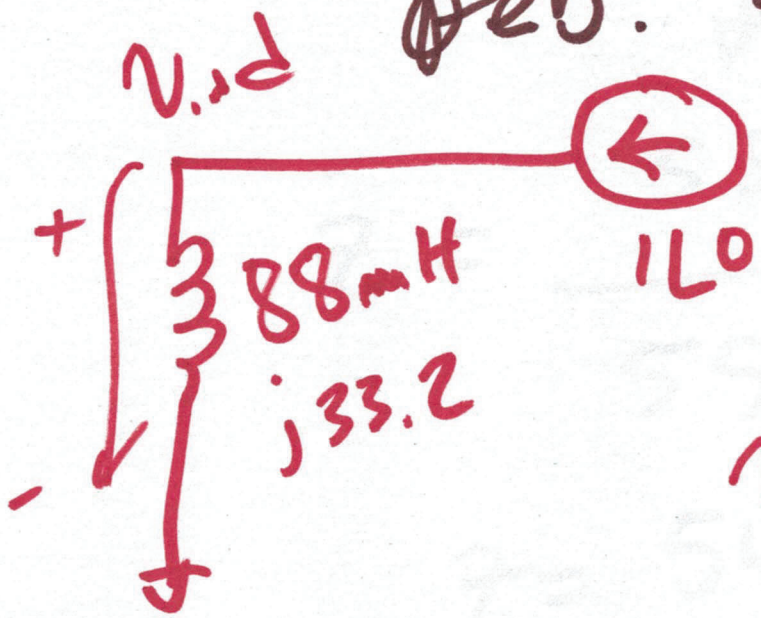
EE 221 Circuits II

Lecture 10

Feb. 24, 2021



$$V_{ind} = 1\angle 0 \cdot 33.2$$

$$33.2\angle 90$$

$$V_{ind} = 33.2\sin(2\pi 60\cdot$$

+

$$\frac{a}{a^2+b^2} + j\frac{-b}{a^2+b^2}$$

Re Im

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

$$\theta = \tan^{-1}\frac{\frac{-b}{a^2+b^2}}{\frac{a}{a^2+b^2}}$$

$$= \pm\tan^{-1}\frac{-b}{a}$$

$$= -\tan^{-1}\frac{b}{a}$$

5)

$$\left|\frac{1}{a+jb}\right| = \frac{1}{\sqrt{a^2+b^2}}$$

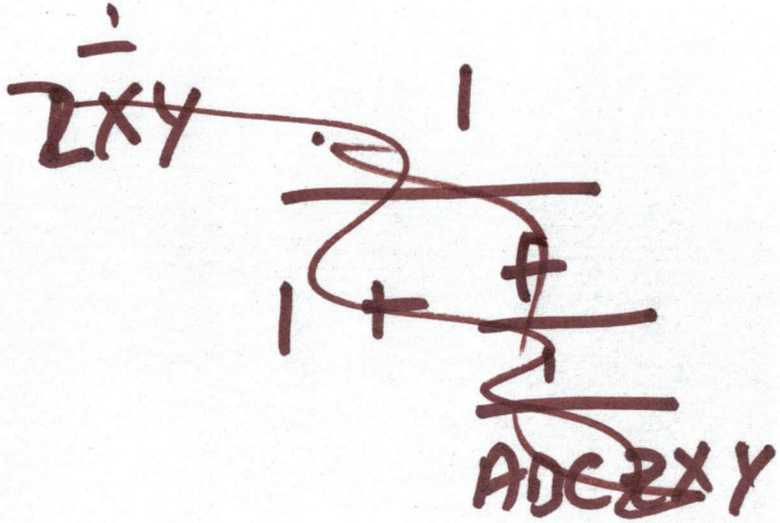
$$\frac{1}{1+j\,ABCDf} = \frac{1}{1+j\,\frac{f}{\frac{1}{ABCD}}}$$

