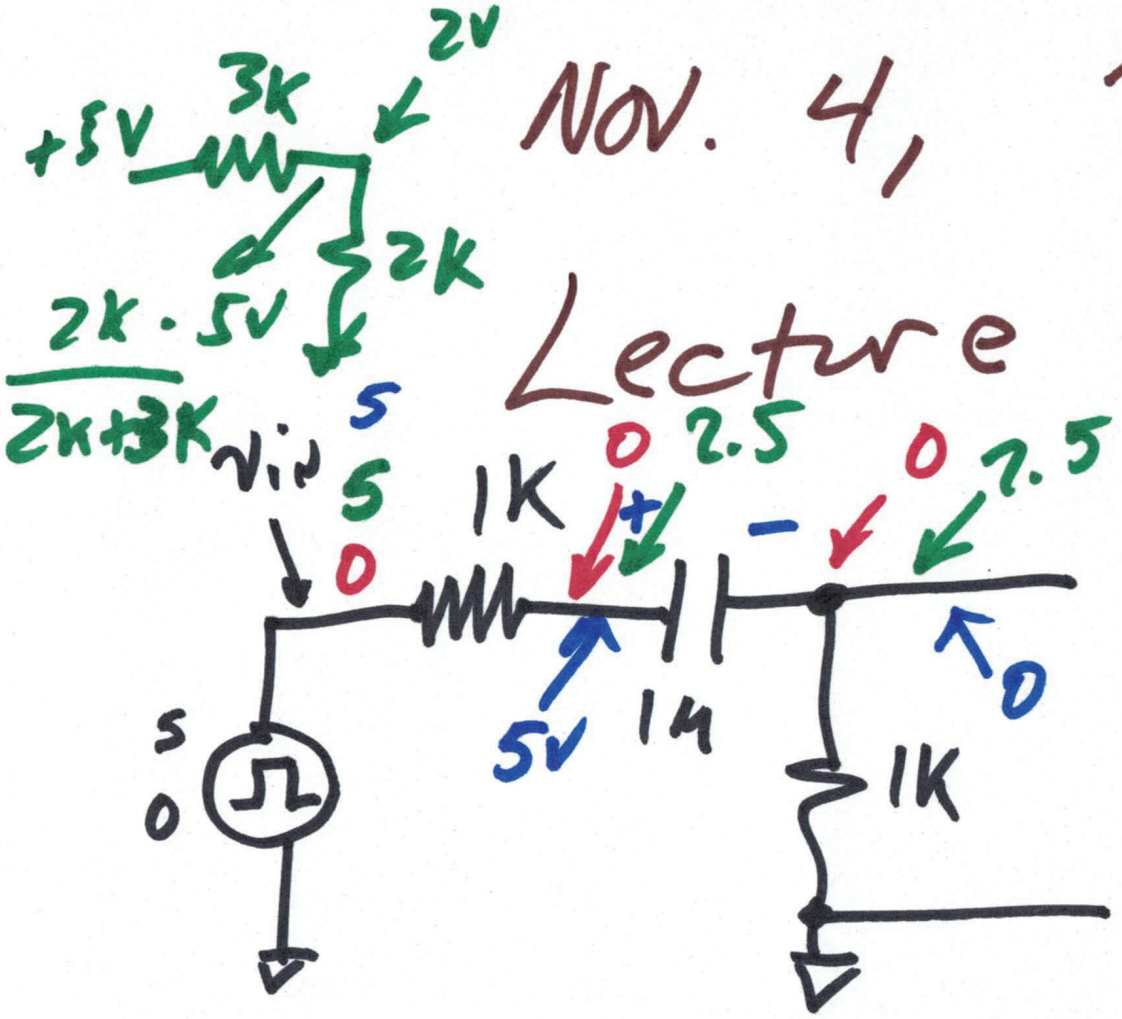
EE 220 Circuits 1

Nov. 4, 2020

Lecture 20



$v_{i1} = 0$ v_{bs}

$v_{i1} = 0$ v_{as}

$v_f = 5V$

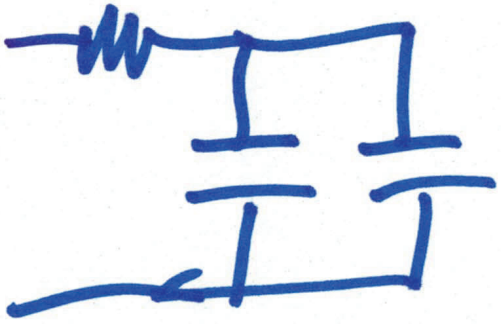
$v_c(t) = 5 - 5e^{-t/2ms}$

