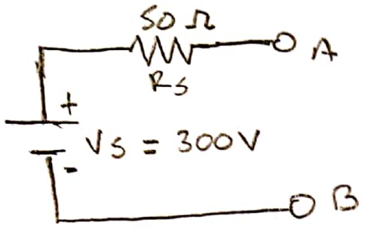
Sección 8-3 Conversiones de Fuente

1.- Una fuente de voltaje tiene los valores $V_S = 300\,V$ y $R_S = 50\,\Omega$. Conviertala en una fuente de corriente equivalente



Datos

$V_S = 300\,V$

$R_S = 50\,\Omega$

Solución

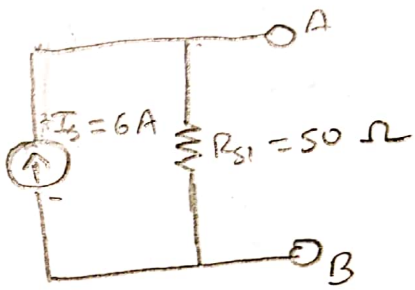
$$I_S = \frac{V_S}{R_S}$$

$$I_S = \frac{300V}{50\,\Omega}$$

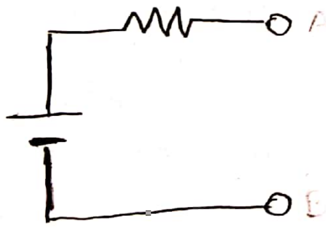
$$\underline{I_S = 6\,A}$$

$R_S = R_{S_1}$

$R_{S_1} = 50\,\Omega$



3.- Una batería tipo D nueva tiene entre sus terminales un voltaje de 1.6V y puede suministrar hasta 8.0 A a un cortocircuito durante muy poco tiempo. ¿Cuál es la resistencia interna de la batería?



Datos

$V_S = 1{,}6\,V$

$I_S = 8.0\,A$

Solución

$V_S = I_S \cdot R_S$

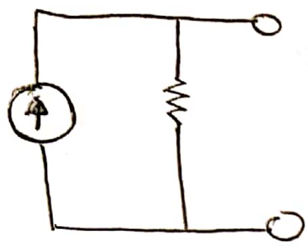
$$R_S = \frac{V_S}{I_S}$$

$$R_S = \frac{1{,}6V}{8.0A}$$

$$\underline{R_S = 200\,m\Omega}$$

Escaneado con CamScanner

5.- Una fuente de corriente tiene una I_s de 600 mA y una R_s de 1,2 KΩ Conviertala en una fuente de voltaje Equivalente.



Datos

$I_s = 600 mA$

$R_s = 1,2 K\Omega$

Solución

$I_s = \frac{V_s}{R_s}$

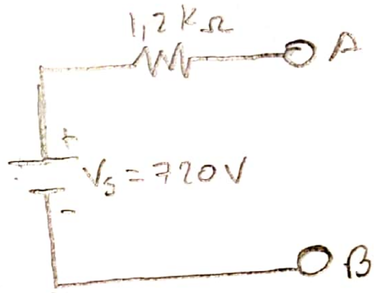
$V_s = I_s R_s$

$V_s = 600m \cdot 1,2K$

$V_s = 720 V$

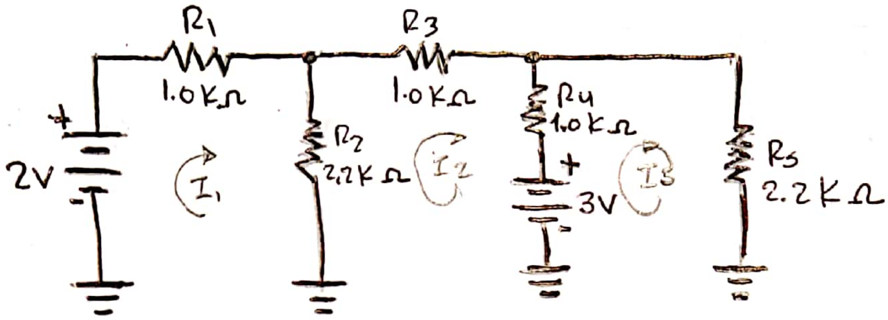
$R_s = R_{s1}$

$R_{s1} = 1,2 K\Omega$



Sección 8-4 El teorema de superposición

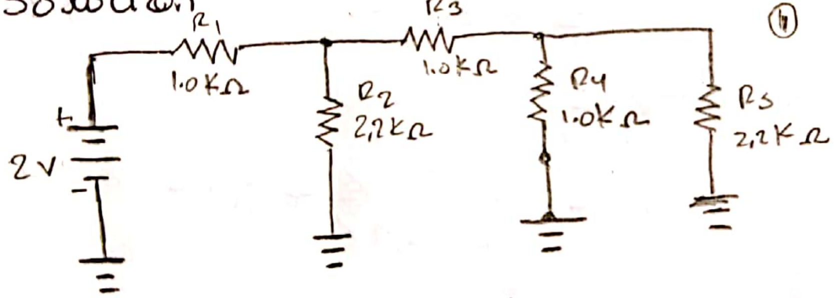
7.: Con el método de superposición, encuentre la corriente a través de R_5 en la figura.



1ero

Apagamos todos las fuentes independientes dejando la que se procedera analizar. Determinamos la corriente de salida. Repetimos para cada una de las fuentes independientes.

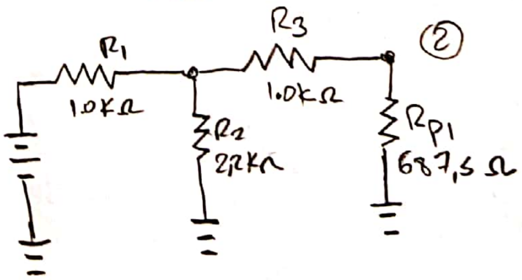
Solución



(1)

Divisor de corriente con V_{S1}

$$I_{TS1} = \frac{V_{S1}}{R_{TS1}}$$

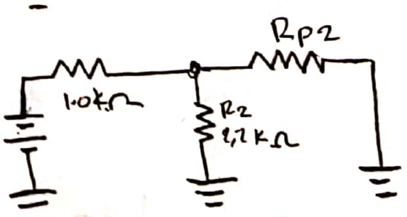


(2)

$$R_{p1} = R_4 \parallel R_5$$

$$R_{p1} = \frac{R_4 \cdot R_5}{R_4 + R_5} \rightarrow R_{p1} = \frac{1K \cdot 2,2K}{1K + 2,2K}$$

