Q.) The relation b/w an AC voltage source and time in SI Unit $V = 120 \sin(100\pi t) \cos 100\pi t$. The peak value of Voltage & frequency

(a) 60V & 100Hz.

(b) 60V & 200Hz.

(c) 120V & 100Hz.

(d) $\frac{120}{\sqrt{2}}$ & 100Hz.

So) $E = E_0 \sin\omega t$

$V = 120 \sin 100\pi t \cos 100\pi t$

$= 60 \times (2 \sin 100\pi t \cdot \cos 100\pi t)$

$V = 60 \sin 200\pi t$

$V = V_0 \sin\omega t$

$\omega = 200\pi$

Peak value $\Rightarrow V_0 = 60$ Volt.

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

$V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{60}{\sqrt{2}} = 30\sqrt{2}\,V.$

$f = \frac{1}{T} = \frac{\omega}{2\pi} = \frac{200\pi}{2\pi} = 100Hz$

$$\sin 2\theta = 2\sin\theta \cdot \cos\theta$$

$$\sin 2(\omega\pi t) = 2\sin(\omega\pi t)\cos(\omega\pi t)$$

$$= \sin 2\omega\pi t$$

Q21) $I = I_0 \cos\omega t$ find I_{rms} of I_0.

Sol) $\overline{I} = I_0 \sin\omega t$

$I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$

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

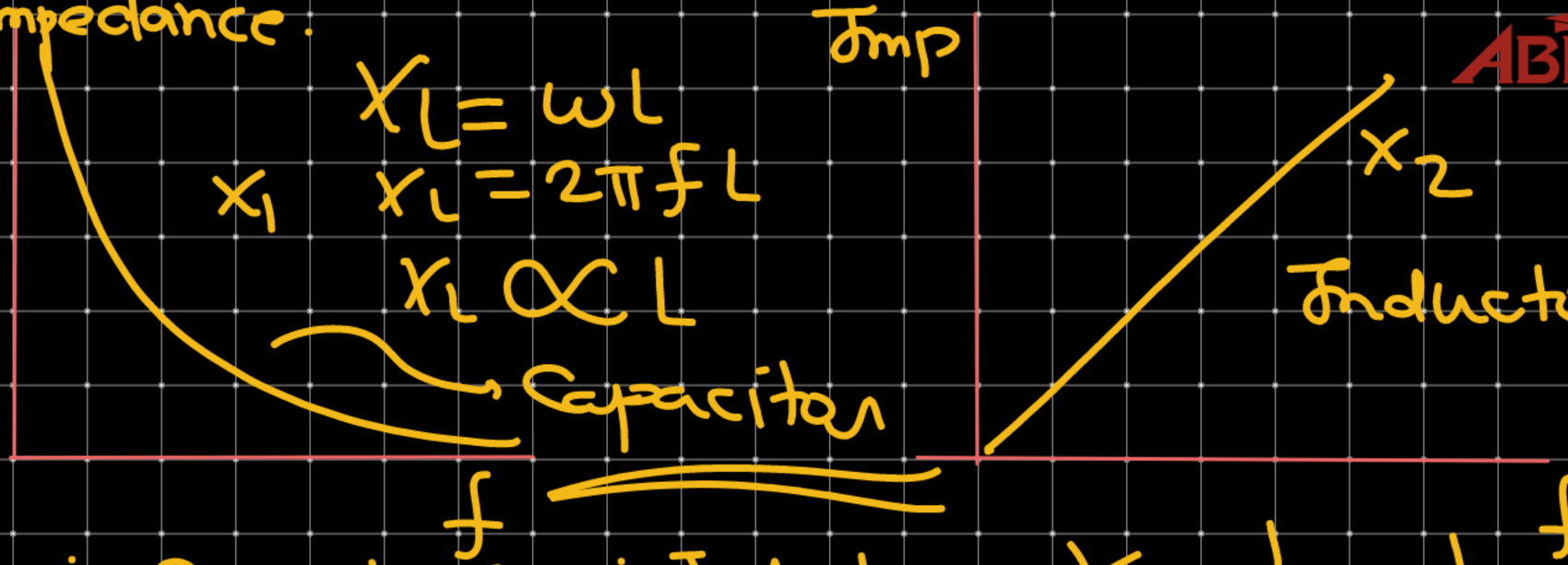
$\sin(90^\circ - \theta) = \cos\theta$

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

$I_{peak} = I_0$

$I_{rms} = \frac{I_0}{\sqrt{2}}$.

