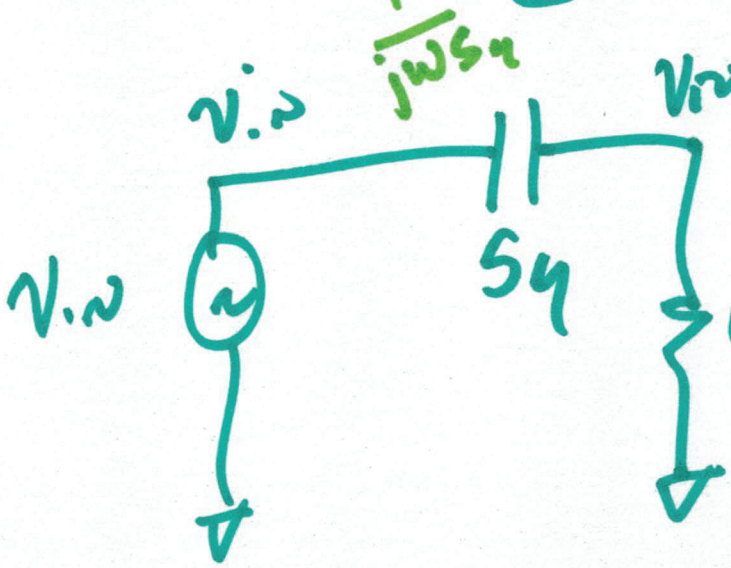
EE 221 Circuits II

March 1, 2021

Lecture 11



$$V_{out} = V_{in} \cdot \frac{100}{100 + \frac{1}{j\omega S_4}}$$

$$\frac{V_{out}}{V_{in}} = \frac{0 + j\omega 500 n}{1 + j\omega 500 n}$$

$$\frac{V_{out}}{V_{in}} = \frac{0 + j\omega\, 0.5\text{m}}{1 + j\omega\, 0.5\text{m}} \longrightarrow \frac{\angle 90^\circ}{1 + j\frac{f}{318}}$$

$$\left|\frac{V_{out}}{V_{in}}\right| = \frac{\sqrt{0^2 + (2\pi f \cdot 0.5\text{m})^2}}{\sqrt{1^2 + (2\pi f \cdot 0.5\text{m})^2}}$$

$$= \frac{\frac{f}{\frac{1}{2\pi\, 0.5\text{m}}}}{\sqrt{1 + \left(\frac{f}{\frac{1}{2\pi\, 0.5\text{m}}}\right)^2}}$$

