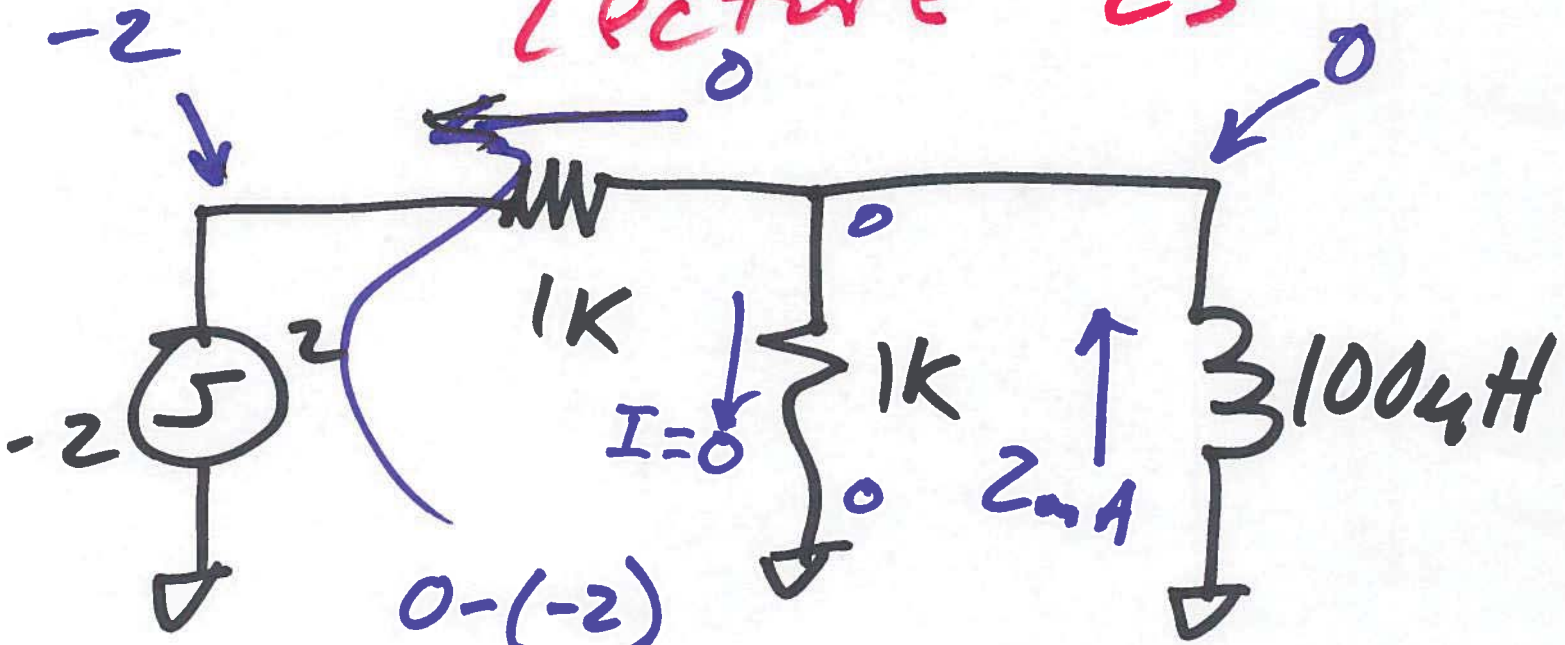
Circuits II

