AC

- Ques based on AC with R

↳ AC with C

→ AC with L

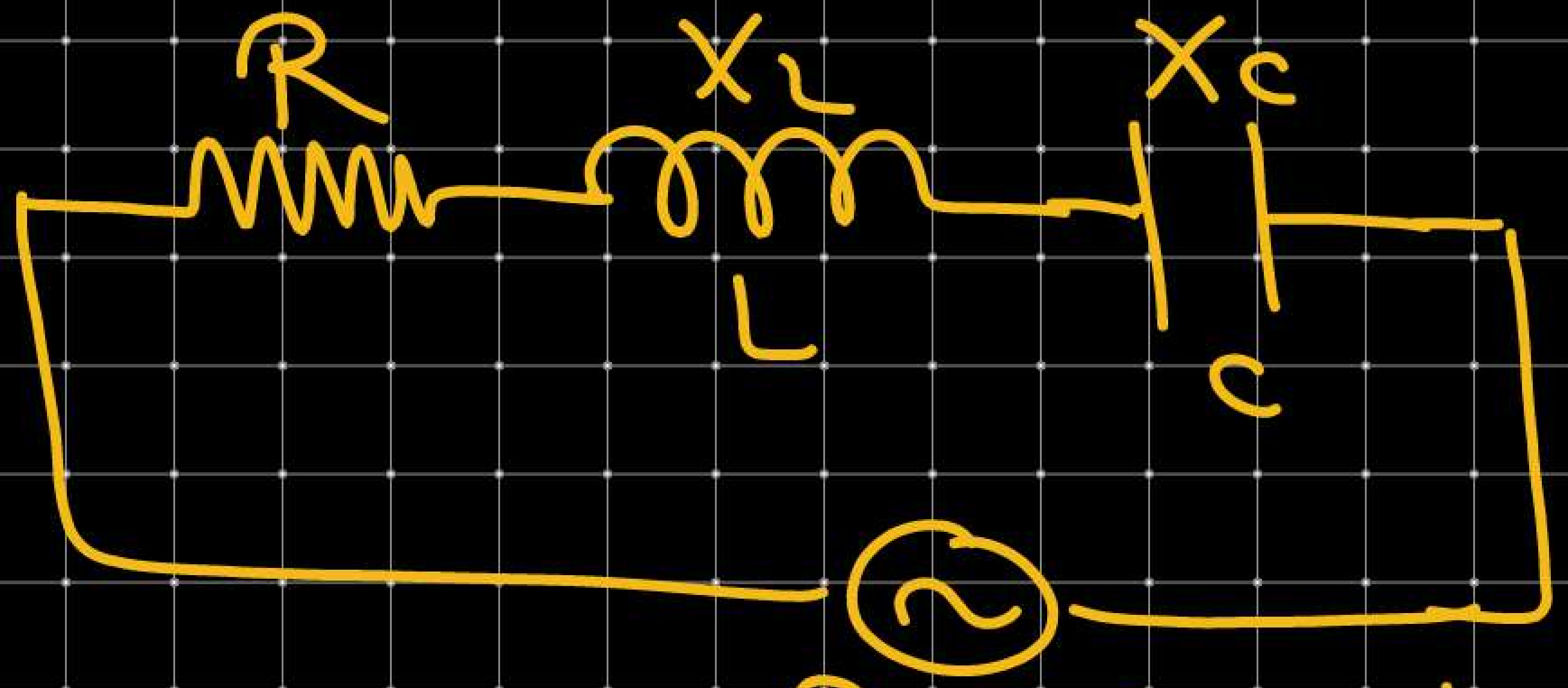
L, R

AC with LCR

R, C

C, L

L-C-R Resonance :-



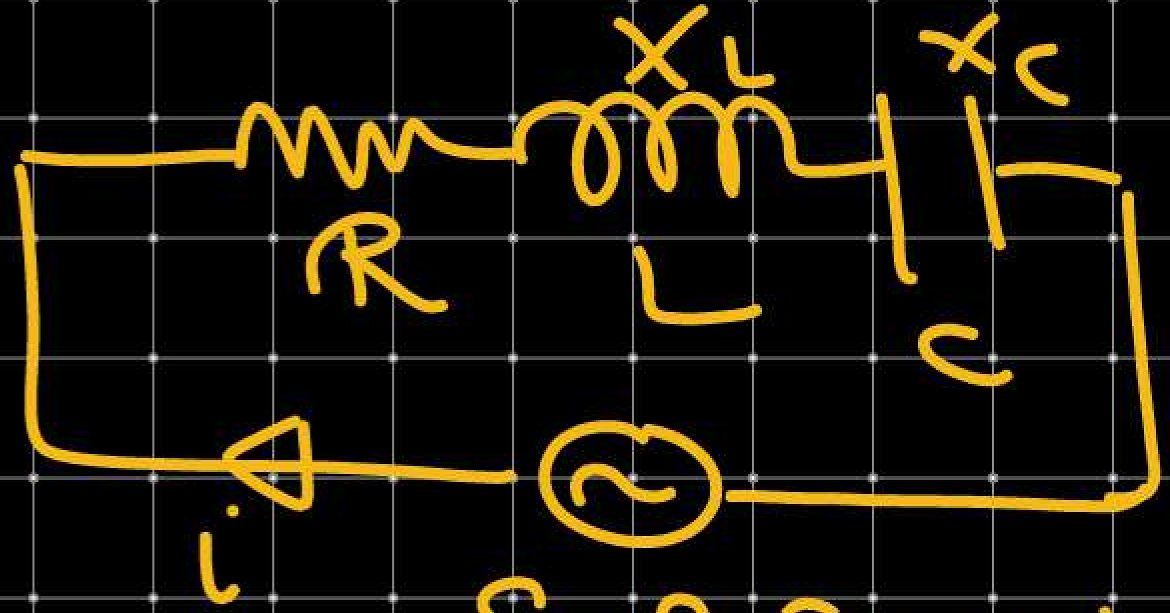
$\mathcal{E} = \mathcal{E}_0 \sin \omega t$

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

Angular frequency $= \omega$

$\omega = 2\pi f$

$f = \frac{\omega}{2\pi}$



$\varepsilon = \varepsilon_0 \sin \omega t$

$R = \frac{\rho l}{A}$

R → ω par depend karta hai.

$\underline{X_L = \omega L}$ → depends on ω.

→ $Z = \sqrt{R^2 + (X_L - X_C)^2}$

$X_C = \frac{1}{\omega C}$ → ω → depend.

↳ At Resonance. $\underline{\underline{X_L = X_C}}$ ⇒ $\omega L = \frac{1}{\omega C}$

$\omega^2 = \frac{1}{LC}$

$\omega = \frac{1}{\sqrt{LC}}$

At Resonance $X_L = X_C$

$\omega L = \frac{1}{\omega C}$

$\omega = \frac{1}{\sqrt{LC}}$

Natural frequency

Resonance frequency.

