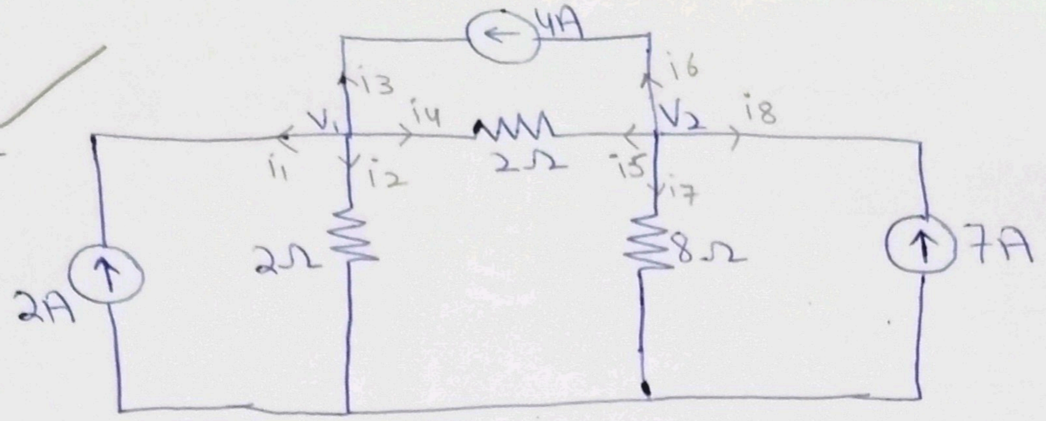
Q3:-



Soln:- $i_1+i_2+i_3+i_4=0$

$$(-2)+\left(\frac{V_1-V_0}{2}\right)+(-4)+\left(\frac{V_1-V_2}{2}\right)=0$$

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

$$\frac{-4+V_1-8+V_1-V_2}{2}=0$$

$$2V_1-V_2=12 \quad \text{——} \; (1)$$

$i_5+i_6+i_7+i_8=0$

$$\left(\frac{V_2-V_1}{2}\right)+(4)+\left(\frac{V_2-V_0}{8}\right)+(-7)=0$$

$$\frac{V_2-V_1}{2}+4+\frac{V_2}{8}-7=0$$

$$\frac{4V_2-4V_1+32+V_2-56}{8}=0$$

$$-4V_1+5V_2=24 \quad \text{——} \; (2)$$

$$-4V_1+5V_2=24 \quad \text{—} \; (2)$$

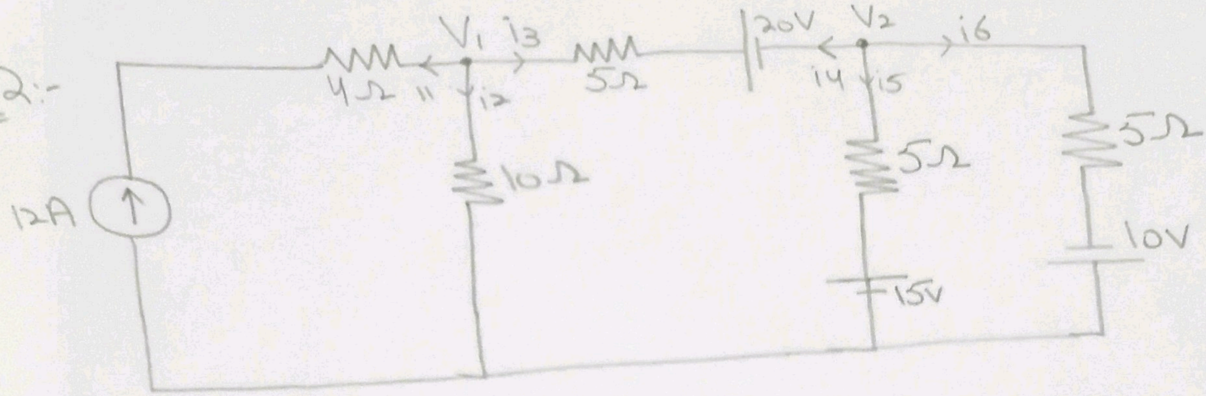
*2 $\quad 4V_1-2V_2=24 \quad \text{—} \; (1)$

$$3V_2=48 \Rightarrow \boxed{V_2=16V} \text{ put in } (1)$$

$$(1) \Rightarrow 2V_1-16=12 \Rightarrow 2V_1=28$$

$$\boxed{V_1=14V}$$

Q2:-



Sol:-

$i_1 + i_2 + i_3 = 0$

$(-12) + \left(\frac{V_1 - V_0}{10}\right) + \left(\frac{V_1 - 20 - V_2}{5}\right) = 0$

