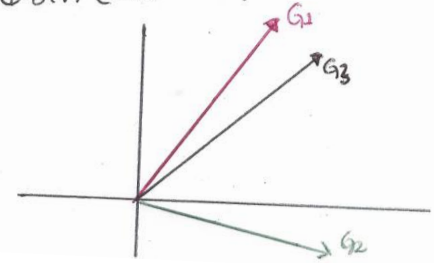
Pregunta: Encuentre el valor del desfase existente entre cada una de las señales siguientes: $g_1(t) = 4\cos(10t - 40º)$; $g_2(t) = -12\,\text{sen}(10t + 160º)$; $g_3(t) = 6\,\text{sen}(10t - 315º)$ (1)

① Usando la identidad trigonométrica $\cos(\beta) = \text{sen}(\beta + \pi/2)$

- $g_1(t) = 4\cos(10t - 40) = 4\,\text{sen}(10t - 40 + 90) = 4\,\text{sen}(10t + 50)$
- $g_2(t) = -12\,\text{sen}(10t + 160) = 12\,\text{sen}(10t + 160 - 180) = 12\,\text{sen}(10t - 20)$
- $g_3(t) = 6\,\text{sen}(10t - 315) = 6\,\text{sen}(10t + 45)$



G1 adelanta 70° a G2

G1 adelanta 5° a G3

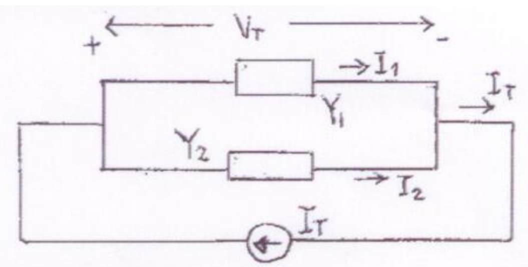
G3 adelanta 65° a G2

PROBLEMA: En el circuito de la figura, conocemos al módulo del voltaje $|V_T| = 10$ V. y la corriente I_2 retrasa 30º al voltaje V_T. Calcule los elementos que conforman a Y_2, si:

a) I_T se encuentra en fase con V_T. Aparte:

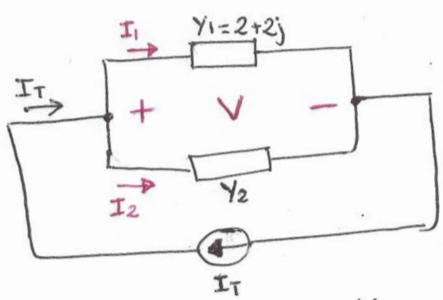
b) I_T adelanta 15º a V_T.

c) Calcule en los dos casos la corriente total I_T.

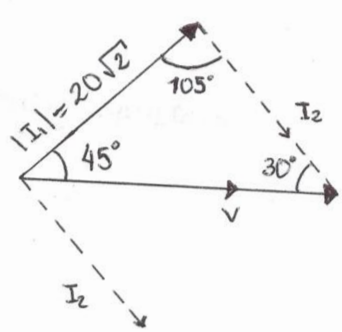


$\omega = 1000$ rad/seg.

③



Tomando como referencia V:



a) Usando el Teorema del Seno:

$$\frac{\text{sen}(45)}{|I_2|} = \frac{\text{sen}(30)}{|I_1|} \Rightarrow |I_2| = 40$$

$$Y_2 = \frac{I_2}{V} = \frac{40\angle -30}{10\angle 0} = 4\angle -30 = 3{,}46 - 2j$$

