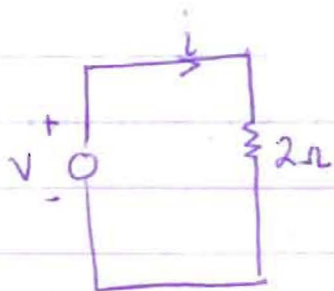


AC Steady State (Phasors)

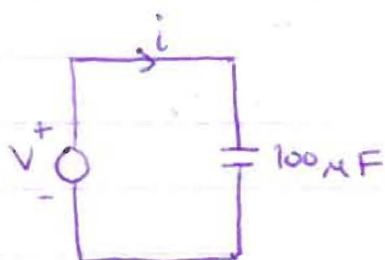


DC

$$\left\| \begin{array}{l} V = 10 \text{ V DC} \\ i = 5 \text{ A DC} \end{array} \right\|$$

AC

$$\left\| \begin{array}{l} v = 10 \cos(1000t) \\ i = 5 \cos(1000t) \end{array} \right\|$$



DC

$$\left\| \begin{array}{l} V = 10 \text{ V DC} \\ i = 0 \text{ A DC} \end{array} \right\|$$

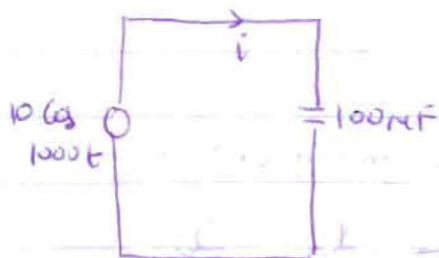
AC

$$V = 10 \cos(1000t)$$

$\underbrace{\quad}_{\text{rad}}$
 $\underbrace{\quad}_5$
 $\underbrace{\quad}_{\text{rad}}$

$$= -1 \sin 1000t$$

find i



$$i = \int \frac{dV}{dt}$$

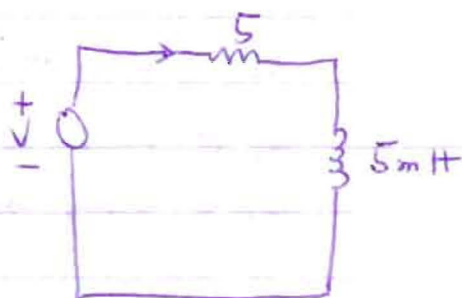
for $t=0$

$$i = 100 \mu\text{F} \cdot \frac{d}{dt} 10 \cos 1000t$$

$$= 100 \times 10^{-6} \cdot -\sin 1000t \cdot 1000$$

$$= 10^{-4} \times 10^4 - \sin 1000t$$

$$= -1 \sin 1000t$$



$$\left\| \begin{array}{l} V = 10 \text{ V DC} \\ i = 2 \text{ A DC} \end{array} \right\|$$

$$V = 10 \cos(1000t)$$

Soln

$$V = iR$$

Hence $V = V_R + V_L$

$$V = L \frac{di}{dt}$$



$$10 \cos(1000t) = 5i + 5m \dot{i}$$

Assume: $i = I_1 \cos(1000t) + I_2 \sin(1000t)$

$$i' = 1000 I_1 \sin(1000t) + 1000 I_2 \cos(1000t)$$

$$10 \cos(1000t) = \underbrace{5 I_1 \cos(1000t)}_{V_R} + \underbrace{5 I_2 \sin(1000t) + (-5000 I_1 \sin(1000t) + 5000 I_2 \cos(1000t))}_{V_L}$$

Group Cosines

$$\Rightarrow 10 \cos(1000t) = 5 I_1 \cos(1000t) + 5000 I_2 \cos(1000t)$$

$$10 = 5 I_1 + 5000 I_2$$

$$\frac{10}{5} = I_1 + 1000 I_2 \Rightarrow I_1 + 1000 I_2 = 2 \quad \text{--- (1)}$$

Group Sines

$$0 \sin(1000t) = 5 I_2 \sin(1000t) + (-5000 I_1 \sin(1000t))$$

$$0 = -1000 I_1 + I_2 \quad \text{--- (2)}$$

(2) into (1) sub for $I_2 \Rightarrow I_1 + 1000(1000 I_1) = 2$

$$I_1 (\sim 10^6) = 2$$

$$I_1 = \frac{2}{10^6} \Rightarrow 2 \mu\text{A} \quad \text{--- (3)}$$

from (1) sub (3)

$$1000 I_2 = 2 - 2 \mu\text{A} \approx 2$$

$$I_2 = 2 \text{ mA}$$

$$i(t) = 2 \mu\text{A} \cos(1000t) + 2 \text{ mA} \sin(1000t)$$

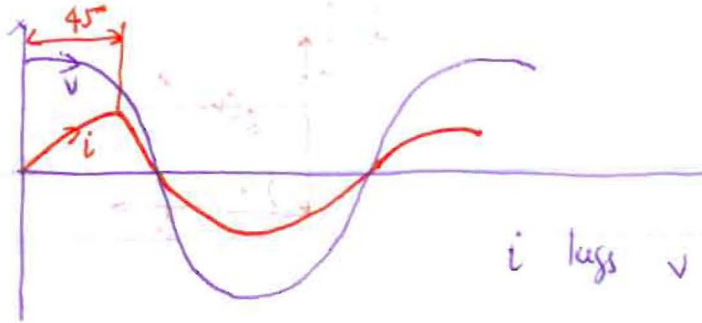
Note if $i(t) = \cos(1000t) + \sin(1000t)$
 $i(t) = \sqrt{2} \cos(1000t - 45^\circ)$
 \downarrow
 $\pi/4$

