Name : Muhammad Saqib Khalil

ID : 13342

Subject : Linear ~~Control~~ Circuit Analysis

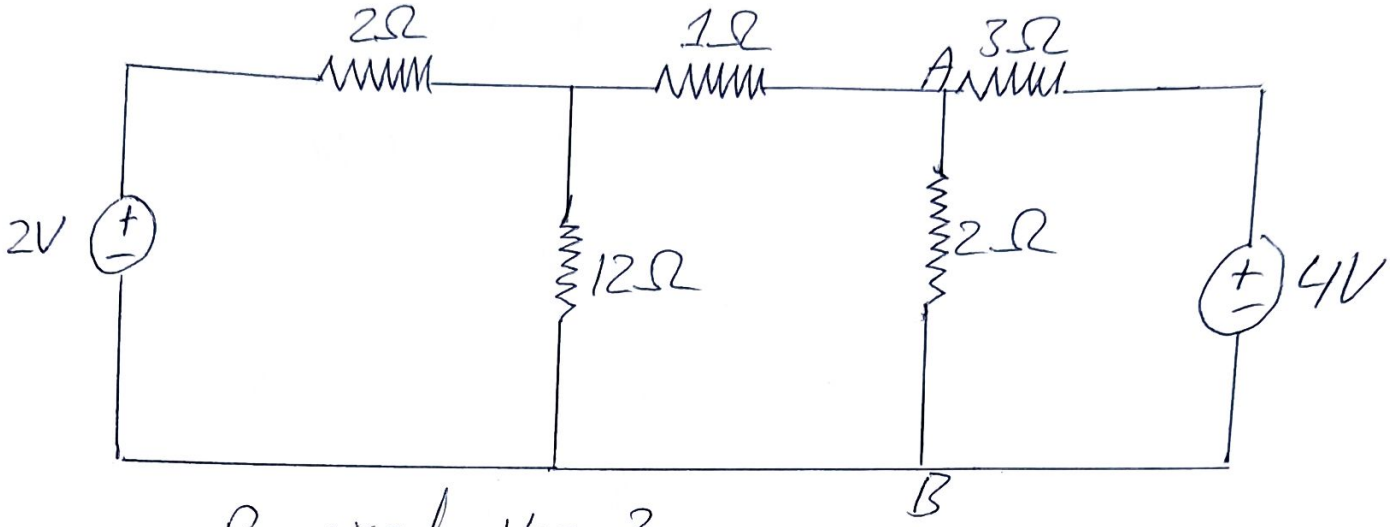
Program : BE (Electrical)

Exam : Summer (2020) Final

Date : 24/09/2020

Submitted to : Engr. WALEED JAN

Q#1 Using superposition principle determine the current through 2Ω resistor connected between terminal A & B in given circuit

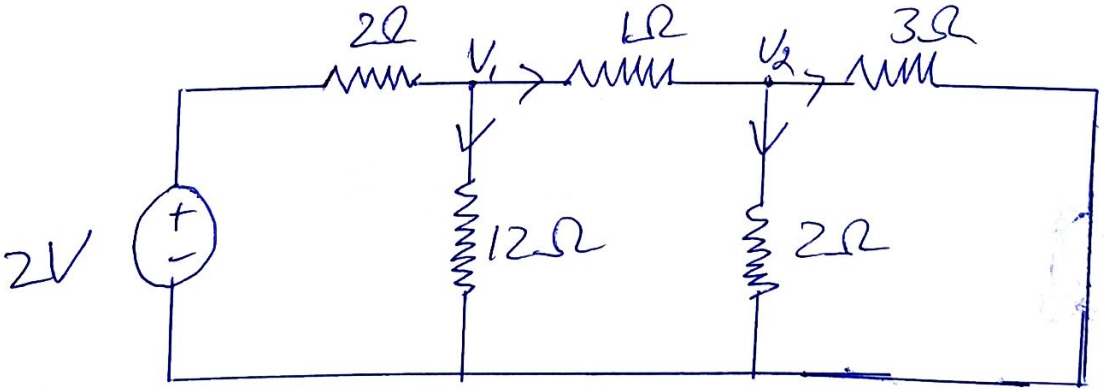


Required $V_{AB} = ?$

Sol:

Using superposition principle:

Suppose we use 2V Volt source & Short the 4Volt source



For find V_{AB} using Nodel Analysis.

(2)

V_1:

$$\frac{V-2}{2} + \frac{V_1}{2} + \frac{V_1 - V_2}{1} = 0$$

$$6V_1 - 12 + V_1 + 12V_1 - 12V_2 = 0$$

$$19V_1 + 12V_2 = 12 \quad \text{——} (1)$$

V_2:

$$\frac{V_2 - V_1}{1} + \frac{V_2}{2} + \frac{V_2}{3} = 0$$

$$6V_2 - 6V_1 + 3V_2 + 2V_2 = 0$$

$$-6V_1 + 11V_2 = 0$$

$$V_2 = \frac{6V_1}{11} \quad \text{——} (2) \quad \text{put in eq (1)}$$

$$19V_1 - 12\left(\frac{6V_1}{11}\right) = 12$$

$$19V_1 - \frac{72V_1}{11} = 12$$

$$19V_1 - 6.5V_1 = 12$$

$$12.45V_1 = 12$$

$$V_1 = \frac{12}{12.45}$$

$$\boxed{V_1 = 0.963\ V}$$

(2)b

$$V_2 = \frac{6V_1}{11}$$

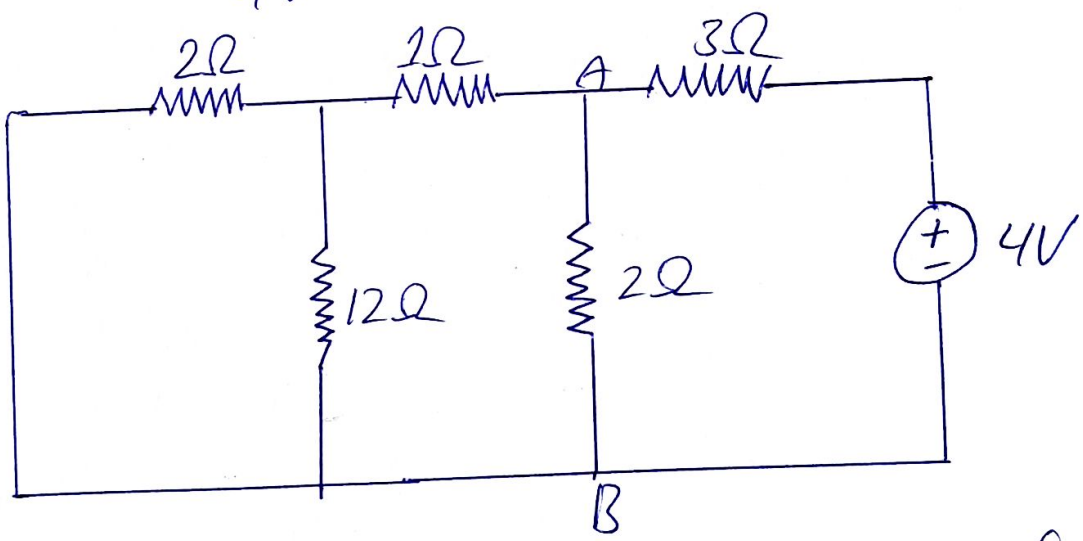
$$= \frac{6(0.963)}{11}$$

$$\boxed{V_2 = 0.525\,V}$$

$$V_{AB} = V_2 - 0$$

$$\boxed{V_{AB} = 0.525\,V}$$

Now 2V source is to be short & 4V is to be use source.