$\frac{-120 + V_1 + 2V_1 - 40 - 2V_2}{10} = 0$

$3V_1 - 2V_2 = 160$ — ①

$i_4 + i_5 + i_6 = 0$

$\left(\frac{V_2 + 20 - V_1}{5}\right) + \left(\frac{V_2 - 15}{5}\right) + \left(\frac{V_2 + 10}{5}\right) = 0$

$V_2 + 20 - V_1 + V_2 - 15 + V_2 + 10 = 0$

$-V_1 + 3V_2 + 15 = 0$

$-V_1 + 3V_2 = -15$ — ②

$3V_1 - 2V_2 = 160$ — ①

$-3V_1 + 9V_2 = -45$ — ② ②×3

$7V_2 = 115$

$\boxed{V_2 = 16.42V}$ put in ②

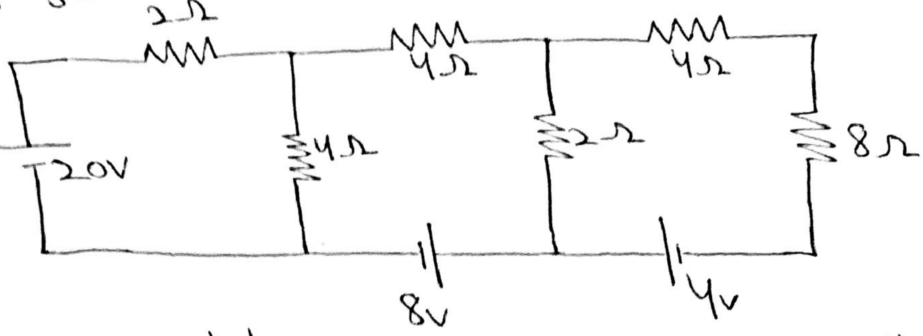
② ⇒ $-V_1 + 49.28 = -15$

$-V_1 = -64.28$ ⇒ $\boxed{V_1 = 64.28V}$

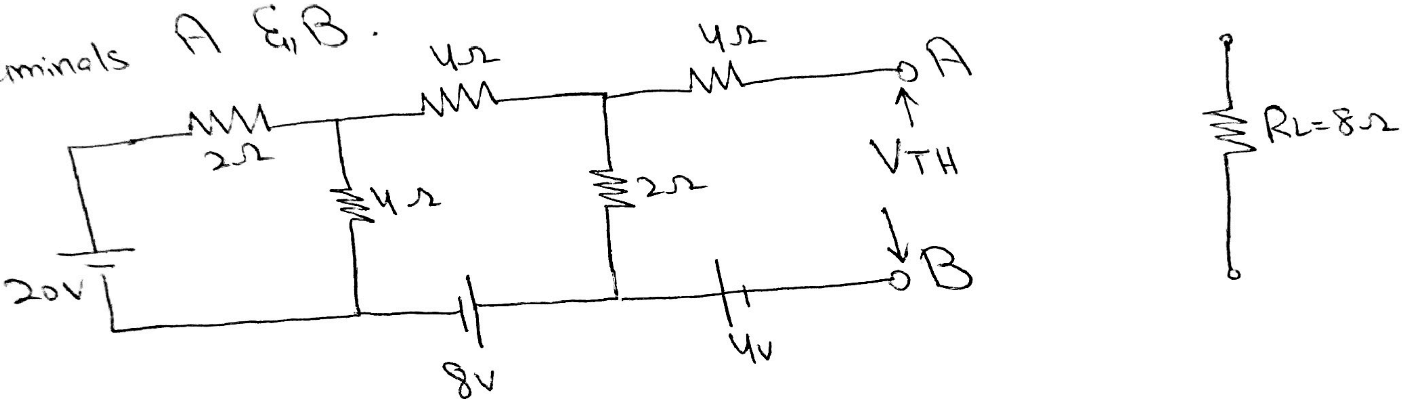
Thevenin's Theorem :

Find the current in 8Ω resistor using Thevenin's Theorem.