$$v_c(t) = 5\left(1 - e^{-t/2ms}\right)$$

$$i_c = C\frac{dv_c(t)}{dt}$$

$$\frac{d}{dt}\left(\frac{-t}{2RC}\right)$$

$$i_c = C\left(\frac{d}{dt}\left(5 - 5e^{-t/2RC}\right)\right)$$

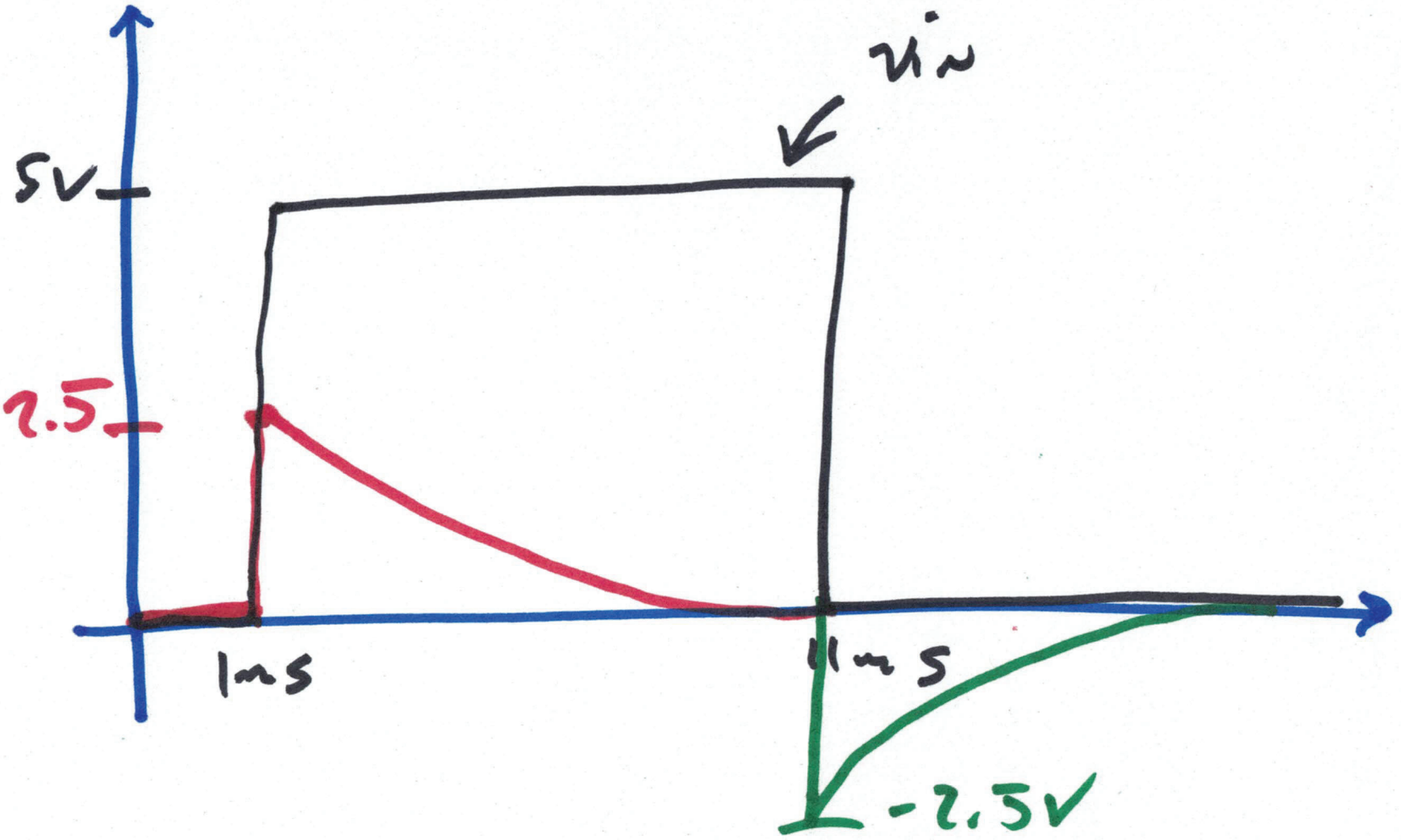


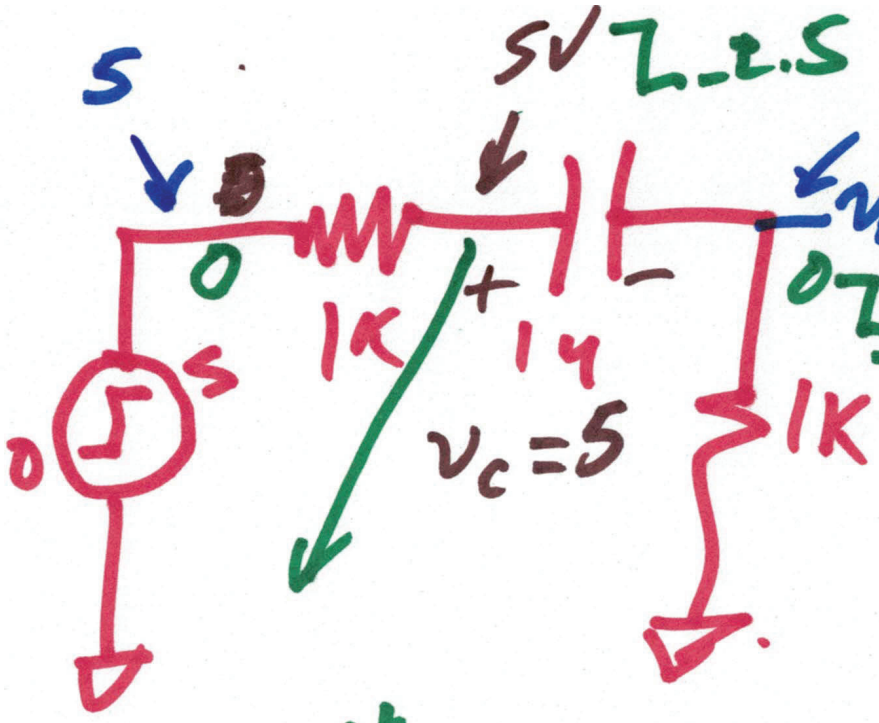
$$= C\left(0 - 5e^{-t/2RC} \cdot \left(\frac{-1}{2RC}\right)\right)$$

$$i_c = 2.5mA\,e^{-t/2ms}$$

$$v_R = 1K \cdot i_c = 2.5e^{-t/2ms}$$

3)


