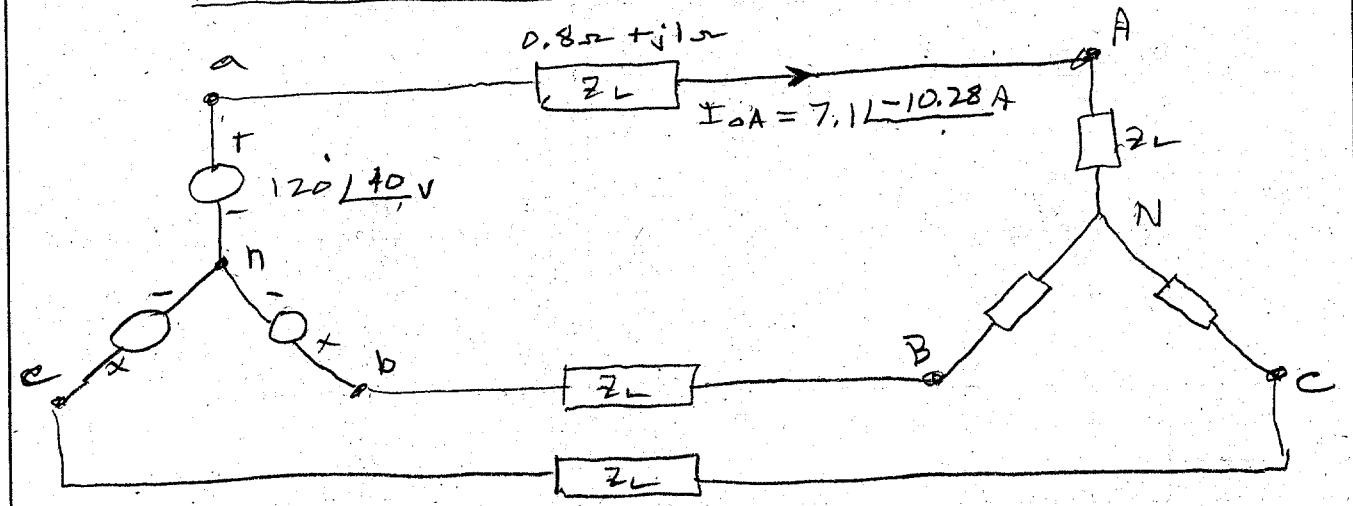
10.21 Given a wye-wye system. (balanced) (1)

DRAW the System



Find: The load impedance

Method 1

$$120\angle 40 = (0.8+j1)(7.1\angle -10.28) + Z_L(7.1\angle -10.28)$$

$$Z_L = \frac{((120\angle 40) - (0.8+j1)(7.1\angle -10.28))}{(7.1\angle -10.28)}$$

