EE 320

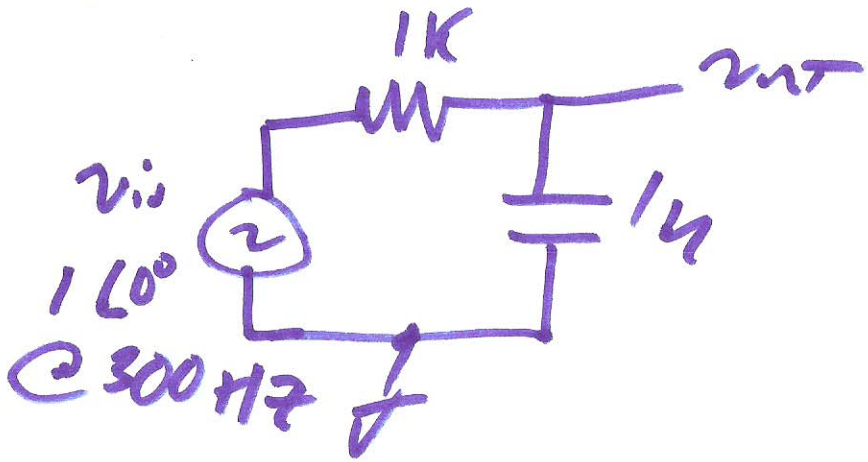
Feb. 25, 2014

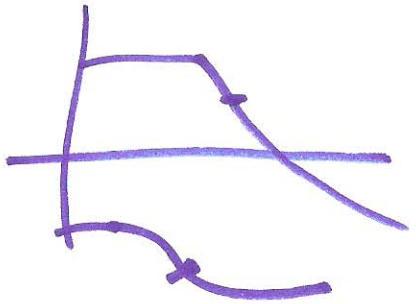
Lecture 12

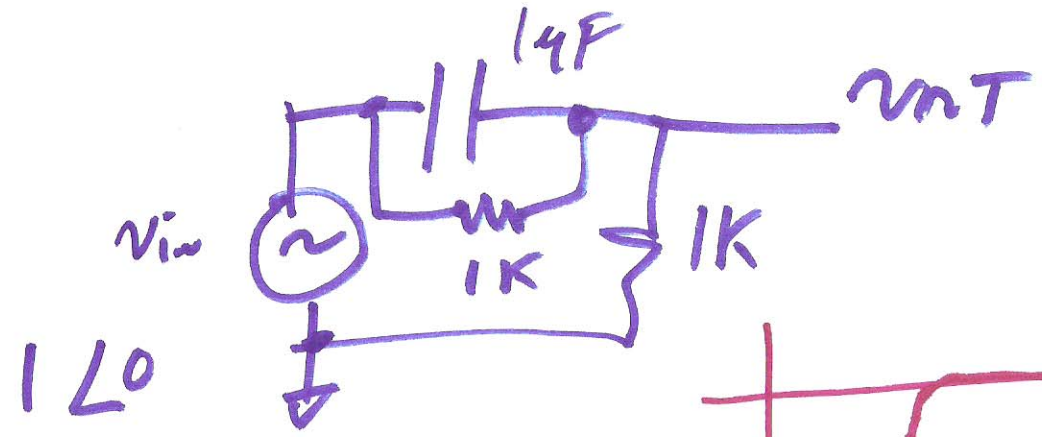
Review for the exam

Magnitude $\left|\frac{V_{out}}{V_{in}}\right|$ $\angle \frac{V_{out}}{V_{in}}$

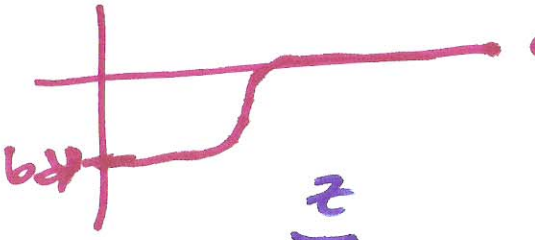
time-domain

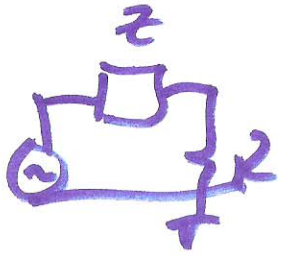






$$Z = \frac{1k \cdot \frac{1}{j\omega 10^{-6}}}{1k + \frac{1}{j\omega 10^{-6}}}$$





