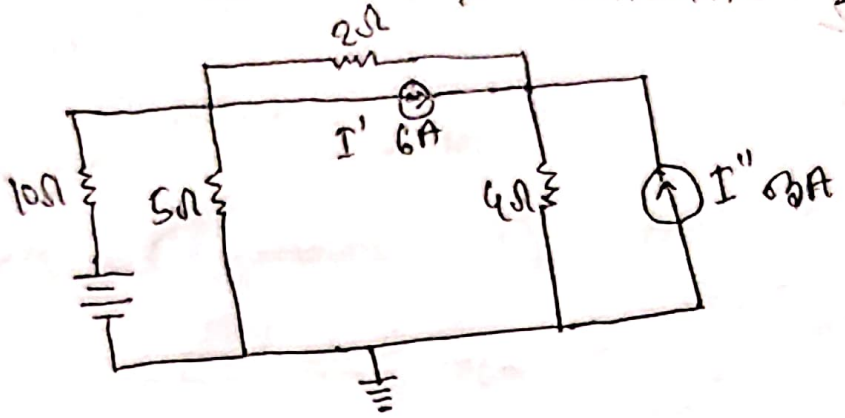
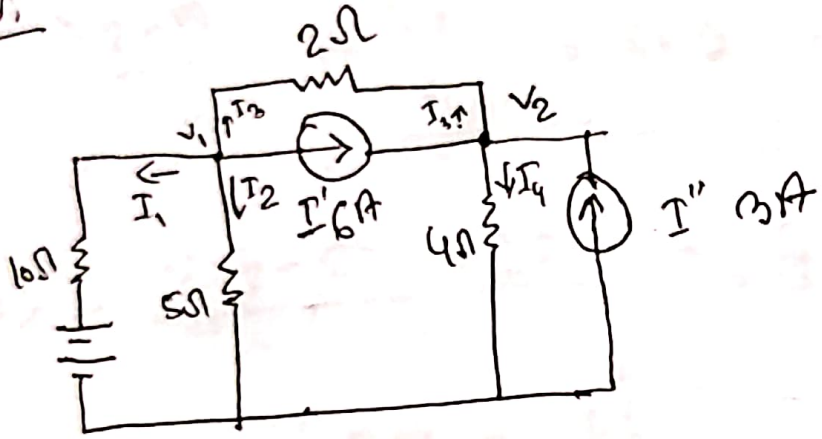
1. Using Nodal Analysis calculate $I_{4\Omega}$ & $I_{10\Omega}$



Solv.



