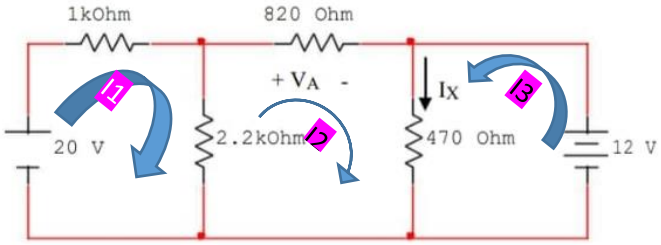
Dos Fuentes prendidas



M1

$-20 + 1K(I_1 - I_2) = 0$

$3.2KI_1 - 2.2KI_2 = 20\ (1)$

M2

$2.2K(I_2 - I_1) + 820I_2 + 470(I_2 + I_3) = 0$

$-2.2KI_1 + 3.49KI_2 + 470I_3 = 0\ (2)$

M3

$-12 + 470(I_2 + I_3) = 0$

$470I_3 + 470I_2 = 12\ (3)$

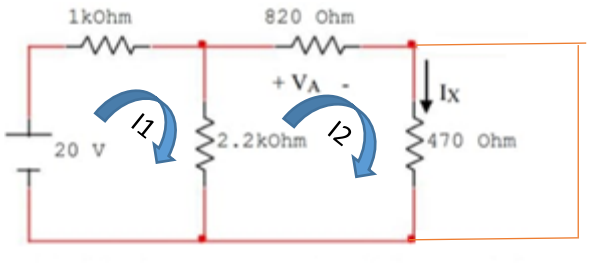
$$\begin{matrix} 3.2KI_1 - 2.2KI_2 = 20 \\ -2.2KI_1 + 3.49KI_2 + 470I_3 = 0 \\ 470I_2 + 470I_3 = 12 \end{matrix} \quad \rightarrow \quad \begin{matrix} I_1 = 7.048mA \\ I_2 = 1.161\ mA \\ I_3 = 24.37\ mA \end{matrix}$$

Con las 2 fuentes

$V_A = I_2 * R = 1.161 * 820 = 952.02\ mV$

$I_X = I_2 + I_3 = 1.161 + 24.37 = 25.531\ mA$

Fuente 12V =0



M1

$-20 + 1K(I_1 - I_2) = 0$

$3.2KI_1 - 2.2KI_2 = 20\ (1)$

M2

$2.2K(I_2 - I_1) + 820I_2 = 0$

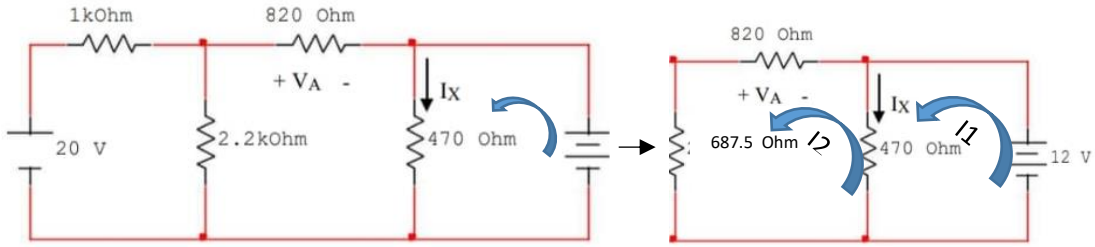
$-2.2KI_1 + 3.02KI_2 = 0\ (2)$

$$\begin{matrix} 3.2KI_1 - 2.2KI_2 = 20 \\ -2.2KI_1 + 3.02KI_2 = 0 \end{matrix} \rightarrow \begin{matrix} I_1 = 12.52mA \\ I_2 = 9.121mA \end{matrix}$$

$V_A = I_2 * R = 9.121mA * 820 = 7.4792\ V$

$I_X = 0 \rightarrow Corto\ circuito$

Fuente 20V =0



M1

$470I_1 - 470I_2 = -12\ (1)$

M2

$820I_2 + 687.5I_2 + 470I_2 - 470I_1 = 0$

$-470I_1 + 1977.5I_2 = 0\ (2)$

$$\begin{matrix} 470I_1 - 470I_2 = -12 \\ -470I_1 + 1977.5I_2 = 0 \end{matrix} \rightarrow \begin{matrix} I_1 = -33.49mA \\ I_2 = -7.96mA \end{matrix}$$

$V_A = I_2 * R = -6.5272\ V$

$I_X = I_2 - I_1 = 25.53mA$