$$= \frac{1K}{1 + j\omega 10^{-3}}$$

$$V_{RT} = V_{in} \cdot \frac{1k}{Z + 1k}$$

$$\frac{V_{RT}}{V_{in}} = \frac{1K}{\frac{1K}{1 + j\omega 10^{-3}} + 1K} = \frac{1 + j\omega 10^{-3}}{2 + j\omega 10^{-3}}$$

$$\frac{V_{OUT}}{V_{IN}} = \frac{1 + j\omega 10^{-3}}{2 + j\omega 10^{-3}} = \frac{1}{2}\left(\frac{1 + j\omega 10^{-3}}{1 + j\omega \frac{10^{-3}}{2}}\right)$$

$$\frac{1}{2\pi 10^{-3}} = 159$$

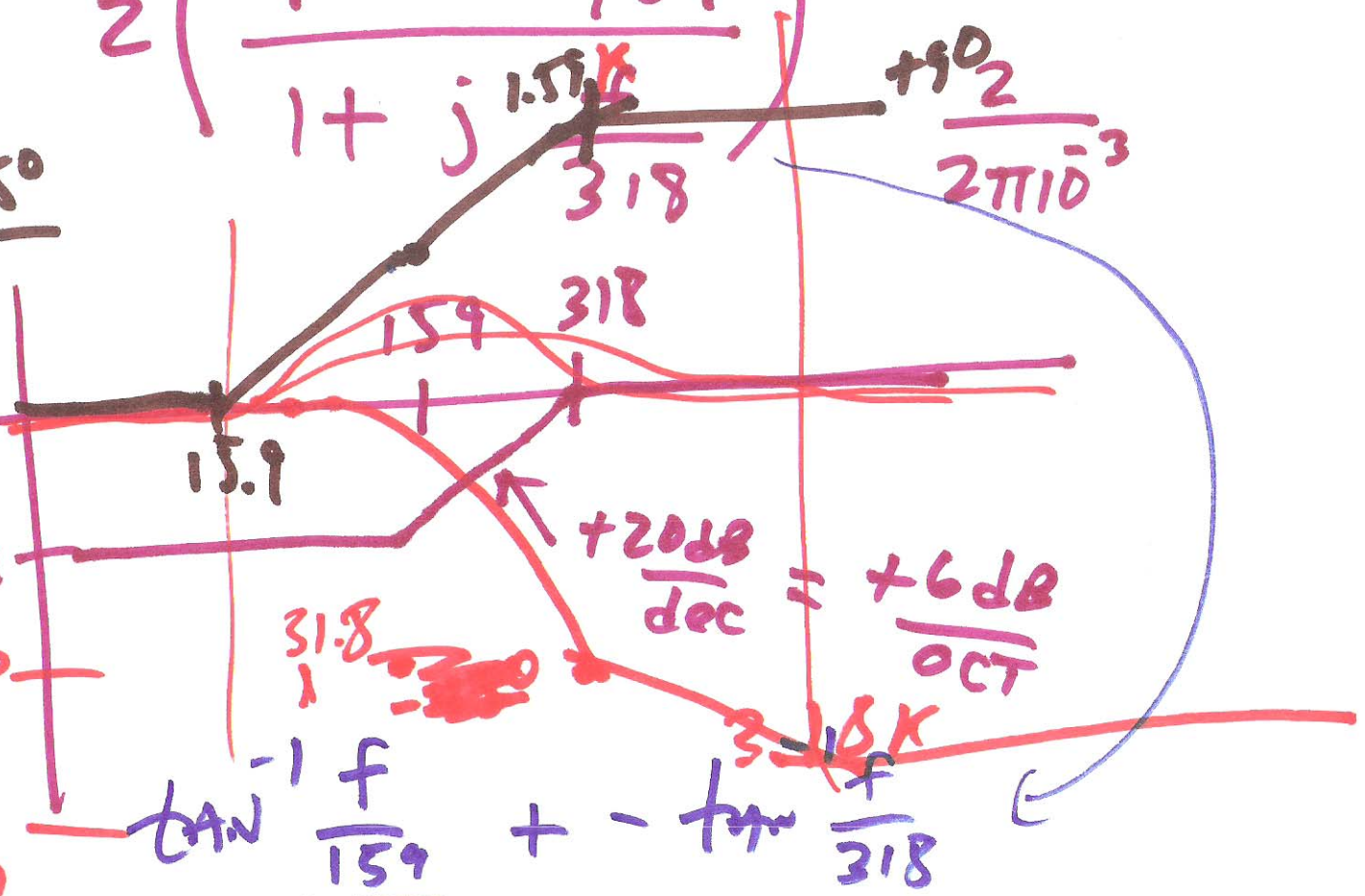
$$\frac{j\omega 10^{-3}}{2} = \frac{j 2\pi f \cdot 10^{-3}}{2} = \frac{1}{2}\left(\frac{1 + j\frac{f}{159}}{1 + j\frac{f}{318}}\right)$$