In V_1 Node Applying KCL we obtain,

$$I_1 + I_2 + I_3 + I' = 0$$

$$\Rightarrow \frac{V_1}{10} + \frac{V_1}{5} + \frac{V_1 - V_2}{2} + 6 = 0$$

$$\Rightarrow \frac{V_1 + 2V_1}{10} + \frac{V_1 - V_2}{2} + 6 = 0$$

$$\Rightarrow \frac{3V_1}{10} + \frac{V_1 - V_2}{2} + 6 = 0$$

$$\Rightarrow \frac{3V_1 + 5V_1 - 5V_2 + 60}{10} = 0$$

$$\Rightarrow \frac{8V_1 - 5V_2 + 60}{10} = 0$$

$$\Rightarrow 8V_1 - 5V_2 + 60 = 0 \quad \text{---(i)}$$

$$\Rightarrow 8V_1 = 5V_2 - 60$$

$$\Rightarrow V_1 = \frac{5V_2 - 60}{8} \quad \text{---(ii)}$$

After Applying KCL at Node V_2 we get,

$$I_3 + I_4 = I' + I''$$

$$\Rightarrow \frac{V_2 - V_1}{2} + \frac{V_2}{4} = 6 + 3 = 9$$

$$\Rightarrow \frac{2V_2 - 2V_1 + V_2}{4} = 9$$

$$\Rightarrow 3V_2 - 2V_1 - 36 = 0$$

$$\Rightarrow 3V_2 - 2\left(\frac{5V_2 - 60}{8}\right) - 36 = 0$$

$$\Rightarrow 3V_2 - \frac{5V_2 - 60}{4} - 36 = 0$$

$$\Rightarrow \frac{12V_2 - 5V_2 - 60 - 144}{4} = 0$$

Sol:-

$\rightarrow 7v_2 - 204 = 0$

$\Rightarrow v_2 = \frac{204}{7} = 29.14$

$v_1 = \frac{5v_2 - 60}{8}$

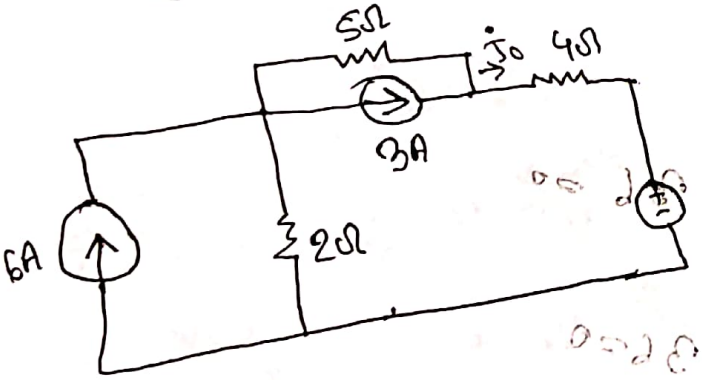
$= \frac{5(29.14) - 60}{8} = \frac{145.71 - 60}{8}$

$= 10.71$

$I_4 = \frac{v_2}{4} = \frac{29.14}{4} = 7.285A$

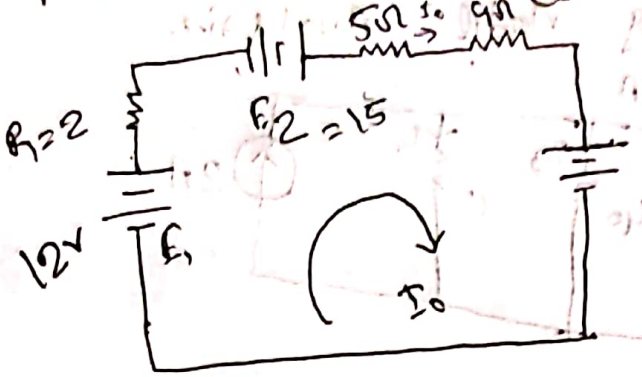
$I_{10} = \frac{v_1}{10} = \frac{10.71}{10} = 1.071\ A$