Q3) Impedance.



$X_L = \omega L$

$X_L = 2\pi f L$

$X_L \propto L$

$X_L \propto f$

(a) X_1 is Capacitor & X_2 is Inductor. $X_L = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

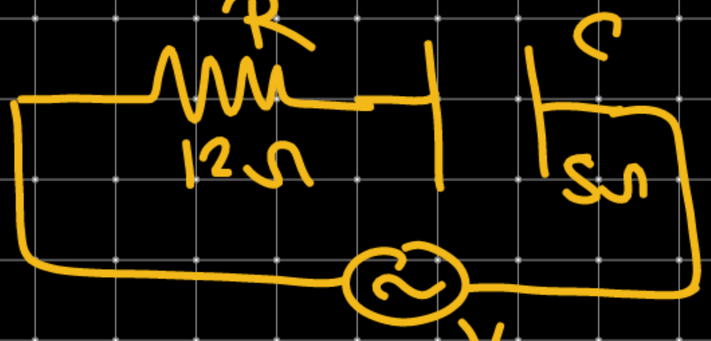
(b) X_2 is " " X_1 " ".

$X_C \propto \frac{1}{f}$

(c) X_1 is Inductor & X_2 is Capacitor

(d) N.O.T.

Q)



Find $Z = ?$

(a) 13Ω ✓

(b) $\sqrt{119}\,\Omega$

(c) 6Ω

(d) 8Ω.

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

$X_L = 0$

$$Z = \sqrt{(12)^2 + (0-5)^2}$$

$$= \sqrt{144 + 25}$$

$$= \sqrt{169}$$

$$= 13\Omega$$

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

$Z \rightarrow$ Impedance

95)

X_L — Inductive reactance

X_C — Capacitive reactance

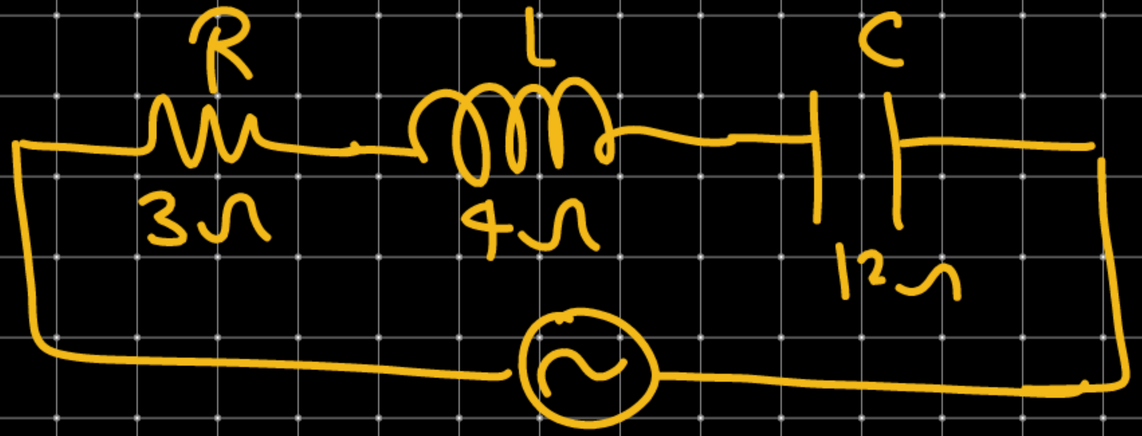
$Z = ?$

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

$$Z = \sqrt{5^2 + (12 - 0)^2}$$

$$= \sqrt{25 + 144} = \sqrt{169} = 13\,\Omega.$$

Q6:-



$Z = ?$

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

$$Z = \sqrt{3^2 + (4 - 12)^2}$$

$$= \sqrt{9 + 64} = \sqrt{73}\ \Omega$$

87)

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

$$\omega = 2\pi f$$

If Capacitance is 2MF & frequency is 100Hz. find X_C = ?