$$= j\frac{f}{\frac{2}{2\pi 10^{-3}}} \quad +45^\circ$$

$$= j\frac{f}{318} \quad 0dB$$

$$= j\frac{f}{f_p} \quad -6dB$$

pole -90°



$$\frac{v_{out}}{v_{in}} = \frac{1 + j\omega 10^{-3}}{2 + j\omega 10^{-3}}$$

$$\left|\frac{v_{out}}{v_{in}}\right| = \frac{\sqrt{1 + (2\pi f \cdot 10^{-3})^2}}{\sqrt{2^2 + (2\pi f \cdot 10^{-3})^2}}, \quad \tan^{-1} 2\pi f \cdot 10^{-3} - \tan^{-1} \frac{2\pi f \cdot 10^{-3}}{2}$$

@ DC $f = 0$, $\left|\frac{v_{out}}{v_{in}}\right| = \frac{1}{2}$

$f_z \rightarrow$ Real = Imag.

$$2\pi f_z \cdot 10^{-3} = 1$$

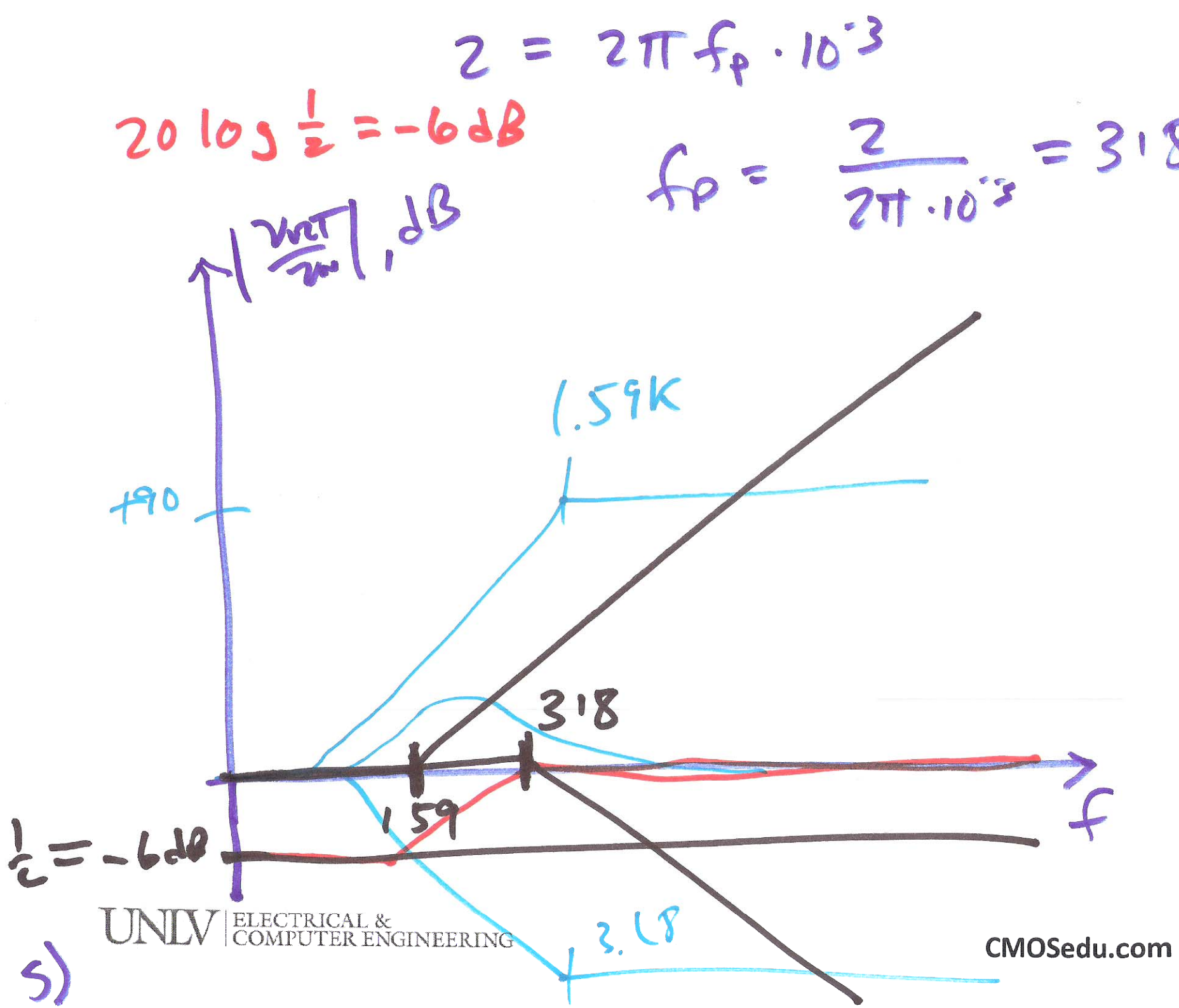
$$f_z = \frac{1}{2\pi 10^{-3}} = 159$$

4)