$$f_{3dB} = \frac{1}{ABCD}$$

$$\angle\frac{1}{1+j\,ABCDf} = -\tan^{-1}\frac{f}{f_{3dB}}$$

$$\frac{1}{1+j\,\frac{f}{f_{3dB}}}$$

$$\frac{1}{2XY + j f ABC} \Rightarrow$$



$$\frac{1}{2XY\left(1 + j f \frac{ABC}{2XY}\right)}$$

$$f_{3dB} = \frac{2XY}{ABC}$$

$$\frac{1}{2XY} \cdot \frac{1}{1 + j\frac{f}{f_{3dB}}}$$

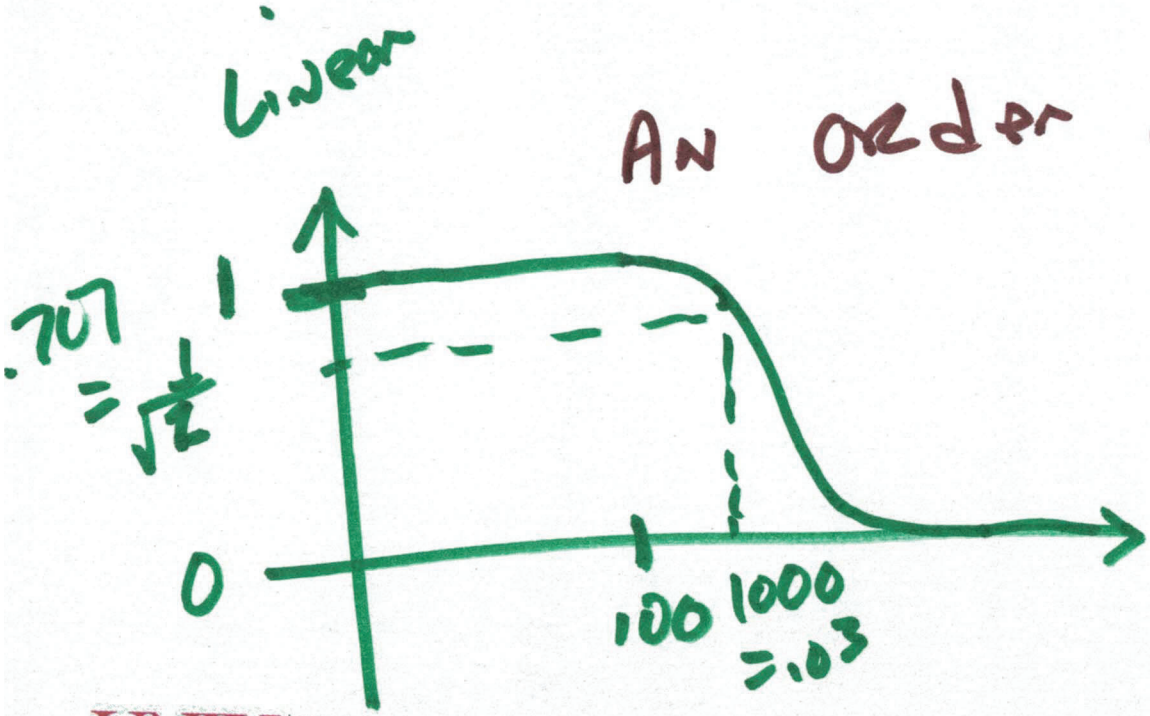
$$\left|\frac{1}{1+j\frac{f}{10^3}}\right| \rightarrow \frac{1}{\sqrt{1+\left(\frac{f}{10^3}\right)^2}}$$

