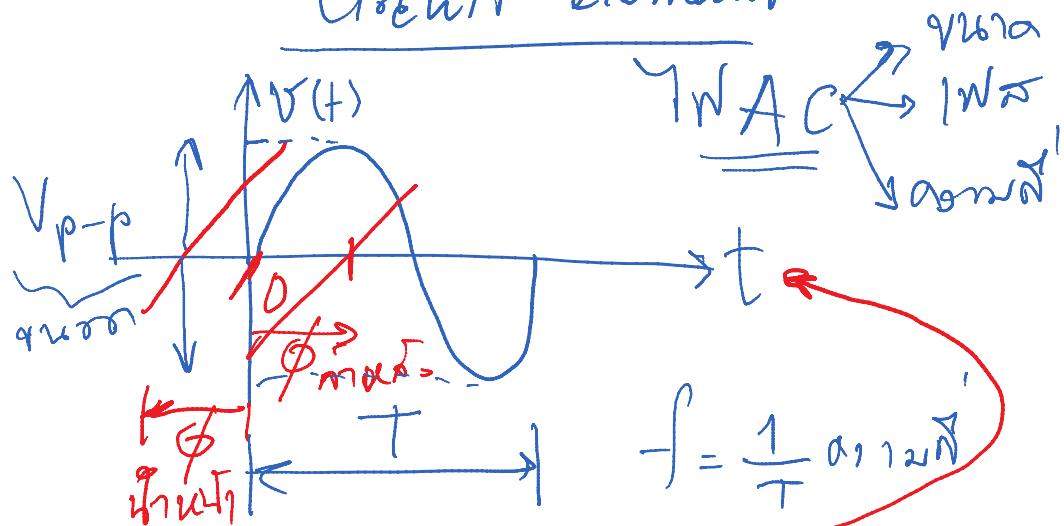


## Phasor relationship for circuit element

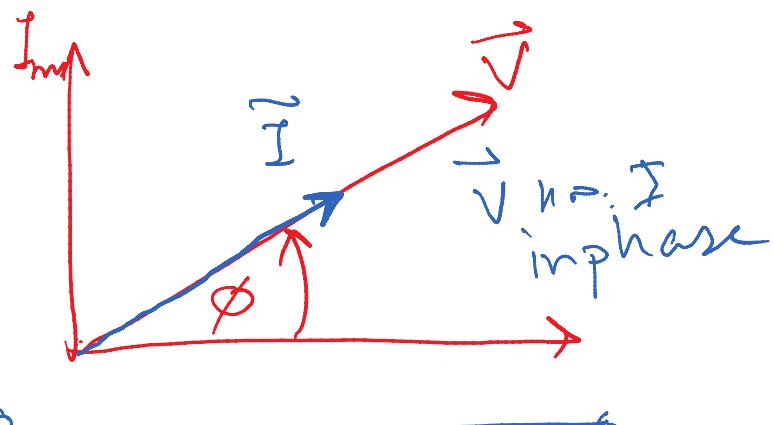
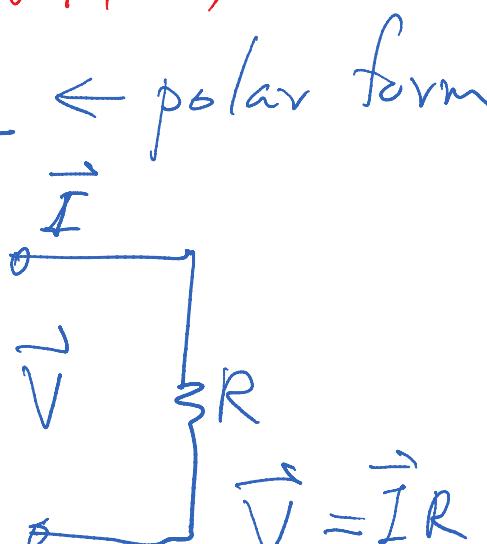
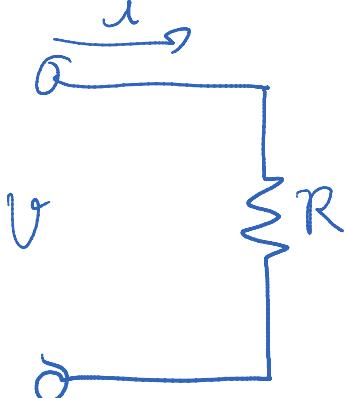