$$2 = 2\pi f_p \cdot 10^{-3}$$

$$20\log\frac{1}{2} = -6\,dB$$

$$f_p = \frac{2}{2\pi \cdot 10^{-3}} = 318$$



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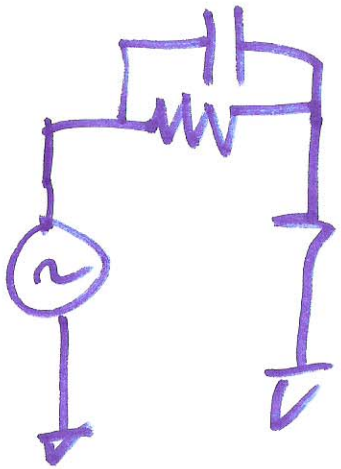
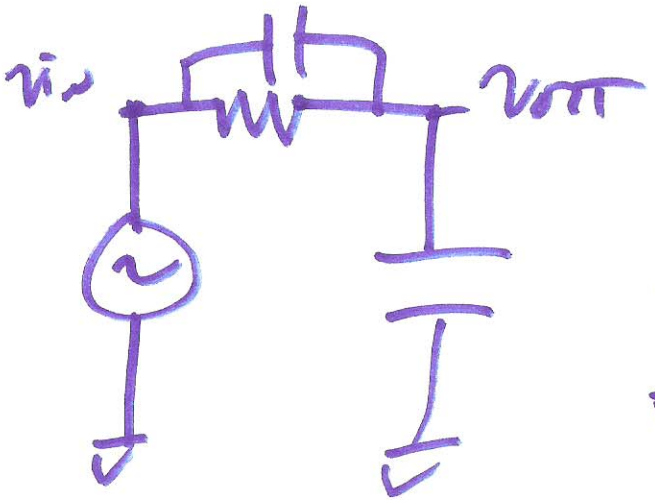
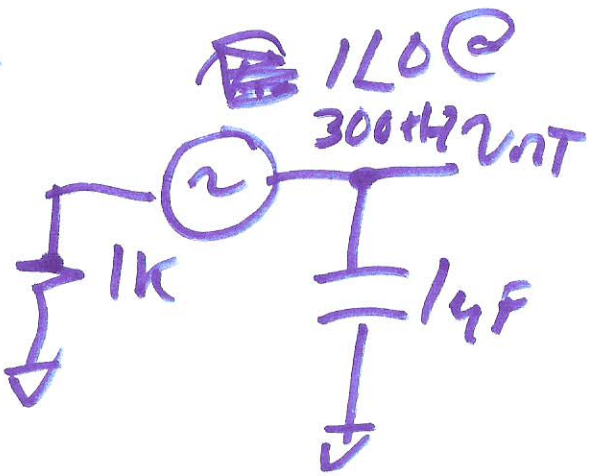
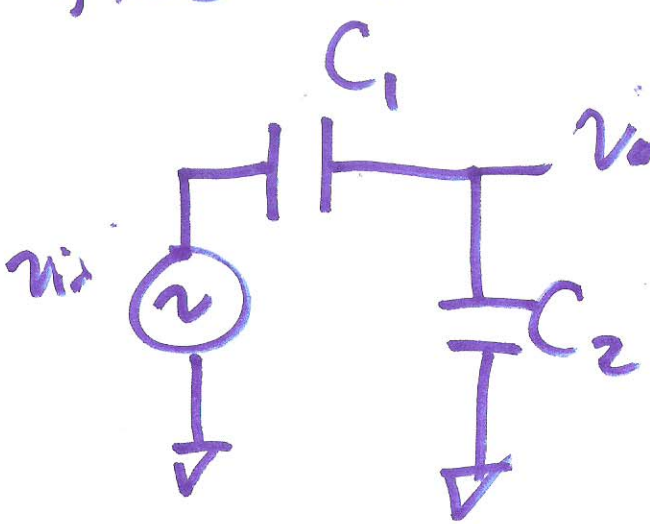


