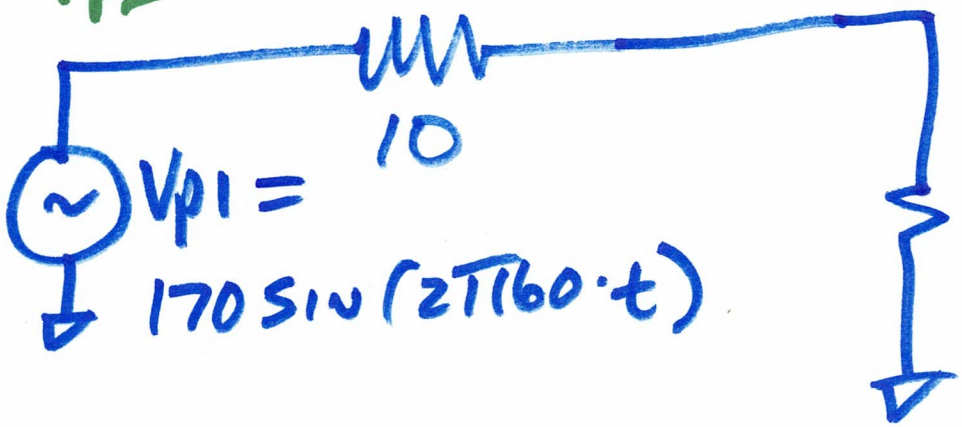
EE 221
Circuits II

Feb. 26, 2020

Lecture 10

$170\sin(2\pi 60 \cdot t + 240)$

$V_{p3} =$



V_{x3}

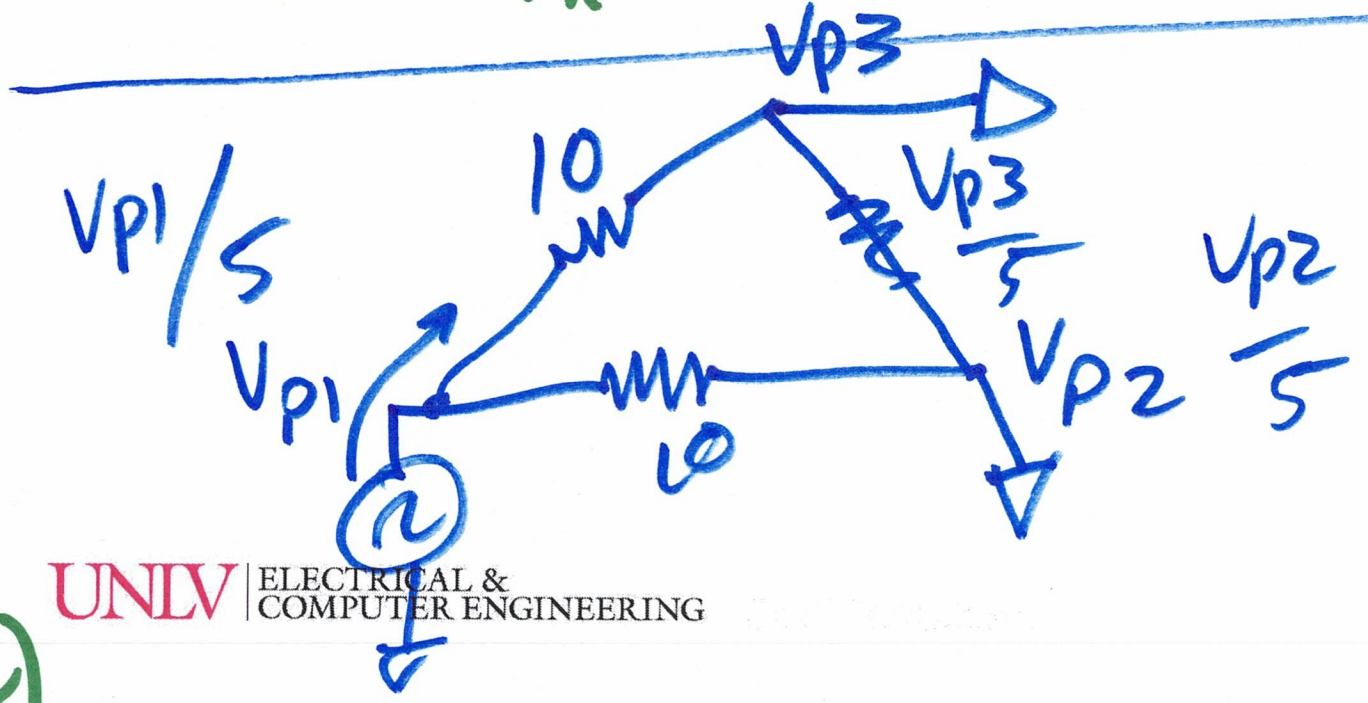
$$V_{x1} = V_{p1} \cdot \frac{5}{5+10}$$

