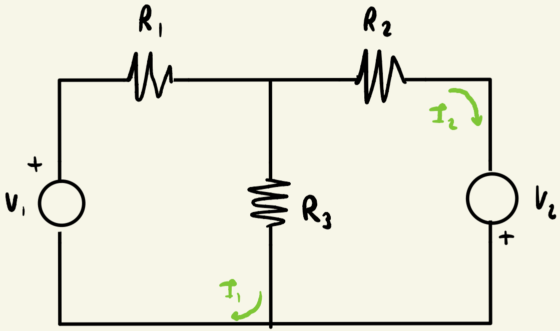
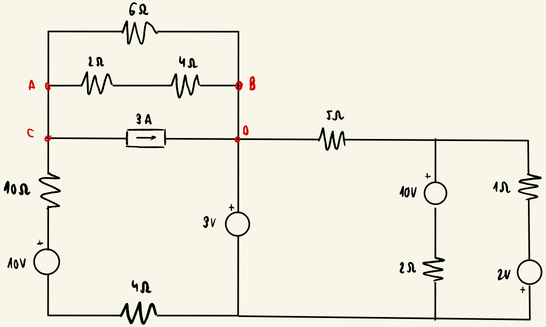
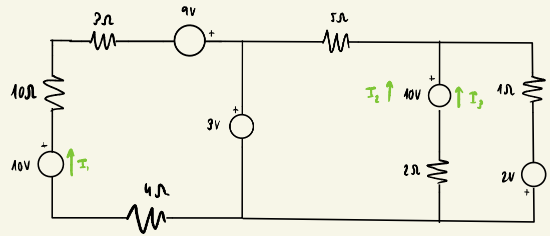


$$\left.\begin{aligned} V_1 &= I_1 R_1 + (I_1 - I_2) R_3 = I_1 R_1 + I_1 R_3 - I_2 R_3 = I_1 (R_1 + R_3) - I_2 R_3 \\ V_2 &= I_2 R_2 + (I_2 - I_1) R_3 = I_2 R_2 + I_2 R_3 - I_1 R_3 = I_2 (R_2 + R_3) - I_1 R_3 \end{aligned}\right\} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} \begin{pmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{pmatrix}$$

$$I_1 = \frac{\begin{vmatrix} V_1 & -R_3 \\ V_2 & R_2 + R_3 \end{vmatrix}}{\begin{vmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{vmatrix}} \qquad I_2 = \frac{\begin{vmatrix} R_1 + R_3 & V_1 \\ -R_3 & V_2 \end{vmatrix}}{\begin{vmatrix} R_1 + R_3 & -R_3 \\ -R_3 & R_2 + R_3 \end{vmatrix}} \longrightarrow \begin{pmatrix} V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} \begin{pmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{pmatrix}$$





$R_{AB} = 2 + 4 = 6\,\Omega$

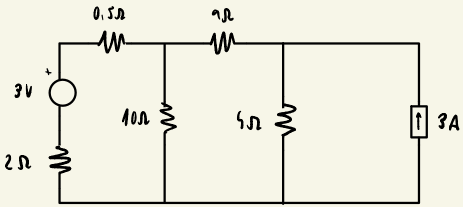
$\dfrac{1}{R_{CD}} = \dfrac{1}{6} + \dfrac{1}{6} = \dfrac{1}{3}$; $R_{CD} = 3\,\Omega$