∴ Observe que $Y_1 + Y_2$ es solo resistivo

otro Procedimiento:

$$I_T = I_1 + I_2$$

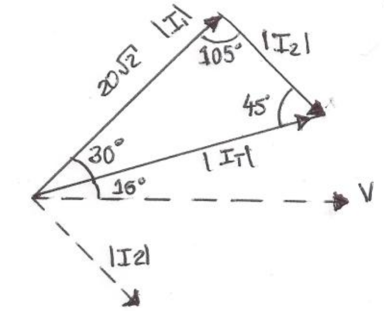
$$|I_T|\angle 0 = 20\sqrt{2}\angle 45° + |I_2|\angle -30°$$

$$-|I_2|\cos(-30) + |I_T|\cos(0) = 20$$

$$-|I_2|\,\text{sen}(-30) + |I_T|\,\cancel{\text{sen}}(0) = 20$$

$$\therefore |I_2| = 40 \Rightarrow Y_2 = \frac{I_2}{V} = \frac{40\angle -30}{10\angle 0} = 4\angle -30$$

b)



$$\frac{sen(30)}{|I_2|} = \frac{sen(45)}{|I_1|}$$

$$|I_2| = 20\sqrt{2}\,\frac{sen(30)}{sen(45)}$$

$$|I_2| = 20$$

$$Y_2 = \frac{I_2}{V} = \frac{20\angle{-30}}{10\angle 0}$$

$$Y_2 = 2\angle{-30}$$

$$Y_2 = 1{,}73 - j\,1{,}0$$

c) $I_T = ?$ $\quad I_T = Y_T \cdot V$

$$I_T = (Y_1 + Y_2)\cdot(10\angle 0)$$

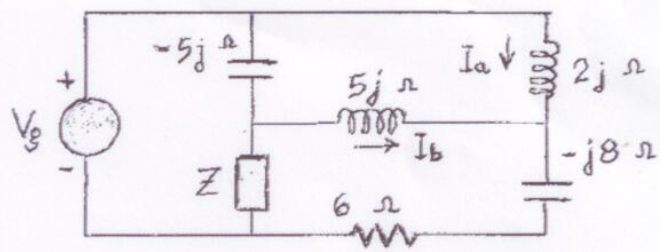
• $I_T = (2+2j+3{,}46-2j)(10\angle 0)$

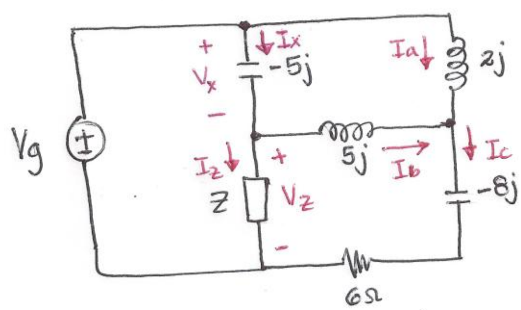
$$I_T = 54{,}6\angle 0$$

• $I_T = (2+2j+1{,}73-j1{,}0)\cdot(10\angle 0)$

$$I_T = 38{,}63\angle 15°$$

PROBLEMA: En el circuito de la figura, calcule la corriente I_b y la impedancia Z, conociendo el valor de la fuente $V_g = 60\angle 0º$ volts, y la corriente $I_a = 5\angle{-90º}$ amp.





$V_g = 60\angle 0$ $\quad$ observe que:

$I_a = 5\angle{-90}$ $\quad -V_g + 2jI_a + I_c(6-8j) = 0$

$$\therefore\ I_c = \frac{V_g - 2jI_a}{6-8j} = 3+4j$$

$I_b + I_a = I_c \quad \therefore\ I_b = I_c - I_a = 3+9j$

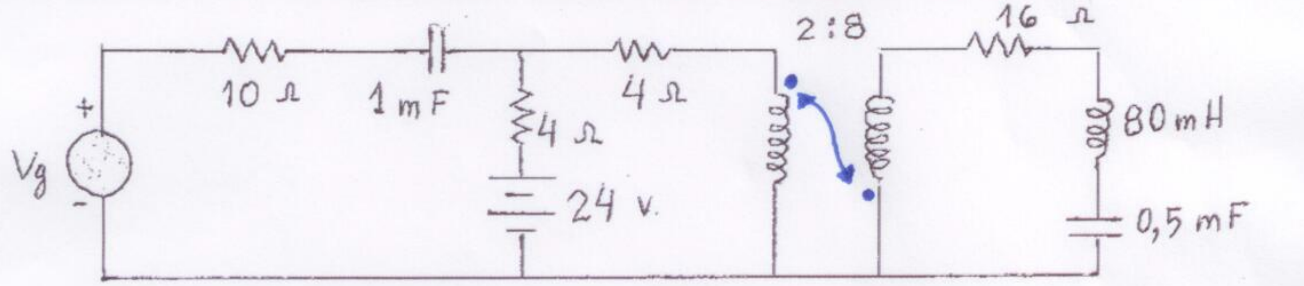
$V_z = 5j \cdot I_b + (6-8j)I_c \quad \Rightarrow \quad V_z = 5+15j$