$\left(\frac{1}{10}\right)^2$

$(.1)^2 .01$

decade → × 10 ÷ 10

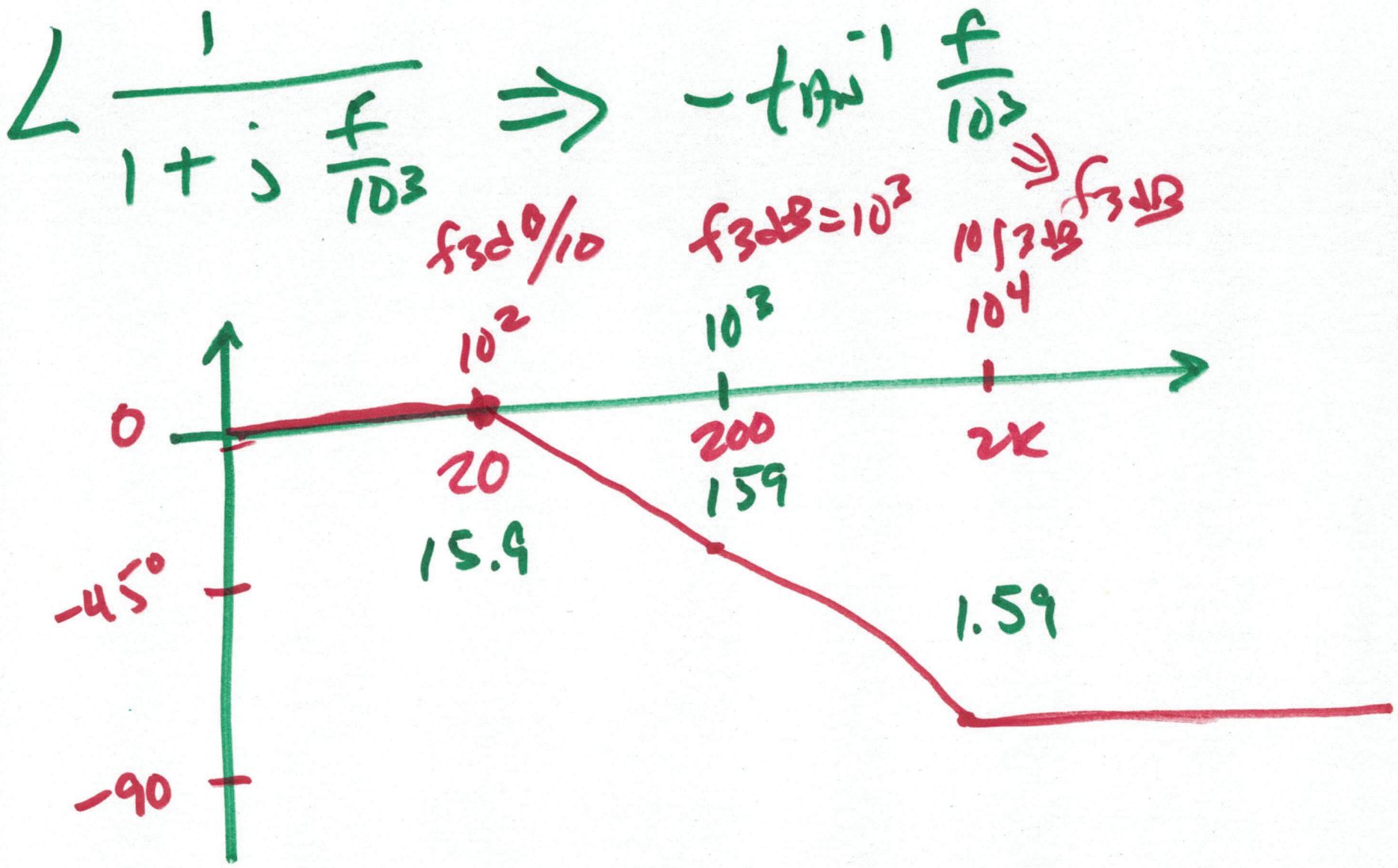
An order of Magnitude × 10 ÷ 10

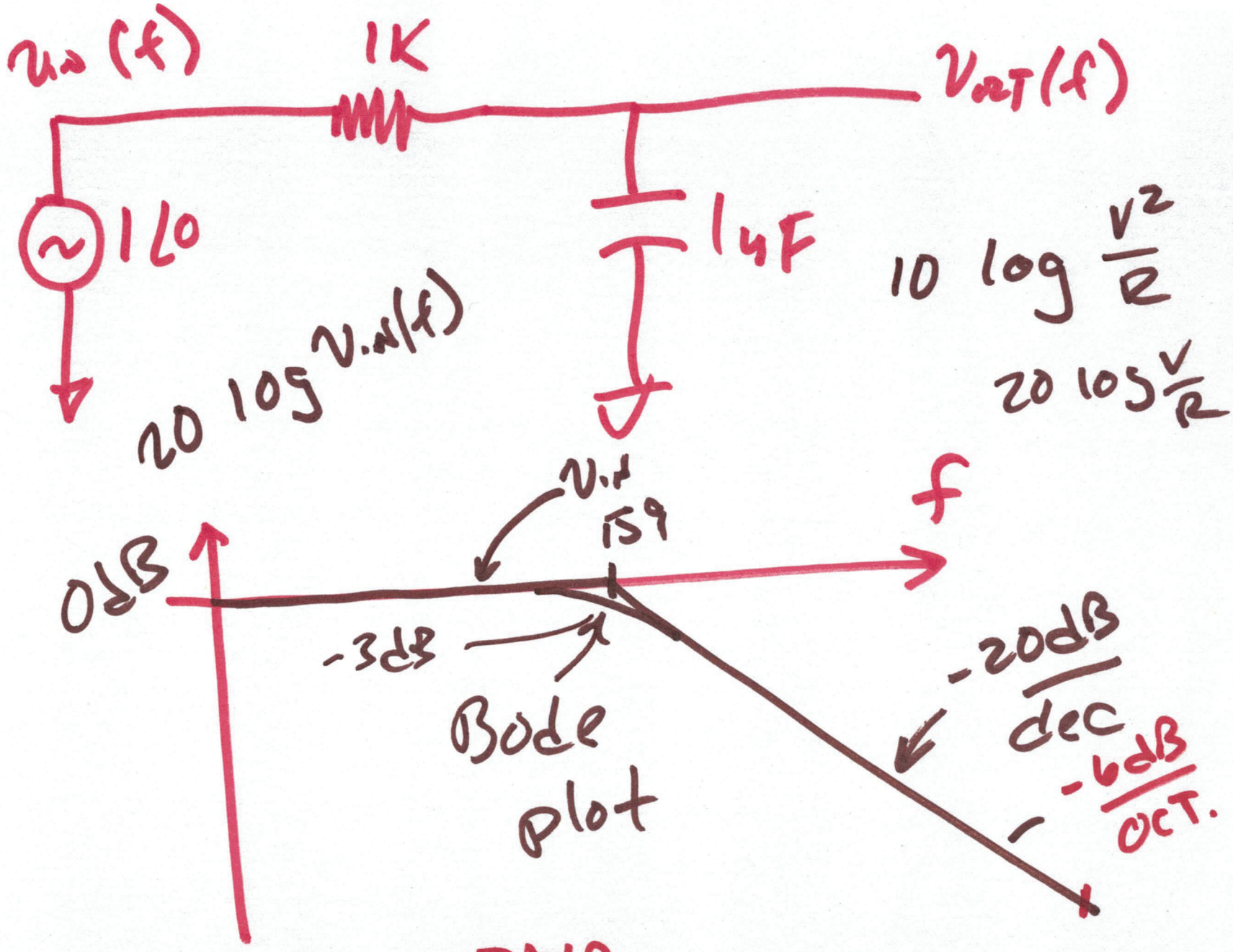


Linear

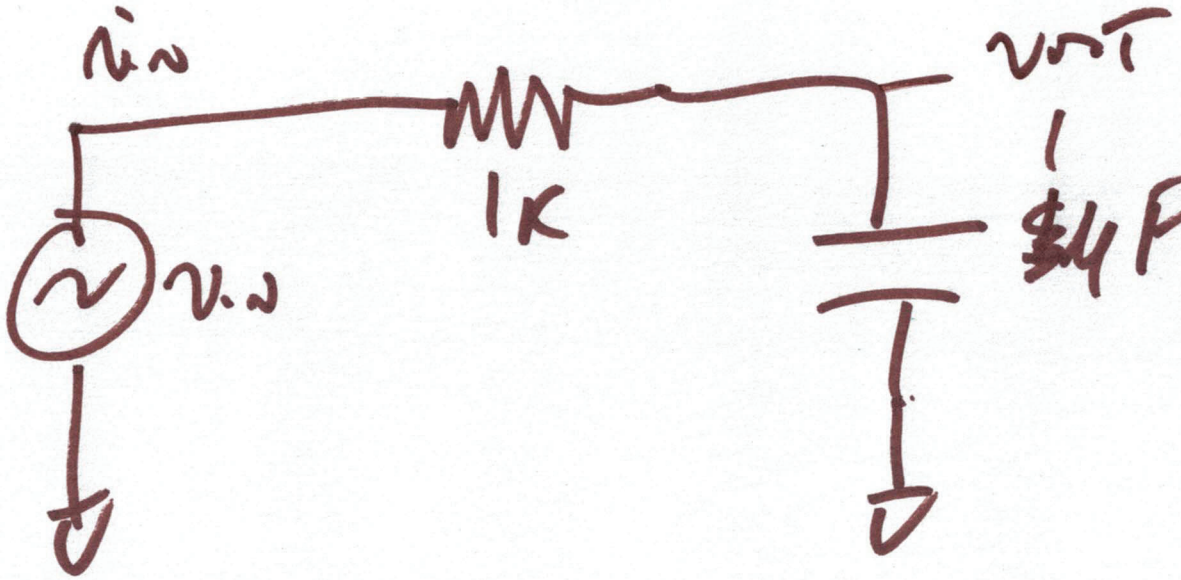
$f >> 10^3$

$\simeq \frac{10^3}{f}$


$\angle \frac{1}{1+j\frac{f}{10^3}} \Rightarrow -\tan^{-1}\frac{f}{10^3}$
$f_{3dB}=10^3$
10^2
10^3
10^4
0
-45°
-90
20
200
2K
15.9
159
1.59



