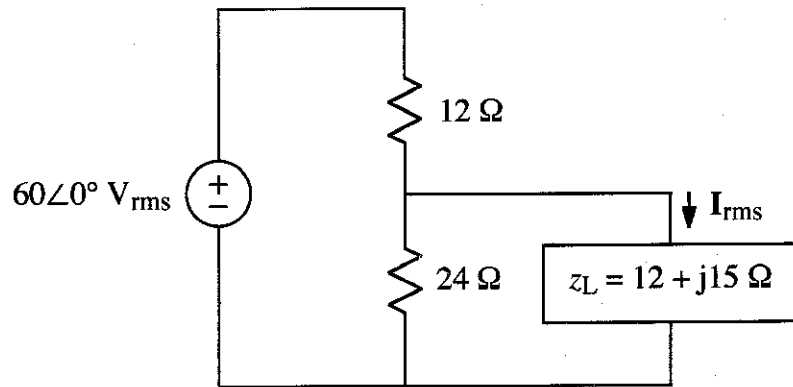
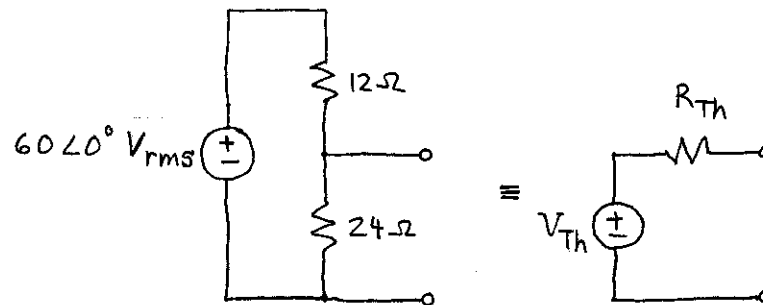


EX:

- Calculate the value of rms current, I_{rms} , flowing through z_L .
- Calculate the complex power, S , for z_L . Include appropriate units.

Sol'n: a) One approach is to use a Thevenin equivalent of the V-src, $12\ \Omega$, and $24\ \Omega$.



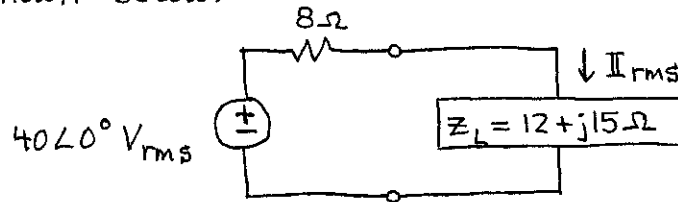
V_{Th} = open-circuit output voltage of original circuit

$$\begin{aligned}
 &= 60\angle 0^\circ V_{rms} \cdot \frac{24\ \Omega}{12\ \Omega + 24\ \Omega} \quad (\text{V divider}) \\
 &= 40\angle 0^\circ V_{rms}
 \end{aligned}$$

R_{Th} = R seen looking into circuit with V-src turned off, (i.e. $60\angle 0^\circ V_{rms}$ becomes wire).

$$R_{Th} = 24\Omega \parallel 12\Omega = 12\Omega \cdot 2 \parallel 1 = 12\Omega \cdot \frac{2}{3} = 8\Omega$$

Using the Thevenin equivalent, our circuit is shown below.



From Ohm's law, we find I_{rms} :

$$I_{rms} = \frac{40\angle 0^\circ V_{rms}}{8\Omega + Z_L} = \frac{40\angle 0^\circ V_{rms}}{8 + 12 + j15\Omega}$$

$$= \frac{40\angle 0^\circ V_{rms}}{20 + j15\Omega}$$

$$I_{rms} = \frac{40\angle 0^\circ V_{rms}}{25\angle 36.9^\circ \Omega}$$

Note: $25 = \sqrt{20^2 + 15^2}$, $36.9^\circ = \tan^{-1} \frac{15}{20}$

$$I_{rms} = \frac{40}{25} \angle (0^\circ - 36.9^\circ) A_{rms}$$

$$I_{rms} = 1.6 \angle -36.9^\circ A_{rms}$$

$$\text{or } 1.28 - j0.96 A_{rms}$$

$$b) \quad S = |I_{rms}|^2 Z_L$$

Note: Since we're using I_{rms} , we do not divide by 2.

$$S = 1.6^2 \cdot (12 + j15) \text{ VA}$$

Note: We use VA as the units to indicate that the value represents S (rather than P or Q).

$$S = 30.72 + j38.4 \text{ VA}$$

$$\text{or } 49.2 \angle 51.3^\circ \text{ VA}$$