

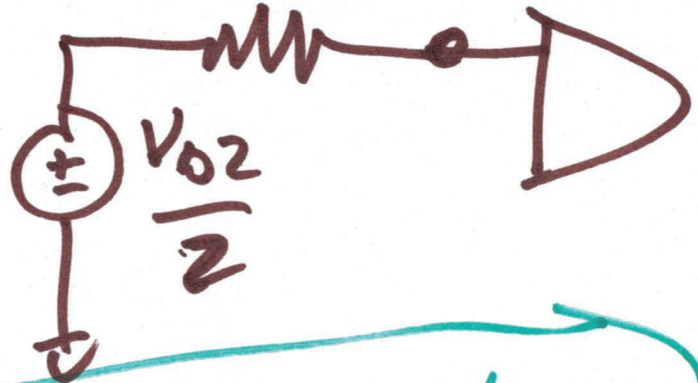
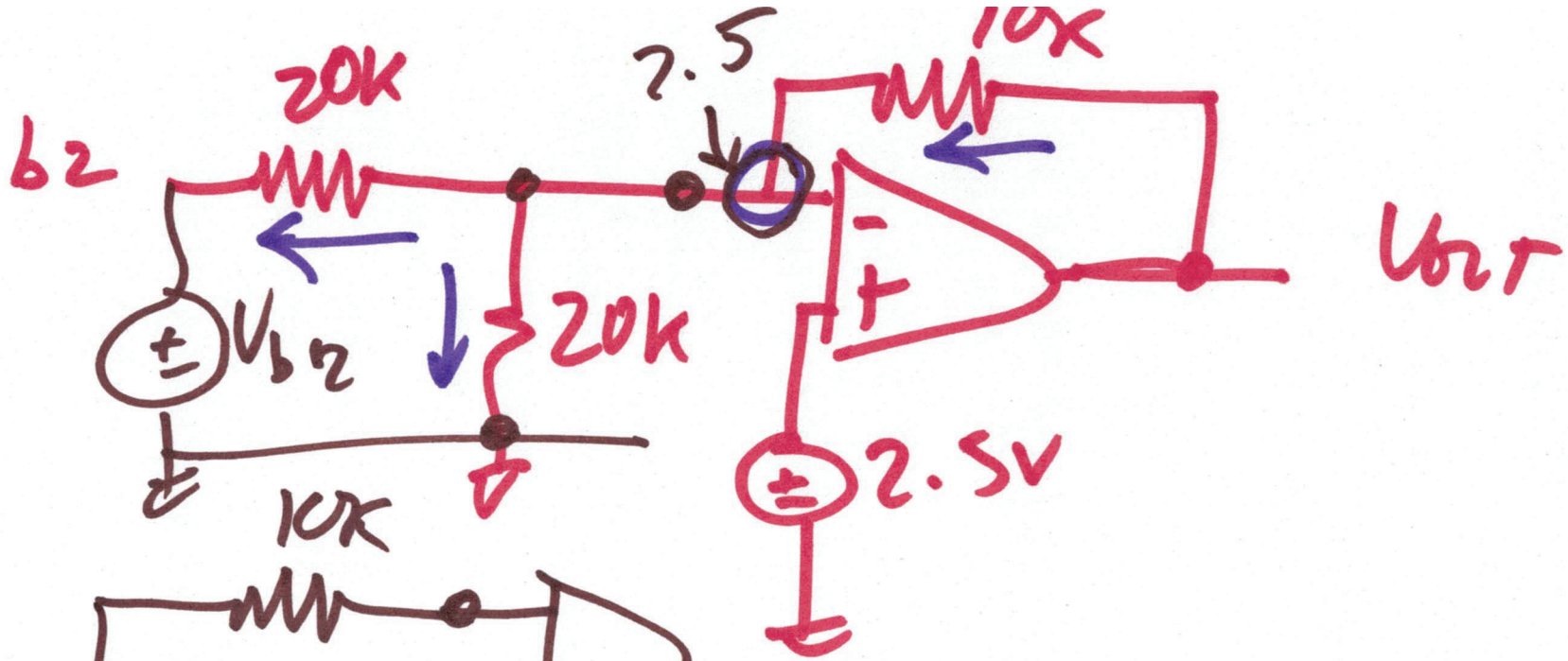
# EE 220 circuits 1

OCT. 19, 2020

2.5 Lecture 15



1)