5V
2.5
1ms
11ms
-2.5V



$v_i = 2.5V$

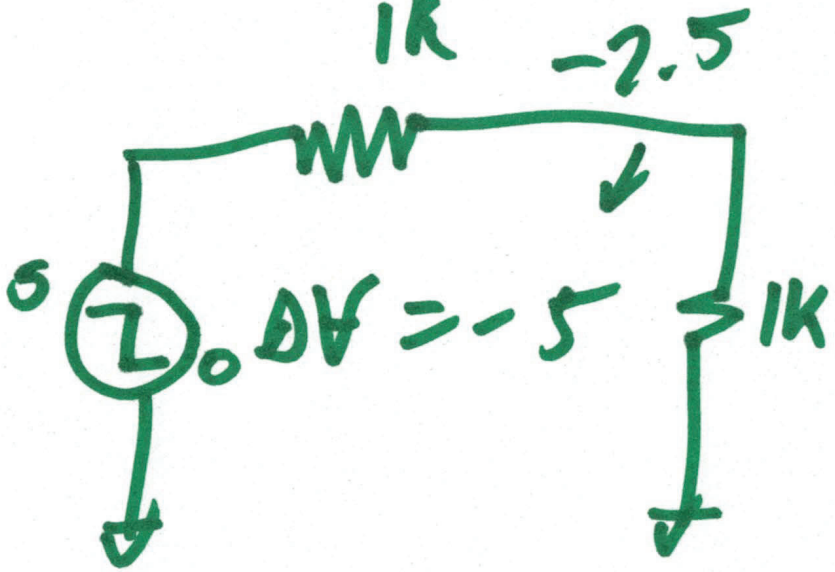
$v_f = 0$

$v_i = -2.5, v_f = 0$

$v_c = v_f + (v_i - v_f)e^{-t/\tau}$

$\tau = 2RC = 2ms$

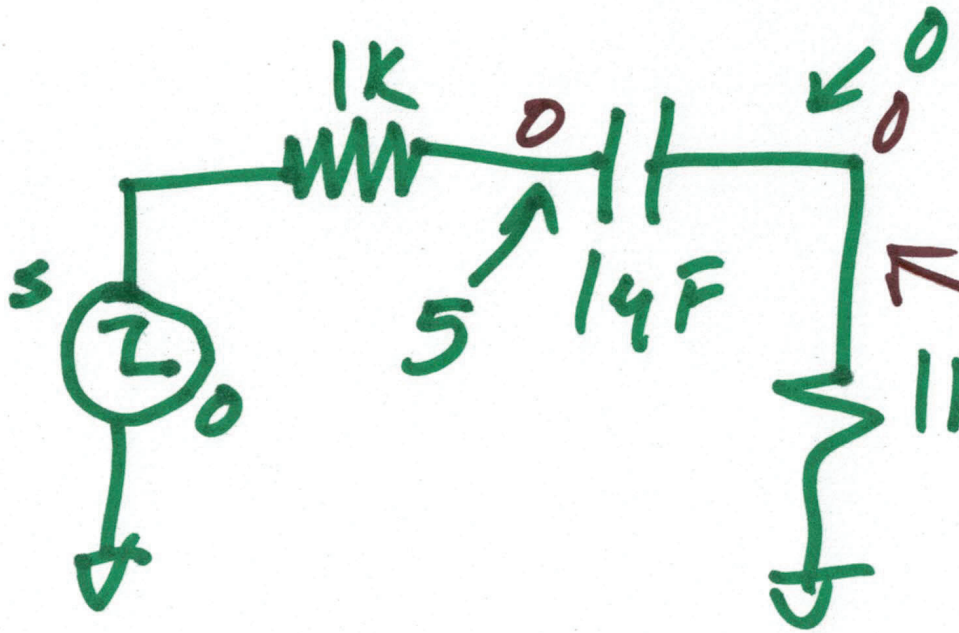
$v_c(t) = 2.5\,e^{-(t-1ms)/2ms}$



$t \geq 1ms$

$v_R(t) = -2.5\,e^{-(t-11ms)/2ms}$

$t \geq 11ms$



$$v_c(t) = 5e^{-t/2RC}$$

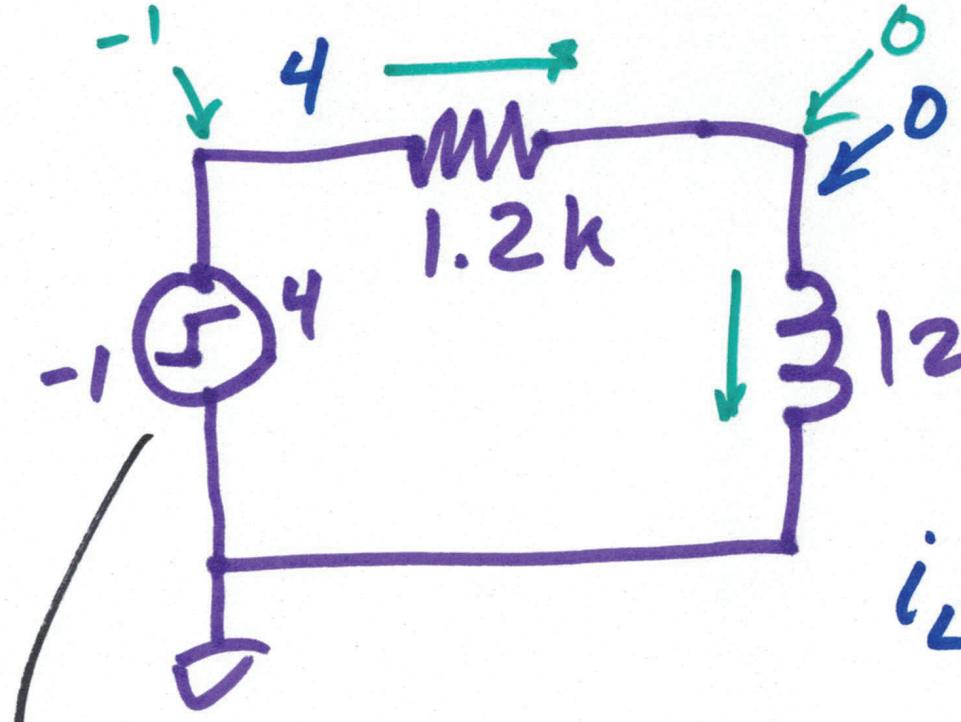
$$i_c = C\frac{dv_c}{dt} = C\cdot\left(\frac{-1}{2RC}\right)5e^{-t/2RC}$$

