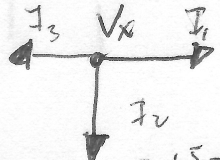
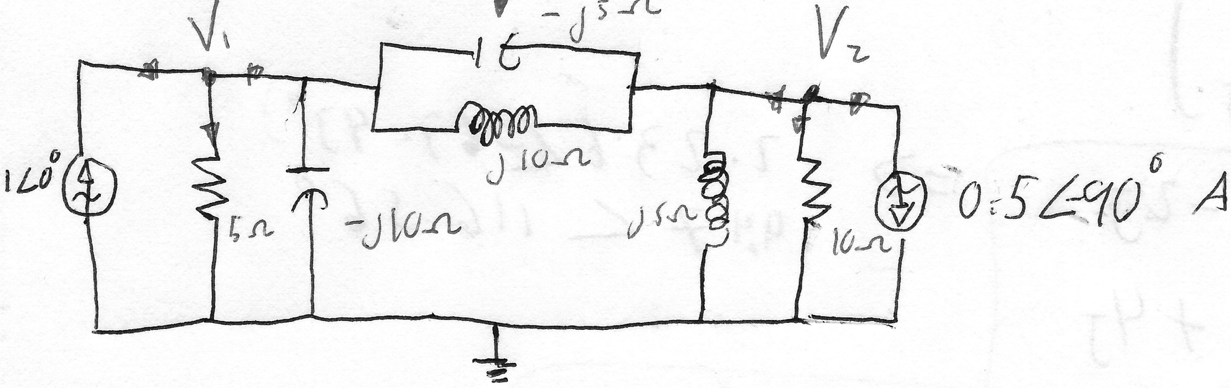
Nota: En todos los problemas supondre que las corrientes salen del nodo es decir





Para V_1 (en nodo 1)

$$\frac{V_1}{5\Omega} + \frac{V_1}{-j10\Omega} + \frac{V_1 - V_2}{j10\Omega} + \frac{V_1 - V_2}{-j5\Omega} = 1A$$

$$V_1\left(\frac{1}{5\Omega} + \frac{1}{-j10\Omega} + \frac{1}{j10\Omega} + \frac{1}{-j5\Omega}\right) - V_2\left(\frac{1}{j10\Omega} + \frac{1}{-j5\Omega}\right) = 1A$$

$$\Rightarrow V_1(0.2 + 0.2j) + V_2(-0.1j) = 1\ A \ldots\ldots \ 0$$

Para $\bar{V}_2$ (en nodo 2)

$$\frac{V_2}{10} + \frac{V_2}{j5} + \frac{V_2 - V_1}{j10\Omega} + \frac{V_2 - V_1}{-j5\Omega} = 0.5j$$

$$-V_1(0.1j) + V_2(0.1 - 0.1j) = 0.5j \ldots\ldots \ 1$$

Resolviendo el sistema de ecuaciones de 2x2

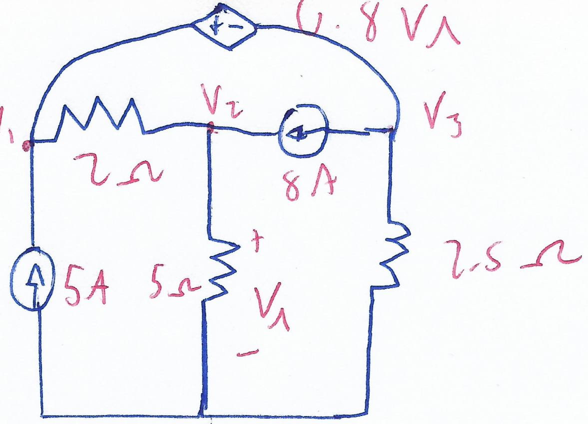
$$\left(\begin{array}{cc|c} \frac{1+j}{5} & -\frac{j}{10} & 1 \\ \frac{-j}{10} & \frac{1-j}{10} & \frac{j}{2} \end{array}\right) \times\left(\frac{5-5j}{2}\right) = \left(\begin{array}{cc|c} 1 & \frac{-1-j}{4} & \frac{5-5j}{2} \\ \frac{-j}{10} & \frac{1-j}{10} & \frac{j}{2} \end{array}\right) \times\left(\frac{j}{10}\right)$$

$$\left(\begin{array}{cc|c} 1 & \frac{-1-j}{4} & \frac{5-5j}{2} \\ 0 & \frac{1-j}{8} & \frac{1+3j}{4} \end{array}\right) \times (4+4j) = \left(\begin{array}{cc|c} 1 & \frac{-1-j}{4} & \frac{5-5j}{2} \\ 0 & 1 & -2+4j \end{array}\right) \times \frac{1+j}{4}$$