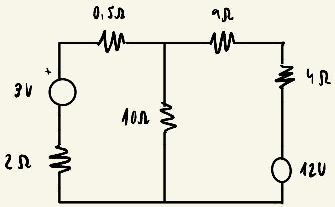
$V_{CD} = RI = 3 \cdot 3 = 9V$

$$\begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix} = \begin{pmatrix} R_{11} & R_{12} & R_{13} \\ R_{21} & R_{22} & R_{23} \\ R_{31} & R_{32} & R_{33} \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \end{pmatrix} \rightarrow \begin{pmatrix} 10+7-3 \\ 10-3 \\ 10+2 \end{pmatrix} = \begin{pmatrix} 10+3+4 & 0 & 0 \\ 0 & 5+2 & 2 \\ 0 & 2 & 3 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \end{pmatrix}$$

$$I_1 = \frac{\begin{vmatrix} & 0 & 0 \\ 7 & 7 & 2 \\ 12 & 2 & 3 \end{vmatrix}}{\begin{vmatrix} 17 & 0 & 0 \\ 0 & 7 & 2 \\ 0 & 2 & 3 \end{vmatrix}} = 0{,}94A$$

$P_1 = 4(0{,}94)^2 = 3{,}5344\ W$





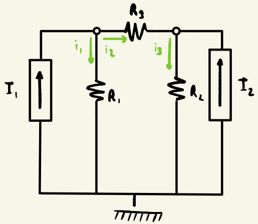
$V = RI = 4 \cdot 3 = 12V$

$$\begin{pmatrix} V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix} \rightarrow \begin{pmatrix} 3 \\ 12 \end{pmatrix} = \begin{pmatrix} 10+2+0{,}5 & 10 \\ 10 & 10+9+4 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix}$$

$$I_1 = \frac{\begin{vmatrix} 3 & 10 \\ 12 & 23 \end{vmatrix}}{\begin{vmatrix} 12{,}5 & 10 \\ 10 & 23 \end{vmatrix}}$$

$$I_2 = \frac{\begin{vmatrix} 12{,}5 & 10 \\ 10 & 23 \end{vmatrix}}{\begin{vmatrix} 12{,}5 & 10 \\ 10 & 23 \end{vmatrix}}$$

Método de tensiones de nudos



Nudo $I_1 = i_3 + i_1 \rightarrow I_1 = \left(\frac{1}{R_1}\right)V_1 + \left(\frac{1}{R_3}\right)(V_1 - V_2) \rightarrow I_1 = G_1 V_1 + G_3 V_1 - G_3 V_2$

Nudo $I_2 = I_2 + i_3 = i_2 \rightarrow I_2 = i_2 - i_3 \rightarrow I_2 = \left(\frac{1}{R_2}\right)V_2 - \left(\frac{1}{R_3}\right)(V_1 - V_2) \rightarrow I_2 = G_2 V_2 - G_3 V_1 + G_3 V_2$

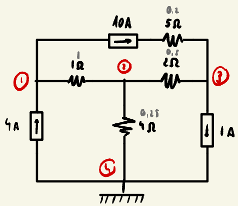
$$\left.\begin{array}{l} I_1 = V_1(G_1 + G_3) - V_2 G_3 \\ I_2 = -V_1 G_3 + V_2(G_2 + G_3) \end{array}\right.$$

$$i_1 = \frac{V_1}{R_1} = \left(\frac{1}{R_1}\right)V_1$$

$$i_2 = \frac{V_2}{R_2} = \left(\frac{1}{R_2}\right)V_2$$

$$i_3 = \frac{V_1 - V_2}{R_3} = \left(\frac{1}{R_3}\right)(V_1 - V_2)$$

$$\begin{pmatrix} I_1 \\ I_2 \end{pmatrix} = \begin{pmatrix} G_1 + G_3 & -G_3 \\ -G_3 & G_2 + G_3 \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix}$$



$$\begin{pmatrix} \Sigma I_1 \\ \Sigma I_2 \\ \Sigma I_3 \end{pmatrix} = \begin{pmatrix} G_{11} & -G_{12} & -G_{13} \\ -G_{21} & G_{22} & -G_{23} \\ -G_{31} & -G_{32} & G_{33} \end{pmatrix} \rightarrow \begin{pmatrix} -6 \\ 0 \\ 9 \end{pmatrix} = \begin{pmatrix} 1,2 & -1 & -0,2 \\ -1 & 1,75 & -0,5 \\ -0,2 & -0,5 & 0,7 \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \\ V_3 \end{pmatrix}$$

