HENRY CARDENAS
TOM REBOLD
ENGR 12
MAY 15, 2015

A11

1.

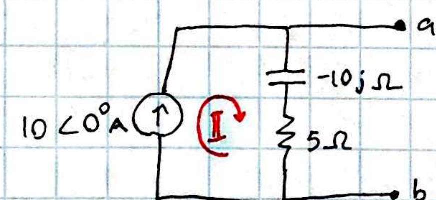
$$A = \begin{array}{cc} I_1 & I_2 \\ \end{array}$$
$$A = \begin{bmatrix} 27+16j & -(26+13j) \\ 13-14j & -(12-16j) \end{bmatrix} \qquad b = \begin{array}{c} k \\ \begin{bmatrix} 0 \\ 150 \end{bmatrix} \end{array}$$

A\b ...

$$\boxed{\begin{aligned} I_1 &= -26 - 52i \\ I_2 &= -24 - 58i \end{aligned}}$$

(A)
(A)

2. THEVENIN PHASOR



$R_{TH} = 5 - 10j = 5\sqrt{5}\angle -63.43$

$\mathbb{I} = 10\angle 0 = 10$

$V_{ab} = \mathbb{I} R_{TH} = 10(5\sqrt{5}\angle -63.43) = 50\sqrt{5}\angle -63.435$

$\boxed{V_{ab} = 111.803\angle -63.435°}$ (V)

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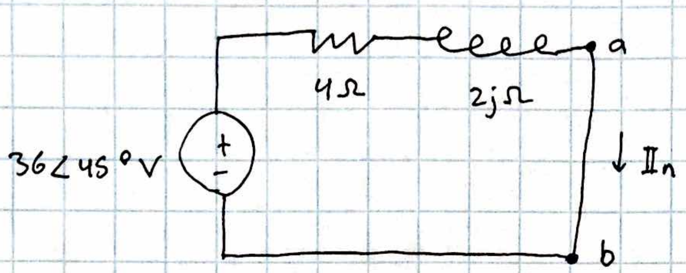
2) NORTON PHASOR

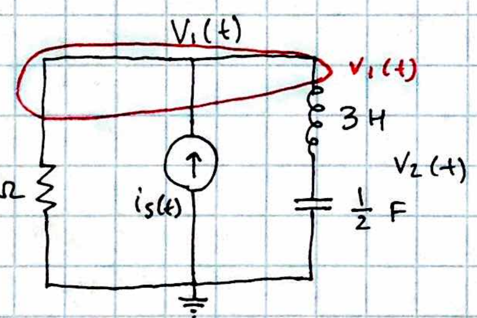


$$\mathbb{I}_n = \frac{\mathbb{V}}{R_T} \qquad \mathbb{V} = 36\angle 45°$$

$$R_T = 4 + 2j = 2\sqrt{5}\angle 26.565$$

$$\boxed{\mathbb{I}_n = 8.050\angle 18.43°} \text{ (A)}$$

3)



$$V_1(t): \quad \frac{V_1}{2} - 8\angle 40° + \frac{V_1}{5j} = 0$$

$$V_1\left(\frac{1}{2} + \frac{1}{5j}\right) = 8\angle 40°$$

$$i_s(t) = 8\cos(2t + 40°)\text{A} = 8\angle 40°$$

$$V_1\left(\frac{\sqrt{29}}{10}\angle -21.8°\right) = 8\angle 40°$$

$w = 2$

$$V_1 = \frac{8\angle 40°}{\frac{\sqrt{29}}{10}\angle -21.8}$$

$$Z_L = jwL = 6j$$

$$Z_C = \frac{1}{jwC} = \frac{1}{j} = -j$$

$$V_1 = 14.86\angle 61.80°$$

$$Z_T = 5j$$

$$\boxed{V_1(t) = 14.86\cos(2t + 61.80°)} \text{ (V)}$$

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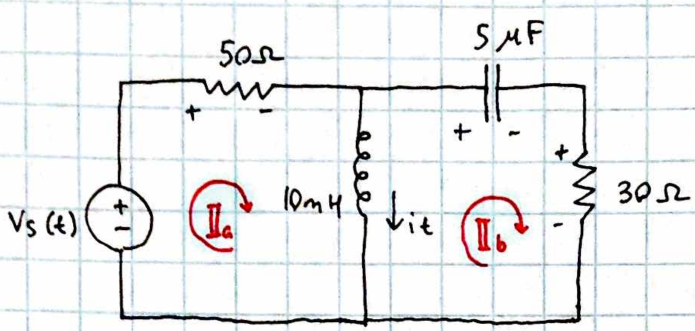
4.



