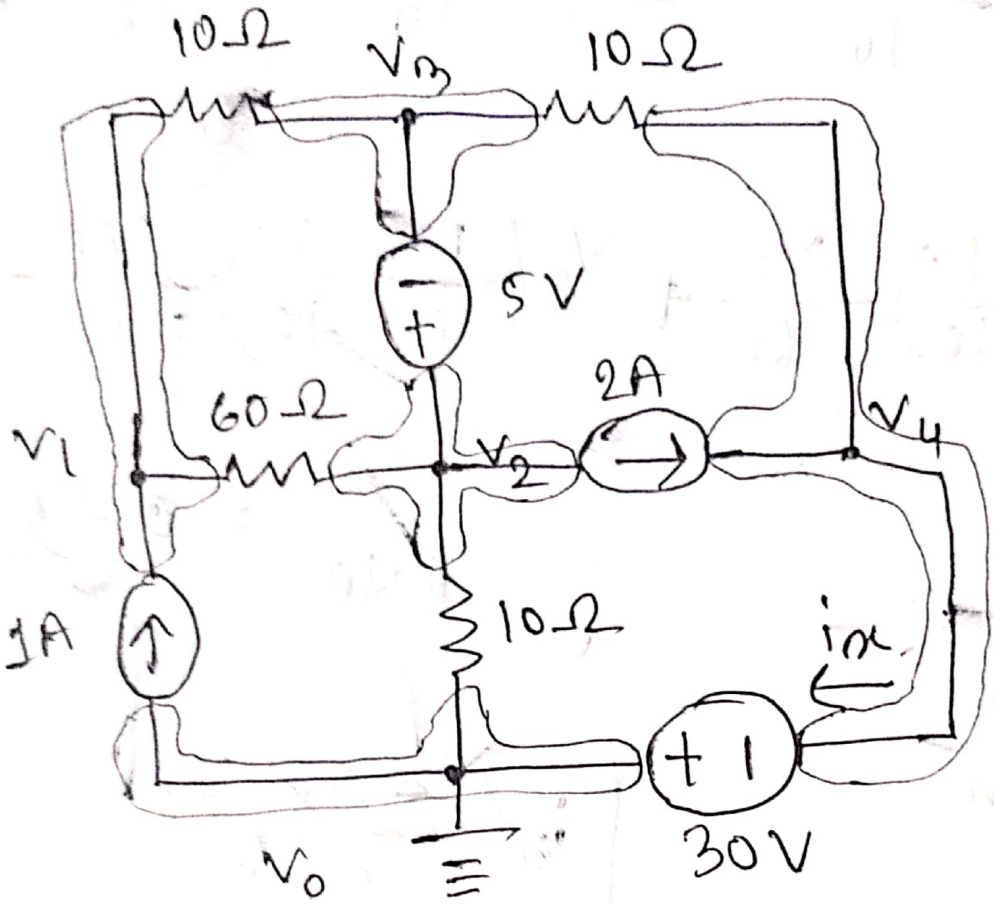
Elmi Tabassum
Sec - 14
ID - 18101222



Node 1:

$$\frac{V_1 - V_3}{10} + \frac{V_1 - V_2}{60} - 1 = 0$$

$$\Rightarrow V_1\left(\frac{1}{10} + \frac{1}{60}\right) - \frac{V_3}{10} - \frac{V_2}{60} = 1$$

Node 2 & 3

$$V_2 - V_3 = 5$$

Supernode equation:

$$\frac{V_2 - V_1}{60} + \frac{V_2 - V_0}{10} + 2 + \frac{V_3 - V_1}{10} + \frac{V_3 - V_4}{10} = 0$$

$$\Rightarrow V_2\left(\frac{1}{60} + \frac{1}{10}\right) - \frac{V_1}{60} + V_3\left(\frac{1}{10} + \frac{1}{10}\right) - \frac{V_1}{10} - \frac{V_4}{10} = 0 - 2$$

Node 4:

~~$\frac{V_4 - V_3}{10}$~~ +

$0 - V_4 = 30$

$\Rightarrow V_4 = -30$

~~$i_x = \frac{V_0 - V_4}{}$~~

~~Now, $V_4 - V_3$~~

$\therefore V_1 = -13.2143\,V$

$V_2 = -17.5\,V$

$V_3 = -22.5\,V$

$V_4 = -30\,V$

Now,

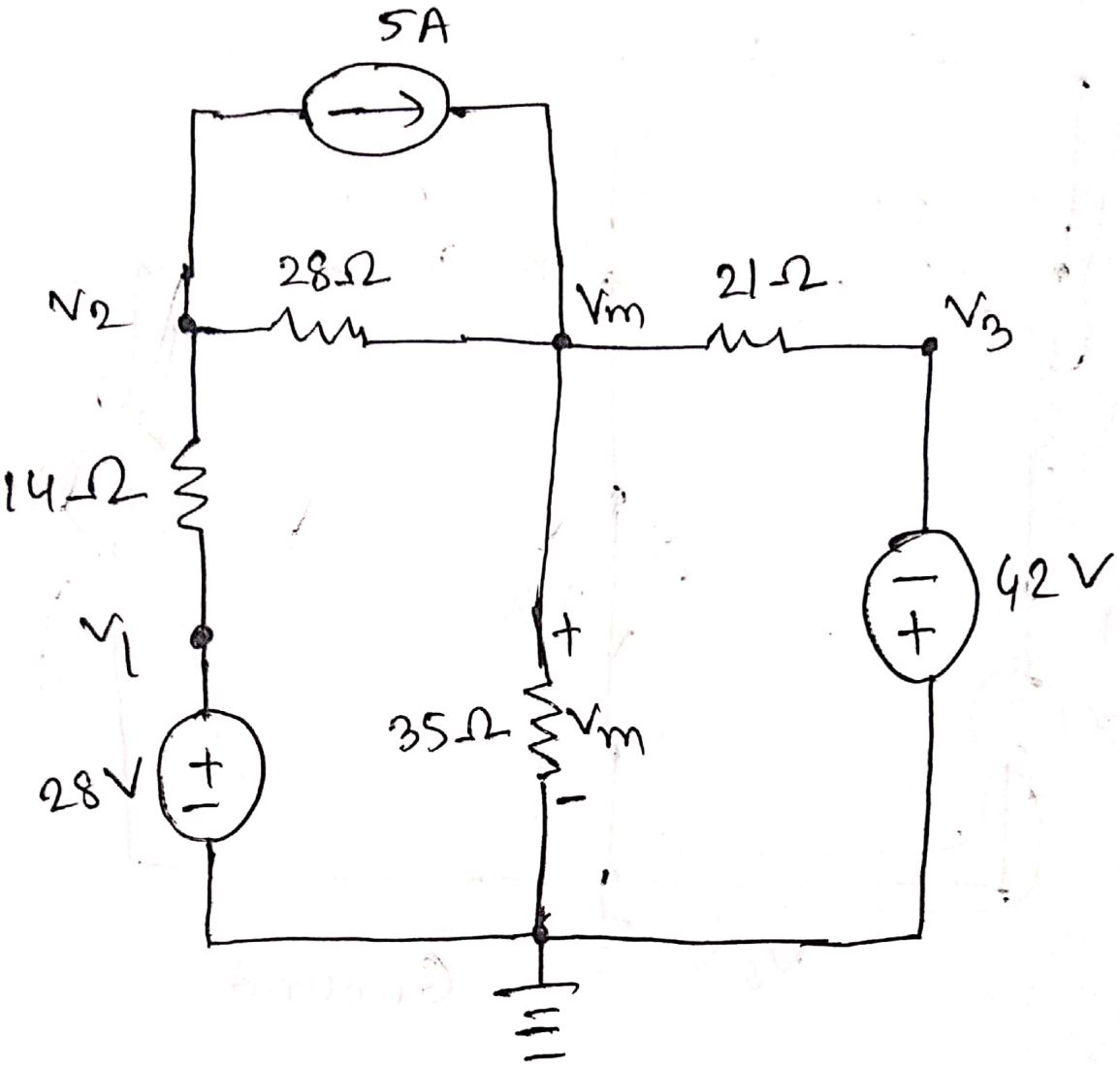
