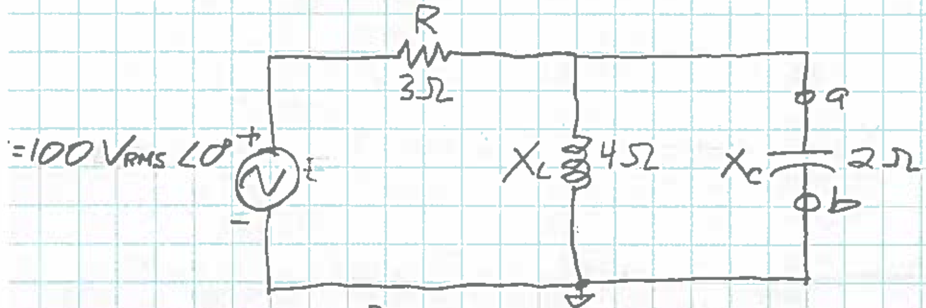
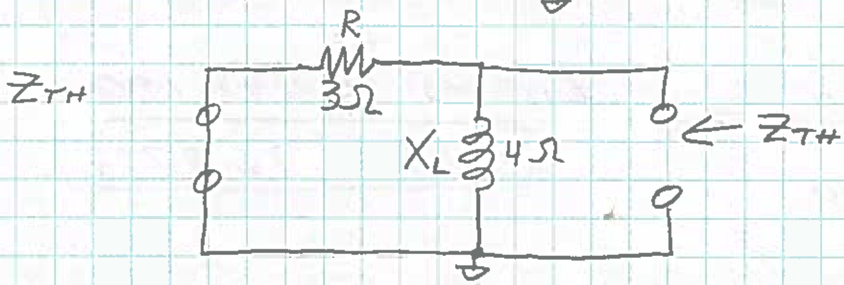
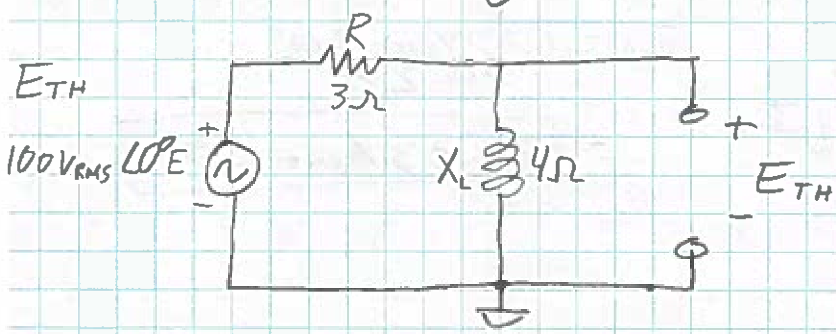
19-15 Find the Thevenin equivalent circuit for the portion of the network below external to the elements between points a and b