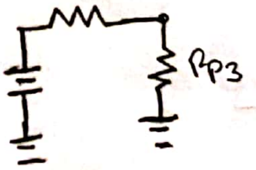
$$\rightarrow R_{p1} = 687,5\ \Omega$$



(3)

$$R_{p2} = R_3 + R_{p1}$$

$$R_{p2} = 1K + 687,5 \rightarrow R_{p2} = 1687,5\ \Omega$$



(4)

$$R_{p3} = R_{p2} \parallel R_2$$

$$R_{p3} = \frac{R_{p2} \cdot R_2}{R_{p2} + R_2} \rightarrow R_{p3} = \frac{1687,5 \cdot 2,2K}{1687,5 + 2,2K}$$

$$\rightarrow R_{p3} = 954.98\ \Omega$$

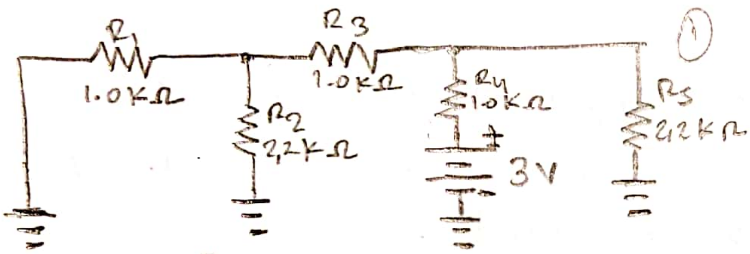
$\rightarrow R_{TS_1} = R_1 + R_{p3} \rightarrow R_{TS_1} = 1K + 954{,}98 \rightarrow R_{TS1} = 1954{,}98\ \Omega$

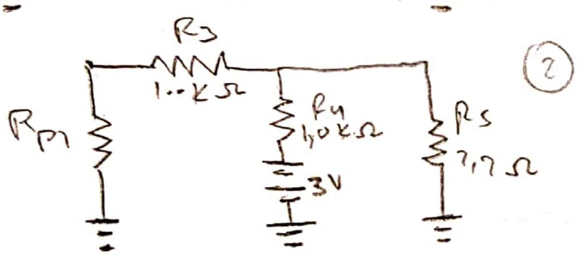
$\rightarrow I_{TS_1} = \dfrac{V_{S1}}{R_{TS1}} \rightarrow I_{TS1} = \dfrac{2V}{1954{,}98\,\Omega} \rightarrow \boxed{I_{TS_1} = 1{,}023\,mA}$

$\rightarrow I_{RSS1} = \left(\dfrac{R_4}{R_5 + R_4}\right) I_{TS_1} \rightarrow I_{RSS_1} = \left(\dfrac{1K}{2{,}2K + 1K}\right) \cdot 1{,}023m$

$\rightarrow \boxed{I_{RSS_1} = 0{,}319\,mA}$

Divisor de corriente con V_{S2}

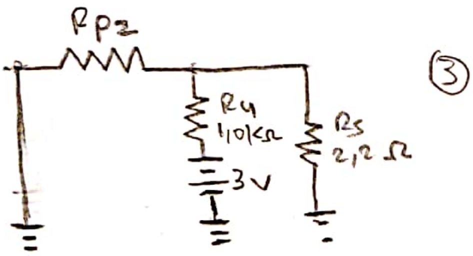




$R_{p1} = R_1 \parallel R_2$

$R_{p1} = \dfrac{R_1 \cdot R_2}{R_1 + R_2}$

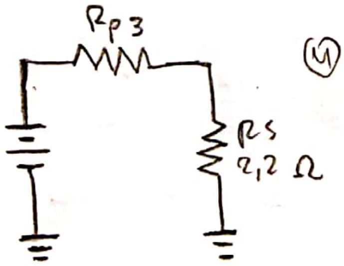
$R_{p1} = \dfrac{1K \cdot 2{,}2K}{1K + 2{,}2K} \rightarrow R_{p1} = 687{,}5\ \Omega$



$R_{p2} = R_{p1} + R_3$

$R_{p2} = 687{,}5 + 1K$

$R_{p2} = 1687{,}5\ \Omega$



$R_{p3} = R_{p2} \parallel R_4$

$R_{p3} = \dfrac{R_{p2} \cdot R_4}{R_{p2} + R_4}$

$R_{p3} = \dfrac{1687{,}5 \cdot 1K}{1687{,}5 + 1K}$

$R_{p3} = 627{,}91\ \Omega$

$\rightarrow R_{TS2} = R_5 + R_{p3} \rightarrow R_{TS2} = 2{,}2K + 627{,}91 \rightarrow R_{TS2} = 2827{,}91\ \Omega$

$\rightarrow I_{TS2} = \dfrac{V_{S2}}{R_{TS2}} \rightarrow I_{TS2} = \dfrac{3V}{2827{,}91\,\Omega} \rightarrow \boxed{I_{TS2} = 1{,}06\ mA}$

$\rightarrow I_{RSS2} = \left(\frac{R_3}{R_5+R_3}\right) I_{TS2} \quad \rightarrow I_{RSS2} = \left(\frac{1K}{2,2K+1K}\right) \cdot 1,06\times10^{-3}$

$\rightarrow \underline{I_{RSS2} = 0,331\ mA}$

2do

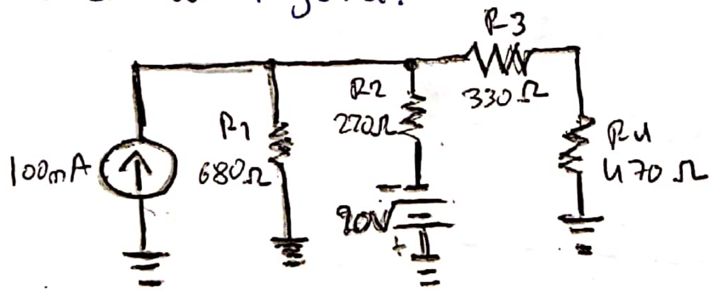
Hallamos la contribución total sumando algebraicamente todas las contribuciones debidas a las fuentes independientes.

$I_{RS} = I_{RSS1} + I_{RSS2}$

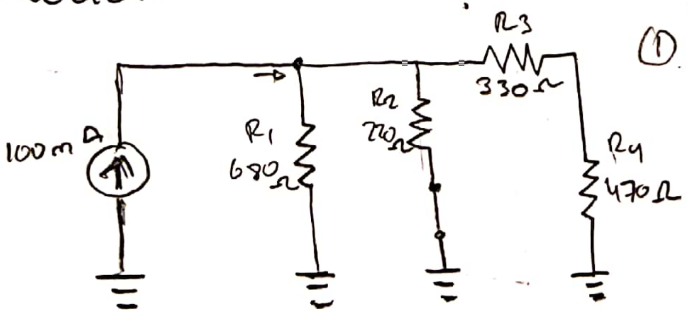
$I_{RS} = 0,319\times10^{-3} + 0,331\times10^{-3}$

$\underline{I_{RS} = 0,651 mA}$ //

9: Con el teorema de superposición, determine la corriente a través de R3 en la figura.