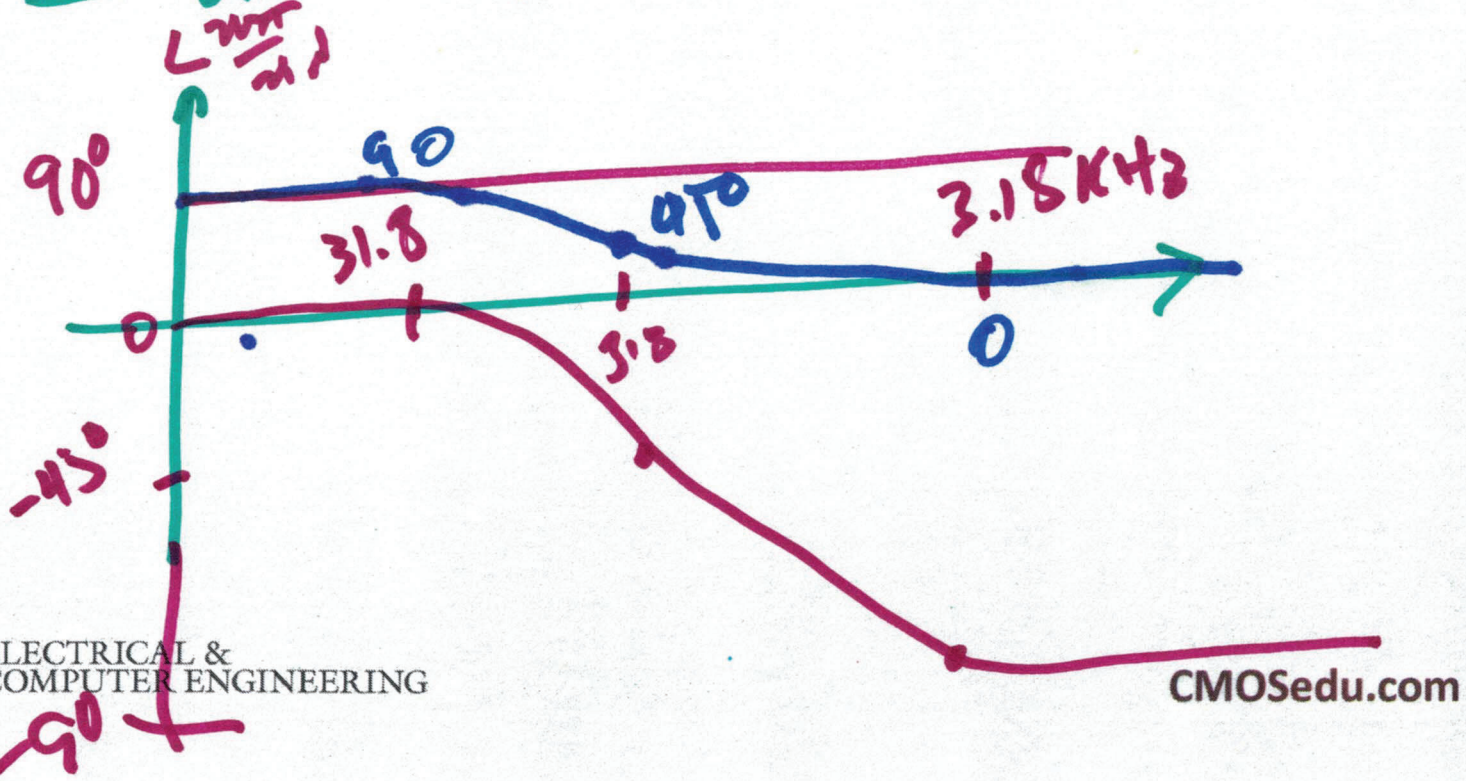
$$f = \frac{1}{2\pi \cdot 0.5\text{m}} = 318\text{Hz}$$

RC

$100.5\,\mu F \parallel 0.5\text{m}$

$$\left|\frac{v_{out}}{v_{in}}\right| = \frac{\frac{f}{318}}{\sqrt{1+\left(\frac{f}{318}\right)^2}} \leftarrow$$

