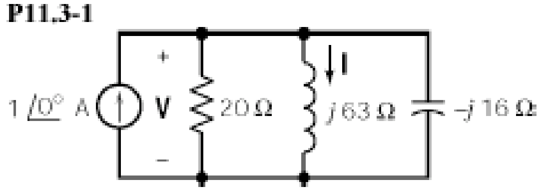
P11.3-1

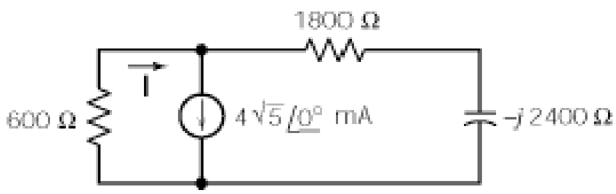


$$1\angle 0° = \frac{\mathbf{V}}{20} + \frac{\mathbf{V}}{j63} + \frac{\mathbf{V}}{-j16} \Rightarrow \mathbf{V} = 14.6\angle -43° \text{ V}$$

$$\mathbf{I} = \frac{\mathbf{V}}{j63} = 0.23\angle -133° \text{ A}$$

$$\begin{aligned} p(t) = i(t)v(t) &= 0.23(\cos\ (2\pi \cdot 10^3 t - 133^\circ)) \times 14.6\ \cos\ (2\pi \cdot 10^3 t - 43^\circ) \\ &= 3.36\ \cos\ (2\pi \cdot 10^3 t - 133^\circ)\ \cos\ (2\pi \cdot 10^3 t - 43^\circ) \\ &= 1.68\ (\cos\ (90^\circ) + \cos\ (4\pi \cdot 10^3 t - 176^\circ)) \\ &= 1.68\ \cos\ (4\pi \cdot 10^3 t - 176^\circ) \end{aligned}$$

P11.3-2



Current division:

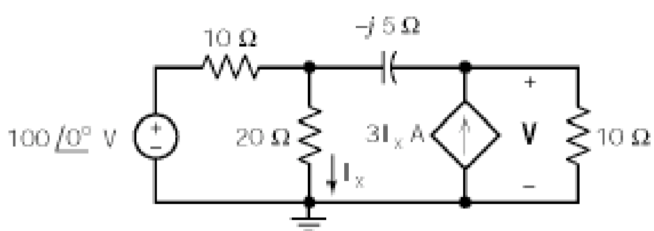
$$\mathbf{I} = 4\sqrt{5}\left[\frac{1800 - j2400}{1800 - j2400 + 600}\right]$$

$$= 5\sqrt{\frac{5}{2}}\angle -8.1° \text{ mA}$$

$$P_{600\Omega} = \frac{|\mathbf{I}|^2\, 600}{2} = 300(25)\left(\frac{5}{2}\right) = 1.875 \times 10^4\ \mu\text{W} = 18.75 \text{ mW}$$

$$P_{source} = \frac{|\mathbf{V}||\mathbf{I}|\cos\theta}{2} = \frac{1}{2}(600)\left(5\sqrt{\frac{5}{2}}\right)\left(4\sqrt{5}\right)\cos(-8.1^\circ) = 2.1 \times 10^4\ \mu\text{W} = 21 \text{ mW}$$

P11.3-3

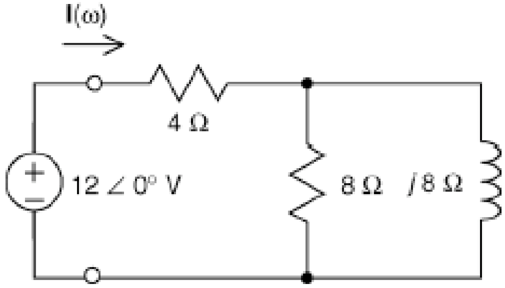


P11.5-1

$$\mathbf{I}^* = \frac{2\,\mathbf{S}}{12\angle 0°} = \frac{2\,(3.6 + j\,7.2)}{12\angle 0°} = 0.6 + j1.2 = 1.342\angle 63.43° \text{ A}$$

$$R + j\,4\,L = \frac{12\angle 0°}{1.342\angle -63.43} = 8.94\angle 63.43 = 4 + j8 \quad \Rightarrow \quad R = 4\ \Omega \text{ and } L = 2\ \text{H}$$

P11.5-3



Let

$$\mathbf{Z}_p = \frac{8(j8)}{8+j8} = \frac{j8}{1+j} \times \frac{1-j}{1-j} = \frac{8+j8}{2} = 4+j4 \ \text{V}$$

Next

$$\mathbf{I} = \frac{12\angle 0°}{4+\mathbf{Z}_p} = \frac{12\angle 0°}{4+(8+j8)} = 1.342\angle -26.6° \ \text{A}$$

Finally

$$\mathbf{S} = \frac{(12\angle 0°)(1.342\angle -26.6°)^*}{2} = 7.2 + j3.6 \ \text{VA}$$

P11.8-1

$$\mathbf{Z}_t = 4000 \parallel -j2000 = 800 - j1600 \ \ \Omega$$

$$\mathbf{Z}_L = \mathbf{Z}_t^* = 800 + j1600 \ \ \Omega$$

$$R + j1000L = 800 + j1600 \Rightarrow \begin{cases} R = 800 \ \Omega \\ L = 1.6 \text{ H} \end{cases}$$

P11.8-2

$$\mathbf{Z}_t = 25,000 \parallel -j50,000 \ = \ 20,000 - j10,000 \ \ \Omega$$

$$\mathbf{Z}_L = \mathbf{Z}_t^* = 20,000 + j10,000 \ \ \Omega$$

$$R + j\omega L = 20,000 + j10,000 \Rightarrow \begin{cases} R = 20 \text{ k}\Omega \\ 100L = 10,000 \\ L = 100 \text{ H} \end{cases}$$

After selecting these values of R and L,

$$|\mathbf{I}| = 1.4 \text{ mA} \ \text{ and } \ P_{\max} = \left(\frac{0.14 \times 10^{-2}}{\sqrt{2}}\right)^2 \left(20 \times 10^3\right) = 19.5 \text{ mW}$$

Since $P_{\max} > 12$ mW , yes, we can deliver 12 mW to the load.

P11.8-3

$$\mathbf{Z}_t = 800 + j1600 \ \Omega \ \text{ and } \ \mathbf{Z}_L = \frac{R\left(\dfrac{-j}{\omega C}\right)}{R - \dfrac{j}{\omega C}} = \frac{R - j\omega R^2 C}{1 + (\omega RC)^2}$$

$$\mathbf{Z}_L = \mathbf{Z}_t^* \quad \Rightarrow \quad \frac{R\left(\dfrac{-j}{\omega C}\right)}{R - \dfrac{j}{\omega C}} = \frac{R - j\omega R^2 C}{1 + (\omega RC)^2} = \ 800 - j1600 \ \Omega$$

Equating the real parts gives

$$800 = \frac{R}{1 + (\omega RC)^2} = \frac{4000}{1 + [(5000)(4000)C]^2} \quad \Rightarrow \quad C = 0.1 \ \mu\text{F}$$