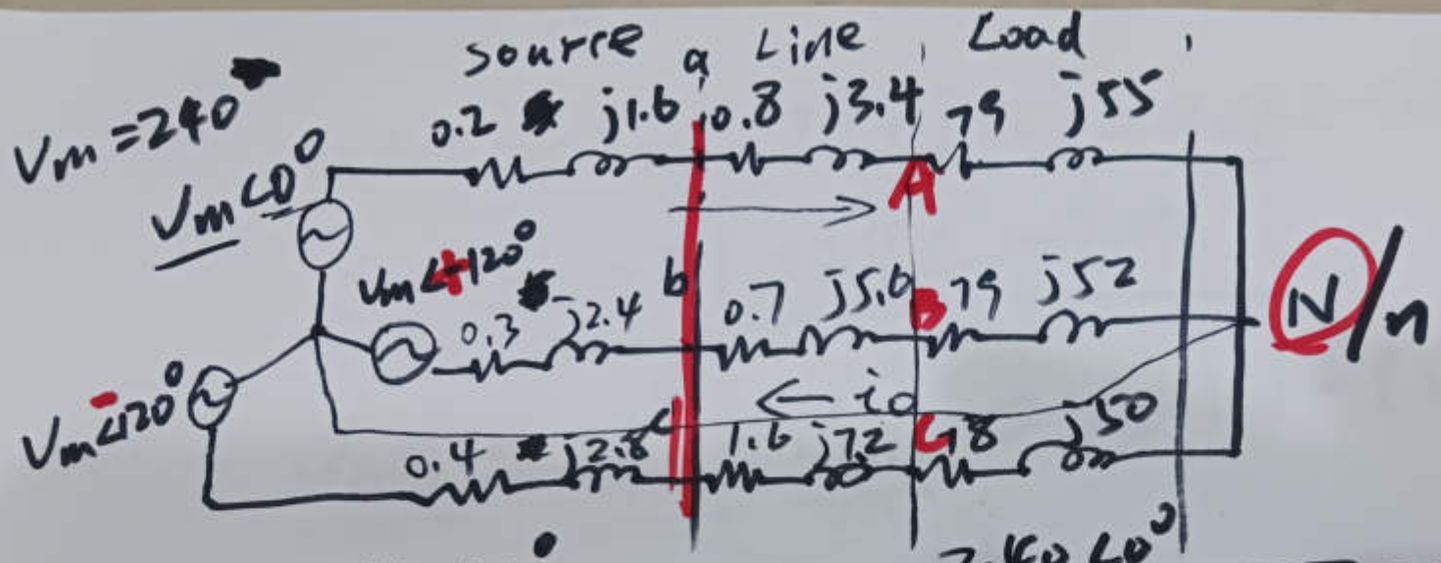
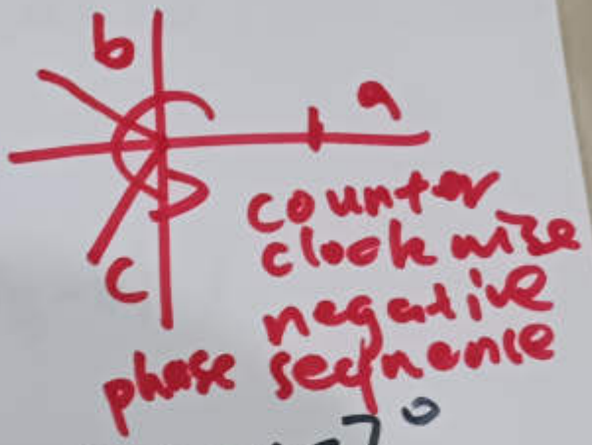




$$I_a = \frac{240\angle 0^\circ}{80 + 60j} = \frac{240\angle 0^\circ}{100\angle 36.87^\circ} = 2.4\angle -36.87^\circ$$

$$I_b = \frac{240\angle -120^\circ}{80 + 60j} = \frac{240\angle -120^\circ}{100\angle 36.87^\circ} = 2.4\angle -156.87^\circ$$

$$I_c = \frac{240\angle 120^\circ}{80 + 60j} = \frac{240\angle 120^\circ}{100\angle 36.87^\circ} = 2.4\angle 83.13$$

$$I_o = I_a + I_b + I_c = 0\ A$$

$V_{AN} = I_a \cdot (19 + j52) = 2.4\angle -36.87^\circ \times 96.26\angle 34.85$

$= 231.024\angle -2.02$

$V_{AB} = V_{AN} - V_{BN} = V_A - V_N - (V_B - V_N)$

$= V_A - V_B = V_{AB}$

$V_{BN} = Z_B \times (19 + j52)$

Balanced three phase system:
Same magnitude, frequency, 120° apart

$$\sqrt{\frac{1.6^2+0.2^2}{0.3^2+2.4^2}}$$

$$\begin{cases} V_a = 240\angle 0^\circ - I_a \cdot (0.2 + j1.6) \\ V_b = 240\angle 120^\circ - I_b (0.3 + j2.4) \end{cases}$$