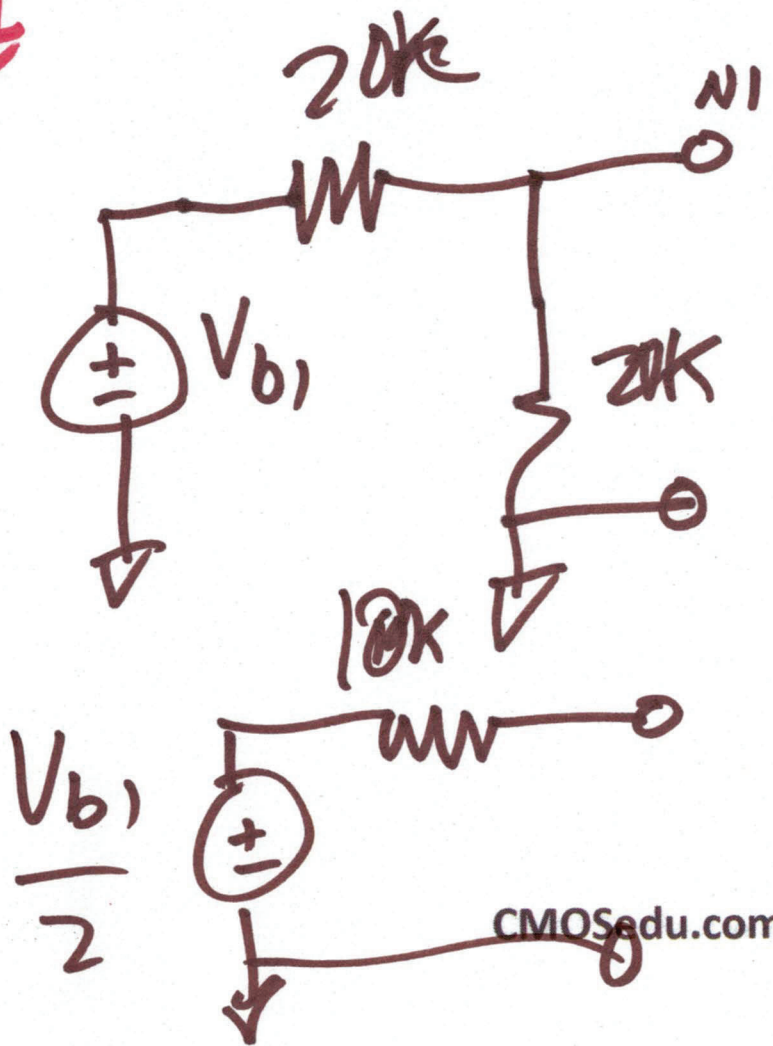
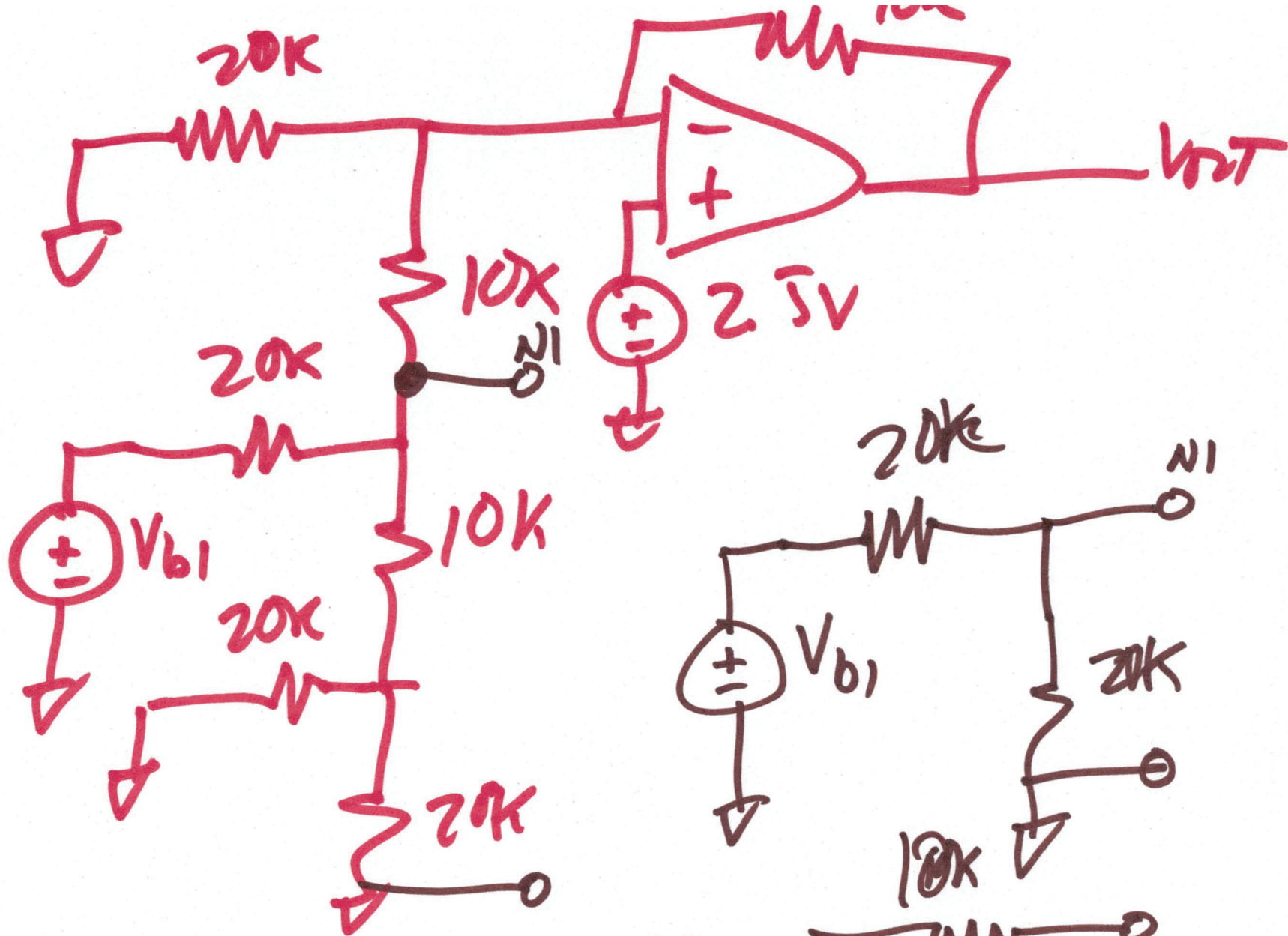
$$V_{out} = 5 - \frac{V_{b2}}{2} - \frac{V_{b1}}{4} - \frac{V_{b0}}{8}$$

