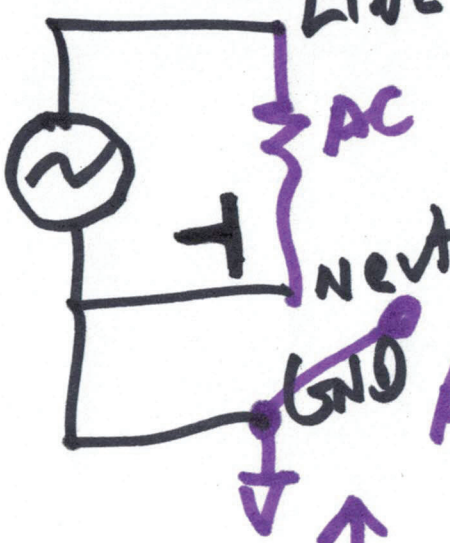
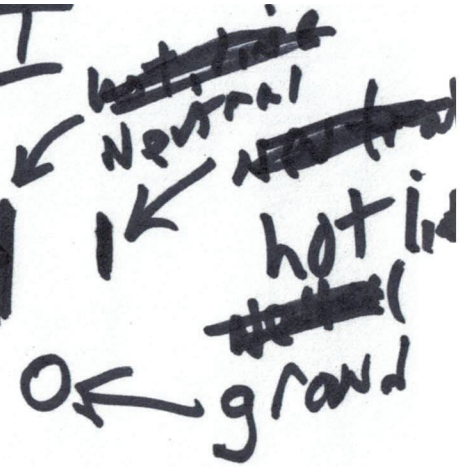
EE 220 CIRCUITS I