after parallel & series simplification

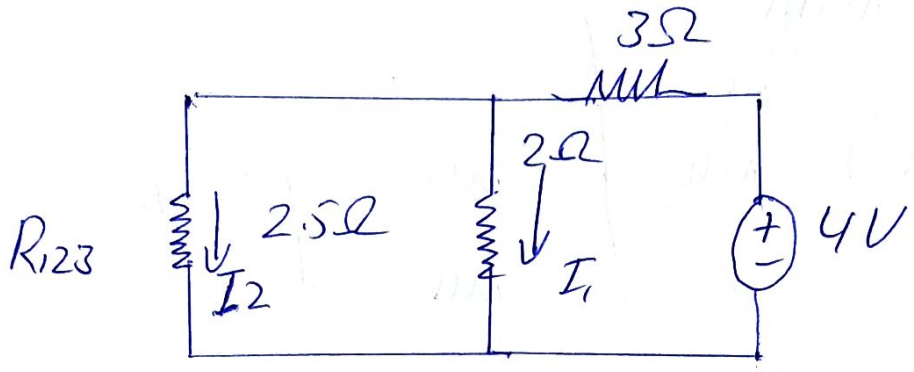
$$R_{12} = 2 // 12$$

$$R_{123} = 2 // 12 + 1$$

(3)

$R_{123} = 1.5 + 1$

$R_{123} = 2.5\ \Omega$



$$V_{AB}'' = \frac{I_1(2)}{2.5//2+3} \quad \text{— A}$$

Using current division Rules.