15V

$$i_c = -2.5\text{mA}\,e^{-t/2\text{ms}}$$

$$v_R(t) = -2.5e^{-t/2\text{ms}}$$

5)

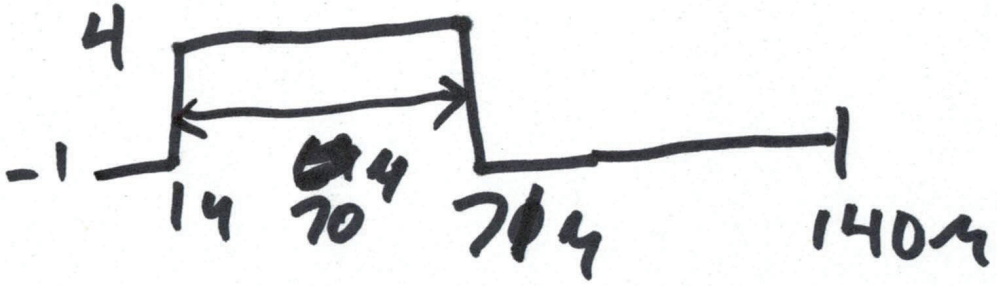


$$i_i = \frac{-1-0}{1.2k} = -.83mA$$

$$i_f = \frac{4-0}{1.2k} = 3.33mA$$

$$i_L = 3.33mA + (-.83mA \rightarrow 3.33mA)\, e^{-t/10\mu s}$$

(-1 4 14 KN 10N 70μ)



