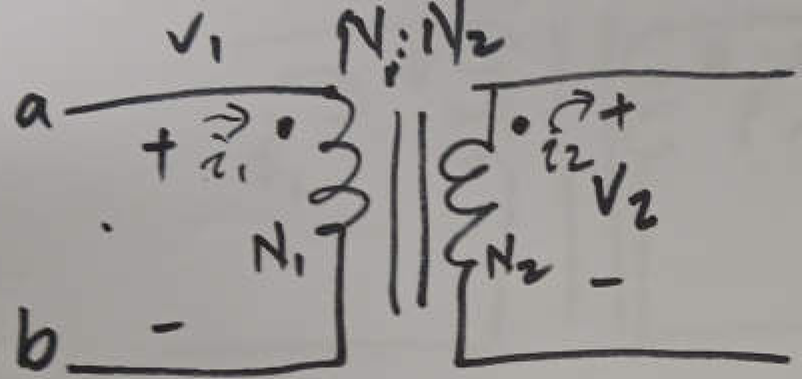
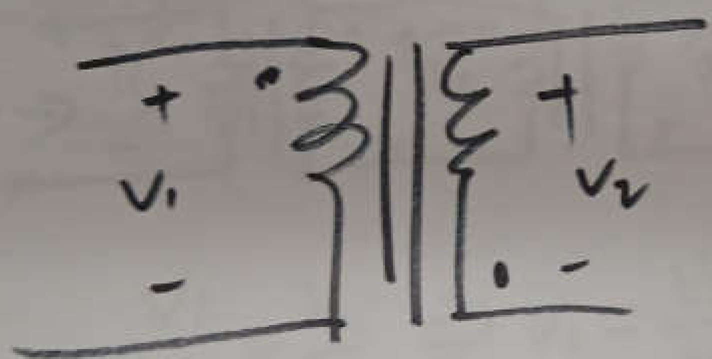
HW10

P9.80 If v_1 and v_2 are both positive or negative at the dotted terminal, then use a plus sign



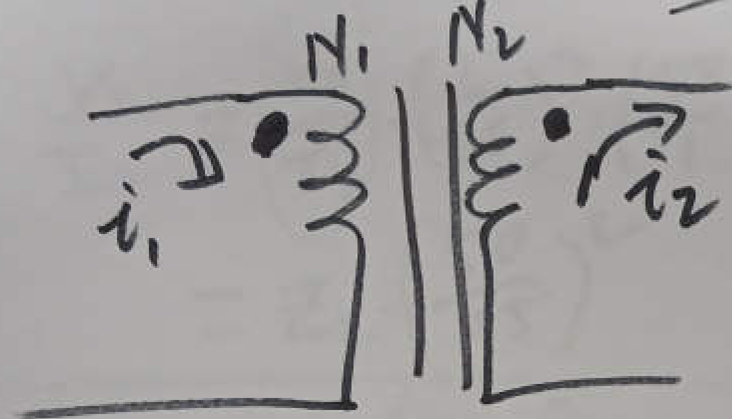
$$\left|\frac{V_1}{N_1}\right| = \left|\frac{V_2}{N_2}\right|$$

$$\frac{V_1}{N_1} = \frac{V_2}{N_2}$$



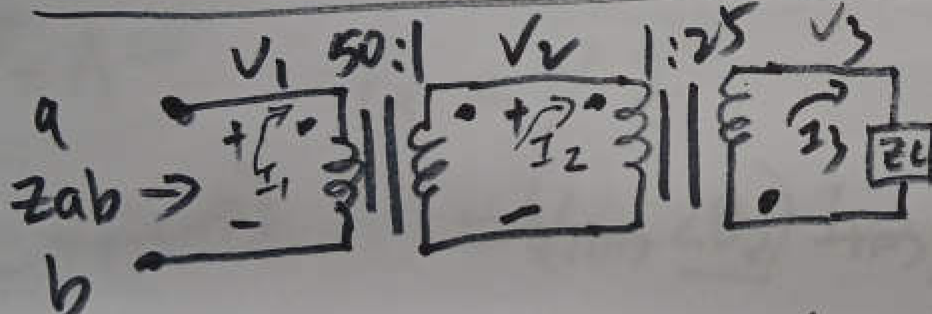
$$\frac{V_1}{N_1} = -\frac{V_2}{N_2}$$

If I_1 and I_2 are both directed into or out of the dotted terminal, use a minus sign.



$$|i_1 N_1| = |i_2 N_2|$$

$$i_1 N_1 = i_2 N_2$$



$= 220 + j120\ \Omega$

$$\frac{V_1}{N_1} = \frac{V_2}{N_2} \Rightarrow V_1 = \frac{V_2}{N_2} \cdot N_1 \quad (1)$$