$$I_1 = \left(\frac{2.5}{2+2.5}\right) I$$

$I_1 = 0.5405A$

$V_{AB}'' = I_1(2)$

$= (0.5405)(2)$

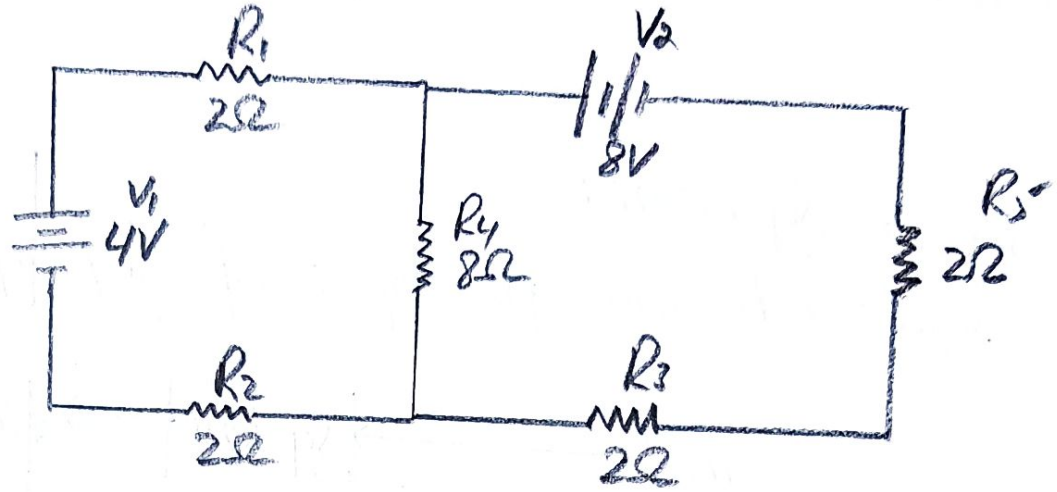
$V_{AB} = 1.081V$

So Net Voltage

$V_{AB} = V_{AB}' + V_{AB}'' \Rightarrow (0.5225 + 1.081)V$

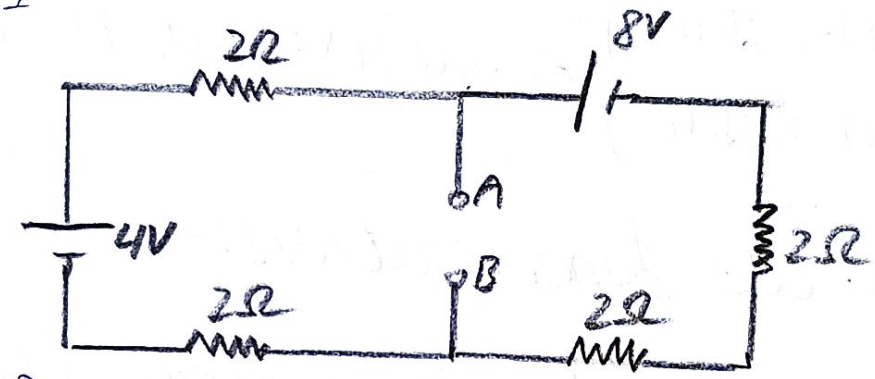
$V_{AB} = 1.6035$

Q#02

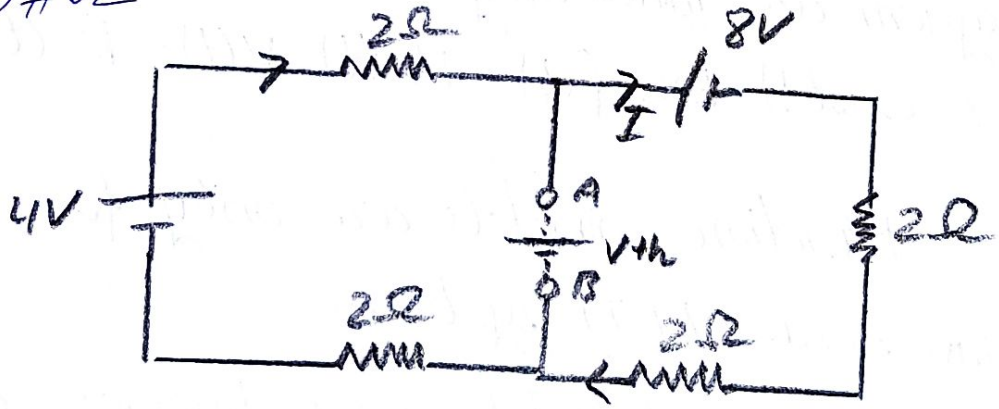


Sol:-

Step#01



Step#02



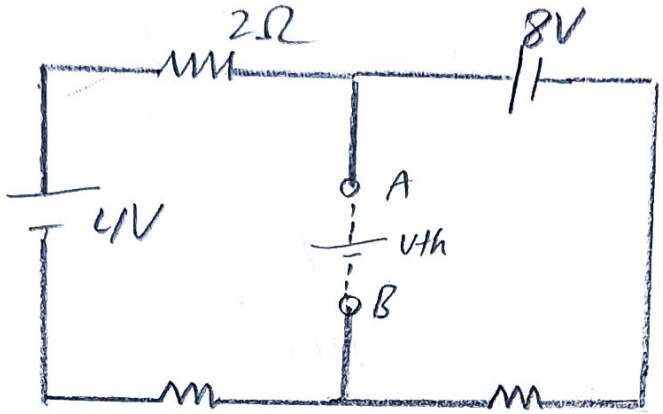
$$4 - 2I - 8 - 2I - 2I - 2I = 0$$

$$-8I - 4 = 0$$

$$I = \frac{-4}{8}$$

$$\boxed{I = -\frac{1}{2}}$$

Step#03

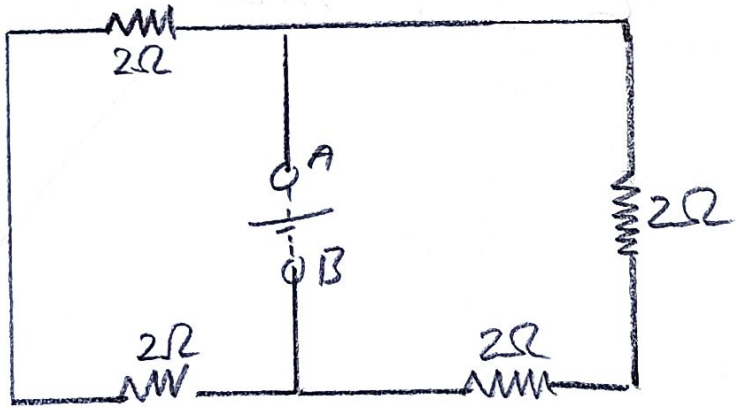


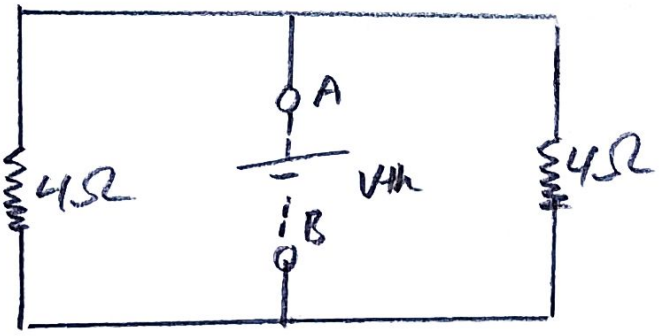
$$4 - 2I - V_{th} - 2I = 0$$

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