$$\left(\begin{array}{cc|c} 1 & 0 & 1-2j \\ 0 & 1 & -2+4j \end{array}\right)$$

$$\Rightarrow \boxed{\begin{aligned} V_1 &= 1-2j \\ V_2 &= -2+4j \end{aligned}} \Rightarrow \begin{aligned} &2.236\angle -63.43^\circ \\ &4.47\angle 116.56^\circ \end{aligned}$$

$$\boxed{\begin{aligned} V_1(t) &= 2.236\cos(-63.43^\circ) \\ V_2(t) &= 4.47\cos(116.56^\circ) \end{aligned}}$$



Por su parnodo tenemos que

$$-V_3+V_1 = 0.8\,V_\lambda$$

$$V_1 - V_3 = 0.8\,V_\lambda \ldots\ldots (0)$$

$$V_\lambda = V_2$$

Para V_1 y V_3 (nodo 1 y 3)

$$\frac{V_1-V_2}{2\Omega} + \frac{V_3}{2.5\Omega} = 5A - 8A$$

$$\frac{V_1}{2\Omega} - \frac{V_2}{2\Omega} + \frac{V_3}{2.5\Omega} = -3A \ldots\ldots (1)$$

Para V_2 (nodo 2)

$$\frac{V_2}{5\Omega} + \frac{V_2-V_1}{2\Omega} = 8A$$

$$-\frac{V_1}{2} + V_2(0.7) = 8A \ldots\ldots (2)$$

utilizando (0) y despejando V_3

$$V_3 = V_1 - 0.8V_2 \ldots\ldots (3)$$

Sustituyendo (3) en (1)

$$\frac{V_1}{2\Omega} - \frac{V_2}{2\Omega} + \frac{(V_1 - 0.8V_2)}{2.5\Omega} = -3A$$

$$V_1(0.9) - V_2(0.82) = -3A \ldots\ldots (4)$$

Resolviendo el sistema de ecuaciones de 2x2

$$\left(\begin{array}{cc|c} -\frac{1}{2} & \frac{7}{10} & 8 \\ \frac{9}{10} & -\frac{41}{50} & -3 \end{array}\right) \times(-2) = \left(\begin{array}{cc|c} 1 & -\frac{7}{5} & -16 \\ \frac{9}{10} & -\frac{41}{50} & -3 \end{array}\right) \left(-\frac{9}{10}\right)$$

$$= \left(\begin{array}{cc|c} 1 & -\frac{7}{5} & -16 \\ 0 & \frac{11}{25} & \frac{57}{5} \end{array}\right) \times\left(\frac{25}{11}\right) = \left(\begin{array}{cc|c} 1 & -\frac{7}{5} & -16 \\ 0 & 1 & \frac{285}{11} \end{array}\right) \times \frac{7}{5}$$

$$= \left(\begin{array}{cc|c} 1 & 0 & \frac{223}{11} \\ 0 & 1 & \frac{285}{11} \end{array}\right)$$

$\Rightarrow V_1 = 20.2\ V$ $\Rightarrow$ Por ③

$V_2 = 25.9\ V$ $V_3 = -0.52$

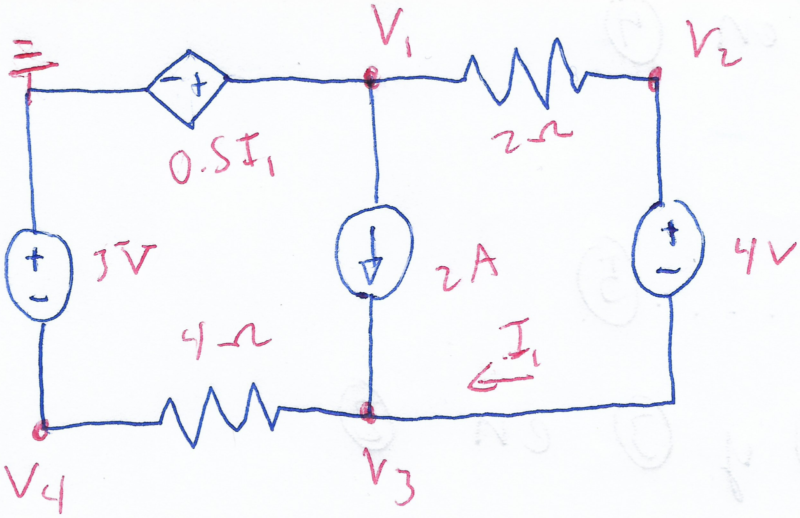
$\Rightarrow V_3 = 0.52$

entonces $\boxed{V_1 = 25.9\ V}$

$P = R \times I^2$

$P = \cancel{R} \times \frac{V_3^2}{R^{\cancel{2}}}$

$$\boxed{P = \frac{V_3^2}{R} = 0.108\ W}$$



Analizando el nodo de V_1 podemos suponer que

$\boxed{V_1 = 0.5 I_1}$ ..... (1)

