EE 220 Circuits 1

12/1/2021

Lecture 27

$V_{IN} = 1 \cdot \sin(2\pi \cdot 10^3 \cdot t)$ Volts

$V_{OUT} = 313\text{m Volts} \sin(2\pi \cdot 10^3 \cdot t + 99^\circ)$

$\theta = \frac{t_d}{T} \cdot 360 = t_d \cdot 360 \cdot f$

$f = \frac{1}{T}$

$\frac{99}{360} \cdot 10^3 = t_d$

$t_d = .275\text{ms}$

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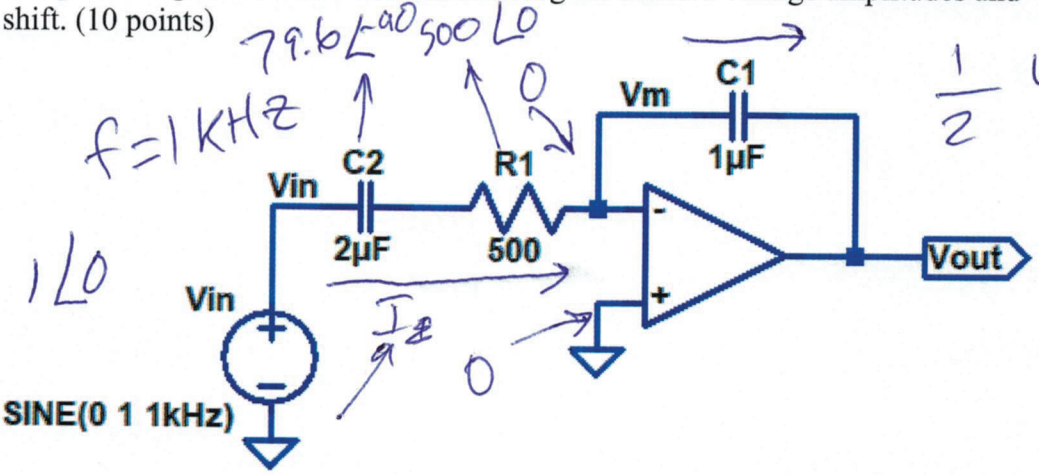
1)

$$\frac{1}{j\omega C} = \frac{1}{\omega C}(-j) = \frac{1}{\omega C}\angle -90$$

9. Find the output voltage of the following circuit using phasor analysis and sketch it along with the input voltage in the time domain showing the relative voltage amplitudes and phase shift. (10 points)



$79.6\angle 90 \quad 500\angle 0$

$f = 1\,KHz$

$1\angle 0$

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

$$\frac{1\angle 0}{500 + j(-79.6)} = \frac{1\angle 0}{79.6\angle -90 + 500\angle 0} = \frac{1\angle 0}{506\angle -9}$$