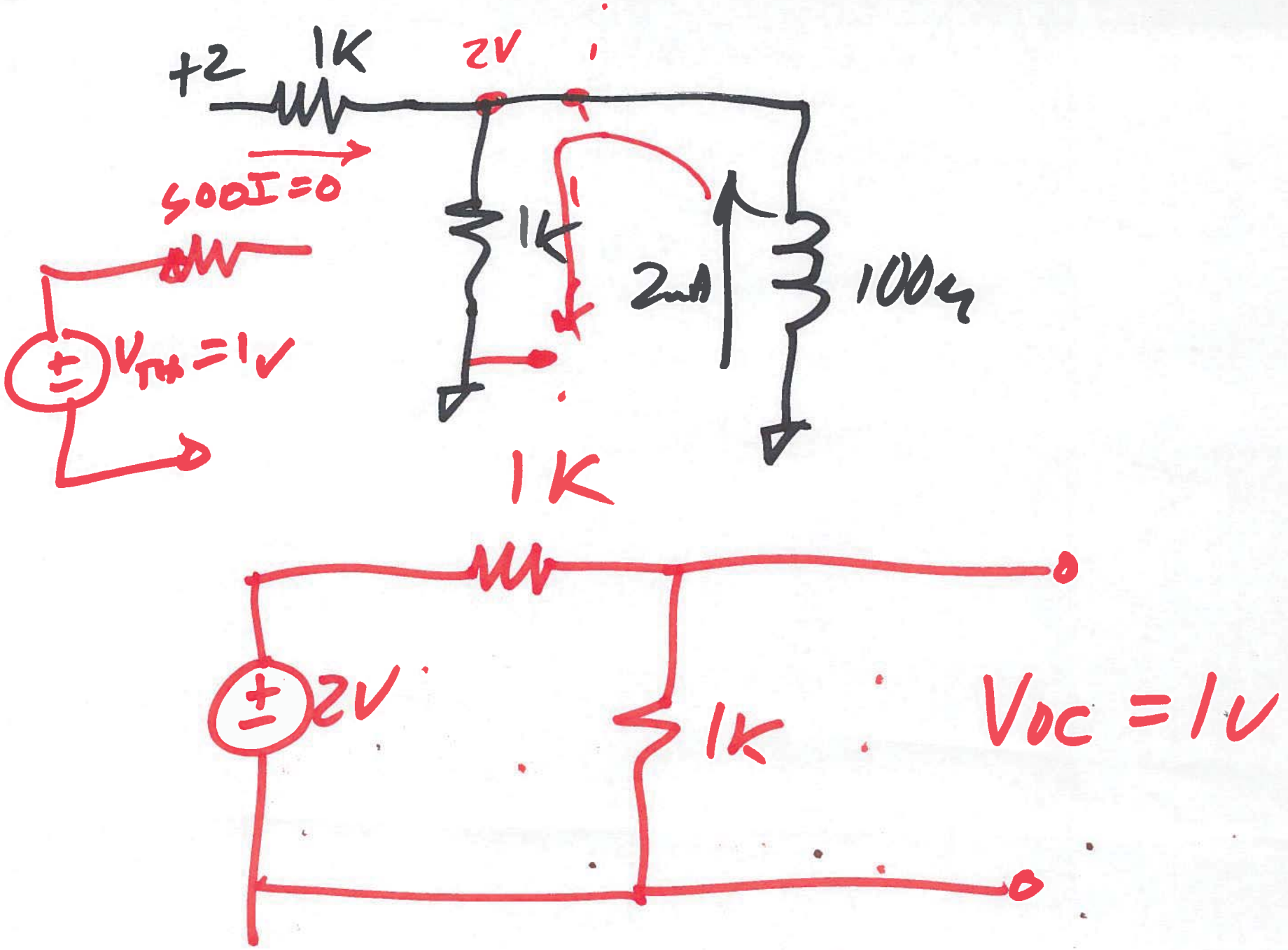
EE 221

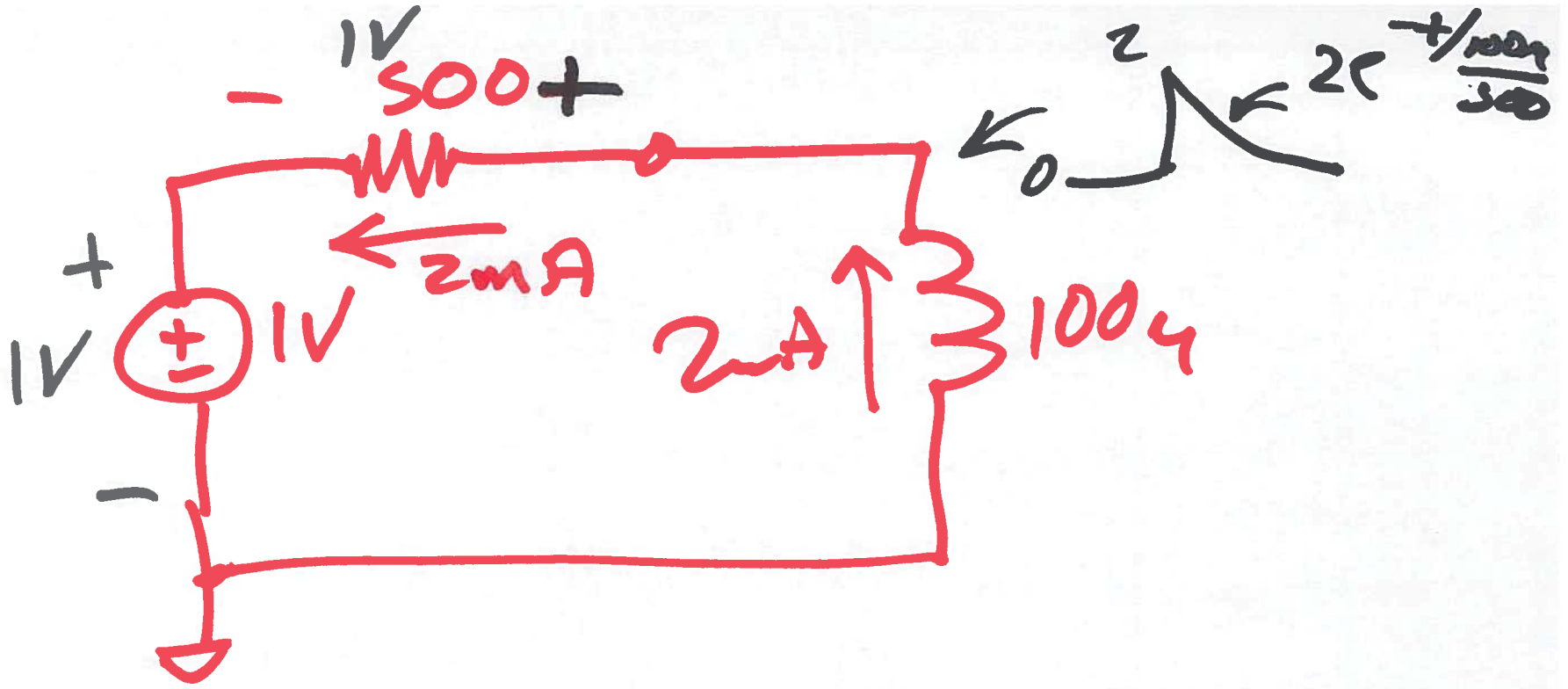
