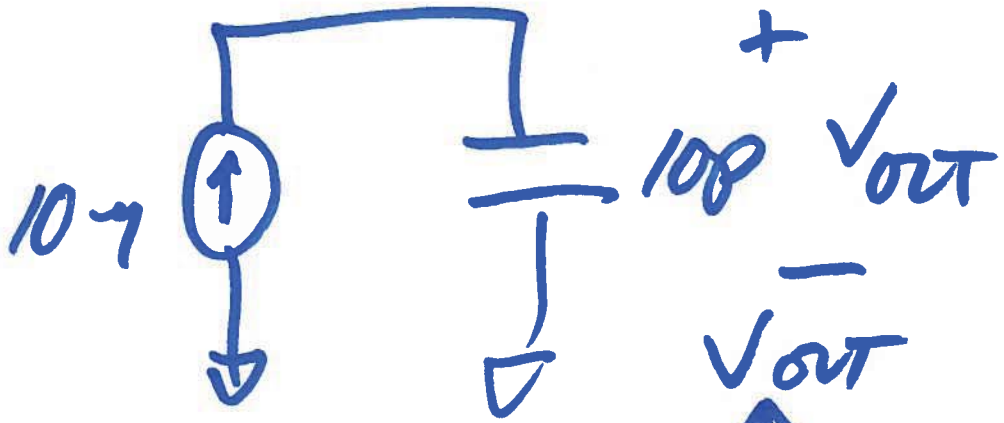
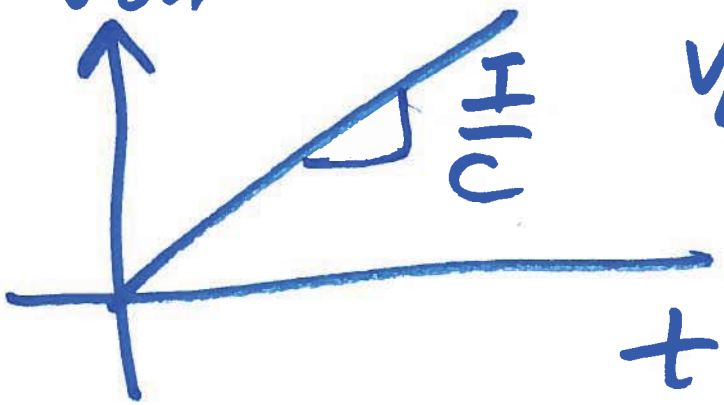
EE 220 Circuits II