$\tan^{-1}\frac{-79.6}{500}$

$\sqrt{500^2 + (-79.6)^2}$

$\frac{1}{506}\angle 0 - (-9)$

$I = 1.97\,mA\angle 9 = \frac{0 - V_{OUT}}{159\angle -90}$

$V_{OUT}\angle 180 = -V_{OUT} = 1.97\,mA\angle 9 \cdot 159\angle -90$

$V_{OUT} = 313\,mV\ \frac{\angle 9 \cdot \angle -90}{\angle 180}$

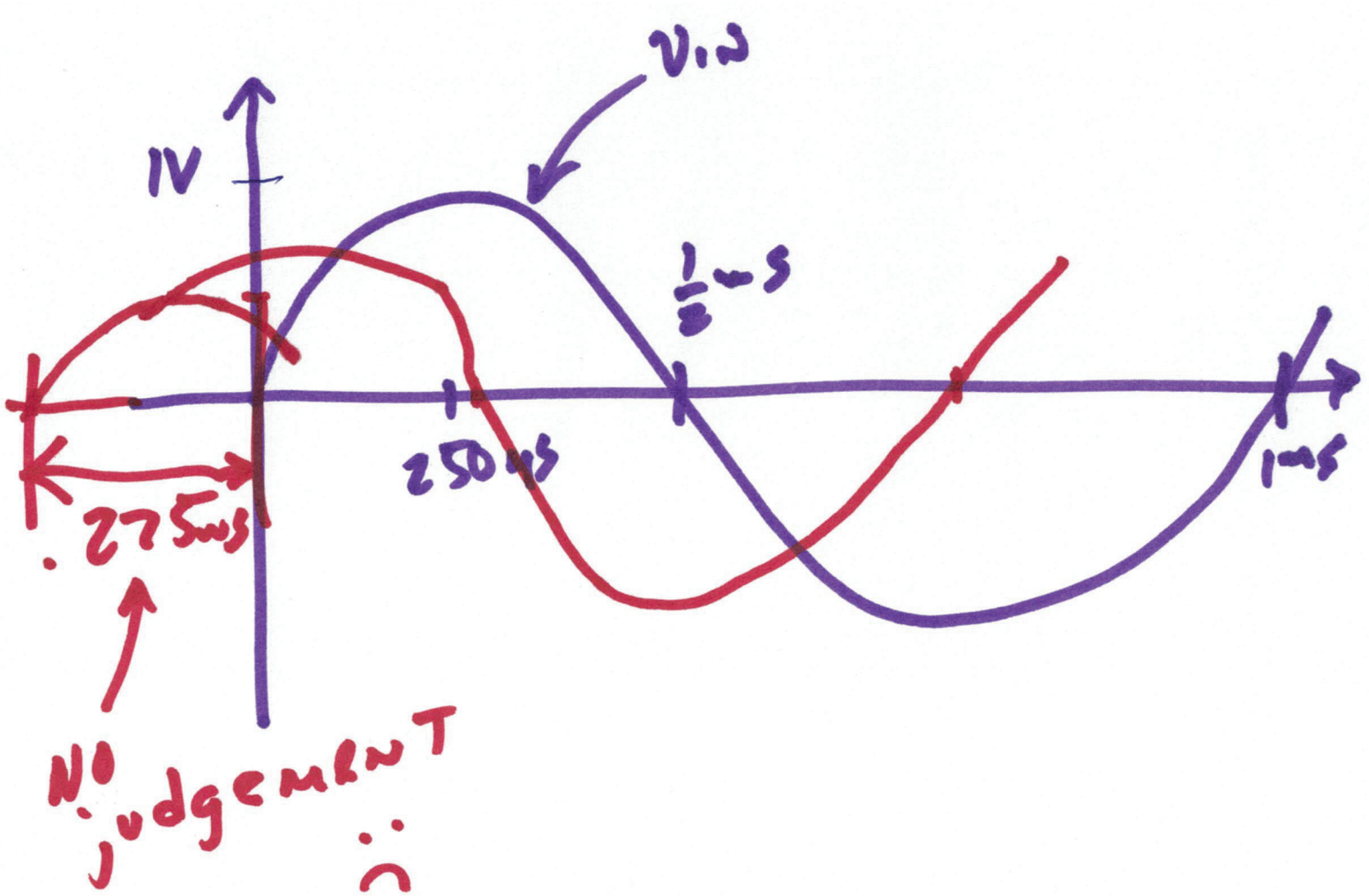
$9 + (-90) - (180)$

$= -261^\circ$

$= +99^\circ$

$V_{OUT} = 313\,mV\angle 99^\circ$

2)