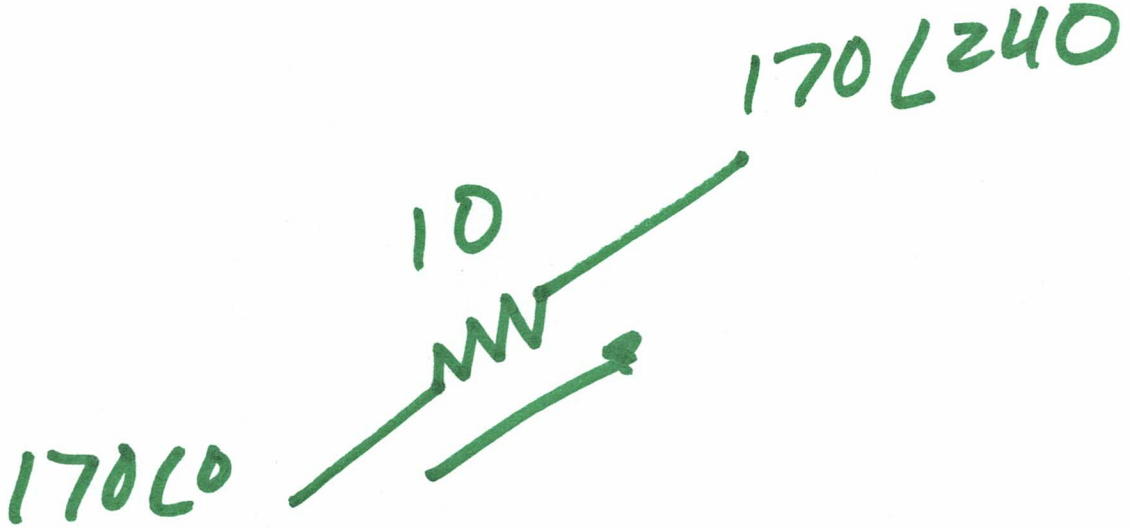
$$V_{x1,2,3} = \frac{V_{p1,2,3}}{3}$$

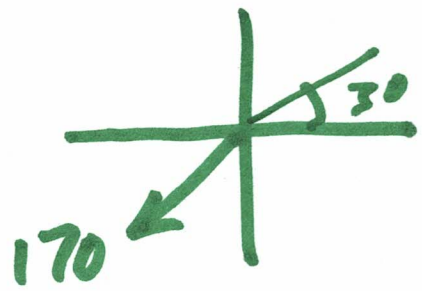
$$V_x = V_{x1} + V_{x2} + V_{x3} =$$

$$= \frac{1}{3} V_p \left(\sin(2\pi 60t) + \sin(2\pi 60t + 120) + \sin(2\pi 60t + 240) \right)$$

