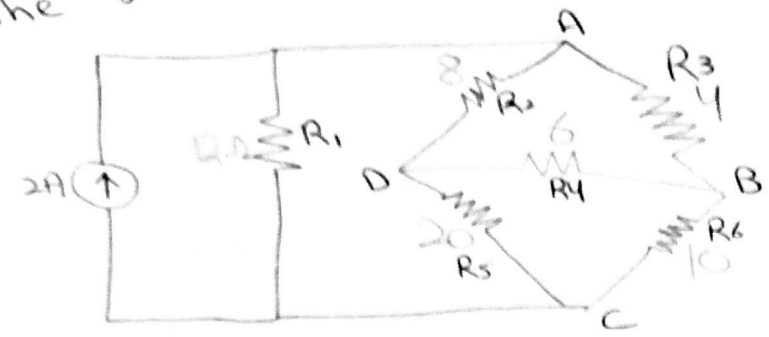
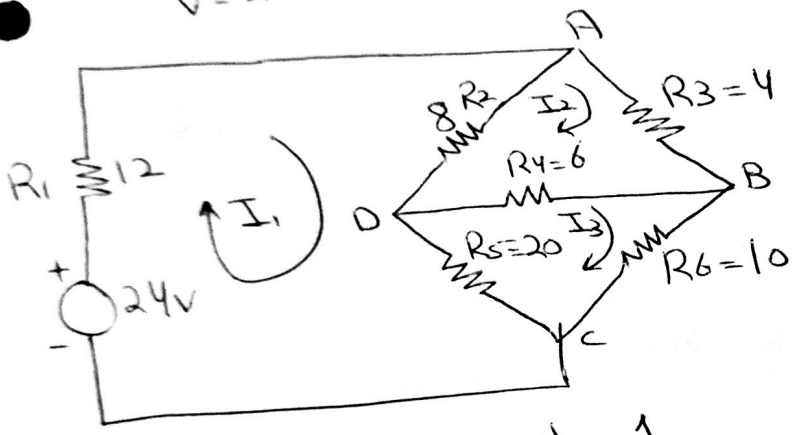
Q. Using mesh current method, find the currents in the resistances R3, R4, R5 & R6 of the ckt shown below:-



Soln:- First converting 2A source in parallel with 12Ω resistance into equivlant voltage source of voltage:-

$V = 2 \times 12 = 24V$



Applying KVL on mesh 1,

$24 - 12I_1 - 8(I_1 - I_2) - 20(I_1 - I_3) = 0$

$10I_1 - 2I_2 - 5I_3 = 6$ — (1)

Applying KVL on mesh 2:-

$-4I_2 - 6(I_2 - I_3) - 8(I_2 - I_1) = 0$

$-4I_1 + 9I_2 - 3I_3 = 0$ — (2)

Applying KVL on mesh 3:-

$-6(I_2 - I_3) - 10I_3 - 20(I_3 - I_1) = 0$

$-10I_1 - 3I_2 + 18I_3 = 0$

$\Rightarrow I_1 = 1.125A, \quad I_2 = 0.75A, \quad I_3 = 0.75A$

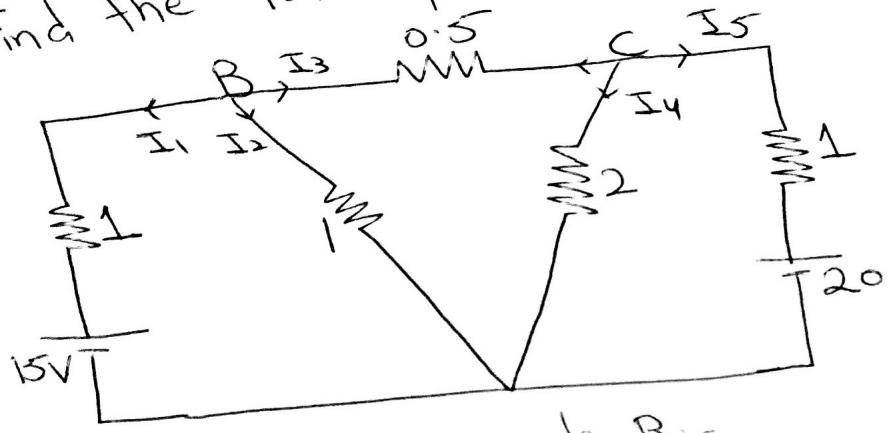
current in $R_3 (=4\Omega) = I_2 = 0.75A \rightarrow$ from A to B