Analizando los nodos V_2 y V_3 determinamos que usaremos supernodo, Así que $V_2 - V_3$ 4V ..... (0)

$$\frac{V_2 - V_1}{2\Omega} + \frac{V_3 - V_4}{4\Omega} = 2A \text{ ...... (2)}$$

Analizando el nodo de V_4 podemos supona que

$\boxed{V_4 = 3V}$ ...... (3)

Analizando la resistencia de 4Ω podemos determinar que

$$V_3 - V_4 = 4\Omega(2A + I_1)$$

simplificando

$$\frac{V_3 - V_4}{4\Omega} = 2A + I_1 \text{ ...... (4)}$$

Sustituyendo 1 y 3 en 4

$$\frac{V_3}{4\Omega} - \frac{3V}{4\Omega} = 2A + 2V_1$$

$$\Rightarrow -2V_1 + \frac{V_3}{4\Omega} = \frac{11}{4} A \quad \ldots\ldots 5$$

ahora sustituyendo 0 y 3 en 2

$$\frac{4V + V_3}{2\Omega} - \frac{V_1}{2\Omega} + \frac{V_3}{4\Omega} - \frac{3V}{4\Omega} = 2A$$

$$\frac{-V_1}{2\Omega} + \frac{3}{4}V_3 = \frac{3}{4} A \quad \ldots\ldots 6$$

Resolviendo el sistema de 2x2

$$\left(\begin{array}{cc|c} -\frac{1}{2} & \frac{3}{4} & \frac{3}{4} \\ -2 & \frac{1}{4} & \frac{11}{4} \end{array}\right) \times(-2) = \left(\begin{array}{cc|c} 1 & -\frac{3}{2} & -\frac{3}{2} \\ -2 & \frac{1}{4} & \frac{11}{4} \end{array}\right) \times(2)$$

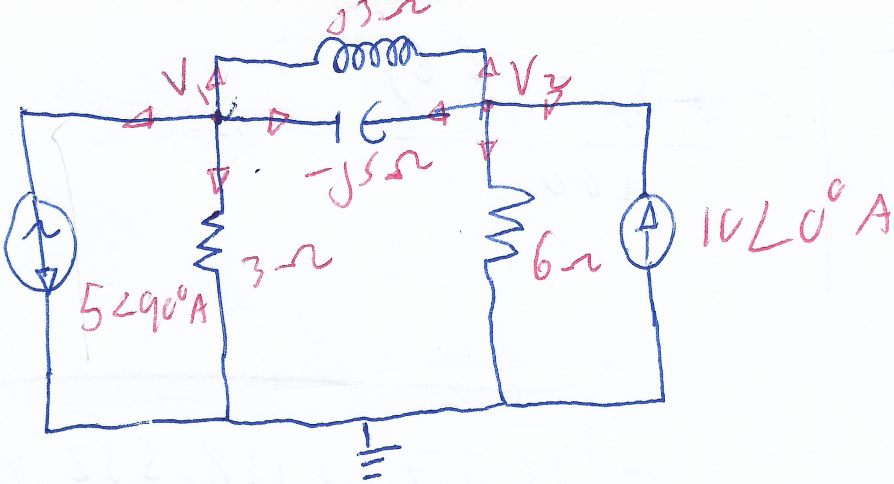
$$= \left(\begin{array}{cc|c} 1 & -\frac{3}{2} & -\frac{3}{2} \\ 0 & -\frac{11}{4} & -\frac{1}{4} \end{array}\right) \times\left(-\frac{4}{11}\right) = \left(\begin{array}{cc|c} 1 & -\frac{3}{2} & -\frac{3}{2} \\ 0 & 1 & \frac{1}{11} \end{array}\right) \times\left(\frac{3}{2}\right)$$

$$= \left(\begin{array}{cc|c} 1 & 0 & -\frac{15}{11} \\ 0 & 1 & \frac{1}{11} \end{array}\right)$$

$$\Rightarrow V_1 = \frac{15}{11}$$

pero por 1 $\quad \frac{15}{11} = \frac{1}{2} I_1 \Rightarrow I_1 = \frac{30}{11}$

$$\boxed{I_1 = 2.727 \text{ A}}$$



Para V_1 (nodo 1)

$$\frac{V_1}{3\Omega} + \frac{V_1 - V_2}{-j5\Omega} + \frac{V_1 - V_2}{j3\Omega} = -5j\ A$$

$$V_1\left(\frac{1}{3} - 0.133j\right) + V_2(0.133j) = -5j\ A \ldots \text{(0)}$$