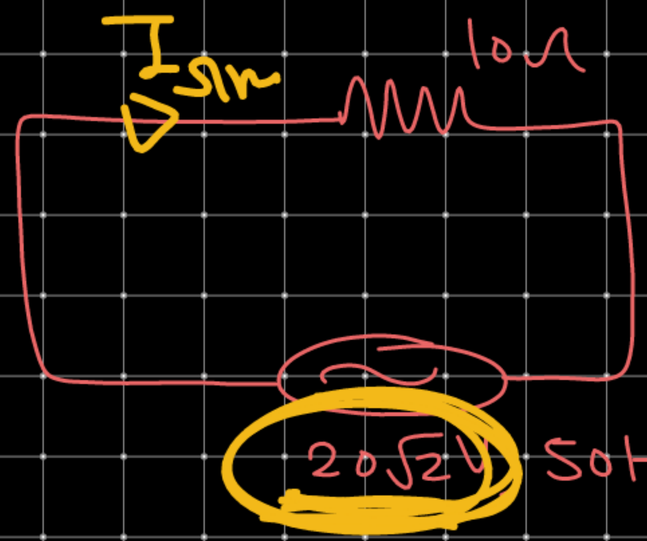
$$X_C = \frac{1}{2\pi f C}$$

$$X_C = \frac{1}{2\pi f C}$$

$$X_C = \frac{1}{2\pi \times 100 \times 2 \times 10^{-6}}$$

$$= \frac{1}{4\pi \times 10^{-4}} = \frac{10^4}{4\pi}\ \Omega$$

Q7)

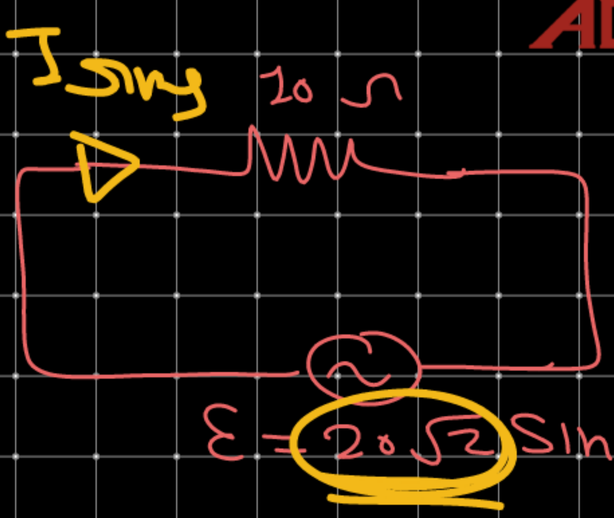


$\Rightarrow V_{rms} = 20\sqrt{2}$ Volt

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

$$= \frac{20\sqrt{2}}{10} = 2\sqrt{2}\ \text{Amp}$$

Q2)



$\mathcal{E}_0 = 20\sqrt{2}$ Volt

$$\mathcal{E}_{rms} = \frac{\mathcal{E}_0}{\sqrt{2}} = \frac{20\sqrt{2}}{\sqrt{2}} = 20\ \text{Volt}$$

$$I_{rms} = \frac{\mathcal{E}_{rms}}{R} = \frac{20}{10} = 2\ \text{Amp}$$

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L-C-R Circuit.

→ Find Potential Across each C, L, R

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

Step II: $\mathcal{E}_{rms} = \frac{E_0}{\sqrt{2}}$

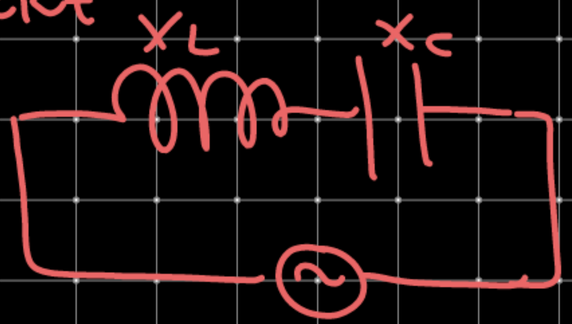
Step III) $i_{rms} = \frac{\mathcal{E}_{rms}}{Z}$

$V_L = i_{rms} X_L$

$V_C = i_{rms} X_C$

$V_R = i_{rms} \times R$

Q8) If $X_L = 50\Omega$ & $X_C = 40\Omega$. Calculate effective value of Current in given ckt



