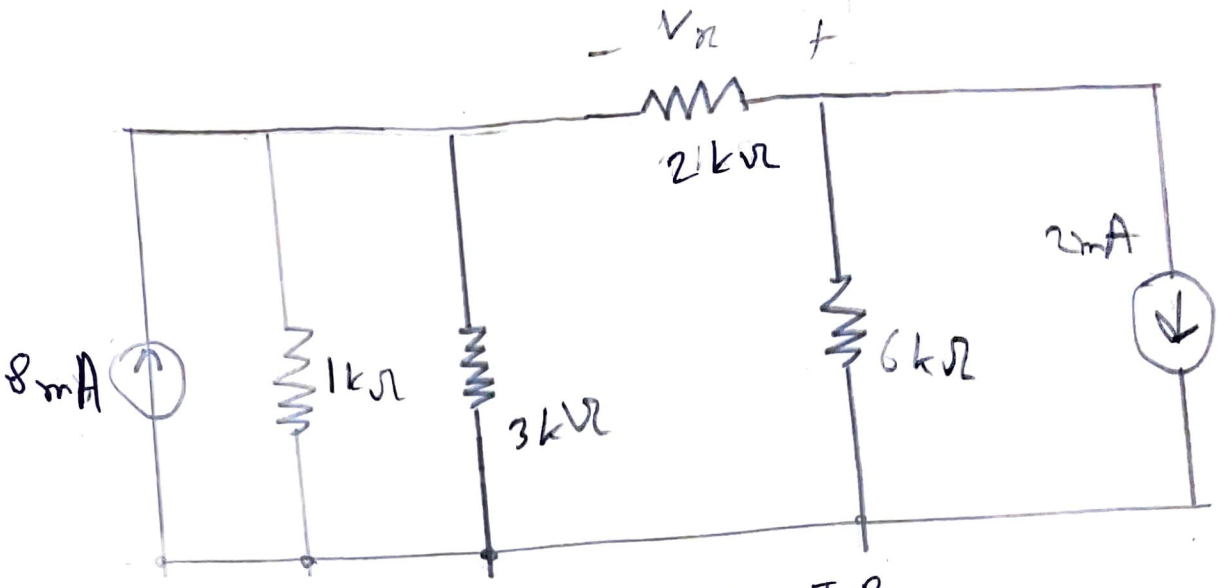
Ans to the Q: N; 2



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

$$= \frac{8}{1 \times 10^{3}} \text{ mA}$$

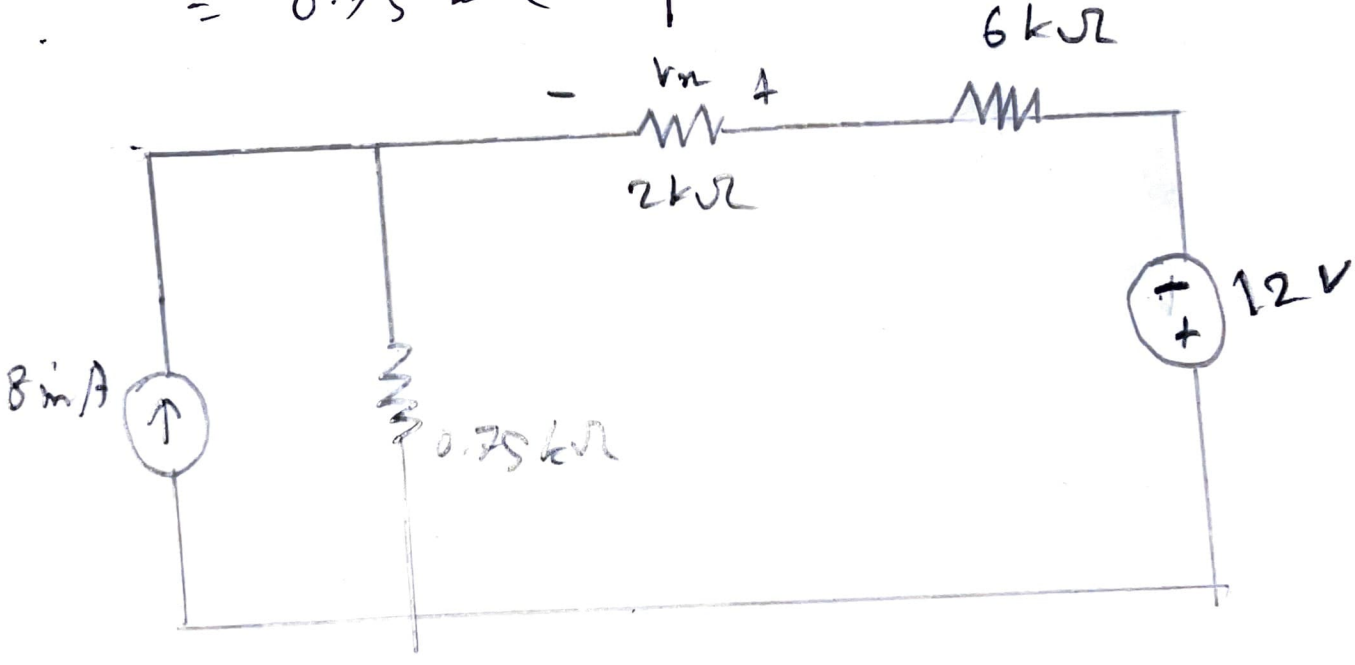
$$= 8 \text{ mA}$$



