EE 221 Circuits II

April 14, 2021

Lecture 21

$$v_{out}(t) = 2 + 2e^{-t/200\mu} \cdot \cos(31.25\text{k}t - 181)$$

$181 \cdot \frac{\pi}{180} = 3.3$

$t = 0 \quad 2 + 2 \cdot 1 \cdot \underbrace{\cos(-189)}_{\approx -1}$

$2 - 2 = 0$

$t = 200\mu s$

$2 + 2e^{-1} \cdot (-1) = 2 - .735$

$= 1.26V$

$e^{-1} = .37$

$31.25k \cdot t - 181$

↑ rad.in.sec ↑ deg.

$2\pi \cdot f \cdot \frac{360}{2\pi}$

$\frac{31250}{2\pi} = f = 5kHz$

$(2\pi \cdot f)\frac{180}{\pi}$

$(31,250) \cdot \frac{180}{\pi} = 1.79e6$

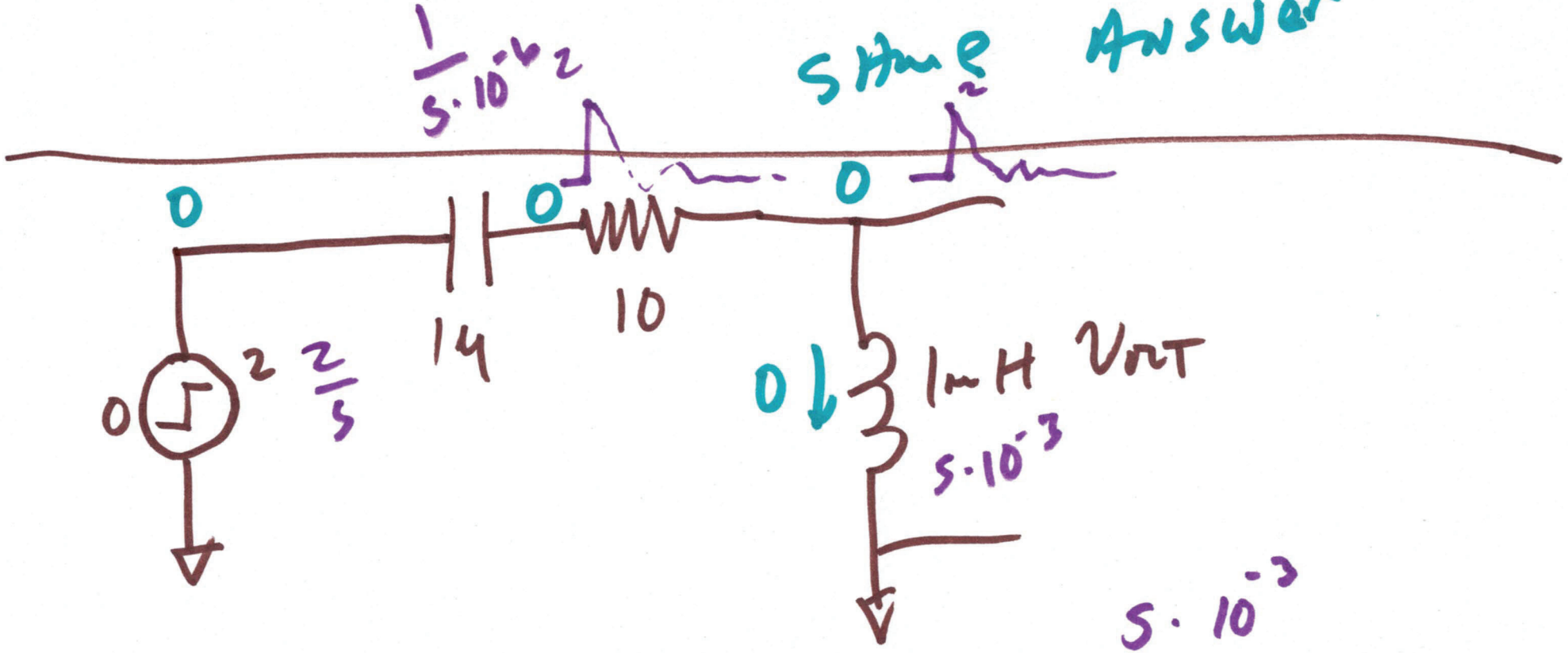
$-1 \approx \cos(1.79e6 \cdot 200ns - 189)$