$$\frac{V_{out} - 2.5}{10k} = \frac{2.5}{20k} + \frac{2.5 - V_{b2}}{20k}$$

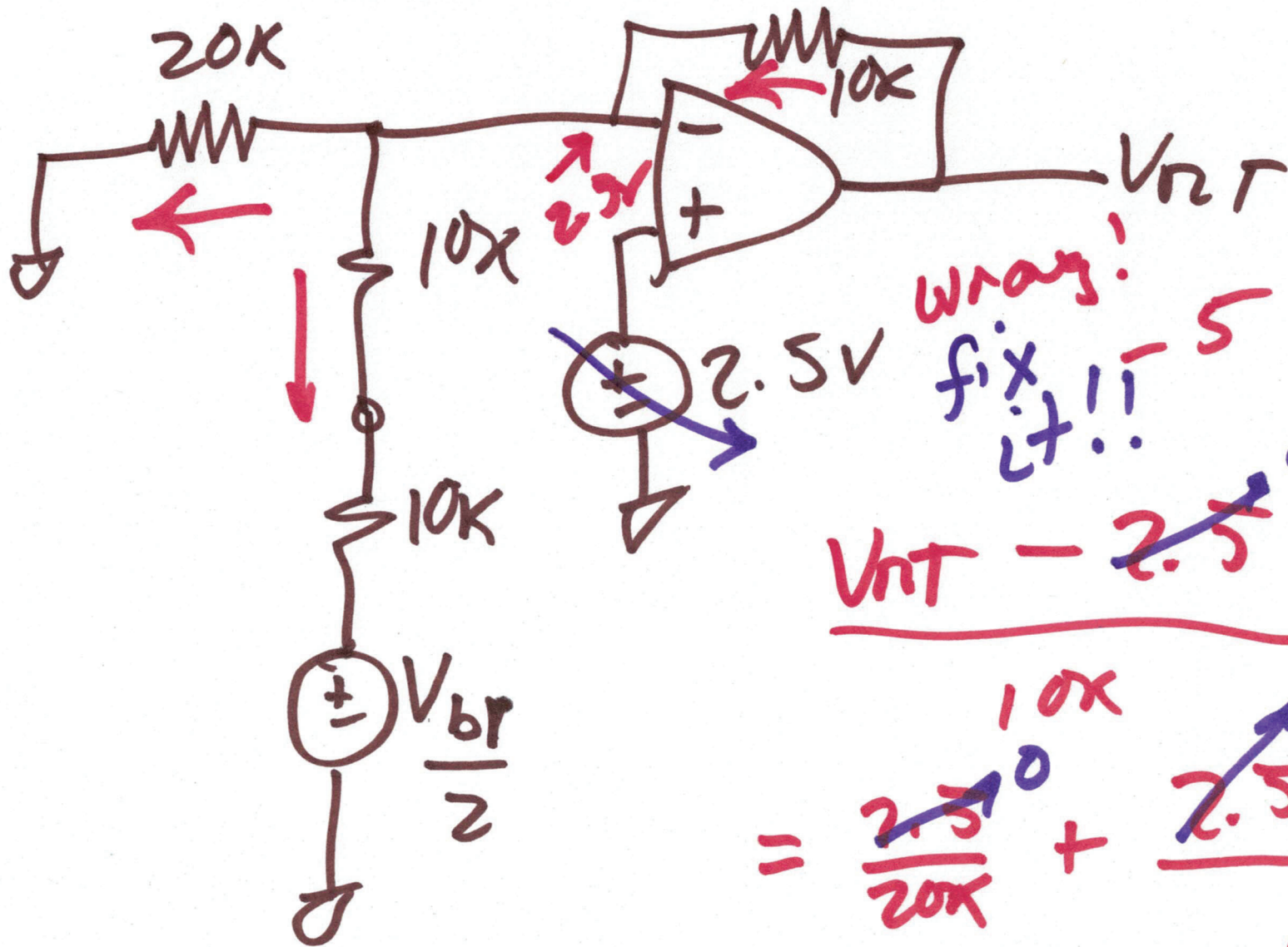
$$2V_{out} - 5 = 5 - V_{b2}$$

$$V_{out} = 5 - \frac{V_{b2}}{2}$$

2)