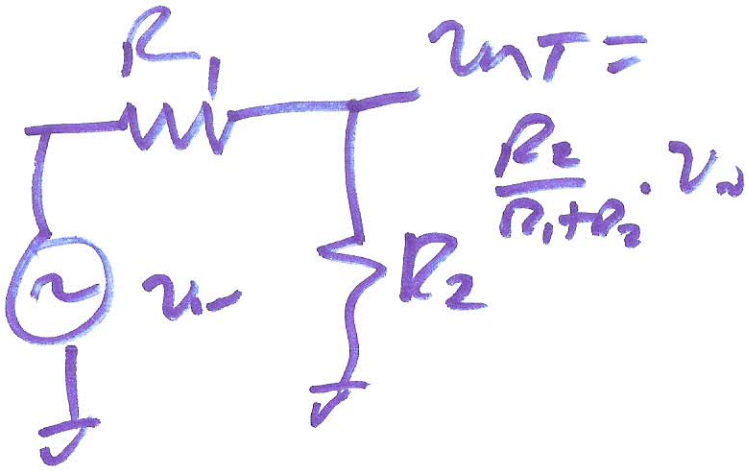




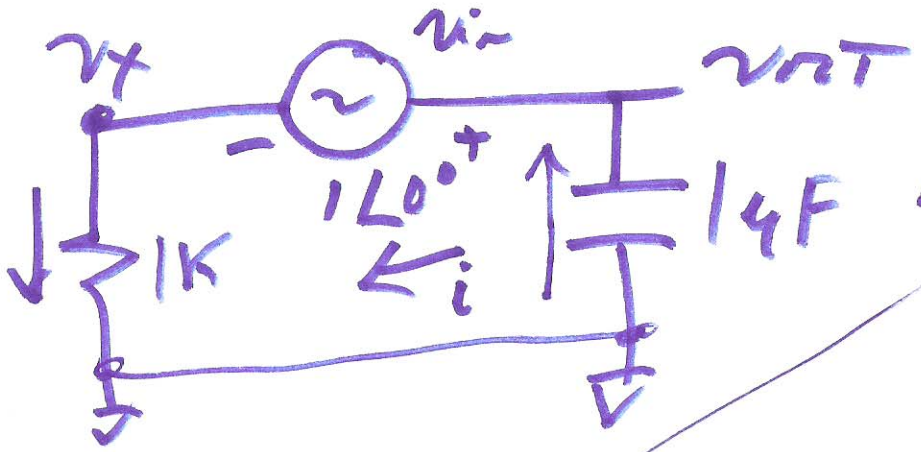
find v_{out}



$$v_{out} = v_{in} \cdot \frac{C_1}{C_1 + C_2}$$



$$v_{out} = v_{in} \cdot \frac{\frac{1}{j\omega C_2}}{\frac{1}{j\omega C_2} + \frac{1}{j\omega C_1}} = v_{in} \cdot \frac{C_1}{C_1 + C_2}$$