Step 1 :-

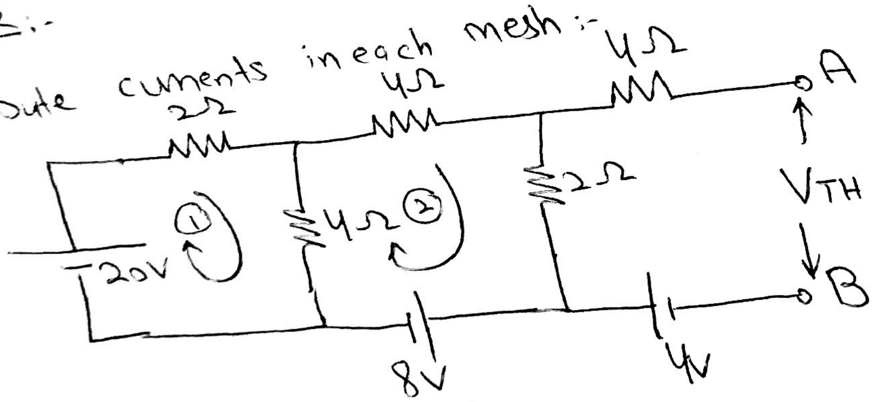


The resistor in which we want to find current is denoted by (R_L). Remove (R_L) and mark the terminals A & B.



Step 2 :-

distribute currents in each mesh :-



Applying KVL on mesh (1) :-

$$20 - 2I_1 - 4(I_1 - I_2) = 0$$

$$20 - 2I_1 - 4I_1 + 4I_2 = 0 \Rightarrow -6I_1 + 4I_2 = -20 \quad \text{—— (1)}$$

Applying KVL on mesh (2) :-

$$-4I_2 - 2I_2 - 8 - 4(I_2 - I_1) = 0$$

$$-6I_2 - 8 - 4I_2 + 4I_1 = 0$$

$$4I_1 - 10I_2 = 8 \quad \text{—— (2)}$$

$$\begin{cases} I_1 = 3.81A \\ I_2 = 0.72A. \end{cases}$$

by Solving eq ① & ②:

$I_1 = 3.81A$ $I_2 = 0.72A$

Step 3:

Find V_{TH} (open ckt voltage across points A & B).

Connect an imaginary Source (V_{TH}) to terminals A & B.

(Note: Take the previous current distribution):

$-V_{TH} + 4 - 2I_2 = 0$

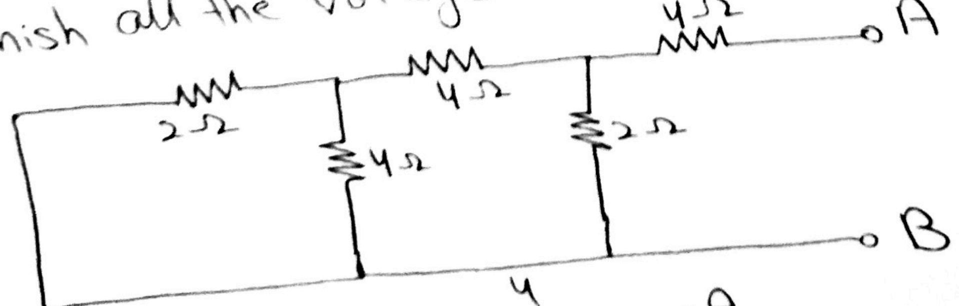
$V_{TH} = 4 - 2(0.72) \Rightarrow V_{TH} = 4 - 1.44$