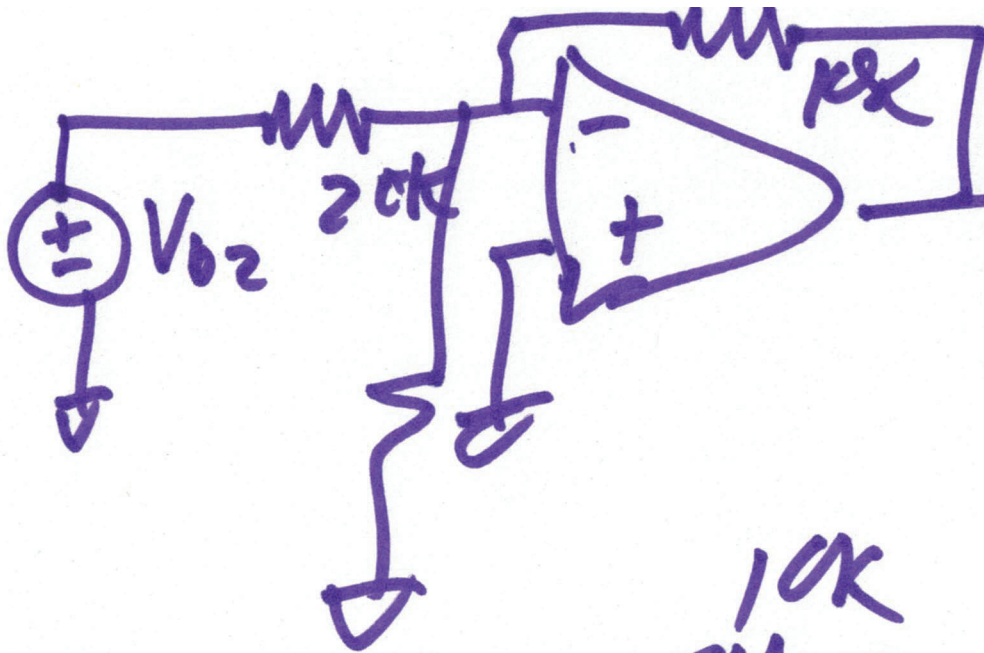
3)



wrap!  
fix it!!  
5

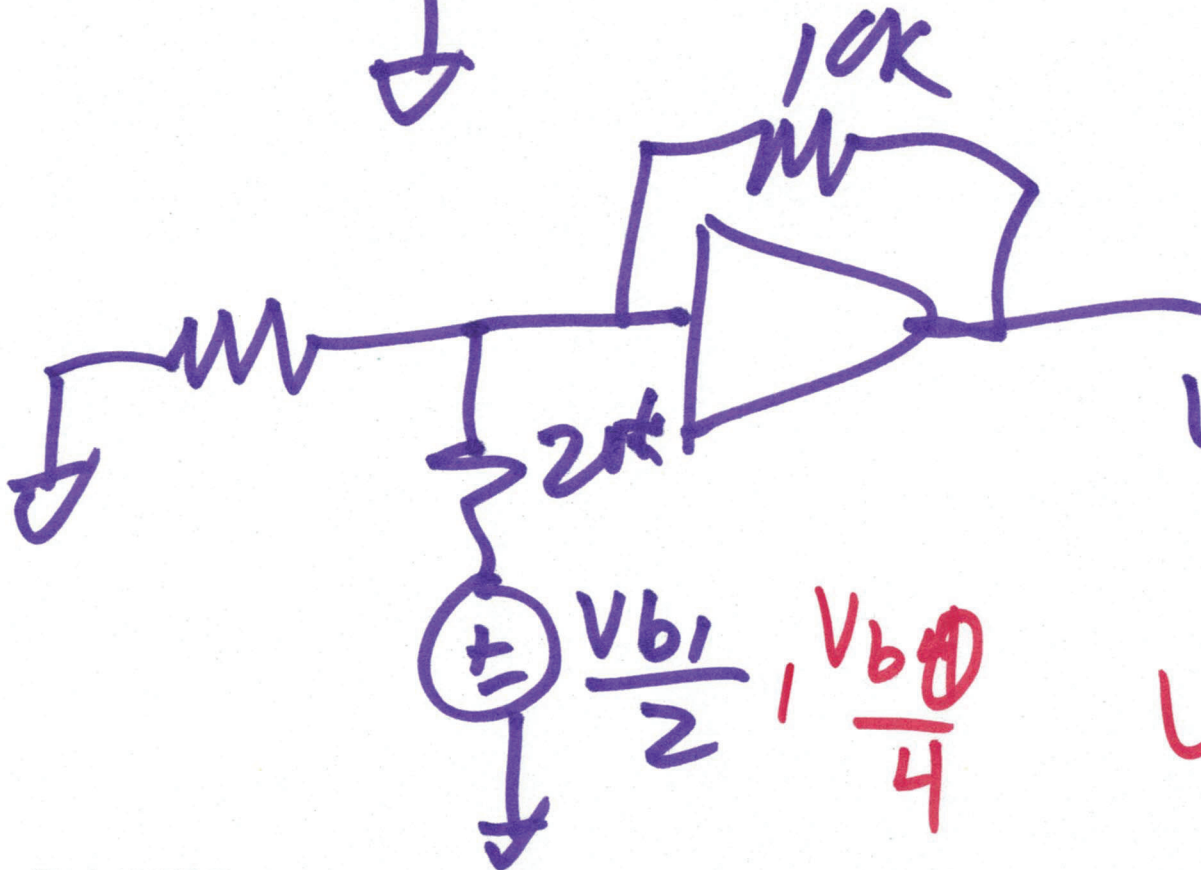
$$V_{out} = \frac{2.5}{20K} + \frac{2.5 - \frac{V_{b1}}{2}}{10K}$$

