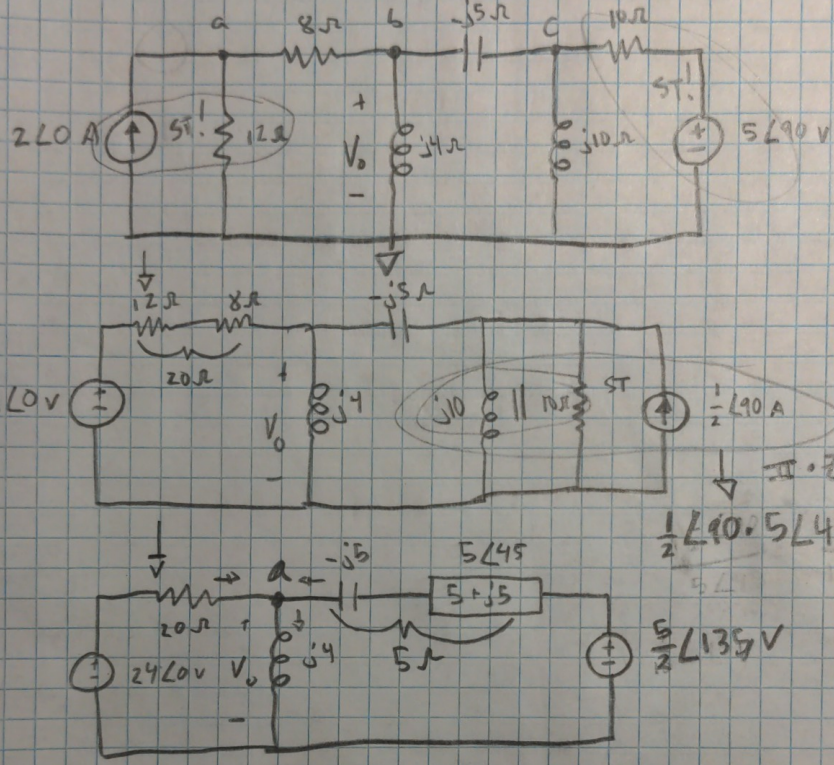
Chris Hunt HW7 ENGR 202

7.11 Use source transformation to find V_o



$\frac{1}{2}\angle 90 \cdot 5\angle 45 = \frac{5}{2}\angle 135$ V

$\frac{5}{2}\angle 135$ V

@ a) $\left(\frac{V_a}{j4} = \frac{24\angle 0 - V_a}{20\Omega} + \frac{\frac{5}{2}\angle 135 - V_a}{5\Omega}\right) 1\Omega$

$V_a(-j.25) = \frac{24}{20}\angle 0 - .05V_a + \frac{1}{2}\angle 135 - .2V_a$

$+ .25V_a$

$(.25 - j.25)V_a = \frac{24}{20}\angle 0 + \frac{1}{2}\angle 135$

$V_a = \frac{\frac{24}{20}\angle 0 + \frac{1}{2}\angle 135}{(.25 - j.25)} = .9858 + j2.4$

$V_o = 2.59\angle 67.67^\circ$ V

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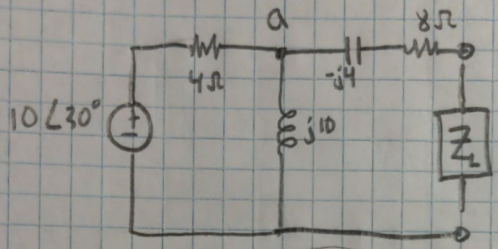
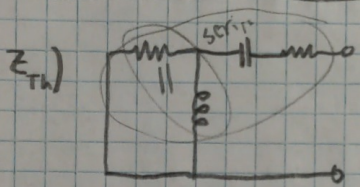
7.2) Determine the Thevenin equivalent



V_{Th}) $V_{Th} = 10\angle 30\left(\frac{j10}{4+j10}\right)$

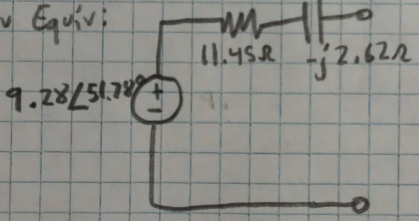
$V_{Th} = 5.74 + j7.3$ V



Z_{Th}) $Z_{Th} = 8 - j4 + \left(\frac{4 \cdot j10}{4+j10}\right)$

$Z_{Th} = 11.45 - j2.62\ \Omega$

Thev Equiv:



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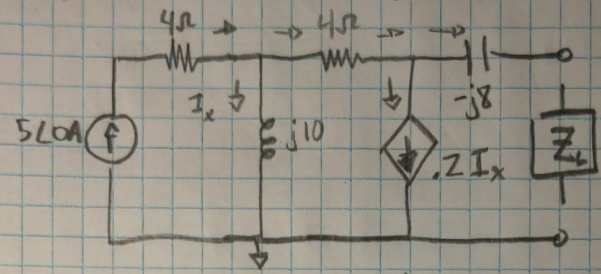
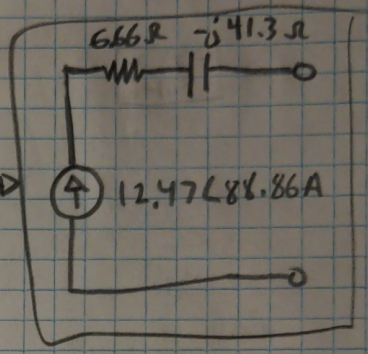
7.3) Find the Norton Equivalent





I_N) @a) $\left(5\angle 0A = \frac{V_a - V_b}{4\Omega} + \frac{V_a}{j10}\right) 1\Omega$

$5\angle 0 = .25V_a - .25V_b - j.1V_a \rightarrow (.25 - j.1)V_a - .25V_b = 5\angle 0V$

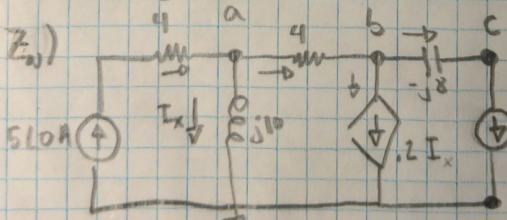
@b) $\left(\frac{V_a - V_b}{4\Omega} = .2\left(\frac{V_a}{j10}\right) + \frac{V_b}{-j8}\right) 1\Omega$

$.25V_a - .25V_b = -j.02V_a + j.125V_b \rightarrow (.25 + j.02)V_a + (-.25 - j.25)V_b = 0$

$$\begin{bmatrix} .25 - j.1 & -.25 \\ .25 + j.02 & -.25 - j.25 \end{bmatrix} \begin{bmatrix} V_a \\ V_b \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \end{bmatrix} \xrightarrow{Ax=b} \begin{bmatrix} V_a \\ V_b \end{bmatrix} = \begin{bmatrix} 103.96 + j39.60 \\ 99.8 - j1.98 \end{bmatrix} V$$

$I_N = \frac{V_b}{-j8} = .2475 + j12.475 = \boxed{12.47\angle 88.86° A = I_N}$

Z_N)



$Z_N = \frac{-V_c}{I_s}$

$\boxed{Z_N = 6.66 - j41.3\ \Omega}$

@a) $5\angle 0 = \frac{V_a - V_b}{4} + \frac{V_a}{j10} \rightarrow (.25 - j.1)V_a - .25V_b = 5\angle 0V$

@b) $\left(\frac{V_a - V_b}{4\Omega} = .2\left(\frac{V_a}{j10}\right) + 1\angle 0A\right) 1\Omega \rightarrow (.25 + j.02)V_a - .25V_b = 1$

$$\begin{bmatrix} .25 - j.1 & -.25 \\ .25 + j.02 & -.25 \end{bmatrix} \begin{bmatrix} V_a \\ V_b \end{bmatrix} = \begin{bmatrix} 5 \\ 1 \end{bmatrix} \rightarrow \begin{bmatrix} V_a \\ V_b \end{bmatrix} = \begin{bmatrix} j33.3 \\ -6.66 + j33.3 \end{bmatrix}$$

$V_c = V_b - (-j8 \cdot 1\angle 0)$

$V_c = -6.66 + j41.3$