

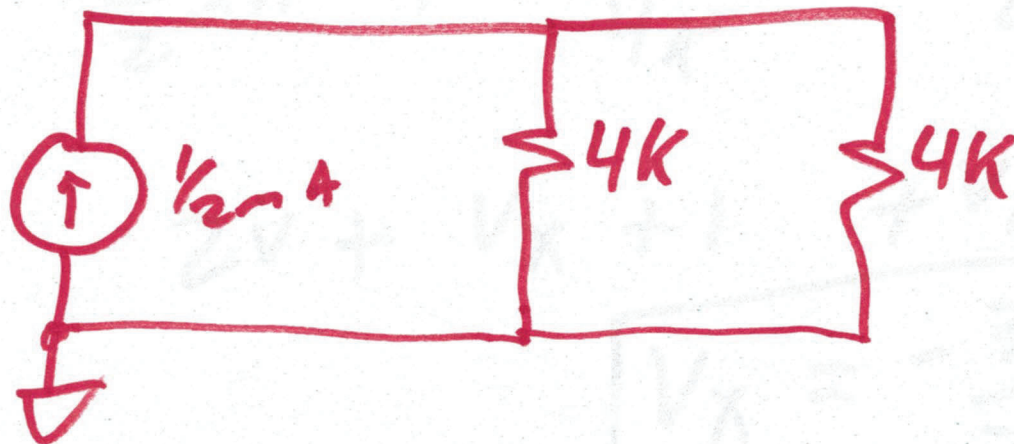
EE 220 Circuits I

Dec. 2, 2020

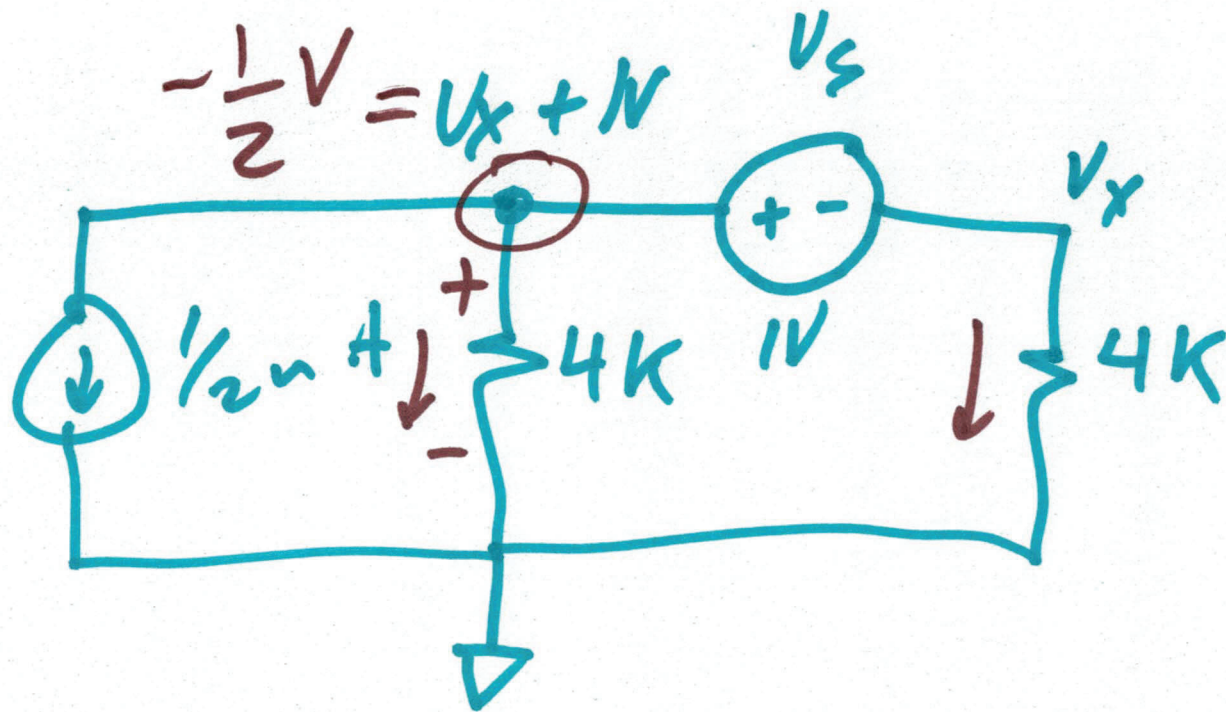
Lecture 27 (LAST ON

Dec. 9 3:10 - 5:10 P

final exam



1)