UNLV | ELECTRICAL & COMPUTER ENGINEERING



$$\frac{1}{\text{\$4F}} = \frac{1}{j \cdot \omega \cdot 1\mu F}$$

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

$$\omega = 2\pi f$$

$$v_{OT} = v_{in} \cdot \frac{\frac{1}{j\omega C}}{\frac{1}{j\omega C} + R} = v_{in} \cdot \frac{1}{1 + j\omega RC}$$

$$v_{out} = 1 \cdot \frac{1}{1 + j\omega RC}$$

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

$$f_{3dB} = \frac{1}{2\pi RC} = \frac{1}{2\pi \cdot 10^3 \cdot 10^{-6}}$$

$$= 159\ Hz$$

$$|v_{out}| = \frac{1}{\sqrt{1 + \left(\frac{f}{159}\right)^2}}$$

$$20 \log \frac{1}{\sqrt{2}} = -3dB$$

$dB \rightarrow 20 \log x$

x	dB
$\frac{1}{\sqrt{2}}$ (.707)	$-3\,dB$
$\frac{1}{2}$	$-6\,dB$
$\frac{1}{5}$	$-14\,dB$
$\frac{1}{10}$	$-20\,dB$
$\frac{1}{100}$	$\rightarrow -40\,dB$

$\times 2 \rightarrow 6\,dB$

$\times 10 \rightarrow 20\,dB$