$\underline{\underline{i_{max}}}$

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

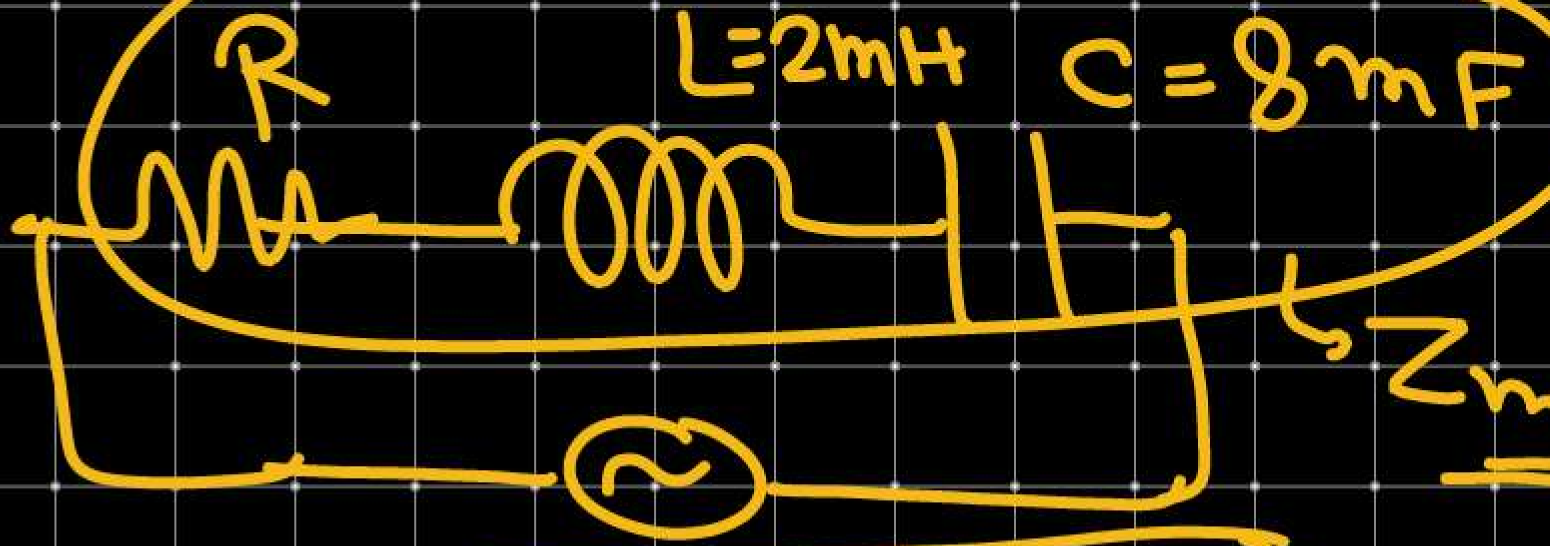
At Resonance

$X_L = X_C$

$X_L - X_L = 0$

$Z = \sqrt{R^2} = \underline{\underline{R}}$

$\boxed{Z_{min} = R}$



$\to Z_{min}$

$\mathcal{E} = \mathcal{E}_0 \sin \omega t$

find Resonance frequency

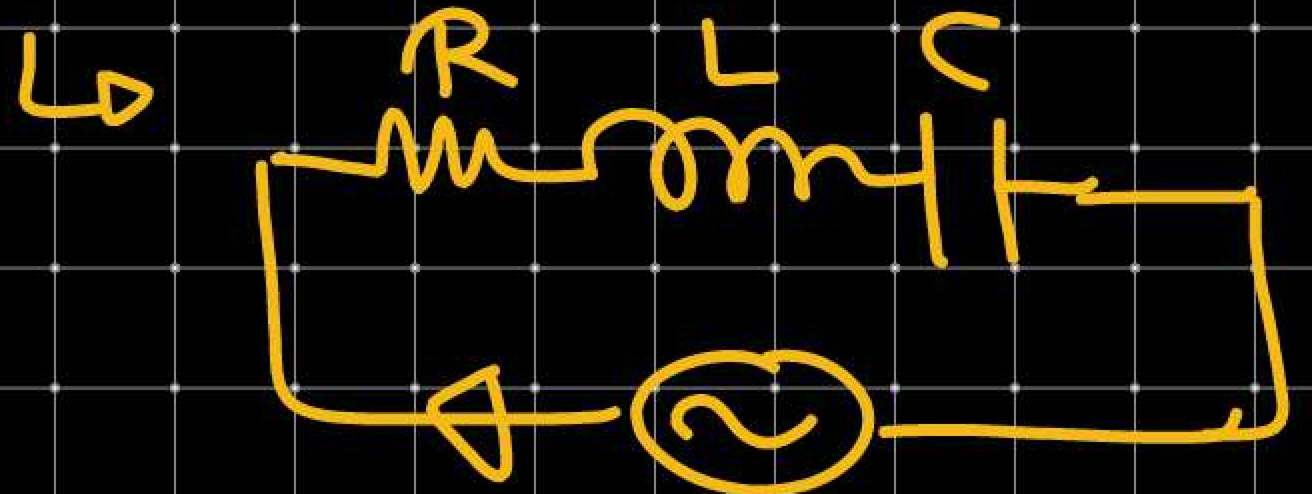
$$\omega = \frac{1}{\sqrt{LC}}$$

$$\omega = \frac{1}{\sqrt{2\times10^{-3}\,H \times 8\times10^{-3}\,F}}$$

$$= \frac{1}{\sqrt{16\times10^{-6}}} = \frac{1}{4\times10^{-3}} = \frac{1000}{4} = \underline{\underline{250}}$$

$\to$ Resonance frequency.