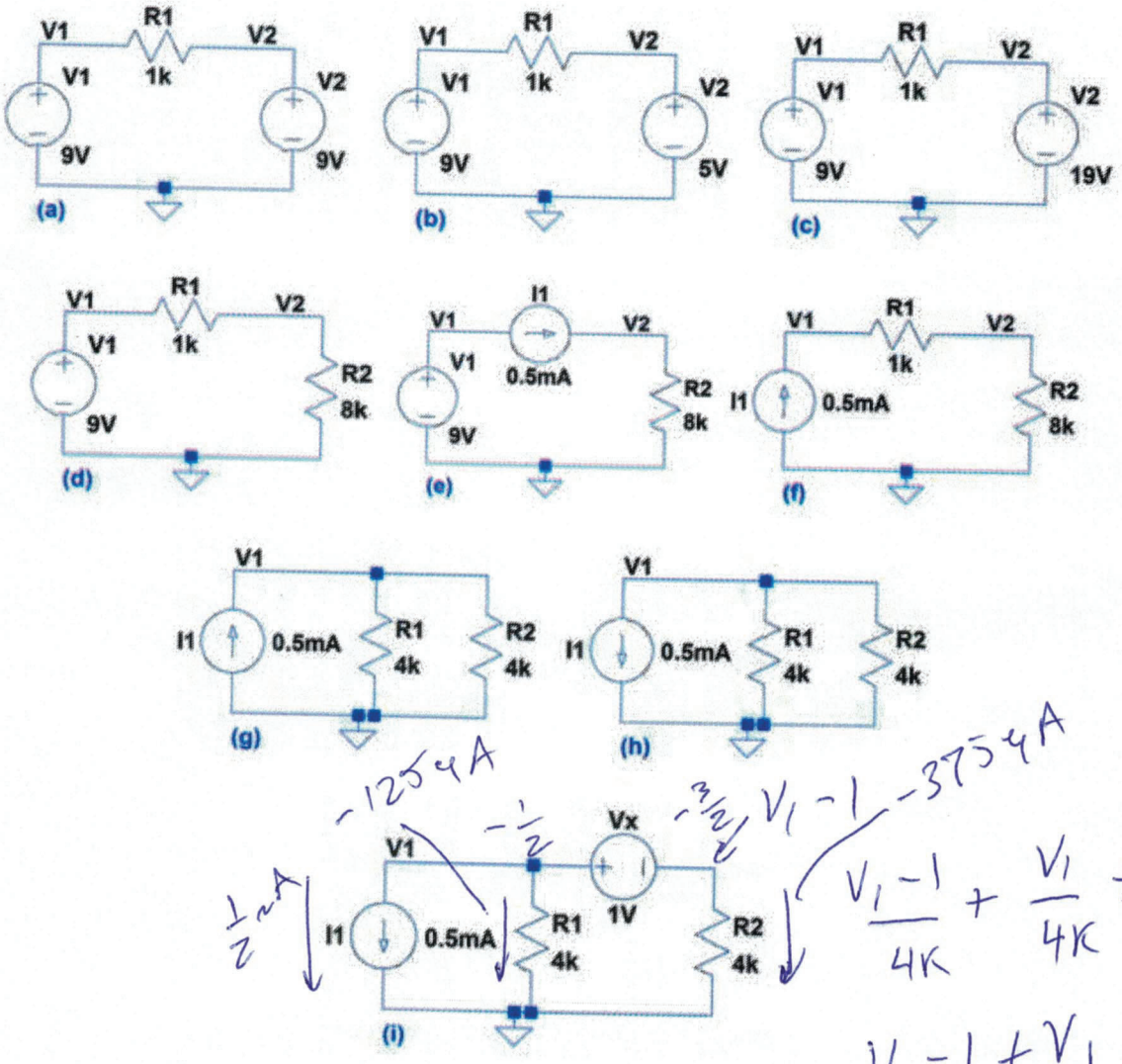

V_{in}
1V
$\frac{1}{2}$ ms
250 µs
1 ms
275 µs
NO JUDGEMENT

Practice Final Exam – EE 220 Circuits I
University of Nevada, Las Vegas

NAME: _____

Closed book and notes.
Use the back of the sheet of paper when needed.

1. Find the currents and voltages in the following circuits. Clearly label the values on the schematics. No need to show your hand calculations, simply write the values. (10 points)



$-1.25\,mA$ $-\frac{1}{2}$ $-\frac{3}{2}$ $V_1 - 1 - 3.75\,mA$

$\frac{1}{2}\,mA$

$\frac{V_1 - 1}{4K} + \frac{V_1}{4K} + \frac{1}{2}mA = 0$

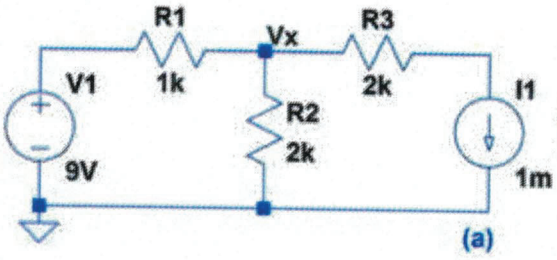
$V_1 - 1 + V_1 + 2V = 0$

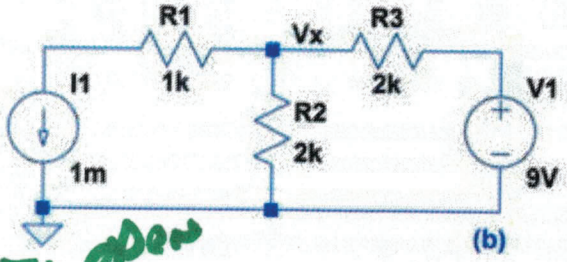
$2V_1 = -1$

$V_1 = -\frac{1}{2}$

4)