$$v_L = L \cdot \frac{di_L}{dt}$$

$$i_L(t) = 3.33\text{mA} - 4.16\text{mA}\, e^{-t/10\text{ns}}$$

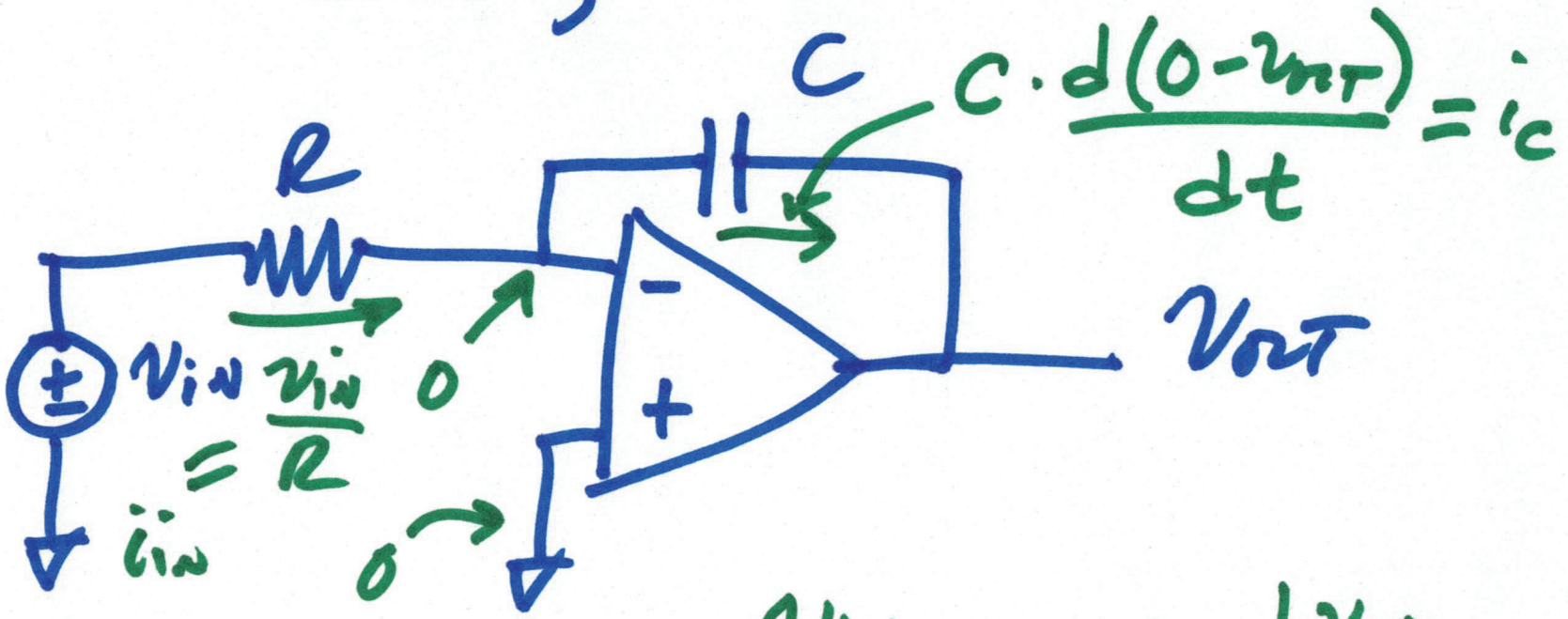
$$v_L(t) = L\frac{di_L(t)}{dt} =$$

$$12\text{nH}\left(-4.16\text{m}\right)\cdot\left(\frac{-1}{10\text{ns}}\right)e^{-t/10\text{ns}}$$