$$V_{th} = 6V$$

Step#04

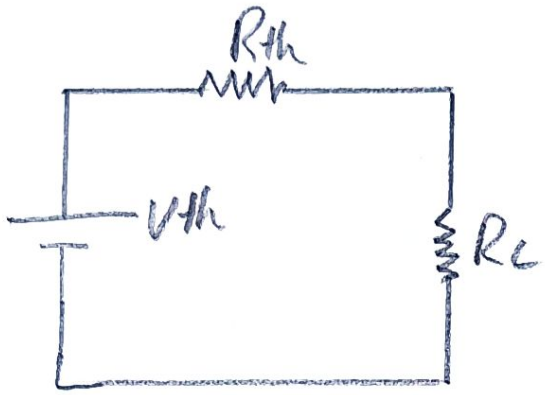




$$R_{th} = \frac{4 \times 4}{4+4} = \frac{16}{8} = 2\Omega$$

$R_{th} = 2\Omega$

Step#02



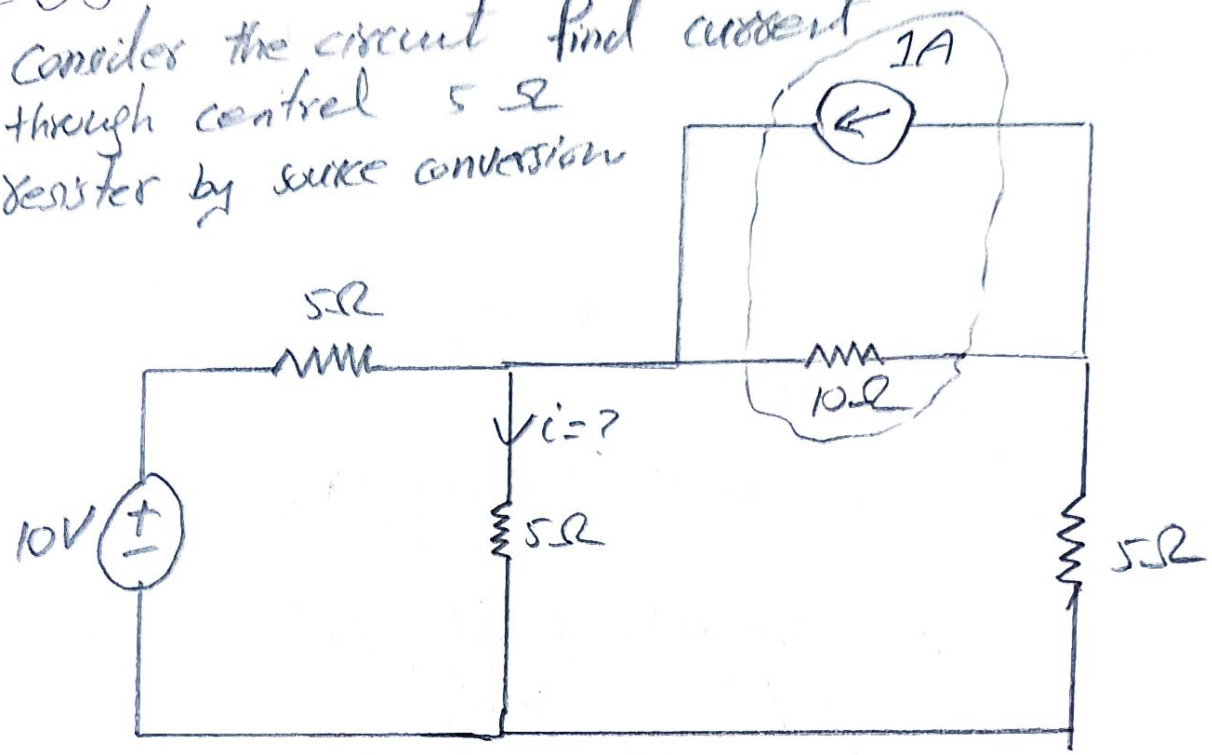
$$I = \frac{V_{th}}{R_{th}+R_L}$$

$$= \frac{6}{2+8}$$

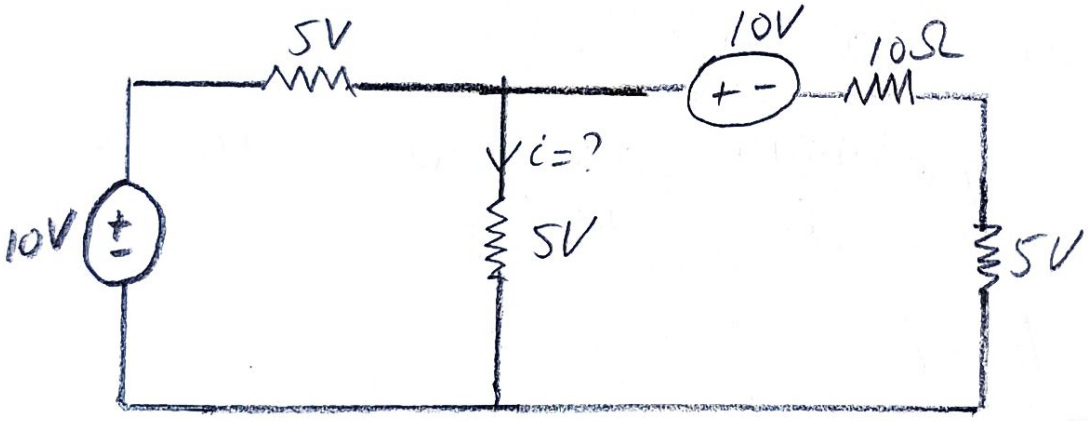
$$= \frac{6}{10}$$

$I = 0.6A$

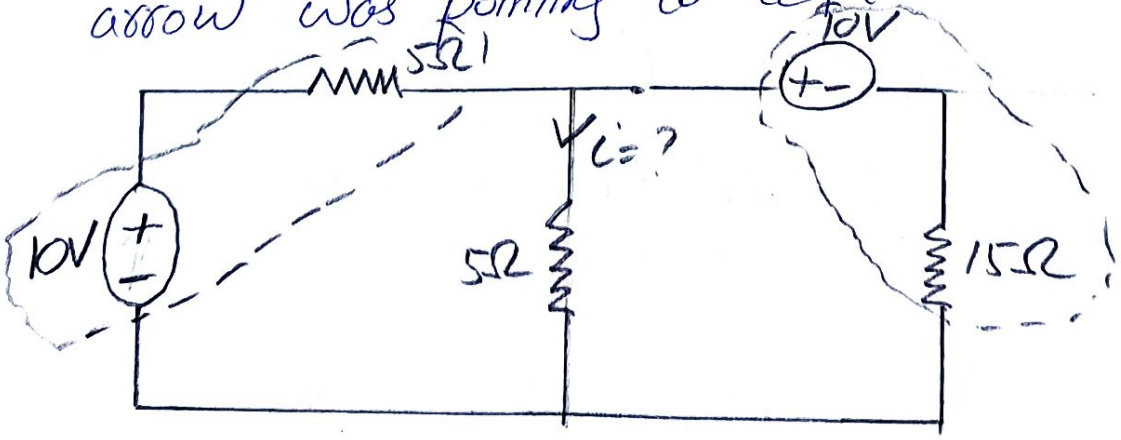
Q#03
Consider the circuit find current through central 5 Ω resister by source conversion



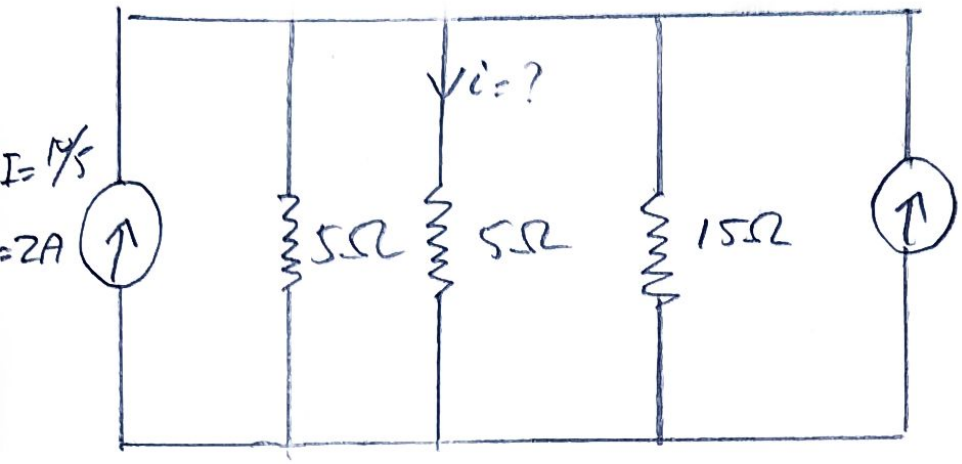
Sol:-

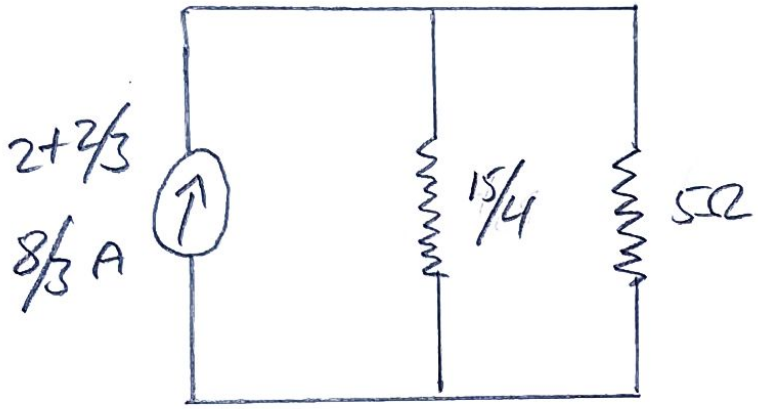


Note that the positive terminal of 10V source is placed to left because the current source arrow was pointing to left



(8)