NOV. 16, 2022

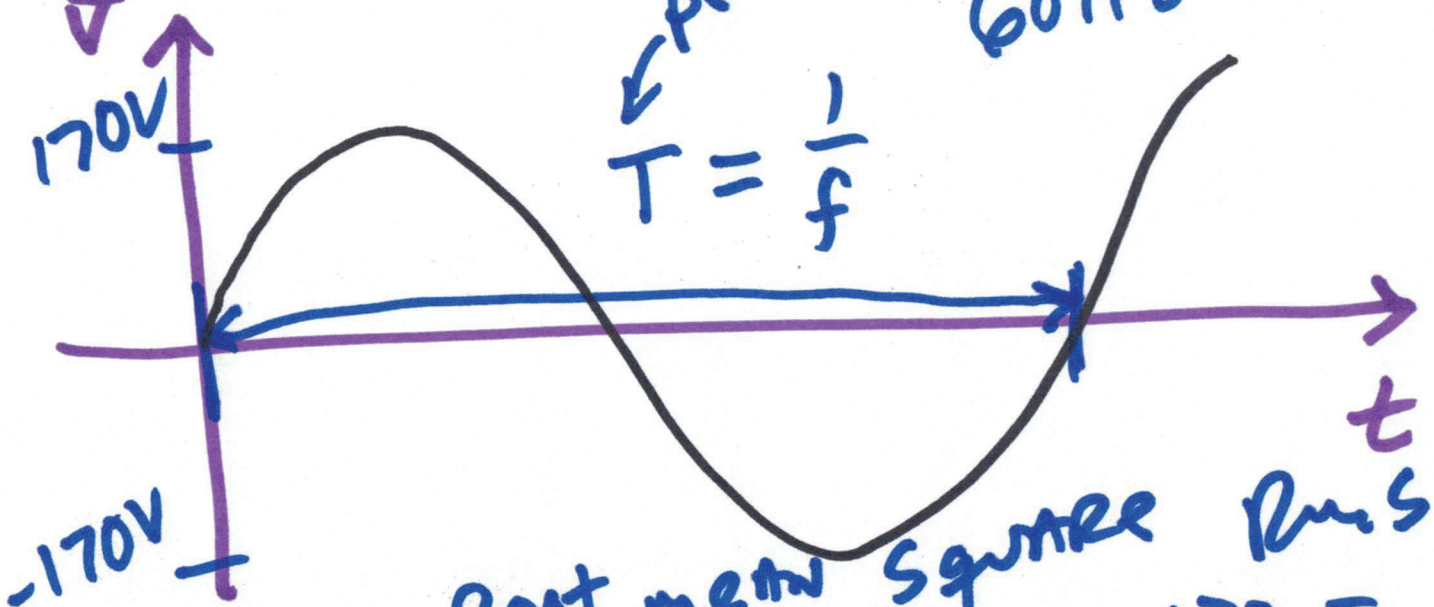
Lecture 21





AC - alternating current

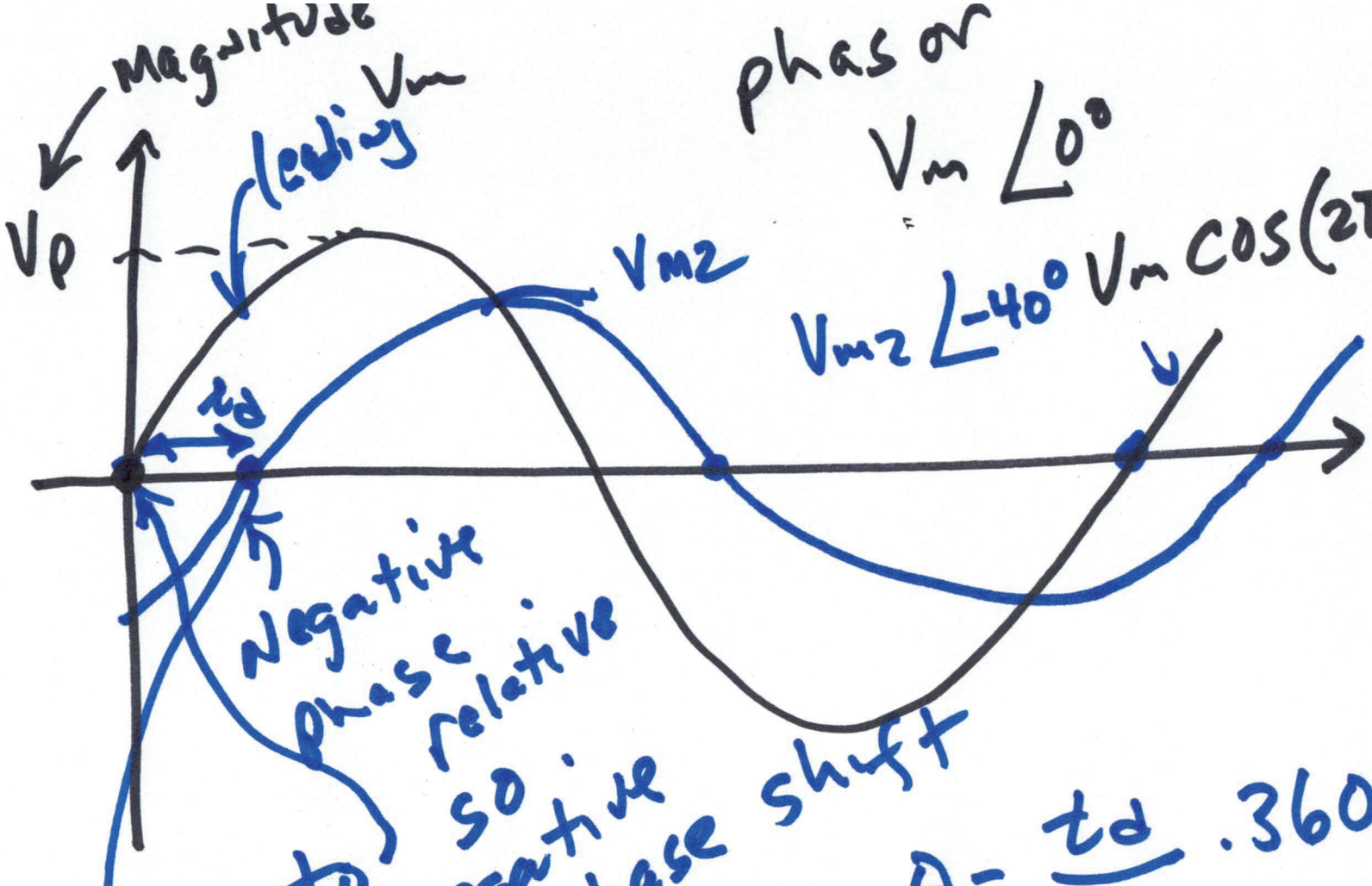