$$V_{out} = -\frac{V_{b1}}{2}$$



$$V_{OUT} = -\frac{V_{b2}}{20k} \cdot 10k$$

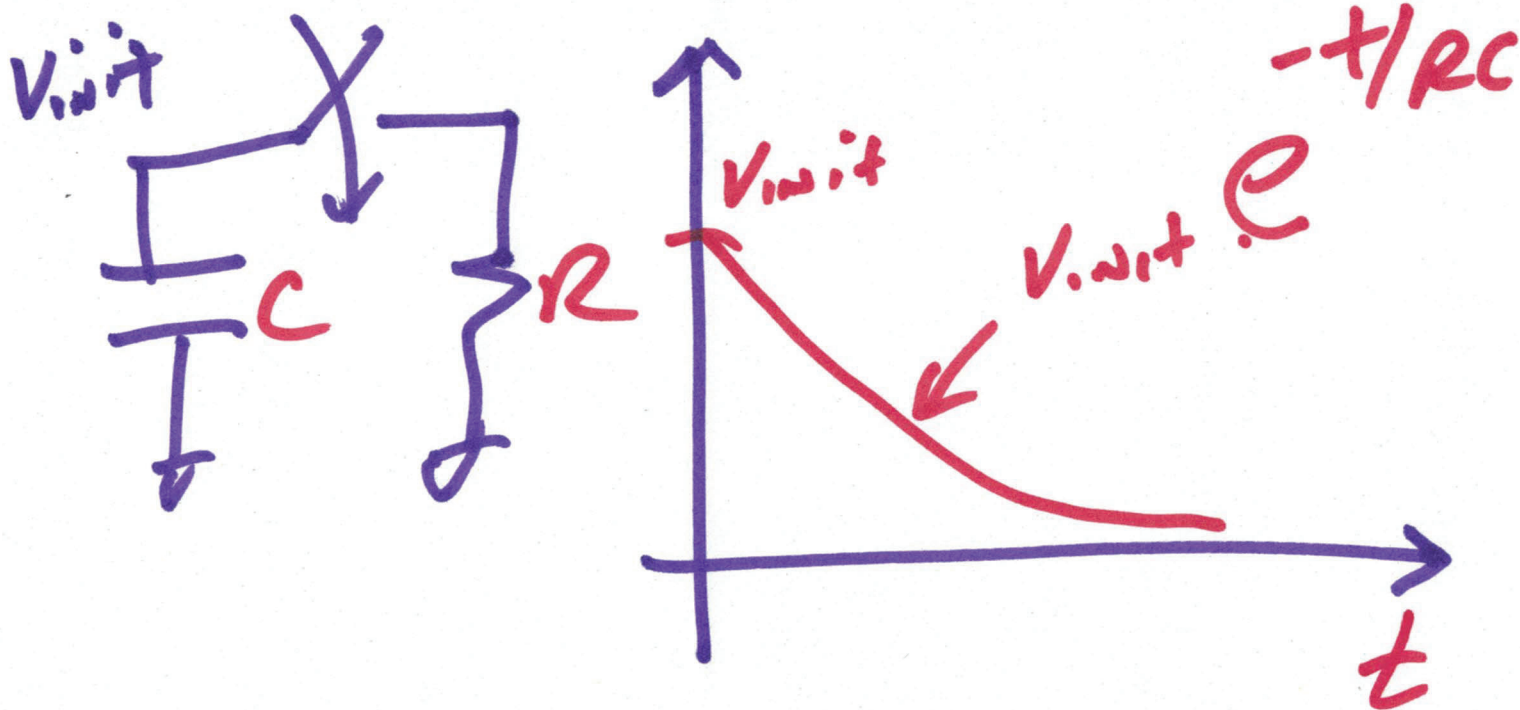
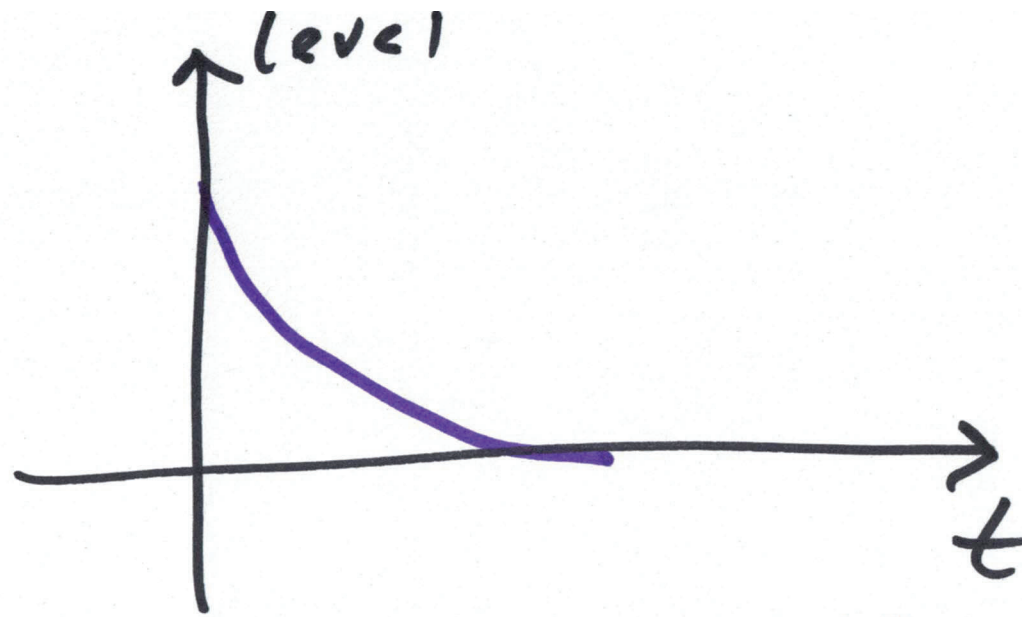
$$V_{OUT} = -\frac{V_{b2}}{2}$$