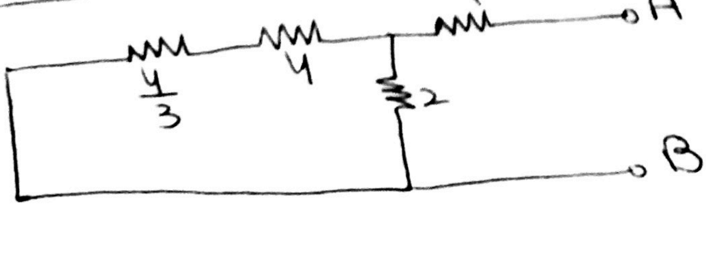
$\boxed{V_{TH} = 2.56V}$

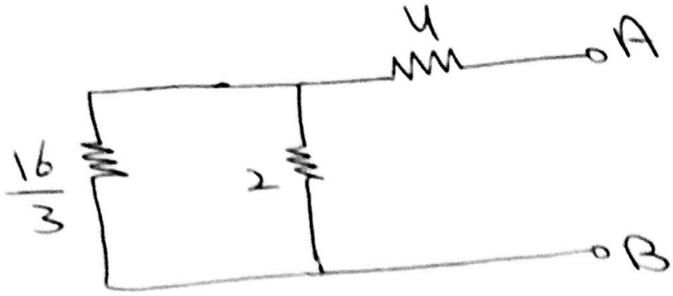
Step 4:

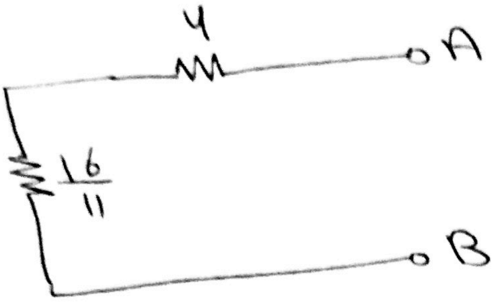
Find R_{TH} (total resistance of the ckt)

→ finish all the voltage Sources.



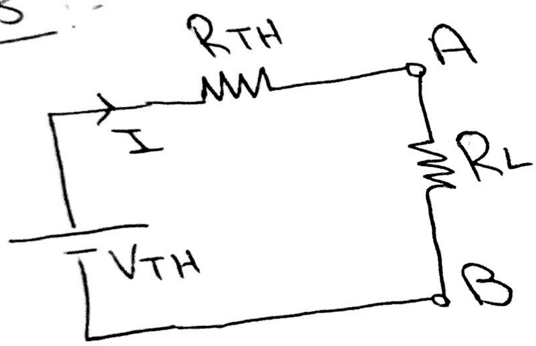






$$\boxed{R_{TH} = 5.45\,\Omega}$$

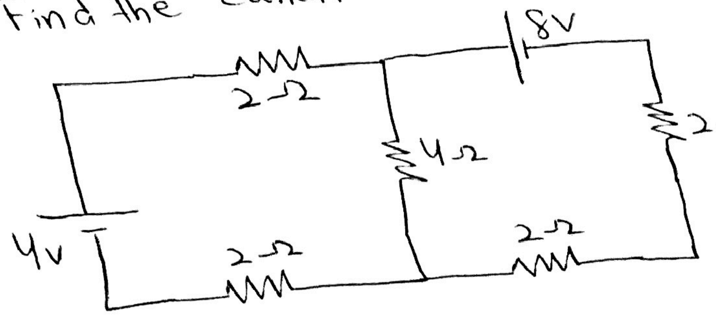
Step 5:



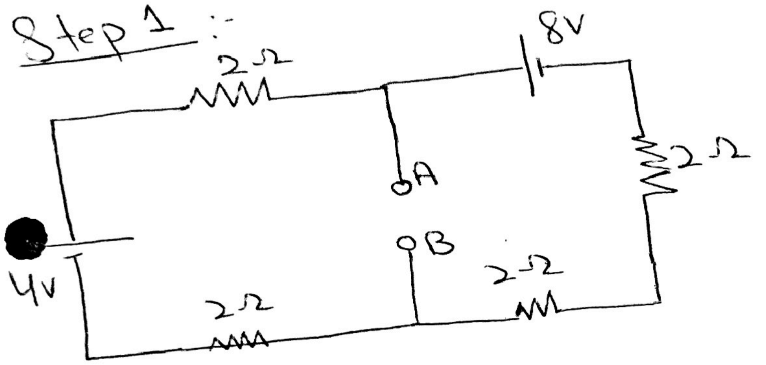
$$I = \frac{V_{TH}}{R_{TH} + R_L} = \frac{2.56}{5.45 + 8}$$

$$I = \frac{2.56}{13.45} = \boxed{0.19A}$$

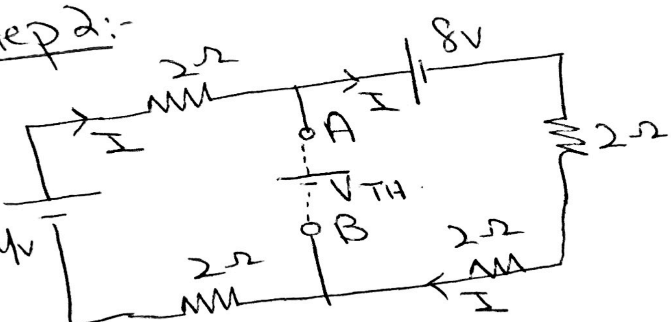
Q2:- Find the current in 4Ω resistor using Thevenin's Theorem:-



