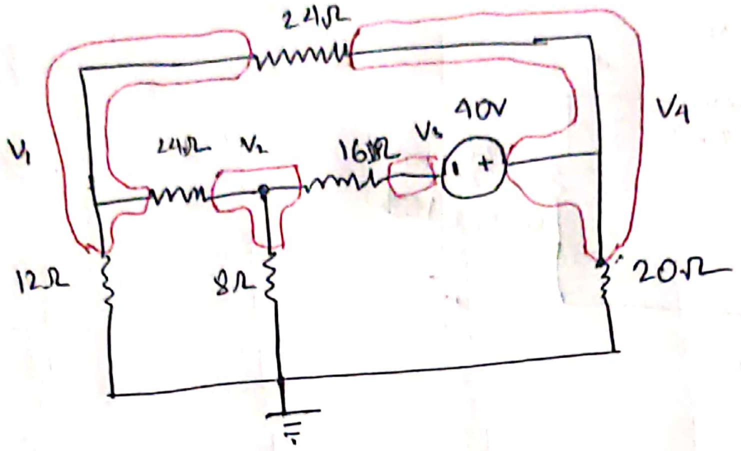
# Ans no. 1




Here,

Node-1,

$$V_1\left(\frac{1}{12}+\frac{1}{24}+\frac{1}{24}\right)-\frac{V_2}{24}-\frac{V_4}{24}=0$$

Node-2,

$$V_2\left(\frac{1}{24}+\frac{1}{16}+\frac{1}{8}\right)-\frac{V_1}{24}-\frac{V_3}{16}=0$$

~~Node-3,~~

Component eqn of $V_3$ & $V_4$,

$$V_4-V_3=40$$

~~$V_3$~~ Super node eqn,

$$V_3\left(\frac{1}{16}\right)-\frac{V_2}{16}+V_4\left(\frac{1}{20}+\frac{1}{24}\right)-\frac{V_1}{24}=0$$

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Now, solving the eq$^n$s using calculator,

$V_1 = 1.79401\,V$

$V_2 = -6.7774\,V$

$V_3 = -26.046511\,V$

$V_4 = 13.95348\,V$

Now,

$$I = \frac{V_3 - V_2}{16}$$

$$= \frac{-26.0465 - (-6.7774)}{16}$$

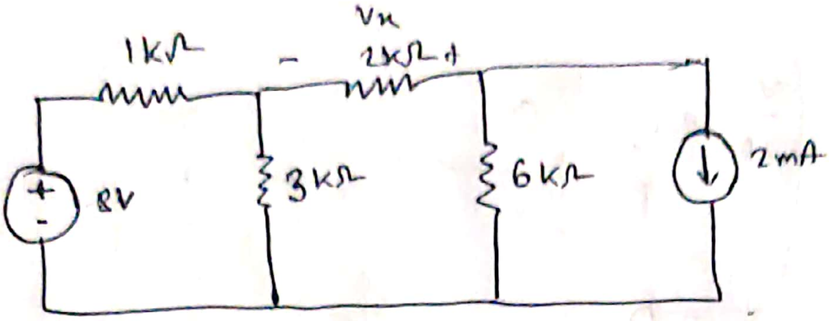
$$= \frac{-19.2691}{16} = -1.2043\,A$$

Hence,

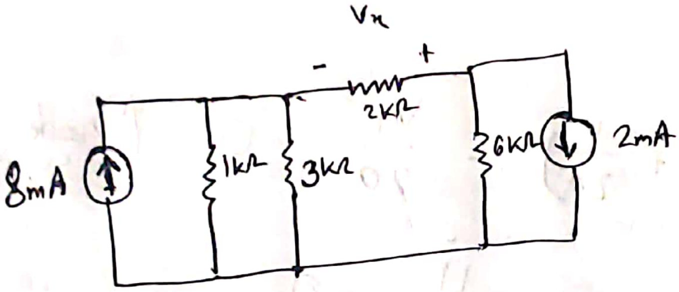
$$P = \Delta V \cdot I = 40 \times (-1.2043)$$