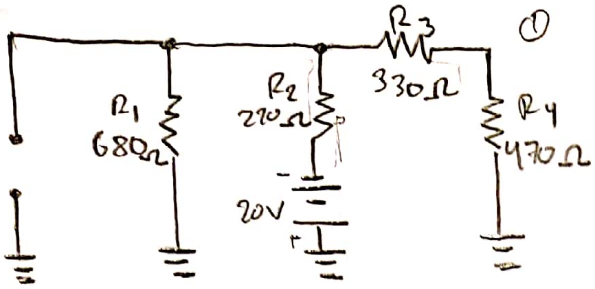
Solución



División de corriente con I_{S1}:

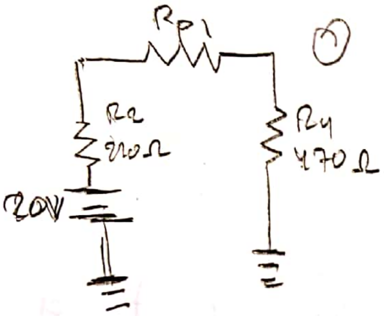
$I_{R3_{S1}} = \frac{I_{S1}(R_2)}{R_1+R_2+R_3+R_4} \quad \rightarrow I_{R3_{S1}} = \frac{100\times10^{-3} \cdot 220}{680+220+330+470}$

$\rightarrow I_{R3_{S1}} = 0,0129\ A$



Division de corriente con V_{S2}

$$I_{TS1} = \frac{V_{S2}}{R_{TS2}}$$



$R_{p1} = R_1 \parallel R_3$

$$R_{p1} = \frac{R_1 \cdot R_3}{R_1 + R_3} \rightarrow R_{p1} = \frac{680 \cdot 330}{680 + 330}$$

$$\rightarrow R_{p1} = 222{,}18\ \Omega$$

$R_{TS2} = R_{p1} + R_4 + R_2$

$R_{TS2} = 222{,}18 + 470 + 220$

$R_{TS2} = 912.18\ \Omega$

$$I_{TS2} = \frac{20V}{912{,}18} \rightarrow I_{TS2} = 0{,}022\ A$$

$$I_{R3S2} = \left(\frac{R_1}{R_3 + R_1}\right) I_{TS2} \rightarrow I_{R3S2} = \left(\frac{680}{330+680}\right) \cdot 0{,}022$$

$$\rightarrow I_{R3S2} = 0{,}015\ A$$

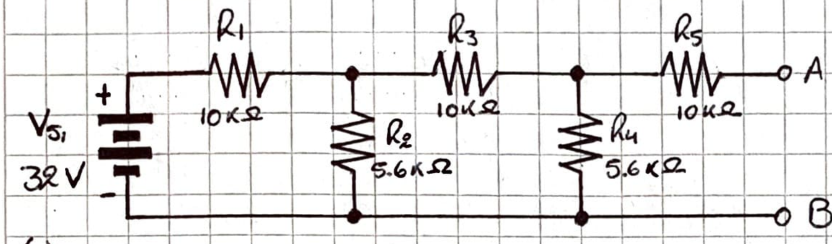
$I_{R3} = I_{R3S1} + I_{R3S2}$

$I_{R3} = 0{,}0129 + 0{,}015$

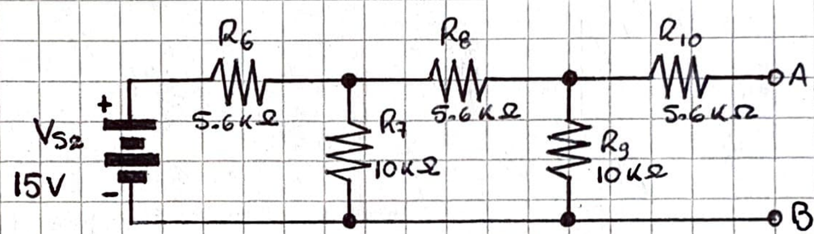
$I_{R3} = 0{,}026\ A$ //

Sección 8.4 El teorema de superposición

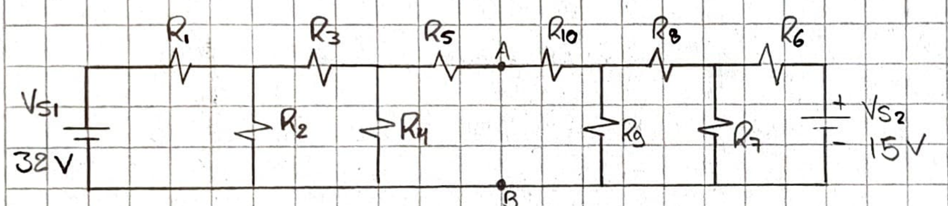
* 15.- La figura 8-75 muestra dos redes en escalera. Determine la corriente producida por cada una de las baterías cuando se conectan las terminales A (A a A) y las terminales B (B a B).



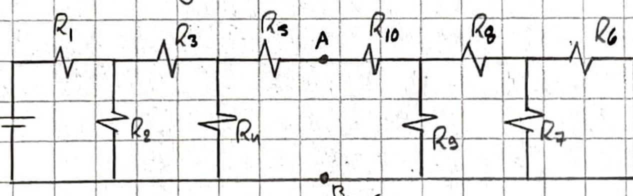
(a)



(b)

