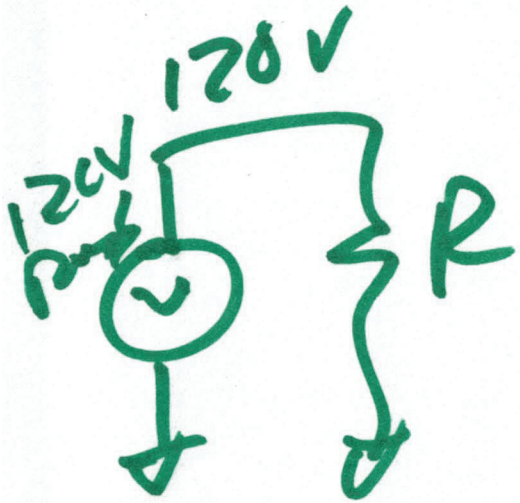
EE 221 Circuits II

Lecture 6

Feb. 6, 2023

$V_{rms} = 120V$ AC

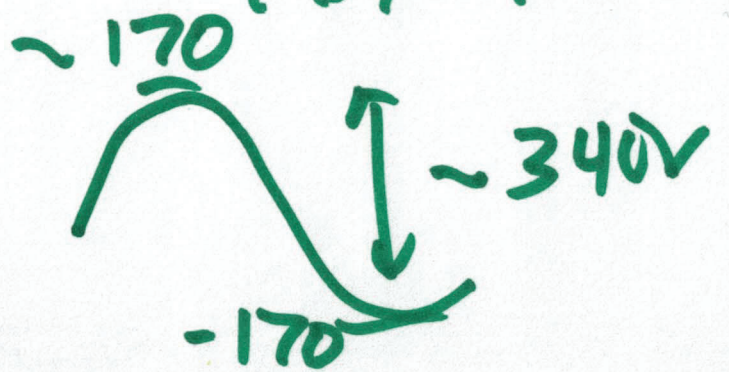
114 → 126 240V



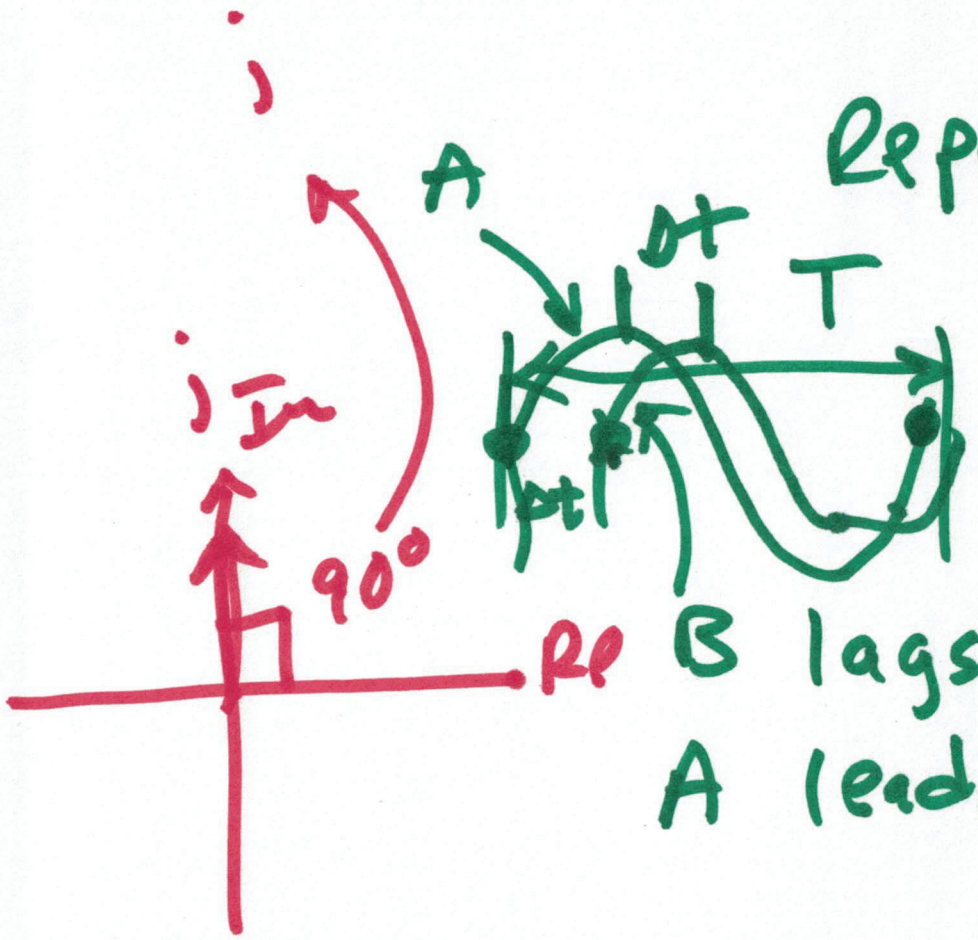
$V_{rms} \cdot \sqrt{2} = V_p = 169.7$

120

$169.7 \sin(2\pi \cdot 60 \cdot t)$



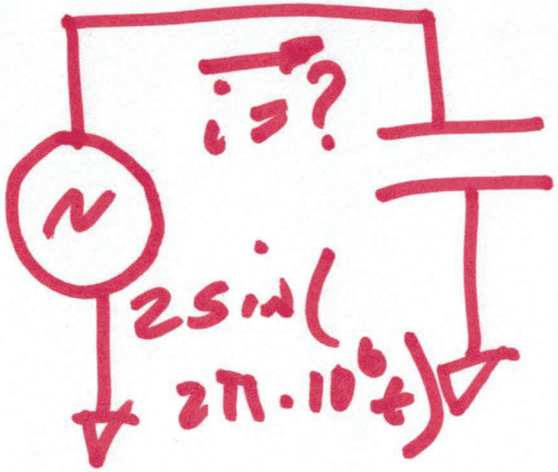
Imaginary Numbers Signals Represent delay