60 Hz → 16.67 ms



$T = \frac{1}{f}$

Root mean square RMS

$120 = \frac{170}{\sqrt{2}}$



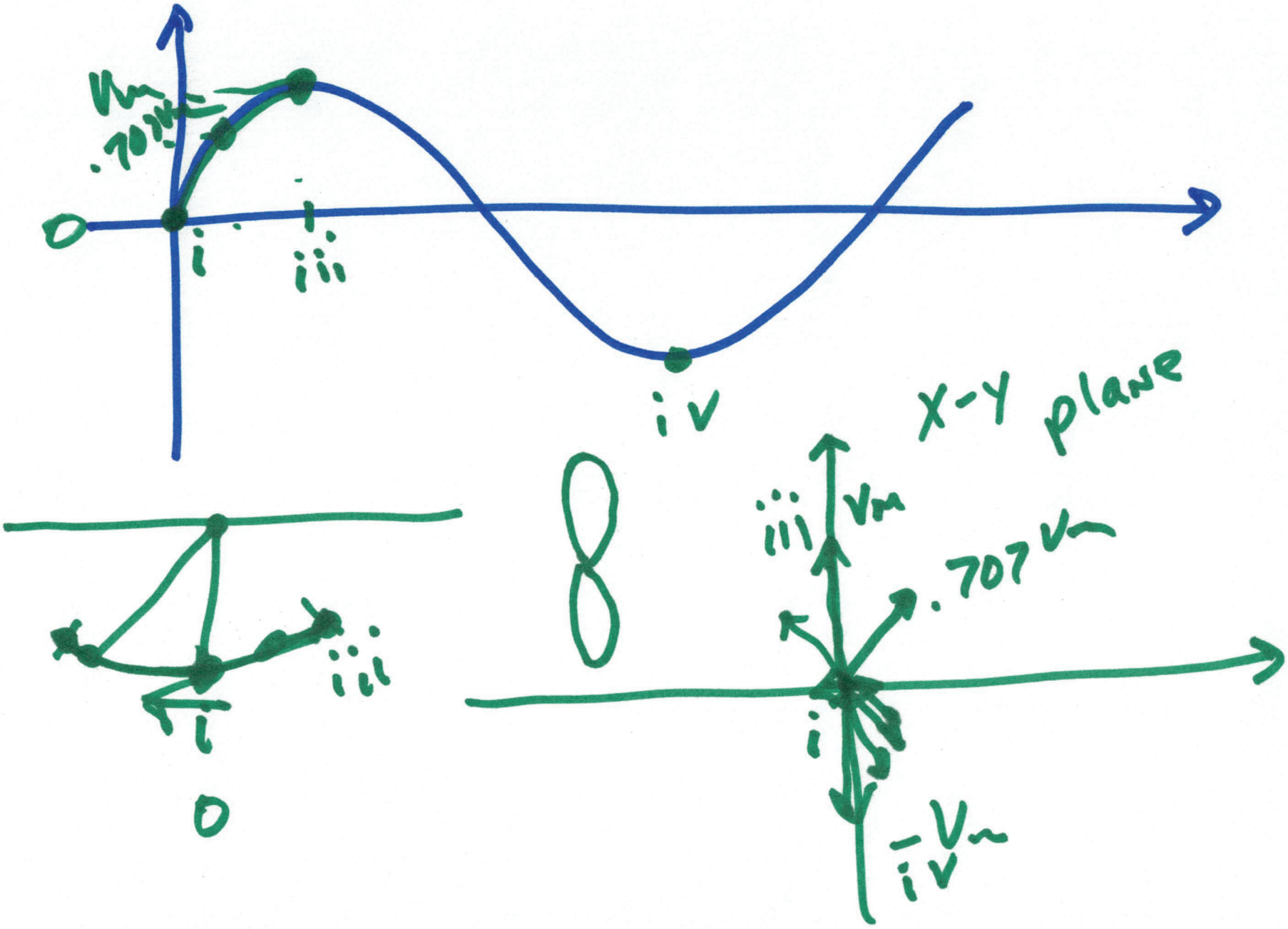
