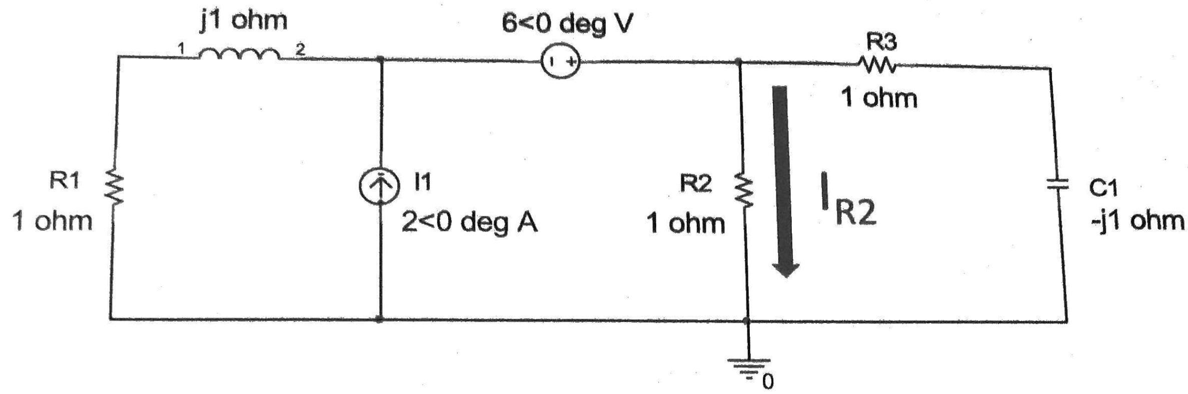
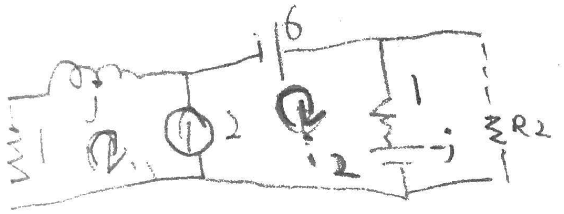
1) Unit 1 and Unit 3



1.1 Find the current, I_{R2}, ***in polar/phasor form*** using the Thevenin equivalent circuit method. ***Include your thevenin circuit schematic.***



$i_2 - i_1 = 2$

$i_1 + ji_1 - 6 + i_2 - i_2 j = 0$

$i_1 + ji_1 + 2 + i_1 - j(2+i_1) = 6$

$-ji_1 + i_1 - j2 - ji_1 = 4$

$2i_1 = 4 + j2$

$i_1 = 2 + j \quad i_2 = i_1 + 2 = 4 + j$

$V_{TH} = i_2(1-j)$

$V_{TH} = (4+j)(1-j) = 4 - 4j + j - j^2$

$5 - 3j$

I_{short}

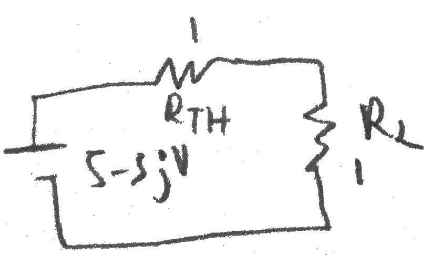
$i_2 - i_1 = 2$

$i_1 + i_1 j - 6 = 0 \quad i_1(1+j) = 6$

$i_1 = 3 - 3j \quad i_2 = 5 - 3j$

$R_{TH} = \frac{V_{TH}}{I_N} = \frac{5-3j}{5-3j} = 1$

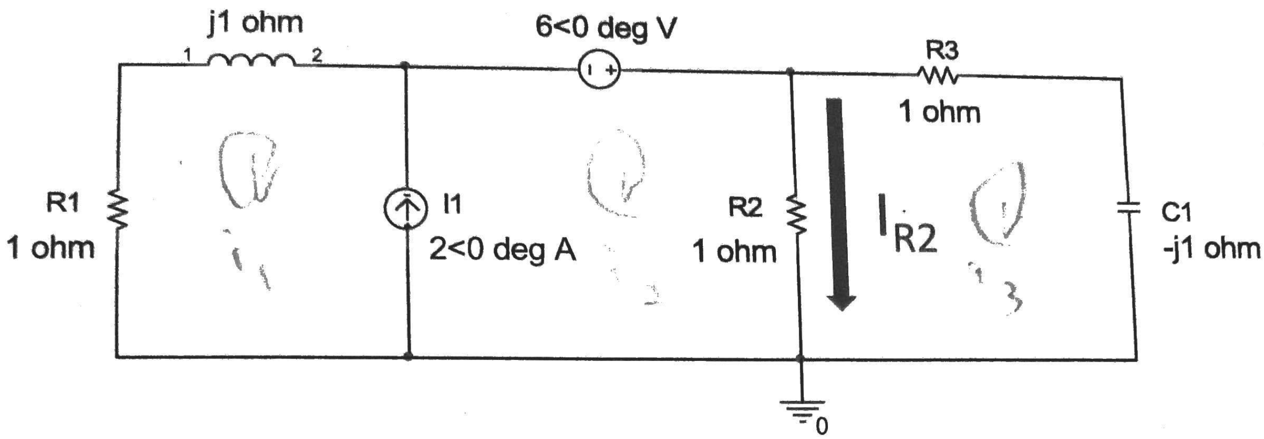
Th:



$I_{R_2} = \frac{5-3j}{2} = 2.5 - 1.5j$

$I_{R2} = 2.92 \angle 329.04°$

2) Unit 1 and Unit 3 (again)



2.1 Using mesh analysis, set up the matrices and symbolic equation (using loop currents) necessary to find, I_{R2}.

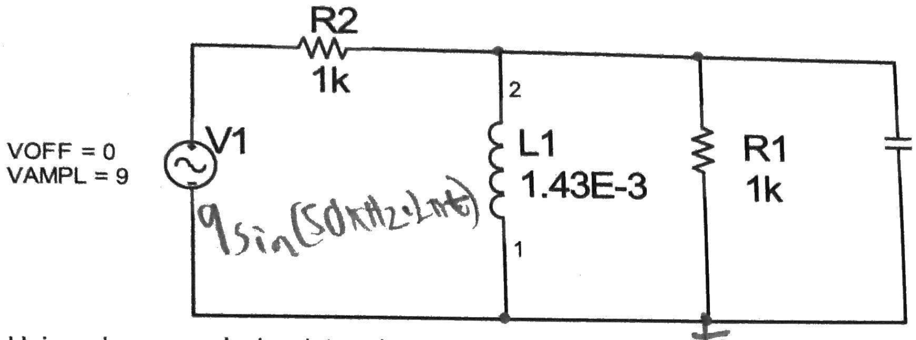
$$i_1 + j i_1 - 6 + i_2 - i_3 = 0$$
$$i_2 - i_1 = 2$$
$$i_3 - i_2 + i_3 - j i_3 = 0$$

$$\begin{array}{ccc} i_1 & i_2 & i_3 \end{array}$$
$$\begin{bmatrix} 1+j & 1 & -1 \\ -1 & 1 & 0 \\ 0 & -1 & 2-j \end{bmatrix} \begin{bmatrix} 6 \\ 2 \\ 0 \end{bmatrix}$$

$$i_1 = 2.5 - j$$
$$i_2 = 4.5 - j$$
$$i_3 = 2 + \frac{1}{2} j$$

$$i_2 - i_3 = I_{R2}$$
$$4.5 - j - 2 - \frac{1}{2} j =$$
$$\boxed{2.5 - 1.5 j = I_{R_2}}$$
$$\Downarrow$$
$$\boxed{I_{R_2} = 2.92 \angle 329.04^\circ}$$

3) Phasors- RLC



3.1: Using phasor analysis, determine the voltage across the capacitor when the source is 50kHz.

3.2 Using phasor analysis, determine the votlage across the capacitor when the source is 50 Hz. (reminder: -90degrees is -j) ***Partial answer check: ZRLC = 0.45j***

3.3. Using phasor analysis, determine the voltage across the capacitor when the source is 50MHz (50E6Hz).(reminder: 90degrees is j)

3.1: $L_1 = j2\pi\cdot 50\times10^3\cdot 1.43\times10^{-3} = 449.25j$ Bottom $= \left(\frac{1}{449.25j} + \frac{-1}{449.97j} + \frac{1}{1000}\right)^{-1}$

$C_1 = \frac{1}{j2\pi\cdot 50\times10^3\cdot 7.074\times10^{-9}} = -449.97j$ $= 1000 + 3.56j$

$V_C = \frac{9(1000+3.56j)}{1000+1000+3.56j} = 4.36 - 0.76j = \boxed{4.43\angle 350.11^\circ}$

3.2: $L_1 = .449j$

Bottom $= \left(\frac{1}{.449j} + \frac{1}{1000} - \frac{1}{449971.56j}\right)^{-1} = .449j + .0002$