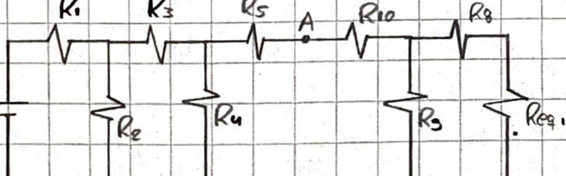


Apagando V_{S2}

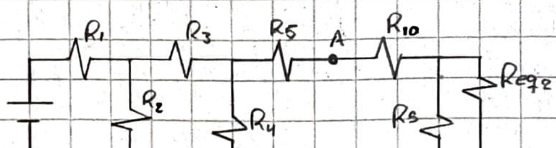


$R_6 \parallel R_7$

$$R_{eq_1} = \frac{10\cdot(5.6)}{10+5.6} = 3.59\ K\Omega$$

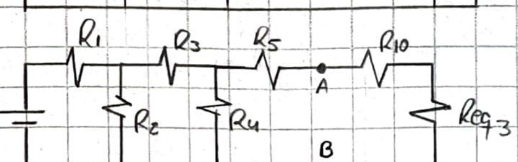


$$R_{eq_2} = R_8 + R_{eq_1} = 5.6 + 3.59 = 9.19\ K\Omega$$

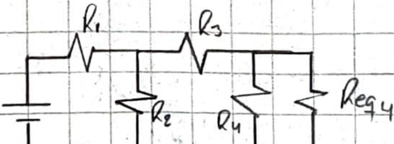


$R_9 \parallel R_{eq_2}$

$$R_{eq_3} = \frac{10\cdot(9.19)}{10+9.19} = 4.79\ K\Omega$$

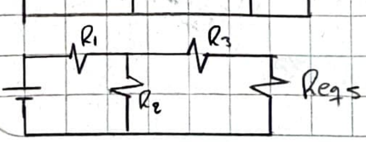


$$R_{eq_4} = R_5 + R_{10} + R_{eq_3} = 10 + 5.6 + 4.79 = 20.39\ K\Omega$$

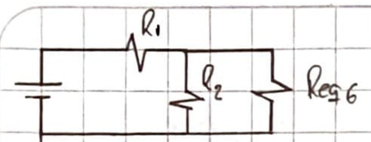


$R_4 \parallel R_{eq_4}$

$$R_{eq_5} = \frac{(5.6)(20.39)}{5.6+20.39} = 4.39\ K\Omega$$



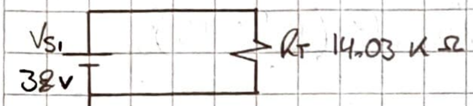
$$R_{eq_6} = R_3 + R_{eq_5} = 10 + 4.39 = 14.39\ K\Omega$$



$R_2 \parallel R_{eq6}$

$$R_{eq7} = \frac{(5.6)(14.39)}{5.6 + 14.39} = 4.03\ k\Omega$$

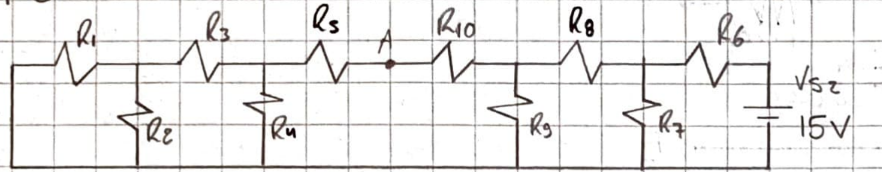
$$R_T = R_1 + R_{eq7} = 10 + 4.03 = 14.03\ k\Omega$$



$$I = \frac{32\ V}{14.03 \cdot 10^3\ \Omega} = 2.28 \cdot 10^{-3}$$

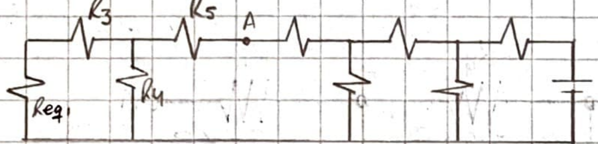
$$\boxed{I = 2.28\ m\Omega}$$

Apagando V_{S1}

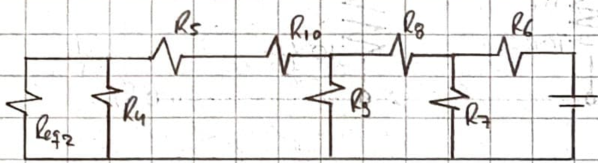


$R_1 \parallel R_2$

$$R_{eq1} = \frac{(10)(5.6)}{10 + 5.6} = 3.59\ k\Omega$$

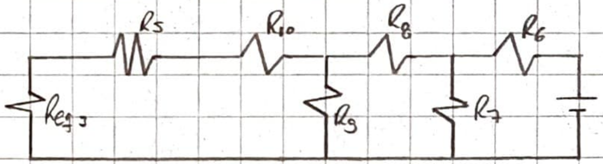


$$R_{eq2} = R_{eq1} + R_3 = 3.59 + 10 = 13.59\ k\Omega$$

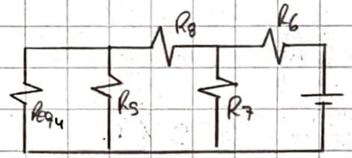


$R_{eq2} \parallel R_4$

$$R_{eq3} = \frac{13.59(5.6)}{13.59 + 5.6} = 3.97\ k\Omega$$

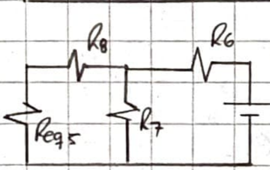


$$R_{eq4} = 3.97 + 10 + 5.6 = 19.57\ k\Omega$$

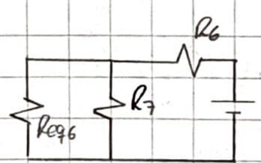


$R_{eq4} \parallel R_9$

$$R_{eq5} = \frac{(19.57)(10)}{19.57 + 10} = 6.62\ k\Omega$$

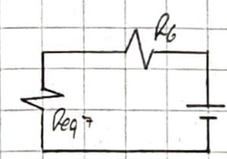


$$R_{eq6} = 6.62 + 5.6 = 12.22\ k\Omega$$



$R_{eq6} \parallel R_7$

$$R_{eq7} = \frac{(12.22)(10)}{12.22 + 10} = 5.5\ k\Omega$$



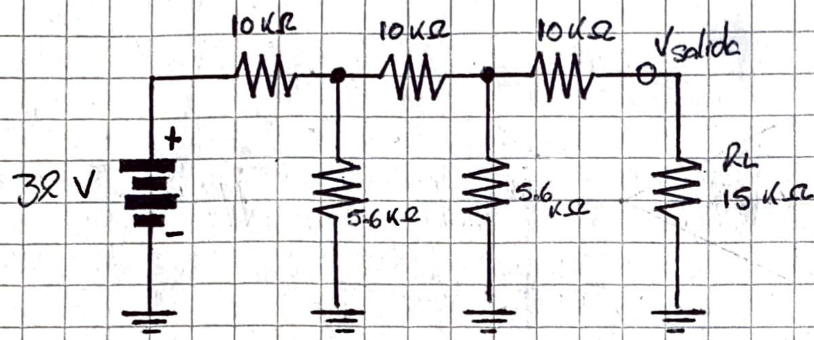
$$R_{eq8} = 5.5 + 5.6 = 11.1\ k\Omega = R_T$$

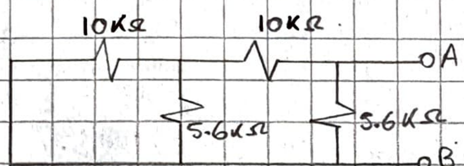
$$I = \frac{15\ V}{11.1 \cdot 10^3\ \Omega} = 1.35 \cdot 10^{-3}\ \Omega$$

$$\boxed{I = 1.35\ mA}$$

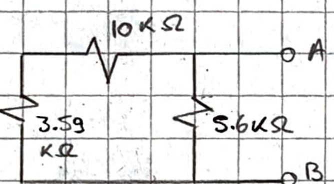
Sección 8.5 Teorema de Thevenin

17.- Con el teorema de Thevenin, determine la corriente a través de la carga R_L en la figura 8-77.