current in $R_4 (=6\Omega) = I_2 - I_3 = 0.75 - 0.75 = 0A$

current in $R_5 (=20\Omega) = I_1 - I_3 = 1.125 - 0.75 = 0.375A$
↳ from D to C

current in $R_6 (=10\Omega) = I_3 = 0.75 \rightarrow$ from B to C

Q:- Find the Total power consumed in the ckt below:
by using nodal analysis:-



Soln:- Applying KCL on node B:-

$$\frac{V_B - 15}{1} + \frac{V_B - V_o}{1} + \frac{V_B - V_c}{0.5} = 0$$

$$(V_B - 15) + (V_B - V_o) + \frac{V_B - V_c}{0.5} = 0$$

$$0.5V_B - 7.5 + 0.5V_B + V_B - V_c = 0$$

$$2V_B - V_c = 7.5 \quad \text{—①}$$

Applying KCL on node C:-

$$\frac{V_c - V_B}{0.5} + \frac{V_c - V_o}{2} + \frac{V_c - 20}{1} = 0$$

$$2V_c - 2V_B + 0.5V_c + V_c - 20 = 0$$

$$-2V_B + 3.5V_c = 20 \quad \text{—②}$$

Current $I_1 = \frac{V_B - 15}{1} = 9.25 - 15 = -5.75\,A$

$I_2 = \frac{V_B}{1} = 9.25\,A$

$I_3 = \frac{V_B - V_C}{0.5} = \frac{9.25 - 11}{0.5} = -3.5\,A$

$I_4 = \frac{V_C}{2} = \frac{11}{2} = 5.5\,A$

$I_5 = \frac{V_C - 20}{1} = 11 - 20 = -9\,A$

Power consumed in ckt:-

$= I^2R$

$= (I_1^2 1) + (I_2^2 1) + (I_3^2 0.5) + (I_4^2 2) + (I_5^2 1)$

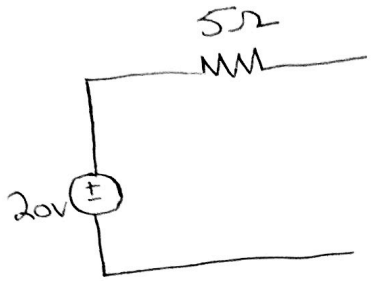
$= (-5.75)^2 + (9.25)^2 + (-3.5)^2(0.5) + (5.5)^2(2) + (-9)^2$

$= 266.25\,W$ Ans:-

Source Transformation:-

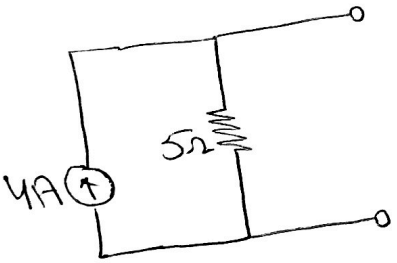
Numerical 1:-

Transform a voltage source of 20V with an internal resistance of 5Ω to a current source. Refer to the fig below:-



Soln:-

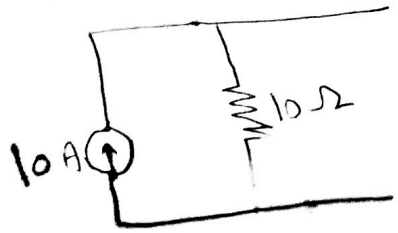
$$I = \frac{V}{Rse} = \frac{20}{5} = 4A \quad \text{(with internal resistance Same as Rse)}$$



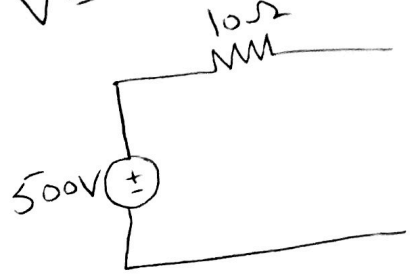
Numerical 2:-

convert the given current source of 50A with internal resistance of 10Ω to the equivalent voltage source.