$$v_{in} = v_{OUT} - v_x$$

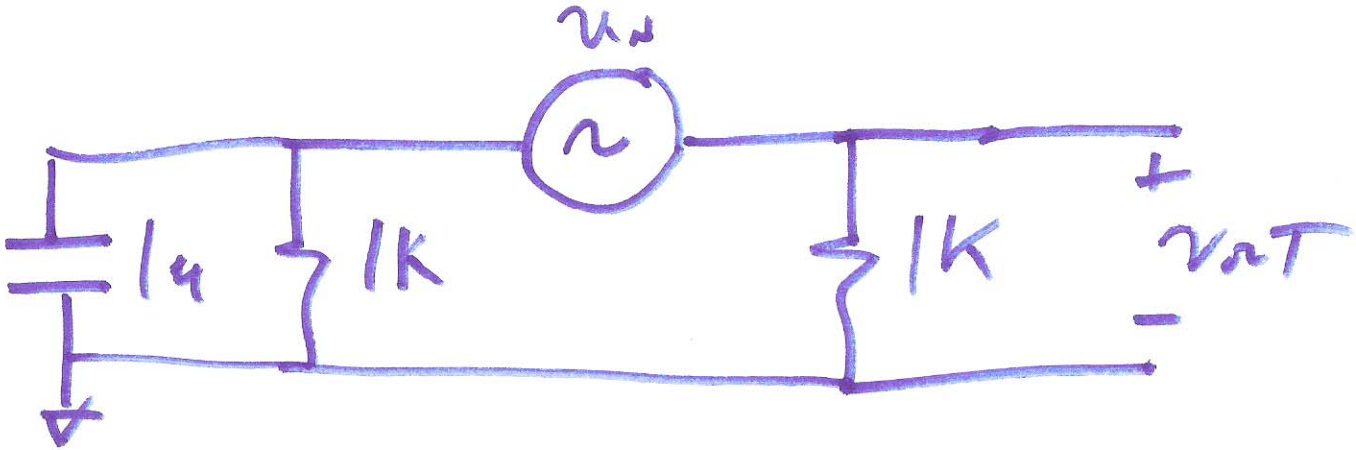
$$i = \frac{v_x}{1K} \Rightarrow i \cdot 1K = v_x$$

$$v_{OUT} = -i \cdot \frac{1}{j\omega 10^{-6}}$$

$$1\angle 0^\circ = -i \cdot \frac{1}{j\omega 10^{-6}} - i \cdot 1K \qquad 1 + j0 = -i\left(1K - \frac{-i}{j\omega 10^{-6}}\right)$$

