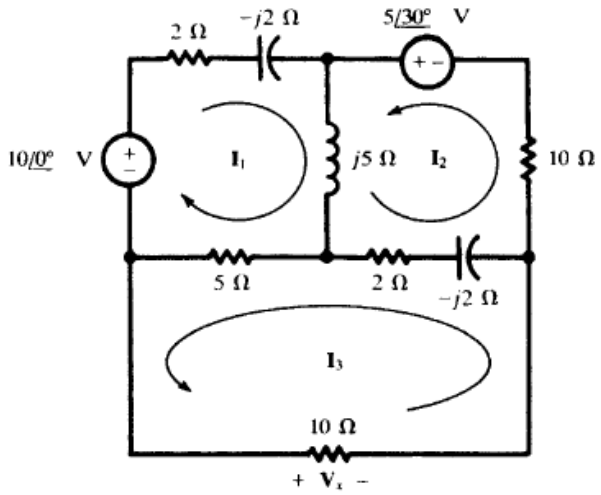
Teoría de Circuitos

Métodos de resolución de circuitos. Problemas resueltos

1- Calcular Vx aplicando método de corrientes de malla.



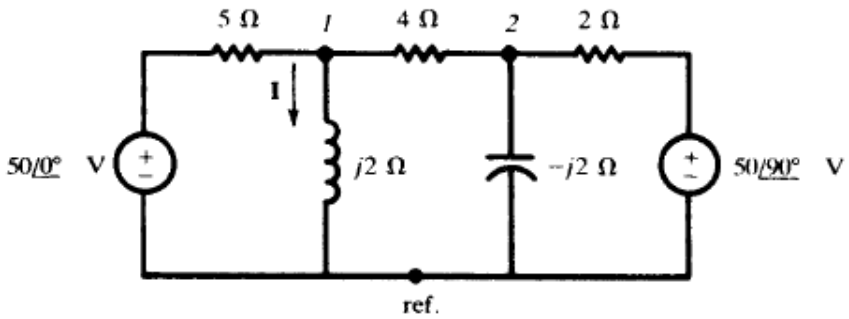
Vx = I3 (10 Ω)

$$\begin{bmatrix} 7+j3 & j5 & 5 \\ j5 & 12+j3 & -(2-j2) \\ 5 & -(2-j2) & 17-j2 \end{bmatrix} \begin{bmatrix} \mathbf{I}_1 \\ \mathbf{I}_2 \\ \mathbf{I}_3 \end{bmatrix} = \begin{bmatrix} 10\ \angle 0^\circ \\ 5\ \angle 30^\circ \\ 0 \end{bmatrix}$$

$$\mathbf{I}_3 = \frac{\begin{vmatrix} 7+j3 & j5 & 10\ \angle 0^\circ \\ j5 & 12+j3 & 5\ \angle 30^\circ \\ 5 & -2+j2 & 0 \end{vmatrix}}{\begin{vmatrix} 7+j3 & j5 & 5 \\ j5 & 12+j3 & -2+j2 \\ 5 & -2+j2 & 17-j2 \end{vmatrix}} = \frac{667.96\ \angle -169.09^\circ}{1534.5\ \angle 25.06^\circ} = 0.435\ \angle -194.15^\circ \quad \text{A}$$

$$\mathbf{V}_x = \mathbf{I}_3(10) = 4.35\ \angle -194.15^\circ\ \text{V}.$$

2- Calcular **I** por tensiones de nodo.

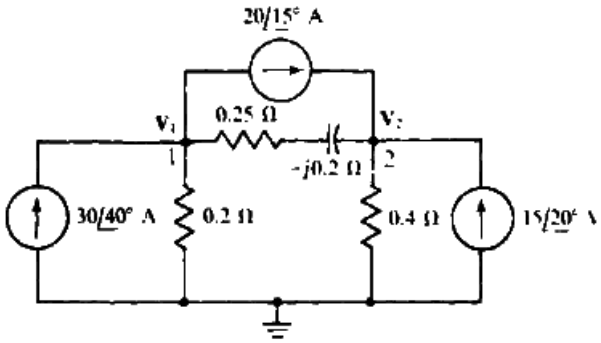


$$\begin{bmatrix} \frac{1}{5}+\frac{1}{j2}+\frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{1}{4}+\frac{1}{-j2}+\frac{1}{2} \end{bmatrix} \begin{bmatrix} \mathbf{V}_1 \\ \mathbf{V}_2 \end{bmatrix} = \begin{bmatrix} \frac{50\ \angle 0^\circ}{5} \\ \frac{50\ \angle 90^\circ}{2} \end{bmatrix}$$

$$\mathbf{V}_1 = \frac{\begin{vmatrix} 10 & -0.250 \\ j25 & 0.750+j0.500 \end{vmatrix}}{\begin{vmatrix} 0.450-j0.500 & -0.250 \\ -0.250 & 0.750+j0.500 \end{vmatrix}} = \frac{13.52\ \angle 56.31^\circ}{0.546\ \angle -15.94^\circ} = 24.76\ \angle 72.25^\circ \quad \text{V}$$