$$R_{eq} = \left(\frac{1}{1} + \frac{1}{3}\right)^{-1} k\Omega$$

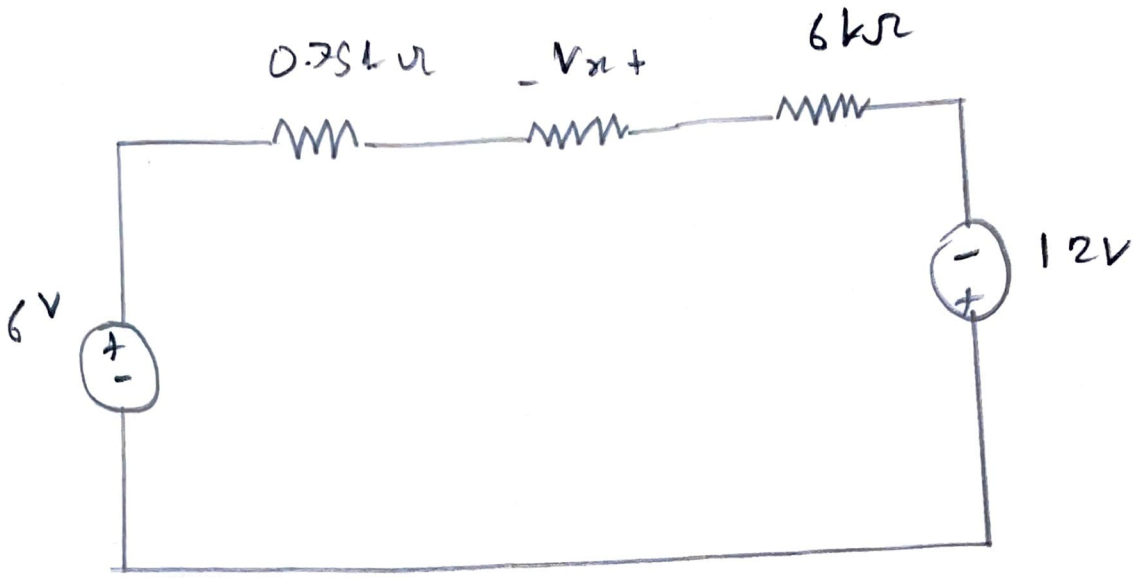
$$= 0.75\ k\Omega$$

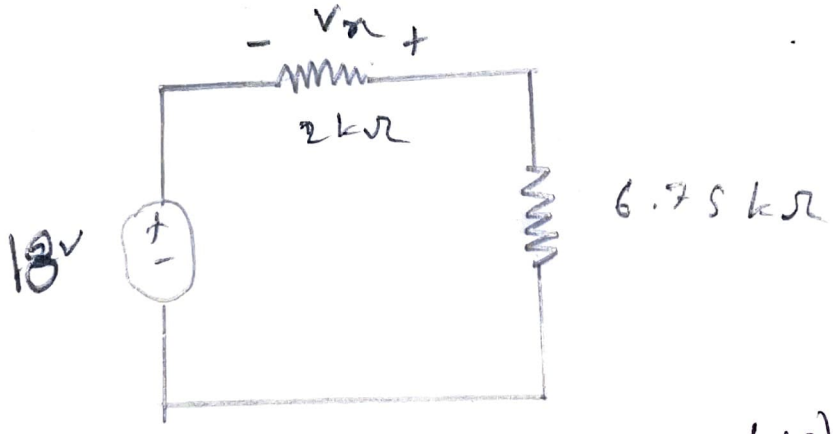
$$V = IR$$
$$= (6k\Omega)\ V$$
$$= 12\ V$$