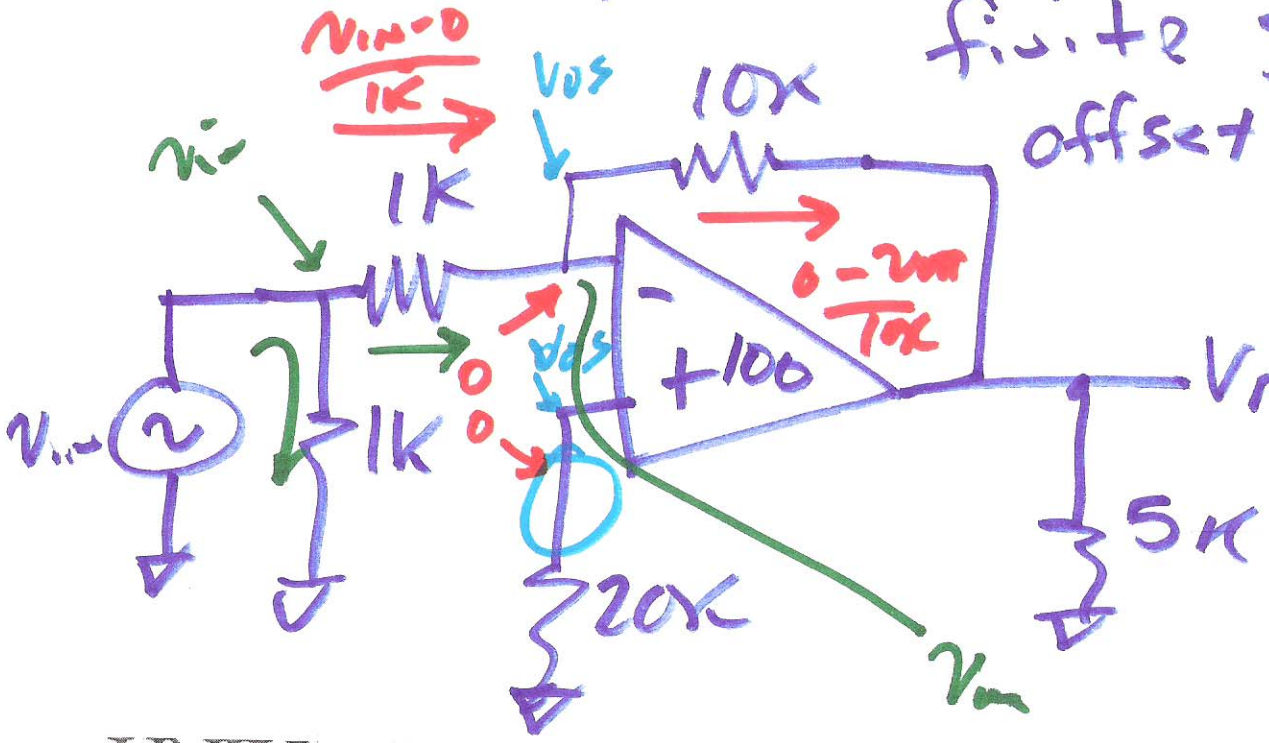
$$1 = -i \cdot \left(1K + \frac{1}{j\omega 10^{-6}}\right)$$

$$v_{OUT} = \frac{1}{1 + j\omega 10^{-3}} = \frac{1}{1 + j\frac{f}{159}} \qquad i = \frac{+1}{1K + \frac{1}{j\omega 10^{-6}}} = \frac{+j\omega 10^{-6}}{1 + j\omega 10^{-3}}$$



Op-Amps

$V_{OT} = 100(V_p - V_n)$



$\frac{V_{in} - V_m}{1K} = \frac{V_m - V_{OT}}{10K}$

$V_{OT} = 100 \cdot (0 - V_n)$

Review Quizes & H.W.

Lectures.

N_1 dep. width

P_1 CAP

N_i forward Bits

Integrators

freq. response

Design square wave to triangle wave