Solve) [Note → effective value ⇓ [rms value]]

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

$= \sqrt{0 + (50 - 40)^2}$

$= \sqrt{10^2} = \underline{10\Omega}$

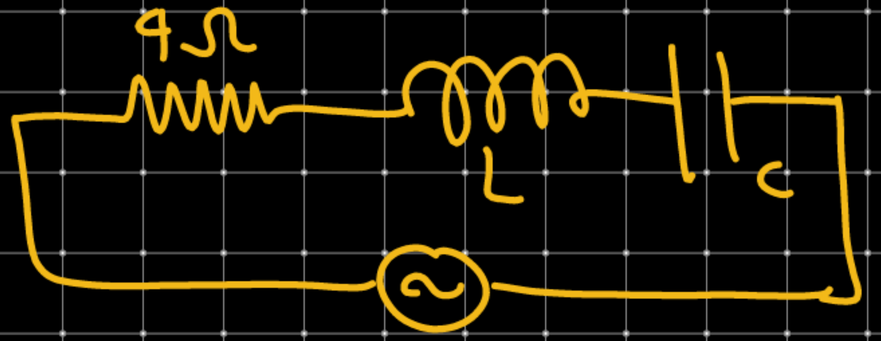
$Z = 10\Omega$

(ii) $V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{40}{\sqrt{2}} = 20\sqrt{2}$ V.

(iii) $I_{rms} = \frac{V_{rms}}{Z} = \frac{20\sqrt{2}}{10} =$

$= 2\sqrt{2}$ Amp

Q9) Find I_{rms}, $X_L = 24\Omega$ $X_C = 21\Omega$



Step I) Z

Step II - V_{rms}.

Step III) $I_{rms} = \frac{V_{rms}}{Z}$.

(I) $Z = \sqrt{4^2 + (24-21)^2}$

$Z = \sqrt{16+9} = 5\Omega$.

(II) $V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{200\sqrt{2}}{\sqrt{2}}$

$V_{rms} = 200$ Volt.