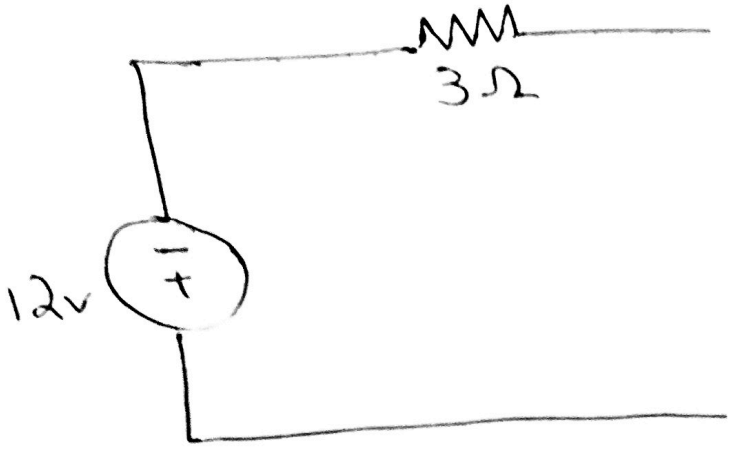
Soln:-



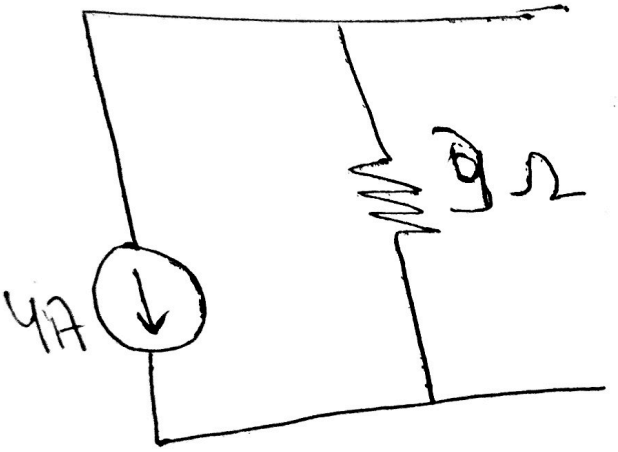
$$V = I \times Rsh = 50 \times 10 = 500V$$



Numerical 3:-



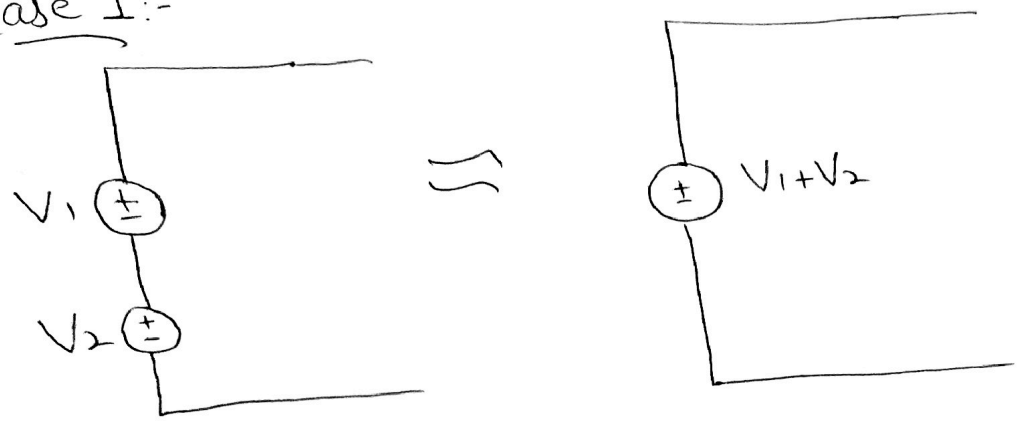
Soln:- $I = \frac{V}{R} = \frac{12}{3} = 4A$