April 29, 2019

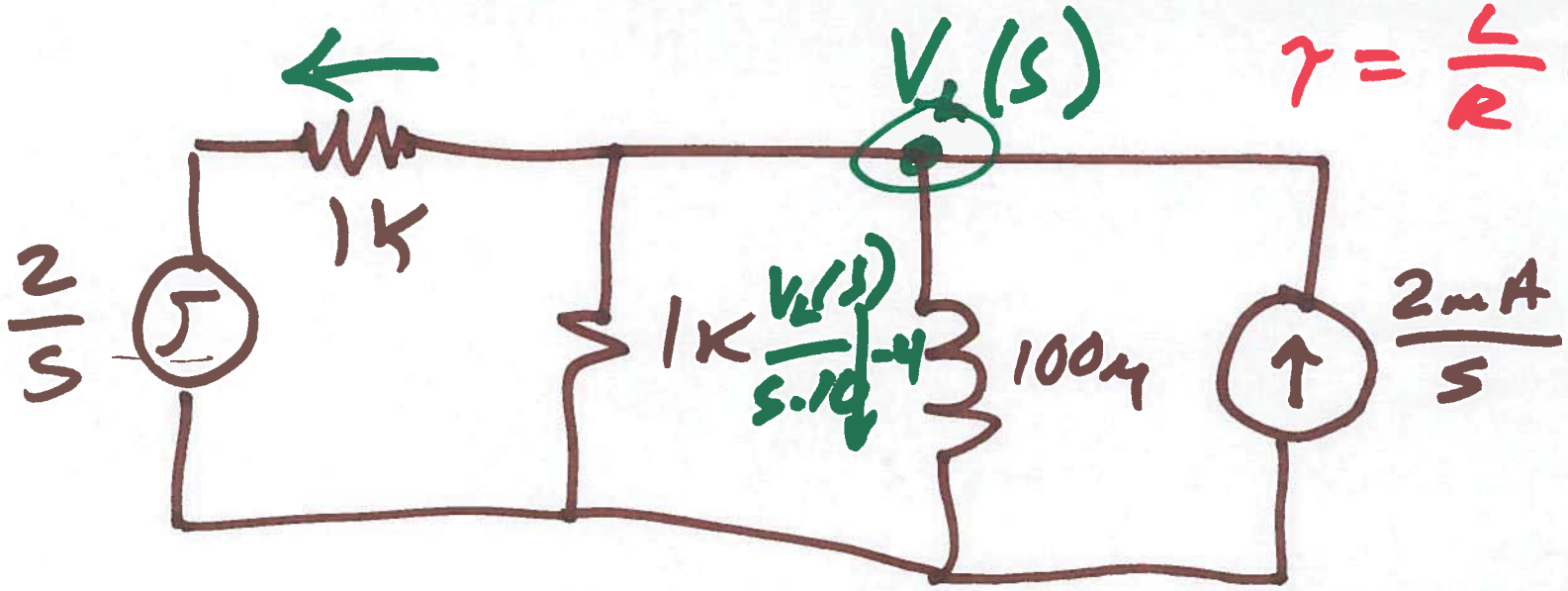
Lecture 23



1)