phasor

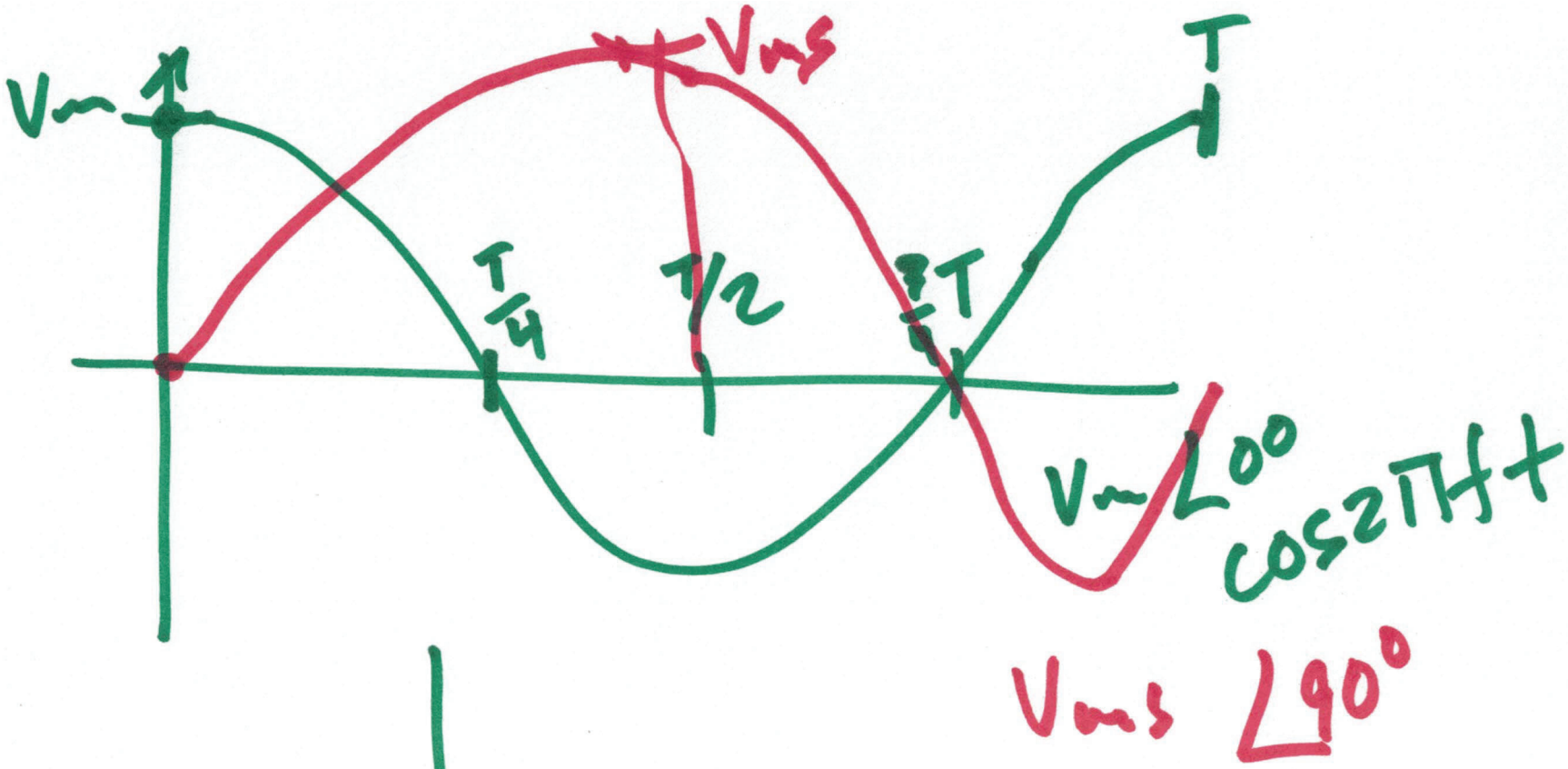
$V_m \angle 0^\circ$

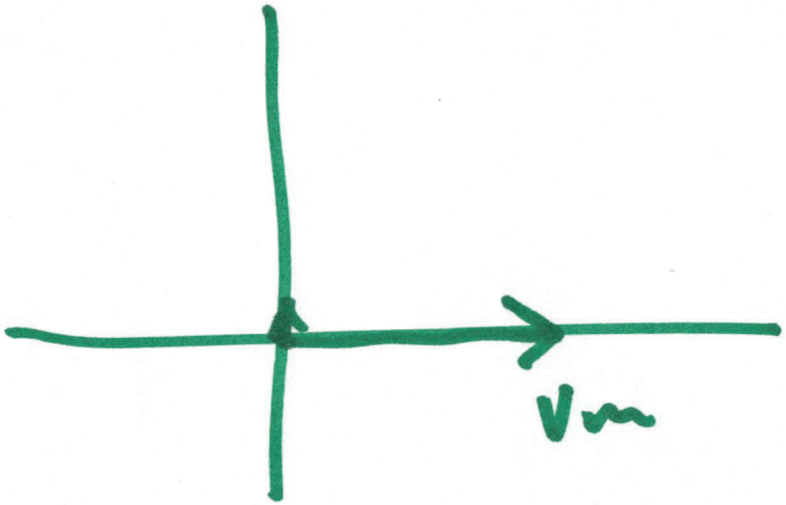
