Chapter 10, Solution 43.

Using the superposition principle, find i_x in the circuit of Fig. 10.88.

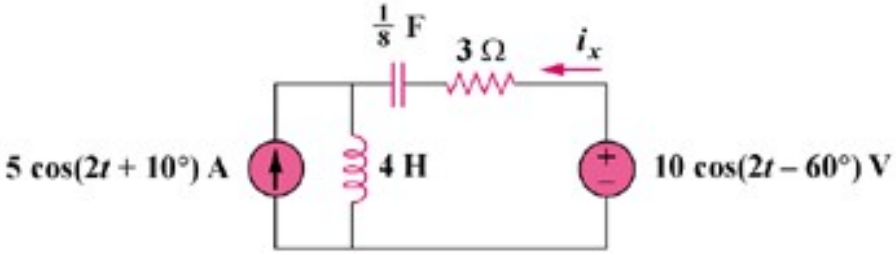


Figure 10.88
For Prob. 10.43.

Solution

Let $\mathbf{I}_x = \mathbf{I}_1 + \mathbf{I}_2$, where $\mathbf{I}_1$ is due to the voltage source and $\mathbf{I}_2$ is due to the current source.

$$\omega = 2$$

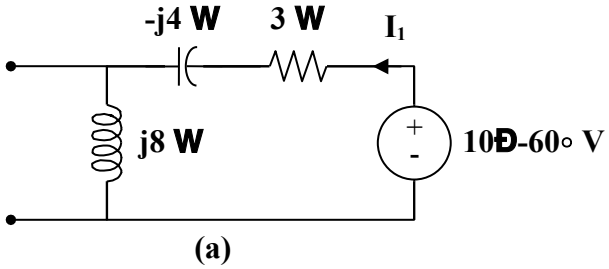
$$5\cos(2t+10^\circ) \longrightarrow 5\angle 10^\circ$$

$$10\cos(2t-60^\circ) \longrightarrow 10\angle -60^\circ$$

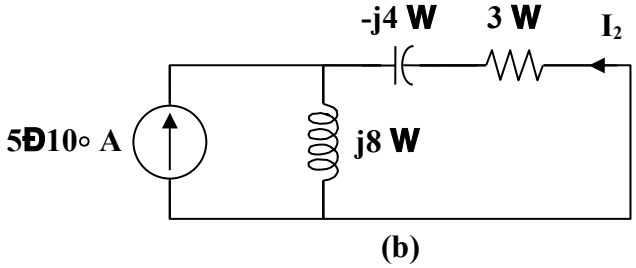
$$4\text{ H} \longrightarrow j\omega L = j8$$

$$\frac{1}{8}\text{F} \longrightarrow \frac{1}{j\omega C} = \frac{1}{j(2)(1/8)} = -j4$$

For $\mathbf{I}_1$, consider the circuit in Fig. (a).



$$\mathbf{I}_1 = \frac{10\angle -60^\circ}{3 + j8 - j4} = \frac{10\angle -60^\circ}{3 + j4}$$



(b)

For $\mathbf{I}_2$, consider the circuit in Fig. (b).

$$\mathbf{I}_2 = \frac{-j8}{3+j8-j4}(5\angle 10°) = \frac{-j40\angle 10°}{3+j4}$$

$$\mathbf{I}_x = \mathbf{I}_1 + \mathbf{I}_2 = \frac{1}{3+j4}(10\angle -60° - j40\angle 10°)$$

$$\mathbf{I}_x = \frac{49.51\angle -76.04°}{5\angle 53.13°} = 9.902\angle -129.17°$$

Therefore, i_x = **9.902 cos(2t – 129.17◦) A**