# EE 220
# Circuits 1

November 1, 2017

Lecture 18

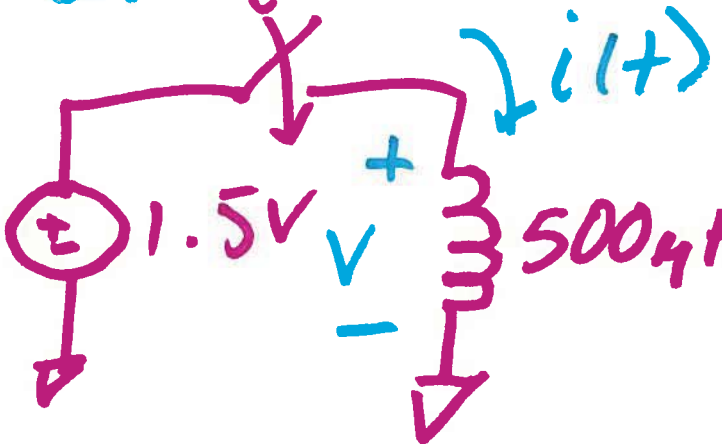
$V = L \cdot \frac{di}{dT}$

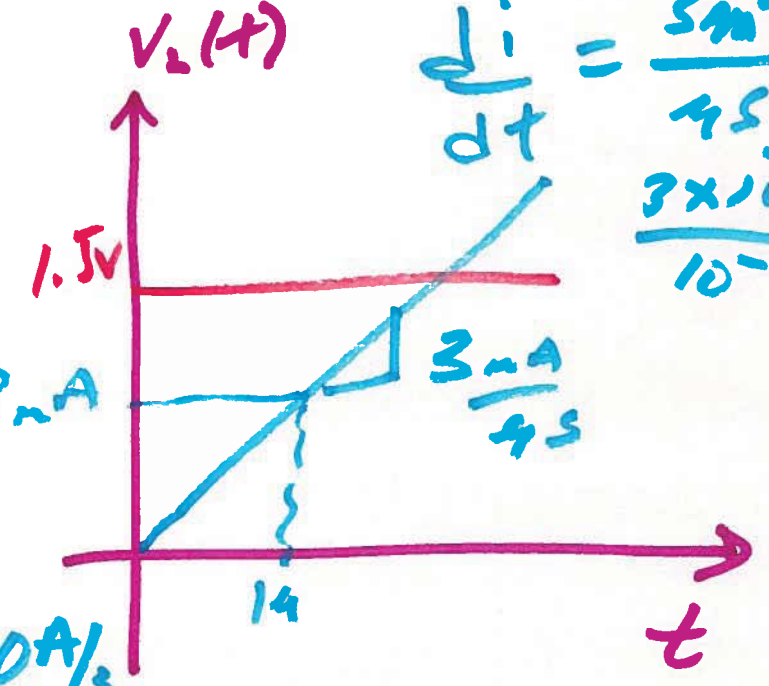
$\frac{1.5}{500\,nH} = \frac{di}{dT}$

$\frac{1.5}{\frac{1}{2} \times 10^{-9}}$

$3{,}000$

$500\,n = 0.5\,m$




$\frac{di}{dt} = \frac{3mA}{4s}$

$\frac{3 \times 10^{-3}}{10^{-9}}$

$3{,}000$

$\frac{di}{dT} = 3{,}000\,A/s$

$= \frac{3mA}{4s}$, $i(t) = \frac{3mA}{4s} \cdot t$

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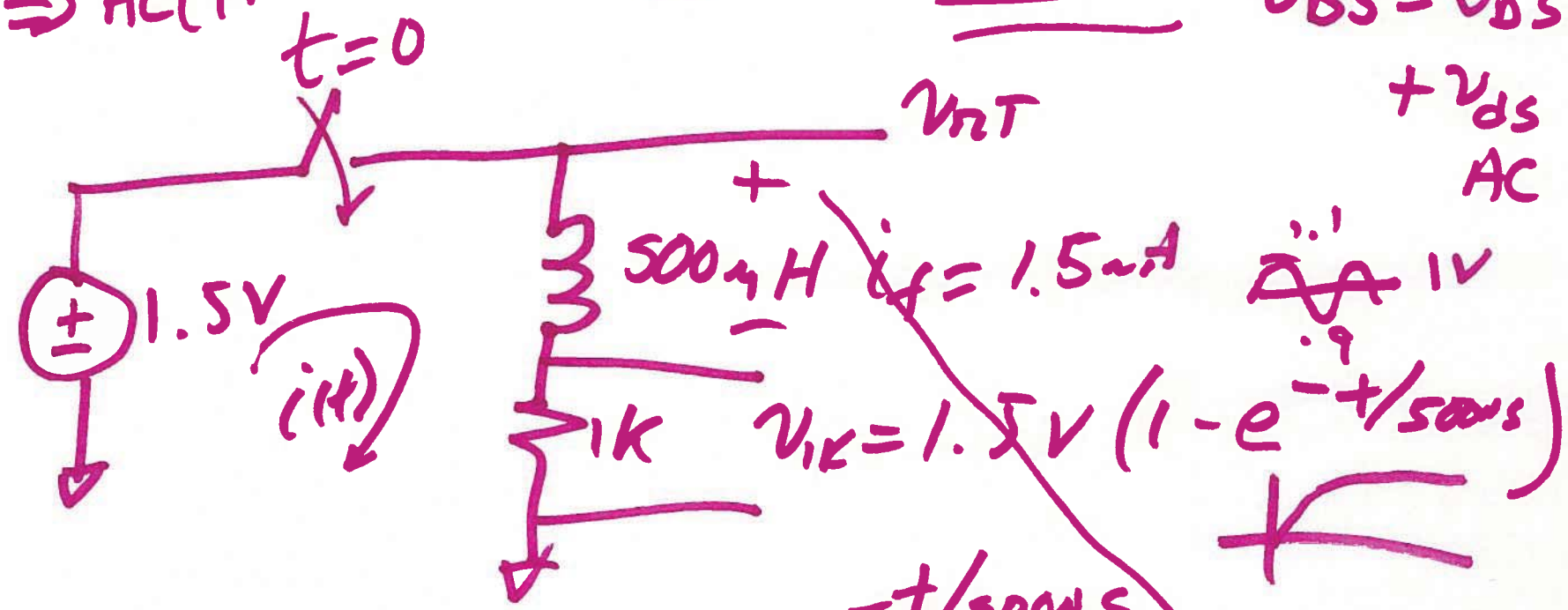
$I \Rightarrow DC$

$i \Rightarrow AC$ (time varying)