+2
1K
2V
500I=0
1K
2mA
100Ω
$V_{TH}=1V$
1K
2V
1K
$V_{OC}=1V$


1V
500
2mA
1V
2A
100
2



$\tau = \frac{L}{R} = \frac{10^{-4}}{\frac{10^3}{2}}$

$$\frac{2mA}{s} = \frac{V_L(s)}{5\cdot10^{-4}} + \frac{V_L(t)}{1K}$$

$$\frac{V_L(s) - \frac{2}{s}}{1K}$$

$$\frac{V_L(s)}{1k} - \frac{2mA}{s}$$

$$\frac{10^3}{10^{-3}}\left(\frac{2mA}{s}+\frac{2mA}{s}\right)=V_L(s)\left(\frac{1}{s\cdot10^{-4}}+\frac{1}{1k}\right)$$

$$\frac{10^3}{s\cdot10^{-4}}\cdot\frac{10^{-3}}{10^{-3}}+\frac{1}{1k}\Big)\cdot10^3$$

$$=\frac{1}{s\cdot10^{-7}}\left(\frac{4}{s}=V_L(s)\cdot\left(\frac{1}{s\cdot10^{-7}}+1+1\right)\right.$$

$$\frac{4}{s}=V_L(s)\cdot\left(\frac{1+s\cdot10^{-7}\cdot2}{s\cdot10^{-7}}\right)$$

$$\frac{4\cdot10^{-7}}{1+s\cdot2\cdot10^{-7}}=V_L(s)=\frac{2}{s+\frac{10^7}{2}}$$