$$\frac{1}{2} \text{ mA} + \frac{V_x + 1}{4 \text{ k}} + \frac{V_x}{4 \text{ k}} = 0$$

$$2 \text{ V} + V_x + 1 + V_x = 0$$

$$V_x = -\frac{3}{2} \text{ V}$$

$$3 = -2V_x$$

$$\frac{3}{-2} = V_x$$

2)

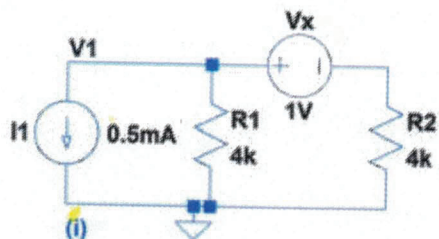
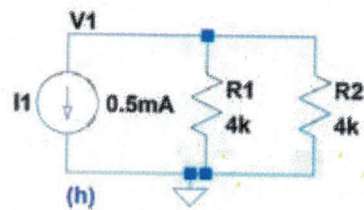
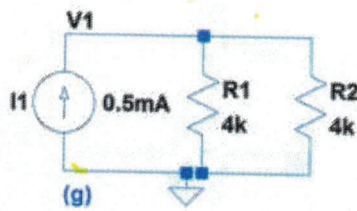
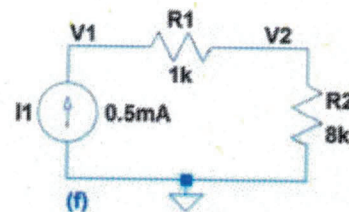
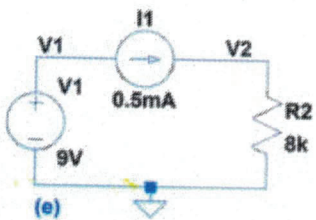
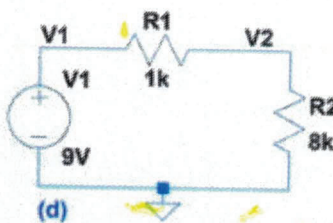
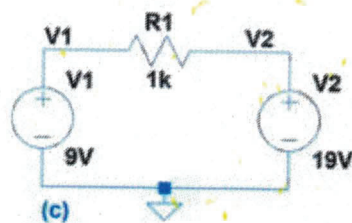
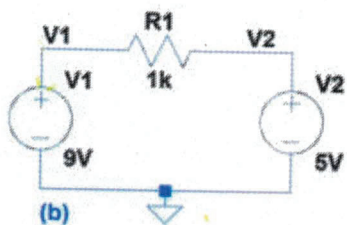
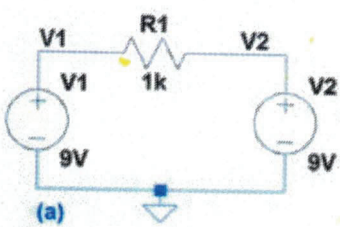
Practice Final Exam – EE 220 Circuits I
 University of Nevada, Las Vegas

NAME: _____

Closed book and notes.

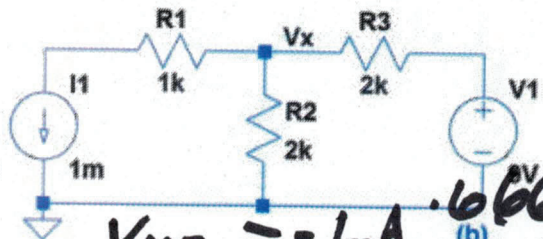
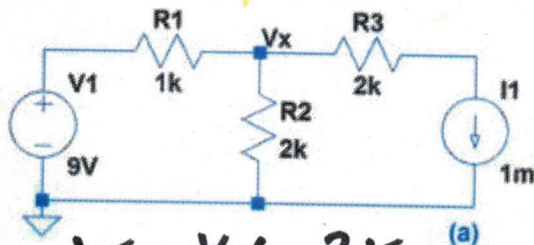
Use the back of the sheet of paper when needed.