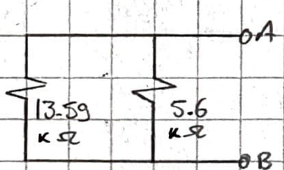




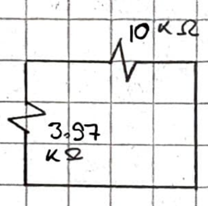
$$R_{eq_1} = \frac{(10)(5.6)}{10+5.6} = 3.59\ K\Omega$$



$$R_{eq_2} = 10 + 3.59 = 13.59\ K\Omega$$

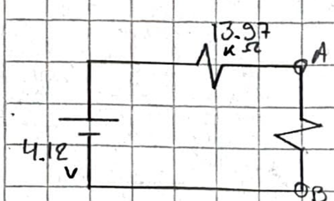


$$R_{eq_3} = \frac{(13.59)(5.6)}{13.59+5.6} = 3.97\ K\Omega$$



$$R_{TH} = 10 + 3.97 = 13.97\ K\Omega$$

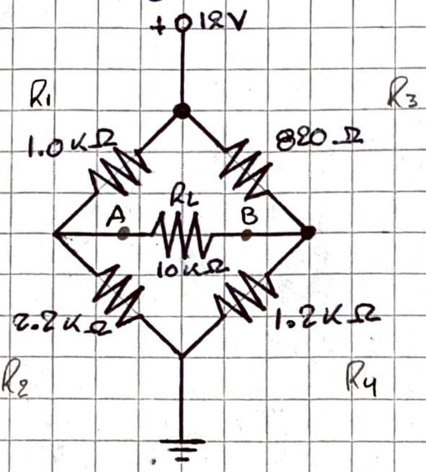
$$\boxed{R_{TH} = 13.97\ K\Omega}$$



$$I = \frac{4.12}{13.97+15} = 0.14\ A$$

$$\boxed{I_L = 0.14\ A.}$$

*21.- Determine la corriente a través del resistor de carga en el circuito puente de la figura 8-81.

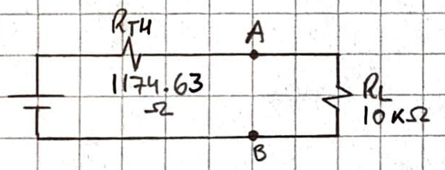


$$V_{TH} = V_A - V_B = 12\left(\frac{2.2\cdot10^3}{2.2\cdot10^3+1\cdot10^3}\right) - 12\left(\frac{1.2\cdot10^3}{820+1.2\cdot10^3}\right) = 1.12\,V$$

$\boxed{V_{TH} = 1.12\,V.}$

$$R_{TH} = \frac{(1\cdot10^3)(2.2\cdot10^3)}{1\cdot10^3+2.2\cdot10^3} + \frac{(820)(1.2)(10^3)}{820+1.2\cdot10^3} = 1174.63\,\Omega$$

$\boxed{R_{TH} = 1174.63\,\Omega}$



$$V_L = \left(\frac{10\cdot10^3}{10\cdot10^3+1174.63}\right)\cdot(1.12) = 1.00227\,V$$

$\boxed{V_L = 1.00227\,V.}$

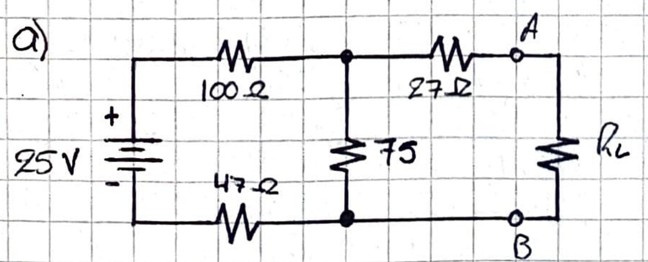
$$I_L = \frac{V_L}{R_L} = \frac{1.00227}{10\cdot10^3} = 100\,\mu A$$

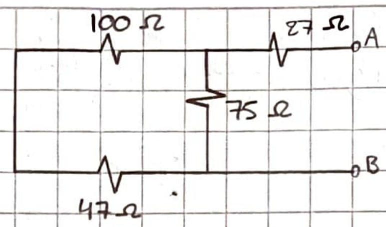
$\boxed{I_L = 100\,\mu A.}$

Sección 8.6 Teorema de Norton

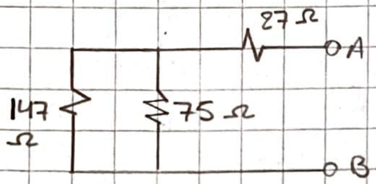
23.- Para cada uno de los circuitos mostrados en la figura 8-76, determine el equivalente Norton visto por R_L.

a)

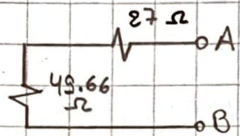




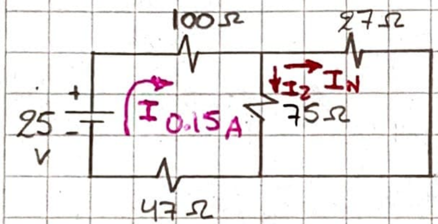
$$R_{eq_1} = 100 + 47 = 147\ \Omega$$



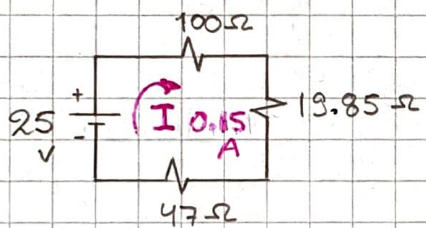
$$R_{eq_2} = \frac{147 \cdot 75}{147 + 75} = 49.66\ \Omega$$



$$\boxed{R_N = 76.66\ \Omega}$$



$$R_{eq} = \frac{27 \cdot 75}{27 + 75} = 19.85\ \Omega$$



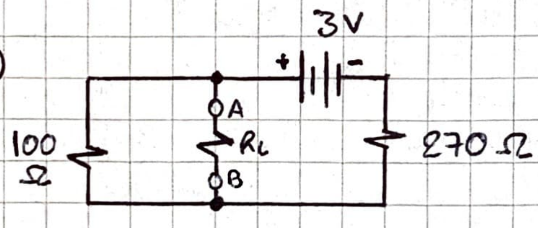
$$R_{eq_2} = 100 + 19.85 + 47 = 166.85\ \Omega$$