$C_1 = -449971.57j$

$V_C = \frac{(9)(.0002 + .449j)}{(1000 + .0002 + .449j)} = 3.61\times10^{-6} + .004j = \boxed{.004\angle 90^\circ}$

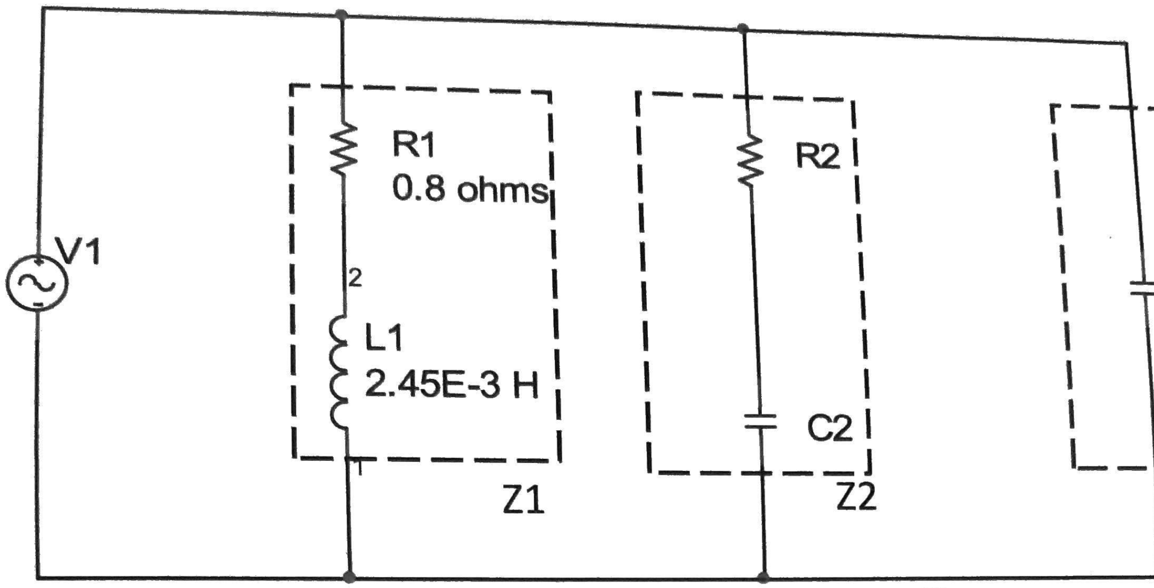
3.3: $L_1 = 449247.75j$ Bottom $- \left(\frac{1}{449247.75j} + \frac{1}{1000} + \frac{-1}{.450j}\right)^{-1} = .0002 - .45j$

$C_1 = -.450j$

$V_C = \frac{9(.0002 + (-.45)j)}{1000 + .0002 + (-.45)j} =$

$3.62\times10^{-6} - .004j = \boxed{.004\angle 270^\circ}$

4) Complex Power



The above circuit has the following parameters:

The frequency of the source is 120 Hz
The power factor for the source is 0.65 leading
The magnitude of the power source is 150 kVA
Z1: IRMS is 300 A
Z2: power factor 0.882

$S_1 = I_{RMS}^2 (0.8 + 2.45E-3)$
$= 7.2\times10^4 + 1.662\times10^5 j$
P Q
$S = 1.811\times10^5 \rightarrow pf: \frac{7.2\times10^4}{1.811\times10^5} = 0.398$

Fill in the chart below. The units are provided for you and you do not need to include units in the boxes.
YES you have all the information you need. I did not leave out information for Z3.

Phase Voltage	P[W]	Q [VAR]	|S| [VAR]	pf
Load 1	72k	166.2k	181.5k	0.398
Load 2	25.5k	-13.6k	28.91k	0.882
Load 3	0	-266k	266.6k	0
Source	97.5k	-114k	150k	0.65

$P_{Z2} = P_T - P_{Z1} - P_{Z3}$
$= -72k + 9.75\times10^4$
2.55×10^4
$S = \frac{2.55\times10^4}{0.882} = 2.89\times10^4$
$Q = S_{Z2}\sin(\cos^{-1}(0.882)) = -1.362\times10^4 \rightarrow$ negative cuz cap

$P_{Z3} = 0$ no real
$Q_{Z3} = Q_T - Q_1 - Q_2$
$= -2.66\times10^5$
$S = \sqrt{P^2 + Q^2} = 2.66\times10^5$
pf: 0