$X_L = X_C$



$\varepsilon = \varepsilon_0 \sin \omega t$

→ At resonance $X_L = X_C$

Angular frequency $\omega = \frac{1}{\sqrt{LC}}$

$Z = R \rightarrow Z_{min}$

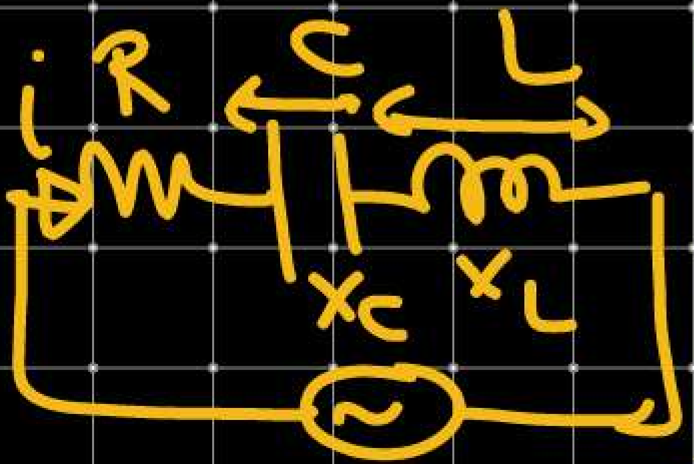
i_{max}

$f = \frac{\omega}{2\pi}$

$f = \frac{1}{\sqrt{LC} \times 2\pi}$

$f = \frac{1}{2\pi\sqrt{LC}}$

$$\Rightarrow \boxed{X_L = X_C}$$



$$\omega L = \frac{1}{\omega C}$$

$$\omega^2 = \frac{1}{LC}$$

$$\omega = \frac{1}{\sqrt{LC}}$$

$$f = \frac{1}{2\pi\sqrt{LC}}$$

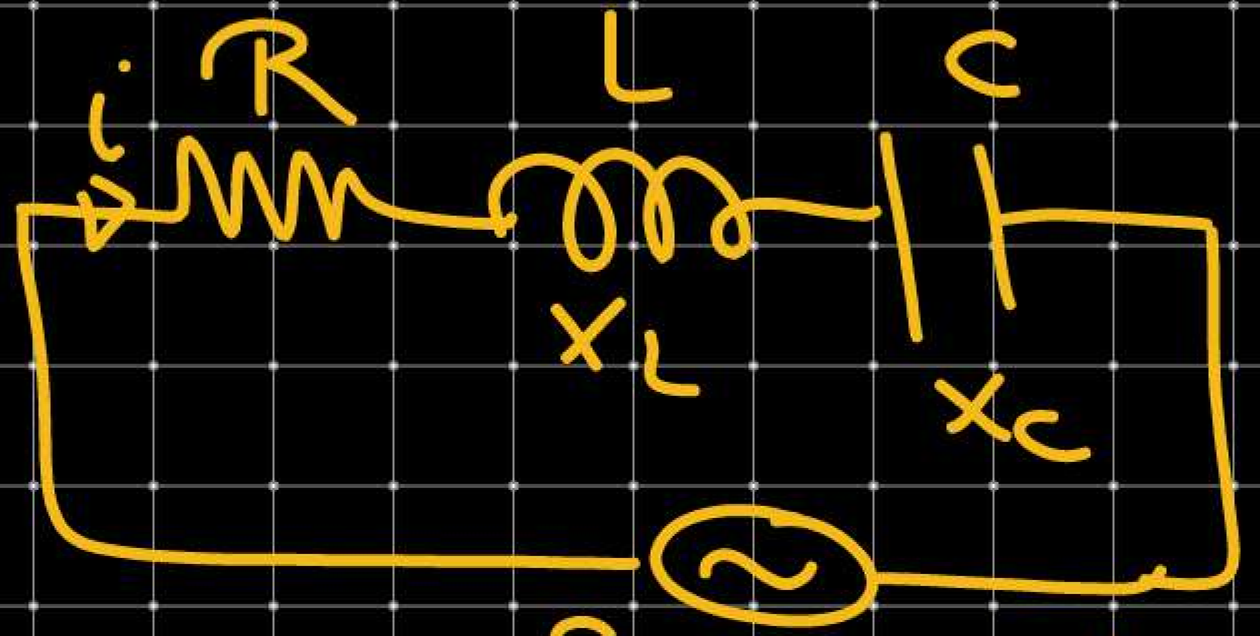
At Resonance

$$\Rightarrow X_L = X_C$$

$$iX_L = iX_C$$

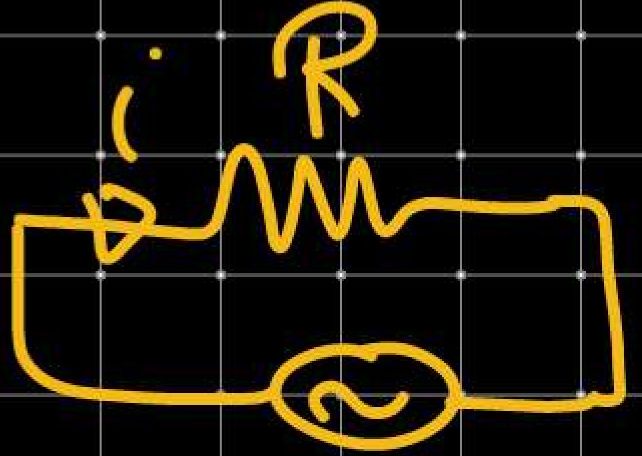
$$\Downarrow$$

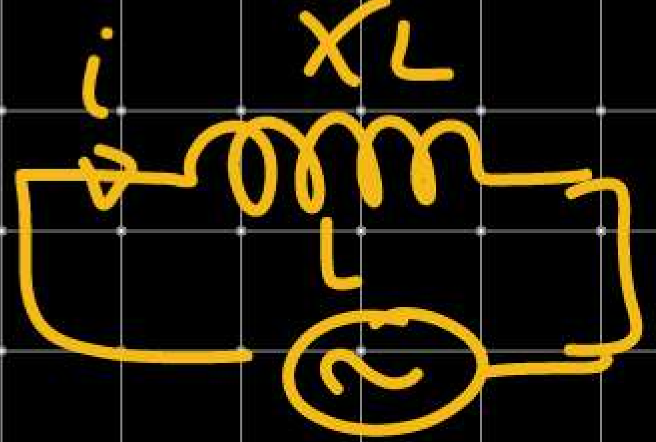
$$\boxed{V_L = V_C}$$



$\varepsilon = \varepsilon_0 \sin \omega t$

#1



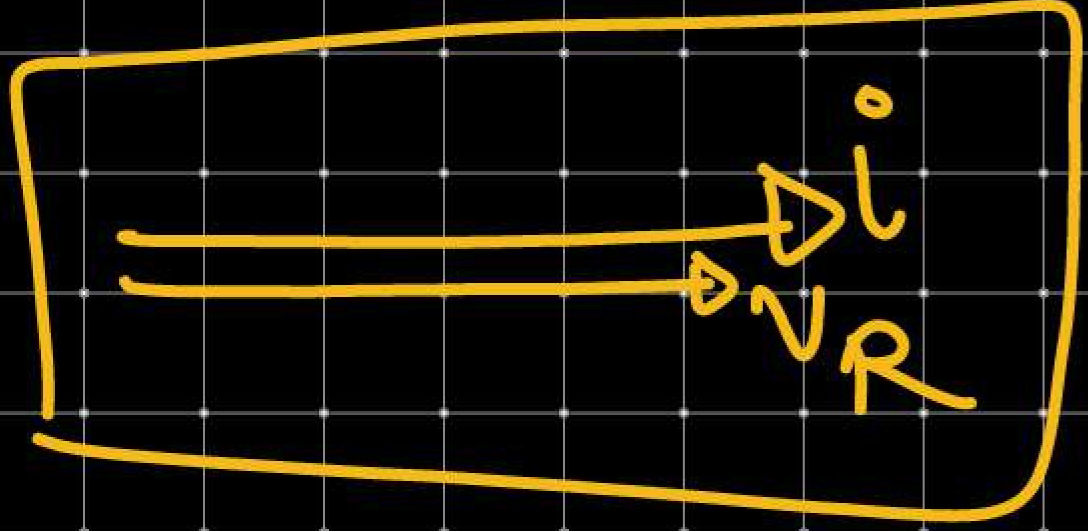


$$\varepsilon = \varepsilon_0 \sin \omega t$$

$$\varepsilon = \varepsilon_0 \sin \omega t$$

$$i = \frac{\varepsilon_0}{R} \sin \omega t$$

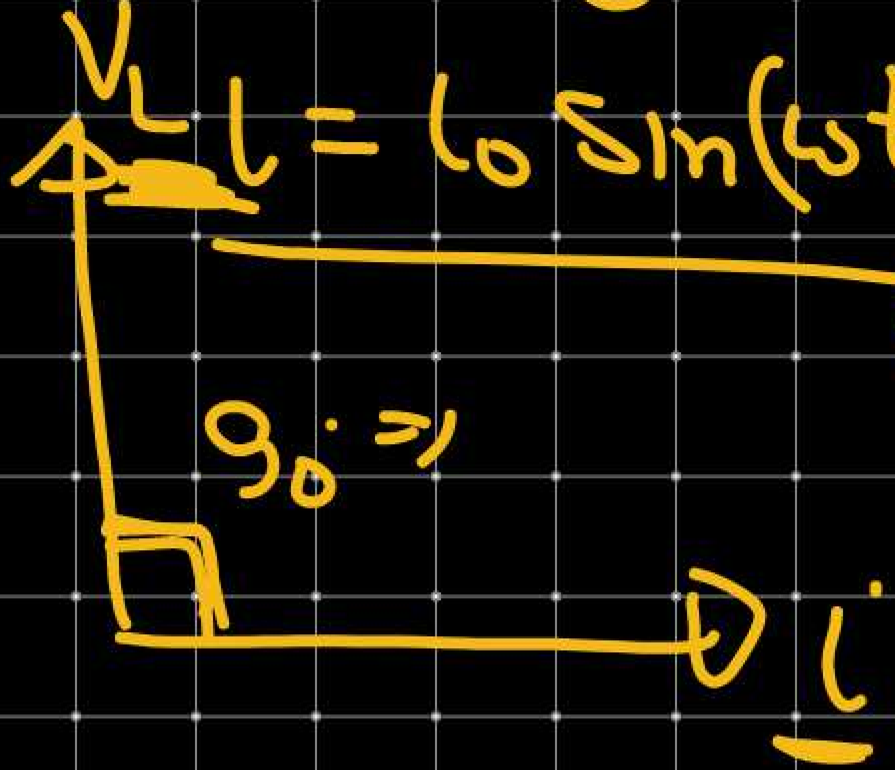
$$i_0 = \frac{\varepsilon_0}{X_L} \sin\left(\omega t - \frac{\pi}{2}\right)$$