$V_{m2} \angle -40^\circ$ $V_m \cos(2\pi \cdot f\, t + \theta)$

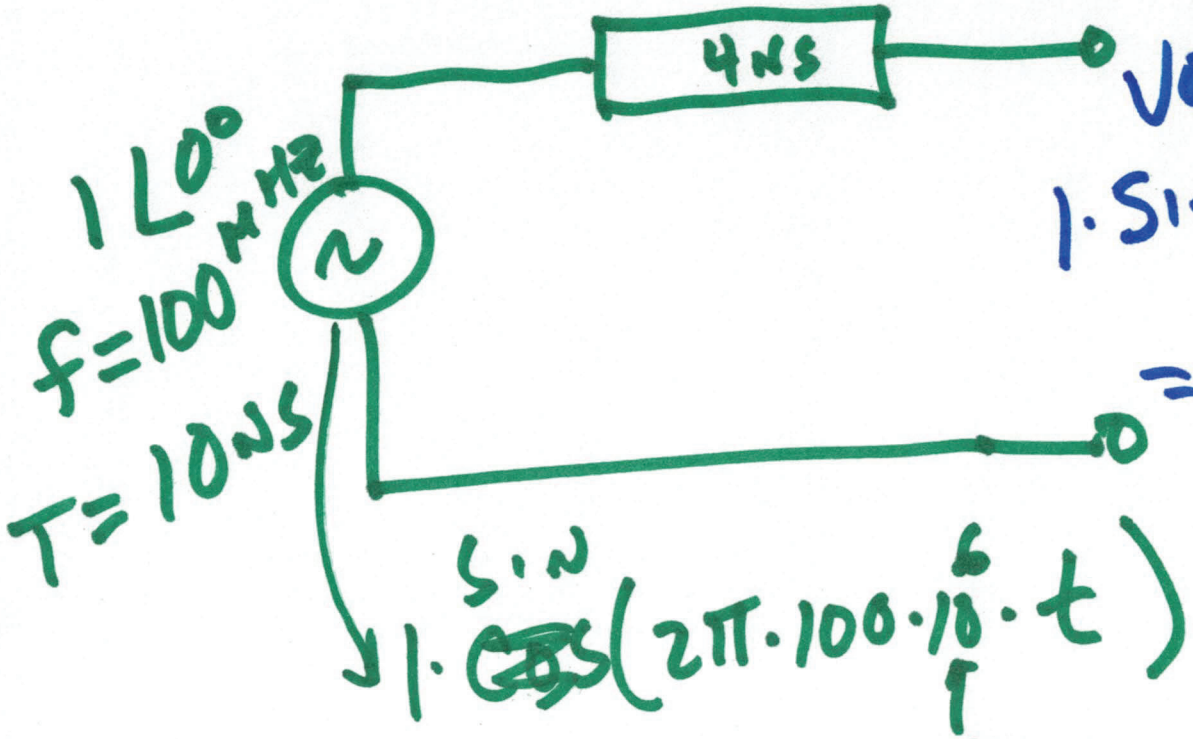
$$\theta = \frac{t_d}{T} \cdot 360 = 40^\circ$$