$$V_x = 0$$





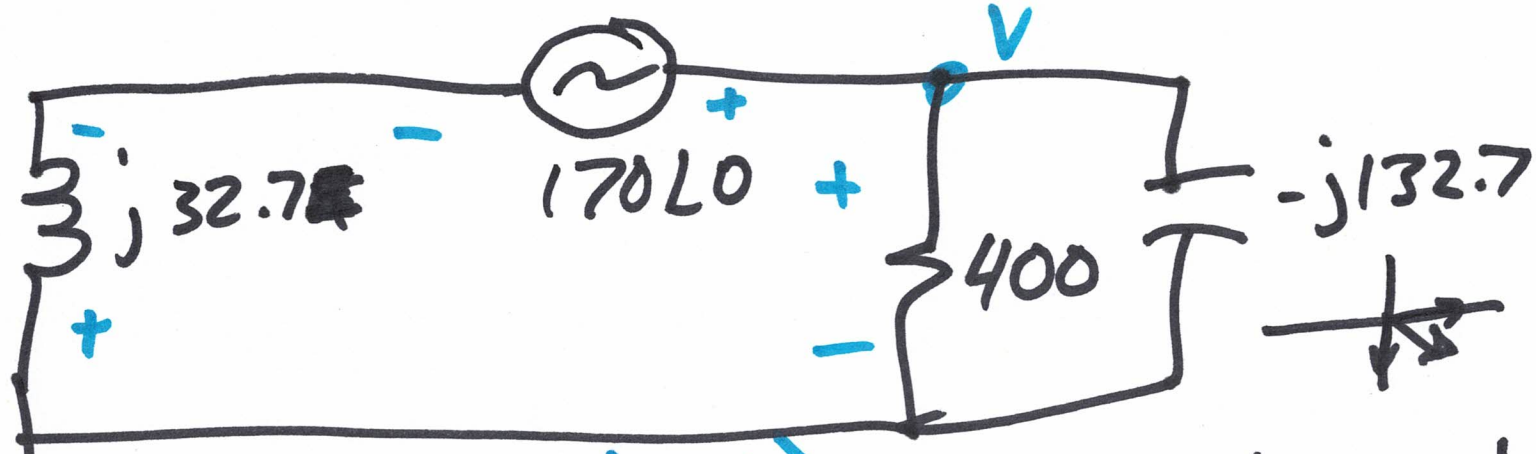


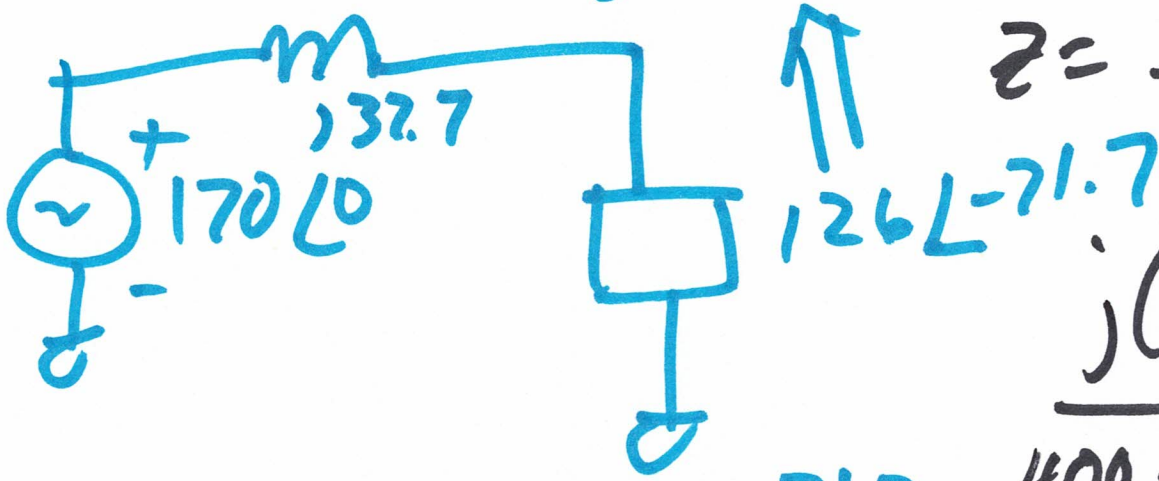
$$-(-85 + -j147)$$

$$\bar{I} = \frac{170 + j0 + 85 + 147j}{10}$$

$$= \frac{255 + 147j}{10}$$

$$= \frac{294.3}{10} \angle 210$$





$39.6 + j(-120)$

$$Z = \frac{400 \cdot (-j132.7)}{400 + j(-132.7)}$$

$$\frac{j(-53k)}{400 + j(-132.7)} = \frac{53k\angle -90}{421\angle -18.3}$$

$$V = 170 \cdot \frac{126\angle -71.7}{j32.7 + 39.6 + j(-120)}$$

$$Z = 126\angle -71.7$$

$$|V| = \frac{170 \cdot 126}{|39.6 + j(-87.3)|}$$