$$i = i_0 \sin \omega t$$

$$i = i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$$

$$\Delta \phi = 0$$



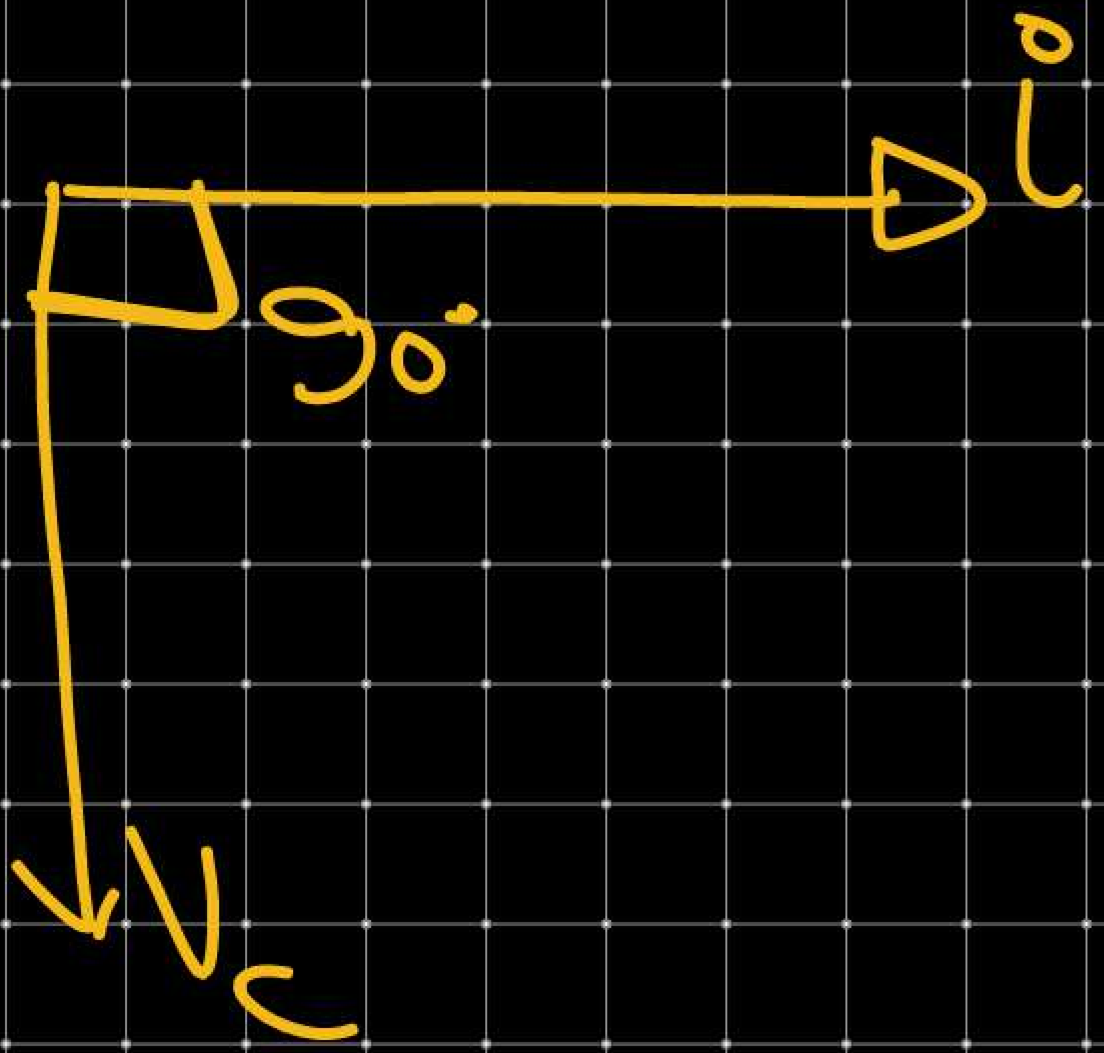
V_L lead $\frac{\pi}{2}$ with i

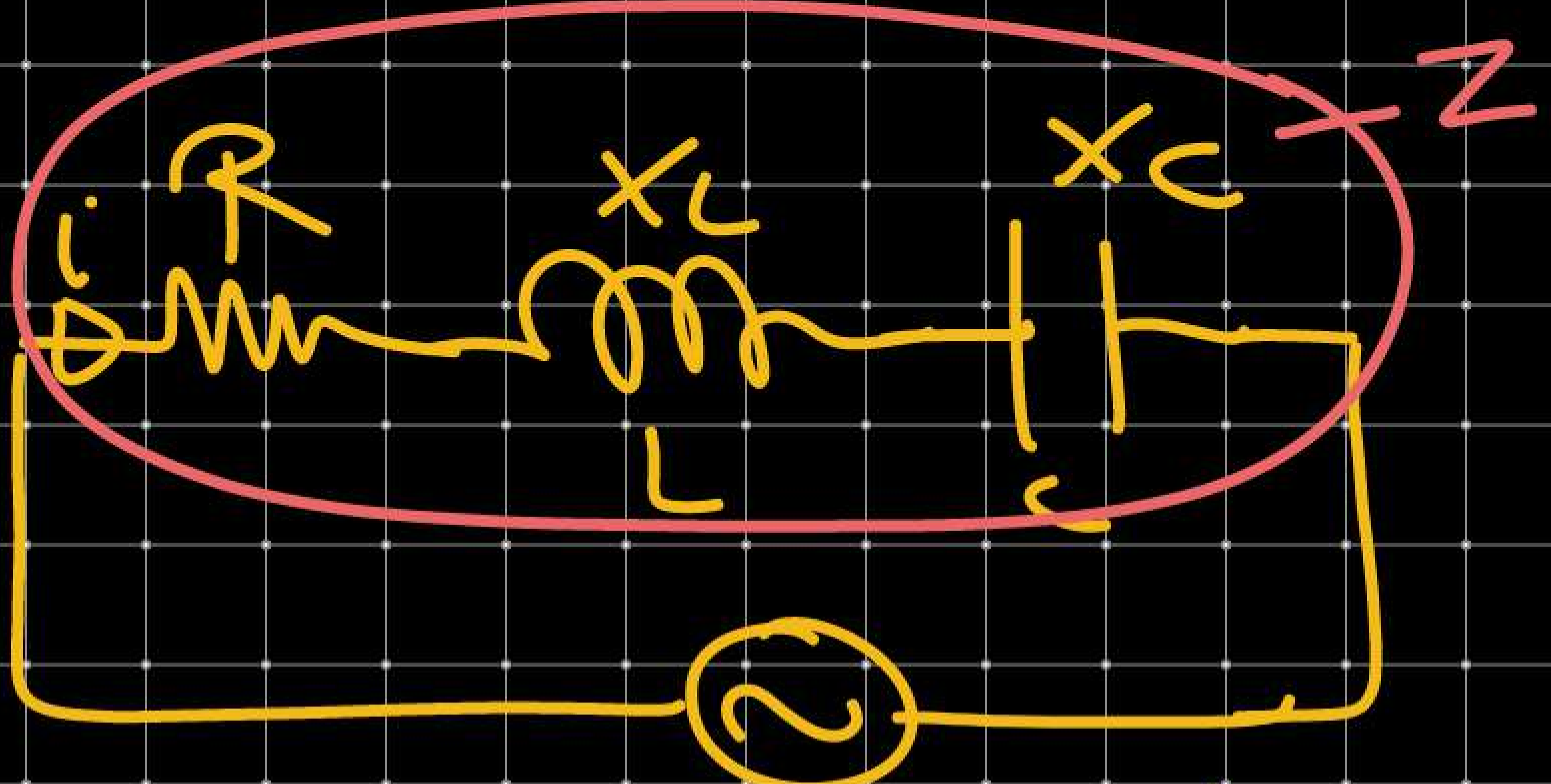
i lead $\frac{\pi}{2}$ with ε

$$\varepsilon = \varepsilon_0 \sin \omega t$$

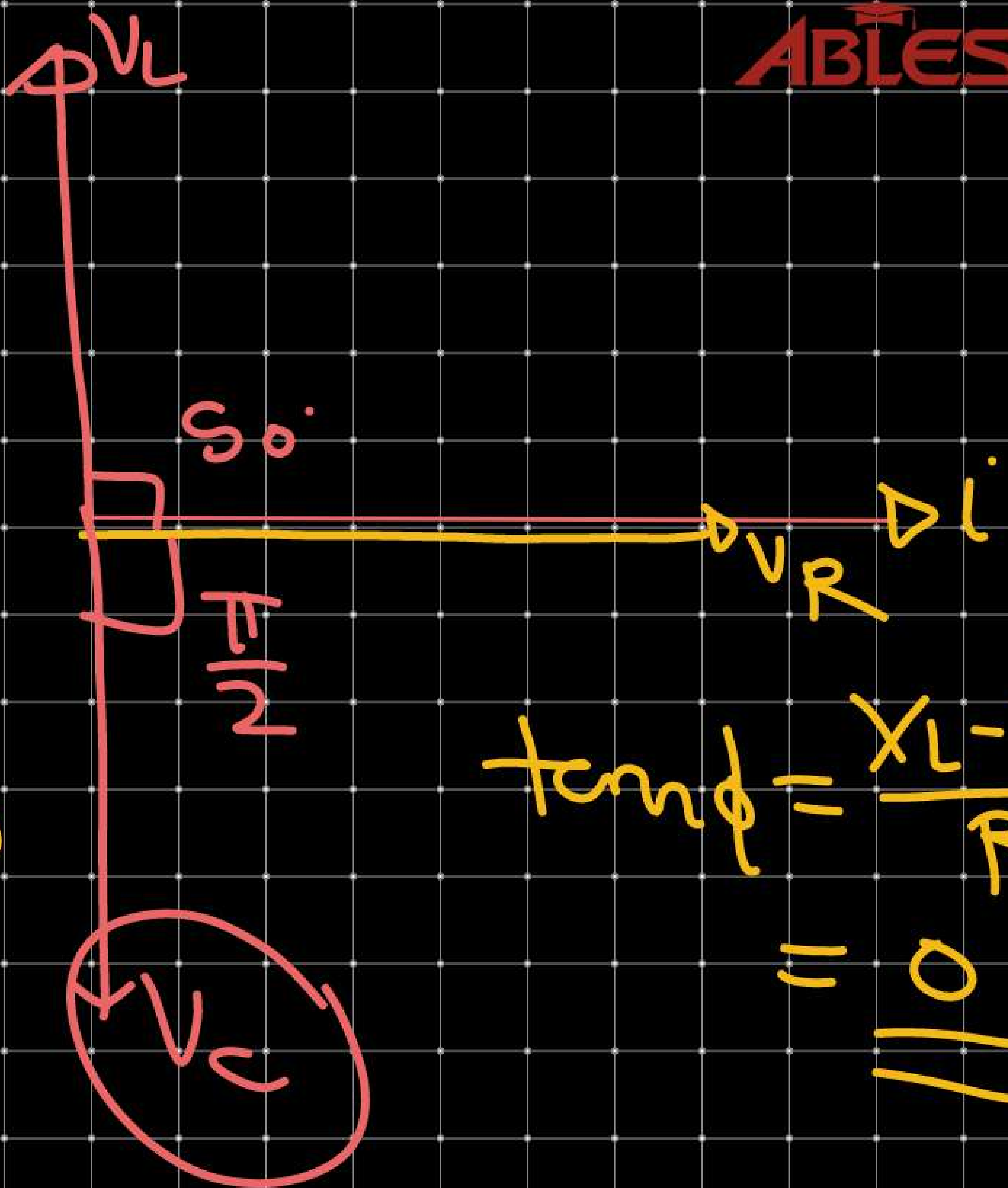
$$\Rightarrow \quad i = \frac{\varepsilon_0}{X_C} \sin\left(\omega t + \frac{\pi}{2}\right)$$

$$i = i_0 \sin\left(\omega t + \frac{\pi}{2}\right)$$



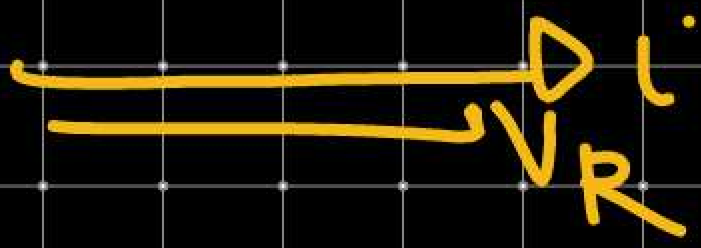


$\varepsilon = \varepsilon_0 \sin\omega t$



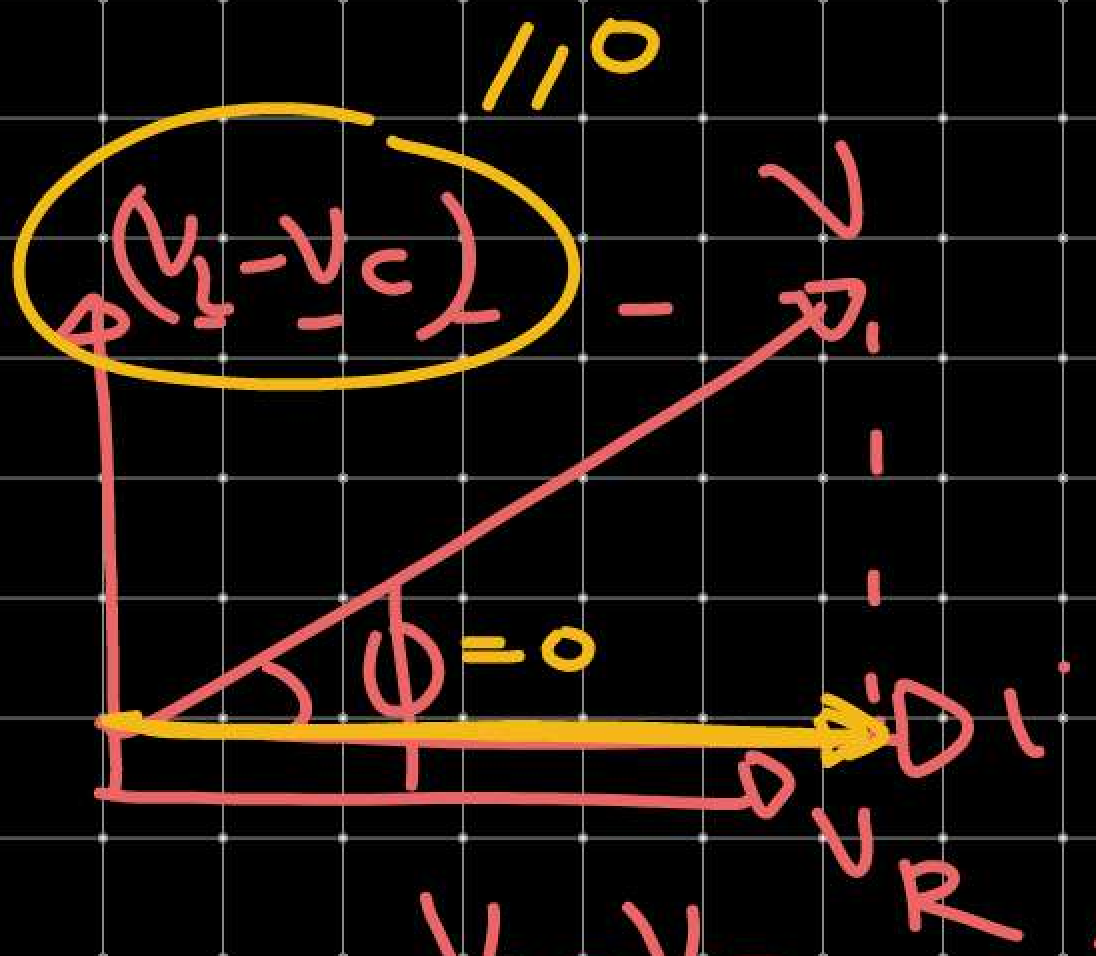
\# If $X_L = X_C$

$V_L = V_C$ $\quad$ $V_L - V_C = 0$



$$\tan\phi = \frac{X_L - X_C}{R}$$

$$= \underline{\underline{0}}$$



$$V_{net} = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$$iZ = \sqrt{(iR)^2 + (iX_L - iX_C)^2}$$