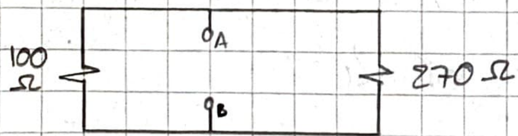
$$I = \frac{25}{166.85} = 0.15\ A$$

$$I_N = 0.15\left(\frac{75}{75+27}\right) = 0.110\ A$$

$$\boxed{I_N = 110\ mA}$$

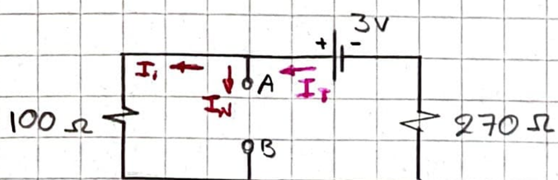
b)





$$R_N = \frac{100 \cdot 270}{100 + 270} = 72.97\ \Omega$$

$$\boxed{R_N = 72.97\ \Omega}$$

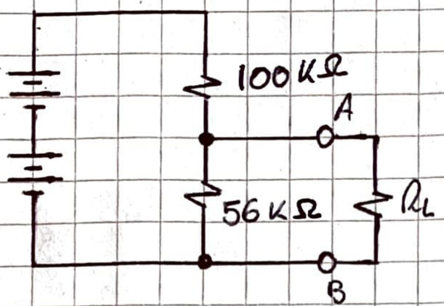


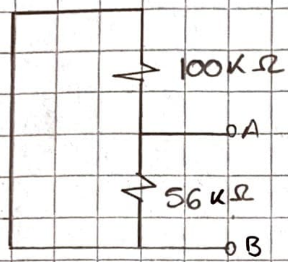
$$I_T = \frac{3}{72.97} = 0.041\ A.$$

$$I_N = 0.041\left(\frac{100}{100+270}\right) = 0.01108\ A$$

$$\boxed{I_N = 11.08\ mA}$$

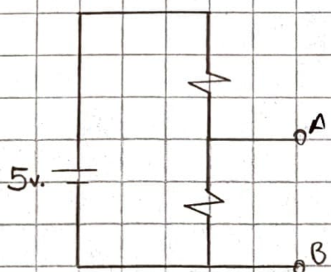
c)





$$R_N = \frac{(100)(56)}{100+56} = 35.89\ K\Omega$$

$$\boxed{R_N = 35.89\ K\Omega}$$

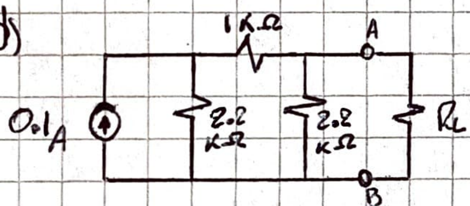


$$V_L = 5\left(\frac{56 \cdot 10^3}{56 \cdot 10^3 + 100 \cdot 10^3}\right) = 1.79\ v.$$

$$I_N = \frac{1.79}{35.89 \cdot 10^3} = 50\ \mu A.$$

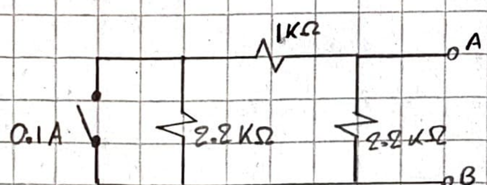
$$\boxed{I_N = 50\ \mu A.}$$

d)



$$R_N = \frac{(3.2)(2.2)}{3.2+2.2} = 1.30\ K\Omega$$

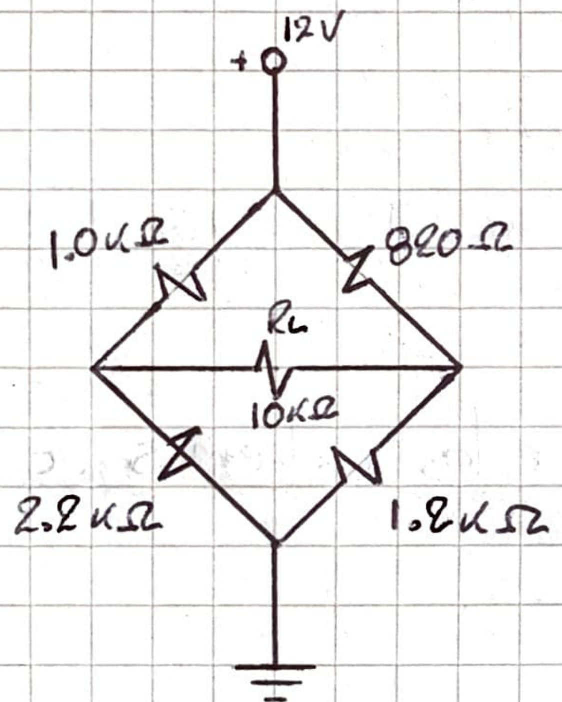
$$\boxed{R_N = 1.30\ K\Omega}$$

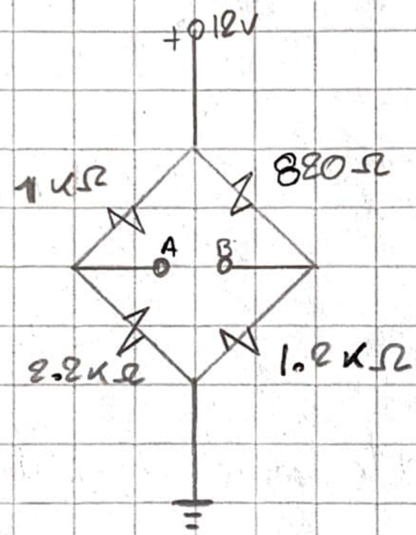


$$I_N = 0.1\left(\frac{2.2}{2.2+1}\right) = 68.75\ mA.$$

$$\boxed{I_N = 68.75\ mA.}$$

27- Determine el circuito equivalente Norton para el puente que aparece en la figura 8-81 sin R_L.