$$\frac{1}{2}$$

$$v_L(t)=2e^{-t/10^{7}/2}u(t)$$

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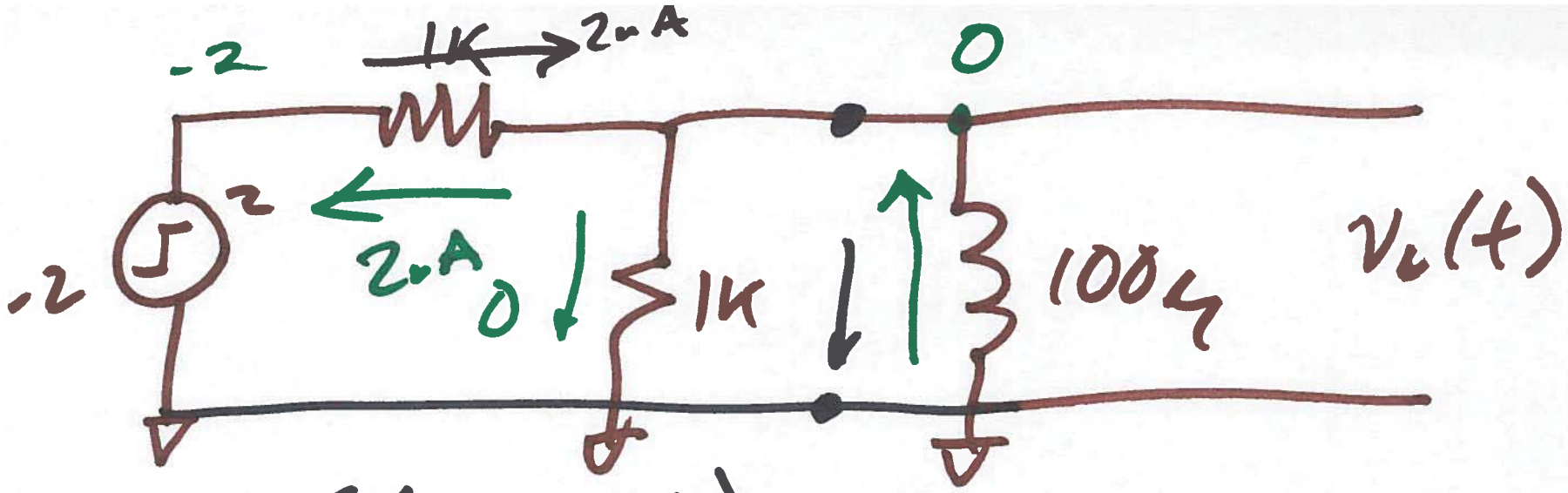
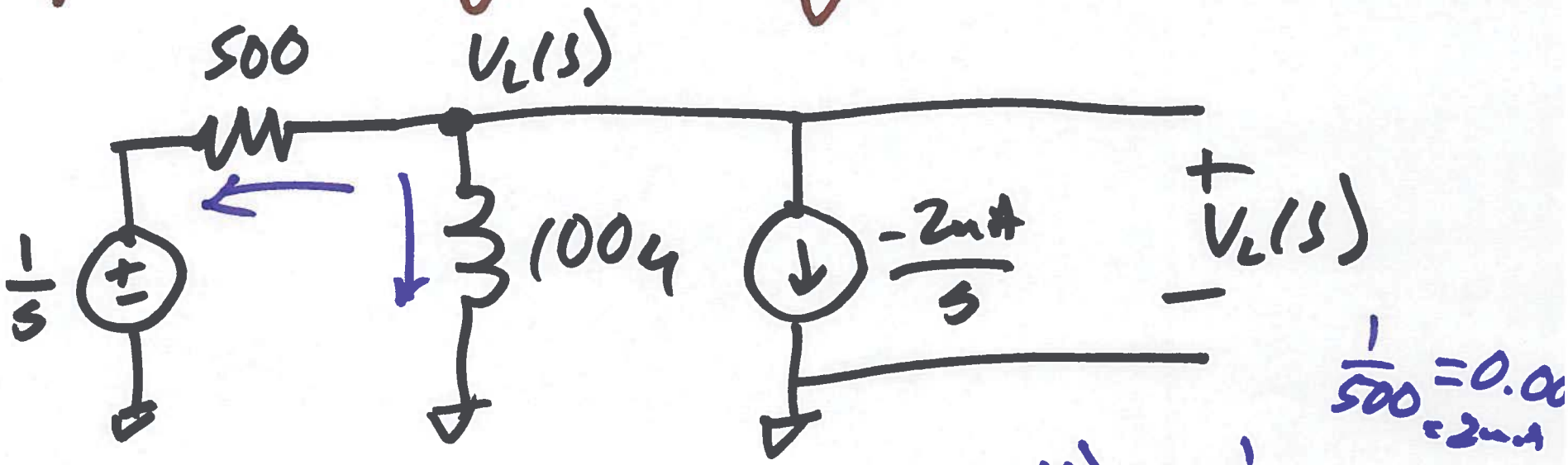
5)





$\frac{1}{500} = 0.002 = 2mA$

$$\frac{-2mA}{s} + \frac{V_L(s)}{5\cdot 10^{-4}} + \frac{V_L(s) - \frac{1}{s}}{500} = 0$$

$$V_L(s)\left(\frac{1}{5\cdot10^{-4}} + \frac{1}{500}\right)\frac{5\cdot10^{-4}}{5\cdot10^{-4}} = \frac{2mA}{s} + \frac{2mA}{s}$$

