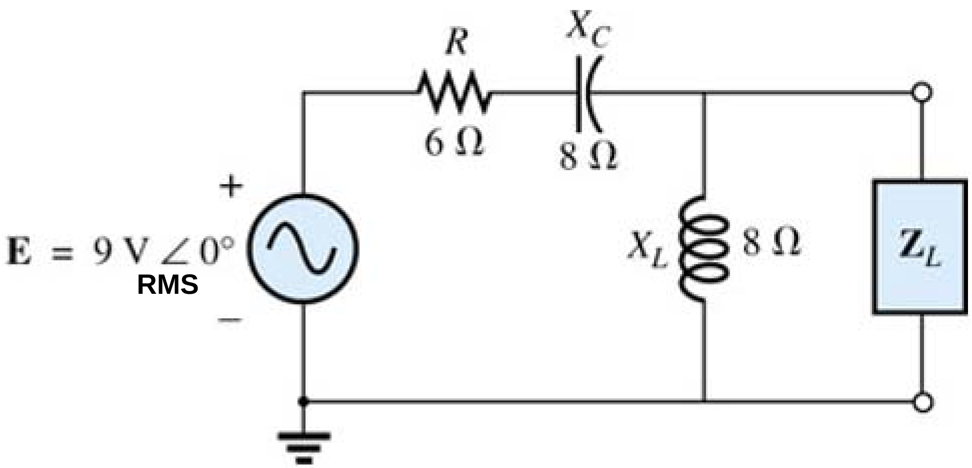
In Class Problem



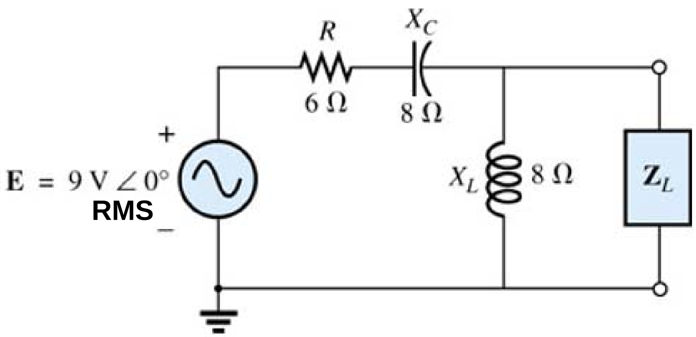
Find:

- The Thevenin equivalent circuit for the network external to $\mathbf{Z}_L$
- The value of $\mathbf{Z}_L$ for maximum power transfer
- The average power dissipated by this load

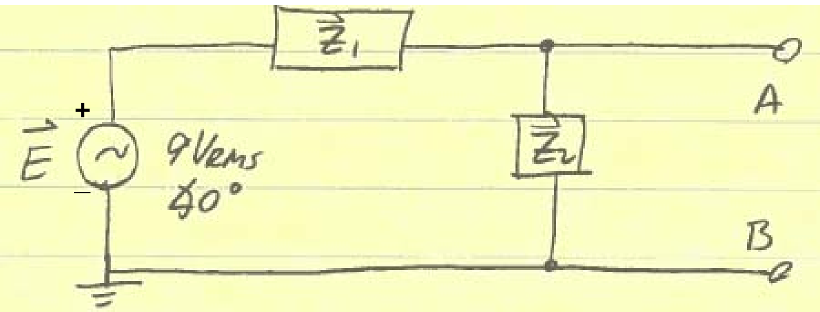
Approach:

- Standard Thevenin approach
- Set $\mathbf{Z}_L = \mathbf{Z}_{TH}^*$
- $P_{ZL} = V_{RMS}\, I_{RMS} \cos(\Theta)$

In Class Problem



Redrawing and finding **V_{TH}**, **Z_{TH}**:



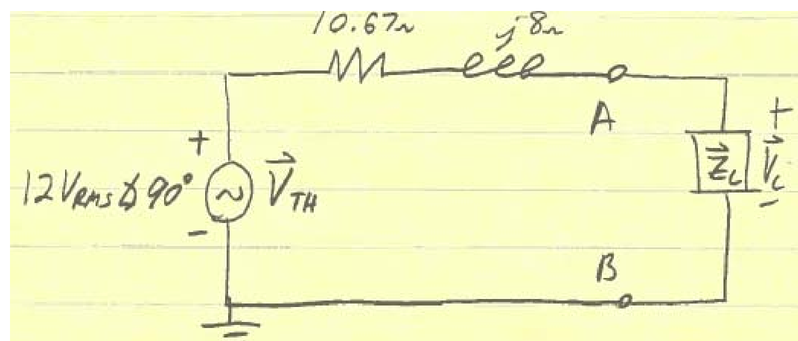
$$Z_1 = (6 - j8)\,\Omega$$
$$Z_2 = j8\,\Omega$$