$$I_1 N_1 = \pm I_2 N_2$$

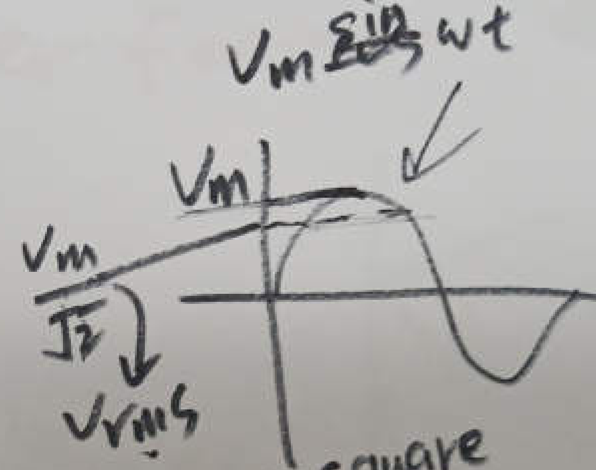
$$\Rightarrow I_1 = \frac{I_2}{N_1} N_2 \quad (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{V_1}{I_1} = \frac{\frac{V_2 N_1}{N_2}}{\frac{I_2}{N_1} N_2} = \frac{V_2}{I_2} \left(\frac{N_1}{N_2}\right)^2$$

$$\frac{V_2}{I_2} = \frac{V_3}{I_3} \cdot \left(\frac{1}{25}\right)^2$$

$$\frac{V_1}{I_1} = \frac{V_3}{I_3} \cdot \left(\frac{1}{25}\right)^2 \cdot \left(\frac{50}{1}\right)^2$$

$$= Z_L \cdot \left(\frac{50}{25}\right)^2$$



root mean square (rms)

Complex Power

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

⇓

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

$$P_x = \underline{V} \cdot \underline{I}^*$$

$$= (V_{rms}\angle\theta_V)(I_{rms}\angle\overline{\theta_I})$$

$$= V_{rms} \cdot I_{rms} \angle(\theta_V - \theta_I)$$

$$= V_{rms} \cdot I_{rms} (\cos(\theta_V - \theta_I) + j\sin(\theta_V - \theta_I))$$

$$= V_{rms} \cdot I_{rms} \cos(\theta_V - \theta_I) + jV_{rms} I_{rms} \sin(\theta_V - \theta_I)$$

$a + bj \rightarrow \sqrt{a^2+b^2}\angle \arctan\frac{b}{a}$

conjugate

$a - bj \rightarrow \sqrt{a^2+b^2} \cdot \angle -\arctan\frac{b}{a}$

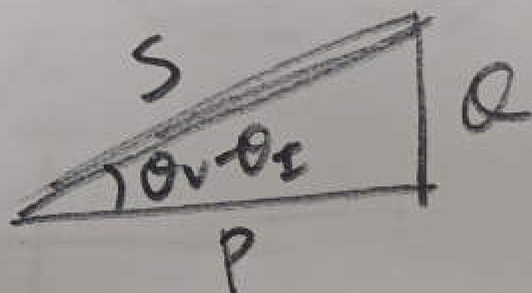
average power
real power "P" watts

reactive power
"Q". VAR. volts Amp reactive

③

$\cos(\theta_V - \theta_I)$ **Power factor**

Pf



$S = \sqrt{P^2 + Q^2}$

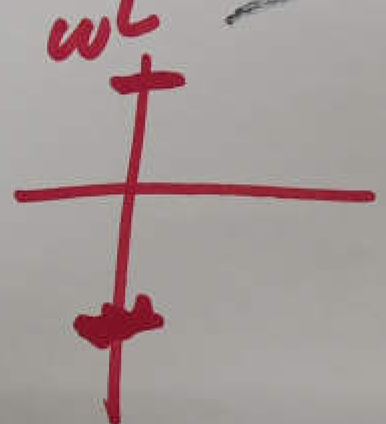
→ Apparent Power

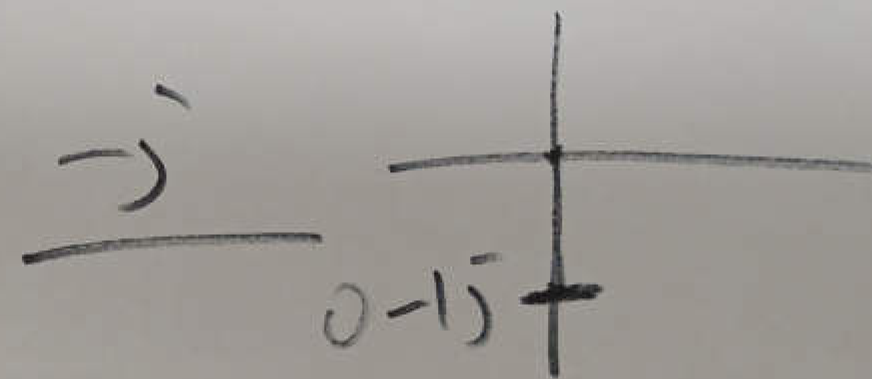
$$\begin{cases} S \cdot Pf = P \\ S \cdot \sin(\theta_V - \theta_I) = Q \end{cases}$$

$\theta_V > \theta_I$, current lagging,
Pf lagging
$Q > 0$, → inductive load

$\theta_V < \theta_I$, current leading.
Pf leading, $Q < 0$, → capacitive load

$$I = \frac{V\angle 0^\circ}{0 + j\omega L} = \frac{V}{\omega L}\angle -90^\circ$$





$$I = \frac{V\angle 0^\circ}{\frac{-j}{\omega L}} = \frac{V}{\frac{1}{\omega C}} \frac{\angle 0^\circ}{\angle -90^\circ} = \frac{V}{\frac{1}{\omega C}} \cdot \angle 90^\circ$$