Study Session III



$$V = \frac{1}{C}\int i \cdot dt$$

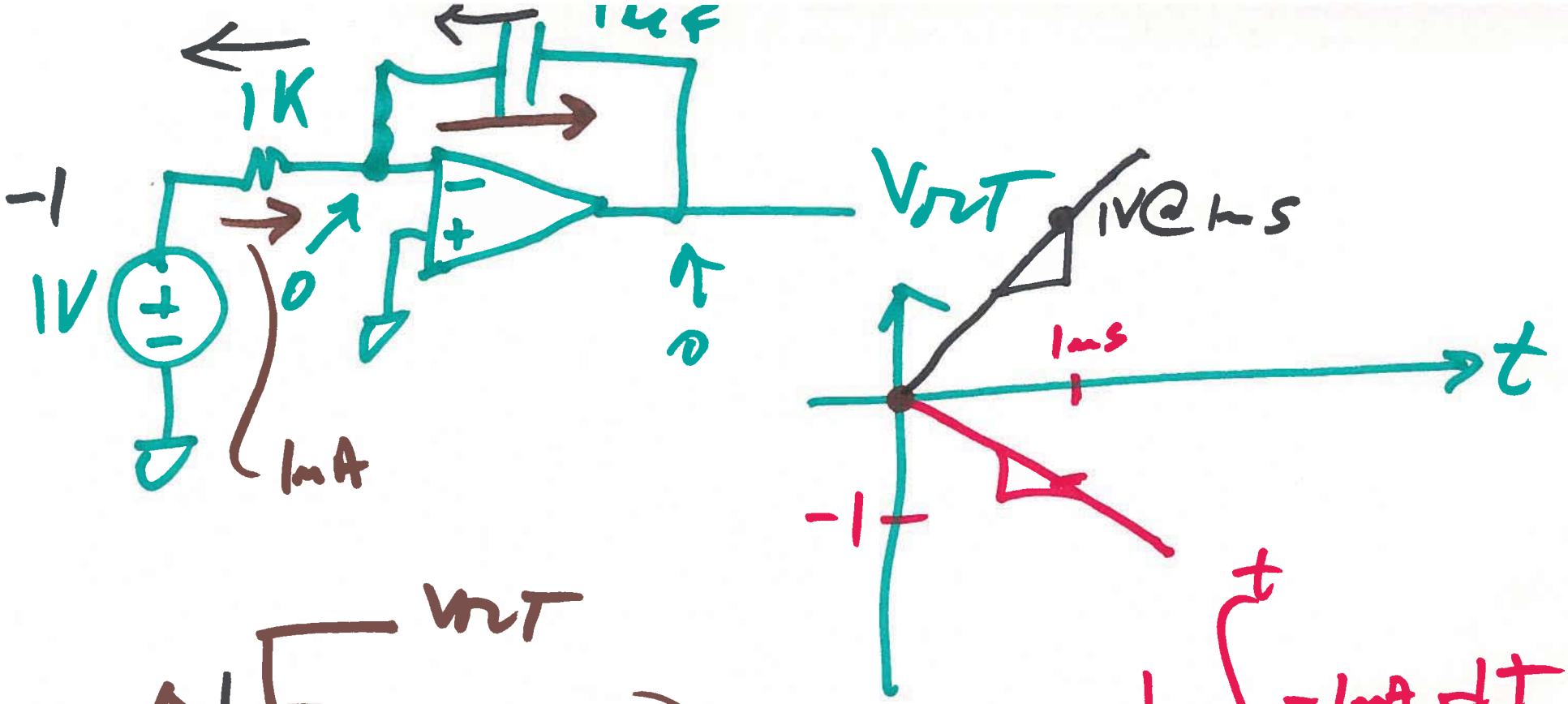
$$I = C\frac{dV_{OUT}}{dt}$$

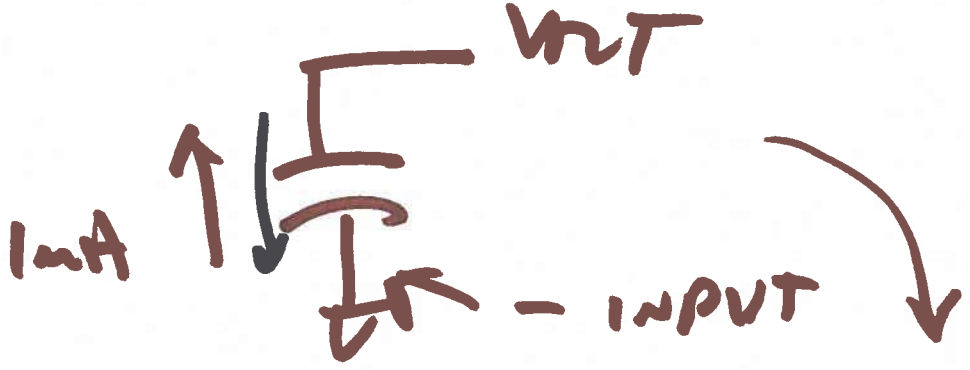


$$V_{OUT} = \frac{1}{C}\int_0^t I \cdot dt$$

$$V_{OUT} = \frac{10n}{100p} \cdot t$$

$\frac{I}{C}$



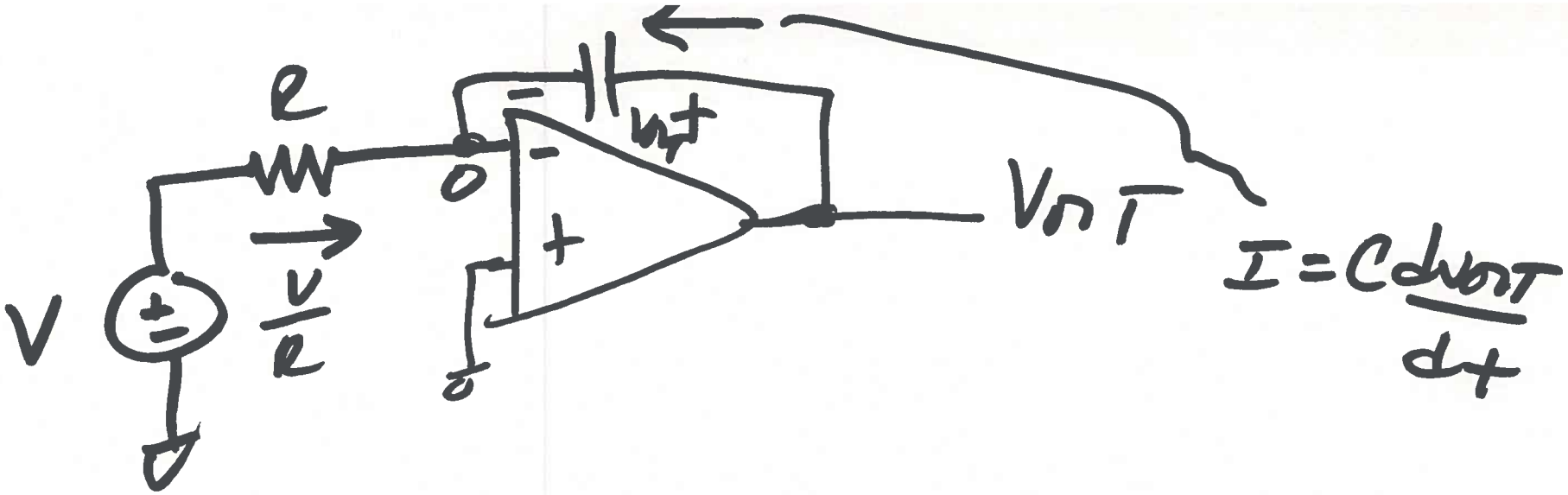


$$\rightarrow V_{OUT} = \frac{1}{C}\int_0^t -1mA\,dt$$

$$= V_{OUT} = \frac{-1V}{ms} = \frac{-1mA}{10^{-6}F} \cdot t$$

$$I \rightarrow \frac{1}{T} \; {}^{+}_{-} V \rightarrow \frac{1}{C}\int i \cdot dt = V$$