Para V_2 (nodo 2)

$$\frac{V_2}{6\Omega} + \frac{V_2 - V_1}{-j5\Omega} + \frac{V_2 - V_1}{j3\Omega} = 10\ A$$

$$V_1(0.133j) + V_2\left(\frac{1}{6} - 0.133j\right) = 10\ A \ldots \text{(1)}$$

Resolviendo el sistema de 2x2

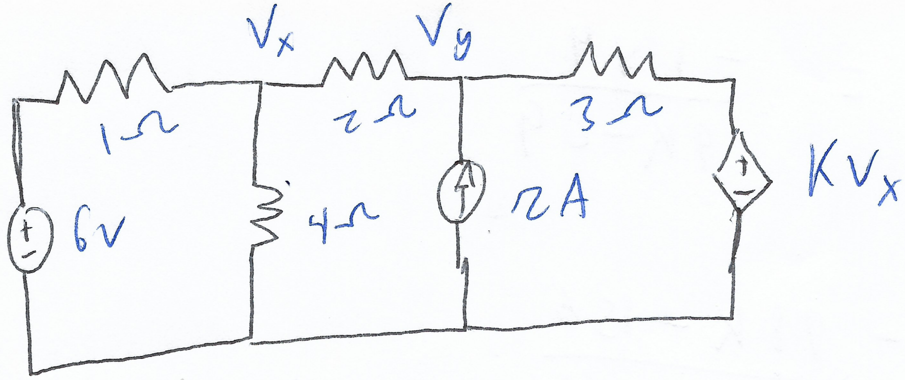
$$\Delta = \begin{vmatrix} \frac{333 - 133j}{1000} & \frac{133j}{1000} \\ \frac{133j}{1000} & \frac{166 - 133j}{1000} \end{vmatrix} = 0.0552 - 0.0663j$$

$$\Delta_1 = \begin{vmatrix} -5j & \frac{133j}{1000} \\ 10 & \frac{1666 - 133j}{1000} \end{vmatrix} = \frac{-133 - 432j}{200}$$

$$\Delta_2 = \begin{vmatrix} \frac{333-133j}{1000} & -5j \\ \frac{133j}{1000} & 10 \end{vmatrix} = \frac{533-266j}{200}$$

$$V_2 = \frac{\Delta_2}{\Delta} = \frac{\frac{533-266j}{200}}{0.0552-0.0663j} = \boxed{31.578+138.532j}$$

$$\boxed{\therefore V_2 = 31.578 + 138.532j \ V}$$



Para Vx

$$\frac{V_x - 6V}{1\Omega} + \frac{V_x}{4\Omega} + \frac{V_x - V_y}{2\Omega} = 0$$

$$V_x\left(\frac{7}{4}\right) - V_y\left(\frac{1}{2}\right) = 6\,A \quad \ldots\ldots \quad (0)$$

Para Vy

$$\frac{V_y - K V_x}{3\Omega} + \frac{V_y - V_x}{2\Omega} = 2\,A$$

$$-V_x\left(\frac{2K+3}{6}\right) + V_y\left(\frac{5}{6}\right) = 2\,A \quad \ldots\ldots \quad (1)$$

Resolviendo el sistema de 2x2

$$\Delta = \begin{vmatrix} \frac{7}{4} & -\frac{1}{2} \\ \frac{-2K-3}{6} & \frac{5}{6} \end{vmatrix} = \frac{-4K+29}{24}$$

$$\Delta_1 = \begin{vmatrix} 6 & -\frac{1}{2} \\ 2 & \frac{5}{6} \end{vmatrix} = 6$$

$$\Delta_2 = \begin{vmatrix} \frac{7}{4} & 6 \\ \frac{-2K-3}{6} & 2 \end{vmatrix} = \frac{4 \times K+13}{2}$$

$$V_x = \frac{\Delta_1}{\Delta} = \frac{6}{\frac{-4K+29}{4}} = \frac{-144}{4K-29}$$

$$V_y = \frac{2}{\frac{-4K+29}{24}} = -\frac{48K-156}{4K-29}$$

Sabemos que $V_y = -\dfrac{48K-156}{4K-29}$

entonces si $0 = -48K - 156$

V_y tomaría el valor de 0

$$\Rightarrow K = -\frac{156}{48} = -\frac{13}{4}$$

$$\boxed{\therefore\ K = -\frac{13}{4}}$$