(III) $I_{rms} = \frac{V_{rms}}{Z} = \frac{200}{5}$

$= 40$ Amp

Q9) Find I_{rms}, $X_L = 24\Omega$ $X_C = 21\Omega$

$V_{rms} = 200V$

$40A = I_{rms}$ $V = 200\sqrt{2}\sin 100\pi t$

$V_L = i_{rms} X_C$

$= 40 \times 21$

$= 210 \times 4 = 840$ Volt

$V_R = i_{rms} \times R$

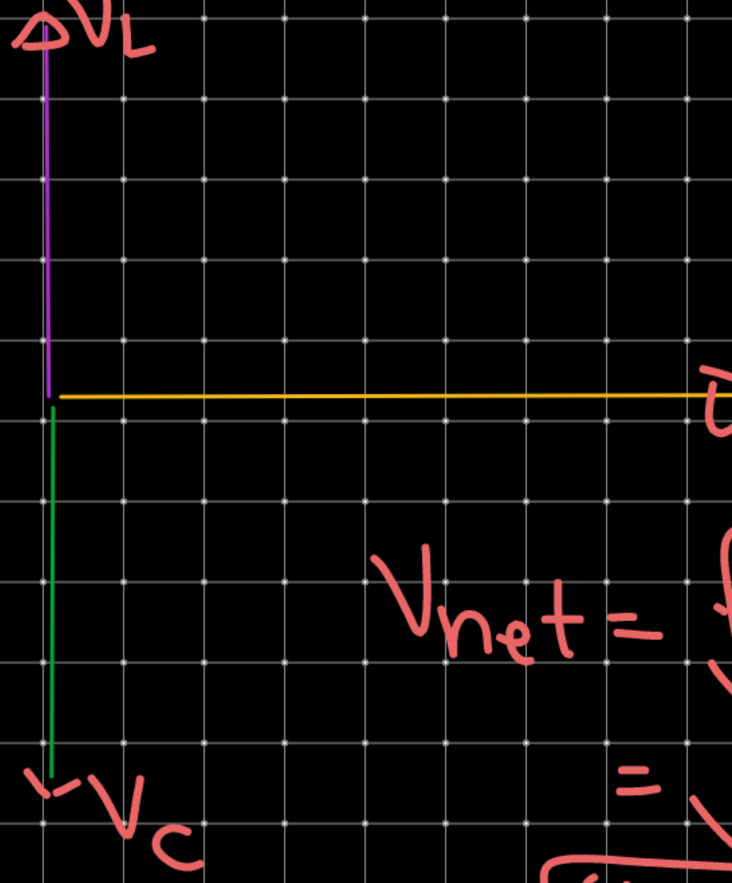
$= 40 \times 4$

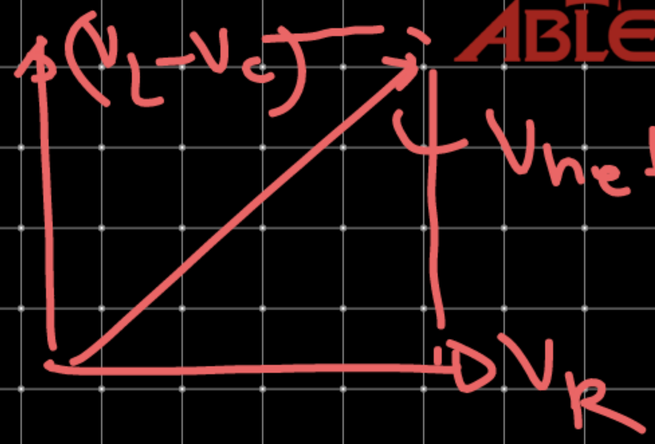
$= 160$ Volt

$V_L = i_{rms} X_L$

$= 40 \times 24$

$= 240 \times 4 = 960V$





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

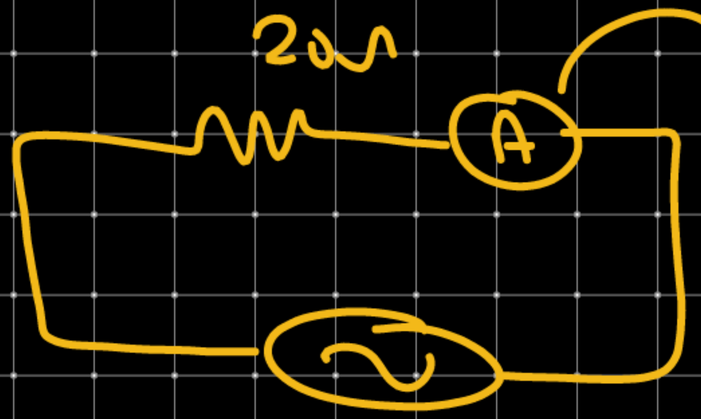
$$= \sqrt{(160)^2 + (960 - 840)^2}$$

$$= \sqrt{(160)^2 + (120)^2}$$

$$= 200 \text{ Volt}$$

Q10) A Voltage $V = 60 \sin \pi t$ Volt is applied across a 20Ω resistor. What will be ac ammeter in series with the resistor is read

Sol)



read I_{rms}

$$\mathcal{E}_{rms} = \frac{60}{\sqrt{2}} = 30\sqrt{2}$$

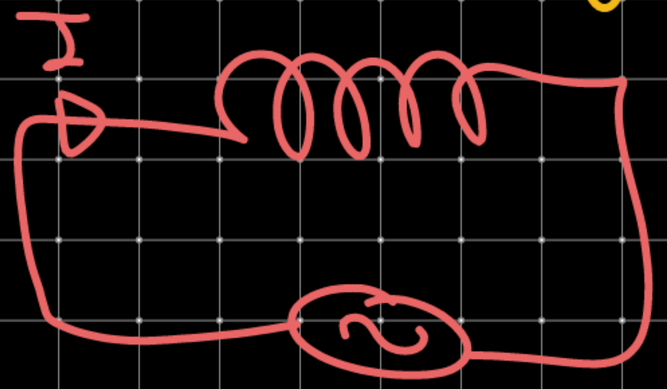
$$I_{rms} = \frac{\mathcal{E}_{rms}}{R}$$

$$= \frac{30\sqrt{2}}{20} = \frac{3}{\sqrt{2}} \text{ Amp}$$

$I_{rms} = ?$

Q.11) An AC Source $E = 100\sin(1000t)$ Volt is connected through a inductor of 10 mH. then Write the eqn of Current.