$\therefore \frac{1}{Req} = \frac{1}{15} + \frac{1}{5}$

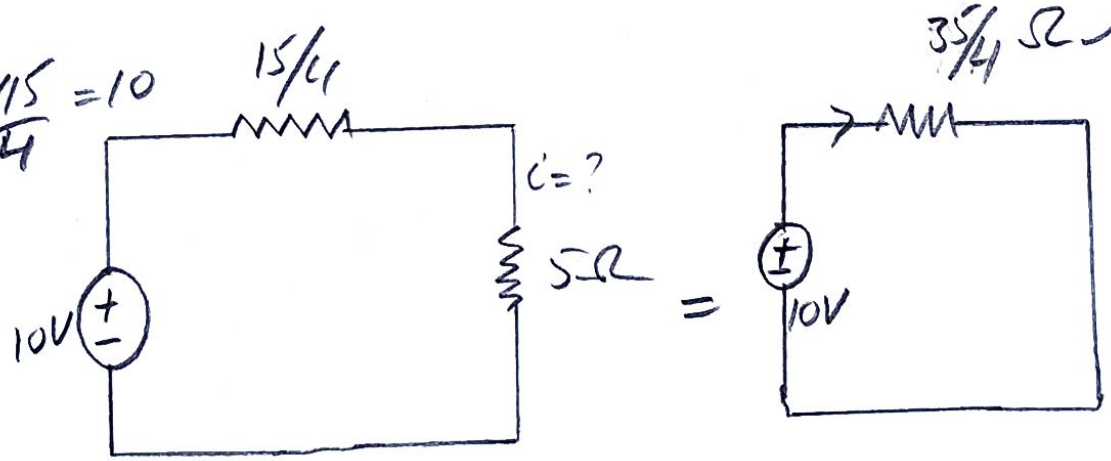
$= \frac{1+3}{15}$

$= \frac{15}{4}$ OR

$Req = 4/15$

$35/4\ \Omega \nearrow \frac{15}{4} + 5 = \frac{15+20}{4}$

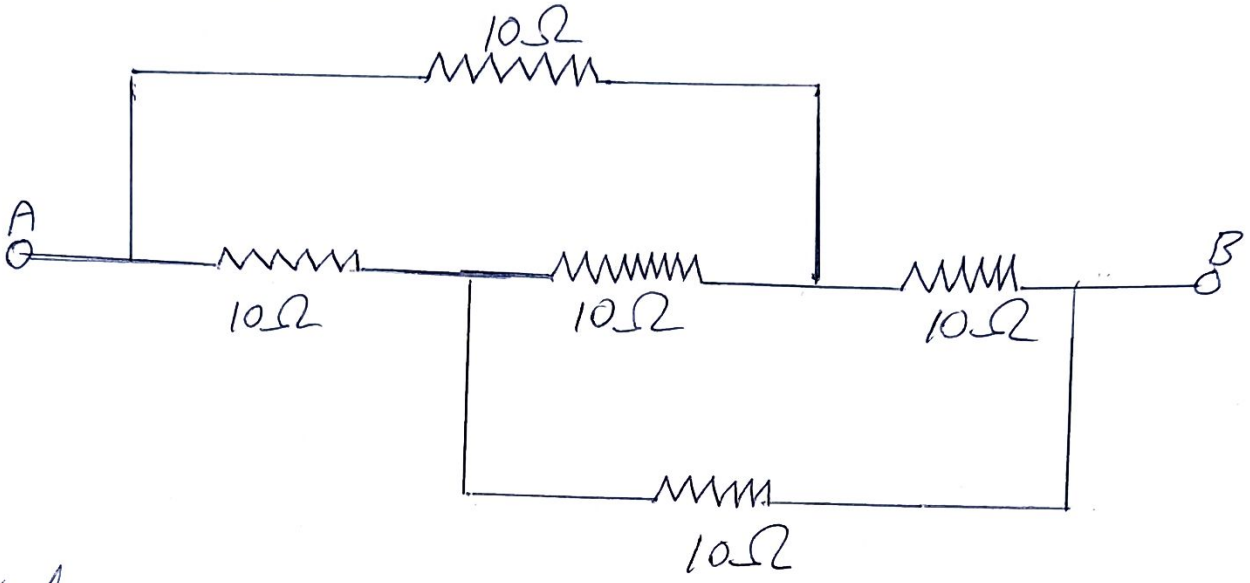
$8/3 \times \frac{15}{4} = 10$



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

Q#4

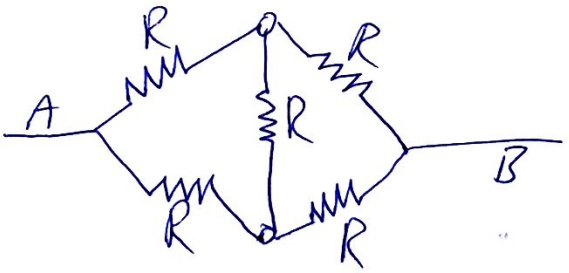
a) Calculate the resistence between terminal A & B for the circuit shown below:



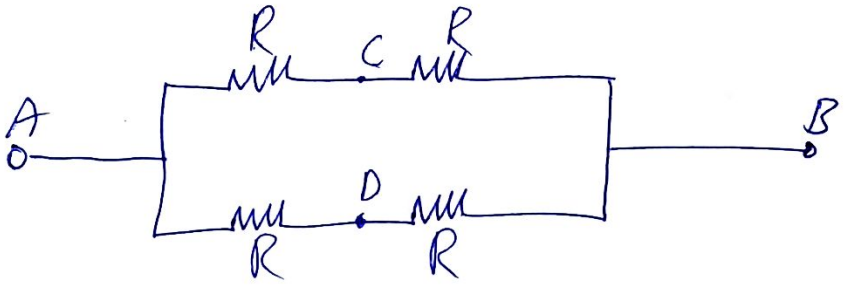
Soli-

A = VA

B = VB



all resistence has some value



(10)