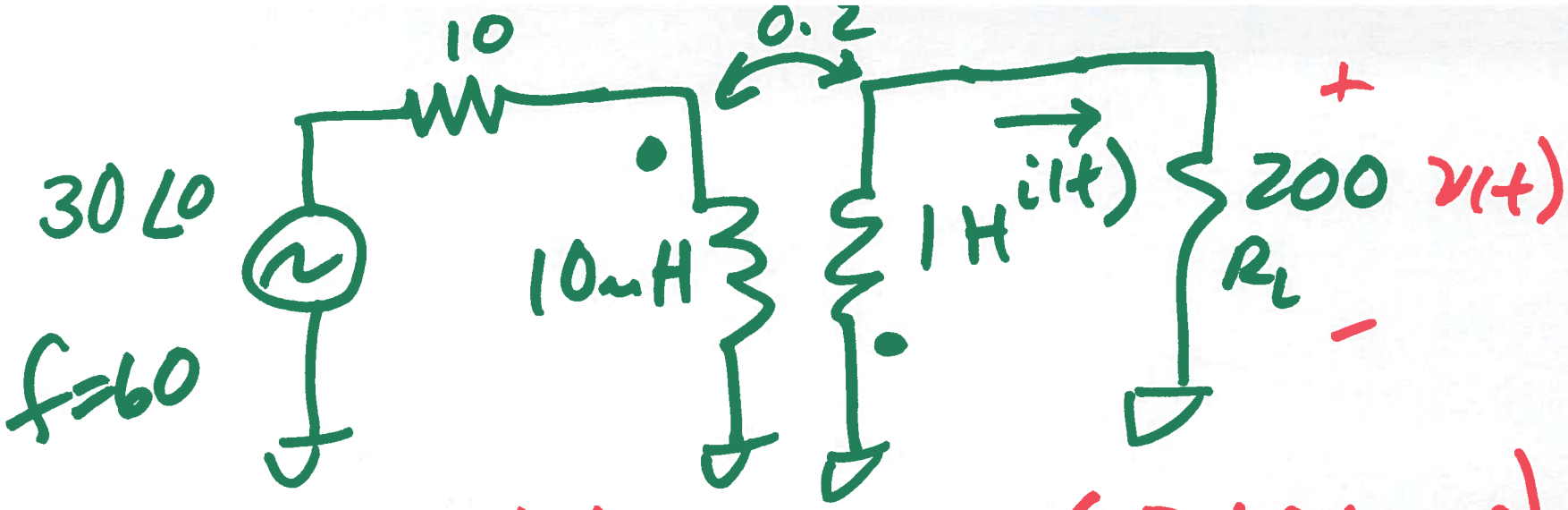
$$V_L(s)\left(\frac{1 + 5\cdot10^{-4}\cdot 2mA}{5\cdot10^{-4}}\right) = \frac{4mA}{s}$$

$$V_L(s) = \frac{10^{-4}\cdot 4\cdot 10^{-3}}{1 + 5\cdot10^{-4}\cdot 2\cdot 10^{-3}}$$

$$V_L(t) = 2e^{-\frac{(t-100n)}{2\cdot10^{-7}}}u(t-100n) \qquad \frac{2}{s + \frac{1}{2\cdot10^{-7}}}$$

$$V_L(t) = 2e^{-t/2\cdot10^{-7}}u(t)$$

7)