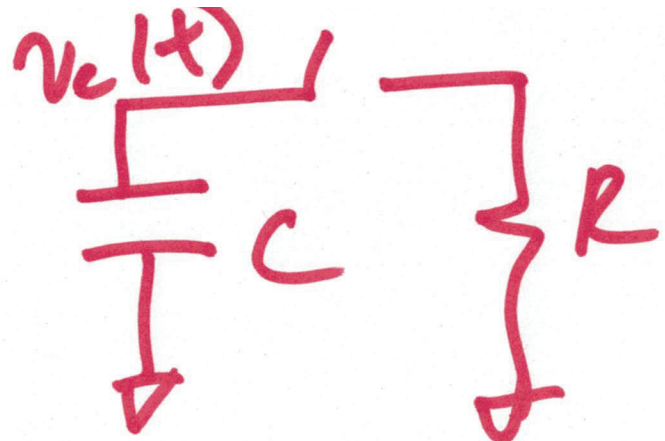
$$V_{OUT} = -\frac{V_{b1}}{4}$$

$$V_{OUT} = -\frac{V_{b0}}{8}$$

5)



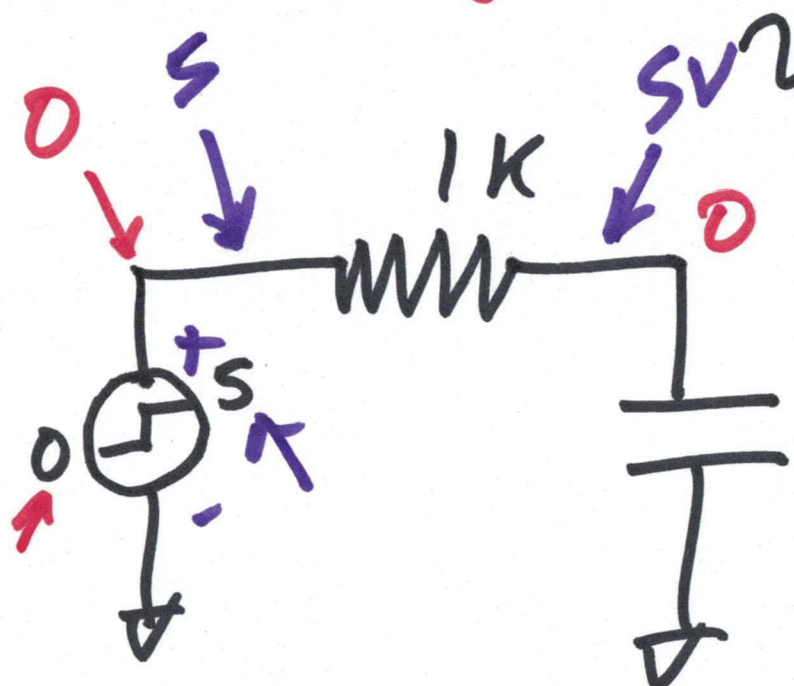
6)