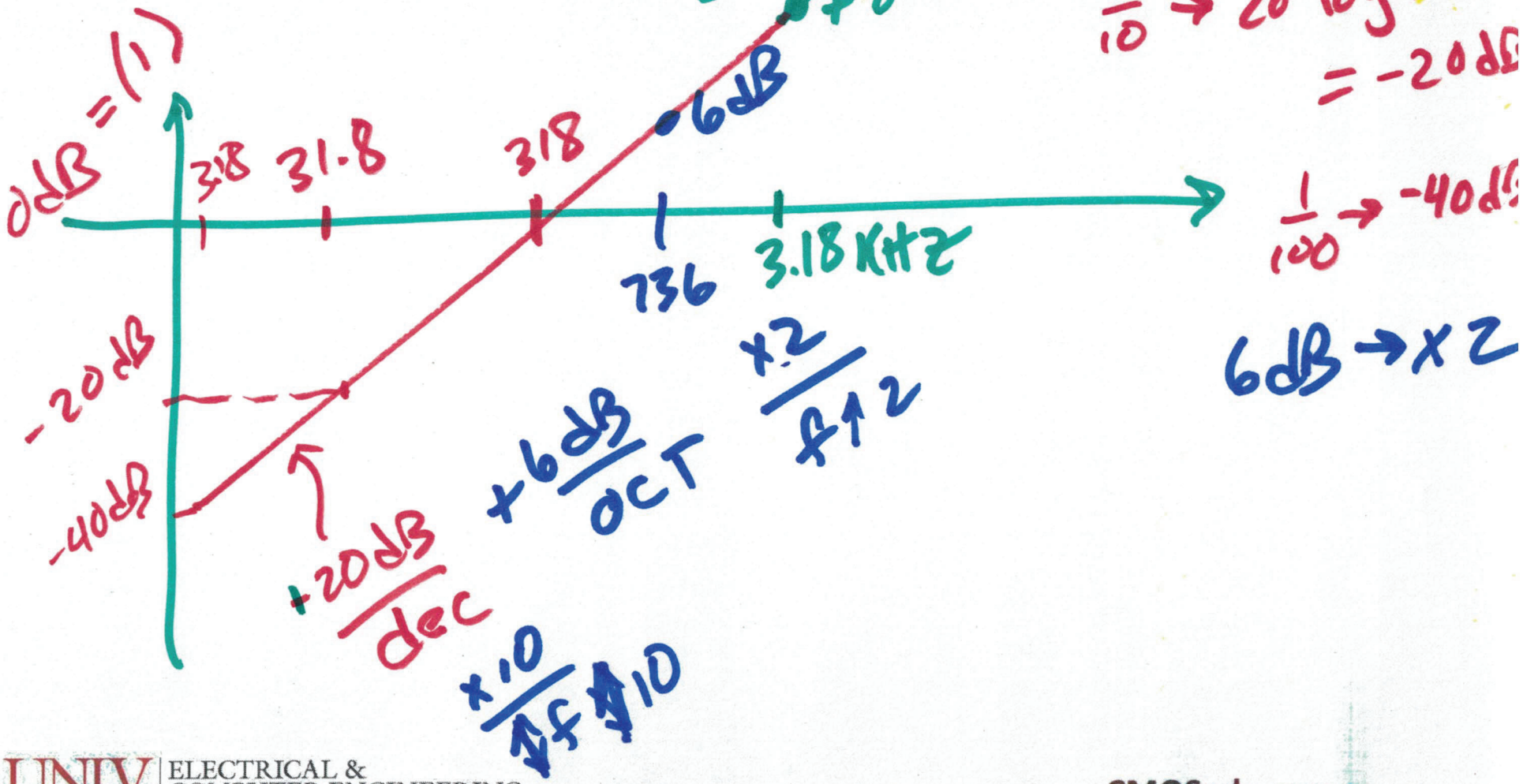
$$\angle\frac{v_{out}}{v_{in}} = 90^\circ - \tan^{-1}\frac{f}{318} \leftarrow$$



$$\left|\frac{V_{OUT}}{V_{IN}}\right| = \frac{\frac{f}{318}}{\sqrt{1+\left(\frac{f}{318}\right)^2}}$$