Step 1 :-



Step 2:-



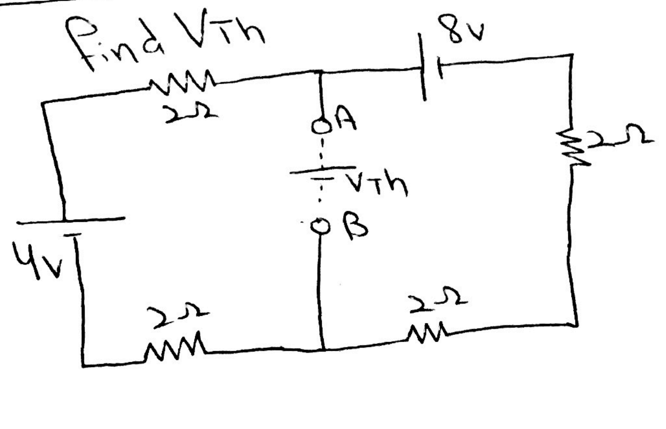
$$4 - 2I - 8 - 2I - 2I - 2I = 0$$

$$-8I - 4 = 0$$

$$I = -\frac{4}{8} \Rightarrow \boxed{I = -\frac{1}{2} A}$$

Step 3 :-

Find V_{Th}



$$4 - 2I - V_{Th} - 2I = 0$$

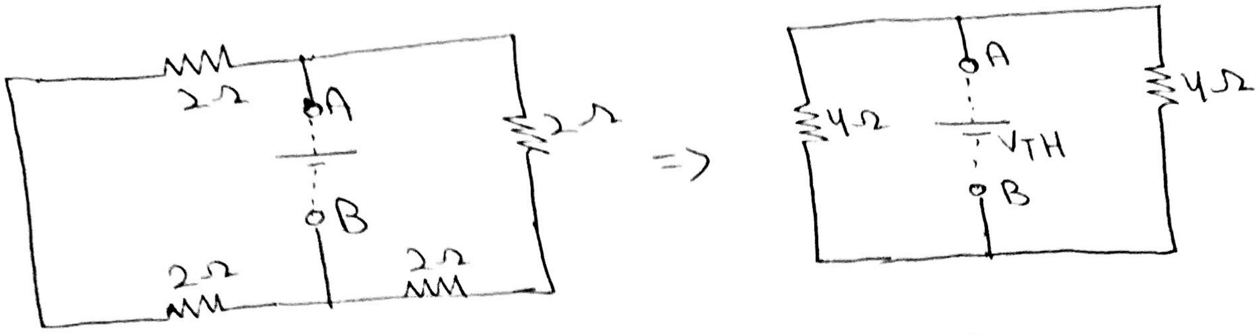
$$V_{Th} = -4I + 4$$

$$V_{Th} = -4\left(-\frac{1}{2}\right) + 4$$

$$V_{TH} = 2 + 4 = 6V$$

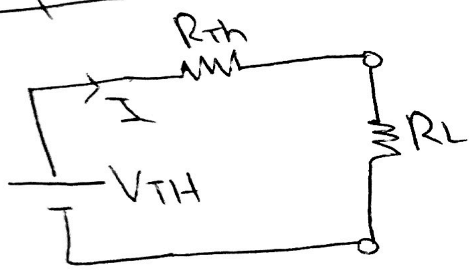
Step 4:-

Finding R_{Th}



$$R_{TH} = \frac{4 \times 4}{4+4} = \frac{16}{8} \Rightarrow \boxed{R_{TH} = 2\Omega}$$

Step 5:-



$$I = \frac{V_{Th}}{R_{Th} + R_L} = \frac{6}{2+4} = \boxed{1A}$$ Ans:-