$Z_{TH} = 3\Omega\angle 0 \,//\, 4\Omega\angle 90$

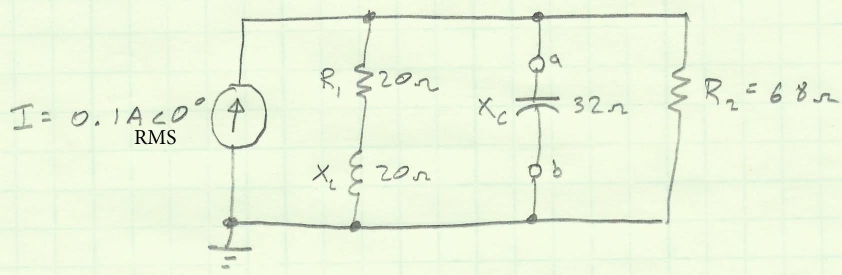
$\boxed{= 2.4\Omega\angle 36.87}$



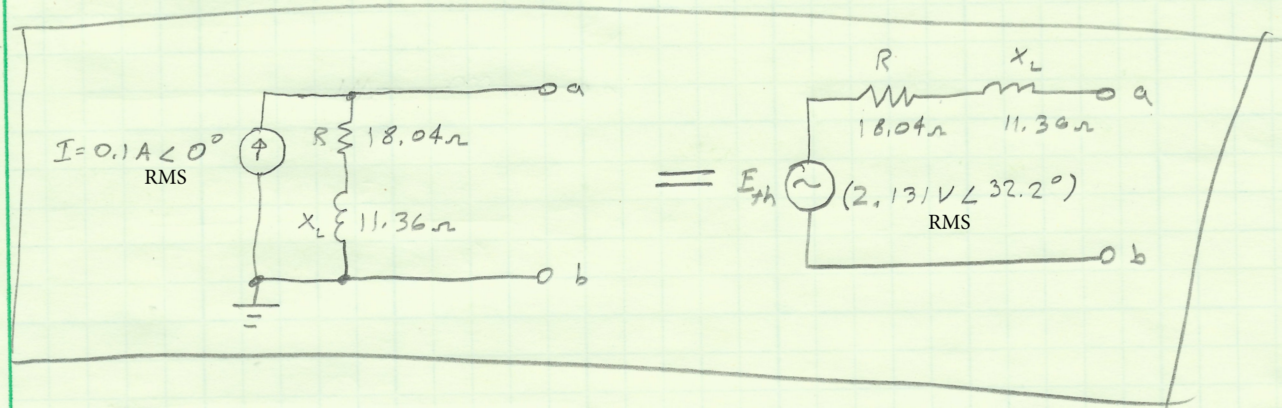
$E_{TH} = 100V_{RMS}\angle 0^\circ\left(\frac{4\Omega\angle 90}{3+j4}\right)$

$\boxed{= 80V_{RMS}\angle 36.87}$

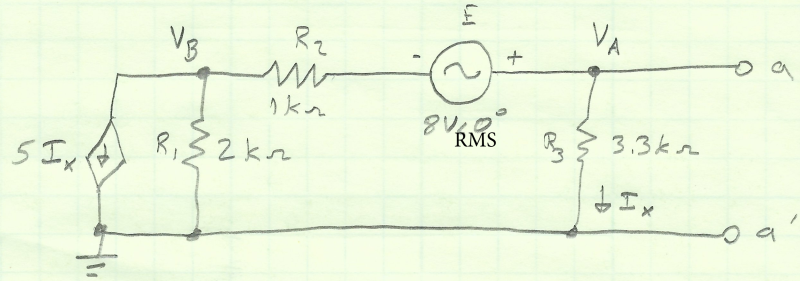
17 Find the Thévenin equivalent circuit for the portion of the network below external to the points a, b:



$$Z_T = R_2 \parallel (R_1 + X_L) = 68Ω \parallel (20Ω + j20Ω) = (18.04 + j11.36)Ω$$



(33) Find the Thévenin equivalent circuit equivalent to the network external to the points a-a':



$$I_x = \frac{V_A}{R_3}$$

Nodal

$$0 = 5\frac{V_A}{R_3} + \frac{V_B}{R_1} + \frac{V_B + E - V_A}{R_2}$$

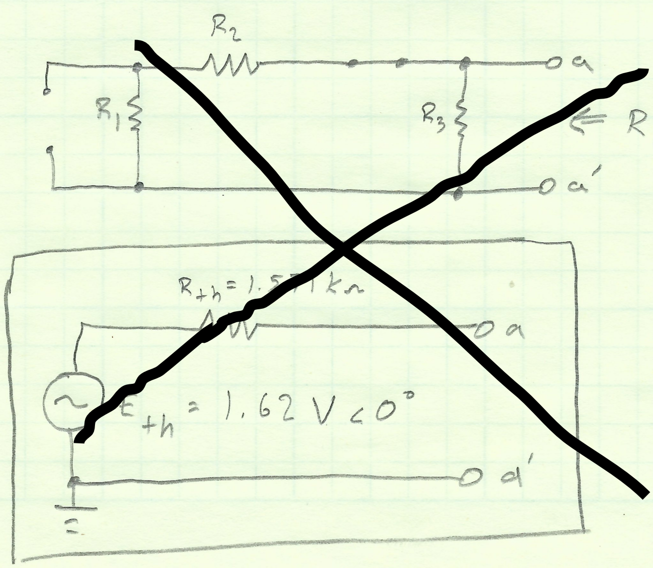
(1) $$-\frac{E}{R_2} = V_A\left[\frac{5}{R_3} - \frac{1}{R_2}\right] + V_B\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$$