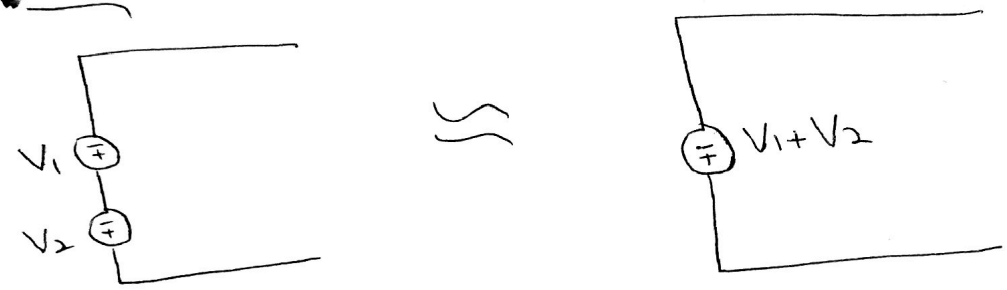
Combination of Sources:-

① :- Voltage Sources in Series :-

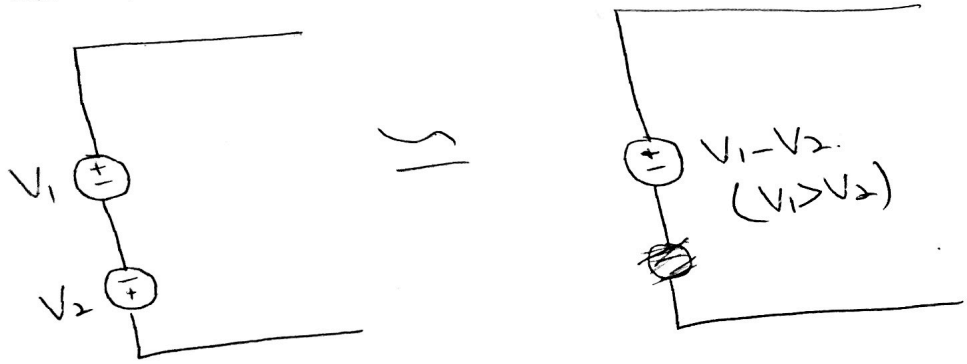
case 1:-



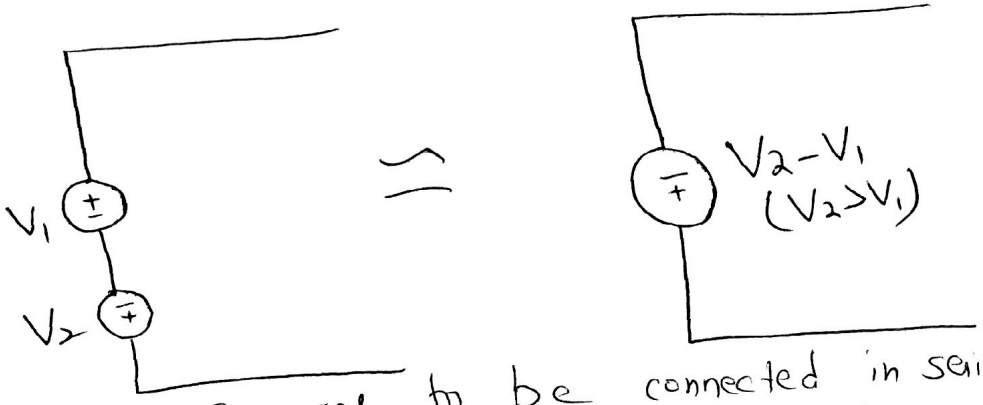
case 2:-



case 3:-



case 4:-



The voltage sources to be connected in series must have same current ratings though their voltage ratings maybe same or different.

(2):- Voltage Sources in Parallel:-

case 1:-

Hence the voltage sources to be connected in parallel must have same polarity and voltage ratings though their current rating may be same or different.

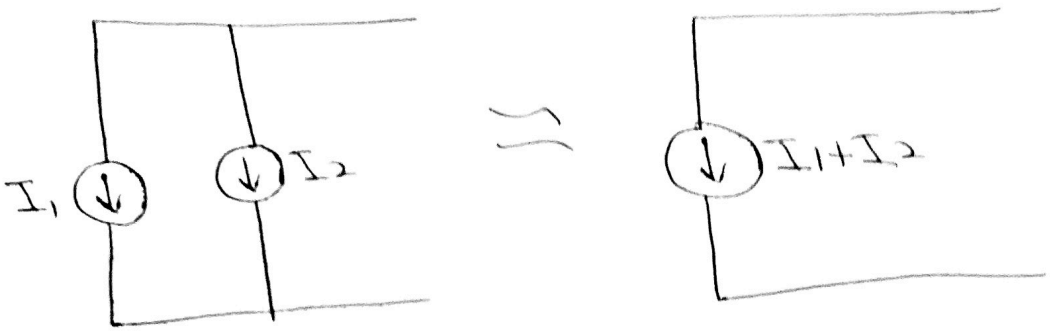
(3):- current Sources in Series:-

Hence the current through series ckt is always same hence it must be noted that the current sources to be connected in series must have same current ratings though their voltage ratings may be same or different.