2)

$$2 + 2e^{-1} \cdot \cos(31.25k \cdot 200m - 3.3)$$

$t = 200m$ ≈ -1

Answer



$$V_{OUT} = \frac{2}{5} \cdot \frac{5 \cdot 10^{-3}}{5 \cdot 10^{-3} + 10 + \frac{1}{5 \cdot 10^{-6}}}$$

$$V_{out}(s) = \frac{2 \cdot s^2 \cdot 10^{-9}}{s \cdot (s^2 10^{-9} + s \cdot 10^{-5} + 1)}$$

$$= \frac{2 \cdot s^2}{s\,(s^2 + s \cdot 10^4 + 10^9)} = \frac{2 \cdot s^2}{s(s-p_1)(s-p_2)}$$

$$p_{1,2} = \frac{-10^4 \pm \sqrt{10^8 - 4 \cdot 10^9}}{2} = -5k \pm j\,31.25k$$

$$\frac{V_{out}(s)}{s} = \frac{2 \cdot s}{(s-p_1)(s-p_2)} = \frac{A}{s-p_1} + \frac{B}{s-p_2}$$

$$v_{out}(t) = A e^{+p_1 t} u(t) + B e^{p_2 t} u(t)$$

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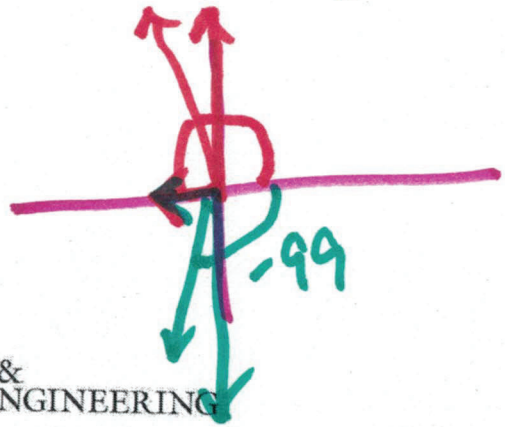
4)

$$A|_{s=p_1} = \frac{2 \cdot p_1}{p_1 - p_2} = \frac{2 \cdot 31.65k\angle 99}{j \cdot 62.5k}$$

$$B|_{s=p_2} = \frac{2 \cdot p_2}{p_2 - p_1} = \frac{2 \cdot 31.65\angle -99}{-j62.5k}$$

$p_1 = -5k + j31.25k \rightarrow 31.65k\angle 99°$

$p_2 = -5k - j31.25k \rightarrow 31.65k\angle -99°$



$31.65k\, e^{j99}$

$31.65k\, e^{j(-99)}$

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5)

$$A = \frac{63.3K \cdot \angle 99}{62.5K \angle 90} \approx 1 \angle 9 = e^{j9}$$

$$B = \frac{63.3K \angle -99}{62.5K \angle -90} \approx 1 \angle -9 = e^{j(-9)}$$

$$v_{OUT}(t) = e^{j9} e^{(-5K + j31.25K)t} u(t) + e^{-j9} e^{(-5K - j31.25K)t} \cdot u(t)$$