$-V_g + V_x + V_z = 0 \quad \therefore\ V_x = V_g - V_x \quad \therefore\ V_x = 55-15j$

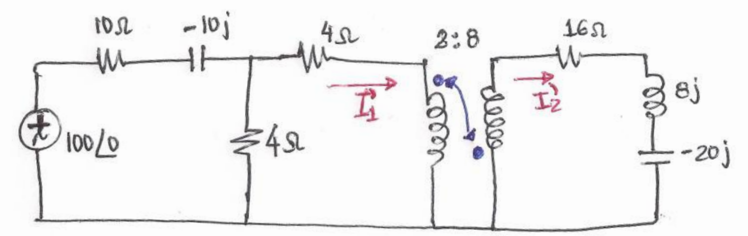
$I_x = I_z + I_b \quad \therefore\ I_z = I_x - I_b = \dfrac{V_x}{-5j} - (3+9j) \quad \therefore\ I_z = 2j$

$Z = \dfrac{V_z}{I_z} \quad \therefore\ Z = \dfrac{5+15j}{2j} \qquad Z = 7{,}5 - 2j$

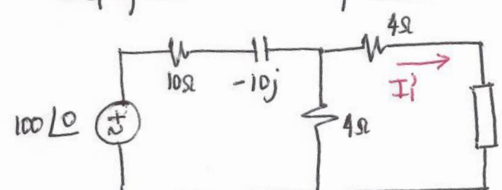
PROBLEMA: En el circuito de la figura, la fuente tiene la expresión $V_g(t) = 100 \text{ sen}(100t)$ V. Se desea conocer el valor de las corrientes $i_1(t)$ e $i_2(t)$ en el dominio del tiempo.



- Como tenemos dos fuentes con frecuencias distintas debemos aplicar superposición: $i_1(t) = i_1'(t) + i_1''(t)$; $i_2(t) = i_2'(t) + i_2''(t)$



Reflejando la impedancia al primario:



$(16-12j)\left(\frac{2}{8}\right)^2 = 1 - 0{,}75j$

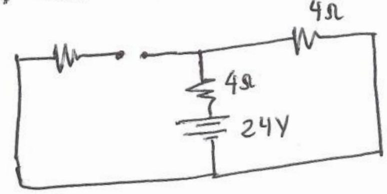
$$I_1' = \frac{100\angle 0}{(10-10j) + 4 // (4+1-0{,}75j)} \cdot \frac{4}{(4+4+1-0{,}75j)} \Rightarrow I_1' = 1{,}989 + j\,1{,}951$$

$* \; i_1'(t) = 2{,}786 \text{ sen}(100t + 44{,}44)$

$$\frac{I_1'}{I_2'} = -\frac{8}{2} \quad \therefore \quad I_2' = -0{,}497 - j0{,}487$$