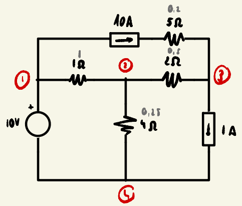
$$P = I^2 R = \frac{V^2}{R}\ W$$

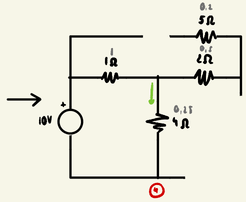
- inversa de R

$$V_2 = \frac{\begin{vmatrix} -1,2 & -6 & -0,2 \\ -1 & 0 & -0,5 \\ -0,2 & 9 & 0,7 \end{vmatrix}}{\begin{vmatrix} 1,2 & -1 & -0,2 \\ -1 & 1,75 & -0,5 \\ -0,2 & -0,5 & 0,7 \end{vmatrix}}$$

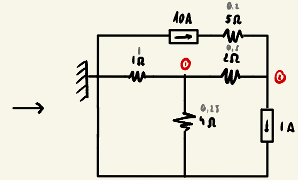
$$P = \frac{(V_2)^2}{4}\ W$$

Método de superposición





$i_4 = \frac{10}{5} = 2A\downarrow$ (F. tensión)



$$\begin{pmatrix} 0 \\ 9 \end{pmatrix} = \begin{pmatrix} 1,75 & -0,5 \\ -0,5 & 0,7 \end{pmatrix} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix}$$

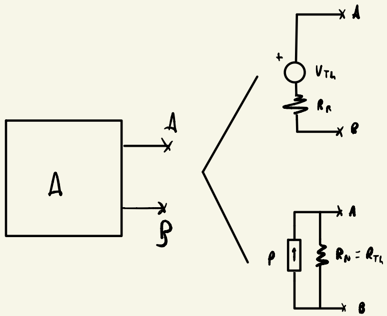
$$V_1 = \frac{\begin{vmatrix} 0,5 & -0,5 \\ 9 & 0,7 \end{vmatrix}}{\begin{vmatrix} 1,73 & -0,5 \\ -0,5 & 0,7 \end{vmatrix}} = \frac{-4,5}{1,225 - 0,025} = \frac{-4,5}{1,2} = -3,75\,V$$

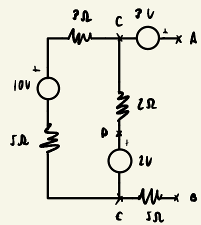
$$i_4 = \frac{3,75}{4} = 0,93\,A\uparrow$$

$$I_{T4} = 2A(\downarrow) - 0,93A(\uparrow) = 1,07A(\downarrow)$$

$$P = i^2 R = (1,07)^2\, 4 = \quad W$$

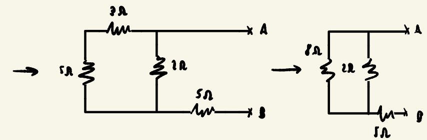
Método de Thevenin y Norton



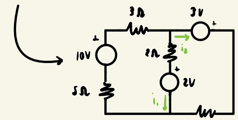


$$V_{TH} = V_{AB}$$

$$V_{AB} = V_{AC} + V_{CD} + V_{DE} + V_{EB} = 3 + \frac{10-2}{10} \times 2 + 2 + 0 = 6,6V = V_{TH}$$

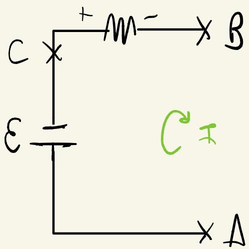


$$R_{TH} = \frac{8 \cdot 2}{8+2} = 1,6$$



$$\begin{pmatrix} 8 \\ 5 \end{pmatrix} = \begin{pmatrix} 10 & -2 \\ -2 & 7 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \end{pmatrix}$$

$$I_N = I_{cc} = \frac{\begin{vmatrix} 10 & -2 \\ 8 & 5 \end{vmatrix}}{\begin{vmatrix} 10 & -2 \\ -2 & 7 \end{vmatrix}} = \frac{50+16}{70-4} = 1A$$