- 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)

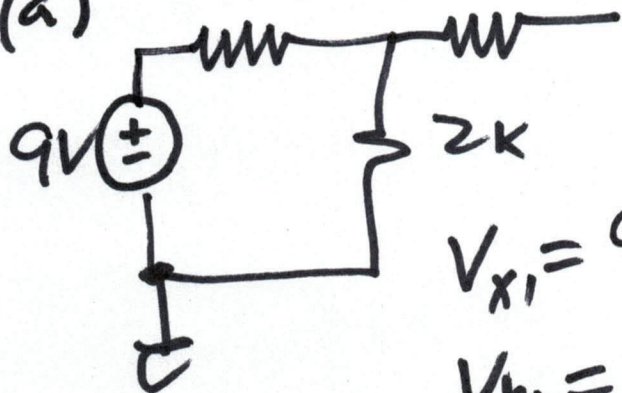


3)

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

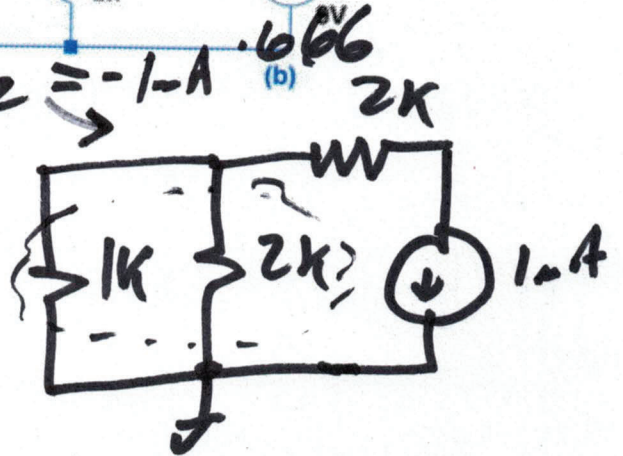


(a)



$$V_{x1} = 9 \cdot \frac{2}{2+1}$$

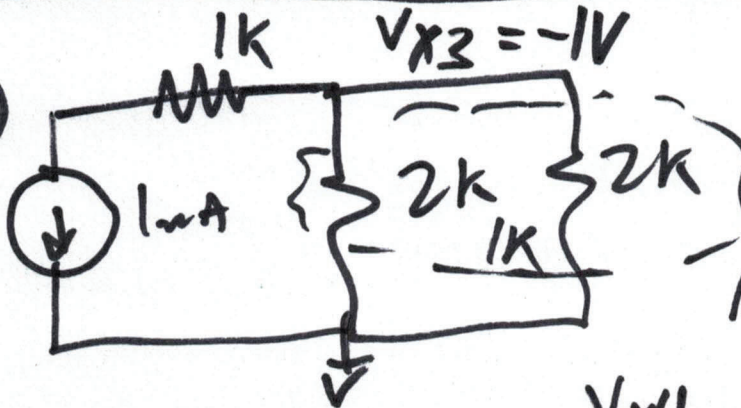
$$V_{x1} = 6V$$



$$V_{x2} = -0.666V$$

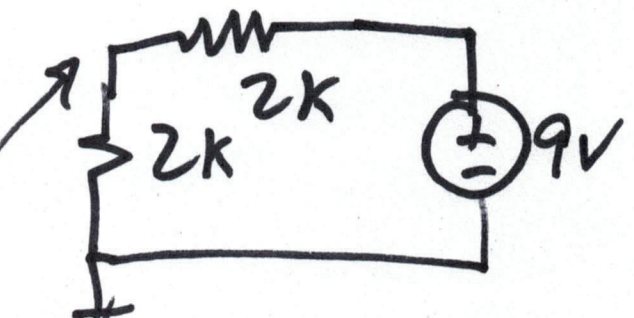
$$a) V_x = V_{x1} + V_{x2} = 5.334V = V_x$$