$$Z_L = 15.62\angle 50.19 = (10+j12) \text{ ohms}$$

//

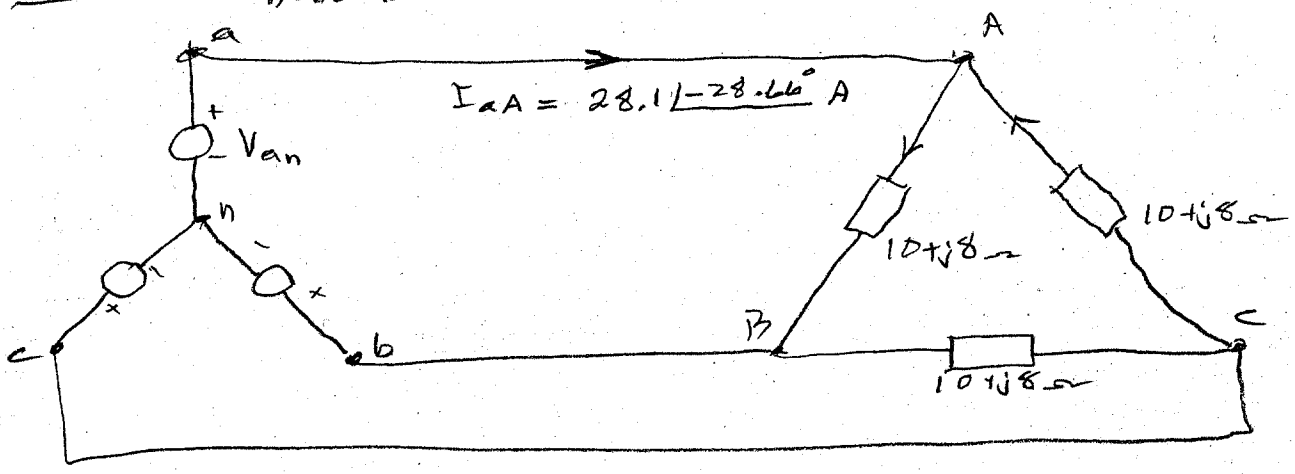
Method 2

$$Z_T = \frac{120\angle 40}{7.1\angle -10.28} = 10.8 + j13$$

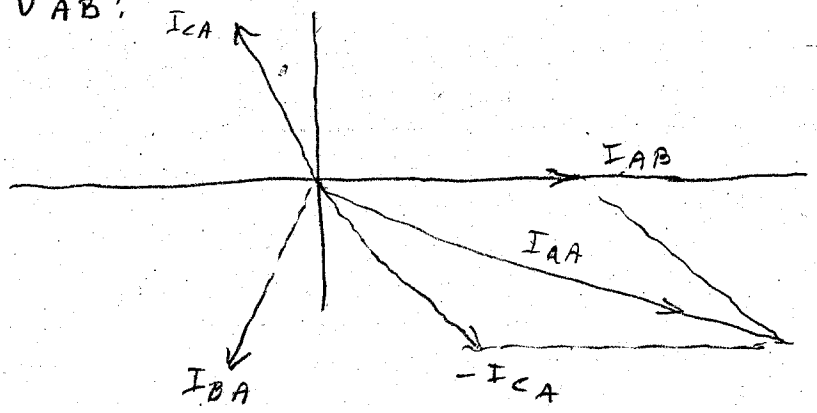
$$Z_L = Z_T - Z_\ell = 10.8 + j13 - 0.8 - j1$$

$$Z_L = (10+j12)\Omega$$

10.29 Balanced



Find V_{AB}:



$$I_{aA} = I_{AB} - I_{CA} = \sqrt{3}\, I_{AB} \angle -30°$$

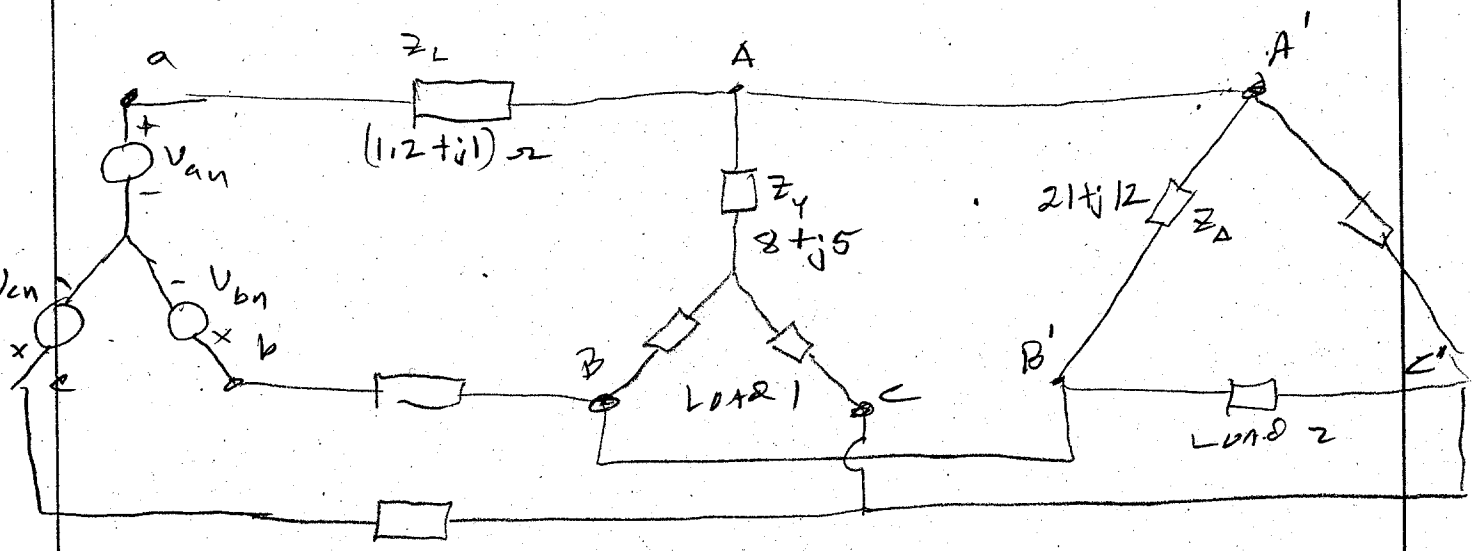
$$I_{AB} = \frac{I_{aA}}{\sqrt{3} \angle -30} = \frac{(28.1 \angle -28.66)}{\sqrt{3} \angle -30}$$