$$\frac{V_B + E - V_A}{R_2} = \frac{V_A}{R_3}$$

(2) $$\frac{E}{R_2} = V_A\left[\frac{1}{R_3} + \frac{1}{R_2}\right] + V_B\left[-\frac{1}{R_2}\right]$$

$V_A = 1.62V\angle 0°_{RMS} = V_a$ $V_{a'} = 0V$

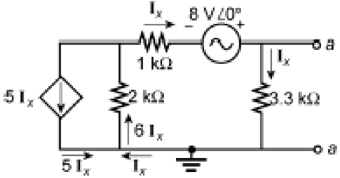
$V_B = -5.89V\angle 0°_{RMS}$



$\cancel{R_{th} = R_3 \parallel (R_1 + R_2) = 1.571k\Omega\angle 0°}$

Must use an alternate method to find Zth since the dependent source is controlled in-network. Use a test source or the following:

33. $\mathbf{E}_{oc}$:
($\mathbf{E}_{Th}$)

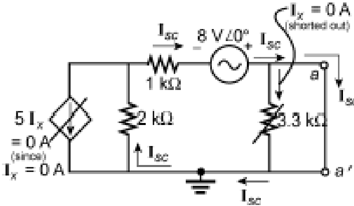


$$\text{KVL: } -6\,\mathbf{I}_x(2\text{ k}\Omega) - \mathbf{I}_x(1\text{ k}\Omega) + 8\text{ V}\angle 0^\circ - \mathbf{I}_x(3.3\text{ k}\Omega) = 0$$

$$\mathbf{I}_x = \frac{8\text{ V}\angle 0^\circ}{16.3\text{ k}\Omega} = 0.491\text{ mA}\angle 0^\circ$$

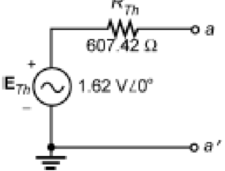
$$\mathbf{E}_{oc} = \mathbf{E}_{Th} = \mathbf{I}_x(3.3\text{ k}\Omega) = \mathbf{1.62\text{ V}\angle 0^\circ}$$

$\mathbf{I}_{sc}$:

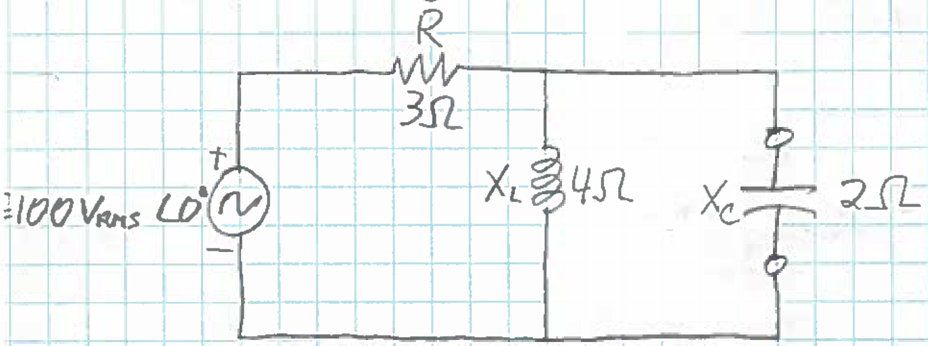


$$\mathbf{I}_{sc} = \frac{8\text{ V}}{3\text{ k}\Omega} = 2.667\text{ mA} \angle 0°$$