y1:- current Sources in parallel :-

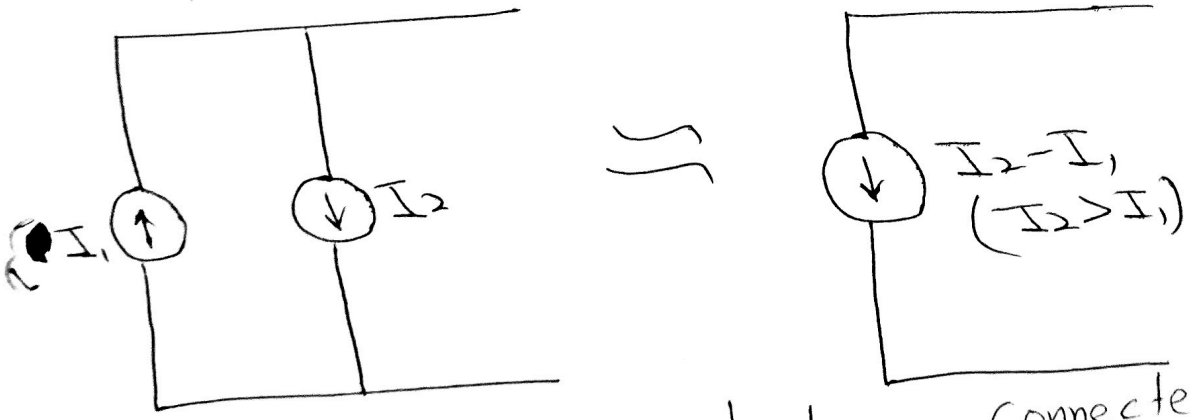
case 1:-

Case 2 :-



Case 3:-

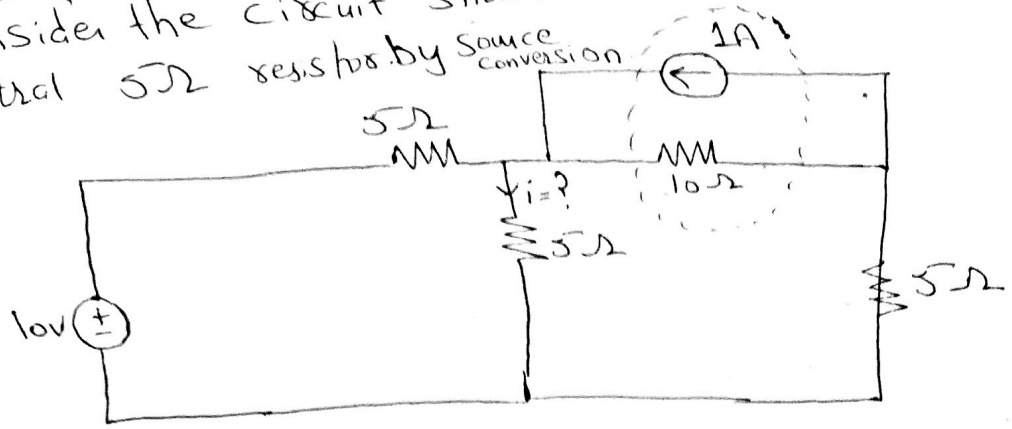
Case 4:-



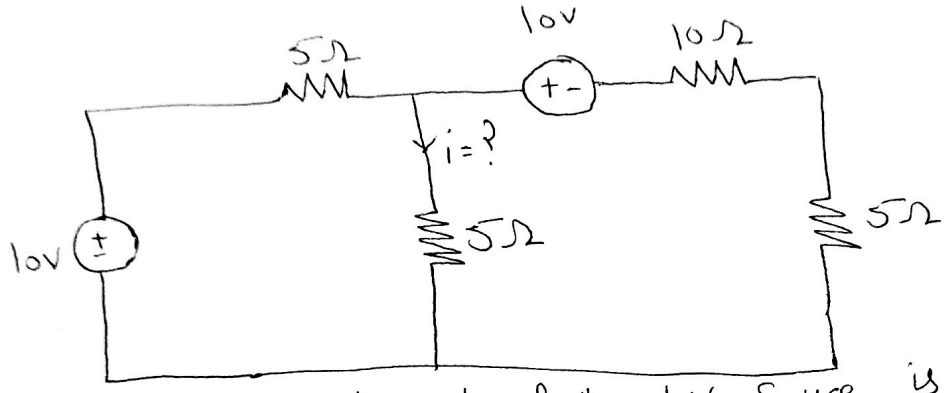
The current sources to be connected in parallel must have same voltage ratings though their current ratings may be same or different.