$V_s(t) = 70\cos(2000\pi t + 30°)\ V$ $\quad w = 2000\pi$

$V_s(t) = 70\angle 30° = 35\sqrt{3} + 35j$

$Z_L = jwL = 20\pi j$

$Z_C = (jwC)^{-1} = -\frac{100}{\pi} j$

I_a: $-(35\sqrt{3} + 35j) + 50 I_a + (I_a - I_b)20\pi j = 0$

$(50 + 20\pi j) I_a - (20\pi j) I_b = 35\sqrt{3} + 35j$

I_b: $(I_b - I_a)20\pi j + \left(-\frac{100}{\pi} j\right) I_b + 30 I_b = 0$

$-20\pi j\, I_a + \left(30 + 20\pi j - \frac{100}{\pi} j\right) I_b = 0$

$$\begin{array}{ccc} I_a & I_b & K \\ \end{array}$$
$$\left[\begin{array}{cc|c} 50 + 20\pi j & -20\pi j & 35\sqrt{3} + 35j \\ -20\pi j & 30 + 20\pi j - \frac{100}{\pi} j & 0 \end{array}\right]$$

$I_a = 0.5252 + 0.3215j$

$I_b = 0.2240 + 0.8684j$

$i(t) = I_a - I_b = 0.312 - 0.5469j = 0.6244 \angle -61.16°$

$$\boxed{i(t) = 0.6244\cos(2000\pi t - 61.16°)\ A}$$

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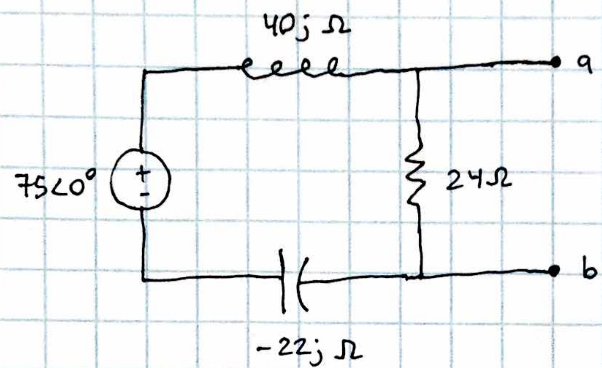
5.



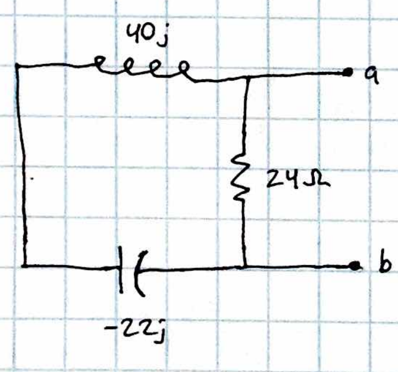
VOLTAGE DIVIDER $V_{ab} = V_{24}$

$$\mathbb{V}_{ab} = 75\left(\frac{24}{40j - 22j + 24}\right) V$$

$$\mathbb{V}_{ab} = 48 - 36j = 60\angle -36.87^\circ$$

$$\boxed{\mathbb{V}_{TH} = 60\angle -36.87^\circ}$$

Z_{TH} IS LOOKBACK IMPEDANCE WITH $75\angle 0^\circ$ SOURCE TURNED OFF



$$Z_{TH} = 24 \,\|\, 40j - 22j$$

$$Z_{TH} = \frac{24 \cdot 18j}{24 + 18j}$$

$$Z_{TH} = \frac{216}{25} + \frac{288}{25}j$$

$$\boxed{\mathbb{Z}_{TH} = 8.64 + 11.52j}$$

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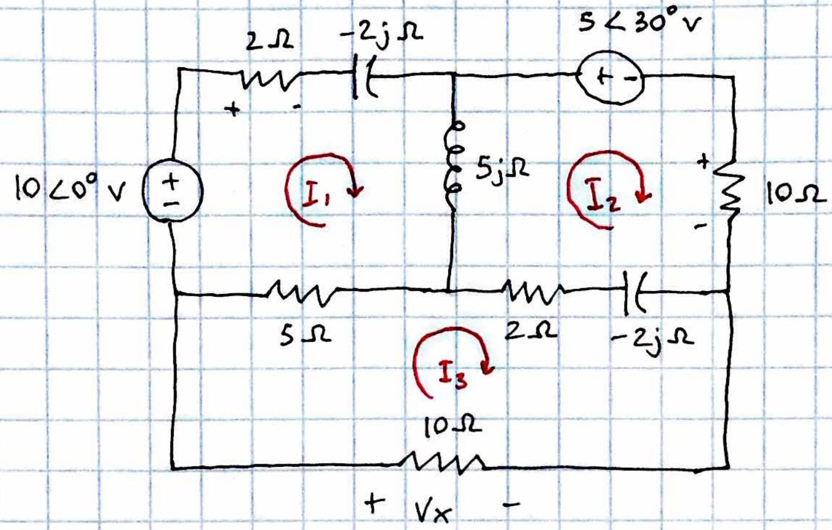
6.