b)



$$V_{x3} = -1V$$

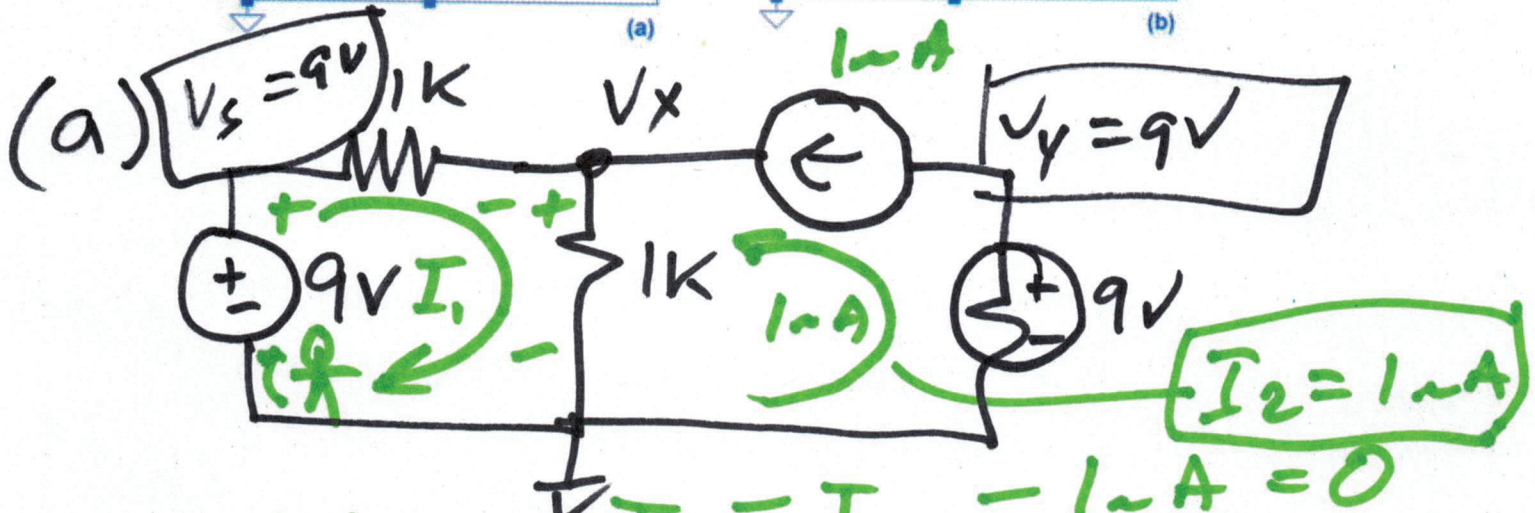
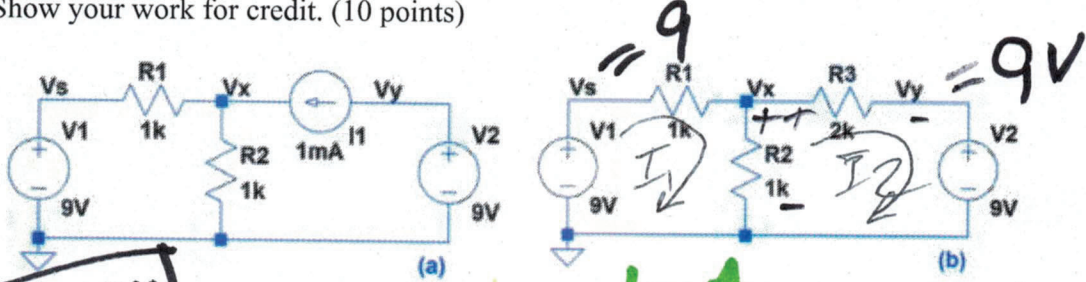
$$V_{x4} = 4.5V$$



$$V_x = V_{x3} + V_{x4} = 3.5V = V_x$$

4)