2. Using superposition show how to find Vx in each of the following circuits. Show your work for credit. (10 points)

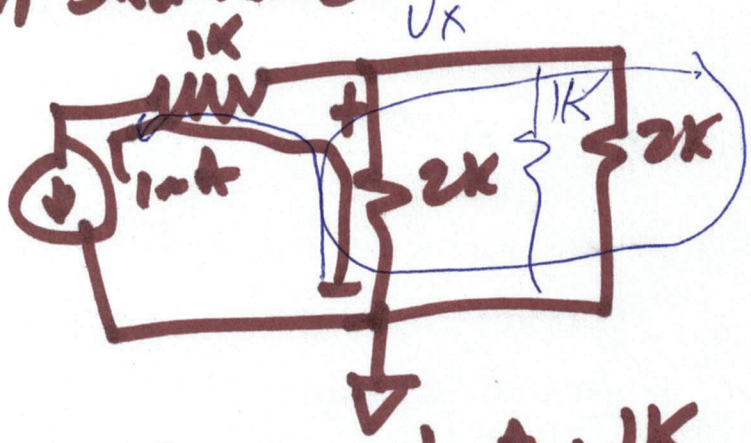




I1 open

$V_{x1} = 9 \cdot \frac{2K}{2K+2K} = 4.5V$

V_1 Shorted



$V_{x2} = -1mA \cdot 1K$

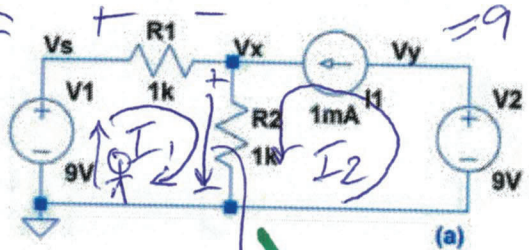
$= -1V$

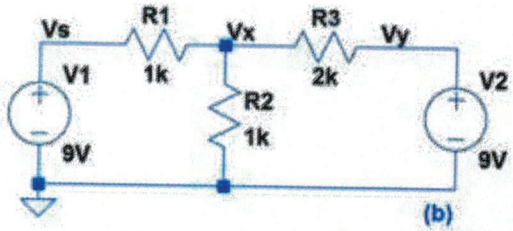
$V_x = 4.5 - 1$

$\boxed{V_x = 3.5V}$

5)

3. Find the voltages and currents in each of the following circuits using mesh analysis. Show your work for credit. (10 points)





$9 = +\ R1\ -$ $= 9$

$1K(I_1 + 1mA)$ $I_1 + I_2 = I_1 + 1mA$ $I_2 = 1mA$

$+9 - 1K\,I_1 - 1K(I_1 + 1mA) = 0$

$9 - 2K\,I_1 - 1V = 0$

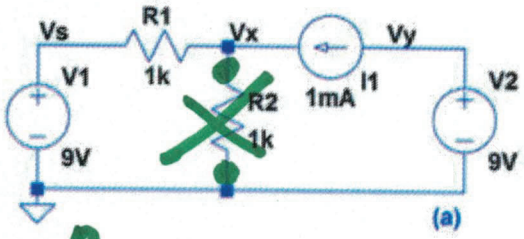
$2K\,I_1 = 8$

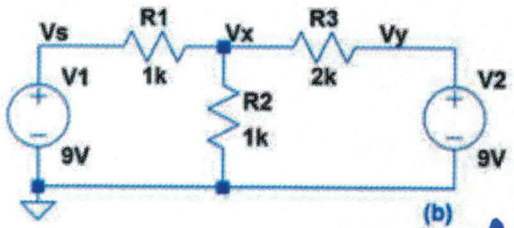
$I_1 = 4mA$

$V_x = 1K \cdot 5mA = 5V$

6)

4. Find the Thevenin and Norton equivalent circuits between Vx and ground with R2 removed in the following circuits. Show your work for credit. (10 points)