NB 2

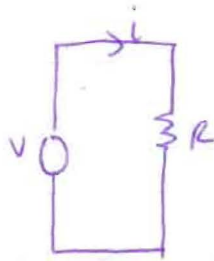
$f \rightarrow 60 \text{ Hz}$

$\omega \rightarrow 60 \text{ Cycle/sec} = \frac{2\pi \text{ rad/cycle}}{1 \text{ cycle}}$

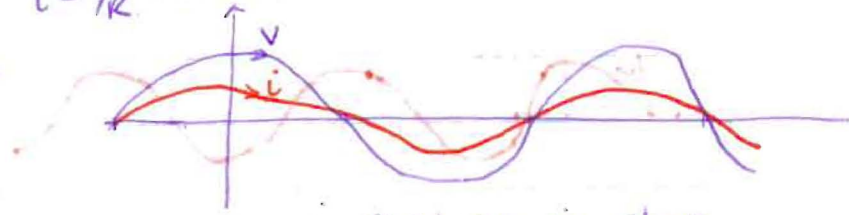
$\omega = 2\pi \cdot 60 \text{ rad/sec}$



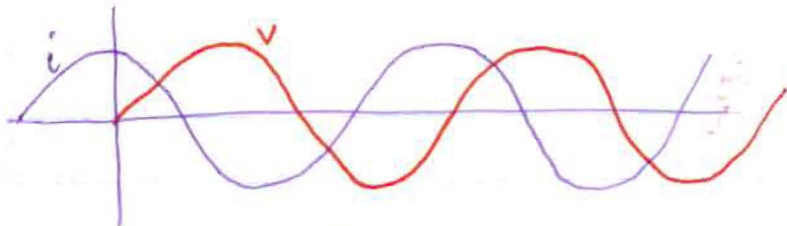
i lags v by 45°



$i = v/R$

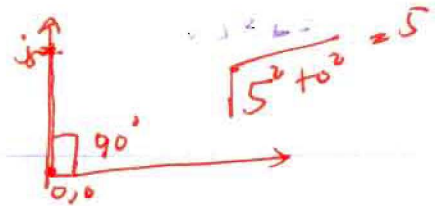
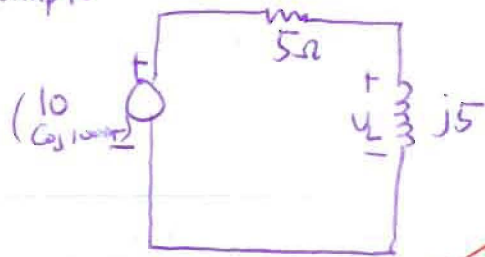


i & v are in phase

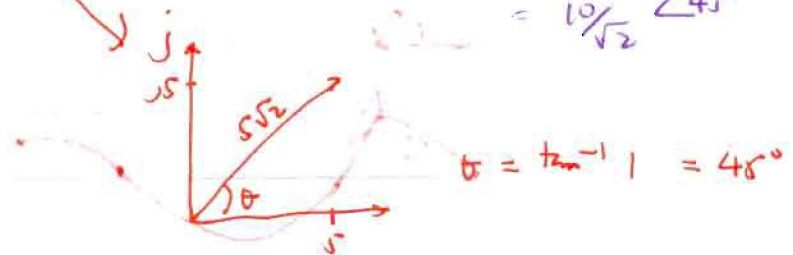


(i leads v) OR (v lags i)

Example

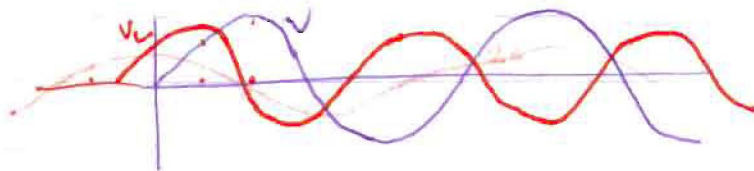


$$\bar{V}_L = (10) \frac{j5}{5 + j5} = \frac{10 \angle 90^\circ}{5\sqrt{2} \angle 45^\circ} = \frac{10}{\sqrt{2}} \angle 90 - 45^\circ = \frac{10}{\sqrt{2}} \angle 45^\circ$$



$$V_L(t) = \frac{10}{\sqrt{2}} \cos(1000t + 45^\circ)$$

$$V(t) = 10 \cos(1000t)$$



||Z

$$V_{rms} = \frac{V_m}{\sqrt{2}}$$