$$= t_d \cdot f \cdot 360$$


Vm
.707Vm
0
i
ii
iii
iv
X-Y plane
iii
Vm
.707 Vm
i
-Vm
iv
0
iii
i


Vm
Vms
T
T/4
T/2
3/4 T
Vm ∠0°
cos2πft
Vms ∠90°


Vm



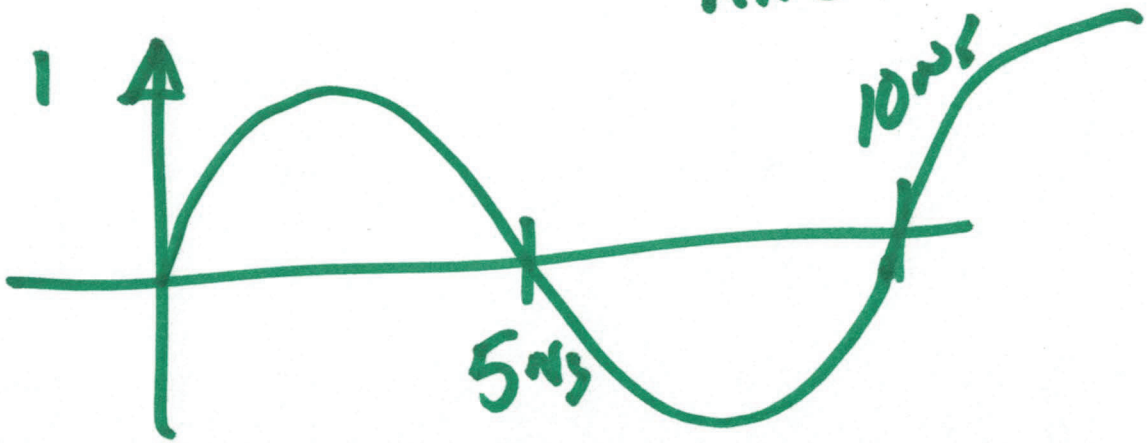
V_{OUT}

$$1\cdot\sin\left(2\pi\cdot 100\cdot 10^{6}\left(t-4ns\right)\right)$$

$$=\sin\left(2\pi\cdot 100\cdot 10^{6}\,t - 2\pi\cdot 100\cdot 10^{6}\cdot 4ns\right)$$

$$\theta = 2\pi\cdot\underbrace{100\cdot 10^{6}}_{f}\cdot t_d$$

$$= 360\cdot\frac{t_d}{T}$$



$$\theta = 360 \cdot \frac{4\,ns}{10\,ns} = 144^\circ$$

$$2\pi \cdot \frac{4}{10\,ns} \rightarrow \frac{2\pi}{360} \text{ degrees} = \text{RADIANS}$$

$$\frac{\pi}{180} \text{ degrees} = \text{RADIANS}$$

$$V_{OUT} = 1 \angle -144^\circ$$

6)

$$V_{OUT} = 0 \cdot \cos(2\pi \cdot 100 \cdot 10^6 \cdot t)$$

$$+ j \sin(2\pi 100 10^6 t - 144^\circ)$$

$$\boxed{e^{j\theta} = \cos\theta + j\sin\theta}$$

Euler's identity

$$\cos\theta = \frac{\quad}{2}$$

$$\boxed{\mathrm{im}\{e^{jk}\} = \sin k}$$

$$\sin(2\pi 100\,\text{MHz}\cdot t - 144^\circ)$$

$$= \text{im}\left(e^{j(2\pi 100\,\text{MHz}\cdot t - 144^\circ)}\right)$$

$$= e^{j2\pi f\cdot t} \cdot e^{-j144^\circ}$$

$$e^{-j2\pi f\cdot t_d}$$

$$e^{-j2\pi \frac{t_d}{T}}$$

$$i = C\frac{dv}{dt}$$

$$\boxed{v = i \cdot j\omega L}$$

$$v = V_m \cos 2\pi f \cdot t$$

z = impedance of a CAP

$$i = C \cdot \frac{d}{dt} V_m \cos 2\pi f \cdot t$$

$$i \cdot z = v$$

$$\boxed{W = 2\pi f}$$

$$\boxed{i \cdot \frac{1}{j\omega C} = v}$$

$$i = C \cdot 2\pi f(-V_m \sin(2\pi f \cdot t))$$

$$i = C \cdot 2\pi f \cdot (+j)(+V_m)\cos 2\pi f \cdot t$$