$$R_{eq} = \frac{2R \times 2R}{2R + 2R}$$

$$= \frac{2(10) \times (10)2}{2(10) + 2(10)}$$

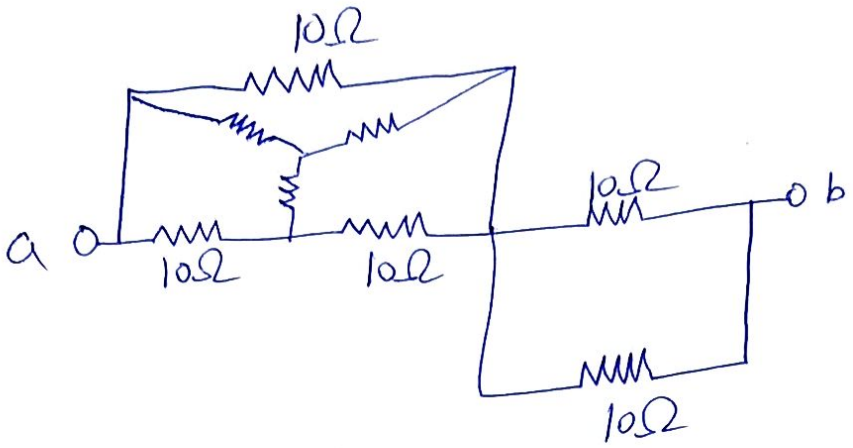
$$= \frac{20 \times 20}{20 + 20}$$

$$= \frac{10}{\cancel{400}\,\cancel{0}}$$

$$\boxed{R_{eq} = 10\Omega}$$

$$\boxed{R_{eq} = R}$$

2nd Method



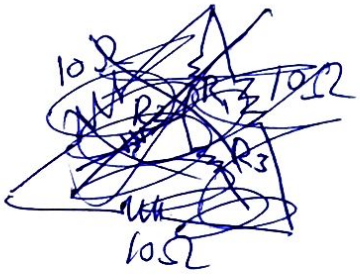
$R_{ab} = ?$

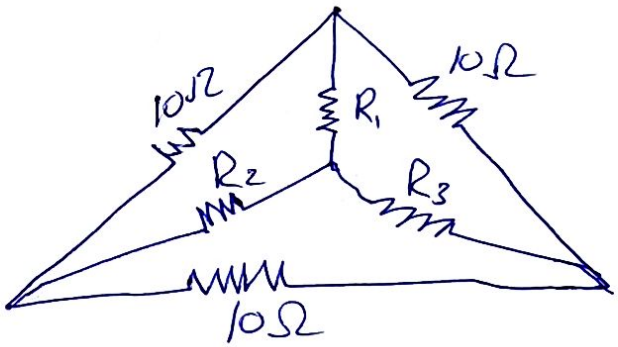
Δ to Y

$$R_1 = \frac{10 \times 10}{10+10+10}$$

$$R_1 = \frac{100}{30}$$

$$\boxed{R_1 = 3.333\ \Omega}$$





$$R_2 = \frac{10 \times 10}{10+10+10}$$

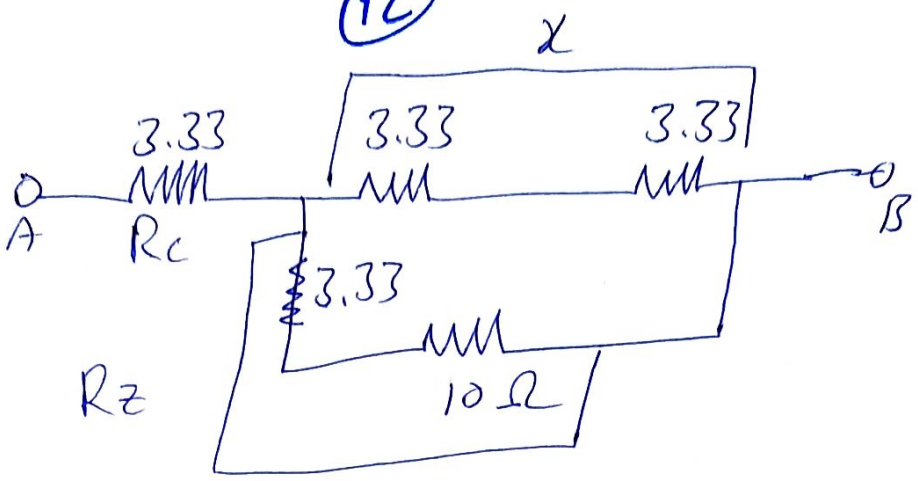
$$R_2 = \frac{100}{30}$$

$$\boxed{R_2 = 3.33\ \Omega}$$

Similarly

$$\boxed{R_3 = 3.33\ \Omega}$$

(12)