$$\frac{V_4 - V_3}{10} - 2 + i_x = 0$$

$$\Rightarrow \frac{-30 - (-22.5)}{10} - 2 = -i_x$$

$$\Rightarrow -i_a = -11/4$$

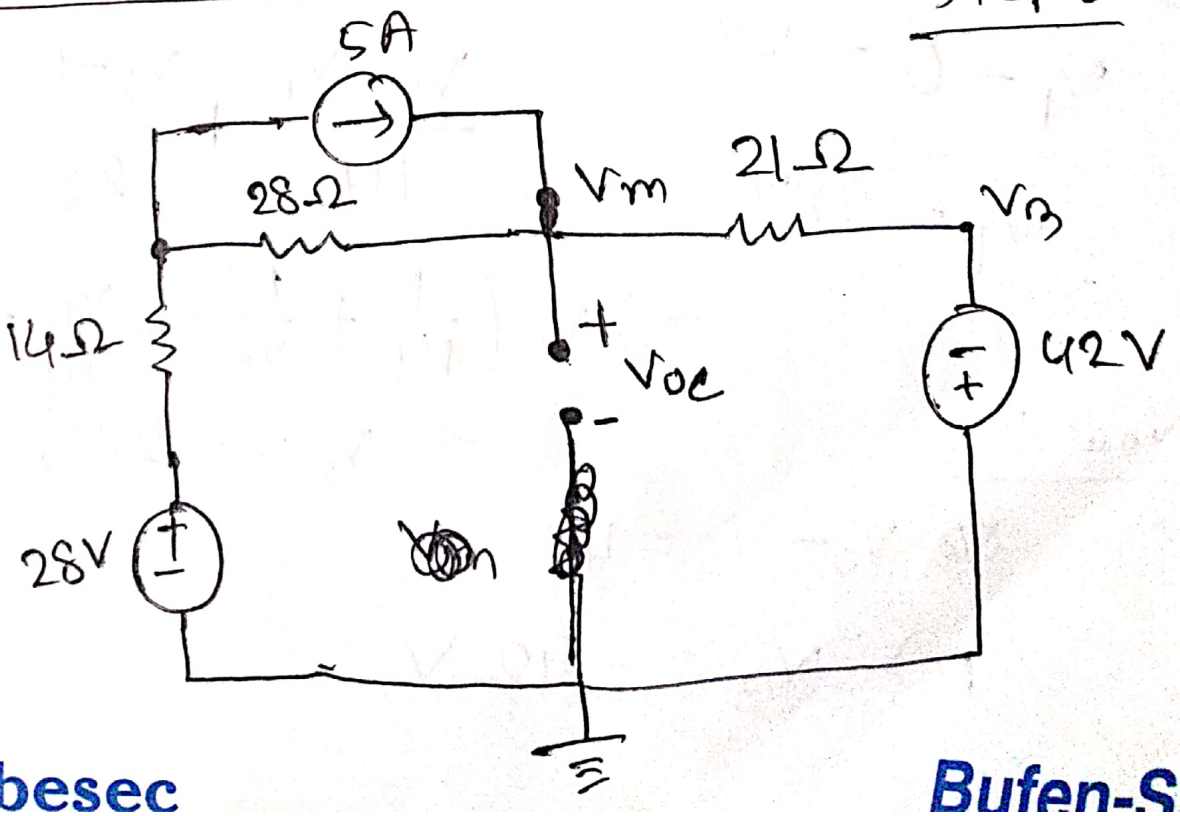
$$\therefore i_a = 2.75A$$

Ans No: 2

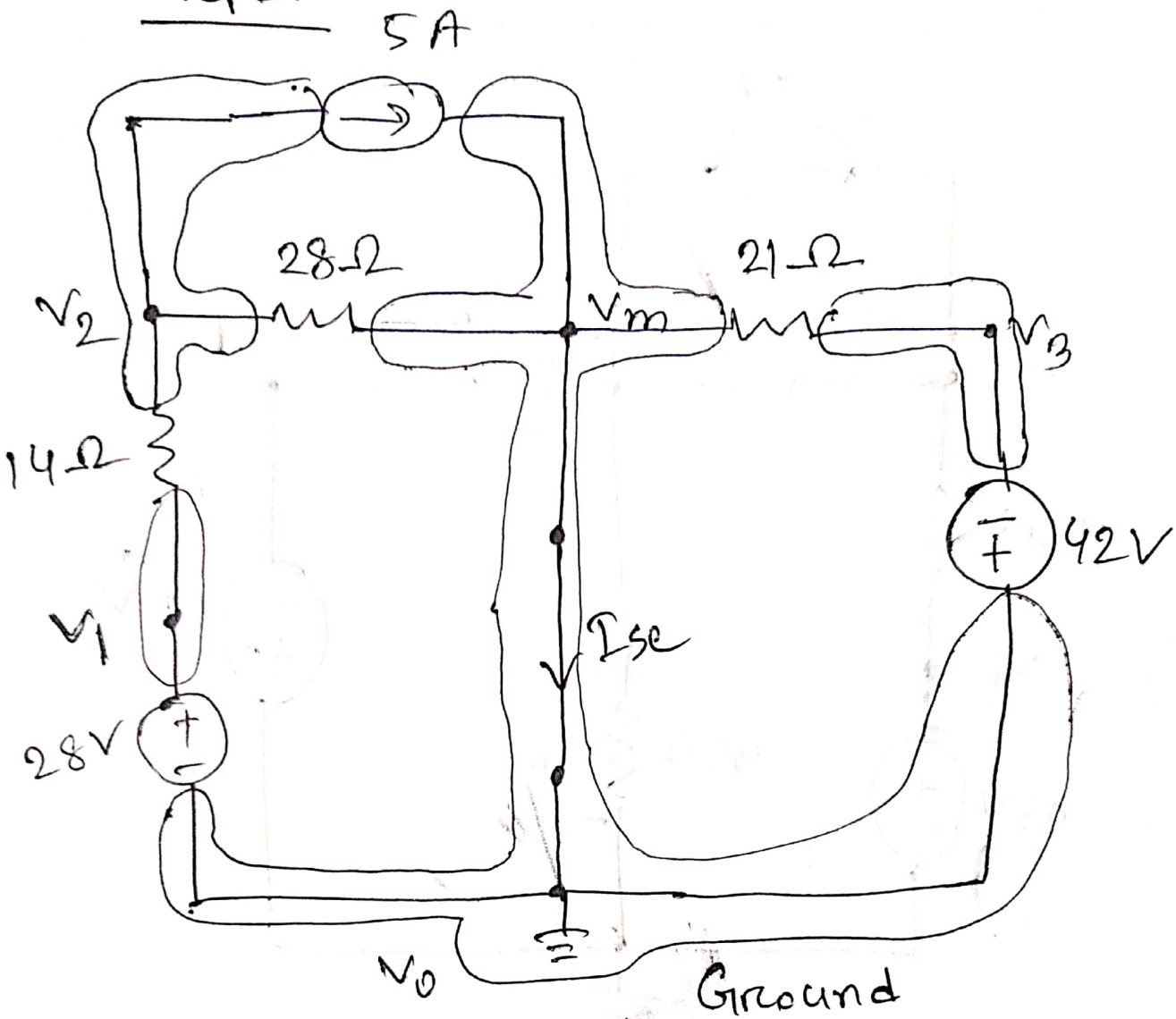


for Isc :

Step 1



Step 2



Node 1 :

$$V_1 - 0 = 28$$

$$V_1 = 28V$$

Node 2

$$\frac{V_2 - V_1}{14} + \frac{V_2 - 0}{28} + 5 = 0$$

$$\Rightarrow V_2\left(\frac{1}{14} + \frac{1}{28}\right) - \frac{V_1}{14} = -5$$