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

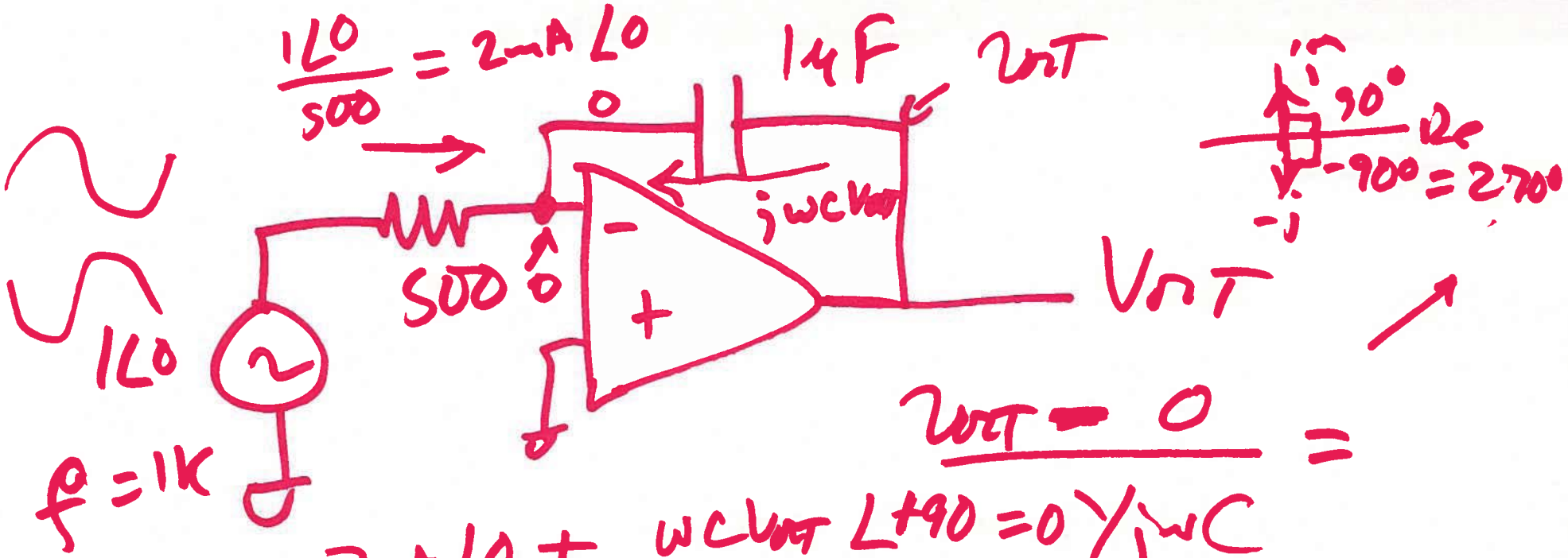


$$I \quad \frac{V}{R} + C\frac{dV_{OUT}}{dt} = 0$$

$$V_{OUT} = -\frac{(V/R)}{C} \cdot t$$

$$C\frac{dV_{OUT}}{dt} = -\frac{V}{R}$$

$$\int dV_{OUT} = \int_0^t -\frac{V}{RC} \cdot dt$$



$$\frac{V_{OUT}}{2mA\angle 0} = 0$$

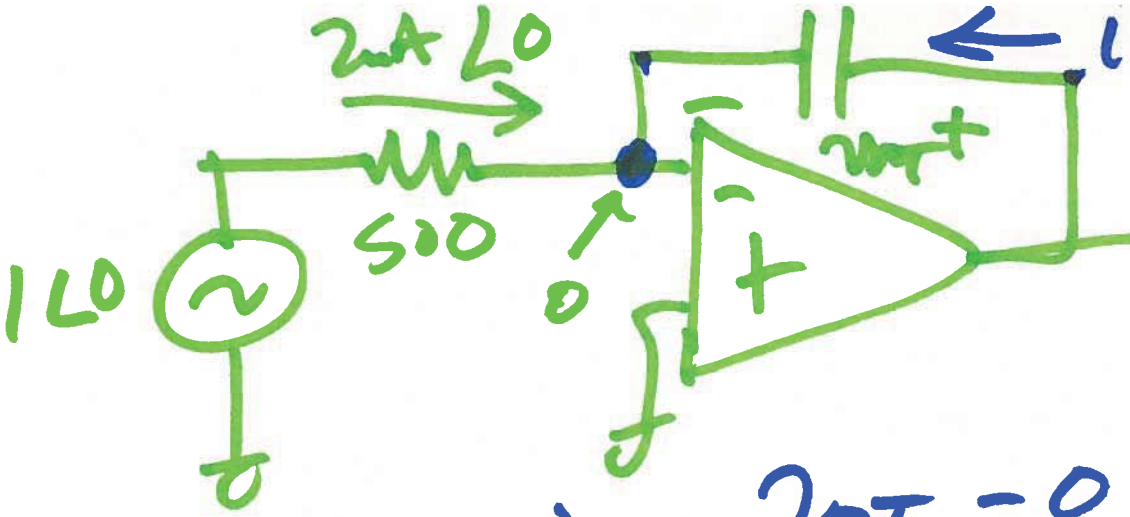
$$2mA\angle 0 + \omega C V_{OUT}\angle 90 = 0 \quad Y/j\omega C$$

$$2mA\angle 0 = -j\omega C V_{OUT} = \omega C V_{OUT}\angle -90°$$

$$2mA\angle 0° + \omega C V_{OUT}\angle 90 = 0$$

$$2mA\angle 0° = -\omega C V_{OUT}\angle 90°$$

$$= \omega C V_{OUT}\angle -90°$$



$T = RC$

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

$$i = \frac{v_{in} - 0}{1/j\omega C} = v_{in} \cdot j\omega C$$

$$v_{out} = v_{in} \omega C \angle 90$$

$$2mA \angle 0 + 6.28 \cdot 10^{-3} \angle 90 = 0$$

$$2mA \angle 0 \equiv 6.28 \cdot 10^{-3} \angle 90$$

$$= v_{in} \cdot 2\pi 10^{3} \cdot 10^{-6} \angle 90$$

$$2mA \angle 0^{\circ} = v_{in} \cdot 6.28 \cdot 10^{-3} \angle 270^{\circ} = v_{in} \cdot 6.28 \cdot 10^{-3} \angle 90$$

$$v_{in} = \frac{2 \cdot 10^{-3} \angle 0^{\circ}}{6.28 \cdot 10^{-3} \angle 270} = \frac{2}{6.28} \angle -270^{\circ}$$

$$= \frac{2}{6.28} \angle 90^{\circ}$$

$$.318 \angle 90^{\circ}$$

5)

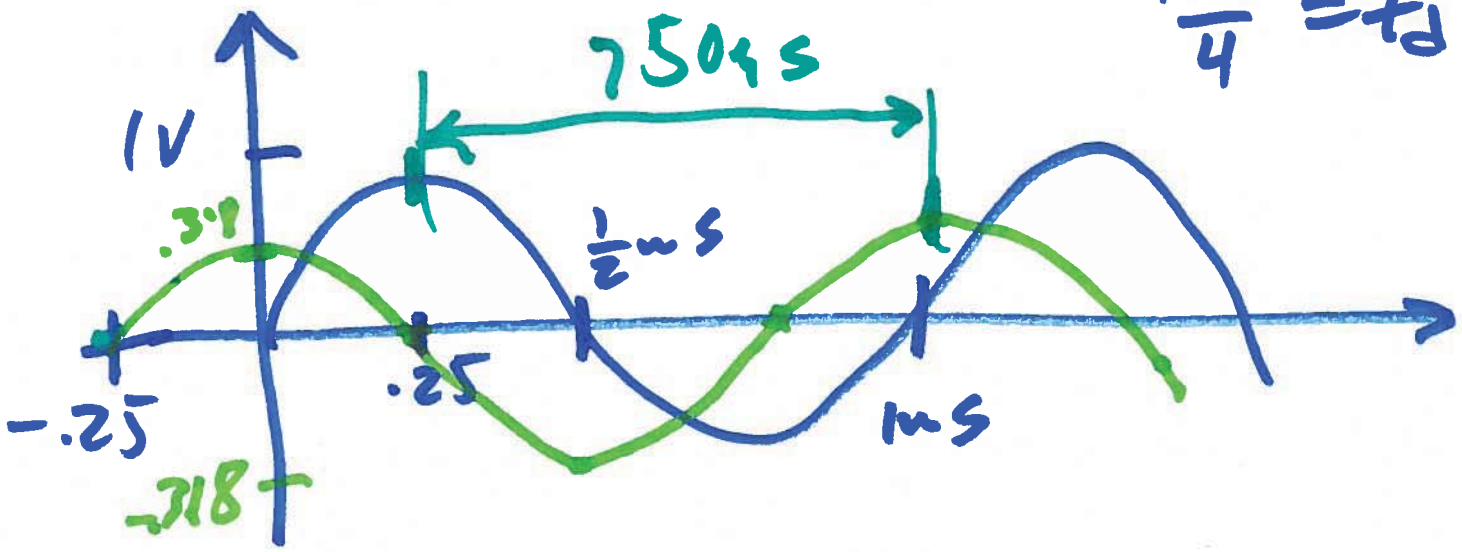
$v_{IN} = 1V \cdot \sin 2\pi \cdot 10^3 \cdot t$