Numerical:-

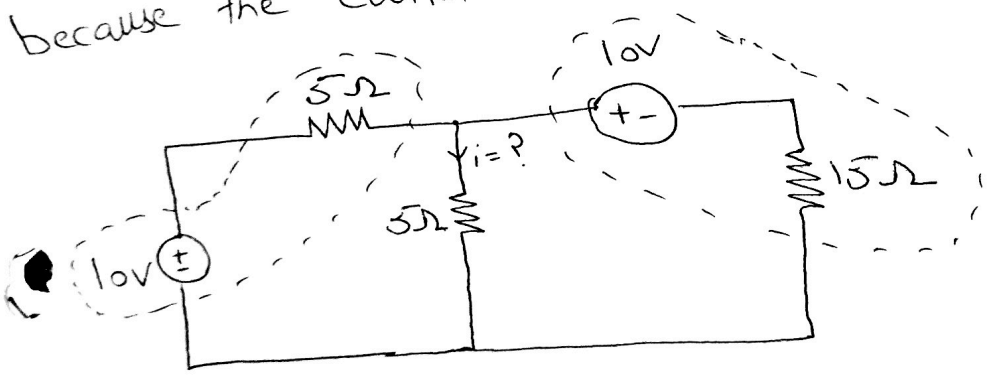
Consider the circuit shown below. Find the current through the central 5Ω resistor by source conversion



Soln:-

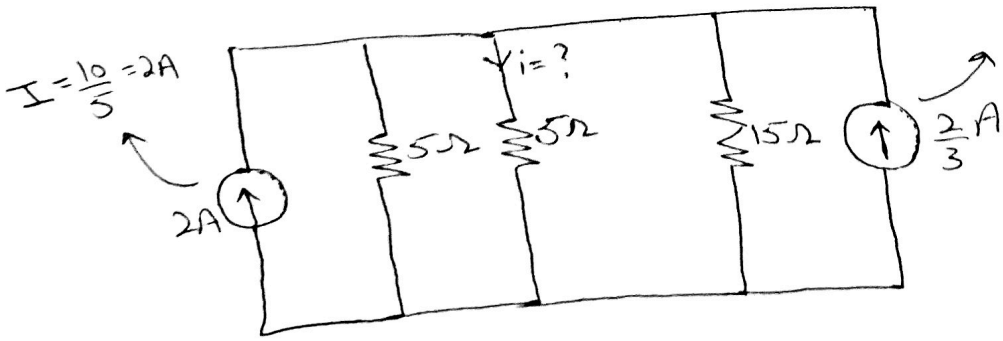


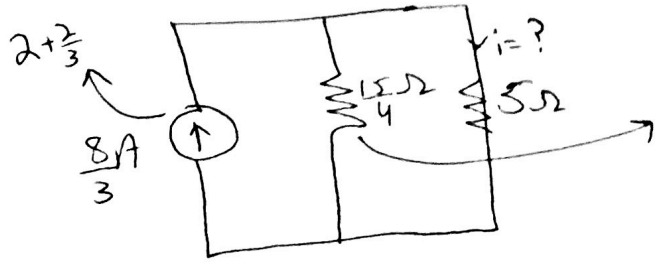
Note that the +ve terminal of the 10V source is placed to the left because the current source arrow was pointing to the left.