$$= -48.172\,W.$$

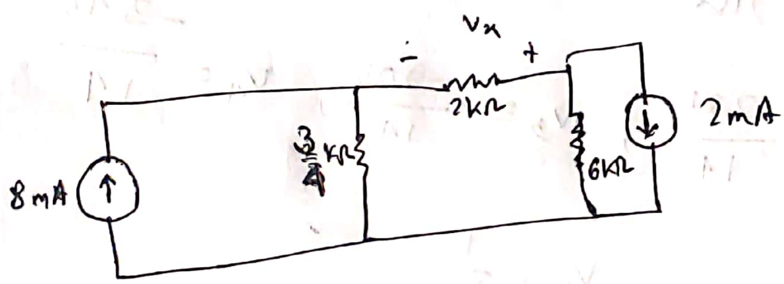
Am no. 2

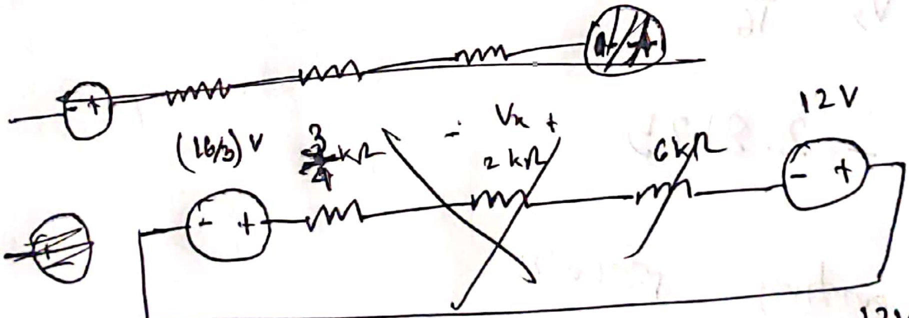



i)

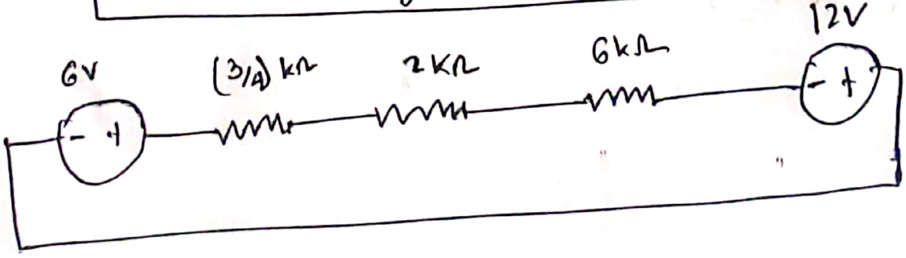



ii)




iii)



