Example

D6.1. Find the currents $\mathbf{I}_1$ and $\mathbf{I}_2$ and the output voltage $\mathbf{V}_0$ in the network in Figure D6.1

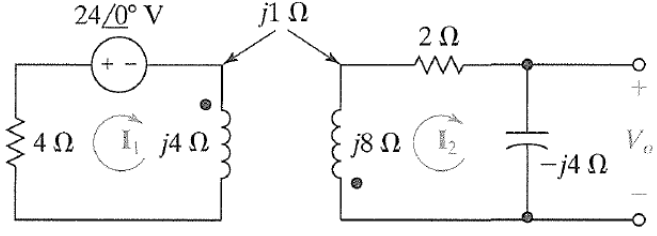


FIGURE D6.1

$-24\angle 0^\circ = (4+j4)I_1 - j1I_2$

$0 = -j1\,I_1 + (2+j4)I_2$

$$\begin{bmatrix} 4+j4 & -j1 \\ -j1 & 2+j4 \end{bmatrix}\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{pmatrix} -24 \\ 0 \end{pmatrix}$$

$-8 + 24j + 1$

$D = -7 + j24$

$$I_1 = \frac{\begin{vmatrix} -24 & -j1 \\ 0 & 2+j4 \end{vmatrix}}{-7+j24} = \frac{-48-j96}{-7+j24} = -4.29\angle -42.8\ \text{A}$$

$$I_2 = \frac{\begin{vmatrix} 4+j4 & -24 \\ -j1 & 0 \end{vmatrix}}{-7+j24} = \frac{j24}{-7+j24} = 0.96\angle -16.3\ \text{A}$$

$V_o = -j4I_2 = 3.84\angle -106.3^\circ\ \text{V}$

Ans: $\mathbf{I}_1 = -4.29\angle -42.8^\circ$ A, $\mathbf{I}_2 = 0.96\angle -16.26^\circ$ A, $\mathbf{V}_0 = 3.84\angle -106.26^\circ$ V.

Example

D6.2. Given the network in Figure D6.2, find the input impedance of the network and the current in the voltage source.

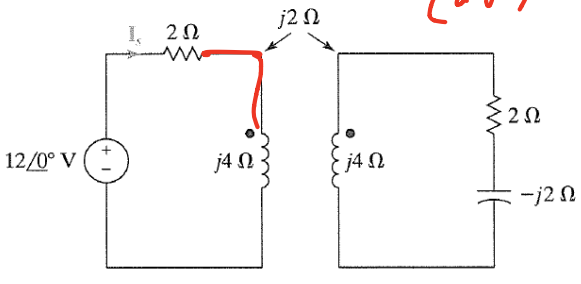


FIGURE D6.2

$(2-j2)$

$Z_i = 2 + j4 + \dfrac{2^2}{2+j4-j2}$

$= 2 + j4 + \dfrac{2^2}{2+j2} = 3 + j3\ \Omega$

$I_s = \dfrac{12}{3+j3} = 2 - j2\ \text{A}$

Ans: $\mathbf{Z}_i = 3 + j3\ \Omega, \mathbf{I}_s = 2 - j2\ \text{A}.$

Example

D6.3. Compute the current $\mathbf{I}_1$ in the network in Figure D6.3.

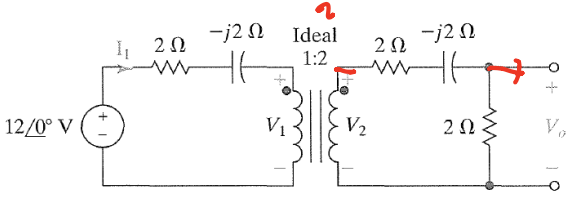


FIGURE D6.3

$$I_1 = \frac{12\angle 0^\circ}{2 - j2 + \frac{1}{4}(4 - j2)} = \frac{12}{3 - j2.5} = 3.07\angle 39.81^\circ \text{ A}$$

Ans: $\mathbf{I}_1 = 3.07\angle 39.81^\circ$ A.

D6.4. Find $\mathbf{V}_0$ in the network in Figure D6.3

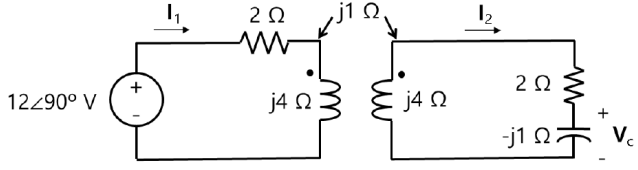
Ans: $\mathbf{V}_0 = 3.07\angle 39.82^\circ$ V.

$$V_o = 2I_2 = 2 \times \frac{I_1}{2} = I_1 = 3.07\angle 39.81^\circ \checkmark$$

Example

- Ex1

(15 points) Consider the following circuit.



(a) (10 points) Complete the following equations about phasor currents, $\mathbf{I}_1$ and $\mathbf{I}_2$.

$$\boxed{2+j4}\ \mathbf{I}_1 + \boxed{-j}\ \mathbf{I}_2 = \boxed{12}$$

$$\boxed{-j}\ \mathbf{I}_1 + \boxed{2+3j}\ \mathbf{I}_2 = 0$$

(b) (5 points) When the calculated $\mathbf{I}_2 = 0.343+j0.686 = 0.767\angle 63.4° = 0.767e^{j63.4°}$ and the frequency of the voltage source is 10 Hz, find **Vc** and $v_c(t)$.

$\theta = -63.4°$

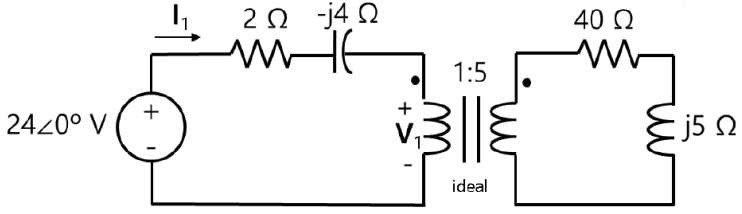
$\mathbf{V}_c = 0.767\angle -26.6°$

$v_c(t) = 0.767\cos(10t - 26.6°)$

Example

- Ex2

(10 points) Consider the following circuits.

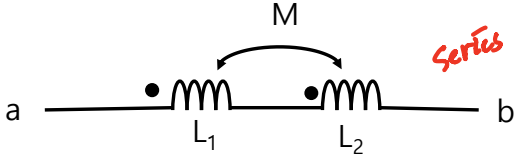


Complete the following equations about phasor currents, $\mathbf{I}_1$ and $\mathbf{V}_1$.

2-j4	$\mathbf{I}_1$ +	1	$\mathbf{V}_1$ =	24
2+j	$\mathbf{I}_1$ +	-5	$\mathbf{V}_1$ = 0	

Example

- Ex3. Find the inductance between terminals a and b
  - (a)



  - (b)