$$\Rightarrow V_2 = -28V$$

Node 3

$$V_0 - V_3 = 42$$

$$\Rightarrow V_3 = -42V$$

~~In Node~~

Current through 21 Ω,

$$\frac{V_3 - V_0}{21} = \frac{-42 - 0}{21} = -2A$$

Current through, 28 Ω,

$$\frac{V_2 - V_0}{28} = \frac{-28 - 0}{28} = -1A$$

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

~~Also, I_{sc}~~

Here in the circuit,

$$I_{sc} = 5A - 1A - 2A$$

$$= 2A$$

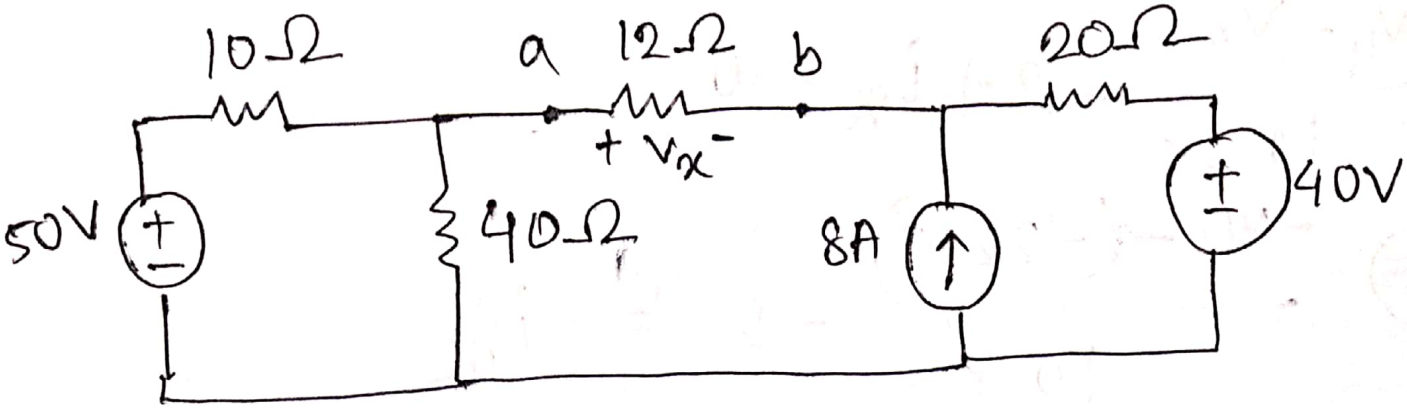
So, We know,

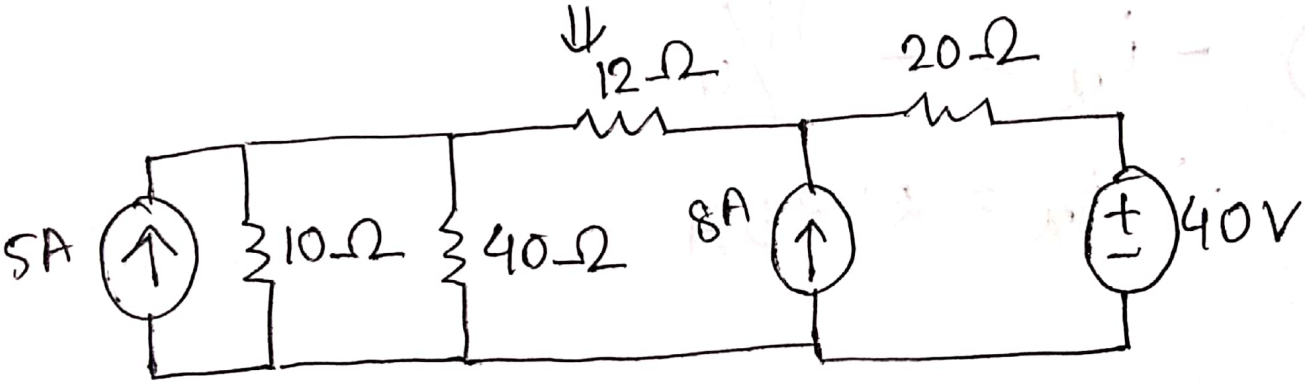
$$R_{th} = \frac{V_{oc}}{I_{sc}}$$

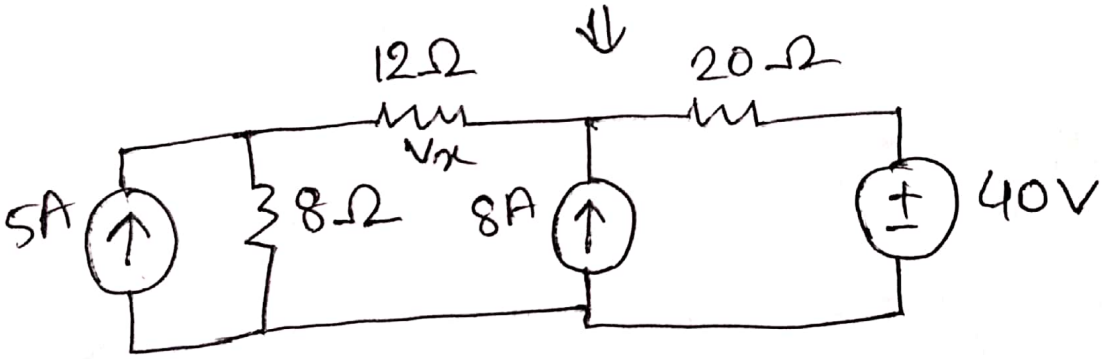
$$= \frac{28}{2} \Omega$$

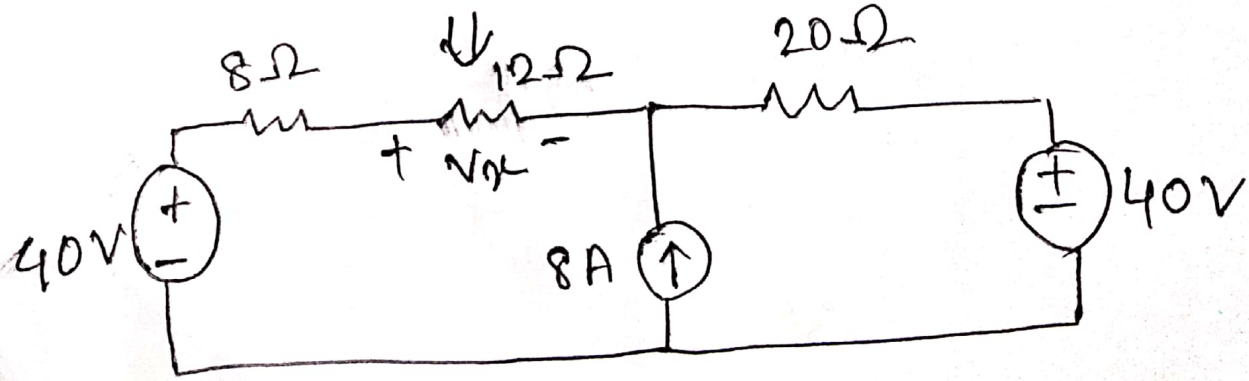
$$= 14 \Omega$$

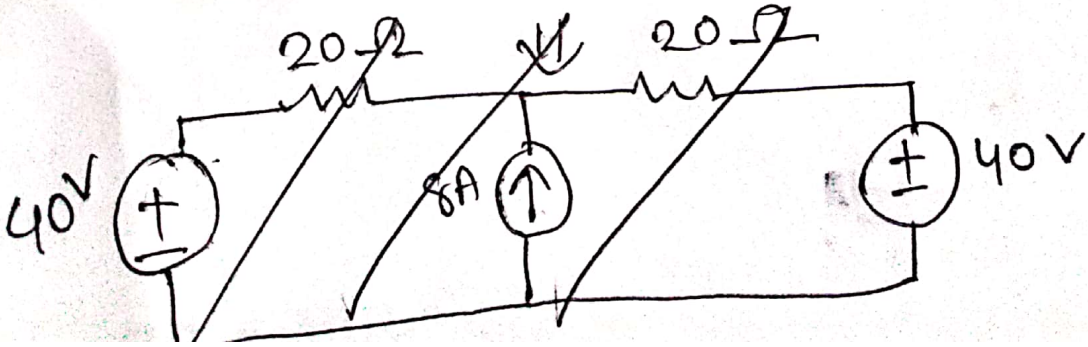
Ans No: 3

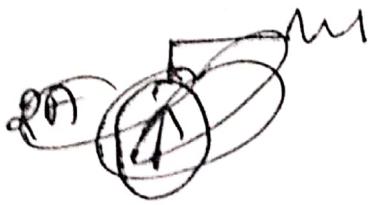


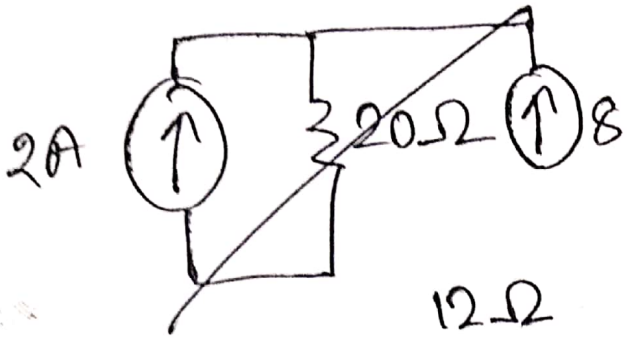