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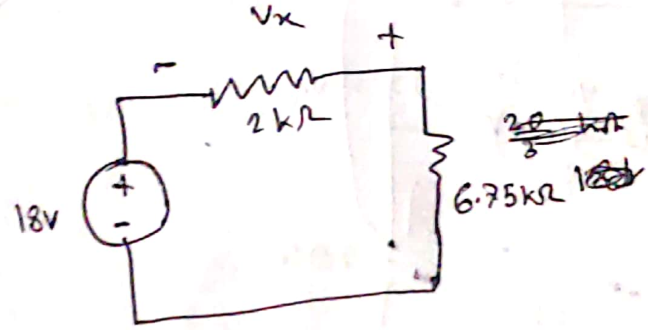
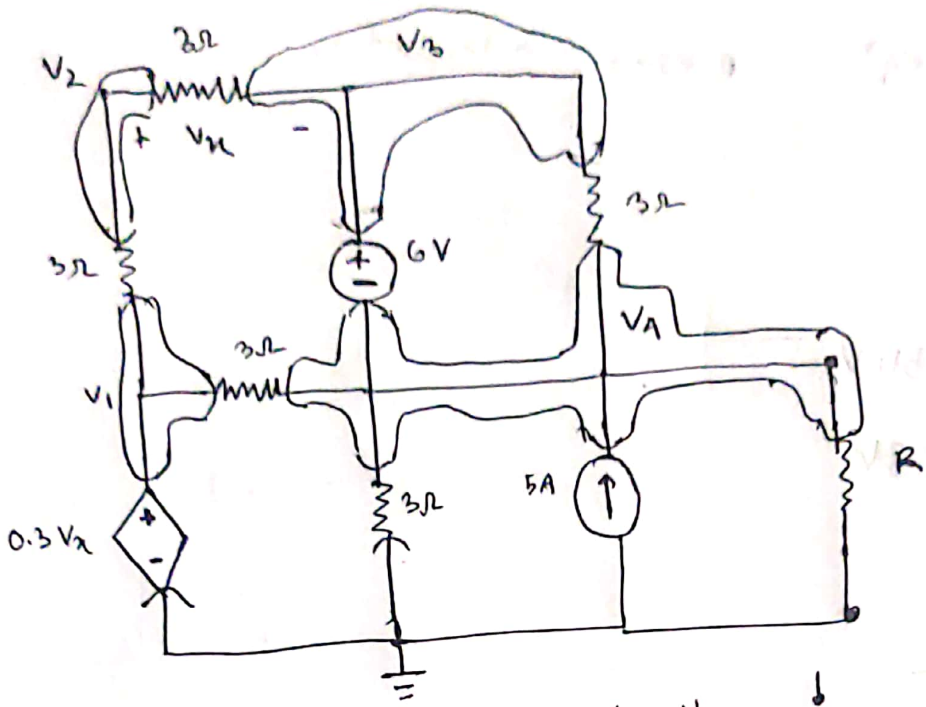



Now,

$$V_x = -\left(V \times \frac{2}{6.75+2}\right) V$$

$$= -4.114V \quad \text{(Ans.)}$$

Am no. 3




Taking, R part as open circuit,

Node (i),

$V_x = V_2 - V_3$

or, $V_1 = 0.3(V_2 - V_3)$

Node (ii)

$V_2\left(\frac{1}{3} + \frac{1}{3}\right) - \frac{V_1}{3} - \frac{V_3}{3} = 0$

Node (iii),

$V_3 - V_4 = 6$

Node (iv),

$V_4\left(\frac{1}{3} + \frac{1}{3} + \frac{1}{3}\right) - \frac{V_1}{3} - \frac{V_3}{3} - 5 + V_3\left(\frac{1}{3} + \frac{1}{3}\right) - \frac{V_4}{3} - \frac{V_2}{3} = 0$

or, $V_4 - \frac{V_1}{3} - \frac{V_3}{3} - 5 + V_3 \cdot \frac{2}{3} - \frac{V_4}{3} - \frac{V_2}{3} = 0$