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

$$v_i = v_{init}$$

$$v_f = 0, v_c(t) = v_{init}e^{-t/\tau}$$



$$v_i = 0$$

$$t \rightarrow (t - 1ms)$$

$$t \geq 1ms$$

$$v_f = 5V$$

$$-t/\tau$$

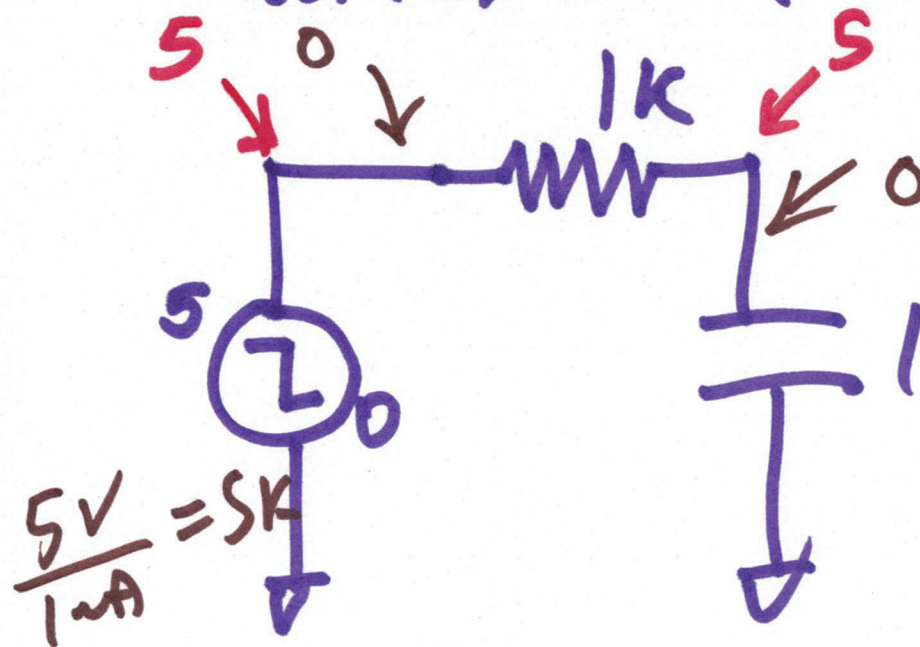
$$\tau = RC = 1ms$$

$$v_c(t) = 5 - 5e^{-t/\tau}$$

$$= 5(1 - e^{-t/\tau})$$

$$V_{out}(t) = 5(1 - e^{-(t-1\mu s)/1\mu s}), t \geq 1\mu s$$

$$\tau = RC = 1\mu s$$



$$V_{init} = 5$$

$$V_f = 0$$

$$-(t - 7\mu s) / 1\mu s$$

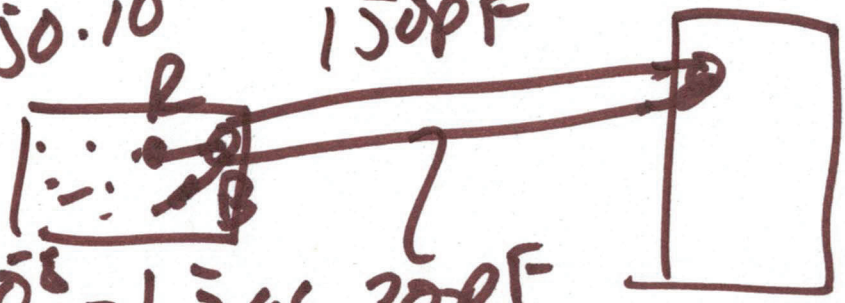
$$10k \cdot 150pF = 1.5 \cdot 10^{-8} s = 1.54ns$$

$$10^4 \cdot 150 \cdot 10^{-12} = 1.5 \cdot 10^{-8}$$

$$150 \cdot 10^{-8}$$

$$V_{out}(t) = 5e^{-(t-7\mu s)/1\mu s}$$

$$t \geq 7\mu s$$



$10^6$  Hz

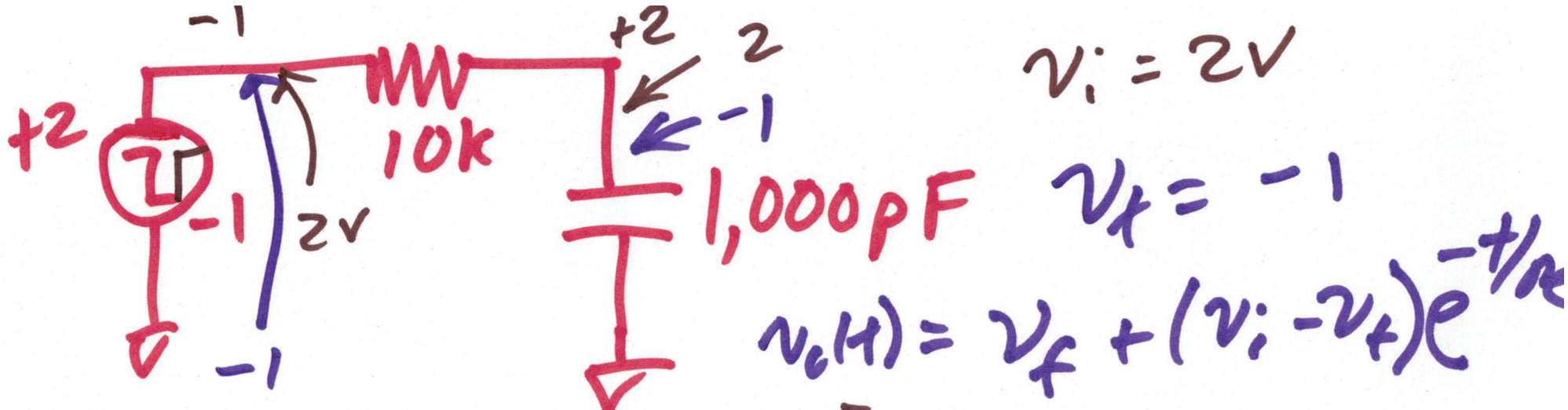
$$\tau = 1/4 = 1/10^6$$



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8)