Resistor ( $R$ )

ຄ່າງສູງສະຫງົບກຳມົດ  $R$

$$i(t) = I_m \cos(\omega t + \phi)$$

$$= I_m \angle \phi \leftarrow \text{polar form}$$





### Capacitor

อนุสูติภพ C ดัง

$$v(t) = V_m \cos(\omega t + \phi)$$

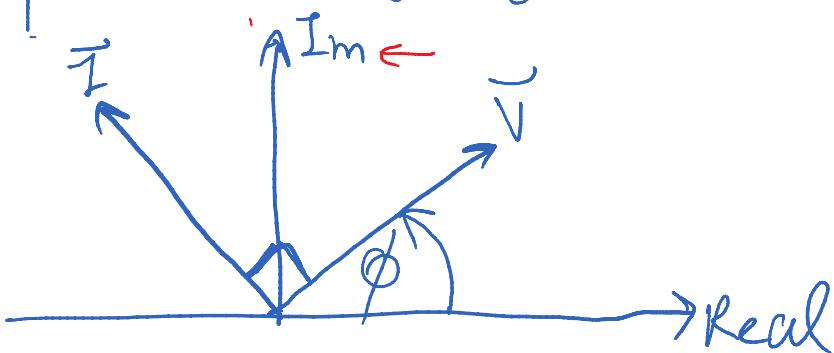
$$\vec{V} = V_m \angle \phi$$

ตามนั้น กระแสในห้องคือ

$$i(t) = C \frac{dv(t)}{dt} = j \omega C \vec{V}$$

$$\vec{I} = \underline{\omega C V_m (\phi + 90^\circ)}$$

Capacitor  $\leftarrow$  I lead  $V \rightarrow 90^\circ$

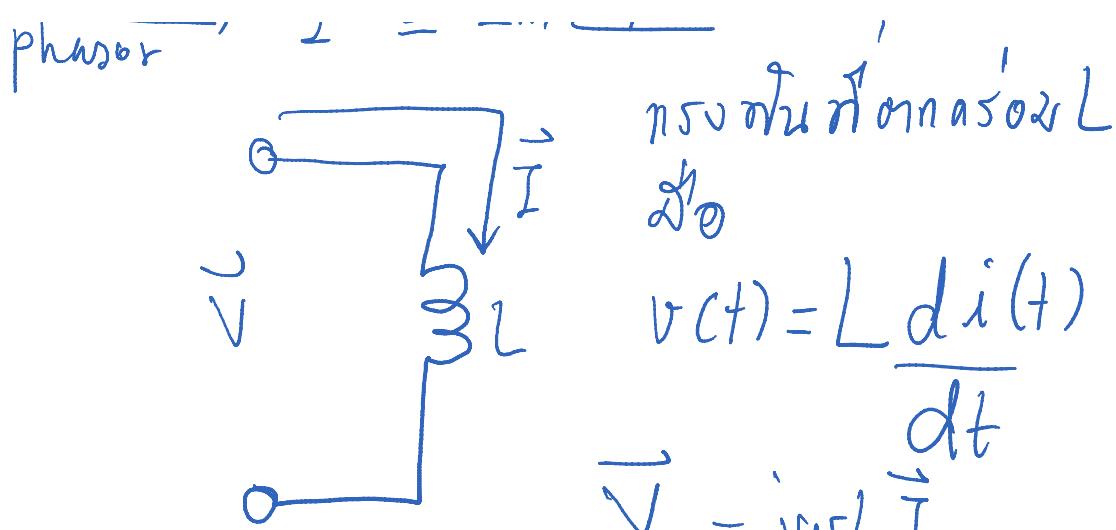


### Inductor (L)

อนุสูติภพ: ห้องคือ  $\frac{1}{j\omega L}$

$$i(t) = I_m \cos(\omega t + \phi)$$

$$\vec{I} = I_m \angle \phi$$



$$\vec{V} = j\omega L \vec{I}$$

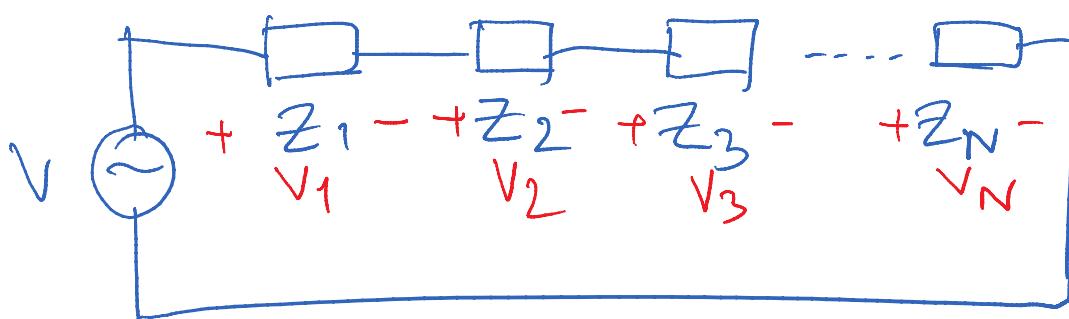
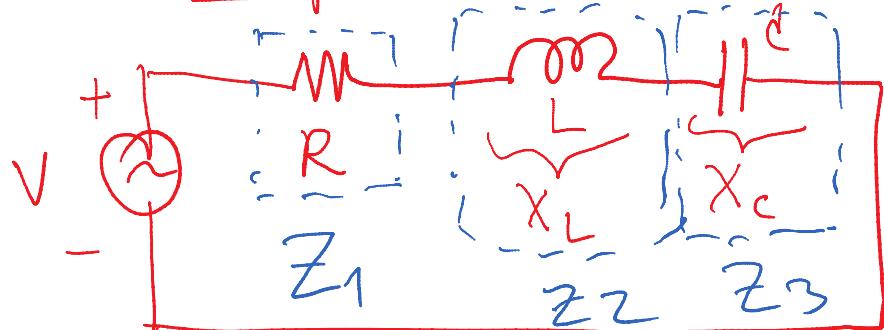
$$\vec{V} = \omega L I_m (\phi + 90^\circ)$$