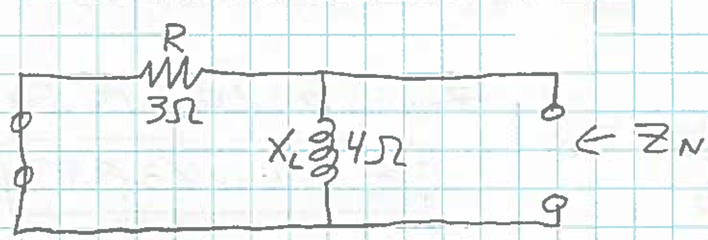
$$\mathbf{Z}_{Th} = \frac{\mathbf{E}_{oc}}{\mathbf{I}_{sc}} = \frac{1.62\text{ V} \angle 0°}{2.667\text{ mA} \angle 0°} = 607.42\ \Omega \angle 0°$$



19-34 Find the Norton equivalent circuit for the network external to the elements a and b.



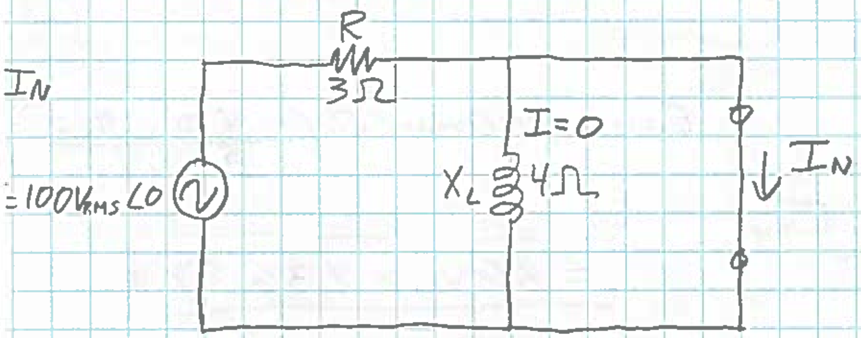
Z_N



$$Z_N = 3\Omega\angle 0 \,//\, 4\Omega\angle 90$$

$$\boxed{= 24\Omega \angle 36.87°}$$

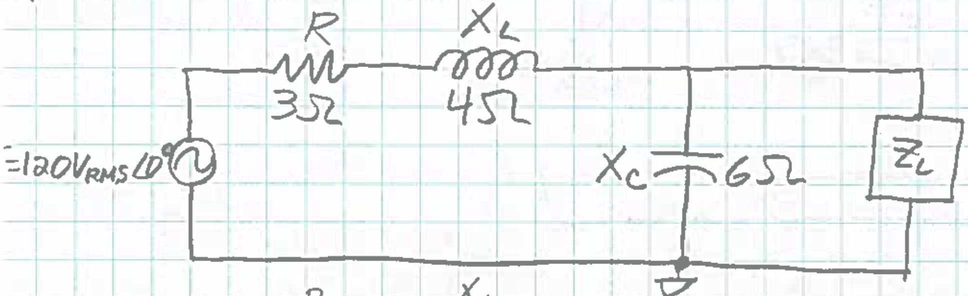
I_N



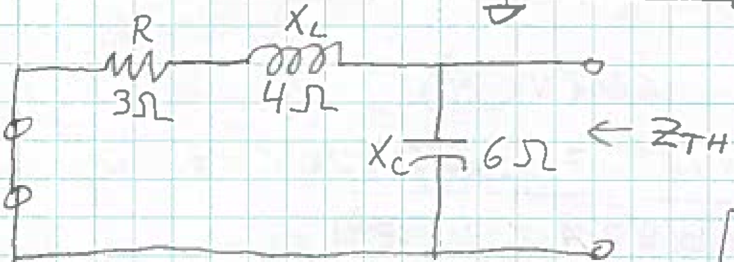
$$I_N = \frac{100 V_{RMS} \angle 0°}{3\Omega \angle 0}$$

$$= \boxed{33.33 A_{RMS} \angle 0°}$$

19-48 Find the load impedance Z_L for the network for maximum power to the load, and find the maximum power to the load.