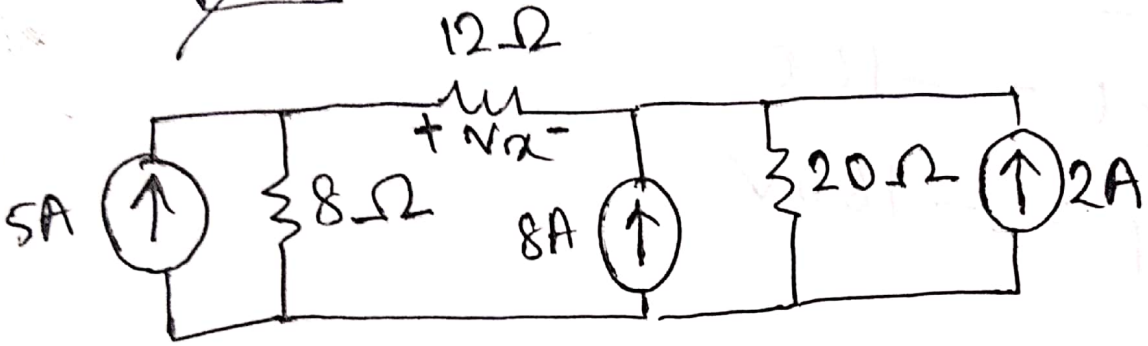


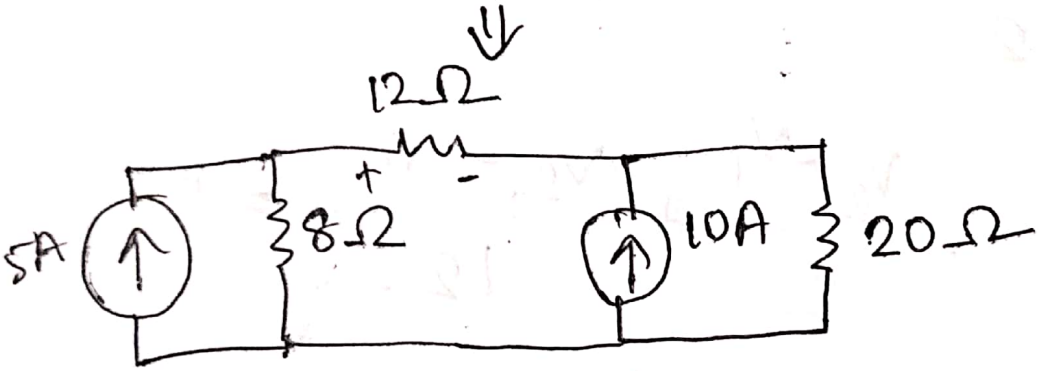


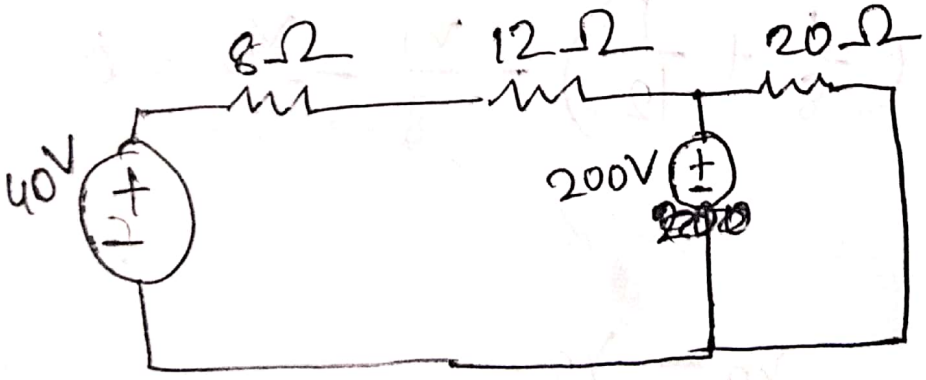


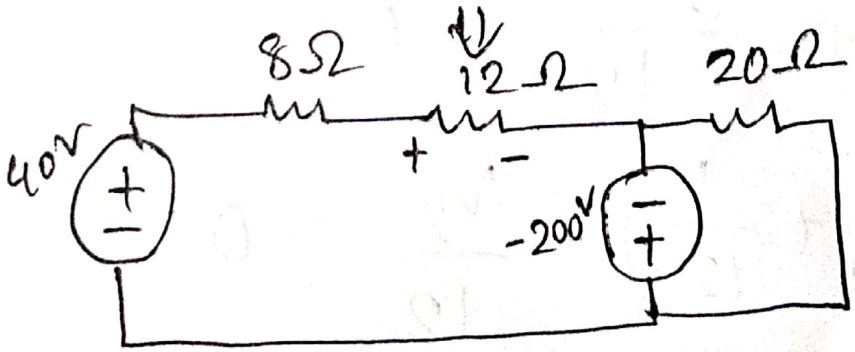


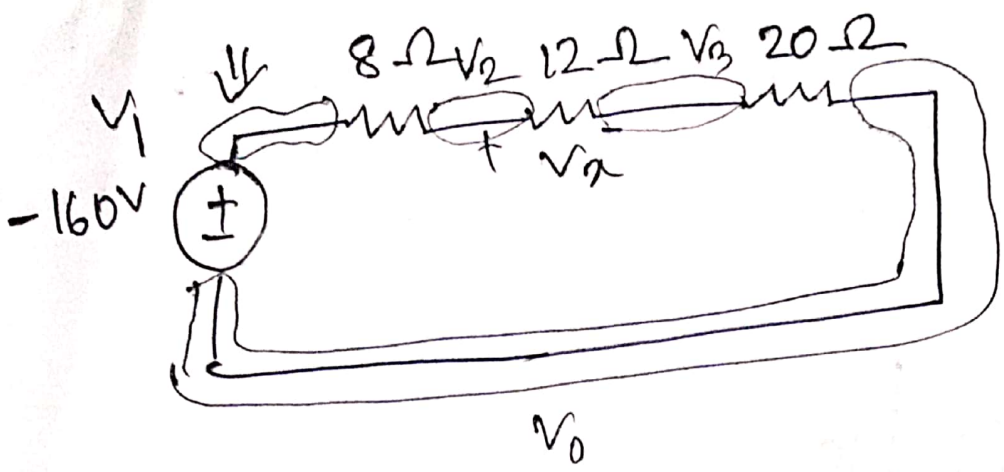












Node 1

$V_1 - 0 = -160$

$V_1 = -160V$

Node 2

$$\frac{V_2 - V_1}{8} + \frac{V_2 - V_3}{12} = 0$$

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

Node 3

$$\frac{V_3 - V_0}{20} + \frac{V_3 - V_2}{12} = 0$$

$$\Rightarrow V_3\left(\frac{1}{20} + \frac{1}{12}\right) - \frac{V_2}{12} = 0$$

$\therefore V_1 = -160V,\ V_2 = -128V,\ V_3 = -80V$

So, $v_x = v_2 - v_3$

$= [-128 - (-80)]\ V$

$= -48\ V$

$$q(V_A - V_B) = W$$

$$(-4)(11 - V_B) = 8$$

$$\Rightarrow -44 + 4V_B = 8$$

$$\Rightarrow 4V_B = 8 + 44$$

$$\Rightarrow V_B = 13\,V$$