$v_{OUT} = 0.318 \sin(2\pi \cdot 10^3 \cdot t + 90^\circ)$ -270°

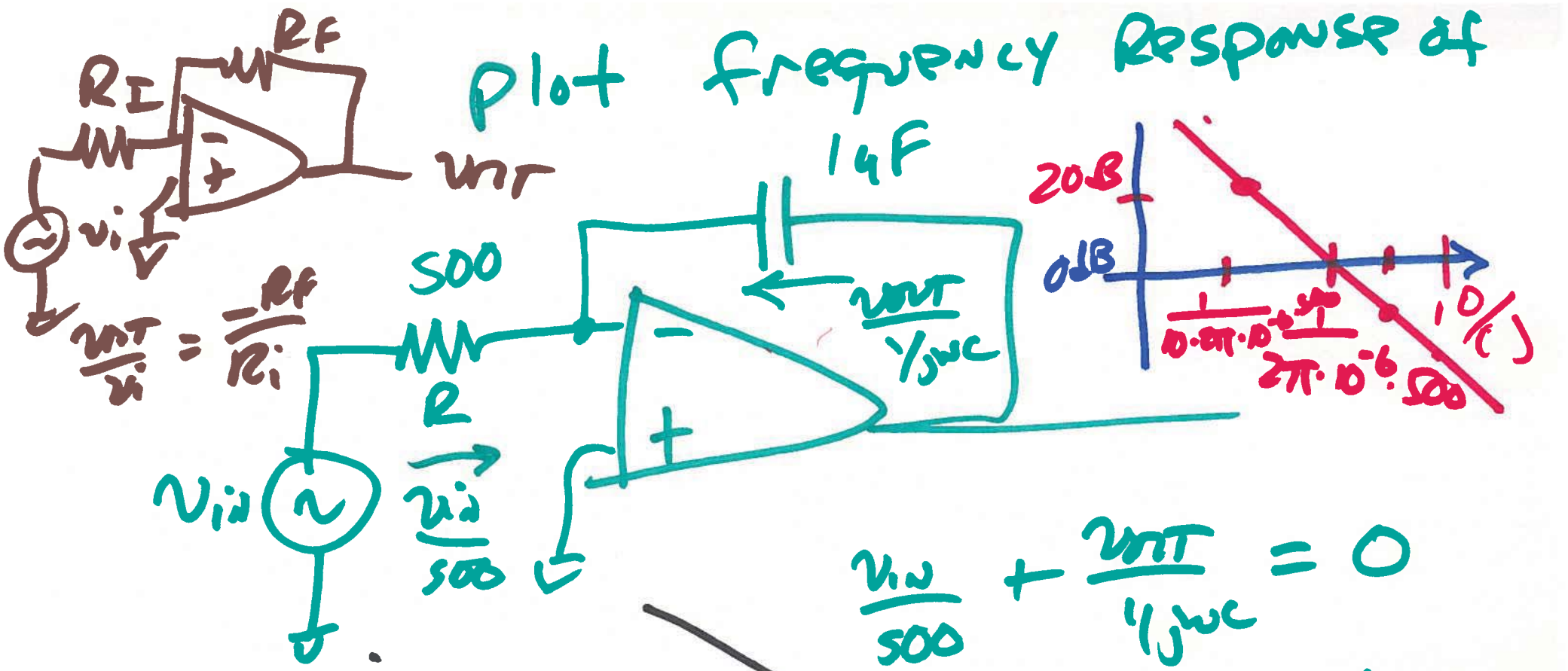
$\theta = \frac{t_d}{T} \cdot 360$

$90^\circ = \frac{t_d}{1ms} \cdot 360$

$\frac{1ms}{4} = t_d = 250\mu s$



b)



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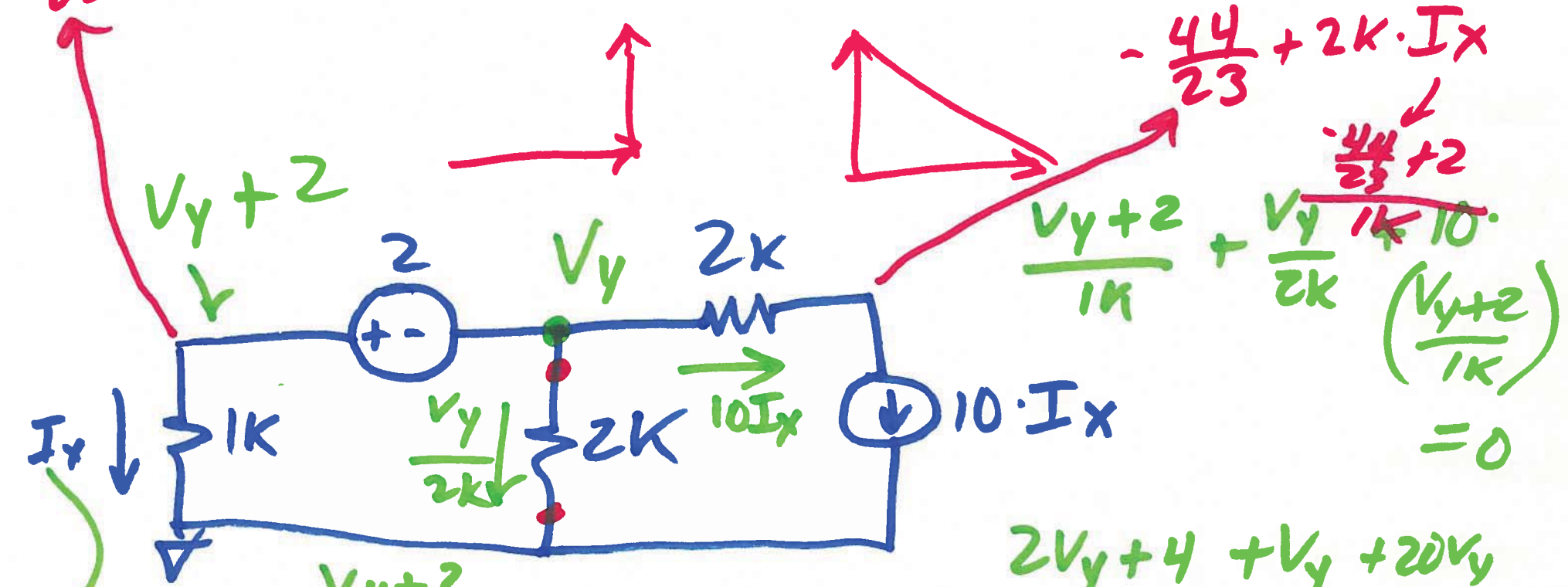
7)