$V_1 = IR = 0.75 \times 8$

$\Rightarrow \quad = 6 \text{ V}$





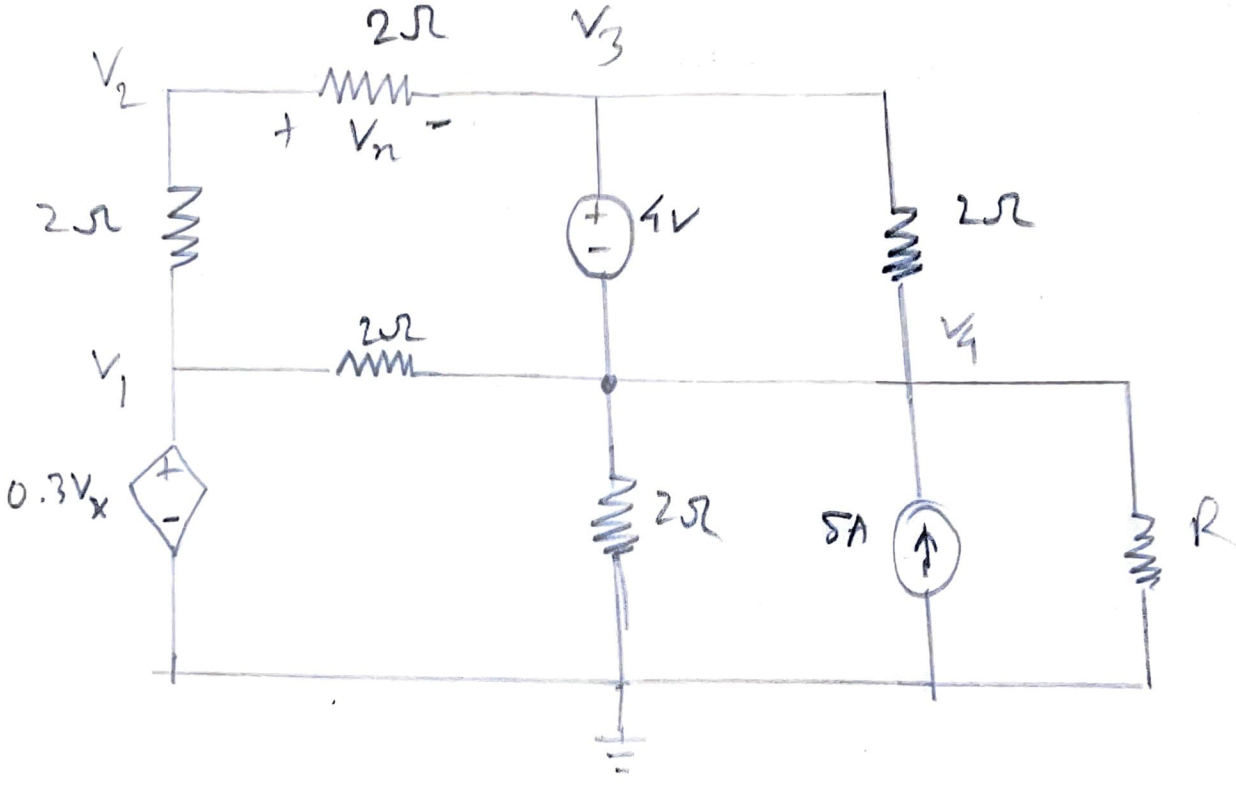
$\therefore V_1 = 18 \text{ V}$

$R_1 = 6.75 \text{ k}\Omega$

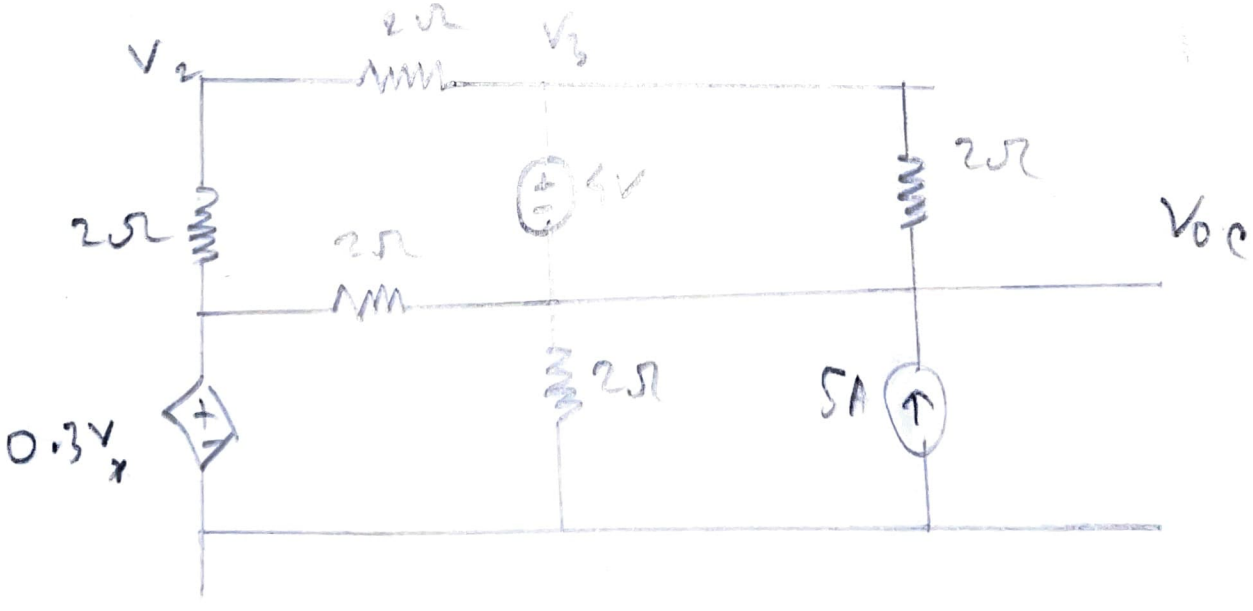
$V_x = \frac{2}{2+6.75} \times (-18)$

$= -4.114 \text{ V}$

Ans to the Q.N:3



Replacing R with an open circuit.



From Node analysis,

$$V_3 - V_2 = V_x$$

$$V_1 = 0.3\, V_x$$

$$\Rightarrow V_1 = 0.3 (V_2 - V_3) \quad \text{.....(i)}$$

For V_2,

$$V_2\left(\frac{1}{2} + \frac{1}{2}\right) - \frac{V_1}{2} - \frac{V_3}{2} = 0$$

$$\Rightarrow V_2 - 0.5\, V_1 - 0.5\, V_3 = 0 \quad \text{.....(ii)}$$

For V_3,

$$V_3\left(\frac{1}{2}+\frac{1}{2}\right)-\frac{V_2}{2}-\frac{V_4}{2}+I=0$$

$$\Rightarrow V_3-0.5V_2-0.5V_4+I=0 \quad \text{---------(iii)}$$

For V_4,

$$V_4\left(\frac{1}{2}+\frac{1}{2}+\frac{1}{2}\right)-\frac{V_1}{2}-\frac{V_3}{2}-I-5=0$$