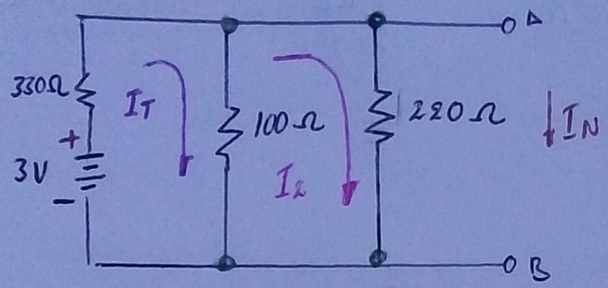


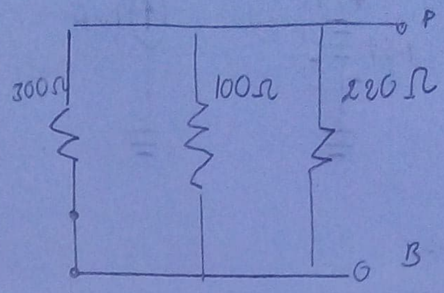
$$R_N = \frac{(10^3)(2.2\cdot 10^3)}{10^3 + 2.2\cdot 10^3} + \frac{(820)(1.2\cdot 10^3)}{820 + 1.2\cdot 10^3} = 1174.63\ \Omega$$

$$R_N = 1174.63\ \Omega$$

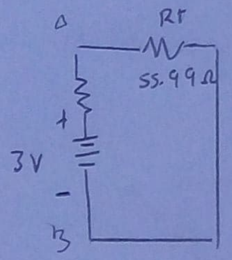
TEOREMA DE NORTON

Aplique el teorema de Norton al circuito de la figura 8-84





OBTENER LA CORRIENTE TOTAL

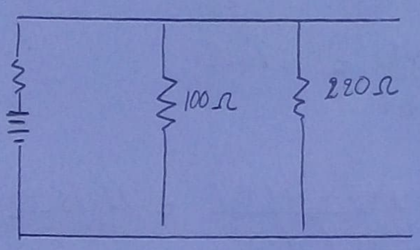


$$\frac{1}{RT} = \frac{1}{330} + \frac{1}{100} + \frac{1}{220}$$

$$RT = 55.93\,\Omega$$

$$I_T = \frac{Vt}{RT} = \frac{3}{55.93} = 53.96\,mA$$

OBTENCIÓN DE LA CORRIENTE DE NORTON (I_N



// MALLA 2 //

$$220 I_2 + 100(I_T - I_2) = 0$$

$$120 I_2 + 100 I_T = 0$$

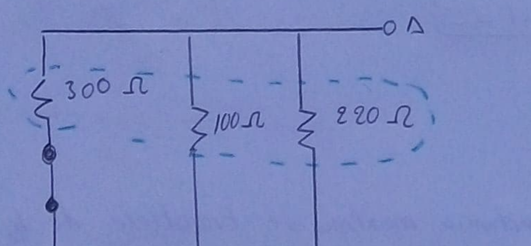
$$I_2 = \frac{-100(53.96)}{120}$$

$$I_2 = -44.71\,mA$$

$I_2 = I_N$

$$\boxed{I_N = -44.71\,mA}$$

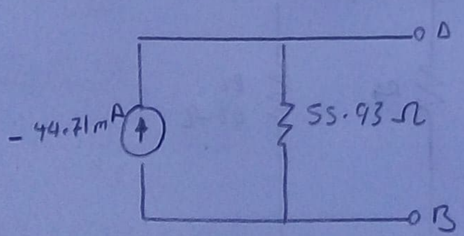
OBTENCIÓN DE LA RESISTENCIA DE NORTON



$$\frac{1}{RT} = \frac{1}{300} + \frac{1}{100} + \frac{1}{220}$$

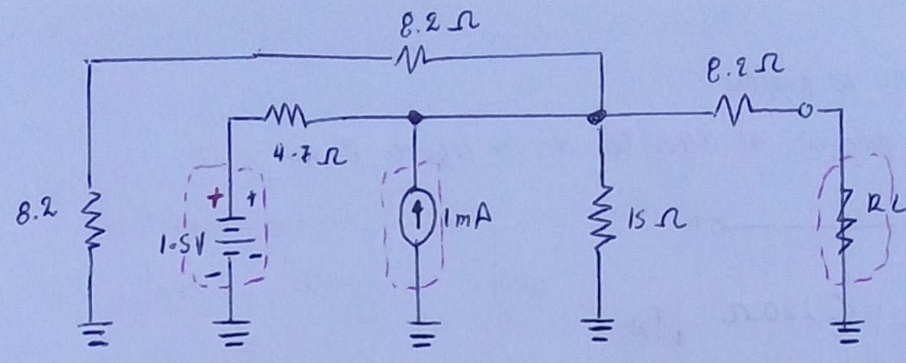
$$RT = 55.93\,\Omega$$

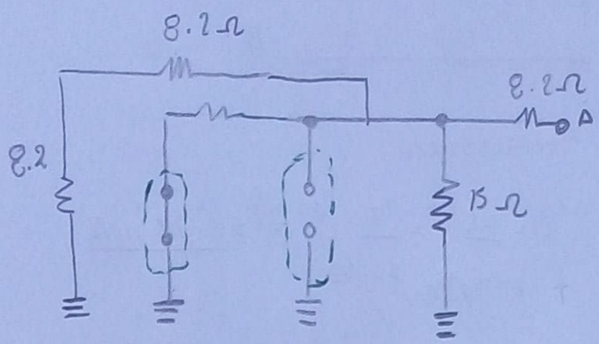
CIRCUITO DE NORTON



TEOREMA DE TRANSFERENCIA DE POTENCIA MÁXIMA

En el circuito de la figura 8-86 determine el valor de RL para transferencia maxima