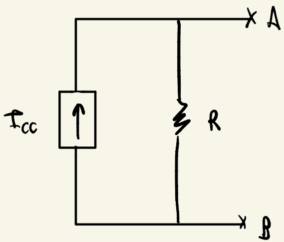
$$I_{CL} = \frac{\mathcal{E}}{R_J} \qquad \mathcal{E} = I_{cc} R$$

$$\longleftrightarrow$$

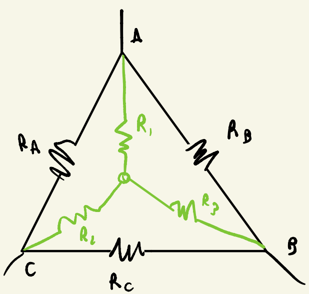
$$R = R$$

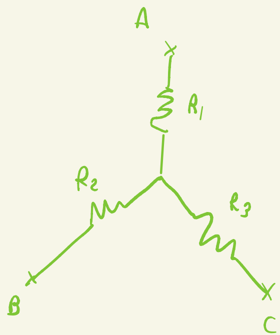
$$V_{CB} = IR$$

$$V_{BC} = -IR$$



$$I_{cc} = \frac{\mathcal{E}}{R}$$

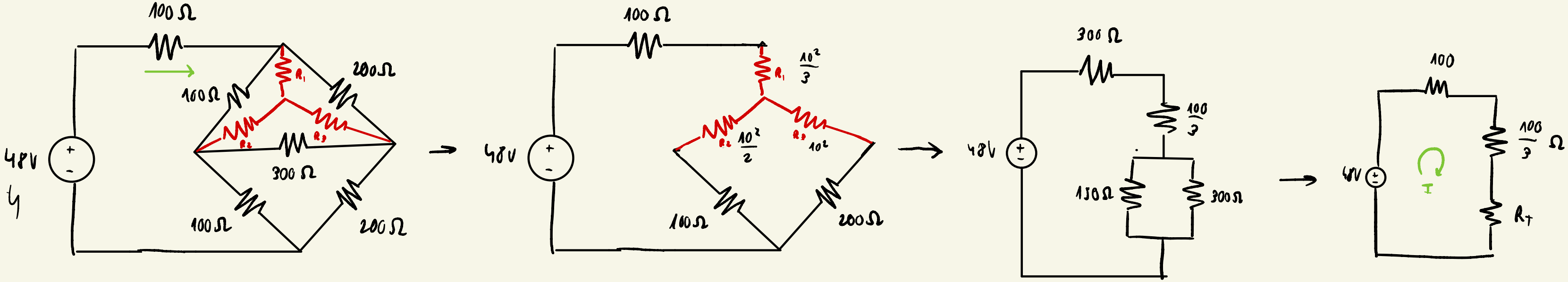




$$R_1 = \frac{R_A R_B}{R_A + R_B + R_C}$$

$$R_2 = \frac{R_A R_C}{R_A + R_B + R_C}$$

$$R_3 = \frac{R_B R_C}{R_A + R_B + R_C}$$



$$R_1 = \frac{2 \cdot 10^4}{6 \cdot 10^2} = \frac{1}{3} \cdot 10^2$$

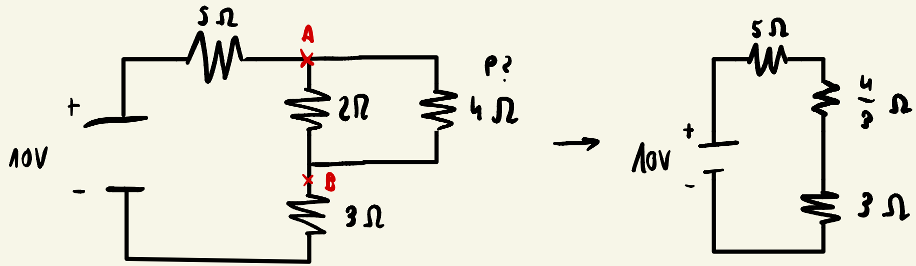
$$R_2 = \frac{3 \cdot 10^4}{6 \cdot 10^2} = \frac{1}{2} \cdot 10^2$$

$$R_3 = \frac{6 \cdot 10^4}{6 \cdot 10^2} = 10^2$$

$$I = \frac{\Sigma E - \Sigma E'}{\Sigma R} = \frac{48}{700/3} = \frac{48 \cdot 3}{700}$$

$$R_T = \frac{150 \cdot 300}{450} = \frac{4500}{45} = 100\ \Omega$$

$$R_T = 200 + \frac{100}{3} = \frac{700}{3}$$



$$I = \frac{\varepsilon}{\sum R} = \frac{10}{5+3+4/3} = \frac{10 \cdot 3}{15+9+4} = \frac{30}{28}\ A$$