$P_{RL} = I_{rms} \cdot V_{rms}$

$= I_{rms}^2 \cdot R$

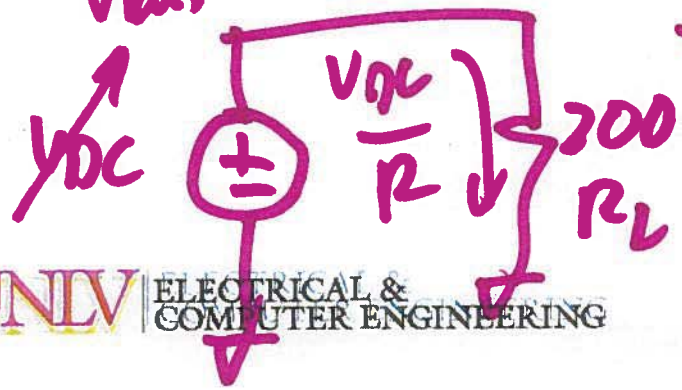
$= V_{rms}^2 / R$

$i(t) = I_p \cdot \cos(2\pi \cdot 60t + \theta)$

$I_{rms} = \frac{I_p}{\sqrt{2}}$

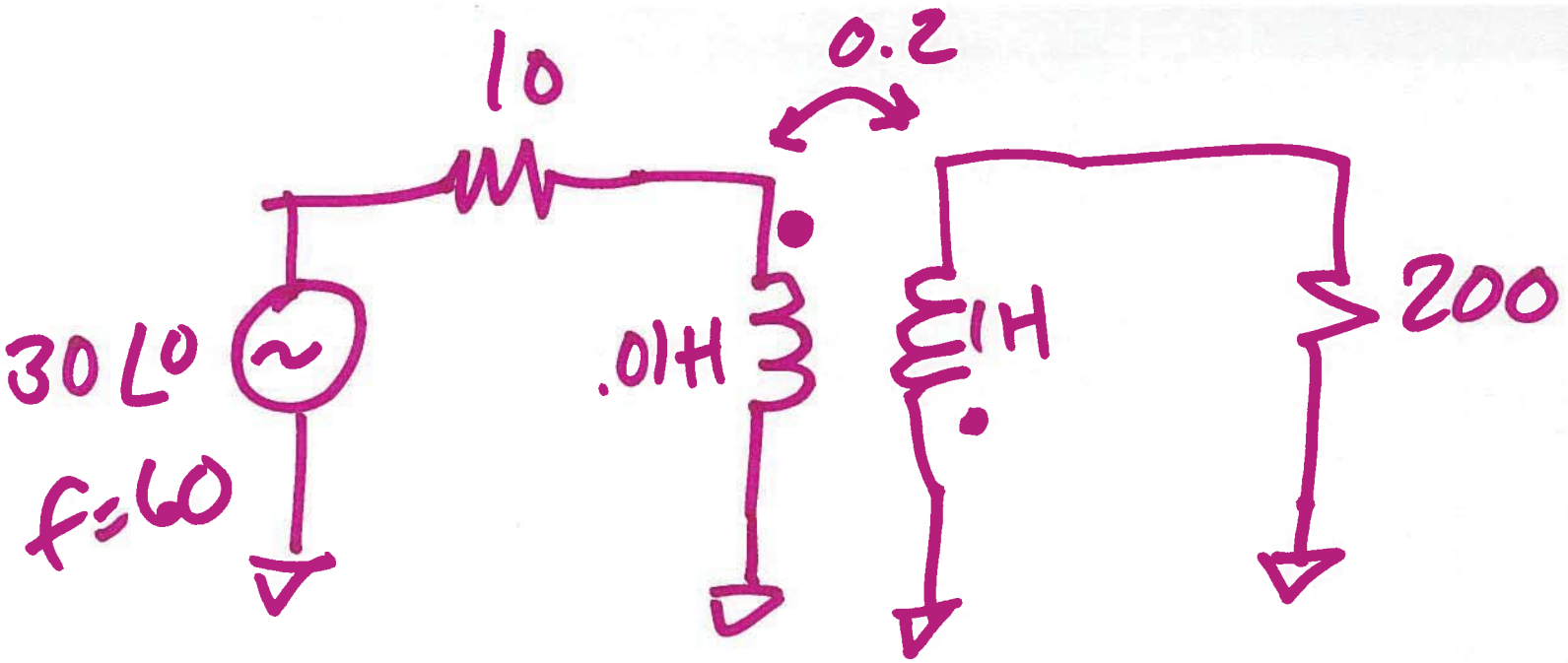
$v(t) = 200 \cdot I_p \cdot \cos(2\pi 60 t + \theta)$

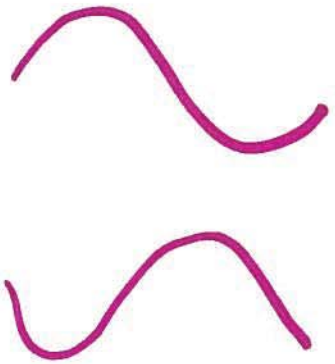
$= 200 \cdot i(t)$



$\frac{V_{DC}^2}{R} = I_{DC} \cdot V_{DC} = I_{DC}^2 \cdot R$

8)