$$V_{IN} = 2 \sin\left(2\pi \cdot \frac{15}{30} \cdot t\right)$$

$$V_{OUT} = 20 \cdot \sin(2\pi \cdot 30 \cdot t + 90)$$



$$2V_y + 4 + V_y + 20V_y + 40 = 0$$

$$23V_y = -44$$

$$V_y = \frac{-44}{23}$$

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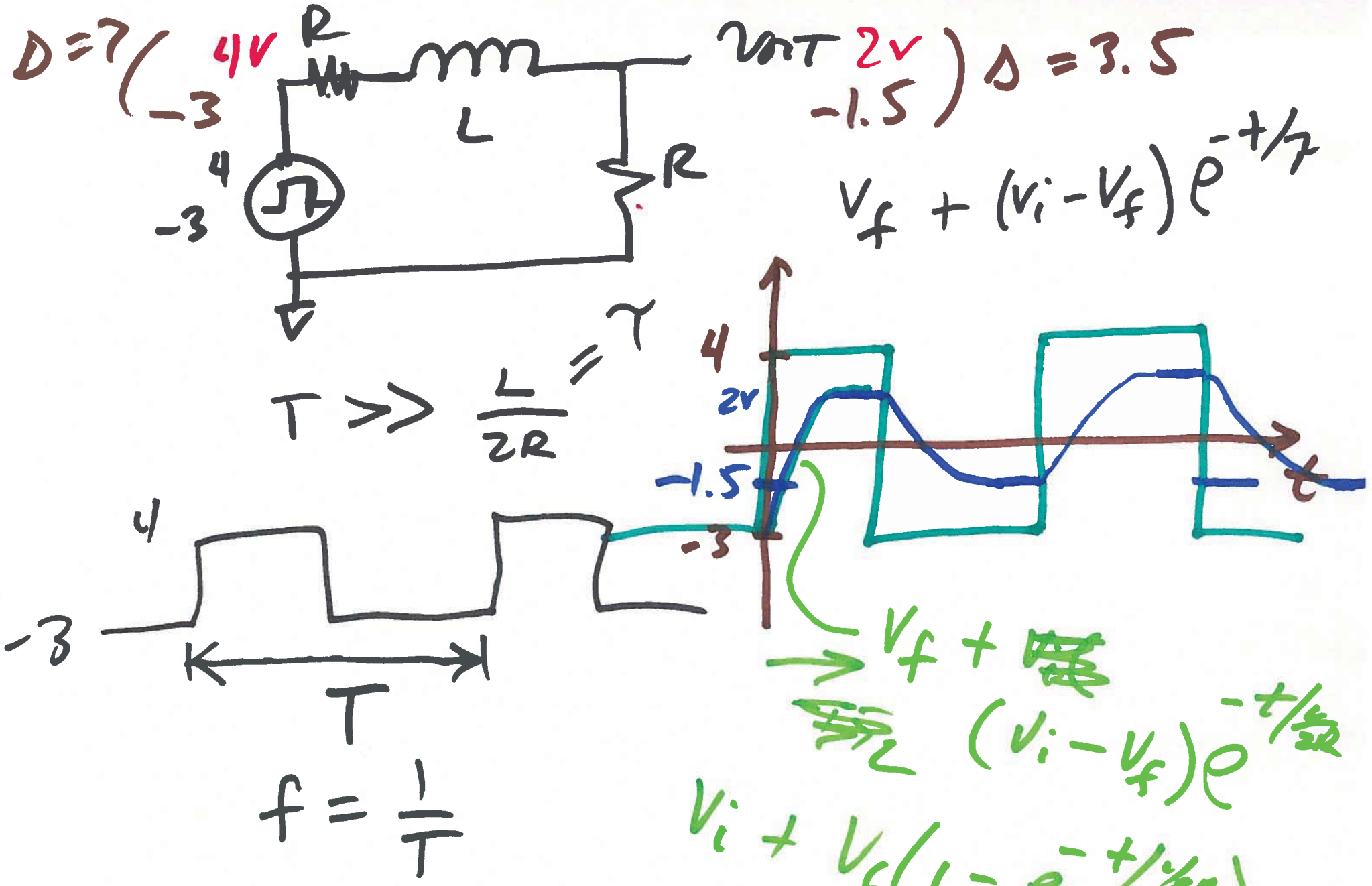
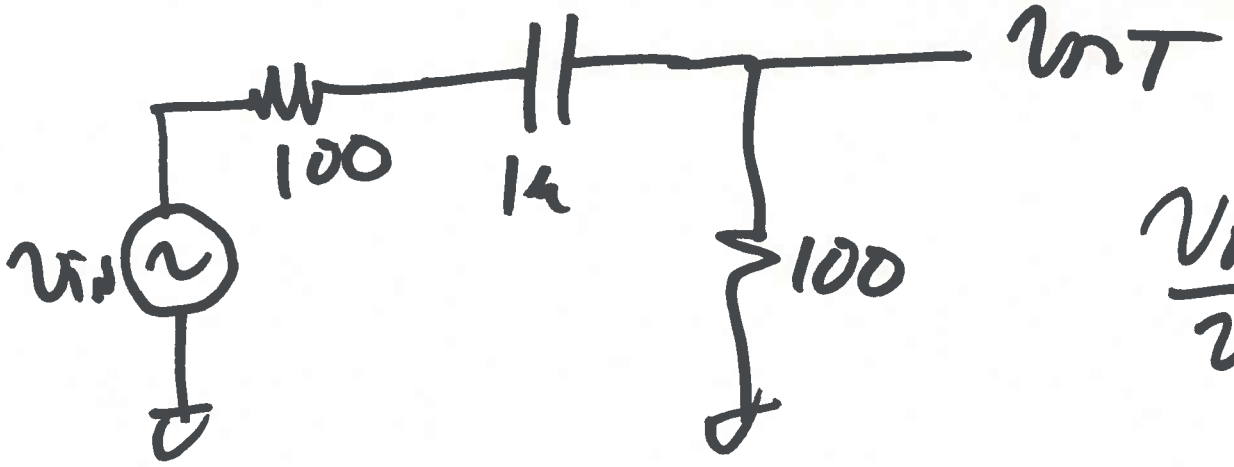
8)