So)



$E = 100\sin(1000t)$

$E = 100\sin(1000t)$

$i = \frac{100}{X_L}\sin\left(1000t - \frac{\pi}{2}\right)$

Q12) A Capacitor of Capacity C is connected in AC Circuit. The applied emf is $V = V_0 \sin \omega t$ then current is

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(a) $I = \frac{V_0}{\omega L} \sin \omega t$

(b) $I = \frac{V_0}{\omega L} \sin\left(\omega t - \frac{\pi}{2}\right)$

(c) $I = V_0 \omega C \sin \omega t$

(d) $I = V_0 \omega C \sin\left(\omega t + \frac{\pi}{2}\right)$

$V = V_0 \sin \omega t$

$i = \frac{V_0}{X_C} \sin\left(\omega t + \frac{\pi}{2}\right)$

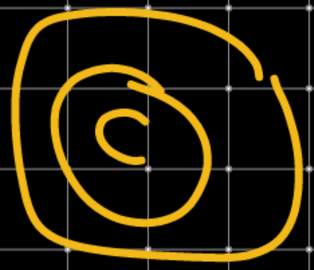
$= \frac{V_0}{\frac{1}{\omega C}} \sin\left(\omega t + \frac{\pi}{2}\right)$

$= V_0 \omega C \sin\left(\omega t + \frac{\pi}{2}\right)$

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

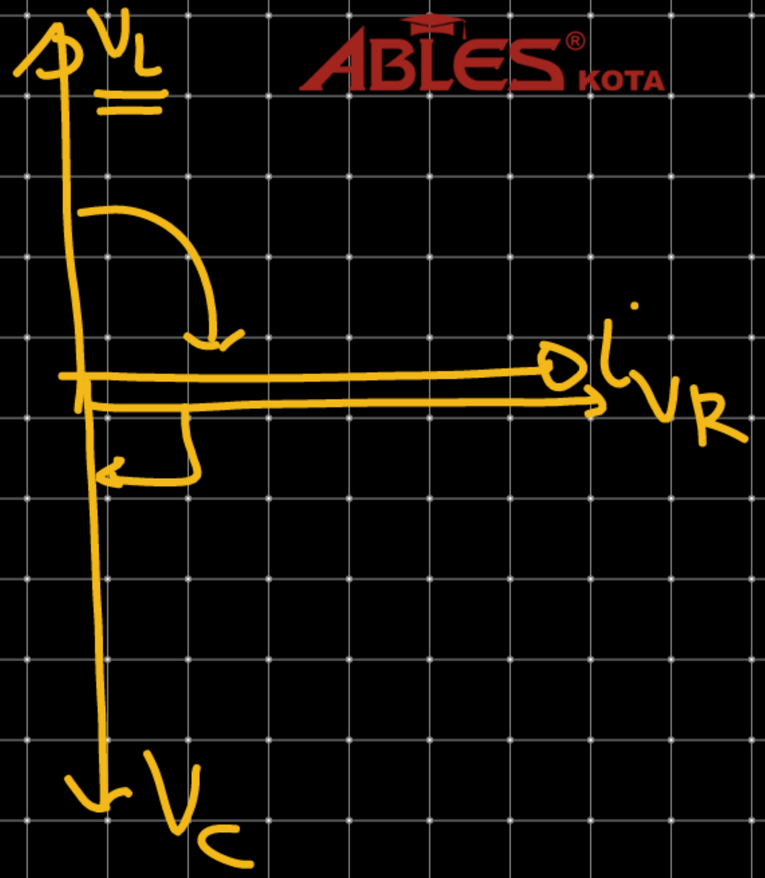
$i = \frac{\varepsilon_0}{\omega L} \sin\left(\omega t - \frac{\pi}{2}\right)$

↳ i lags by $\pi/2$ with ε_{mf}



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

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



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In Inductor

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

$$I = \frac{\mathcal{E}_0}{\omega L} \sin\left(\omega t - \frac{\pi}{2}\right)$$

In Capacitor

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

$$i = \frac{\mathcal{E}_0}{X_C} \sin\left(\omega t + \frac{\pi}{2}\right)$$

$$i = \frac{\mathcal{E}_0}{1/\omega C} \sin\left(\omega t + \frac{\pi}{2}\right)$$

In Inductor

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

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