$I = \frac{10}{15} = \frac{2}{3}A$

$I = \frac{10}{5} = 2A$

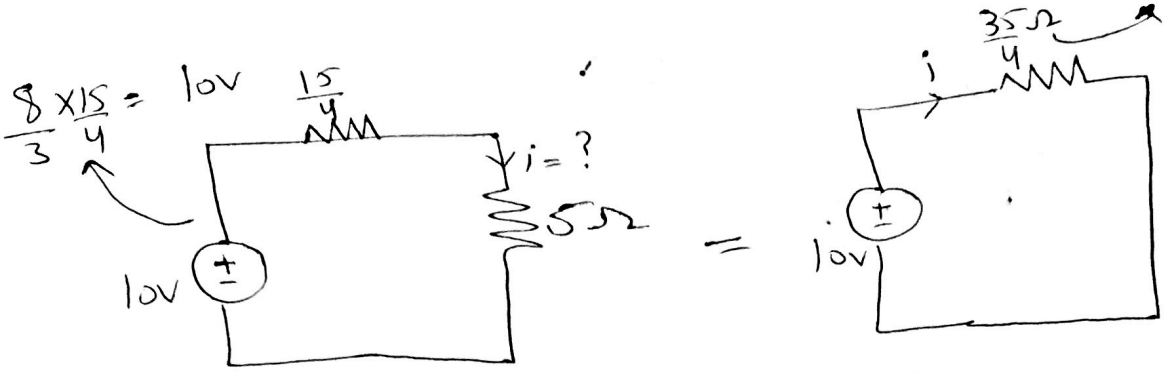




$$\frac{1}{Req} = \frac{1}{5} + \frac{1}{15} = \frac{3+1}{15} = \frac{4}{15}$$

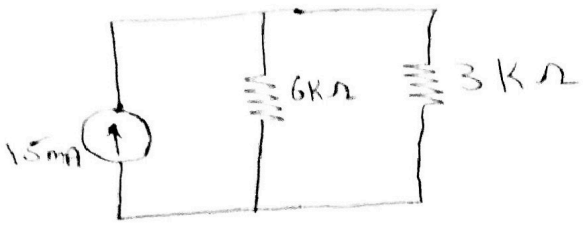
$$Req = \frac{15}{4}\Omega$$

$\frac{15}{4} + 5 = \frac{15+20}{4}$

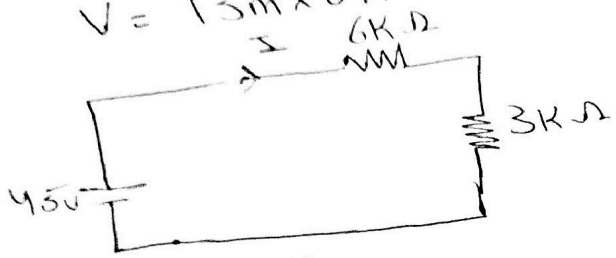


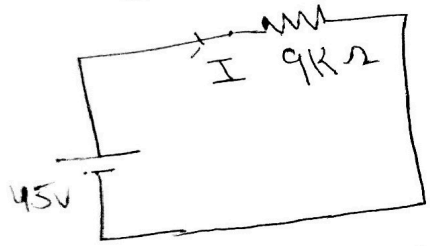
$$i = \frac{10}{\frac{35}{4}} = \frac{10 \times 4}{35} = \boxed{\frac{8}{7} A}$$

Q:- Find the current in 6KΩ resistor in the below figure by converting the current source to a voltage source. ①



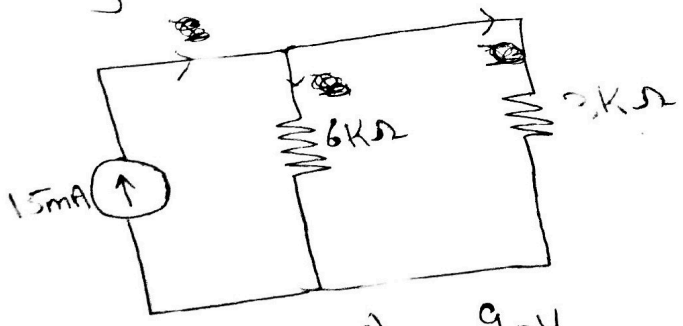
Sol:- $V = 15m \times 6K = 45V$



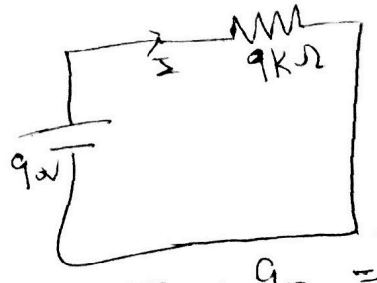


$$I = \frac{V}{R} = \frac{45}{9 \times 10^3} = \boxed{5mA}$$

Q2:- Find the current in the 3KΩ resistor in below fig by converting the current source to voltage source.



Sol:- $V = (15 \times 10^{-3})(6 \times 10^3) = 90V$



$$I = \frac{90}{9 \times 10^3} = \boxed{10mA}$$