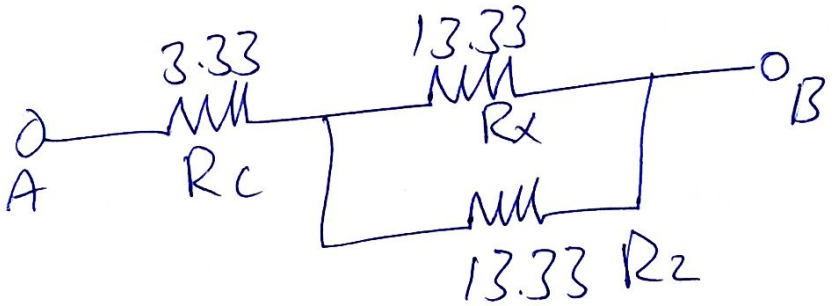


$$R_x = 10 + 3.33$$

$$R_x = 13.33\ \Omega$$

$$R_z = 10 + 3.33$$

$$R_z = 13.33$$

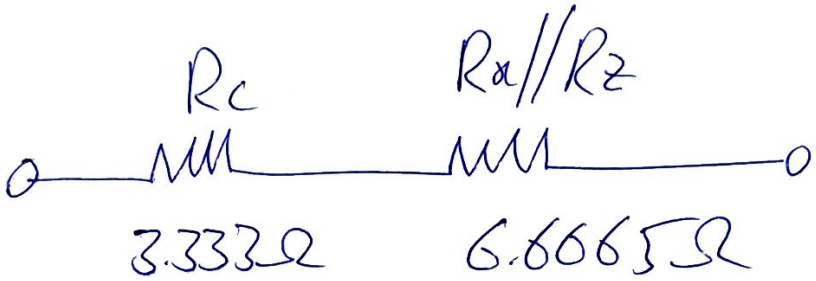


$$R_x // R_z = \frac{R_x \times R_z}{R_x + R_z}$$

$$= \frac{13.33 * 13.33}{13.33 + 13.33}$$

$$R_x // R_z = \frac{177.768}{26.66}$$

$$\boxed{R_x // R_z = 6.665\,\Omega}$$



$$R_{ab} = R_c + R_x // R_z$$

$$R_{ab} = 3.33 + 6.6665$$

$$\boxed{R_{ab} = 9.99}$$

$$R_{ab} \cong R$$

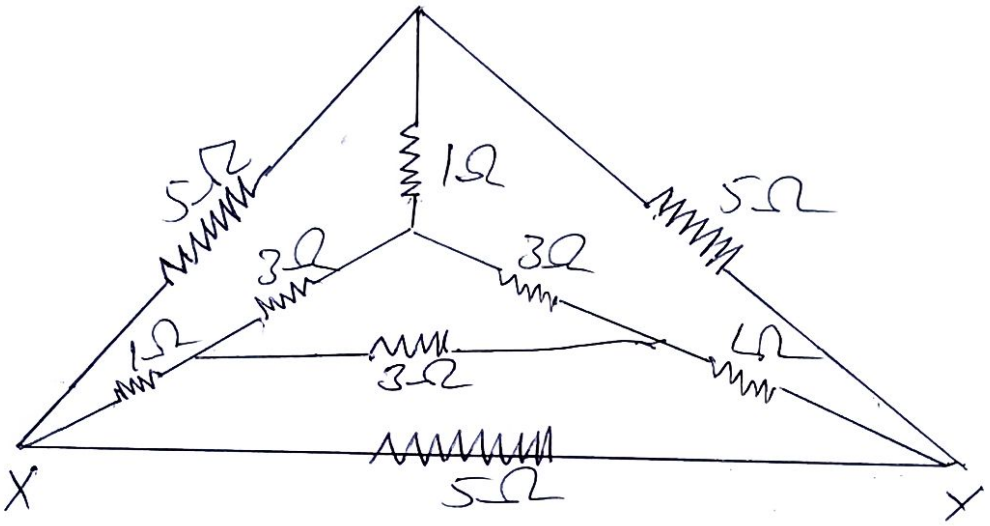
$$\boxed{R_{eq} = R}$$

$\therefore\ 9.99 \cong 10$

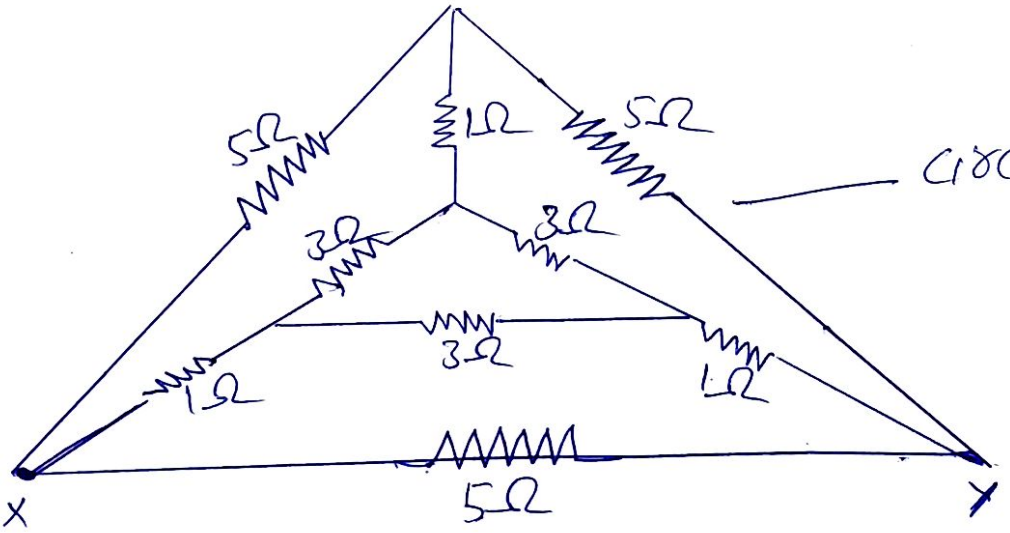
Q#4(b)

(14)

Determine the resistence between terminal X & Y for the circuit shown in figure



Sol:-



circuit A

(15)

$$R_1 = \frac{3\times3}{3+3+3} = \frac{9}{9} = 1$$

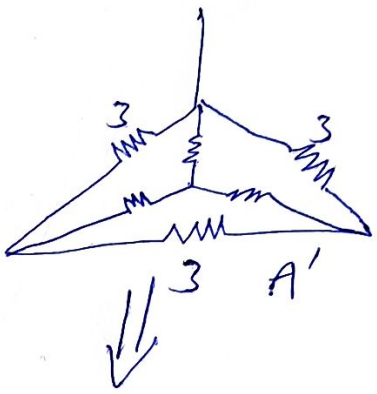
$R_1 = 1\,\Omega$

$$R_2 = \frac{3\times3}{3+3+3} = \frac{9}{9} = 1$$

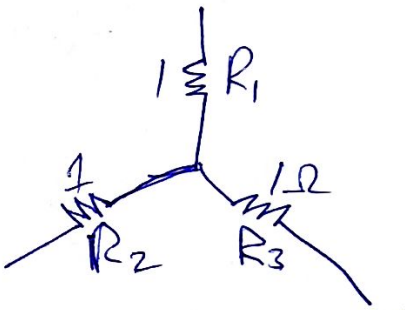
$R_2 = 1\,\Omega$

$$R_3 = \frac{3\times3}{3+3+3} = \frac{9}{9} = 1$$

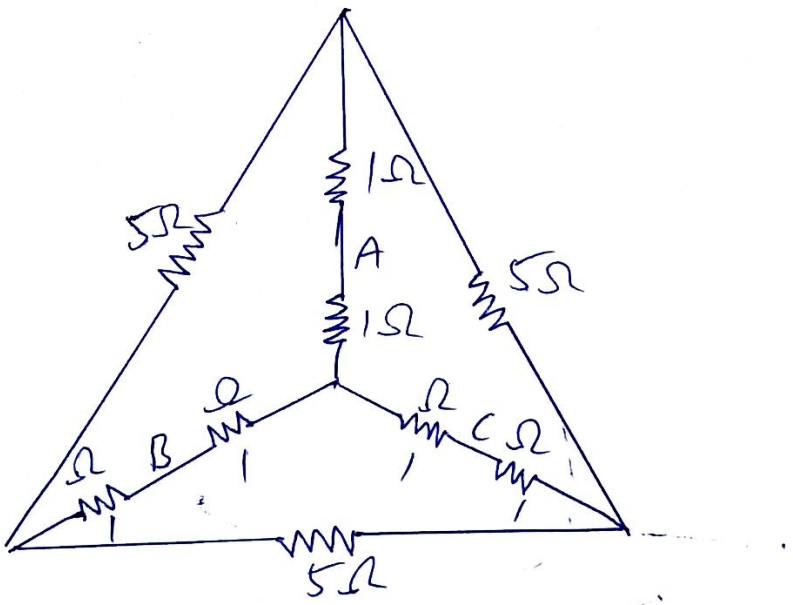
$R_3 = 1\,\Omega$



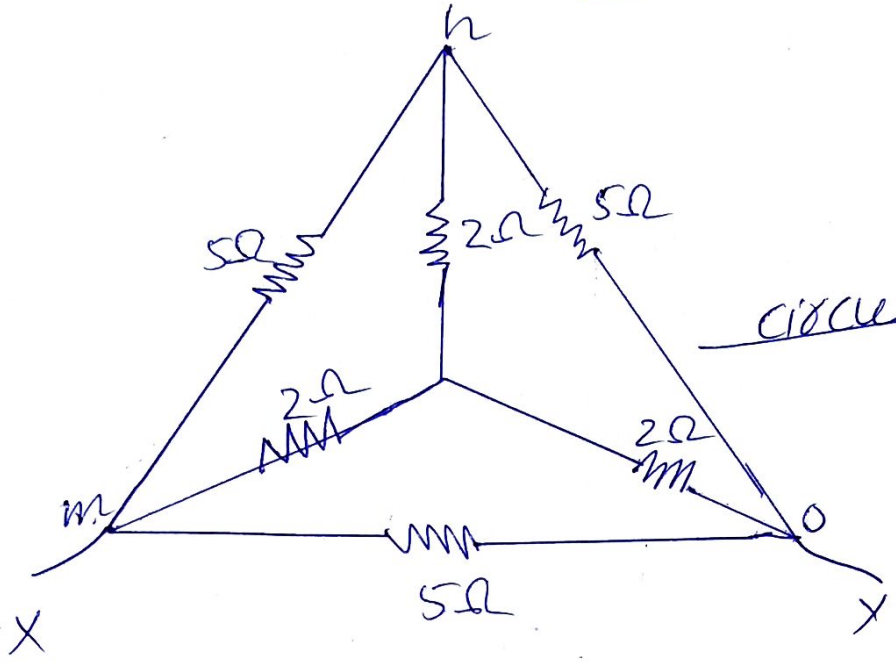
Δ to Y



*Put in circuit A



16



circuit (13)