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



$$9 - 1k \cdot I_1 - 1k \cdot (I_1 + 1mA) = 0$$

$$9 - 1k \cdot I_1 - 1k \cdot (I_1 + 1mA) = 0$$

$$2I_1 = 8mA, \quad I_1 = 4mA$$

$$V_x = 1k(4mA + 1mA) = V_x = 5V$$

$$9 - 1k \cdot I_1 - 1k(I_1 - I_2) = 0$$

$$-(9 + 2kI_2 - 1k(I_1 - I_2)) = 0$$

$$-1kI_1 + 2kI_2 = 0, \quad I_2 = \frac{1}{2}I_1$$

5) $9 - 1k \cdot I_1 - 1k(I_1 + \frac{1}{2}I_1) = 0$

Prob. 3) cont'd

$$9 - 1kI_1 - 1kI_1 - \frac{1}{2}kI_1 = 0$$

$$9 = 2.5kI_1, \quad I_1 = \frac{9}{2.5k}$$

$$I_1 = 3.6 \mu A$$

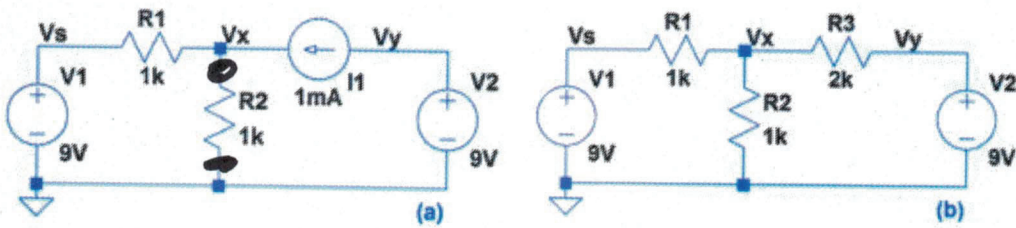
$$I_2 = -1.8 \mu A$$

$$V_x = 1k(I_1 - I_2)$$

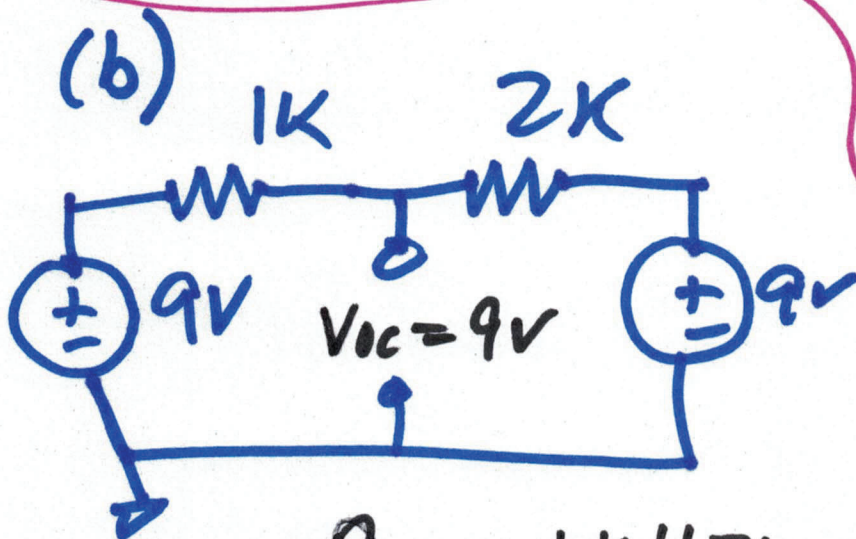
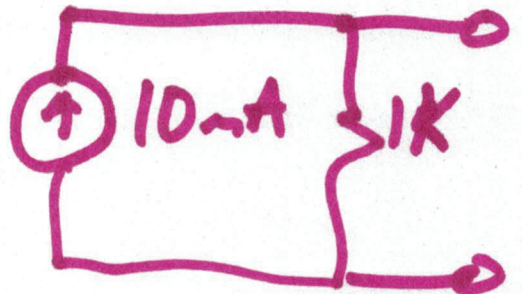
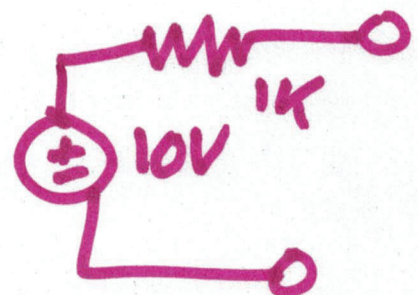
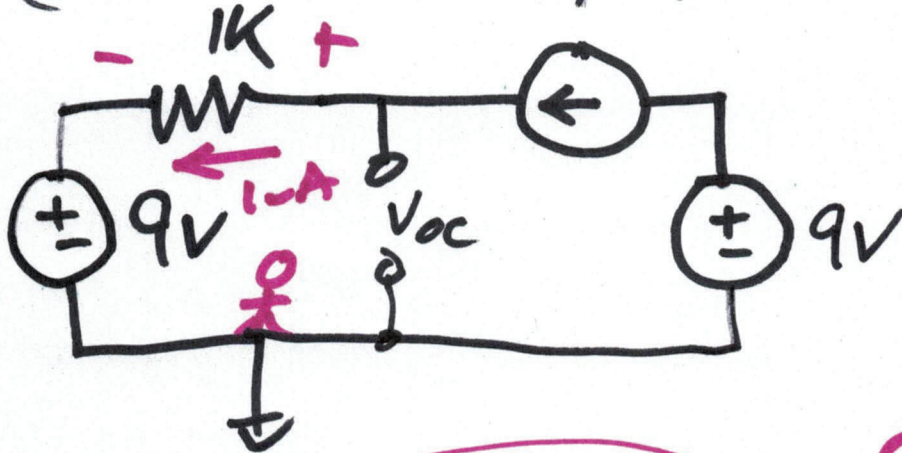
$$= 1k(3.6 \mu A - (-1.8 \mu A)) = 5.4V = V_x$$