$$10^4 \cdot 10^3 \cdot 10^{-12} = 10^{-5} = 104s$$

$$v_c(t) = -1V + 3e^{-t/104}$$

$t=0 \quad v_c = 2V$   
 $t=\infty \quad v_c = -1$

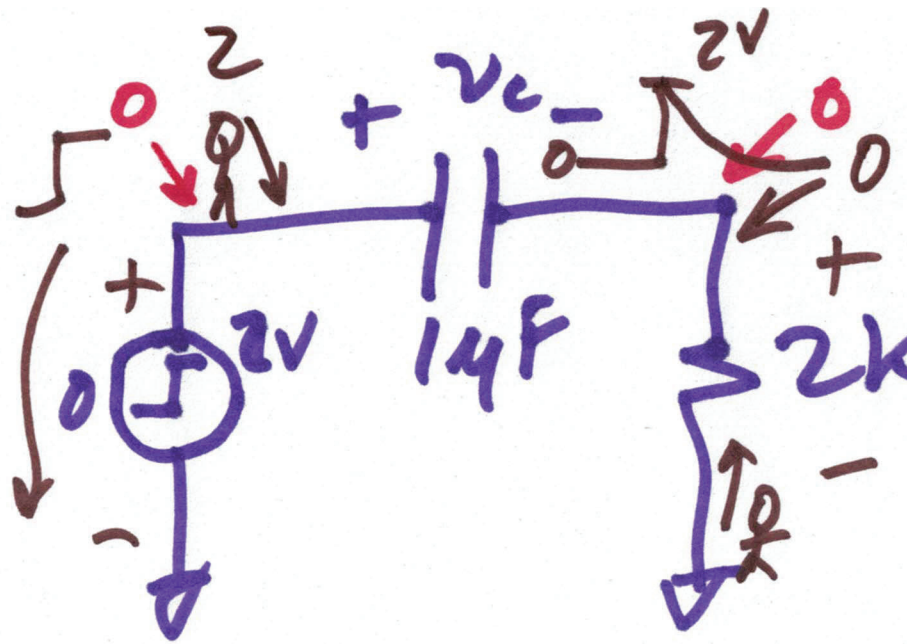
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$$v_i = -1$$

$$v_f = 2$$

$$v_c(t) = 2 + (-1 - 2)e^{-t/RC}$$

9)



$$v_i = 0 - 0 = 0$$

$$v_f = 2V$$

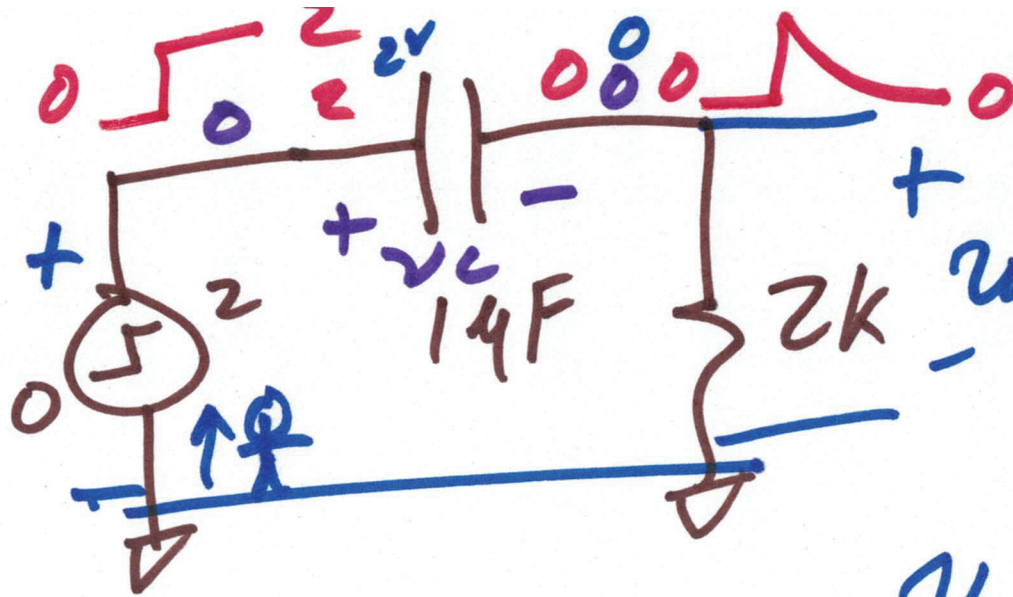
$$v_c = 2 + (0 - 2)e^{-t/2ms}$$

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

$$v_{RT} + v_c - 2 = 0$$

$$v_{RT} = 2 - v_c$$

$$= 2e^{-t/2ms}$$



$$v_{c}(0) = 0$$

$$v_c = 2$$

$$v_c = 2 + (0 - 2)e^{-t/2\mu s}$$

$$+2 - v_c - v_{out} = 0 \quad = 2(1 - e^{-t/2\mu s})$$

$$2 - 2(1 - e^{-t/2\mu s}) = v_{out}$$

$$v_{out} = +2e^{-t/2\mu s}$$