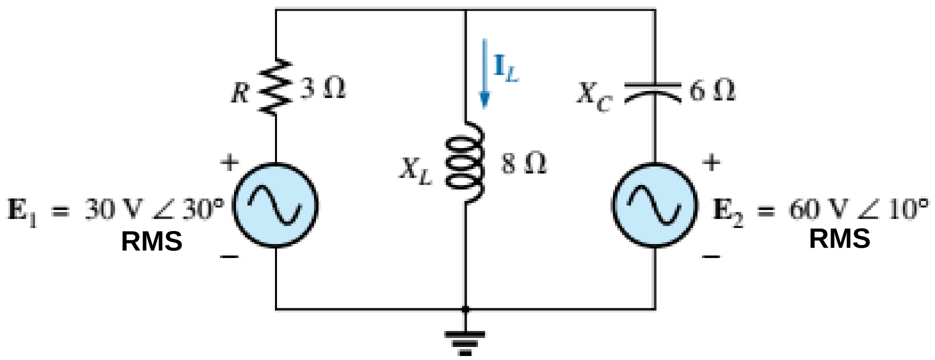
In Class Problem



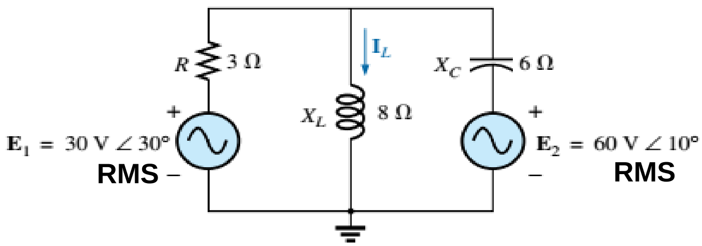
Find:

- The current through the inductor, **I_L**

Approach:

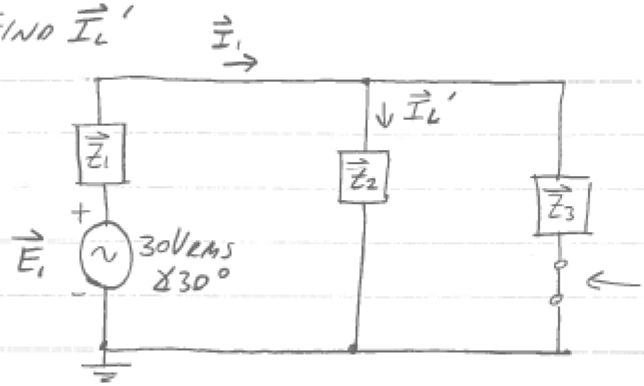
- Use superposition
- 2 Sources, 2 Circuits to **REDRAW and ANALYZE**

In Class Problem



① REDRAW THE NETWORK W/ THE FIRST SOURCE ENERGIZED + THE SECOND SOURCE RELAXED

– FIND $\vec{I}_L{}'$



$\vec{Z}_1 = 3\Omega$

$\vec{Z}_2 = j8\Omega$

$\vec{Z}_3 = -j6\Omega$

← S/C FORMERLY KNOWN AS $\vec{E}_2$

Looking in from source **E1**:

$\vec{Z}_T = \vec{Z}_2 // \vec{Z}_3 + \vec{Z}_1$

$= j8\Omega // -j6\Omega + 3\Omega$

$\underline{\vec{Z}_T = (3 - j24)\,\Omega}$

$\vec{I}_1 = \dfrac{\vec{E}}{\vec{Z}_T} = \dfrac{30 V_{RMS} \angle 30^\circ}{(3 - j24)\,\Omega} = \underline{1.24 A_{RMS} \angle 112.9^\circ}$

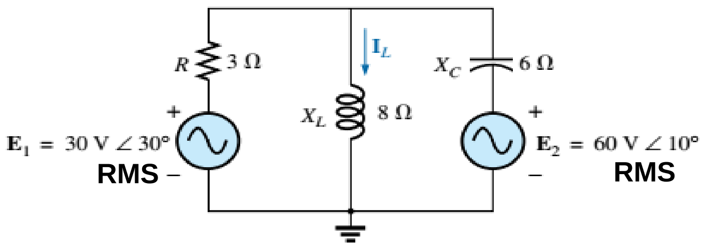
Current Divider (special case)

$\vec{I}_L{}' = \vec{I}_1 \left(\dfrac{\vec{Z}_3}{\vec{Z}_3 + \vec{Z}_2} \right)$

$= 1.24 A_{RMS} \angle 112.9^\circ \left(\dfrac{-j6\Omega}{+j2\Omega} \right)$

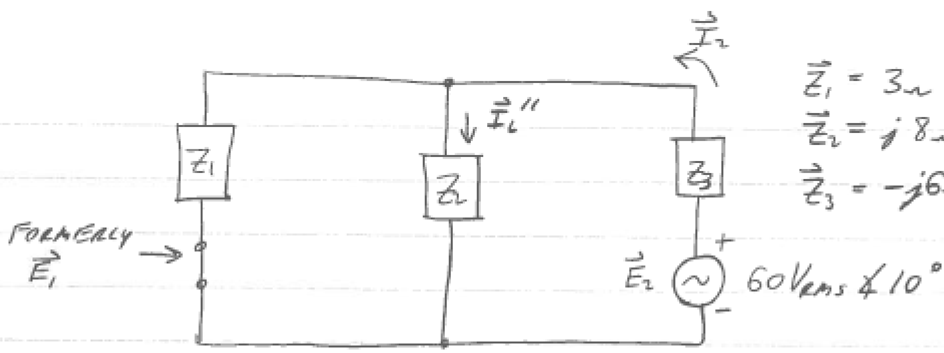
$\underline{\underline{I_L{}' = 3.72 A_{RMS} \angle -67.13^\circ}}$

In Class Problem



(2) REDRAW THE NETWORK W/ THE FIRST SOURCE RELAXED + THE SECOND SOURCE ENERGIZED

– FIND I_L''



$\vec{Z}_1 = 3\Omega$

$\vec{Z}_2 = j8\Omega$

$\vec{Z}_3 = -j6\Omega$

Looking in from source **E2**:

$$\vec{Z}_T = \vec{Z}_1 // \vec{Z}_2 + \vec{Z}_3$$

$$= 3\Omega // j8\Omega + (-j6\Omega)$$

$$\underline{\vec{Z}_T = (2.63 + j5.014)\Omega}$$

(2.63 – j 5.014) Ohms

$$\vec{I}_2 = \vec{E}_2 / \vec{Z}_T = \left(\frac{60 V_{rms} \angle 10°}{2.63 - j5.014\Omega} \right)$$

$$= \underline{10.6 A_{rms} \angle 72.32°}$$

Current Divider (special case)

$$\vec{I}_L'' = \vec{I}_2 \left(\frac{\vec{Z}_1}{\vec{Z}_1 + \vec{Z}_2} \right)$$

$$= 10.6 A_{rms} \angle 72.32° \left(\frac{3\Omega}{(3 + j8\Omega)} \right)$$

$$\underline{\vec{I}_L'' = 3.72 A_{rms} \angle 2.88°}$$

Algebraically summing the currents:

$$\vec{I}_L = \vec{I}_L' + \vec{I}_L''$$

$$\boxed{\vec{I}_L = 6.1 A_{rms} \angle -32.1°}$$