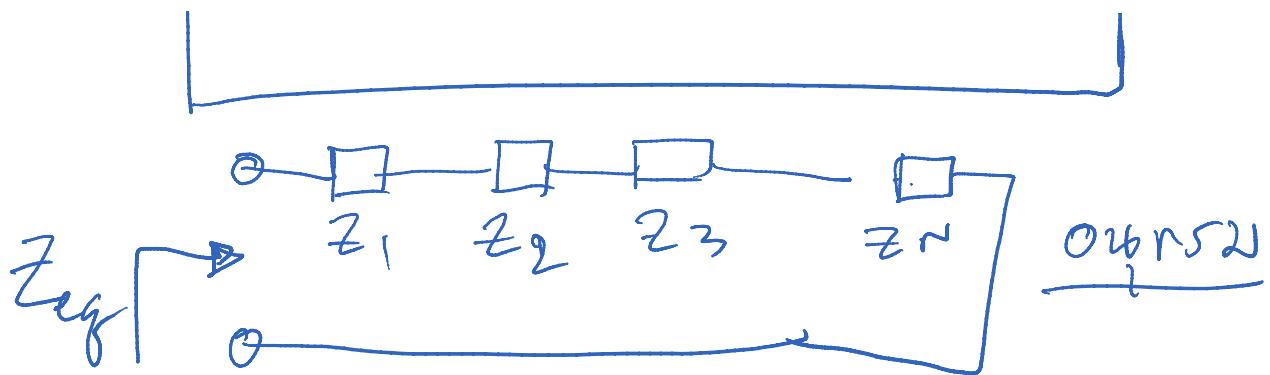
Impedance

$$|Z| = \sqrt{R^2 + X^2}$$

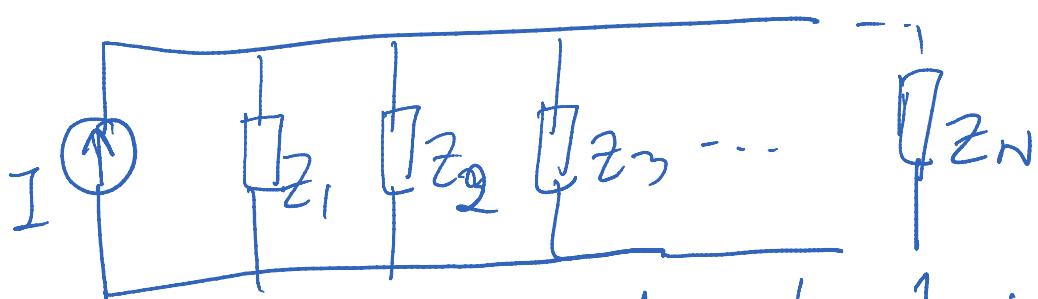
$X_C$   $X_L = j\omega L$

### Impedance Combination

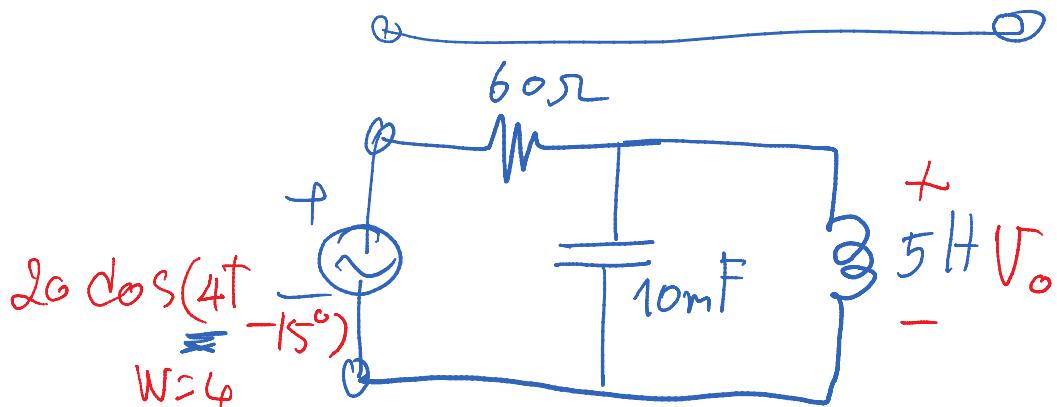




$$Z_{eq} = \frac{V}{I} = z_1 + z_2 + z_3 + \dots + z_N$$



$$\frac{1}{Z_{eq}} = \frac{I}{V} = \frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_3} + \dots + \frac{1}{z_N}$$



20 cos(4t - 15°)

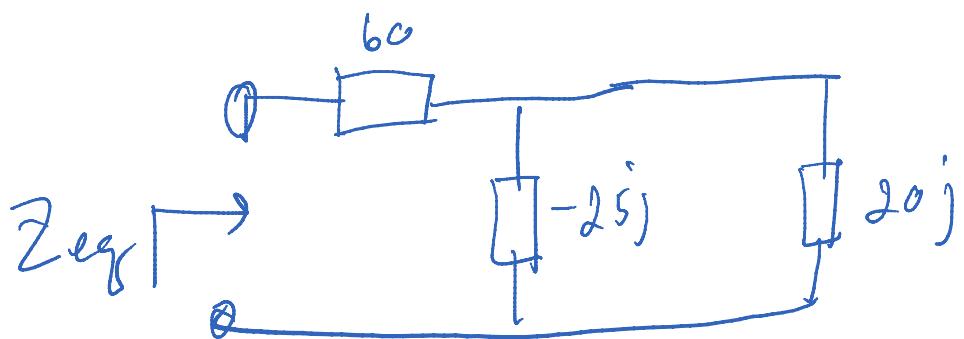
7.07V<sub>0</sub>

$$Z_C = \frac{1}{j\omega C}, \quad Z_L = j\omega L$$

$\sqrt{-1}$

$$Z_C = \frac{1}{j(4)(10 \text{ mF})} = -25j \quad \left( \frac{1000}{4 \times 10 \times 10^{-3}} \right)$$

$$Z_L = j\omega L = j(4)(5) = 20j$$



$$Z_{eq} = \frac{1}{-25j} + \frac{1}{20j} = \frac{(-25j)(20j)}{-25j + 20j}$$

$$Z_{eq} = \frac{20 \times 25}{-5j} = 100j \quad \text{※}$$

$$Z_{eq} = 60 + 100j$$

$$V_o = \frac{V_x (Z_c || Z_L)}{R + (Z_c || Z_L)} = \frac{20(-15^\circ)(100j)}{60 + 100j} \quad \text{※}$$