$R_{TH} = 1K$

$V_{OC} = V_{TH}$

$-1K + V_X$

1mA

9V

$V_X = 10$

9V

1K

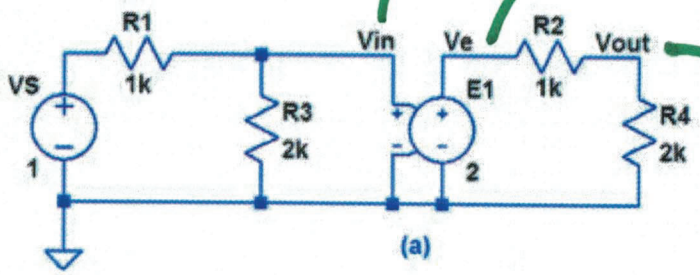
10mA

$+V_X - 1K \cdot 1mA - 9V = 0$

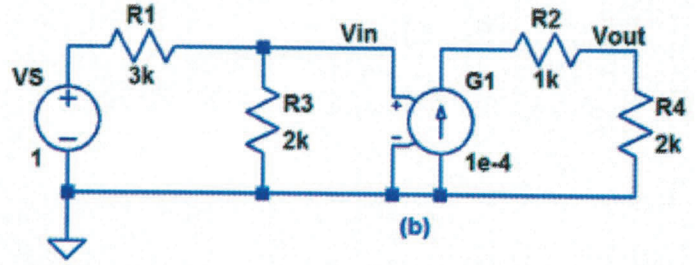
$V_X = 10$

7)

5. Find Vout in each of the following circuits. Show your work for credit. (10 points)



(a)

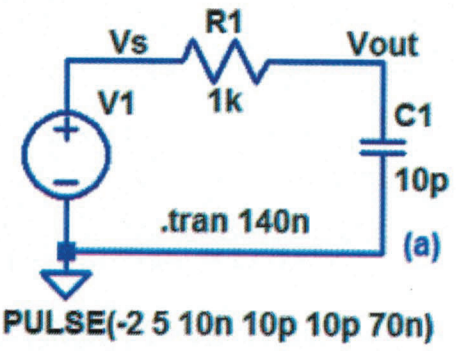


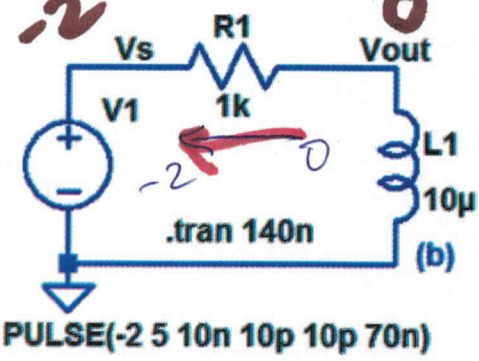
(b)

$\frac{4}{3} \cdot \frac{2}{2+1} = \frac{8}{9}$ V

8)

6. Write the equations and sketch along with the input pulse (on the same plot), for each of the input pulse's transitions, for the output of each of the following circuits. (10 points)





$\frac{7-5}{1K} = 2mA$

$\frac{0-(-2)}{1K}$

$2mA$

a)