$$\theta = \frac{\Delta t}{T} \cdot 360$$

B lags A → phase shift is Negative

A leads B → phase sh. ft is positive



$i = ?$

$v_c = 2\sin(2\pi 10^6 \cdot t)$

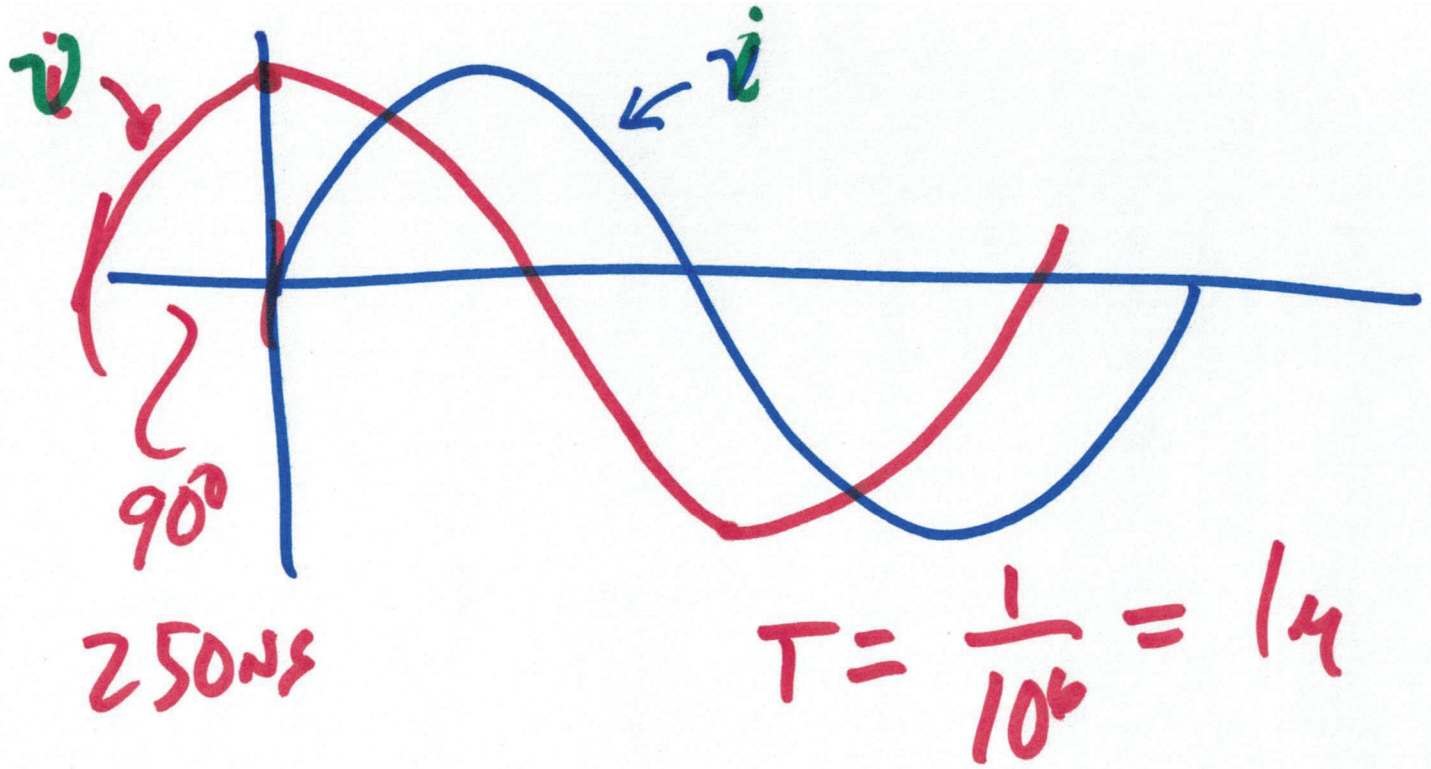
$1\,MHz = 10^6$

$$i = C \cdot \frac{dv_c}{dt}$$

$$i = 1\mu F \cdot \frac{d(2\sin(2\pi 10^6 t))}{dt}$$

$$= 1\mu F \cdot 2\cos(2\pi 10^6 t) \cdot 2\pi 10^6$$

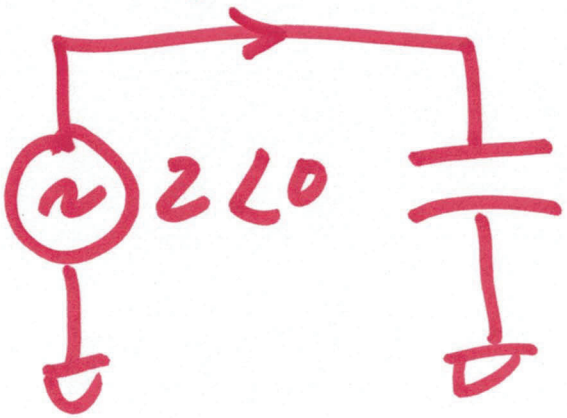
$$= 4\pi \sin(2\pi 10^6 t - 90^\circ)$$



$$Z_C = \frac{1}{j \cdot 2\pi \cdot f \cdot C}$$

$$\frac{V_c}{Z_C}$$