$$V_o = 17.15 \angle 15.96^\circ$$

$$V_o = 17.15 \cos(4t + 15.96^\circ) \quad \text{※}$$

$$60 + 100j \rightarrow \sqrt{60^2 + 100^2} =$$

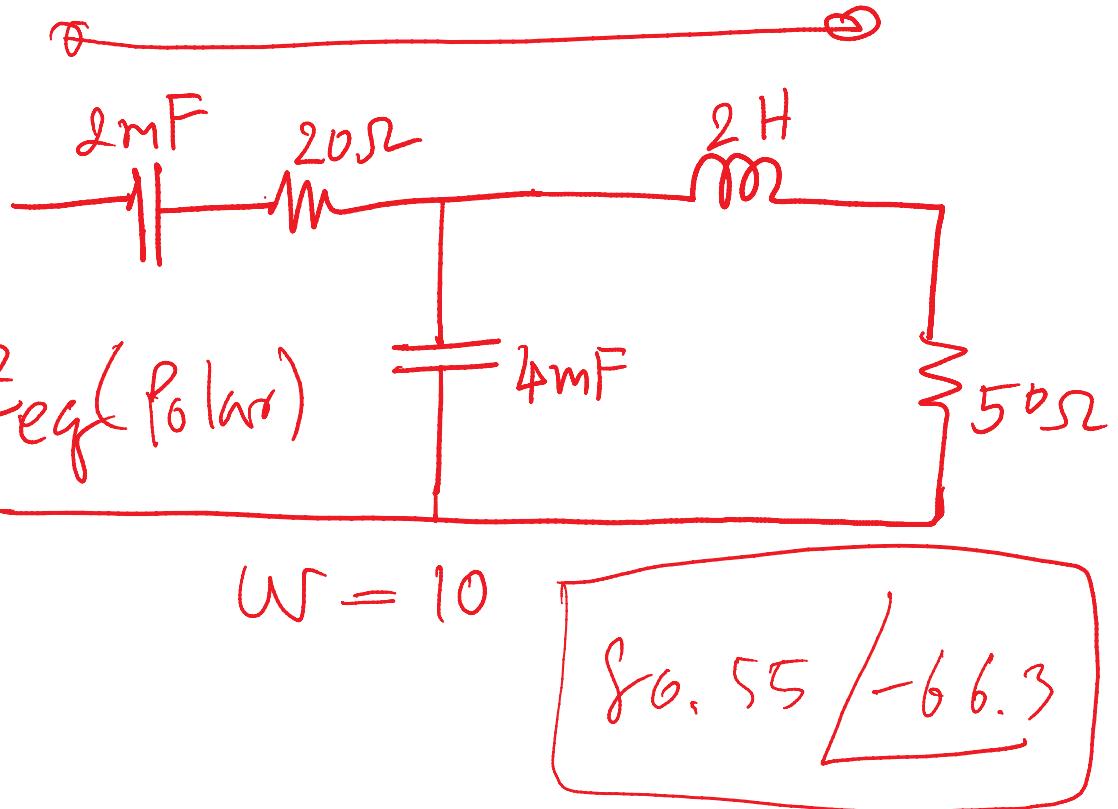
$$\phi = \tan^{-1}\left(\frac{100}{60}\right) =$$



$$\begin{aligned}
 Z &= (5+j2)(-1+j4) - 5 \angle 60^\circ \\
 &= -5+j20 - 2j + j^2 8 - \left( 5 \left[ \cos 60^\circ + j \sin 60^\circ \right] \right) \\
 &= -13 + 18j - 2.5 - 4.33j \\
 &= -15.5 + 13.67j \quad \times
 \end{aligned}$$

$$\begin{aligned}
 Z &= \frac{10+j5 + 3 \angle 40^\circ}{-3+j4} + 10 \angle 30^\circ \\
 &= \frac{10+j5 + 2.29+j1.93}{-3+j4} + 8.66+j5 \\
 &= \frac{12.29+j6.93}{-3+j4} = \frac{14.109}{5} / \frac{29.417}{126.87} - \\
 &= 8.23 - j2.2 \quad \times
 \end{aligned}$$

$$j \cdot \frac{-j}{-j} = \frac{-j}{-j^2}$$



86.55 / -66.3