$$v_L(t) = \frac{12\cdot 4.16}{10}\, e^{-t/10\text{ns}}$$

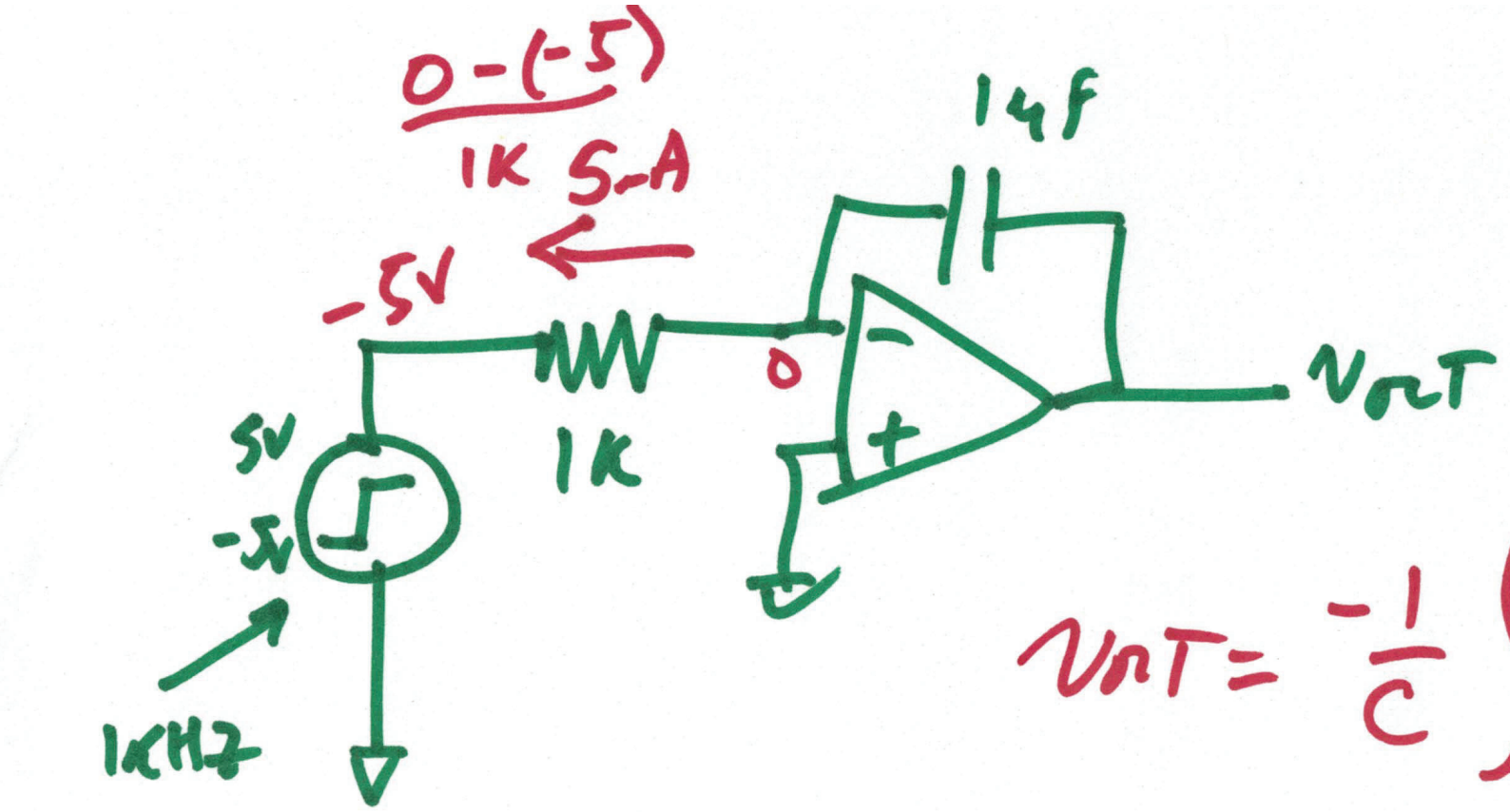
$$= 5e^{-t/10\text{ns}}$$

Integrators

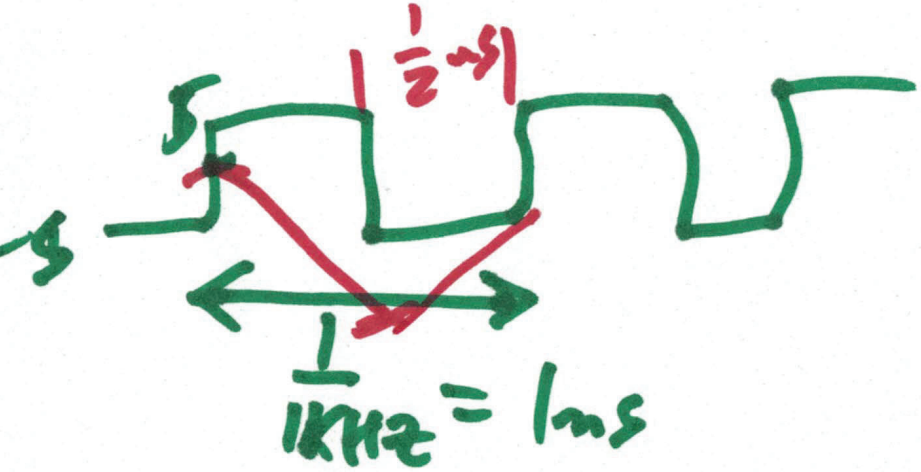


$$\frac{v_{IN}}{R} = -C \cdot \frac{dv_{OUT}}{dt}$$

$$-\frac{1}{C}\int_0^t i_{IN}\,dt = \int_0^t -\frac{1}{C}\cdot\frac{v_{IN}}{R}\cdot dt = \int dv_{OUT} = v_{OUT}$$



$$v_{OUT} = \frac{-1}{C}\int_0^t 5mA \cdot dt$$



$$= \frac{-5mA}{1\mu F} \cdot t$$

$$v_{OUT} = \frac{-5V}{ms} \cdot t$$