$v_{DS} = V_0 - V_S \rightarrow DC$

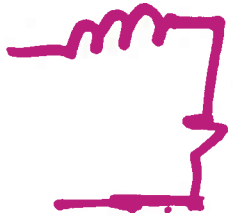
$v_{ds} = AC$ $\quad i_i = 0$

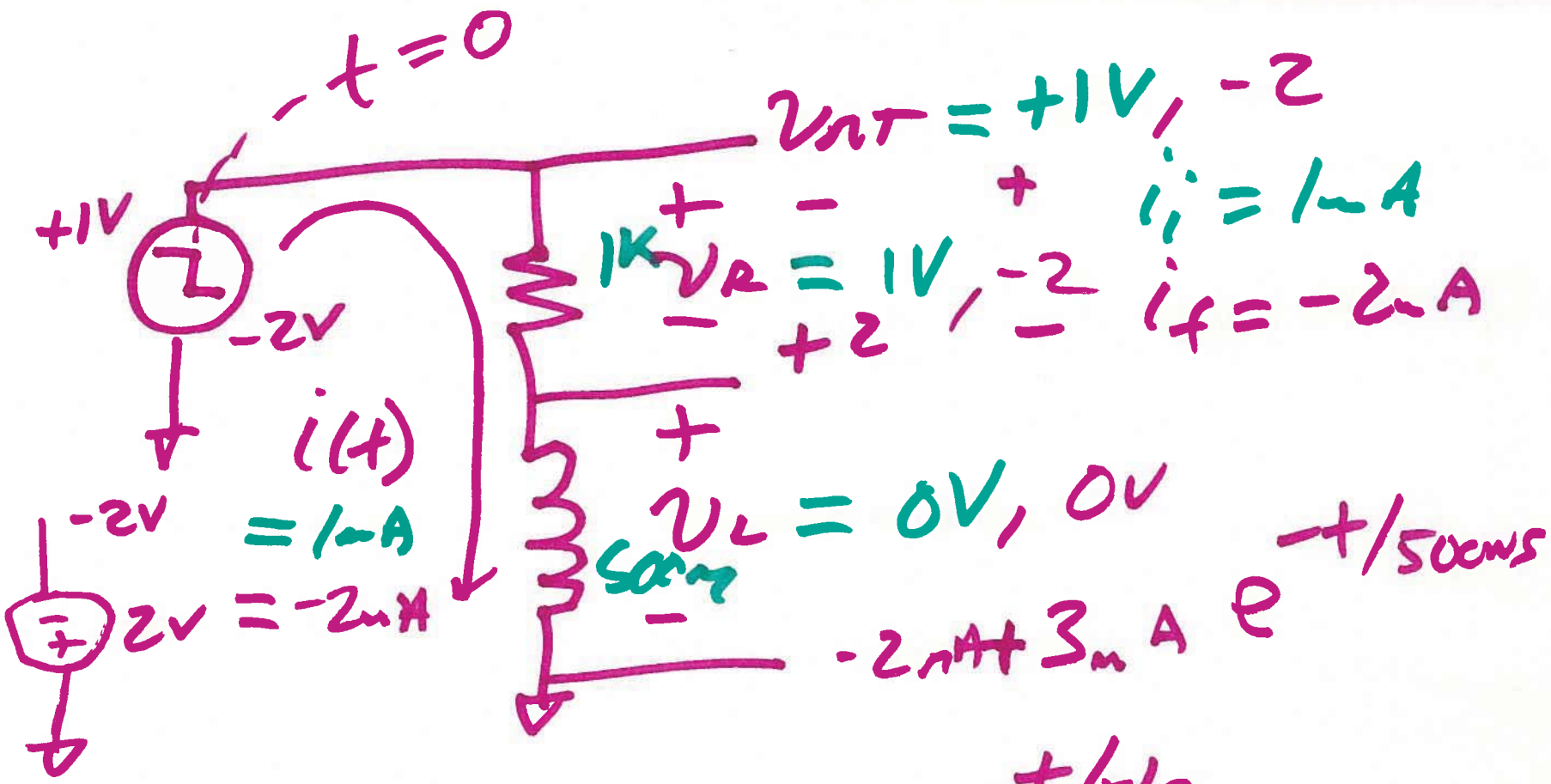
$v_{DS} = V_{DS}$ (DC) $+ v_{ds}$ (AC)




$$i(t) = i_f + (i_i - i_f) e^{-t/500ns}$$

$$= 1.5\,mA\,(1 - e^{-t/500ns})$$