I_1: $$-10 + 2I_1 - 2jI_1 + (I_1 - I_2)5j + (I_1 - I_3)5 = 0$$

$$-10 + \cancel{2I_1} - \cancel{2jI_1} + \cancel{5jI_1} - \cancel{5jI_2} + \cancel{5I_1} - \cancel{5I_3} = 0$$

$$(2 - 2j + 5j + 5)I_1 + (-5j)I_2 + (-5)I_3 = 10$$

I_2: $$(I_2 - I_1)5j + (5\angle 30^\circ) + 10I_2 + (I_2 - I_3)(-2j) + (I_2 - I_3)2 = 0$$

$$\cancel{5jI_2} - \cancel{5jI_1} + \cancel{10I_2} + \cancel{-2jI_2} + \cancel{2jI_3} + \cancel{2I_2} - \cancel{2I_3} = -(5\angle 30)$$

$$(-5j)I_1 + (5j + 10 - 2j + 2)I_2 + (2j - 2)I_3 = -\frac{5\sqrt{3}}{2} - \frac{5}{2}j$$

I_3: $$10I_3 + (I_3 - I_1)5 + (I_3 - I_2)2 + (I_3 - I_2)(-2j) = 0$$

$$\cancel{10I_3} + \cancel{5I_3} - \cancel{5I_1} + \cancel{2I_3} - \cancel{2I_2} - 2jI_3 + \cancel{2jI_2} = 0$$

$$(-5)I_1 + (-2 + 2j)I_2 + (10 + 5 + 2 - 2j)I_3 = 0$$

$$\begin{array}{c} \begin{array}{cccc} I_1 & I_2 & I_3 & k \end{array} \\ \left[\begin{array}{ccc|c} 7+3j & -5j & -5 & 10 \\ -5j & 12+3j & -2+2j & -\frac{5\sqrt{3}}{2} - \frac{5}{2}j \\ -5 & -2+2j & 17-2j & 0 \end{array}\right] \end{array}$$

$I_3 = 0.4221 - 0.1065j$

$V_x = -10 \cdot I_3$

$$V_x = -10 \cdot I_3 = -4.2209 + 1.0645j$$

$$\boxed{V_x = 4.353 \angle 165.8 \text{ V}}$$

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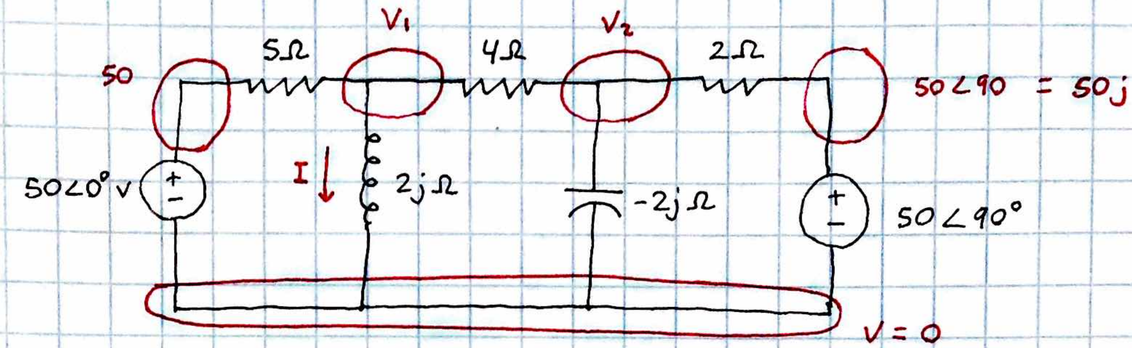
7.



V_1:

$$\frac{V_1 - 50}{5} + \frac{V_1}{2j} + \frac{V_1 - V_2}{4} = 0$$

$$\frac{V_1}{5} - \frac{50}{5} + \frac{V_1}{2j} + \frac{V_1}{4} - \frac{V_2}{4} = 0$$

$$\underline{\left(\frac{1}{5} + \frac{1}{2j} + \frac{1}{4}\right)V_1 - \frac{1}{4}V_2 = 10}$$

V_2:

$$\frac{V_2 - V_1}{4} + \frac{V_2}{-2j} + \frac{V_2 - 50j}{2} = 0$$

$$\frac{V_2}{4} - \frac{V_1}{4} - \frac{1}{2j}V_2 + \frac{1}{2}V_2 - 25j = 0$$

$$\underline{\left(-\frac{1}{4}\right)V_1 + \left(\frac{1}{4} - \frac{1}{2j} + \frac{1}{2}\right)V_2 = 25j}$$

$$\begin{array}{ccc} V_1 & V_2 & K \\ \end{array}$$

$$\left[\begin{array}{cc|c} \frac{9}{20} + \frac{1}{2j} & -\frac{1}{4} & 10 \\ -\frac{1}{4} & \frac{3}{4} - \frac{1}{2j} & 25j \end{array}\right]$$