D=?
4V
-3
R
L
R
4
-3
2nT 2V
-1.5
D=3.5
$V_f + (V_i - V_f)e^{-t/\tau}$
$T >> \frac{L}{2R} = \tau$
4
2V
-1.5
-3
t
4
-3
T
$f = \frac{1}{T}$
$V_f +$
$(V_i - V_f)e^{-t/\tau}$
$V_i + V_f(1 - e^{-t/\tau})$



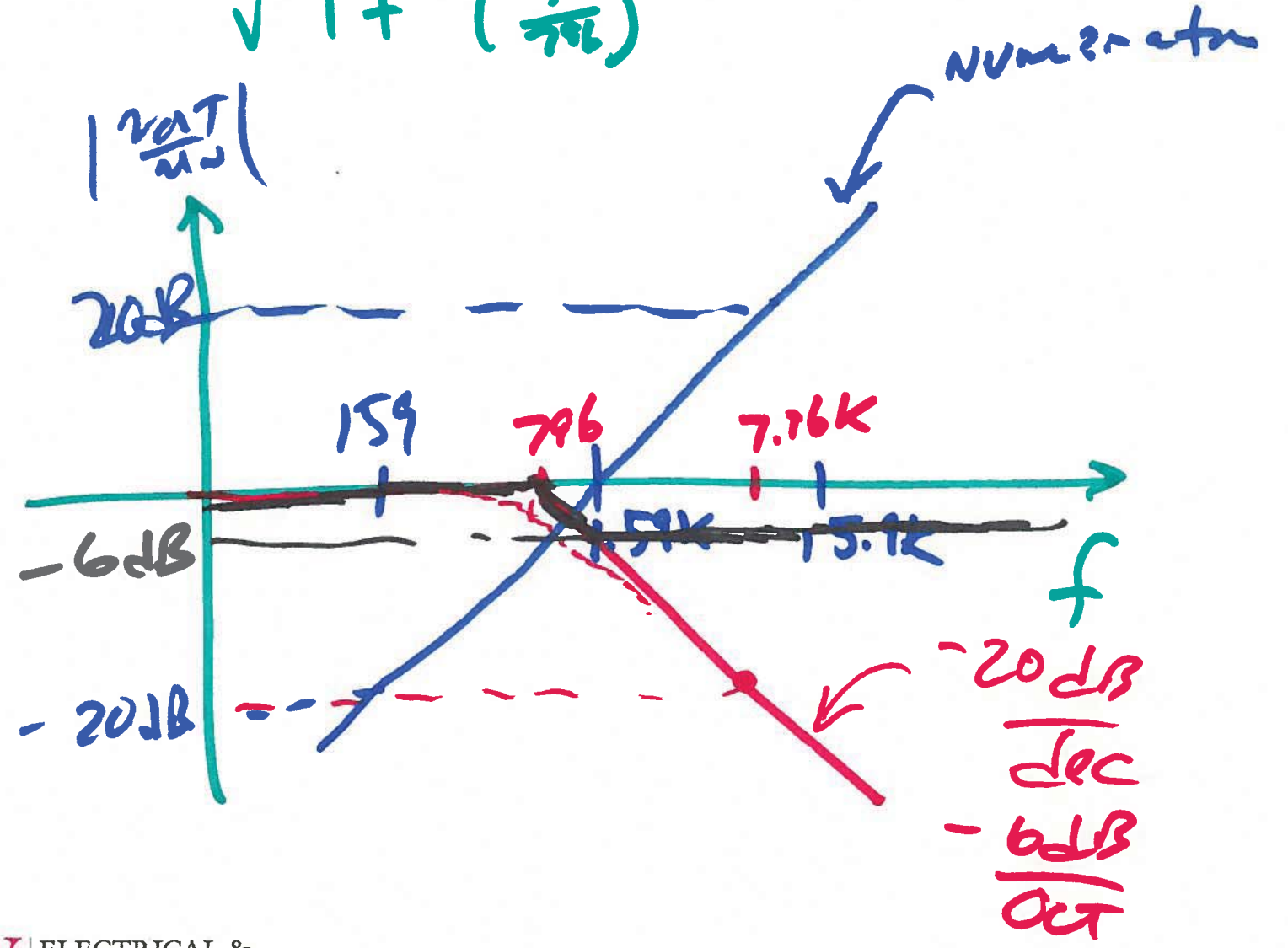
$$\frac{V_{OUT}}{V_{in}} = \frac{100}{200 + \frac{1}{j\omega \cdot 10^{-6}}}$$

$$\frac{V_{OUT}}{V_{in}} = \frac{0 + j \cdot \omega \cdot 100 \cdot 10^{-6}}{1 + j\omega \cdot 200 \cdot 10^{-6}} = \frac{0 + j\,\frac{f}{1.59K}}{1 + j\,\frac{f}{796}}$$