2. Using source transformation find i_o in the ckt.



Sol:-

After source conversion the ckt become,



$I_1 = \frac{E_1}{R_1}$

$\Rightarrow E_1 = I_1 R_1 = 6 \times 2 = 12V$

$E_2 = I_2 R_2 = 3 \times 5 = 15V$

Applying KVL in ckt,

$-E_1 + I_0 R_1 - 15 + I_0 R_2 + I_0 R_3 + 20 = 0$

$\Rightarrow -12 + 2I_0 - 15 + 5I_0 + 4I_0 + 20 = 0$

$\Rightarrow -27 + 11I_0 + 20 = 0$

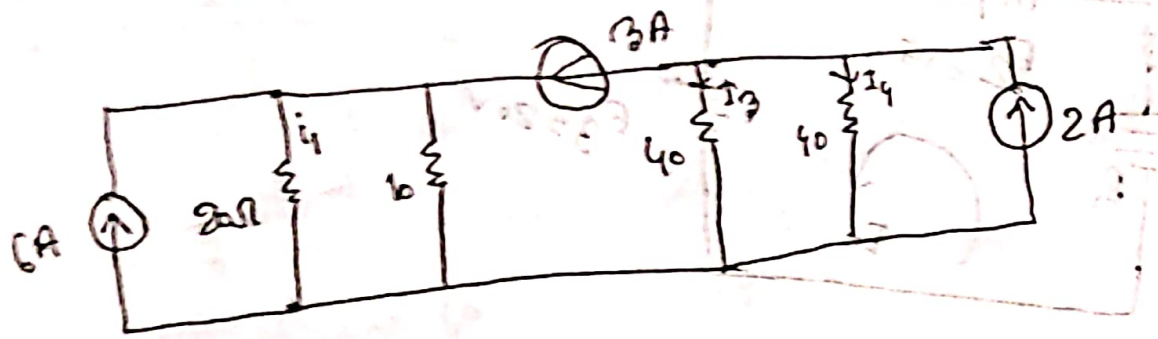
$\Rightarrow -7 + 11I_0 = 0$

$\Rightarrow 11I_0 = 7$

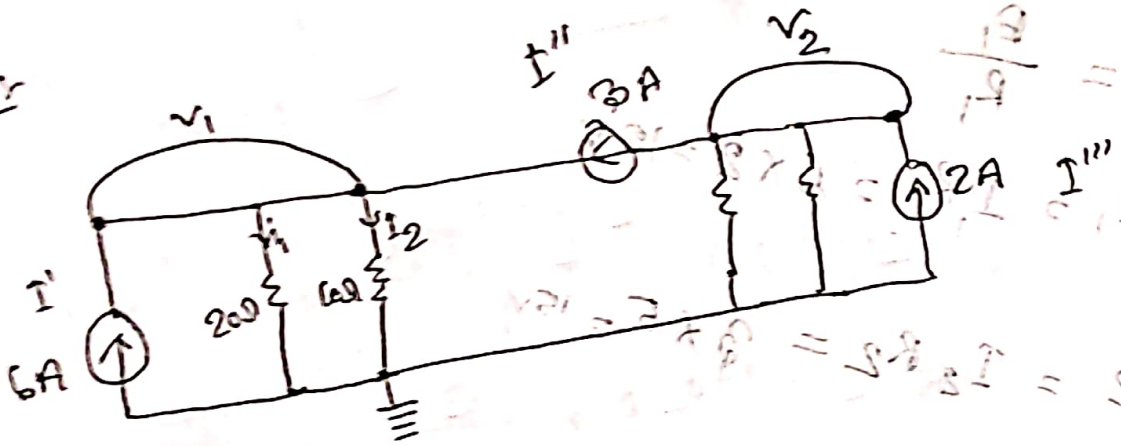
$\Rightarrow I_0 = \frac{7}{11}$

Ans

1. Find I_1, I_2, I_3 & I_4 using nodal Analysis.



Solⁿ:



$I_n = V_1$ node,

$$i_1 + i_2 = I' + I''$$

$$\Rightarrow \frac{V_1}{20} + \frac{V_1}{10} = 6 + 3 = 9$$

$$\Rightarrow \frac{V_1 + 2V_1}{20} = 9$$

$$\Rightarrow 3V_1 = 180 \Rightarrow V_1 = 60$$

In V_2 Node

$i_3 + i_4 = I' + I''$

$\Rightarrow \frac{V_2}{40} + \frac{V_2}{40} + 3 = 2$

$\Rightarrow \frac{V_2 + V_2 + 120}{40} = 2$

$\Rightarrow 2V_2 + 120 = 80 \Rightarrow 2V_2 = 80 - 120$

$\Rightarrow \frac{-40}{2} = -20$

$\Rightarrow V_2 = -20$

$i_3 = \frac{V_2}{40} = \frac{-20}{40} = -\frac{1}{2}$

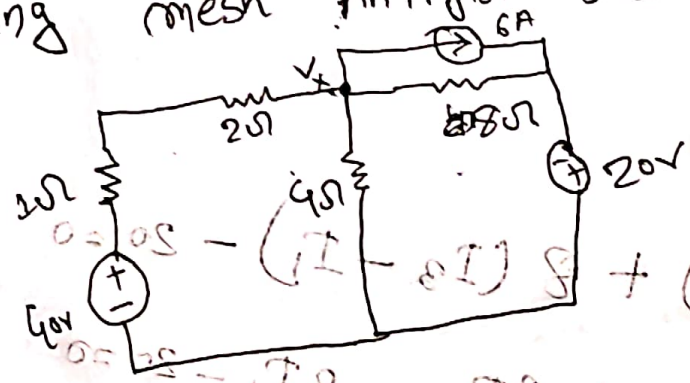
$i_1 = \frac{V_1}{20} = \frac{60}{20} = 3,$