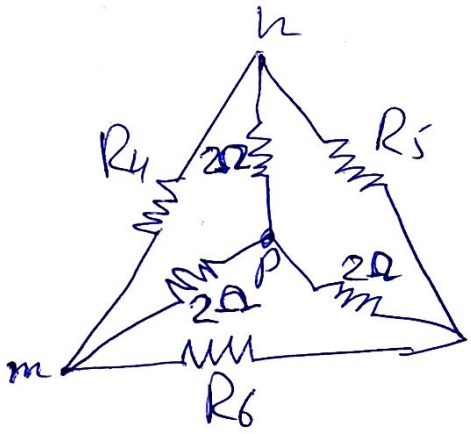
$R_4 = 2+2 + \frac{2\times 2}{2}$

$R_4 = 6\Omega$

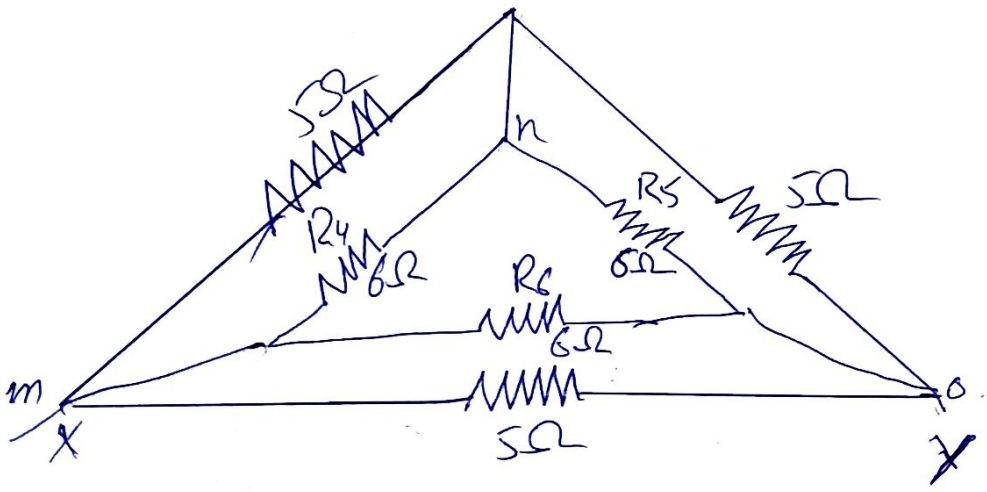
$R_5 = 4+2$

$R_5 = 6\Omega$

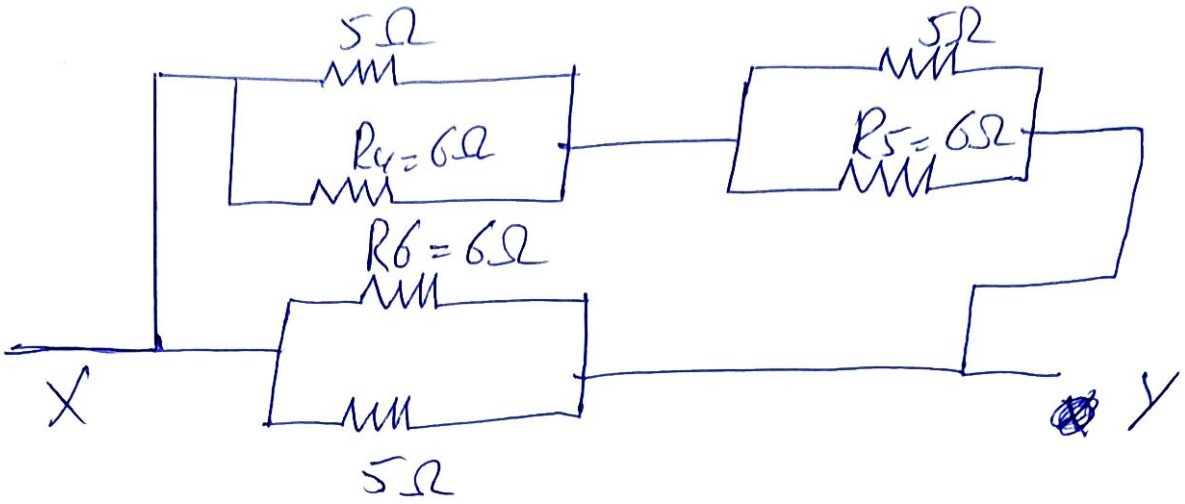
$R_6 = 6\Omega$



Put it circuit B



(17)

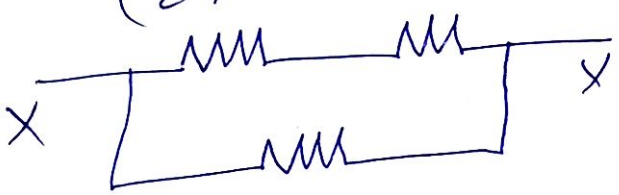


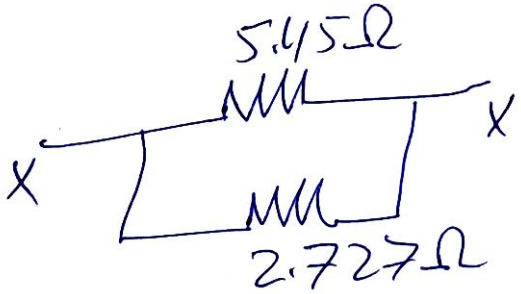
So

$$R_{eq} = 5 \,//\, R_6 = 5 \,//\, 6 = \frac{5 \times 6}{5+6} = \frac{30}{11}$$

$$\boxed{R_{eq} = 2.727\,\Omega}$$

$(2.727 + 2.727)\Omega$





$\therefore$ 1.81717Ω

$$\frac{5.45 \times 2.725}{5.52 \times 2.725} = 1.8174$$

$$\boxed{Z_{eq} = Z_{xy} = 1.81717\,\Omega}$$