$$I_{AB} = 16.22 \angle 1.34° \text{ A}$$

$$V_{AB} = Z_L I_{AB} = (10 + j8)(16.22 \angle 1.34)$$

$$\boxed{V_{AB} = 207.7 \angle 40° \text{ V rms}}$$

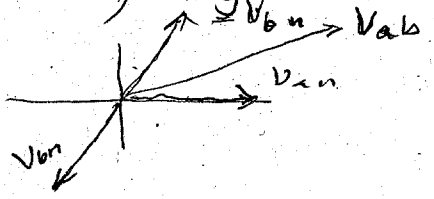
10.37 BALANCED



Given: $V_{ab} = 208\angle 60^\circ$ V

Find the phase currents in the wye load.

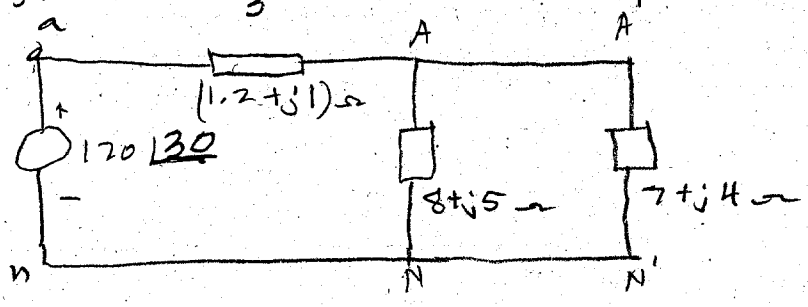
Approach: Put the system in a wye source, wye Load 1, wye load 2



$$V_{an} = \frac{V_{ab}\angle -30}{\sqrt{3}}$$

$$V_{an} = 120\angle 30$$

$$Z_{y2} = \frac{Z_\Delta}{3} = 7+j4$$



$$Z_\gamma = \frac{(8+j5)(7+j4)}{15+j9} = 4.35\angle 30.79^\circ\ \Omega$$

10.37 cont.

$$I_{aA} = \frac{(120\angle 30)\div}{((1.2+j1) + (4.35\angle 30.79))}$$

$$I_{aA} = 20.35\angle -3.17^\circ \text{ A}$$

Use current splitting

$$I_{AN} = \frac{I_{aA} \times (7+j4)}{15+j9} = \frac{(20.35\angle -3.17)(7+j4)}{15+j9}$$

$$I_{AN} = 9.38\angle -4.4^\circ \text{ A rms}$$

$$I_{BN} = 9.38\angle -124.4^\circ \text{ A rms}$$

$$I_{cN} = 9.38\angle 115.6 \text{ A rms}$$

How would you get the currents in the Δ load impedances?