$$1.5V_4-0.5V_1-0.5V_3-I-5=0 \quad \text{---------(iv)}$$

By adding (iii) and (iv),

$$0.5V_3-0.5V_2+V_4-0.5V_1-5=0 \quad \text{---------(v)}$$

Again,

$$V_3-V_4=4 \quad \text{---------(vi)}$$

By solving (i), (ii), (v), (vi),

$V_1 = -1.14894$

$V_2 = 2.68085$

$V_3 = 6.51069$

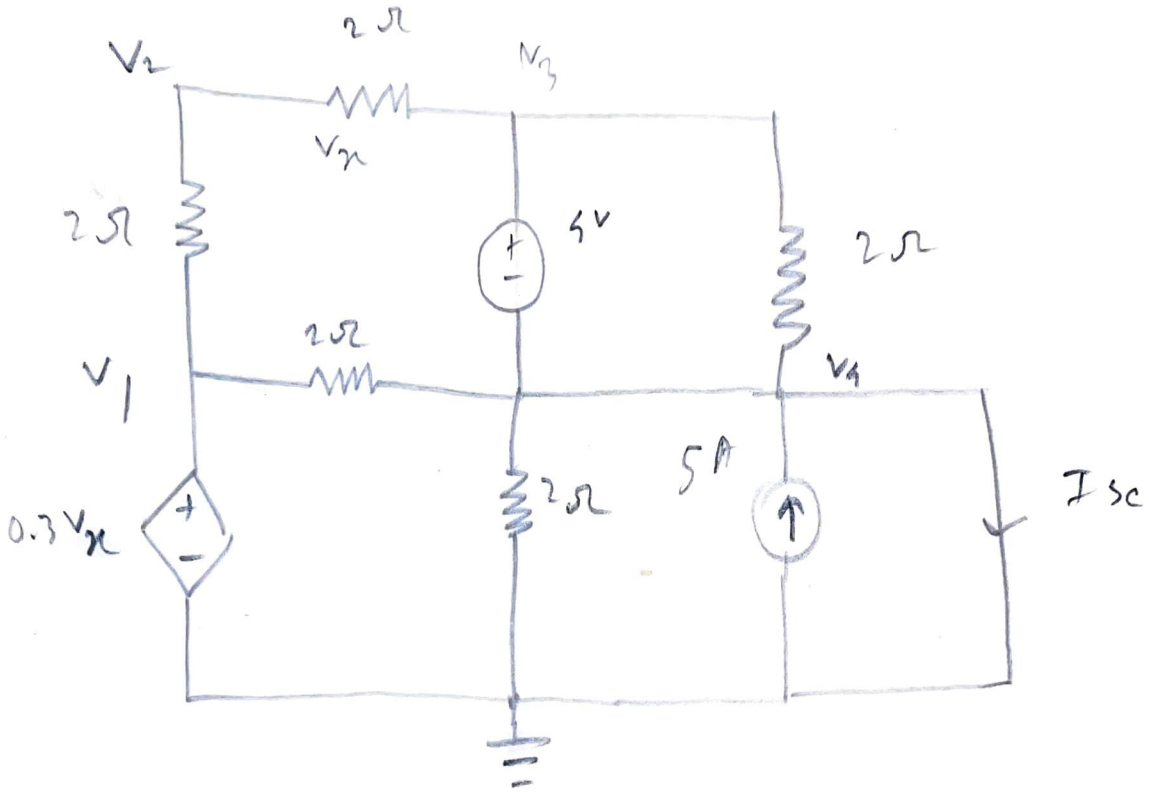
$V_4 = 2.15069$

Here, $V_{oc} = V_4$

$\therefore V_{th} = V_4 - 0$

$V_{th} = 2.15069$

Now, we will add short circuit inplace of R.



By doing node analysis,

$V_1 = -1.15894\ V$ ..... (i)

$V_3 = 4V$ ..... (ii)

$V_2\left(\frac{1}{2}+\frac{1}{2}\right) - \frac{V_1}{2} - \frac{V_3}{2} = 0$

$\Rightarrow V_2 = 1.42553$

As, V_4 has been grounded,

$V_4 = 0$

$I_1 = \frac{0 - V_1}{2}$

$= 0.57442 \text{ A}$

$I_2 = 5 \text{ A}$

$I_3 = \frac{0 - V_3}{2}$

$= -2 \text{ A}$

$\therefore I_1 + I_2 + I_3 = I_{sc}$

$\Rightarrow I_{sc} = 3.57442$ (A mA)

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

$= \frac{2.51069}{3.57442} = 0.702 \Omega$

(A mA)