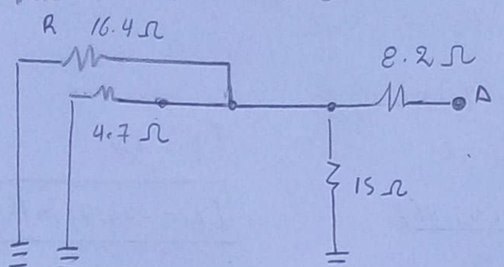


La fuente de voltaje se corto circuitan

La fuente de corriente se abre

La RL se abre

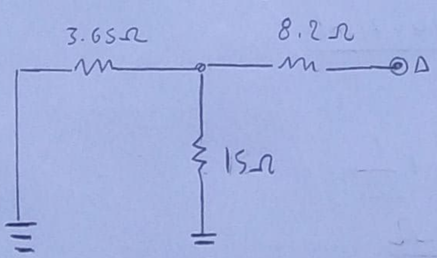
Reducir el circuito



$R_{8.2} + R_{8.2} = 16.4\ \Omega$

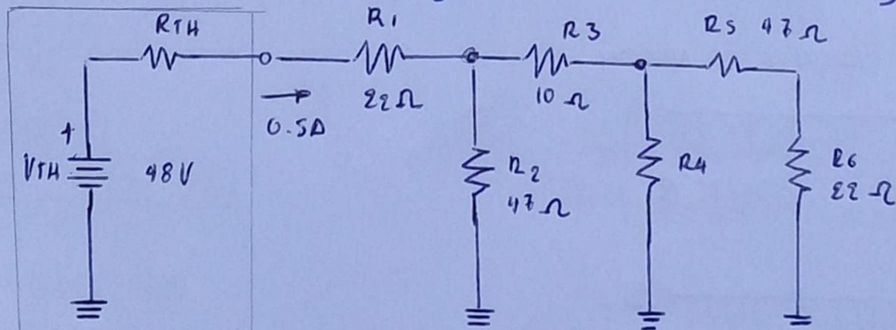
$R_{16.4} \parallel R_{4.7} = \dfrac{16.4(4.7)}{16.4+4.7} = 3.65\Omega$

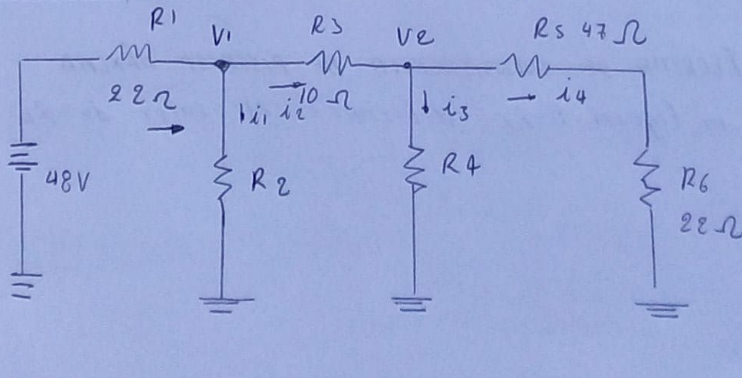
$R_{8.2} + (R_{3.65} \parallel R_{15}) = 8.2 + \dfrac{(3.65)(15)}{3.65+15} = 11.13\ \Omega$



$\boxed{R_L = 11.1\ \Omega}$

Calcule los valores de R_4 y R_{TH} cuando la potencia maxima se transfiere de la fuente thevenizada a la red en configuración de escalera de la figura 8-87?





$i_1 = \dfrac{V_1 - 0}{47}$

$i_2 = \dfrac{V_1 - V_2}{10}$

$i_3 = \dfrac{V_2}{47}$

$i_4 = \dfrac{V_2}{R_4}$

- $0.5 = i_1 + i_2$

$$0.5 = \frac{V_1}{47} + \frac{V_2}{10} - \frac{V_2}{10}$$

① $\boxed{0.5 = 0.12 V_1 - 0.1 V_2}$

- $i_2 = i_4 + i_3$

$$\frac{V_1}{10} - \frac{V_2}{10} = \frac{V_2}{R_4} + \frac{V_2}{47}$$

② $0.1 = 0.12 V_2 + \frac{V_2}{R_4}$

$V = I R$

$V = (0.5)(22) = 11\ V$

Remplazo en ① y en 2

① $0.5 = 0.12(11) - 0.1 V_2$

$V_2 = 8.2$ //

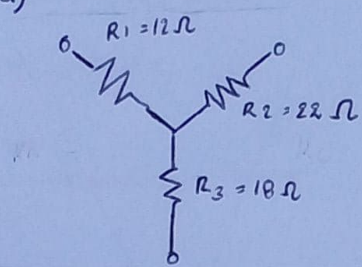
② $0.1 = 0.2(8.2) + \frac{8.2}{R_4}$

$\boxed{R_4 = 70.64\ \Omega}$

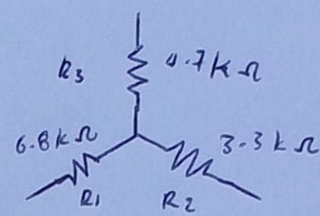
CONVERSIONES DELTA a Y (Δ A Y) y Y a Δ

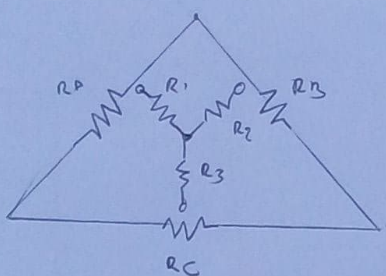
En la figura 8-84, convierta la red Y en una red delta

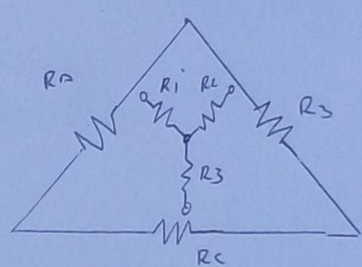
a)



b)







$$R_A = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_2}$$

$$R_A = \frac{(12 \times 22) + (22 \times 18) + (12 \times 18)}{22}$$

$\underline{\underline{R_A = 39.81\ \Omega}}$

$$R_B = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_1}$$

$$R_B = \frac{(12 \times 22) + (22 \times 18) + (12 \times 18)}{12}$$

$\underline{\underline{R_B = 73\ \Omega}}$

$$R_C = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_3}$$

$$R_C = \frac{(12 \times 22) + (22 \times 18) + (12 \times 18)}{18}$$

$R_C = 48.7\ \Omega$

$$R_A = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_2}$$

$$R_A = \frac{(6.8 \times 3.3) + (3.3 \times 4.7) + (6.8 \times 4.7)}{3.3}$$

$\underline{R_A = 21.2\ k\Omega}$

$$R_B = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_1}$$

$$R_B = \frac{(6.8 \times 3.3) + (3.3 \times 4.7) + (6.8 \times 4.7)}{6.8}$$

$\underline{\underline{R_B = 10.3\ k\Omega}}$

$$R_C = \frac{(R_1 \cdot R_2) + (R_2 \cdot R_3) + (R_1 \cdot R_3)}{R_3}$$

$$R_C = \frac{(6.8 \times 3.3) + (3.3 \times 4.7) + (6.8 \times 4.7)}{4.7}$$

$\underline{\underline{R_C = 14.9\ k\Omega}}$