$$\cos x = \frac{e^{jx} + e^{-jx}}{2}$$

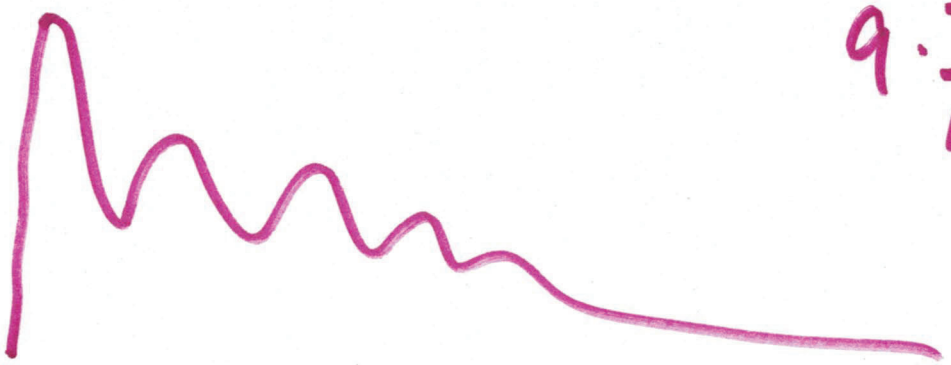
$$= 2 e^{-5Kt} \left(\frac{e^{j(31.25K \cdot t + 9)} + e^{-j(31.25Kt + 9)}}{2} \right) u(t)$$

$$5K = \frac{1}{200\mu}$$

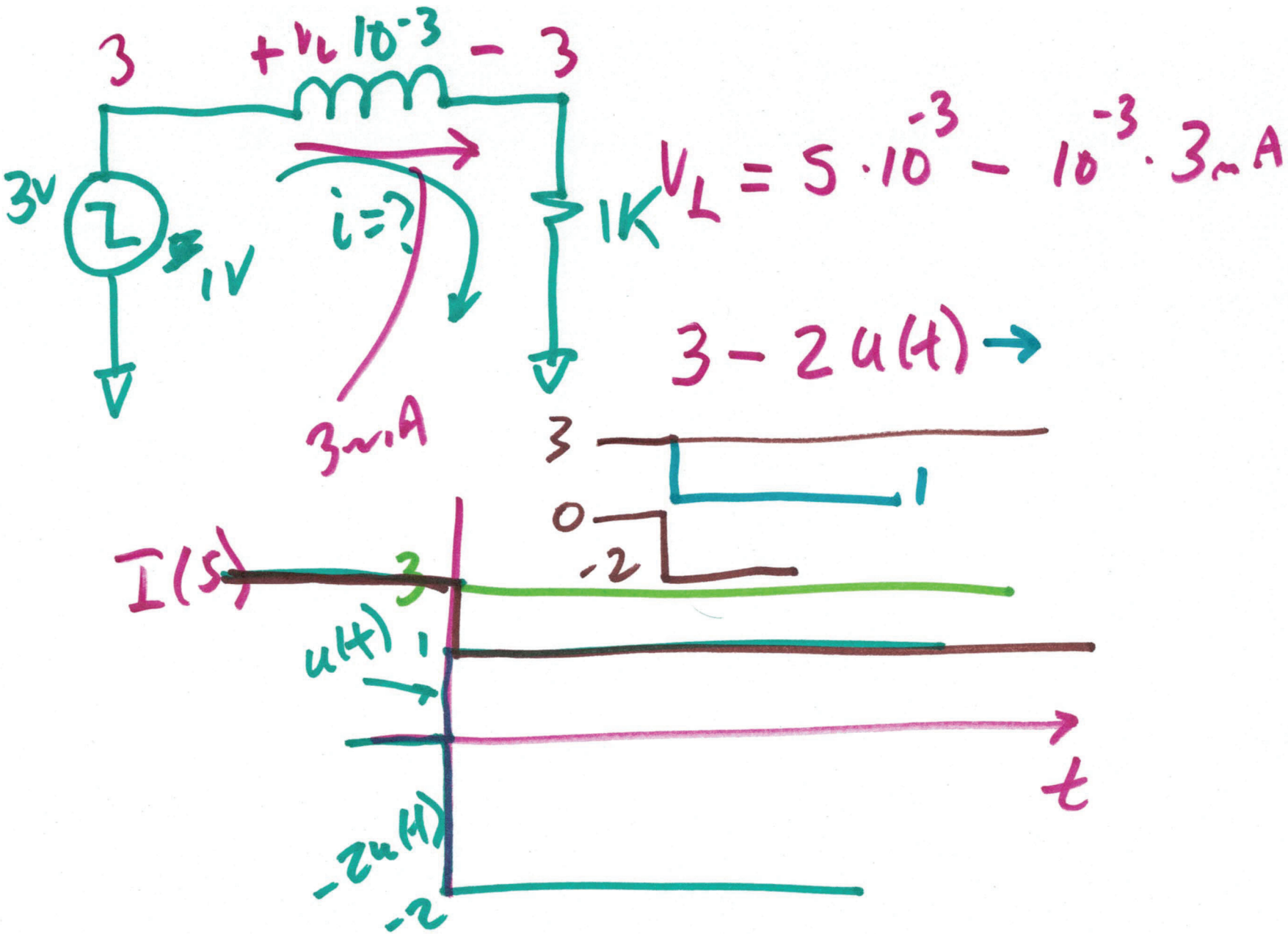
6)