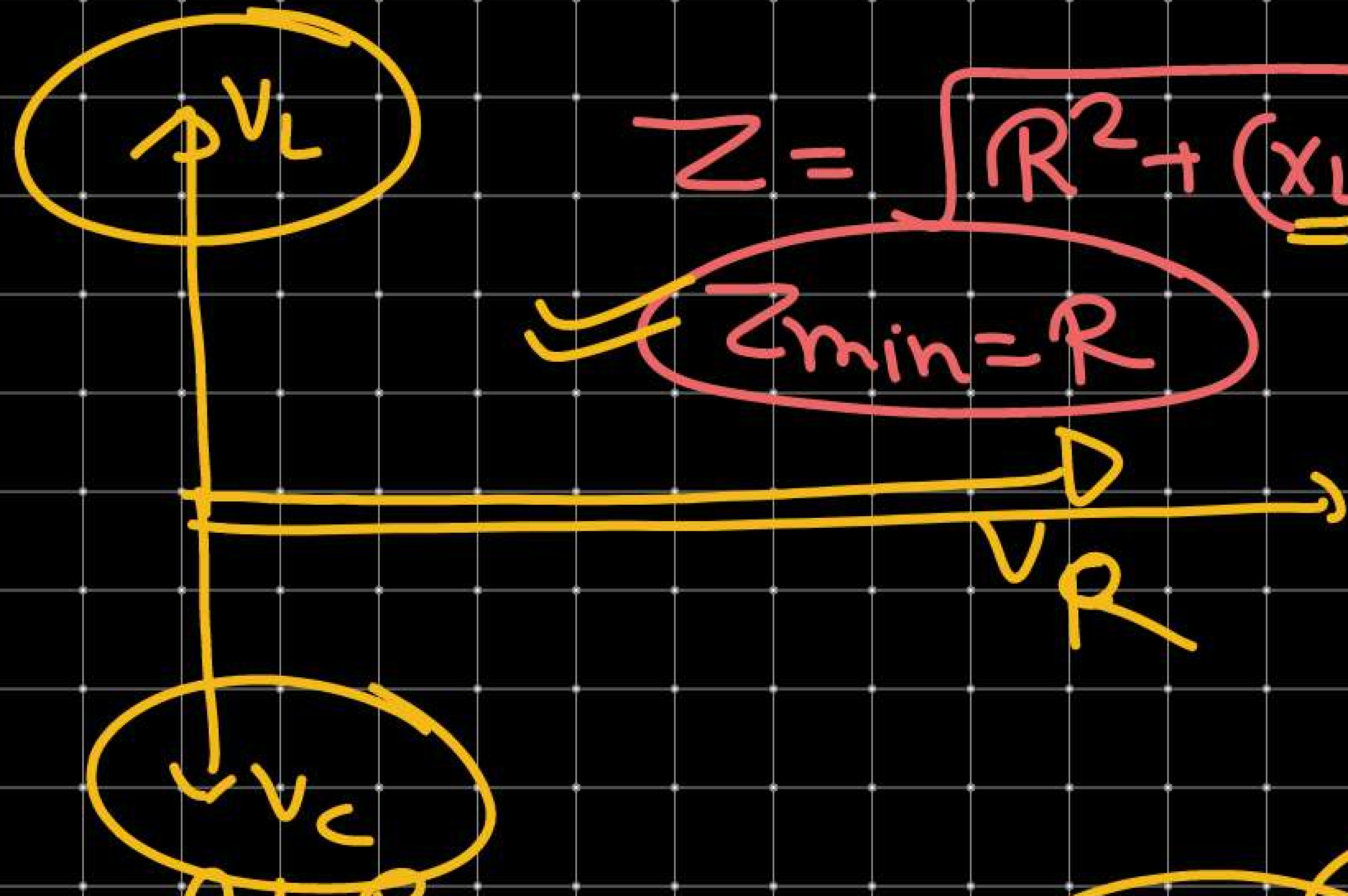
$$\cancel{i} Z = \sqrt{\cancel{i^2} R^2 + \cancel{i^2} (X_L - X_C)^2}$$

$$\boxed{Z = \sqrt{R^2 + (X_L - X_C)^2}}$$

$$\tan\phi = \frac{V_L - V_C}{V_R}$$

$$\tan\phi = \frac{\cancel{i} X_L - \cancel{i} X_C}{\cancel{i} R}$$

$$\tan\phi = \frac{X_L - X_C}{R}$$

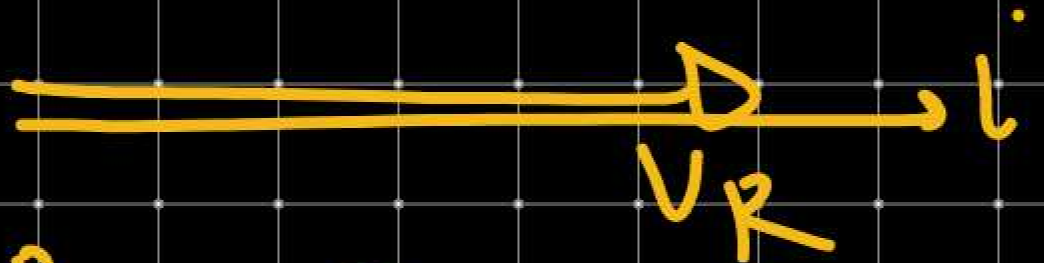


$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z_{min} = R$$

$$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

$i =$



$\Sigma \, \epsilon f i = 0$

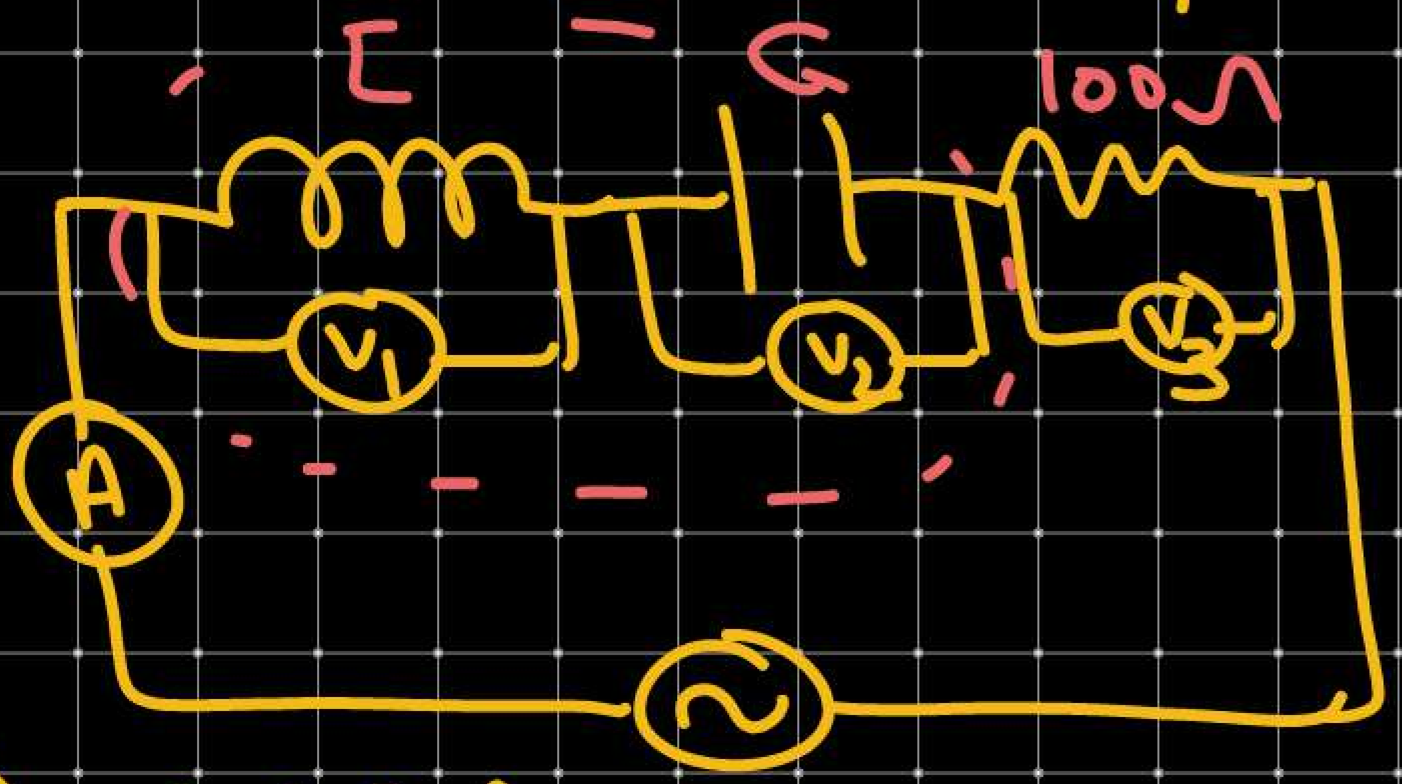
Phase diff $= 0$

$\Rightarrow$ At Resonance Condition

$\phi = 0$

$V_{net} = 0$

In the given ckt the reading of Voltmeter V_1 & V_2 are 300 volt each. the reading of V_3 & ammeter A are respectively.



(a) 220V, 2.0A   220V, 50Hz

(b) 220V, 2.2A

(c) 100V, 2.0A   (d) 150V, 2.2A.