or, $-\frac{V_1}{3} - \frac{V_2}{3} + \frac{V_3}{3} + \frac{2V_4}{3} = 5$

Here,

$V_1 = -1.7234\ V$

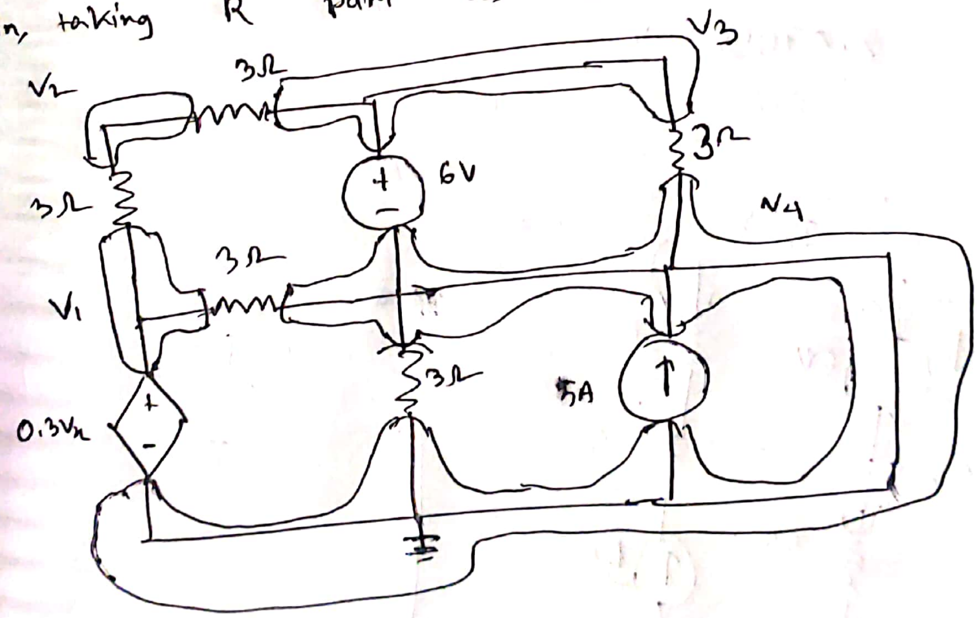
$V_2 = 4.02127\ V$

$V_3 = 9.76595\ V$

$V_4 = 3.76595\ V$

Here,
$V_4 = V_{oc} = V_{th} = 3.76595\ V$ or, $3.766\ V$

Again, taking R part as closed circuit,




@ Node-I
$V_1 = 0.3(V_2 - V_3)$ ___ (1)

For node - II,

$$V_2\left(\frac{1}{3}+\frac{1}{3}\right)-\frac{V_1}{3}-\frac{V_3}{3}=0 \quad -\ (ii)$$

For node ~~(3)~~ III,

$$V_3 - V_4 = 6V$$

~~For~~, or, $V_3 = 6V$

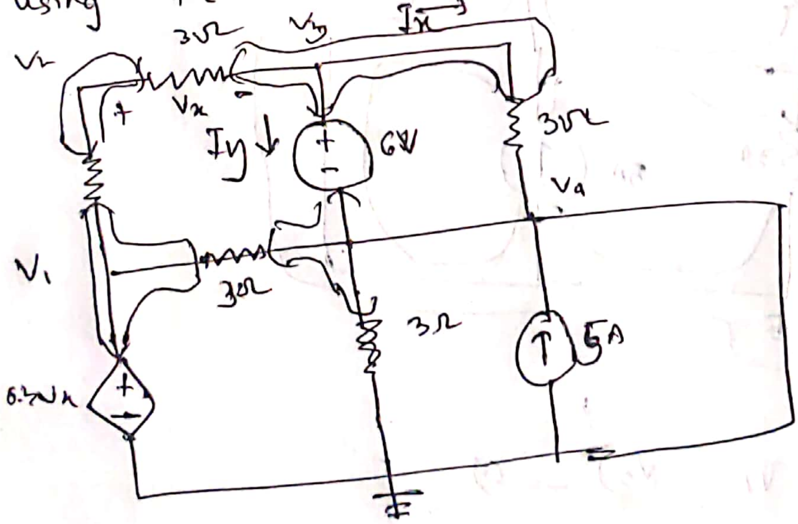
Now,

$V_1 =$ ~~1.3846153~~ $-1.058823\ V$

$V_2 =$ ~~10.61538~~ $2.470588\ V$

$V_3 = 6V$

~~At~~ Here, using the circuit



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Here,

$I_0 = I_x + I_y$

A/C,

$$I_0 = \frac{V_1 - V_3}{3} = -1.17647\,A$$

Again

$$I_x = \frac{V_3 - V_4}{3} = \frac{6}{3} = 2$$

Again

$$I_y = I_0 - I_x = -3.17647\,A$$

Now, putting all values in node (4),

$$-5 + \frac{0 - V_1}{3} + \frac{0-0}{3} + \frac{0 - V_3}{3} + I_{sc} = 0 \quad [\cancel{\Sigma I_{in}} + \cancel{\Sigma I_{out}} = 0]$$

or

$$I_{sc} = \frac{0-(-1.05882)}{3} + \frac{-6}{3} + 5$$

$$= 0.352941 + 3$$

$$= 3.35294\,A$$

Now

$V_{th} = I_{sc} \cdot R_{th}$ or, $R_{th} = \frac{V_{th}}{I_{sc}} = 1.116\,\Omega$

(Ans.)