$$i(t) = i_f + (i_i - i_f)e^{-t/\tau_R}$$

$$= -2mA + (1mA - (-2mA))e^{-t/\tau_R}$$

$$t > 0$$

$\tau_R = 500\,ns$

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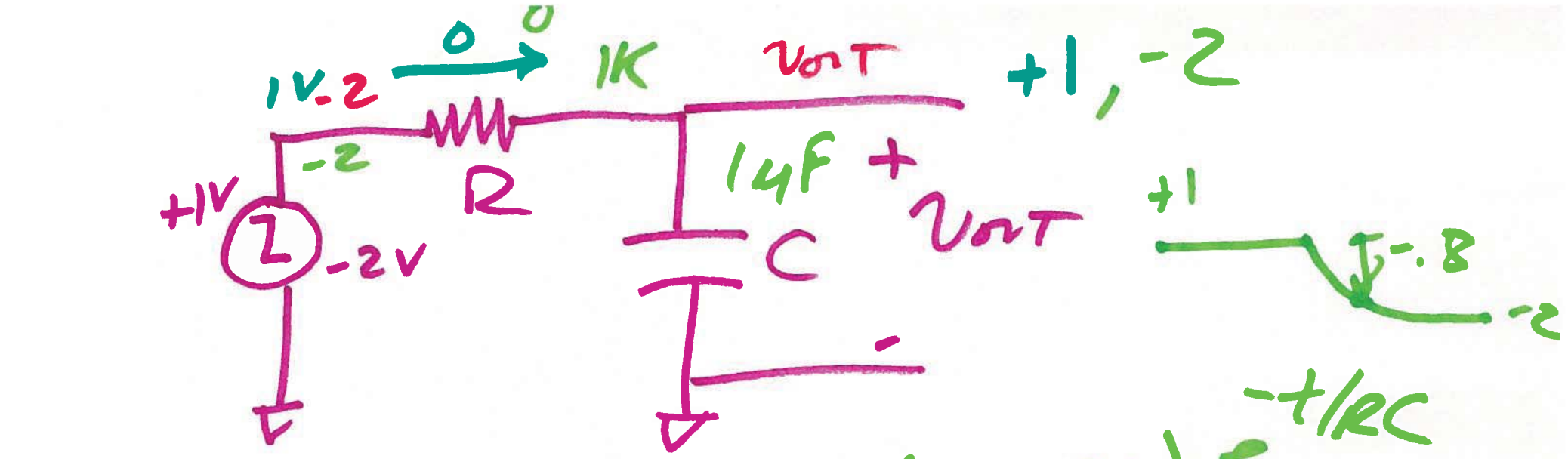
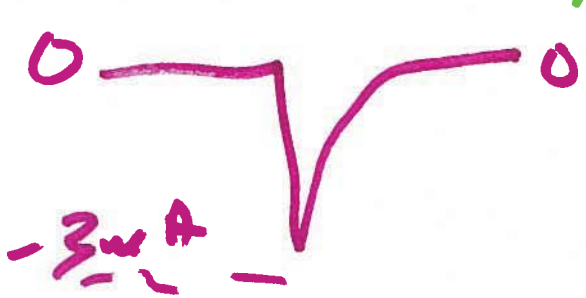