Sol

$V_C = V_L$

$V_2 = V_1$

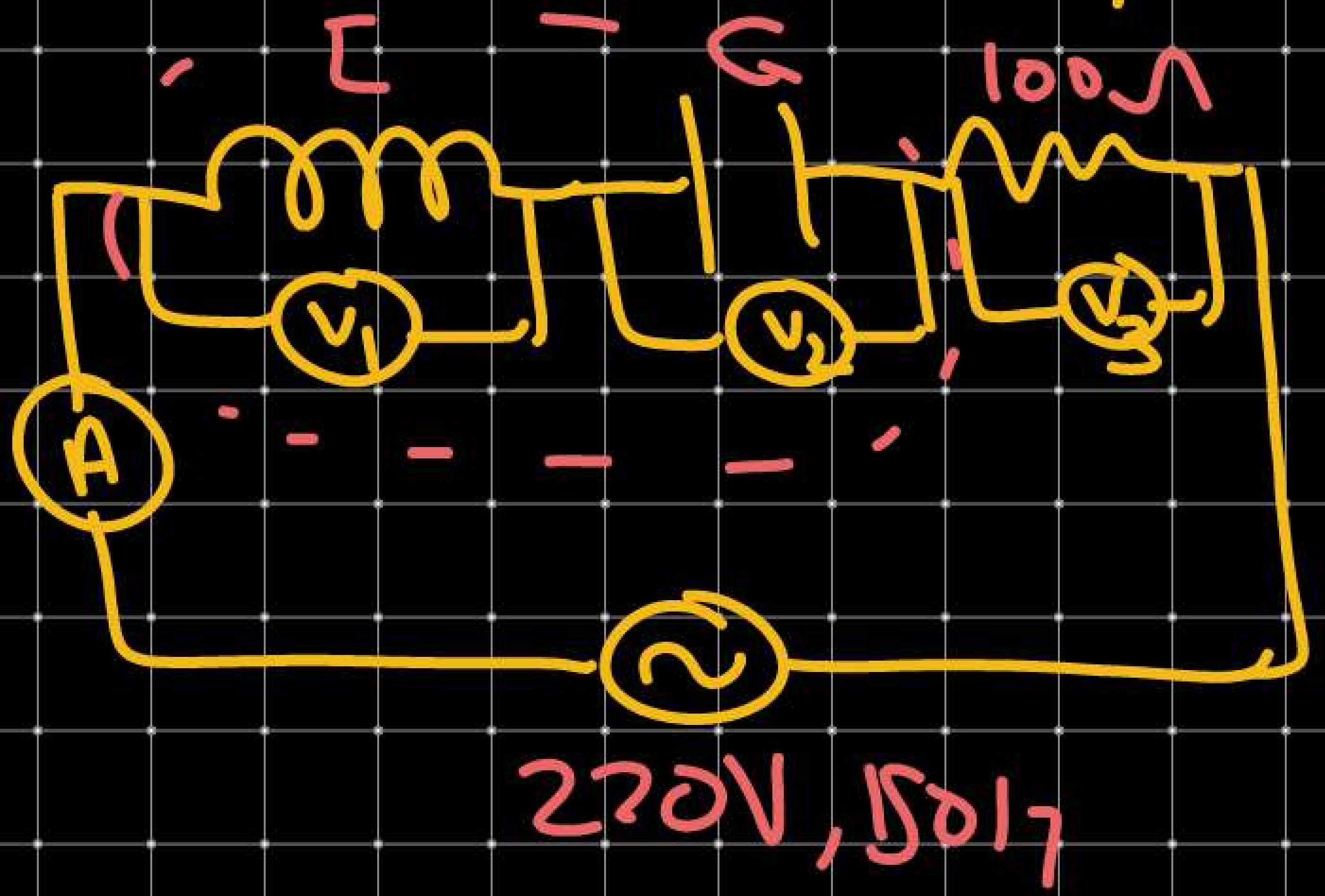
$220V = V_3$

$i_{rms} = \frac{V_{rms}}{R}$

$= \frac{220}{100}$

$= 2.2$ Amp

In the given ckt the reading of Voltmeter V_1 & V_2 are 300 volt each. the reading of V_3 & ammeter A are respectively.