$$i \quad V_c = i \cdot Z_C, \quad i = j2\pi f \cdot C \cdot V_c$$

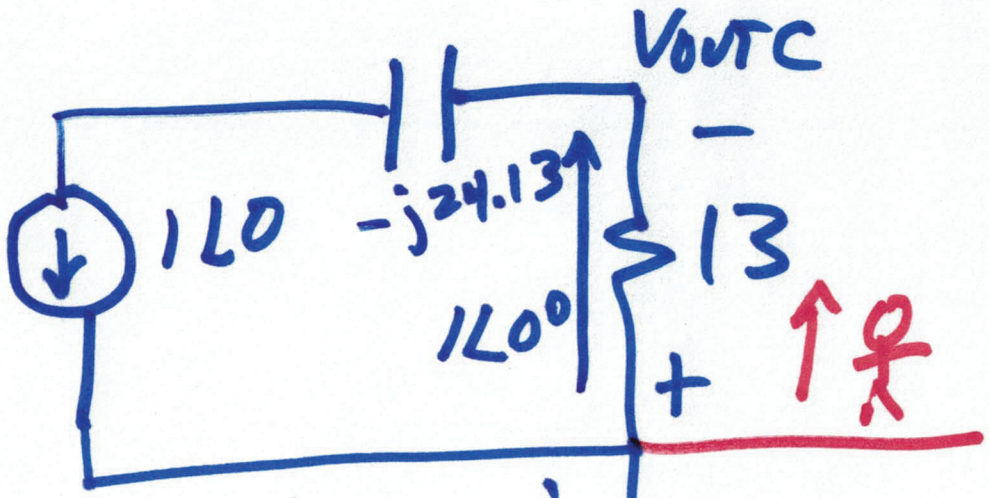


$$\frac{1}{j \cdot 2\pi \cdot 10^6 \cdot 10^{-6}} = \frac{1}{j 2\pi f C}$$

$$i_C = \frac{V_C}{Z_C} = \frac{2\angle 0}{\frac{1}{j2\pi f C}} = \frac{4\pi}{2 \cdot 2\pi f C} j$$

$$\dot{i}_C = 4\pi \cdot j \Rightarrow 4\pi \angle 90$$

$$i_C = 4\pi \sin(2\pi \cdot 10^6 \cdot t + 90)$$



$$\frac{1}{j}\cdot\frac{j}{j}=\frac{j}{-1}=-j$$

$$j\cdot j=\sqrt{-1}\cdot\sqrt{-1}=-1$$

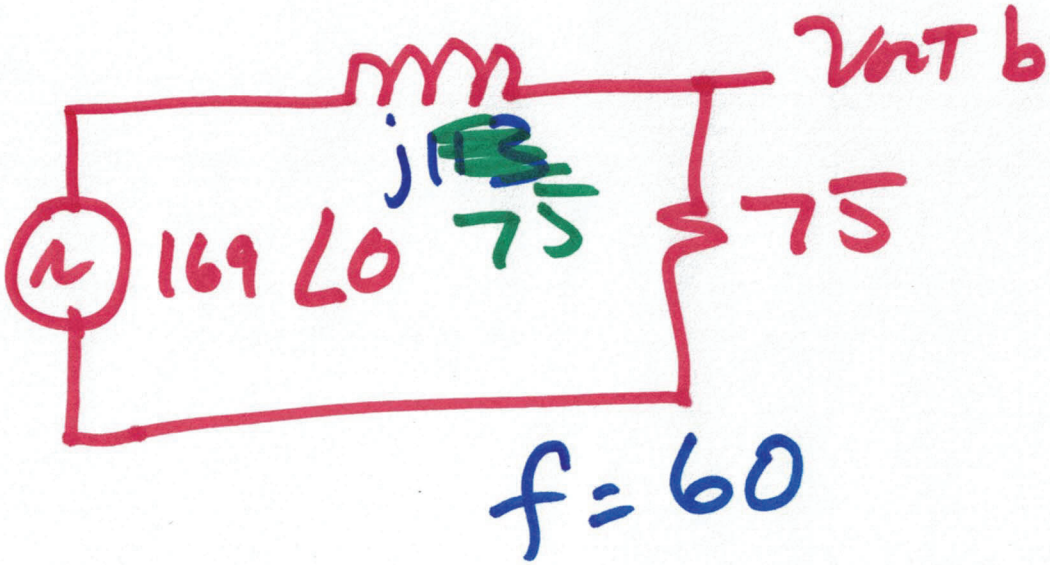
$$Z_C=-j\cdot\frac{1}{2\pi\cdot 60\cdot 1104}$$

$$-1\angle 0^\circ\cdot 13=V_{OUTC}$$

$$V_{OUTC}=13\sin(2\pi\cdot 60\cdot t)$$

$$=13\sin(2\pi\cdot 60t+180)$$

$$=13\sin(2\pi\cdot 60t-180)$$



V_{out} b

$Z_L = j \cdot 2\pi f \cdot .2$

$= j$ 75.

$$V_{outTb} = 169\angle 0 \cdot \frac{75}{75 + j}$$

$$= 169\angle 0 \cdot \frac{75\angle 0}{|x+jy| = \sqrt{x^2+y^2}}$$

$$\frac{}{\sqrt{(75)^2+(75)^2}\ \angle \tan^{-1}\frac{75}{75}}$$

$$75\sqrt{2}$$

8)

$$Z_{nTb} = 169\angle 0 \; \frac{75\angle 0}{75\sqrt{2}\cdot\angle 45^\circ}$$

$$Z_{nTb} = \frac{169}{\sqrt{2}}\angle -45^\circ$$