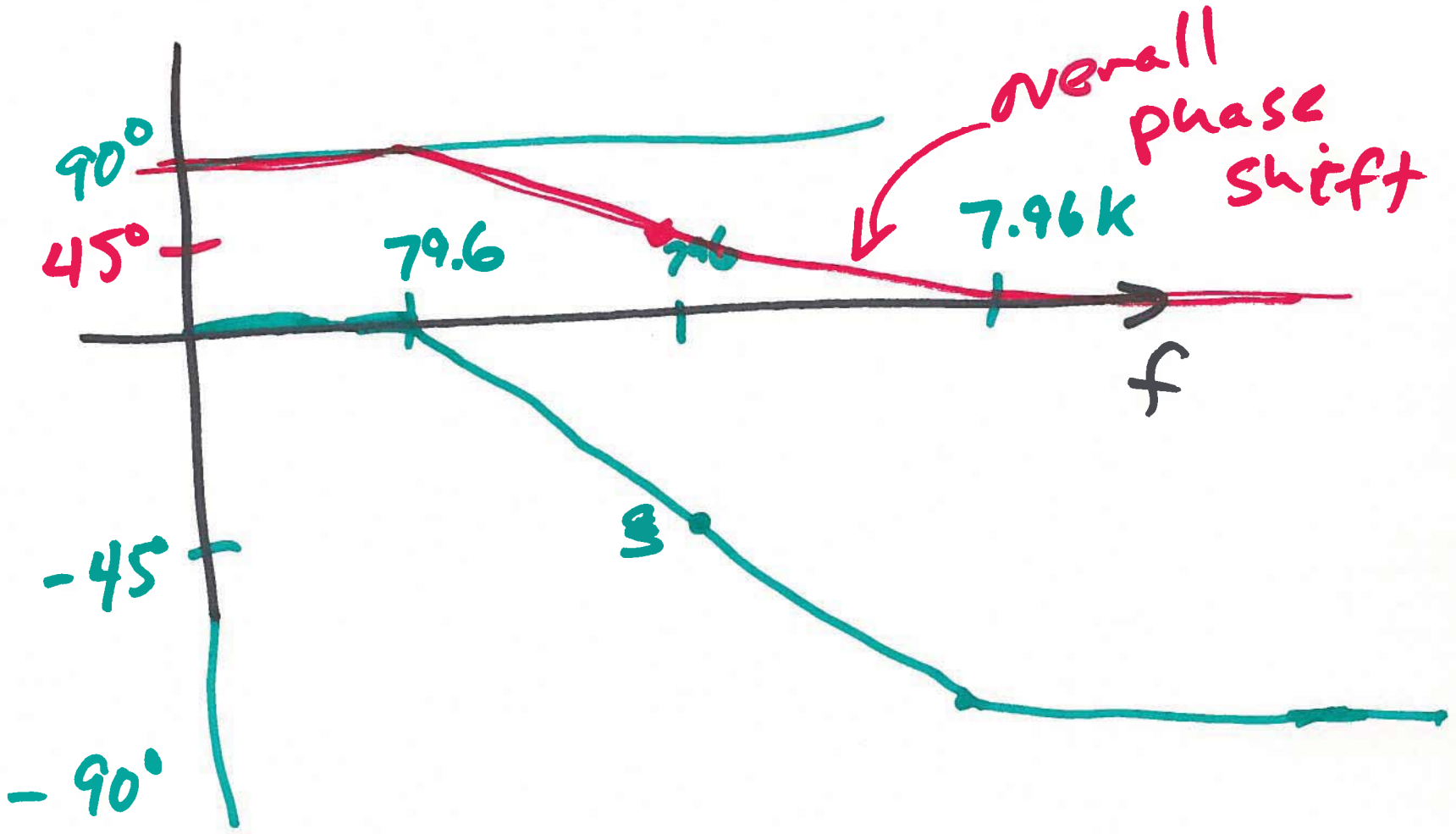
$$\left|\frac{V_{OUT}}{V_{in}}\right| = \frac{\frac{f}{1.59K}}{\sqrt{1 + \left(\frac{f}{796}\right)^2}} \qquad \angle\frac{V_{OUT}}{V_{in}} = 90 - \tan^{-1}\frac{f}{796}$$

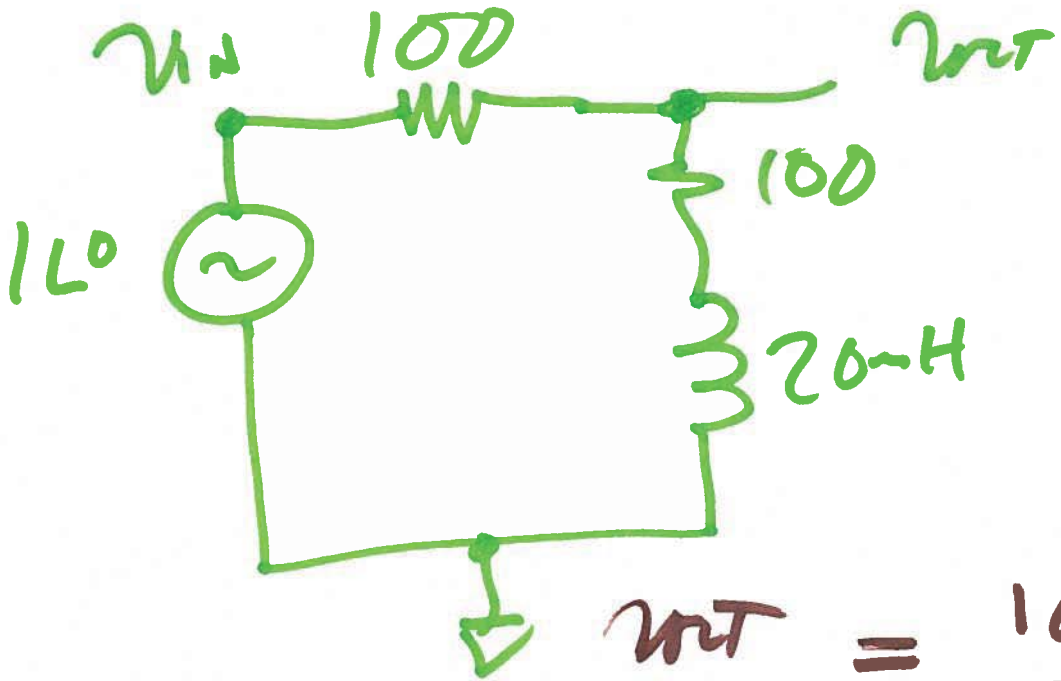
$$\left|\frac{v_{OUT}}{v_{IN}}\right| = \frac{\frac{f}{1.59K}}{\sqrt{1+\left(\frac{f}{1.59K}\right)^2}}$$

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



$$\angle \frac{20LT}{\lambda\omega} = 90 + \left(-\tan^{-1}\frac{f}{796}\right)$$





$$\frac{v_{out}}{v_{in}} = \frac{100 + j\omega\, 20\text{mH}}{200 + j\omega\, 20\text{mH}}$$