$1 \rightarrow 20\log 1 = 0\ dB$

$\frac{1}{10} \rightarrow 20\log 10^{-1} = -20\ dB$



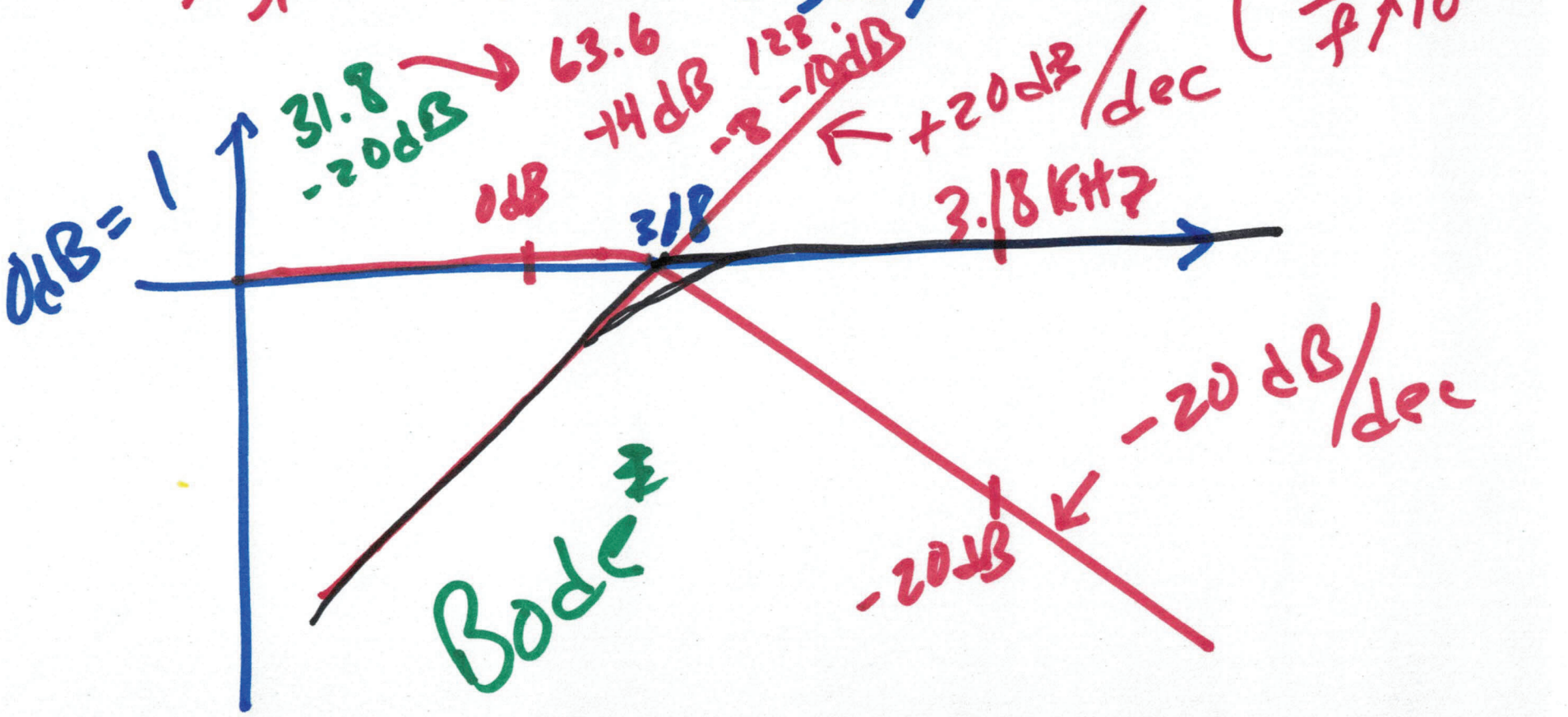
$\frac{1}{100} \rightarrow -40\ dB$

$6\ dB \rightarrow \times 2$

$$\left|\frac{20T}{2w}\right| = \frac{\frac{f}{318}}{\sqrt{1+\left(\frac{f}{318}\right)^2}}$$