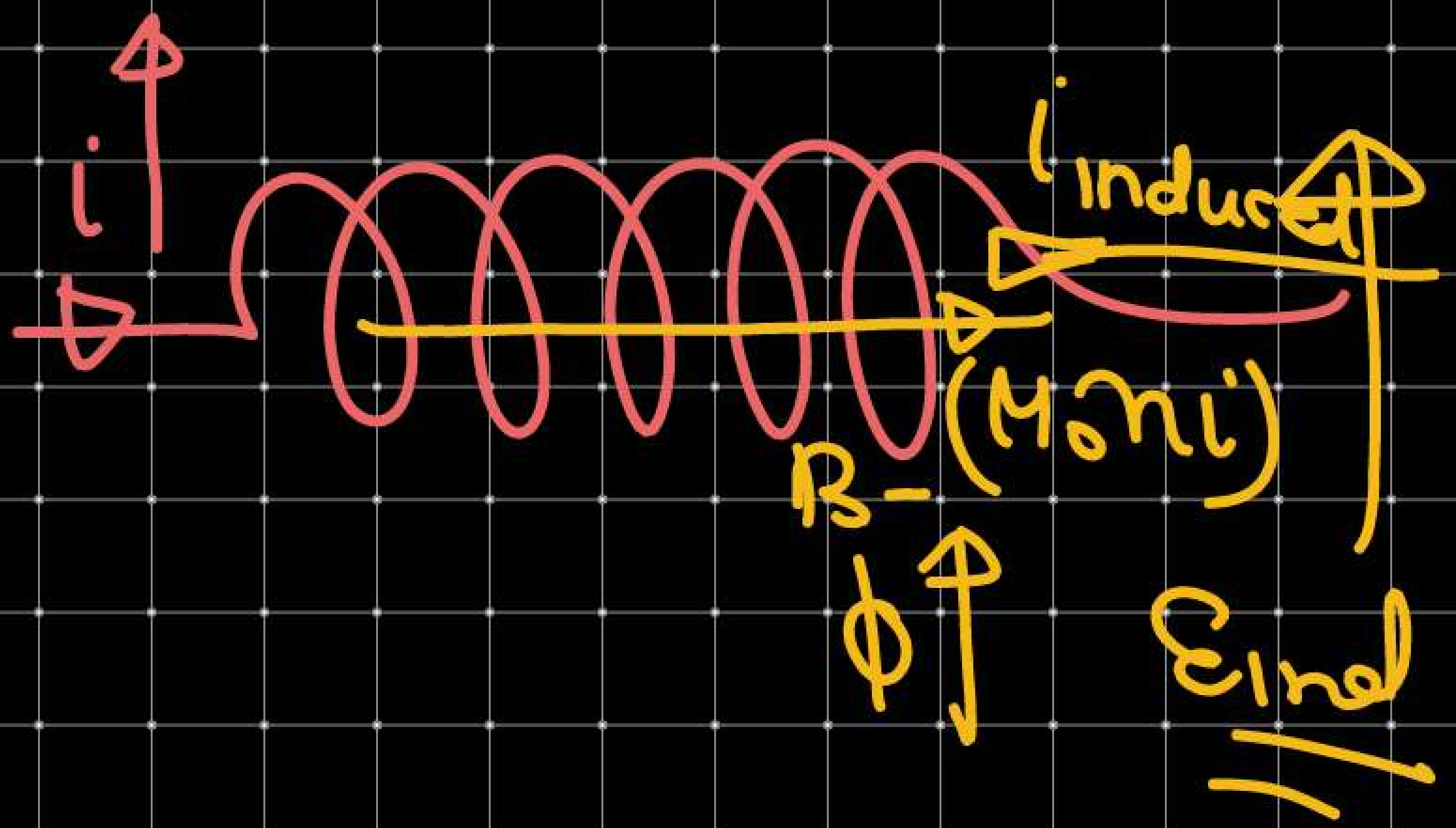
$$V = \sqrt{V_R^2 + (V_L - V_C)^2}$$

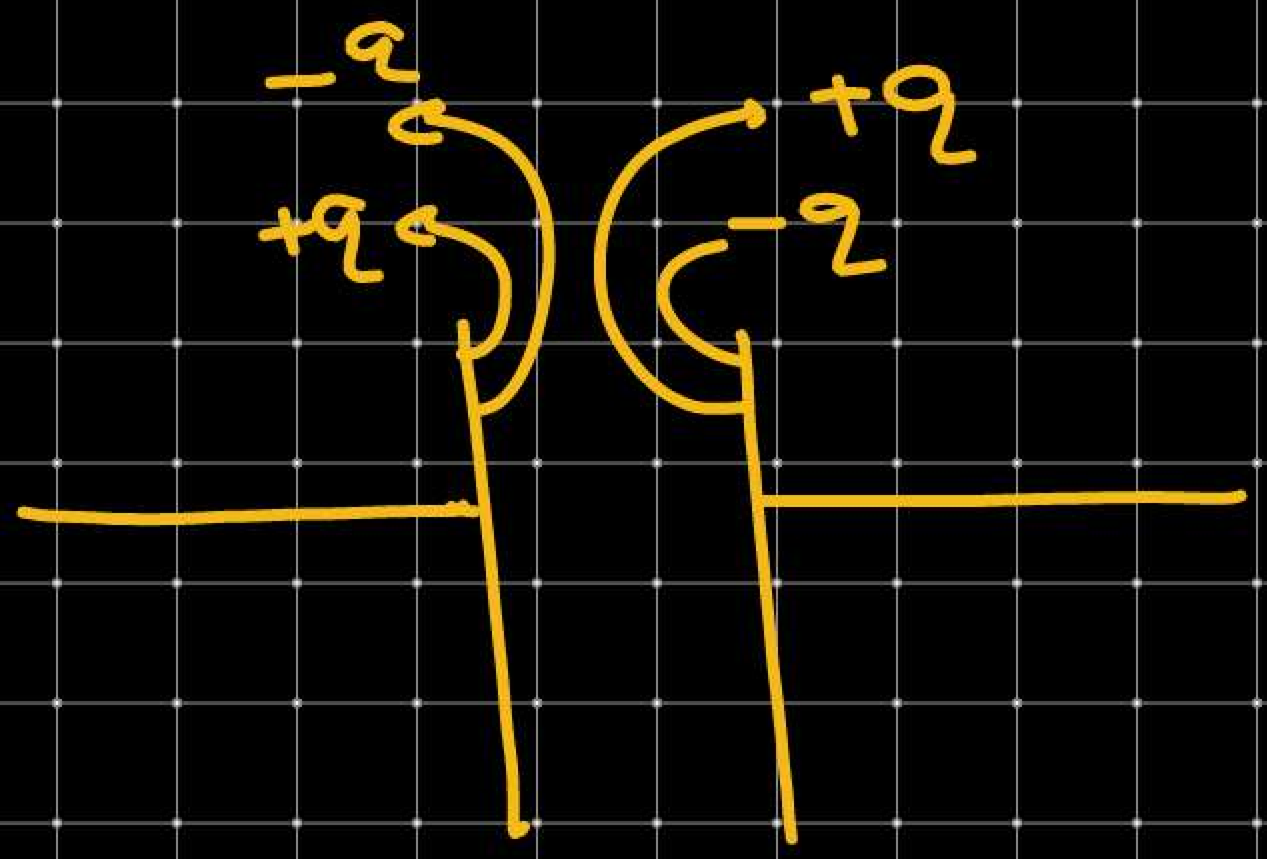
$$220V = \sqrt{V_R^2 + 0}$$

$$220V = V_R$$

$$220 = i \times 100$$

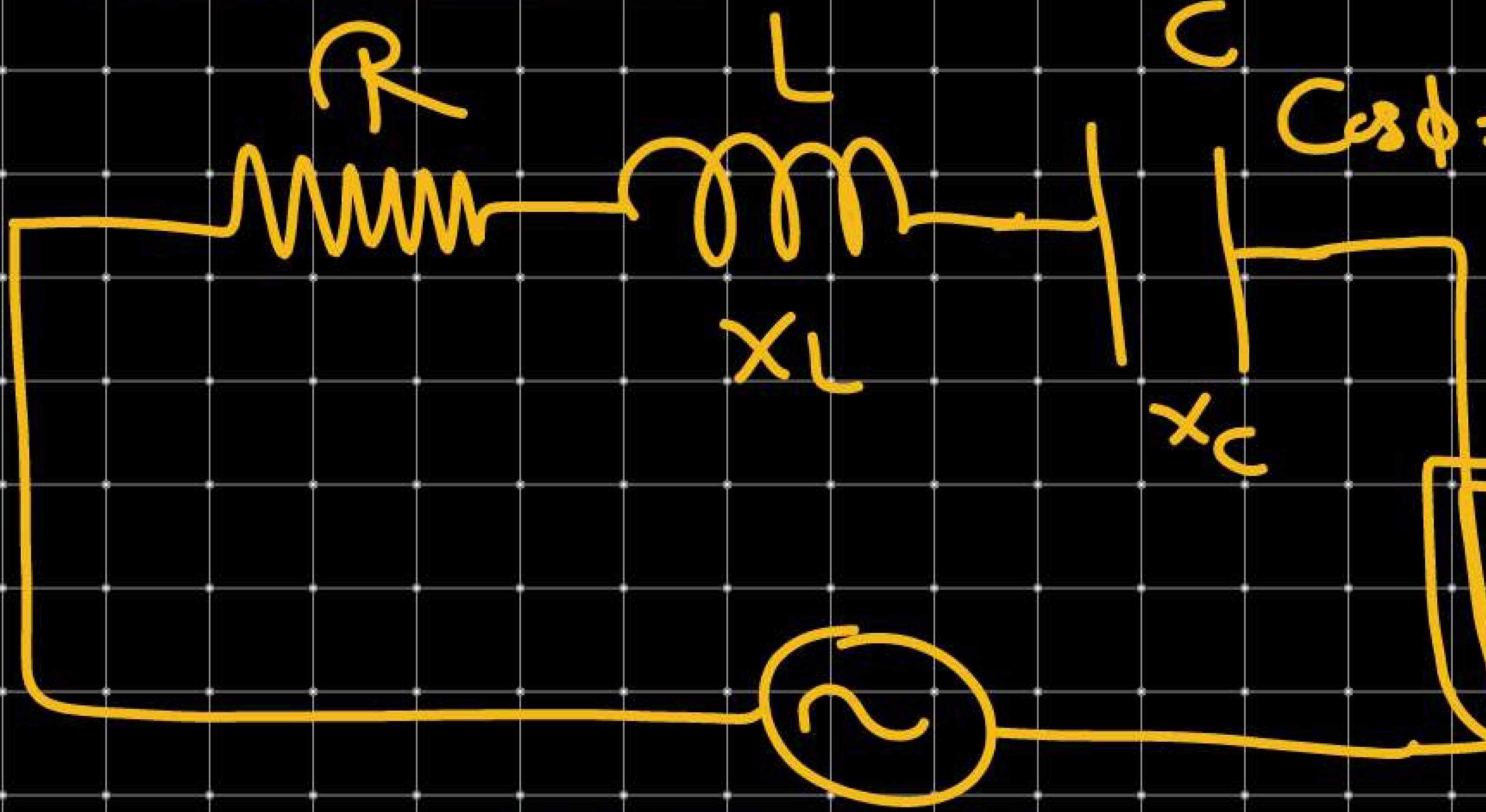
$$i = 2.2 \text{ Amp}$$


i
$i_{induced}$
$B - (\mu_0 n i)$
$\phi \uparrow$
ε_{ind}



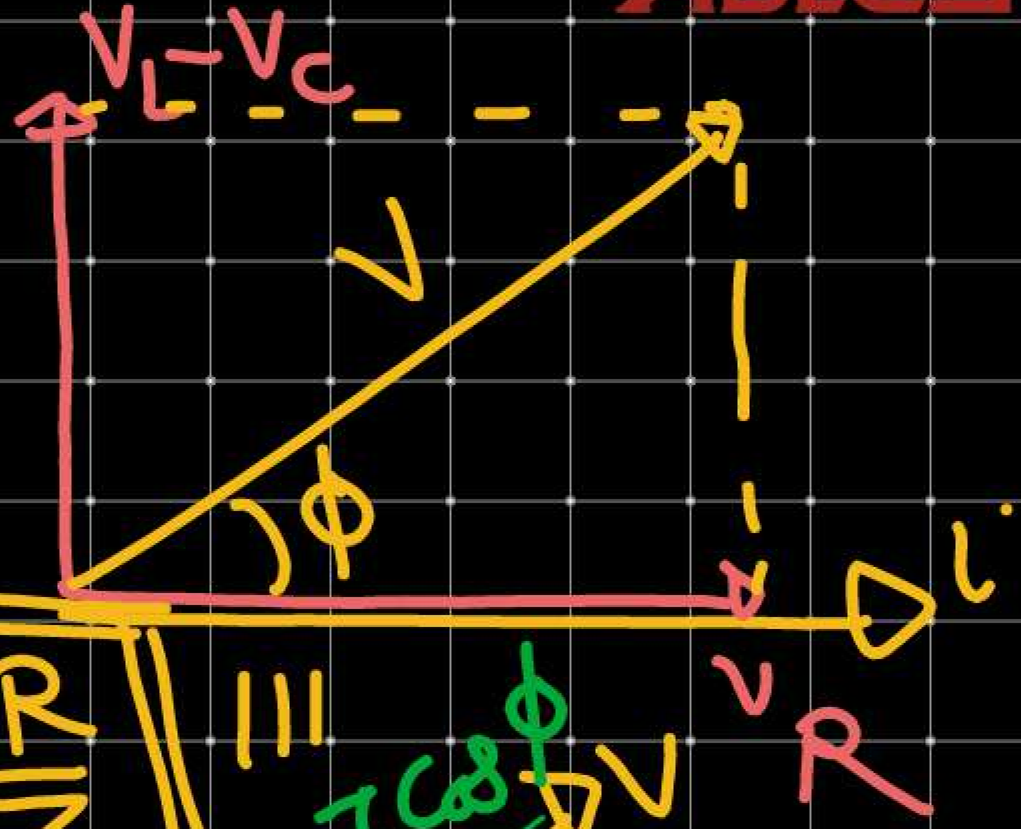
$\mathcal{E} = \mathcal{E}_0 \sin\omega t$