$$|V| = \frac{170 \cdot 126}{96}$$

$$V_{rms} I_{rms} = \frac{158^2}{400}$$

$$V_{peak} = 223.1$$

$$\boxed{62.16\,W}$$

$$V_{rms} = \frac{223.1}{\sqrt{2}} = 157.6$$

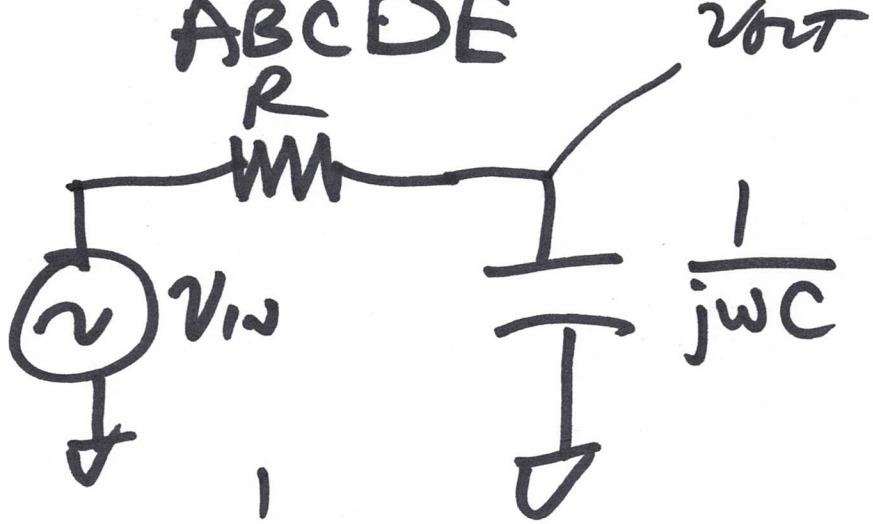
5)

$$ABCDEF = \frac{F}{\frac{1}{ABCDE}} = \frac{F}{F_{3dB}}$$

$$F_{3dB} = \frac{1}{ABCDE}$$

TRANSFER FUNCTION

$$\frac{V_{OUT}}{V_{IN}}$$



$$V_{OUT} = V_{IN} \cdot \frac{\frac{1}{jwC}}{R + \frac{1}{jwC}}$$

$$\left|\frac{1}{a+jb}\right| \qquad \frac{V_{out}}{V_{in}} = \frac{1}{1+j\omega RC}$$