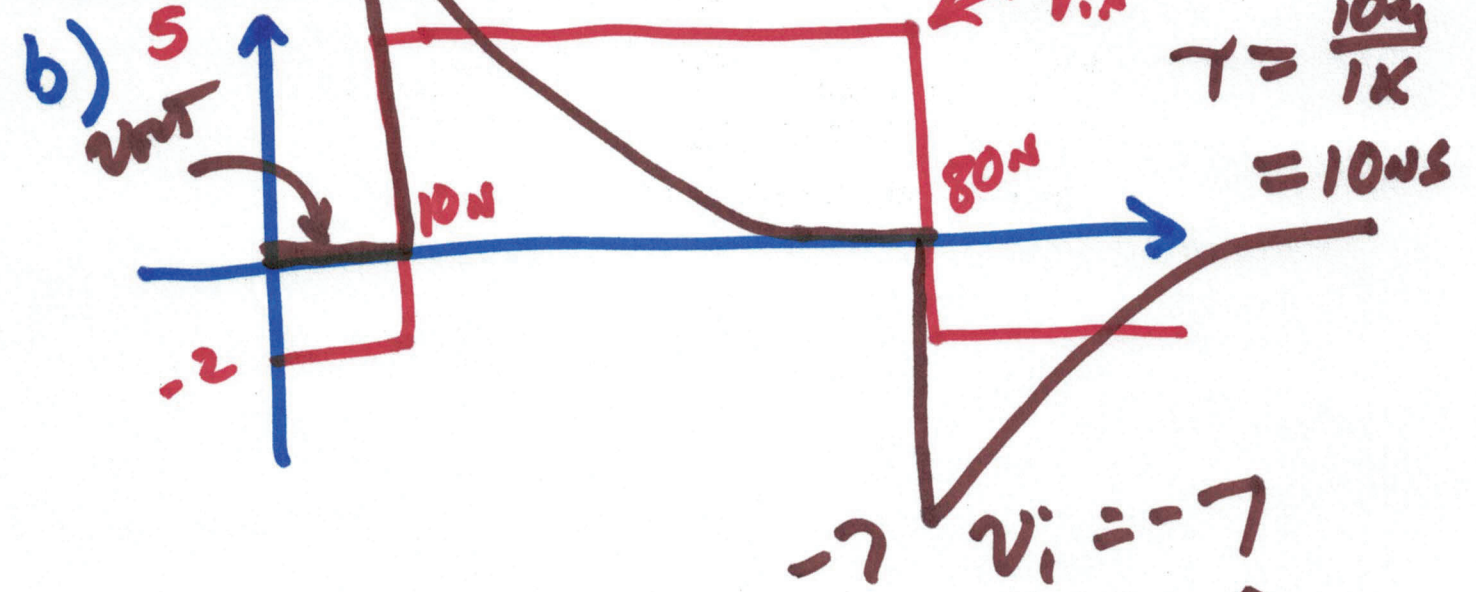
$v_i = 7$

$v_k = 0$

$v_{out} = 0 + (7-0)e^{-\frac{(t-10n)}{10n}}$

$10n \le t \le 80n$

b)



$\tau = \frac{10n}{1K} = 10ns$

-7

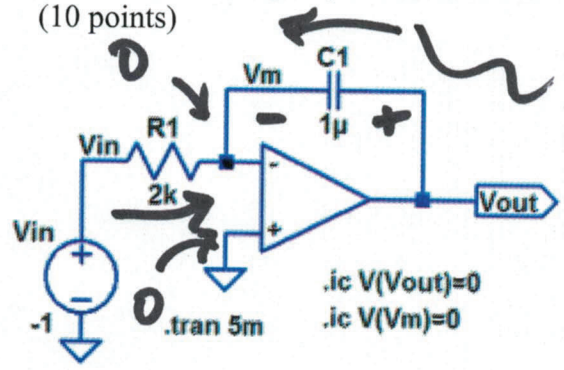
$v_i = -7$

$v_f = 0$

$v_{out} = -7e^{-\frac{(t-80n)}{10n}}$

$t \ge 80n$

7. Plot the output of the following circuit from a time 0 to 5 ms. Assume that the capacitor is initially discharged (both sides are at 0 V). Ensure you show how you calculate Vout. (10 points)



$i_c = C \frac{d v_{RT}}{dt}$

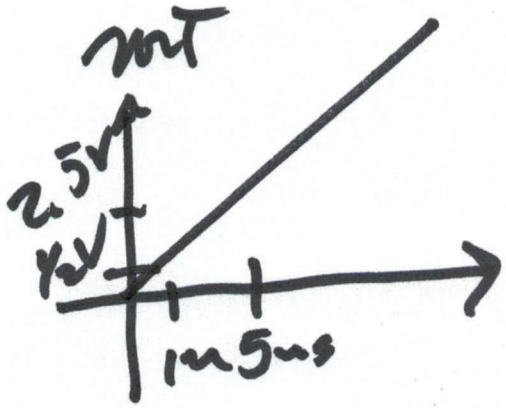
$2K \cdot 1\mu = 2m$

$\frac{v_{IN}}{2K} + i_c = 0$

$\frac{v_{IN}}{2K} + C \cdot \frac{d v_{RT}}{dt} = 0$

$\frac{d v_{RT}}{dT} = -\frac{v_{in}}{2m} t - 1$

$v_{RT} = -\frac{1}{2m} \int_0^t v_{in} \cdot dt$



$v_{RT} = \frac{1V}{2ms} \int_0^t .dt$

$v_{RT} = \frac{t}{2ms} V$

10)