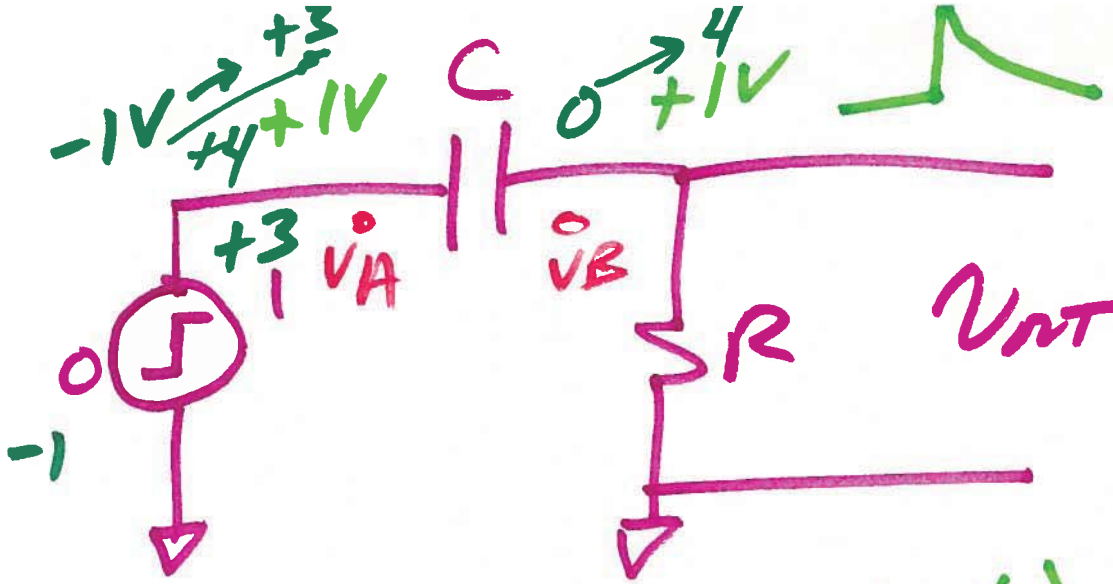

$$v_{out} = v_f + (v_i - v_f)\, e^{-t/RC}$$

$$-2 + (1 - (-2))\, e^{-t/1ms}$$

$$v_{out}(t) = -2 + 3e^{-t/1ms}$$

$$i = \frac{-2 - v_{out}}{1K} = \frac{-2 - (-2 + 3e^{-t/1ms})}{1K}$$

$$= -3mA\, e^{-t/1ms}$$




$v_i = 1V$

$v_f = 0$

$$v_{out}(t) = v_f + (v_i - v_f)e^{-t/RC}$$

$$v_{out} = 1\,e^{-t/RC}$$

$$v_{out} = 4 \cdot e^{-t/RC}$$

$$(V_A - V_B)C = Q$$