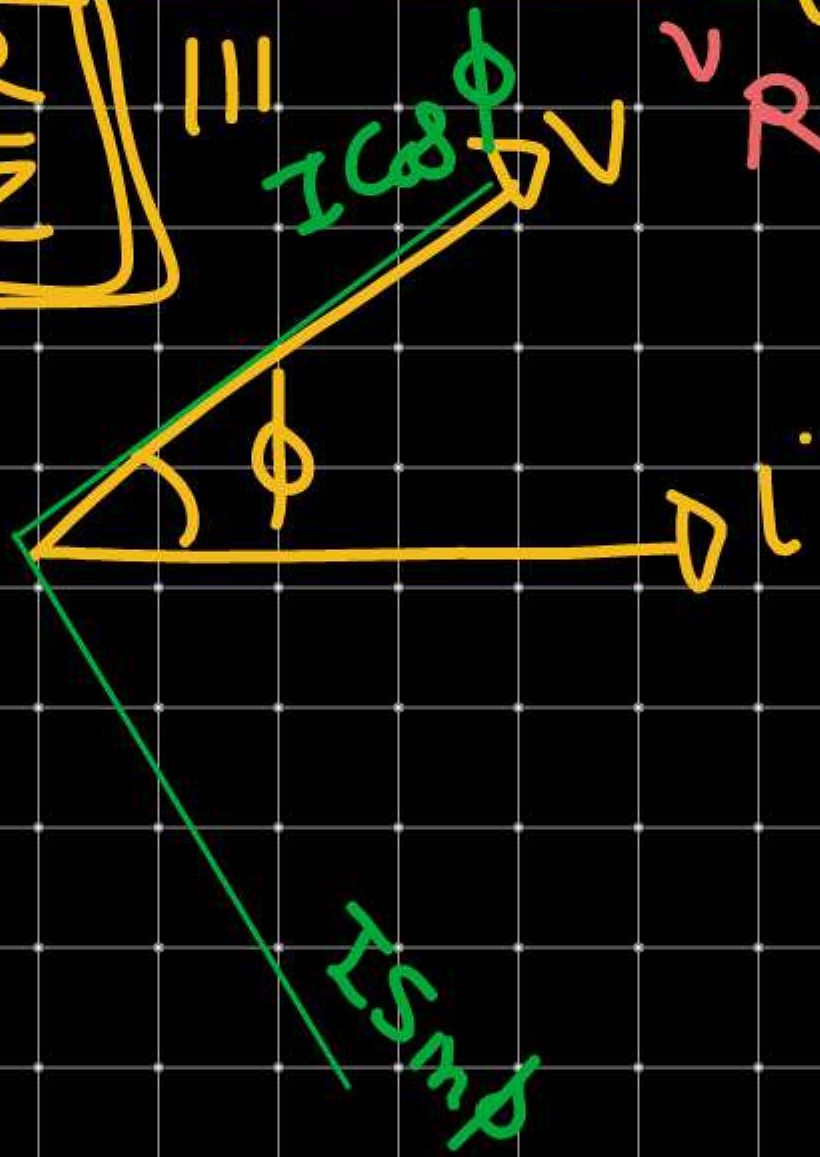
Power in LCR



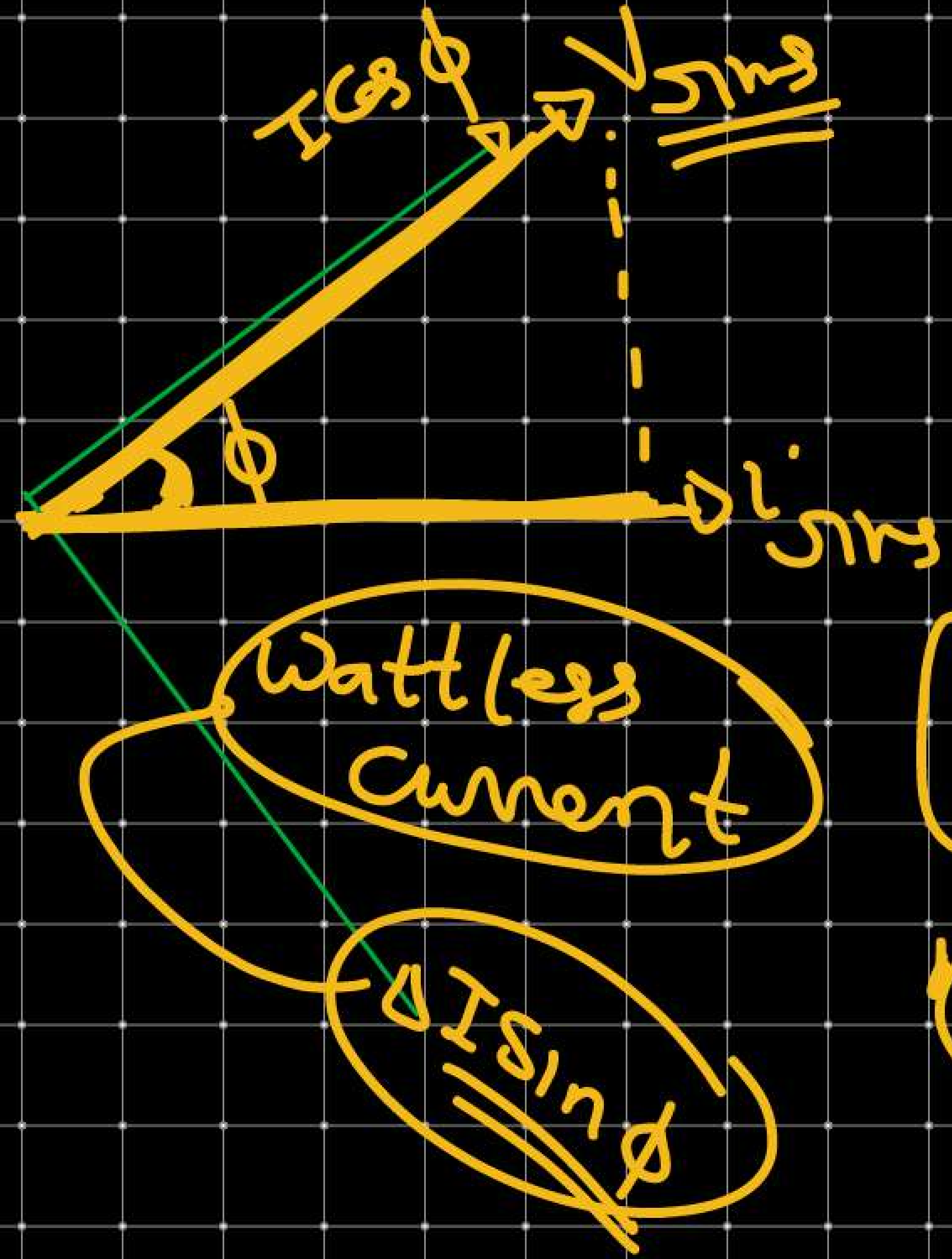
$$\cos\phi = \frac{V_R}{V} = \frac{\cancel{i}R}{\cancel{i}Z}$$

$$\boxed{\cos\phi = \frac{R}{Z}}$$





$$\boxed{\tan\phi = \frac{V_L - V_C}{V_R} = \frac{X_L - X_C}{R}}$$



Power in AC with LCR

$$P = V_{rms} I_{rms} \cos\phi$$

** $\cos\phi \rightarrow$ Power factor

$$\boxed{\cos\phi = \frac{R}{Z}} \qquad \boxed{\cos\phi = \frac{R}{Z} = \frac{V_R}{V}}$$

Useful current $\rightarrow I\cos\phi$

Power In AC Circuit

$$\boxed{P = V_{rms} I_{rms} \cos\phi}$$

$V_{rms} \rightarrow$ rms value of Voltage

$I_{rms} \rightarrow$ rms value of Current

$V_0 \rightarrow$ Peak value of Voltage

$I_0 \rightarrow$ Peak value of Current

$$P = \frac{V_0}{\sqrt{2}} \times \frac{I_0}{\sqrt{2}} \cos\phi$$

$$P = \frac{V_0 I_0}{2} \cos\theta$$

$$P = \frac{V_0 I_0}{2} \cos\phi$$

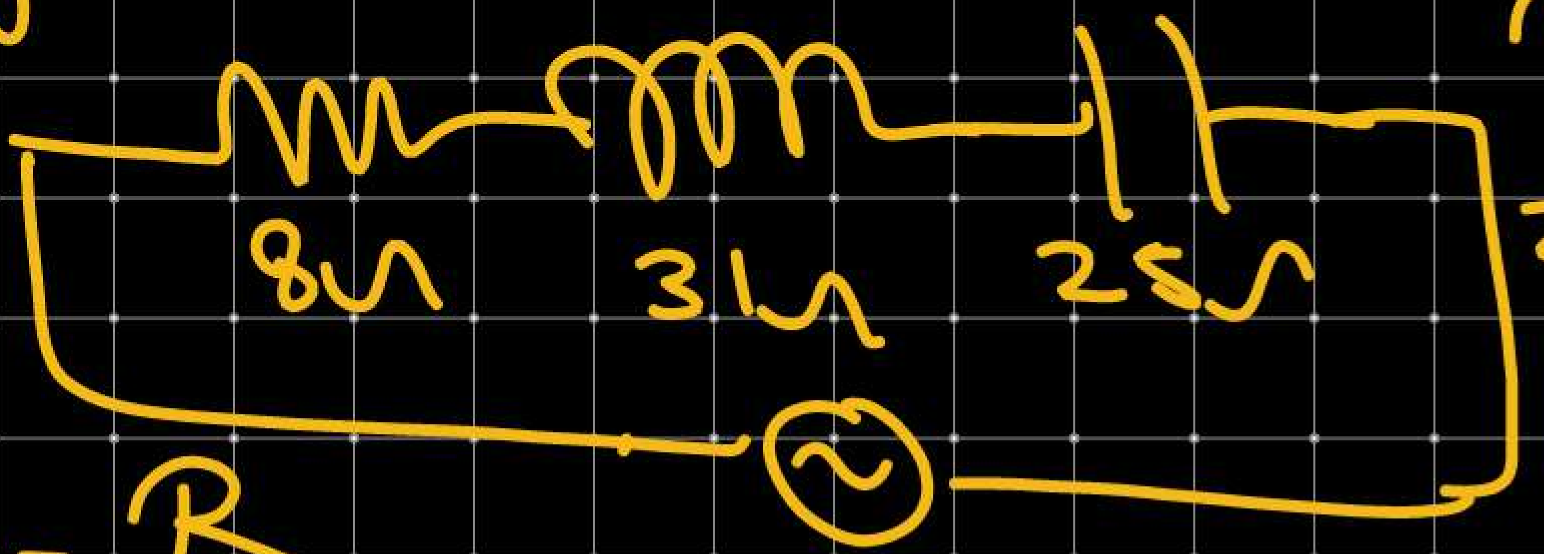
A Coil of inductive reactance 31 Ω has a resistance 8 Ω. it is placed in series with a Capacitive of Capacitive reactance 25 Ω. The Comb is Connected by an AC Source $\underline{110\,\text{Volt}}$. The Power factor of Circuit is.

(a) 0.33 $\underline{\tan\phi}$

(b) 0.80

(c) 0.64

(d) 0.56



$R = 8\,\Omega$

$Z = \sqrt{8^2 + (31-25)^2}$

$= \sqrt{64+36}$

$= \underline{10\,\Omega}$

$\cos\phi = \dfrac{R}{Z}$

$\cos\phi = \dfrac{8}{10} = \underline{0.8}$

Q2) $\varepsilon = \varepsilon_0 \sin\omega t$

$I = I_0 \sin(\omega t - \phi)$

(Power) = ?

(a)

(b)

(c)

(d)

$\varepsilon = \varepsilon_0 \sin\omega t$

$i = i_0 \sin(\omega t - \phi)$

Phase diff $= \phi$.

$(P_{av}) = ?$

$P = \frac{V_0 I_0}{2} \cos\phi$

(a) $\frac{E_0 I_0}{2} \cos\phi$

(b) $E_0 I_0$

(c) $\frac{E_0 I_0}{2}$

(d) $\frac{E_0 I_0}{2} \sin\phi$.

ϕ = Phase diff b/w ε & I

$P = V_{rms} I_{rms} \cos\phi$

$P_{av} = \frac{\varepsilon_0 I_0}{2} \cos\phi$

$$i = \frac{1}{\sqrt{2}} \sin 100\pi t$$

$$e = \frac{1}{\sqrt{2}} \sin\left(100\pi t + \frac{\pi}{3}\right)$$

$$(P_{av}) = ?$$

$$P_{av} = V_{rms} I_{rms} \cos\phi$$

$$= \frac{1}{\sqrt{2}\times\sqrt{2}} \times \frac{1}{\sqrt{2}\times\sqrt{2}} \cos\frac{\pi}{3}$$

$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8} \text{ Watt}$$