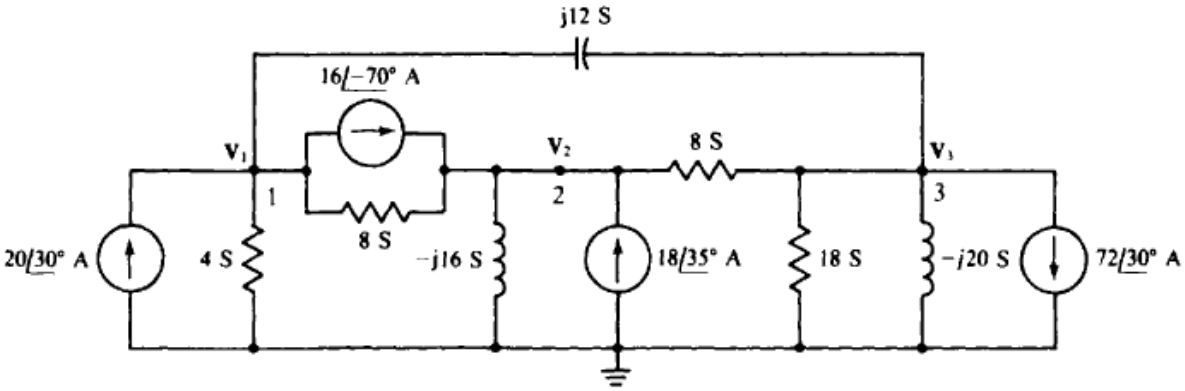
$$\mathbf{I} = \frac{24.76\ \angle 72.25^\circ}{2\ \angle 90^\circ} = 12.38\ \angle -17.75^\circ \quad \text{A}$$

3- Encontrar las tensiones en los nodos



$$\begin{bmatrix} 7.69\angle 14.7 & -3.12\angle 38.7 \\ -3.12\angle 38.7 & 5.31\angle 21.6 \end{bmatrix} \begin{bmatrix} \mathbf{V}_1 \\ \mathbf{V}_2 \end{bmatrix} = \begin{bmatrix} 14.6\angle 75.4 \\ 35.0\angle 17.1 \end{bmatrix}$$

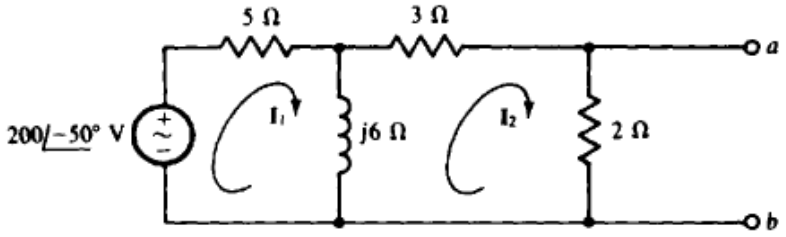
4- Encontrar las tensiones en los nodos



$$
\begin{aligned}
(12 + j12)\mathbf{V}_1 - 8\mathbf{V}_2 - j12\mathbf{V}_3 &= 27.7\angle 64.7^\circ \\
-8\mathbf{V}_1 + (16 - j16)\mathbf{V}_2 - 8\mathbf{V}_3 &= 20.8\angle -13.1^\circ \\
-j12\mathbf{V}_1 - 8\mathbf{V}_2 + (26 - j8)\mathbf{V}_3 &= -72\angle 30^\circ
\end{aligned}
$$

$\mathbf{V}_1 = 2.07\angle -26.6^\circ$ V, $\mathbf{V}_2 = 1.38\angle 7.36^\circ$ V, and $\mathbf{V}_3 = 1.55\angle -146^\circ$ V.

5- Encontrar el circuito equivalente de Thevenin entre a y b.



$$\mathbf{Z}_{Th} = 2\|(3 + j6\|5) = \frac{2[3 + 5(j6)\|(5 + j6)]}{2 + 3 + 5(j6)\|(5 + j6)} = 1.55\angle 5.27^\circ\ \Omega$$

$$\mathbf{I}_2 = \frac{\begin{vmatrix} 5 + j6 & 200\angle -50^\circ \\ -j6 & 0 \end{vmatrix}}{\begin{vmatrix} 5 + j6 & -j6 \\ -j6 & 5 + j6 \end{vmatrix}} = \frac{-(-j6)(200\angle -50^\circ)}{(5 + j6)^2 - (-j6)^2} = \frac{1200\angle 40^\circ}{65\angle 67.4^\circ} = 18.46\angle -27.4^\circ\ \text{A}$$

$$\mathbf{V}_{Th} = 2\mathbf{I}_2 = 2(18.46\angle -27.4^\circ) = 36.9\angle -27.4^\circ\ \text{V}$$