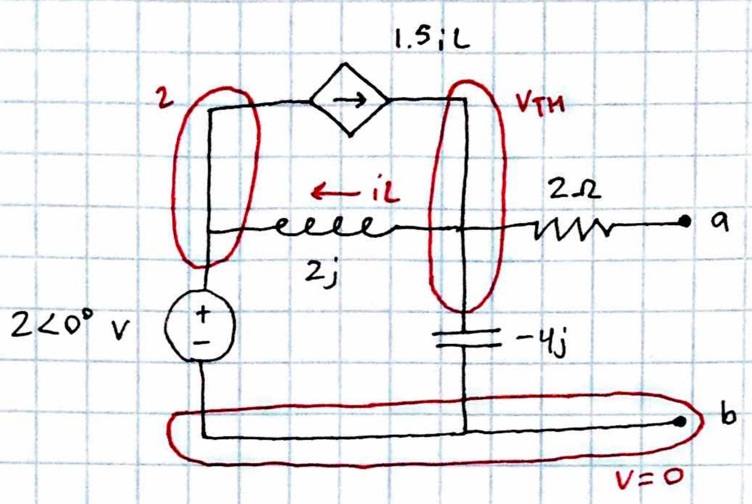
$V_1 = 7.5472 + 23.58j$

$V_2 = 20.7547 + 27.36j$

$$I = \frac{V_1}{2j} = \frac{7.5472 + 23.58j}{2j} = 11.7925 - 3.7736j$$

$$\boxed{I = 12.38 \angle -17.74 \text{ A}}$$

8.



VTH: $-1.5 i_L + i_L + \frac{V_{TH}}{-4j} = 0$

CONS: $\frac{V_{TH} - 2}{2j} = i_L$

$$\begin{array}{ccc} V_{TH} & i_L & K \\ \left[\begin{array}{cc|c} -\frac{1}{4j} & -\frac{1}{2} & 0 \\ 1 & -2j & 2 \end{array}\right] \end{array}$$

$V_{TH} = 1\ V$

$i_L = \frac{1}{2} j$

$$\boxed{V_{TH} = 1 \angle 0^\circ}$$

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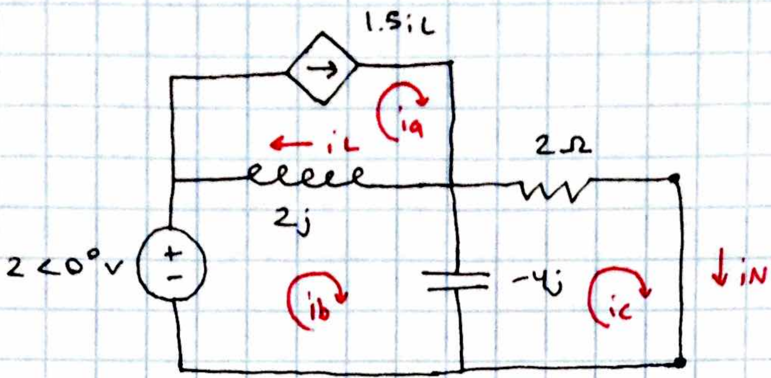
8.



ia: $i_a = 1.5 i_L \rightarrow \underline{i_a - 1.5 i_L = 0}$

ib: $-2 + 2j(i_b - i_a) - 4j(i_b - i_c) = 0$

$2j\,i_b - 2j\,i_a - 4j\,i_b + 4j\,i_c = 2$

$\underline{-2j\,i_a - 2j\,i_b + 4j\,i_c = 2}$

ic: $-4j(i_c - i_b) + 2i_c = 0$

$-4j\,i_c + 4j\,i_b + 2i_c = 0$

$\underline{4j\,i_b + (2-4j)\,i_c = 0}$

CONS: $i_a - i_b = i_L \rightarrow \underline{i_a - i_b - i_L = 0}$

$$\begin{array}{ccccc} i_a & i_b & i_c & i_L & k \end{array}$$
$$\left[\begin{array}{cccc|c} 1 & 0 & 0 & -1.5 & 0 \\ -2j & -2j & 4j & 0 & 2 \\ 0 & 4j & 2-4j & 0 & 0 \\ 1 & -1 & 0 & -1 & 0 \end{array}\right] \qquad i_c = \frac{1}{4} + \frac{1}{4}j$$

$i_c = i_N = \frac{1}{4} + \frac{1}{4}j \qquad Z_{TH} = \frac{V_{TH}}{i_N} = \frac{1}{\frac{1}{4} + \frac{1}{4}j}$

$$\boxed{Z_{TH} = 2.828 \angle -45.00\ \Omega}$$