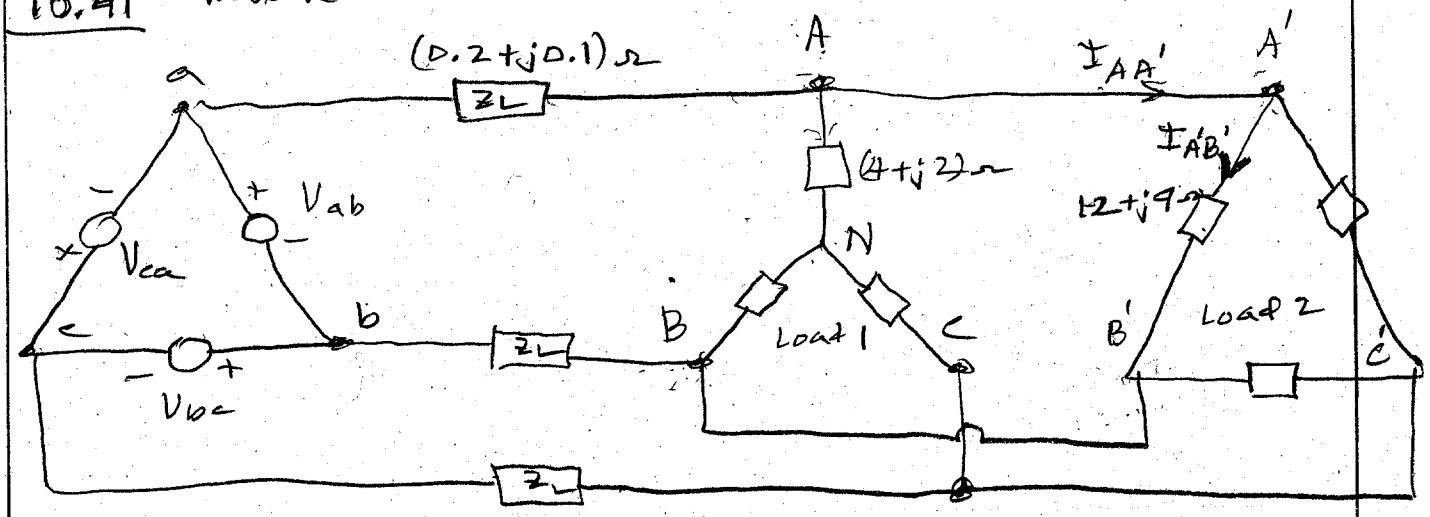
Find $V_{AB} = I_{bB} Z_2 + V_{ab} - I_{aA} Z_2$

then $I_{A'N'} = \frac{V_{AB}}{Z_\Delta}$

wlg

4A

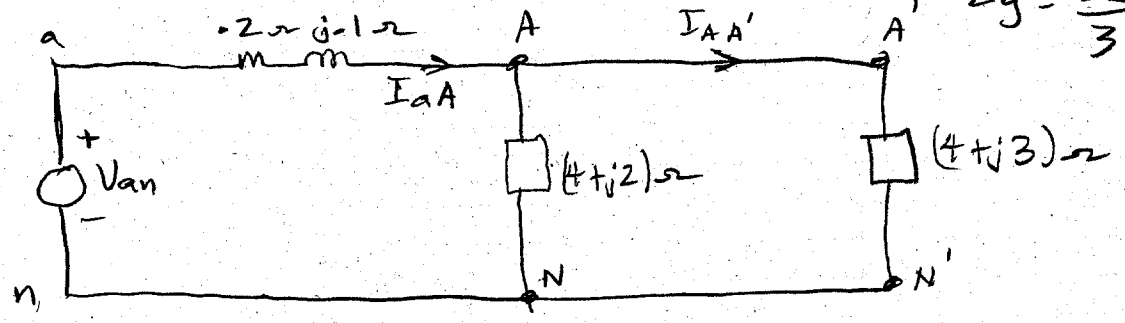
10.41 Balanced



Given: $I_{A'B'} = 16 \angle 45^\circ$ A rms

Required: Find the phase voltages of the source: V_{ab}, V_{bc}, V_{ca}.

$Z_Y = \frac{Z_\Delta}{3}$



$I_{AA'} = \sqrt{3}\ I_{A'B'} \angle -30^\circ = 16\sqrt{3} \angle 15^\circ$ A

with current splitting;

$$(16\sqrt{3} \angle 15) = \frac{I_{aA} \times (4+j2)}{(8+j5)}$$

$I_{aA} = 58.46 \angle 20.4$ A

10.41 cont

- $V_{an} = (0.2+j0.1)(58.46\angle 20.4) + (16\sqrt{3}\angle 15)(4+j3)$

$V_{an} = 151.6\angle 51.5°$

$V_{ab} = \sqrt{3}\, V_{an}\angle 30$

$V_{ab} = (\sqrt{3} \times 151.6\angle 51.5 \quad \angle 30)$

$V_{ab} = 262.6\angle 81.5°\ V$

$V_{bc} = V_{ab}\angle -120°\ V$

$V_{ca} = V_{ab}\angle 120$ OR $V_{ab}\angle -240\ V$