$j\omega L$

$$\frac{v_{out}}{v_{in}} = \frac{100}{200} \cdot \frac{1 + j\omega \frac{20\text{mH}}{100}}{1 + j\omega \frac{20\text{mH}}{200}}$$

$$\frac{1}{2\pi \cdot \frac{20\text{mH}}{100}} = 796$$

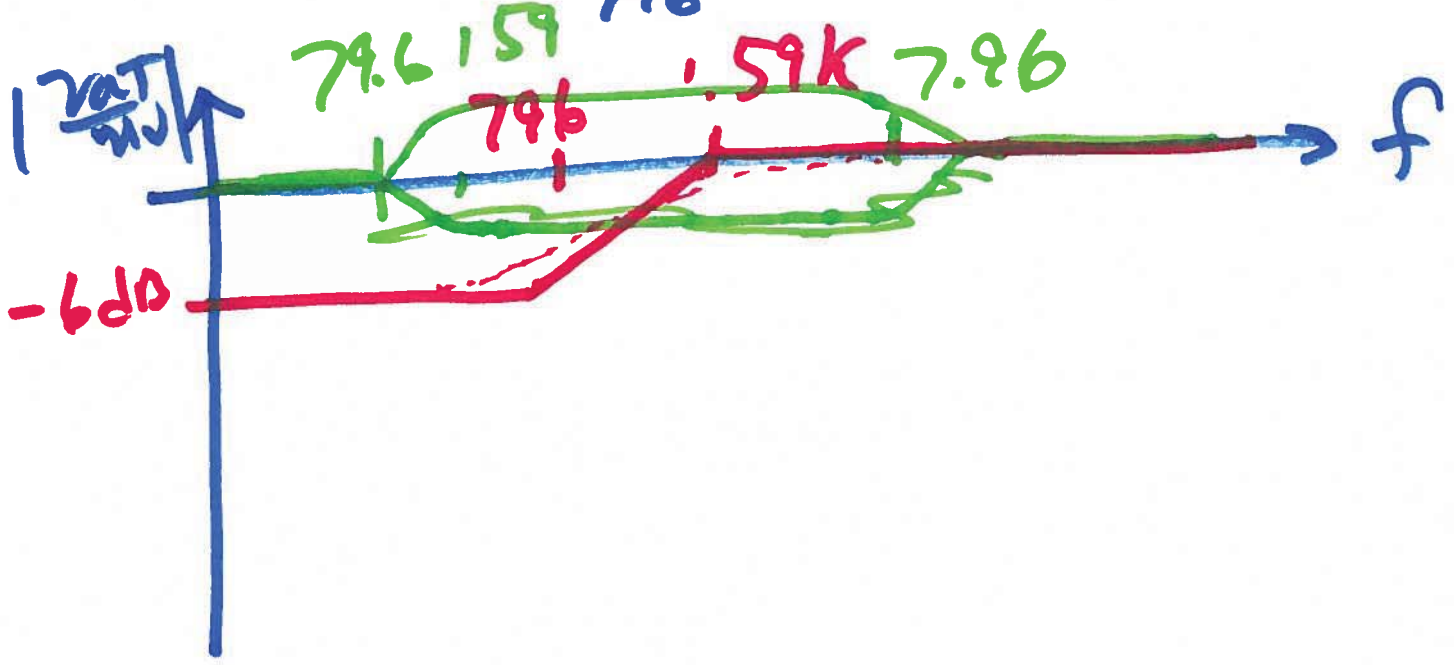
$$\frac{1}{2\pi \frac{20\text{mH}}{200}} = 1.59\text{k}$$

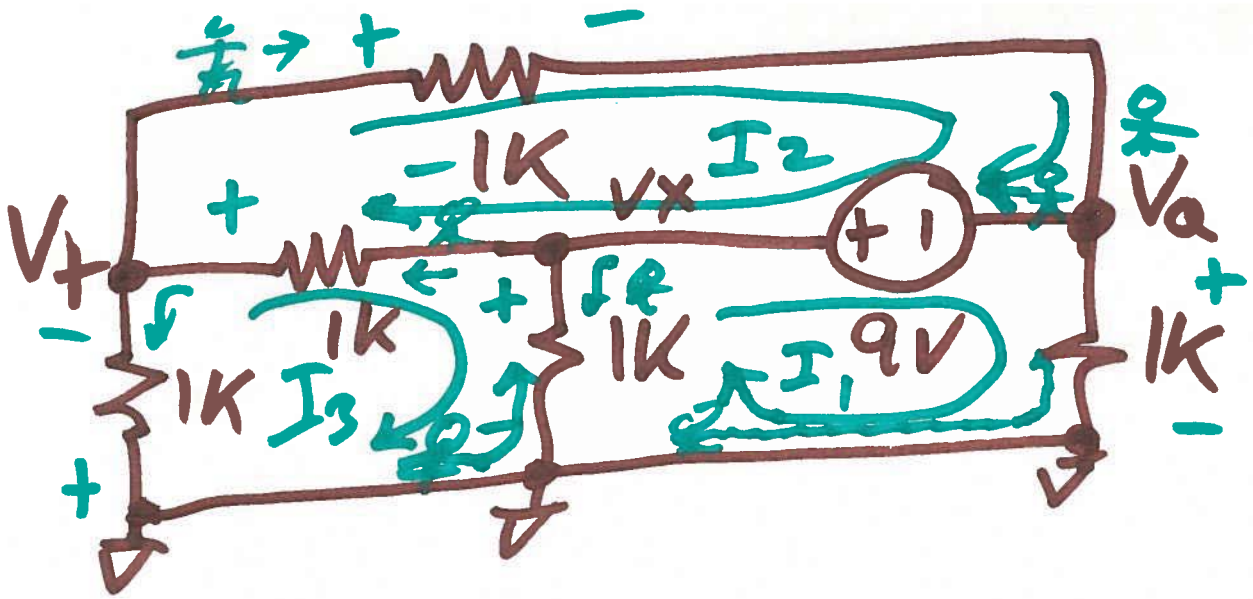
$$= \frac{1}{2} \cdot \frac{1 + j\frac{f}{796}}{1 + j\frac{f}{1.59\text{k}}}$$

$$\left|\frac{2nT}{2J}\right| = 20\log\frac{1}{2} + 20\log\sqrt{1+\left(\frac{f}{796}\right)^2} - 20\log\sqrt{1+\left(\frac{f}{1.59k}\right)^2}$$

$-6dB$

$$20 + \tan^{-1}\frac{f}{796} - \tan^{-1}\frac{f}{1.59k}$$





$$9V - 1k(I_3 - I_1) + 1k \cdot I_1 = 0$$

$$9V + 1k(I_3 - I_2) - I_2 \cdot 1k = 0$$

$$1k(I_3 - I_1) + 1k(I_3 - I_2) + 1k \cdot I_3 = 0$$