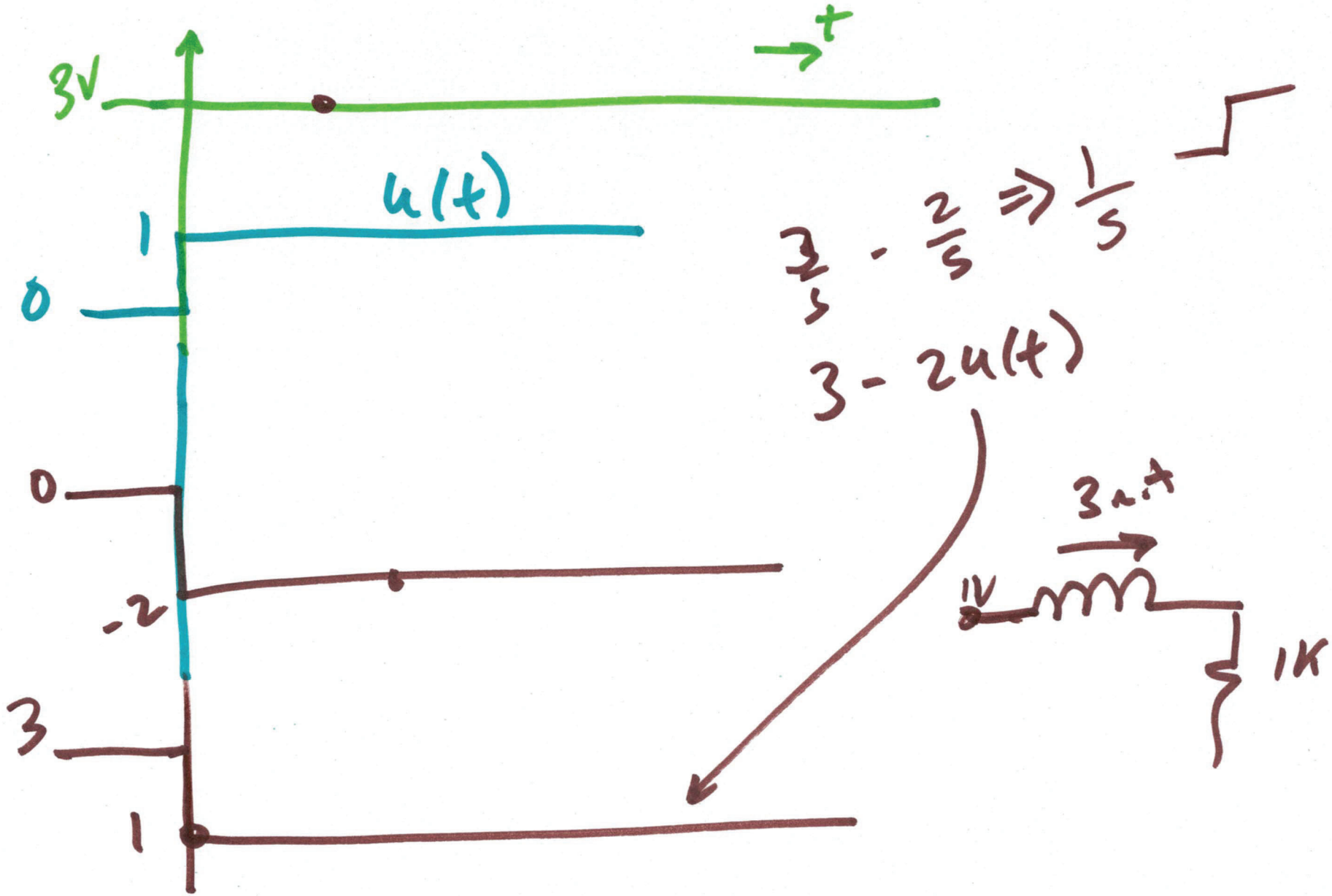
$$v_{out}(t) = 2e^{-t/200n} \cdot \cos(31.25Kt + 9) \cdot u(t)$$