6)

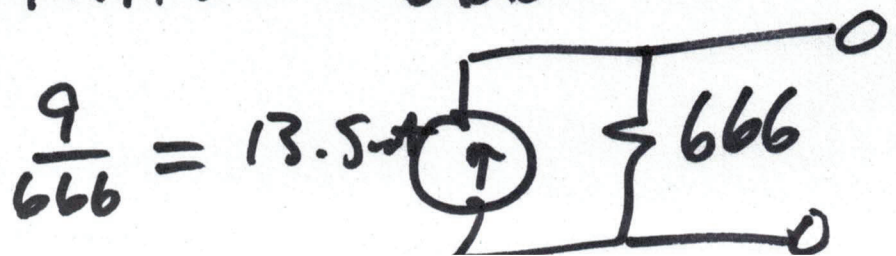
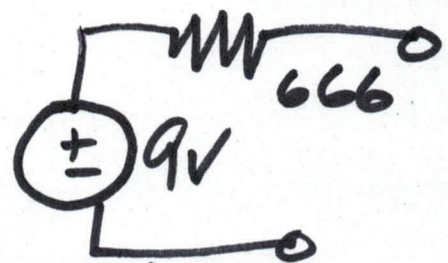
4. Find the Thevenin and Norton equivalent circuits between V_x and ground with R_2 removed in the following circuits. Show your work for credit. (10 points)



(a) $R_{TH} = 1k$, $V_{oc} = 9 + 1k \cdot 1mA$
 $V_{oc} = 10V$

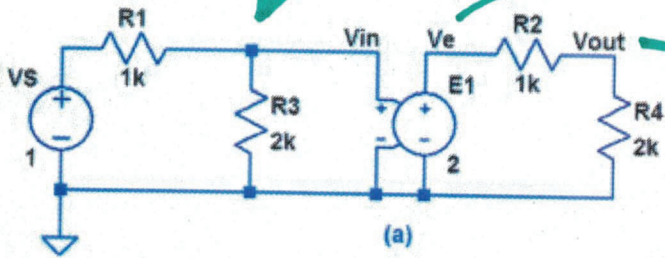


$R_{TH} = 1k || 2k = 666$



7)

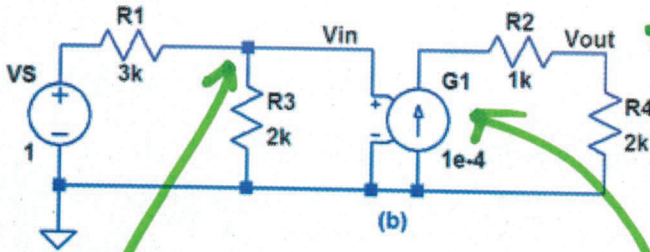
5. Find V_{out} in each of the following circuits. Show your work for credit. (10 points)