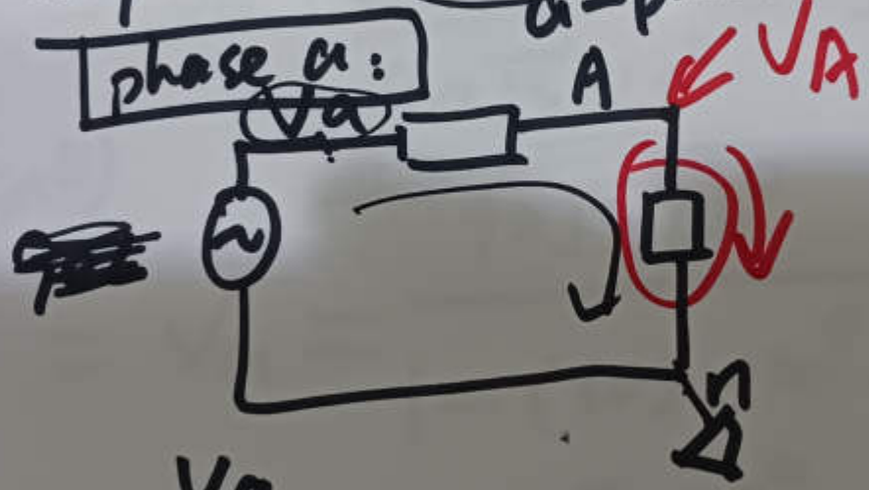
(2)

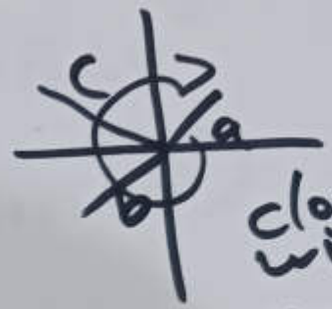
P11.9 Balanced, Three phase, Y-Y connected

- Line voltage at the source $V_{ab} = 90\sqrt{3}\angle 0^\circ$ V
- phase sequence is positive
- Line impedance $2+j3\ \Omega$
- Load impedance $28+j37\ \Omega$

Part A

$V_{an} = V_a$

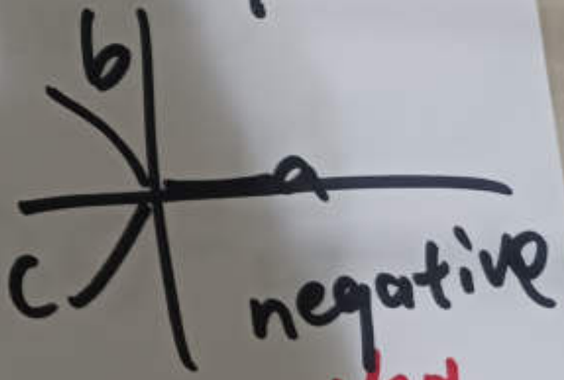




clock wise positive phase sequence

Part B

$$I_a = \frac{V_a}{30+j40}$$



Part C: Line voltage at the load in the a-phase

$V_{AB} = V_{AN} - V_{BN}$

$= V_A - V_B$

(4)

$$V_{ab} = V_a \angle 0^\circ - V_a \angle -120^\circ = 90\sqrt{3} \angle 0^\circ$$

$$= V_a (1 \angle 0^\circ - 1 \angle -120^\circ) = 90\sqrt{3} \angle 0^\circ$$

$$= V_a (1 - e^{-j120^\circ}) = 90\sqrt{3} \angle 0^\circ$$

$$= V_a (1 - (\cos -120^\circ - j \sin 120^\circ))$$

$$= \boxed{90\sqrt{3} \angle 0^\circ}$$

$Ae^{-j\theta} = A\angle\theta$

$= A(\cos\theta + j\sin\theta)$

$$= V_a = \frac{90\sqrt{3} \angle 0^\circ}{1 - (\cos -120^\circ - j \sin 120^\circ)}$$

$$= \frac{90\sqrt{3} \angle 0^\circ}{1 - (-0.5 - j0.866)} = \frac{155.88 \angle 0^\circ}{1.732 \angle 30^\circ}$$

$$= \boxed{90 \angle -30^\circ}$$

(25)

11.2 4. Complex power

$a+bj$ $\arctan\frac{b}{a}$

$a-bj$, $-\arctan\frac{b}{a}$

$= V \times I^*$

$= V_m \angle \theta_V \cdot I_m \angle \theta_I^*$

$= V_m \angle \theta_V \cdot I_m \angle -\theta_I$

$= V_m I_m \angle \theta_V - \theta_I$?

$= V_m I_m \cos(\theta_V - \theta_I) + V_m I_m \sin(\theta_V - \theta_I)$ α

(6)