$$V_{AB} = R_{eq} \cdot \frac{30}{28} = \frac{4}{3} \cdot \frac{30}{28} = \frac{40}{28}$$

$$I = \frac{V}{R} = \frac{40/28}{4} = \frac{10}{28}\ A$$

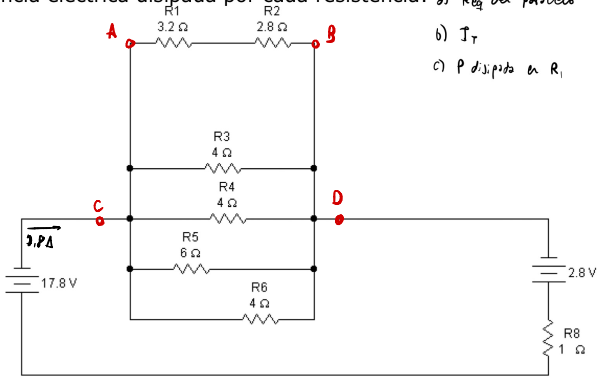
$$P = I^2 R = 4\left(\frac{10}{28}\right)^2\ W$$

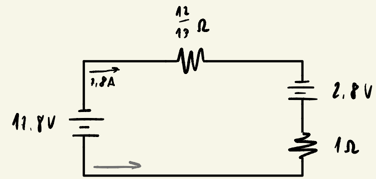
9.- Completar el siguiente cuadro con el voltaje, la intensidad de corriente y la potencia eléctrica disipada por cada resistencia:

a) R_{eq} del paralelo

b) I_T

c) P disipada en R_1





a) $R_{AB} = 2{,}8 + 3{,}2 = 6\ \Omega$

$R_{CD}: \frac{1}{R_{CD}} = \frac{1}{6} + \frac{1}{4} + \frac{1}{4} + \frac{1}{6} + \frac{1}{4} = \frac{2}{6} + \frac{3}{4} = \frac{13}{12} \quad ; \quad R_{CD} = \frac{12}{13}\ \Omega$

b) $I_T = \frac{\Sigma\varepsilon - \Sigma\varepsilon'}{R_T} = \frac{17{,}8 - 2{,}8}{1 + 12/13} = \frac{15}{25/13} = 7{,}8\ A$

c) $V_{CD} = I_T R_{eq} = 7{,}8 \cdot \frac{12}{13} = 7{,}2\ V$

$i_{3,2} = \frac{V_{AB}}{R_{AB}} = \frac{7{,}2}{6}\ A$

$P_{R_1} = I^2 R_1 = \left(\frac{7{,}2}{6}\right)^2 3{,}2 = 4{,}6\ W$