$$9 \cdot \frac{\pi}{180} = .157$$

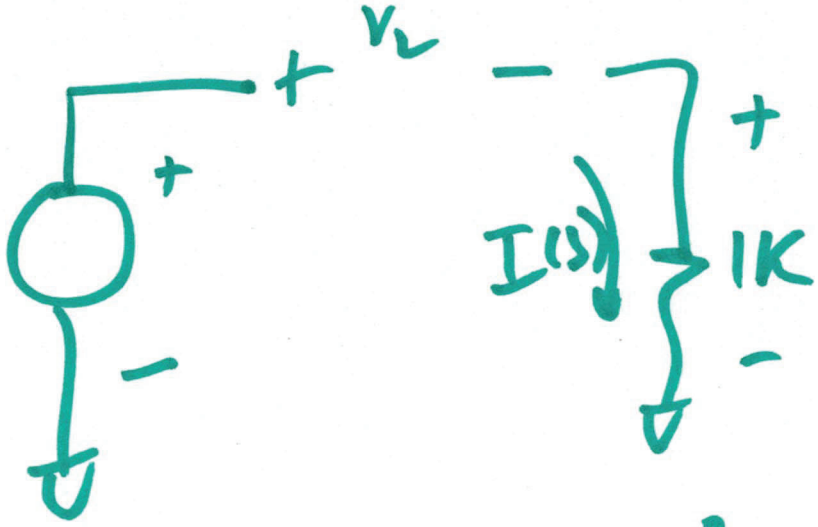


$$2 \cdot .6 \cdot (-1) = \underline{-1.2V}$$


3
+ v_L 10^{-3} −
3
3V
1V
i=?
1K
3mA
$V_L = 5 \cdot 10^{-3} - 10^{-3} \cdot 3_m A$
3 − 2u(t) →
3
1
0
-2
I(s)
3
u(t)
1
t
-2u(t)
-2


3V
t
u(t)
1
0
0
-2
3
1
$\frac{3}{s} - \frac{2}{s} \Rightarrow \frac{1}{s}$
3 - 2u(t)
3u.t
1V
1K

$$I(s) = \frac{\frac{1}{s}}{s \cdot 10^{-3} - 10^{-3} \cdot 3\,mA \cdot 1K}$$



$$\frac{1}{s} - s \cdot 10^{-3} \cdot I(s) + 10^{-3} \cdot 3\,mA - I(s) \cdot 1K = 0$$

$$I(s) = \frac{10^{-3}}{s} - s \cdot 10^{-6} + 10^{-3} \cdot 3\,mA$$