$* \; i_2'(t) = 0{,}696 \text{ sen}(100t - 135{,}56)$

- Circuito en DC



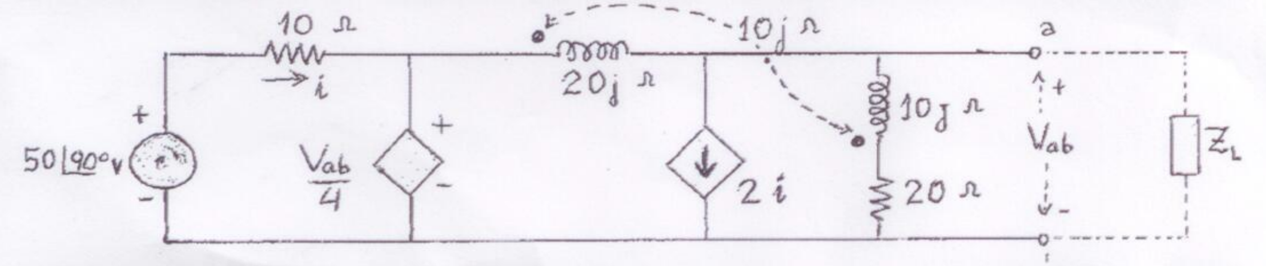
$i_2''(t) = 0$

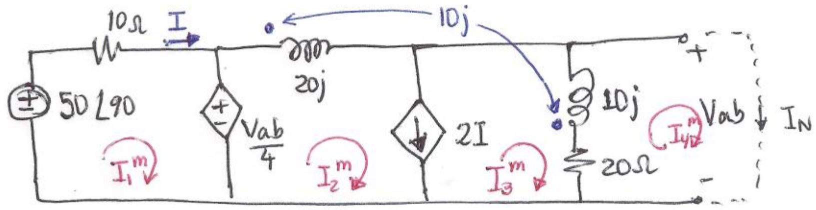
$i_1''(t) = \frac{24}{8} = 3\text{A}$

$\therefore \quad i_1(t) = 3 + 2{,}786 \text{ sen}(100t + 44{,}44)$

$i_2(t) = 0{,}696 \text{ sen}(100t - 135{,}56)$

PROBLEMA: En el circuito de la figura, se desea conocer el equivalente de Thevenin existente entre los nudos "a" y "b". Luego, conectamos en estos nudos "a" y "b" una impedancia de carga Z_L de valor $(4+14j)\,\Omega$, calcular la corriente que recibe esta carga Z_L.





• Cálculo de I_N: si $V_{ab} = 0\,V$

$I = I_1^m = \frac{50\angle 90}{10} = 5j$

Ecuación de condición: $I_2^m - I_3^m = 2 I_1^m$

$\Rightarrow \boxed{I_2^m - I_3^m = 10j}$ (I)

$-\frac{V_{ab}}{4} + 20j\,I_2^m + 10j\,(I_4^m - I_3^m) + V_{ab} = 0$

como $V_{ab} = 0$ $\Rightarrow$ $\boxed{20j\,I_2^m - 10j\,I_3^m + 10j\,I_4^m = 0}$ (II)

$(20+10j)(I_4^m - I_3^m) + 10j\,I_2^m = 0$ $\quad \boxed{10j\,I_2^m - (20+10j)\,I_3^m + (20+10j)\,I_4^m = 0}$ (III)

Resolviendo el sistema de ecuaciones:

$I_N = I_4^m = -10j = 10\angle -90$

• Cálculo de V_{Th}:

$V_{ab} = (20+10j)\,I_3^m - 10j\,I_2^m$ $\Rightarrow$ $\boxed{10\,I_1^m - j\frac{10}{4} I_2^m + \frac{(20+10j)}{4} I_3^m = 50\angle 90}$ (I)

$-50\angle 90 + 10 I_1^m + \frac{V_{ab}}{4} = 0$

Ecuación de condición: $\Rightarrow$ $\boxed{2 I_1^m - I_2^m + I_3^m = 0}$ (II)

Supermalla: $-\frac{V_{ab}}{4} + 20j\,I_2^m - 10j\,I_3^m + V_{ab} = 0$ $\Rightarrow$ $\boxed{12{,}5j\,I_2^m + (15 - 2{,}5j)\,I_3^m = 0}$ (III)

Resolviendo:

$I_1^m = -3{,}5 + 2j$

$I_2^m = -2 + 6{,}5j$

$I_3^m = 5 + 2{,}5j$

$V_{ab} = V_{th} = 140 + j120$

$Z_{th} = \frac{V_{th}}{I_n} = \frac{140 + j120}{-10j}$

$\boxed{Z_{th} = -12 + 14j}$

$I_{carga} = \frac{V_{th}}{Z_{th} + 4 + j14} = 2{,}64 - j5{,}75$

$I_{carga} = 6{,}33\angle -65{,}34$