$$\vec{V}_{TH} = \vec{E}\left(\frac{\vec{Z}_2}{\vec{Z}_1 + \vec{Z}_2}\right) = 9\,V_{RMS}\angle 0^\circ \left(\frac{j8\,\Omega}{6\,\Omega}\right)$$

$$\underline{\underline{V_{TH} = 12\,V_{RMS}\angle 90^\circ}}$$

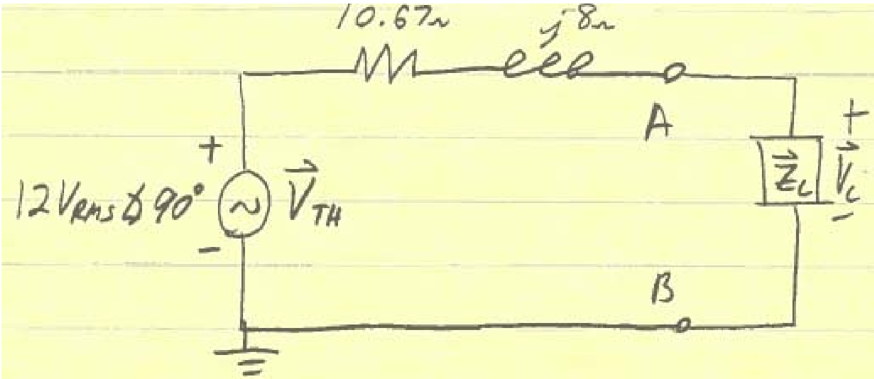
$$\vec{Z}_{TH} = \vec{Z}_1 // \vec{Z}_2$$
$$= (6 - j8)\,\Omega \;//\; (j8\,\Omega)$$
$$\underline{\underline{Z_{TH} = (10.67 + j8)\,\Omega}}$$

Therefore, we now have:



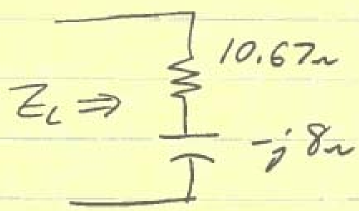
NP

In Class Problem



For MAX PWR XFER

$\vec{Z}_L = (10.67\Omega - j8\Omega)$



Finding **VL**, **IL** and **PL**:

$$\vec{V}_L = \vec{V}_{TH}\left(\frac{\vec{Z}_L}{\vec{Z}_L + \vec{Z}_{TH}}\right)$$

$$= 12V_{RMS}\angle 90^\circ \left(\frac{10.67 - j8}{[10.67 - j8] + [10.67 + j8]}\right)$$

$$\vec{V}_L = 7.5\,V_{RMS}\angle 53.14^\circ$$

$$\vec{I}_L = \frac{\vec{V}_L}{Z_L} = \frac{7.5\,V_{RMS}\angle 53.14^\circ}{(10.67 - j8)\Omega}$$

$$= \underline{562.3\,mA_{RMS}\angle 90^\circ}$$

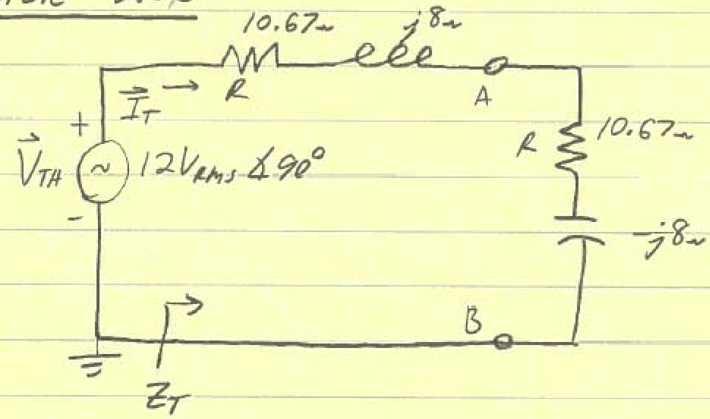
$$P_L = (V_{L_{RMS}})(I_{L_{RMS}})\,\cos(\theta)$$

$$= (7.5\,V_{RMS})(0.562\,A_{RMS})\,\cos(|53.14^\circ - 90^\circ|)$$

$$P_L = (4.217)(0.8) = \boxed{3.37\,W}$$

In Class Problem

ANOTHER LOOK



$$\vec{Z}_T = 2R = \underline{21.34\,\Omega}$$

$$\vec{I}_T = \frac{\vec{V}_{TH}}{\vec{Z}_T} = \frac{12V_{RMS}\angle 90°}{21.34\,\Omega}$$

$$= \underline{0.562A_{RMS}\angle 90°}$$

$$P_T = (V_{TH_{RMS}})(I_{T_{RMS}})\cos(\theta)$$

$$= (12V)(0.562A)\cos(0)$$

$$= \underline{6.74\,W}$$

$$\therefore P_L = \frac{1}{2}P_T = \boxed{3.37W}$$