Z_{TH}

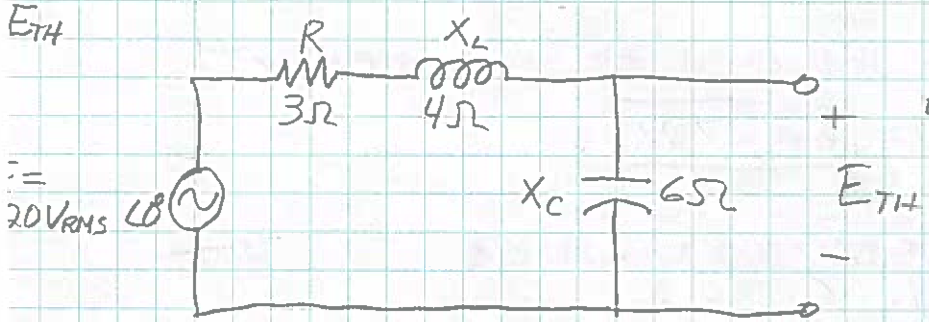


$$Z_{TH} = (3\Omega\angle 0 + 4\Omega\angle 90) // 6\Omega\angle -90$$

$$= 8.32\Omega\angle -3.18$$

$$\boxed{Z_L = 8.32\angle 3.18}$$

E_{TH}



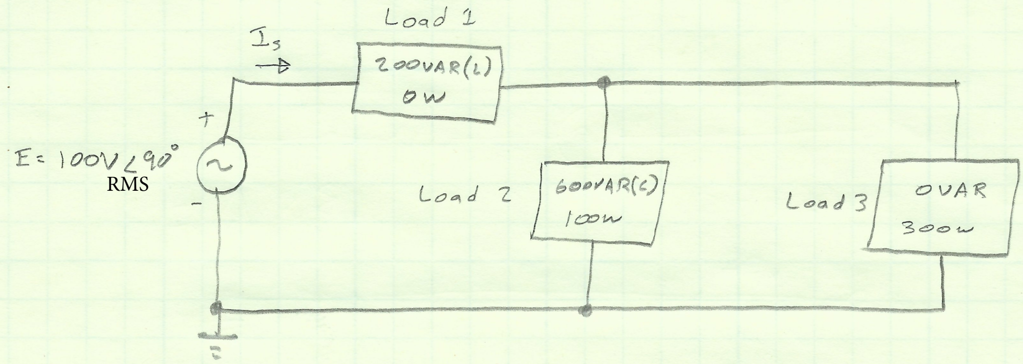
$$E_{TH} = 120V\angle 0° \left(\frac{6\Omega\angle -90}{3 + j4 - j6} \right)$$

$$= 199.7\,V_{RMS}\angle -56.31$$

$$P_{max} = \frac{E_{TH}^2}{4R_{TH}} = \frac{(199.7V)^2}{4 \cdot 8.32\Omega} = \boxed{1198\,W}$$

$$=$$

④ For the system below:



a) Determine total watts, total VAR, total VA, and F_p

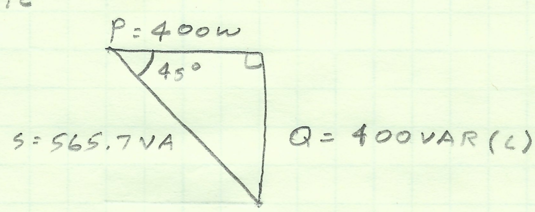
$$P_T = 100W + 300W = \boxed{400W}$$

$$Q_T = 200VAR(L) + 600VAR(C) = \boxed{400VAR(C)}$$

$$S_T = \sqrt{P_T^2 + Q_T^2} = \boxed{565.7\ VA}$$

$$F_p = \frac{P_T}{S_T} = \frac{400W}{565.7\ VA} = \boxed{0.707\ (\text{leading})} \longrightarrow 45^\circ$$

b) Draw the power triangle



c) Find the current I_s

$$P_T = E \cdot I_s \cdot F_p \qquad |I_s| = \frac{P_T}{E \cdot F_p} = \frac{400\ W}{(100V)(0.707)} = 5.66A_{RMS}$$

$$\theta_I = \theta_E + \cos^{-1}(F_p) = 90^\circ + 45^\circ = 135^\circ$$

$$\boxed{I_s = (5.66A_{RMS}\angle 135^\circ)}$$