$i_2 = \frac{V_1}{10} = \frac{60}{10} = 6,$

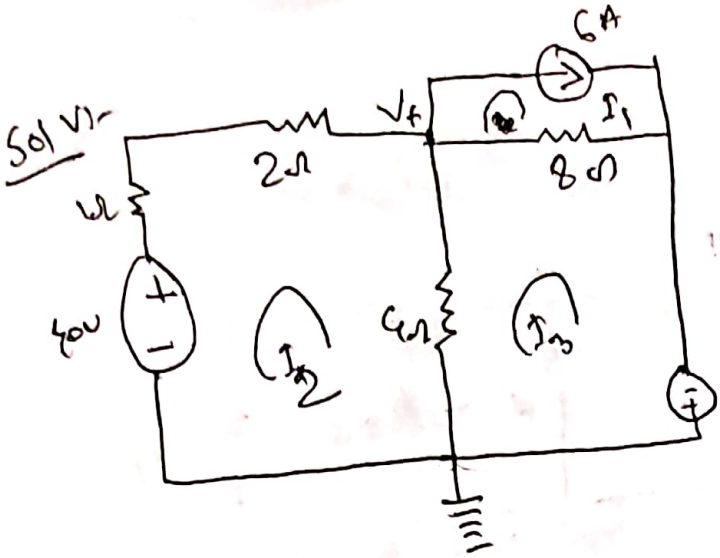
$i_4 = \frac{V_2}{40} = -\frac{1}{2}$

(Ans)

2. Using mesh Analysis find V_x in the ckt.



Sol Vr-



$I_1 = 6A$

In Loop 2,

$$-40 + I_2R_1 + I_2R_2 + I_2R_3 = 0$$

$$\Rightarrow -40 + 2I_2 + 2I_2 + (I_2 - I_3)4 = 0$$

$$\Rightarrow -40 + 8I_2 - 4I_3 = 0$$

$$\Rightarrow -40 + 8I_2 - 4I_3 = 0 \quad \text{---(i)}$$

In Loop : 3,

$$4(I_3 - I_2) + 8(I_3 - I_1) - 20 = 0$$

$$\Rightarrow 4I_3 - 4I_2 + 8I_3 - 8I_1 - 20 = 0$$

$$\Rightarrow 12I_3 - 4I_2 - 8I_1 - 20 = 0$$

$\Rightarrow 12I_3 - 4I_2 - 8.6 - 20 = 0$

$\Rightarrow 12I_3 - 4I_2 - 48 - 20 = 0$

$\Rightarrow 12I_3 - 4I_2 - 68 = 0$

$\Rightarrow 12I_3 = 4I_2 + 68$

$\Rightarrow I_3 = \frac{4I_2 + 68}{12}$ — (ii)

Putting I_3 value into eq (i) we get,

$-40 + 7I_2 - 4\left(\frac{4I_2 + 68}{12}\right) = 0$

$\Rightarrow -40 + 7I_2 - \frac{4I_2 + 68}{3} = 0$

$\Rightarrow \frac{-120 + 21I_2 - 4I_2 + 68}{3} = 0$

$\Rightarrow -120 + 17I_2 + 68 = 0$

$\Rightarrow 17I_2 = 52$

$\Rightarrow I_2 = \frac{52}{17} = 3.058\ A$

I_2 value putting in I_3 we get,

$I_3 = \frac{4.(3.058) + 68}{12} = 6.68\ A$

$$V_x = I_x R_x$$

$$= (I_1 - I_2).4$$

$$= (6 - 3.058) \times 4$$

$$= 11.768$$

Ans: (ii)