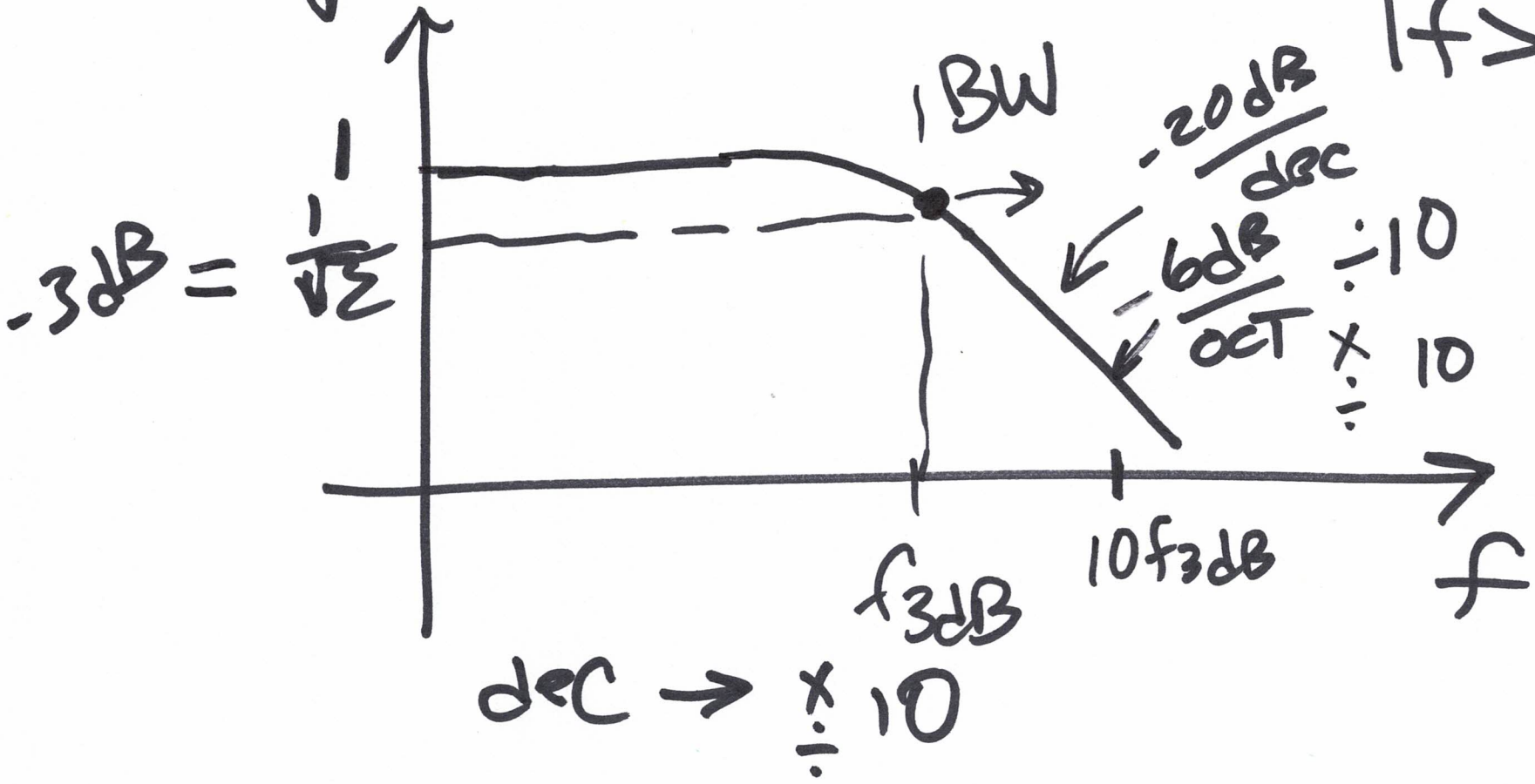
$$= \frac{1}{\sqrt{a^2+b^2}} \qquad = \frac{1}{1+j\,2\pi f RC}$$

$$\angle\frac{1}{a+jb} = -\tan^{-1}\frac{b}{a} \qquad f_{3dB} = \frac{1}{2\pi RC}$$

$$\frac{1}{|a+jb|} = \frac{1}{\sqrt{a^2+b^2}} = \frac{1}{1+j\frac{f}{f_{3dB}}}$$

$$\frac{1}{\angle a+jb} \quad \frac{1}{\tan^{-1}\frac{b}{a}} = -\tan^{-1}\frac{b}{a}$$

$$\left|\frac{v_{2T}}{v_N}\right| = \frac{1}{\sqrt{1^2 + \left(\frac{f}{f_{3dB}}\right)^2}} \simeq \left|\frac{f_{3dB}}{f}\right| \quad f >> f_{3dB}$$



dec → $\times \div$ 10

oct → $\times \div$ 2

decibels

Voltage or current

$$20 \log \frac{V_{out}}{V_{in}}$$

$V_o^2/R \quad V_{in}^2/R$

$$\frac{V_{out}}{V_{in}} = \frac{1}{10} \rightarrow -20\,dB$$

$$\frac{V_{out}}{V_{in}} = \frac{1}{2} \rightarrow -6\,dB$$

$$\frac{V_{out}}{V_{in}} = \frac{1}{\sqrt{2}} = -3\,dB$$

Power

$$10 \log \frac{P_{out}}{P_{in}}$$

$$\frac{1}{10} \rightarrow -10\,dB$$