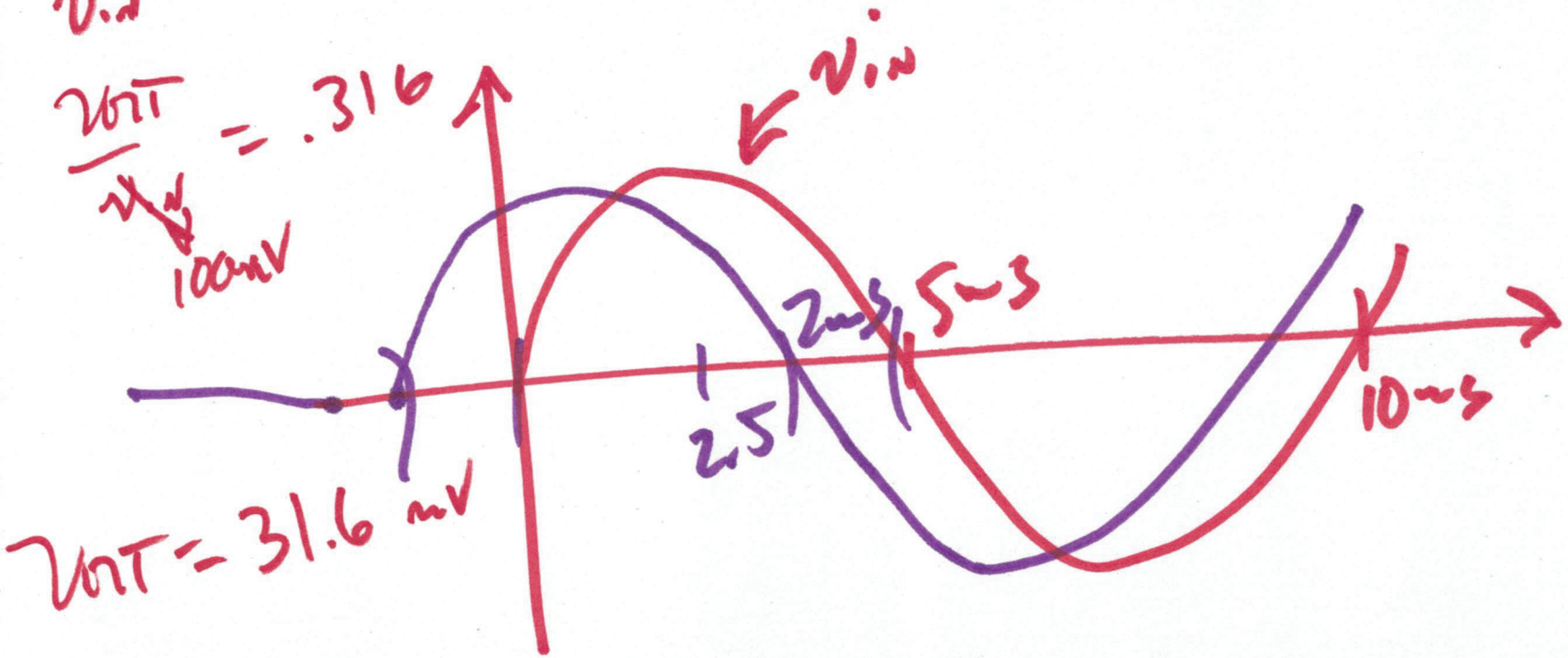
$f=3B$ $\frac{1}{\sqrt{2}}$ $-3dB$

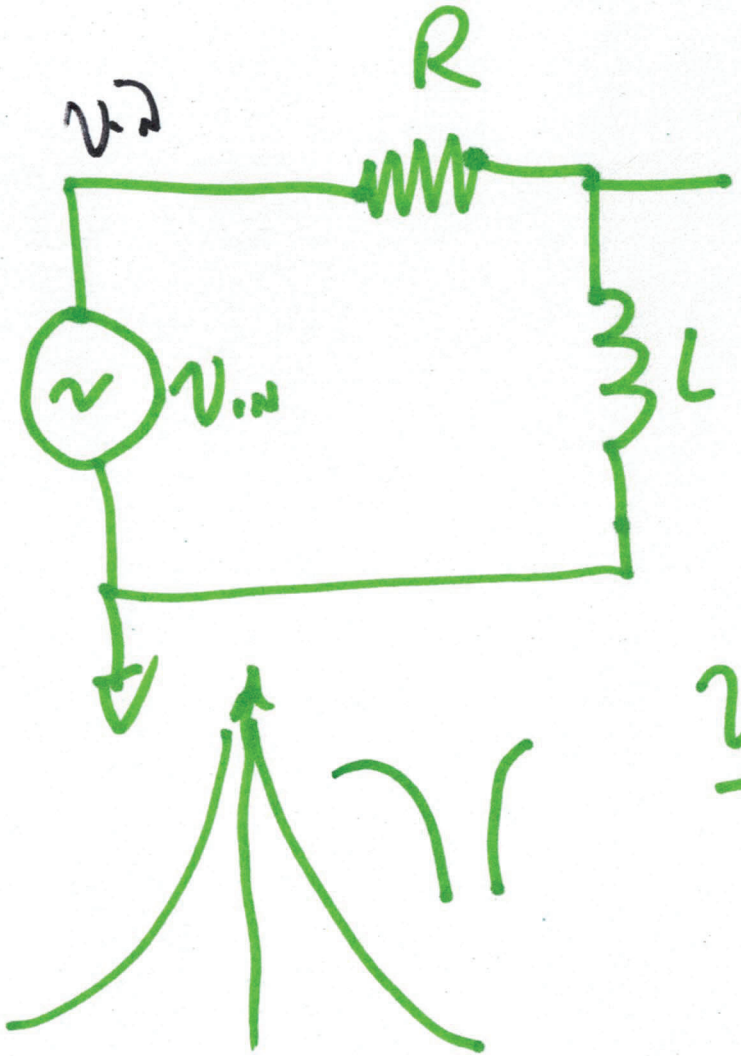
$\nearrow^2$ $\nearrow^2$



$-10\,dB = 20\log\frac{V_{OUT}}{V_{in}} + 72°$ 0dB $V_{OUT} = 100mV$

$\frac{V_{OUT}}{V_{in}} = 10^{-10/20}$ $72 = \frac{\Delta t}{10ms} \cdot 360$ $\Delta t = 2ms$



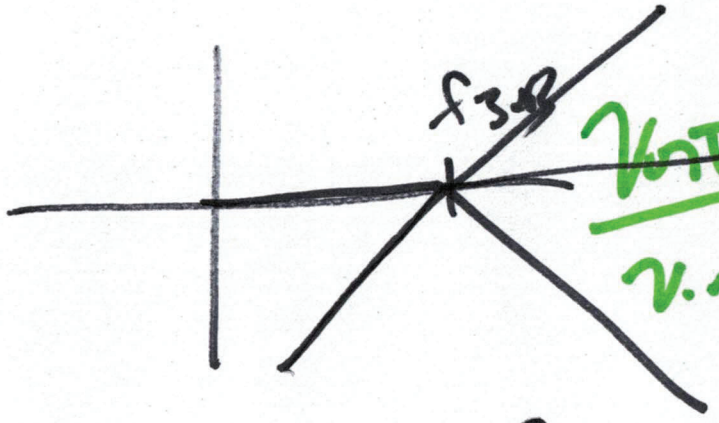


$$v_{out} = v_{in} \cdot \frac{jwL}{jwL + R}$$

$$\frac{v_{out}}{v_{in}} = \frac{jw\,L/R}{1 + jw\,L/R}$$

$$= \frac{0 + j\,\dfrac{f}{\frac{1}{2\pi\,L/R}}}{1 + j\,\dfrac{f}{\frac{1}{2\pi\,L/R}}}$$

pole →



$$\frac{V_{out}}{V_{in}} = \frac{0 + j\frac{f}{f_{3dB}}}{1 + j\frac{f}{f_{3dB}}}$$

$$\left|\frac{V_{out}}{V_{in}}\right| = \frac{\frac{f}{f_{3dB}}}{\sqrt{1 + \left(\frac{f}{f_{3dB}}\right)^2}}$$

$$f_{3dB} = \frac{1}{2\pi\frac{L}{R}} = \frac{1}{2\pi\tau}$$

$\frac{L}{R}$ = RC

$$T = \frac{L}{R}$$

$$\angle\frac{V_{out}}{V_{in}} = 90 - \tan^{-1}\frac{f}{f_{3dB}}$$