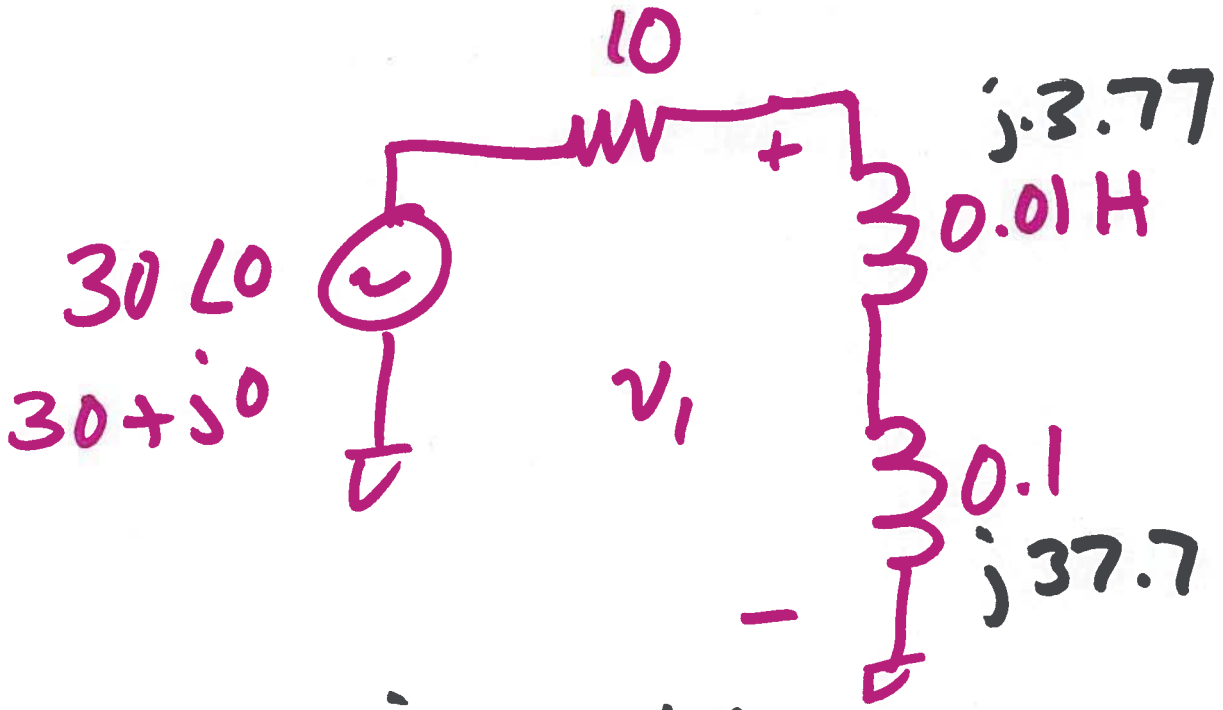


$$M = 0.2 = k \cdot \sqrt{0.01 \cdot 1}$$

$$k = 2$$

This is not possible so I'm assume $k = 0.1$ for

$$k = 1$$



$$j\omega L = j \cdot 2\pi \cdot 60 \cdot 0.01$$

$$= 3.77j$$

$$30\angle 0 = I_1 \cdot 10 + j \cdot 3.77 \cdot I_1 - I_2 \cdot j37.7$$

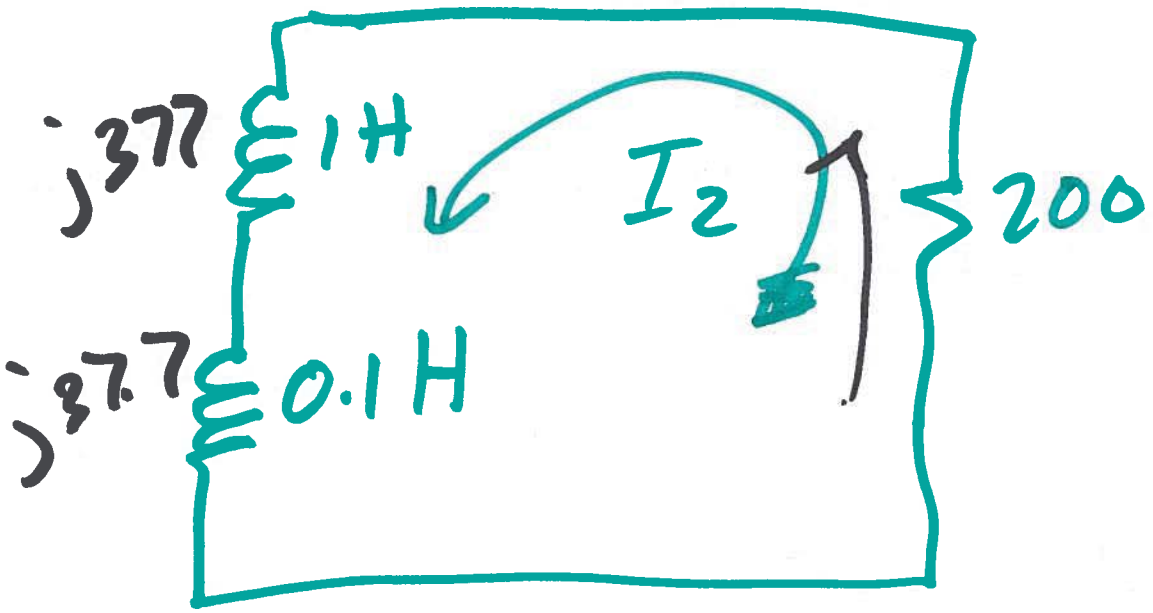
$3.77\angle 90°$

$10\angle 0°$

$$30\angle 0 = I_1 \cdot 10 + I_1 \cdot j3.77 - I_2 \cdot j37.7$$

$37.7\angle -90°$

10)



1.

$$I_2 \cdot j377 - I_2 \cdot 37.7 - 200 I_2 = 0$$