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

$$2 \cdot \frac{2}{3} = \frac{4}{3}V$$

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



$$= 2k \cdot 40\mu A$$

$$= 80\mu A$$

$$1 \cdot \frac{2}{2+3} = \frac{2}{5}V$$

$$\frac{2}{5}V \cdot 10$$

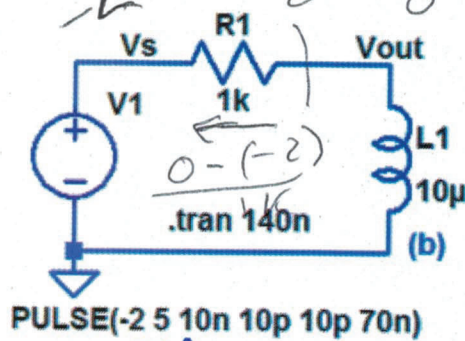
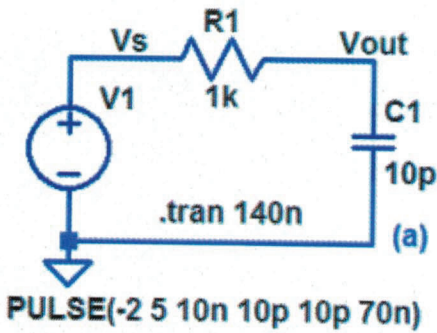
$$= 40\mu A$$

$$= 0.04\mu A$$

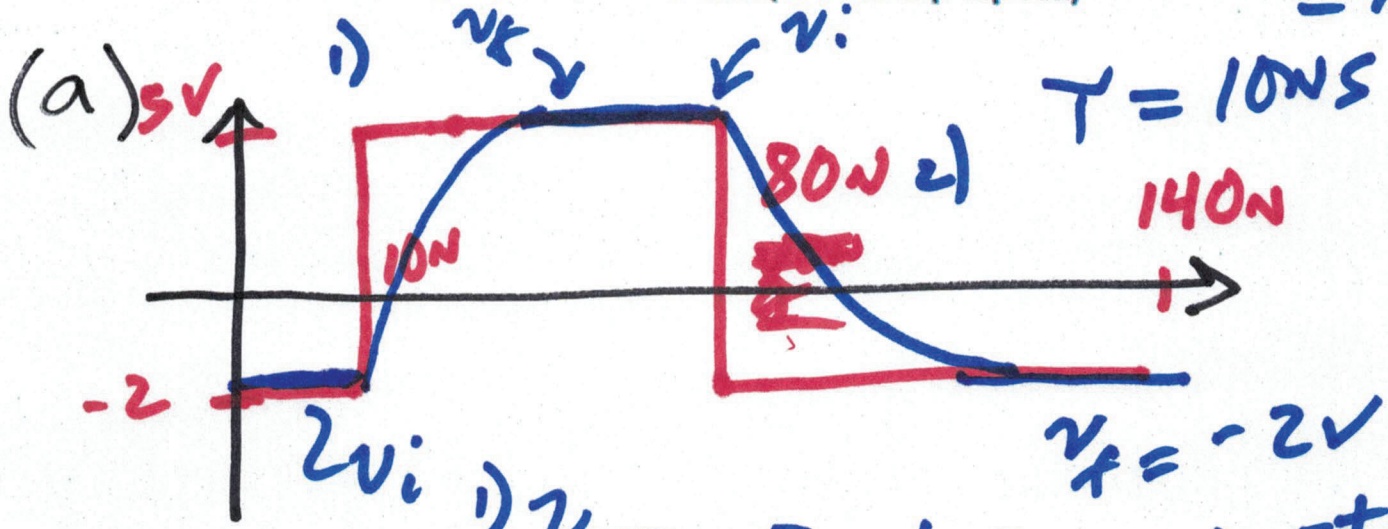
8)

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

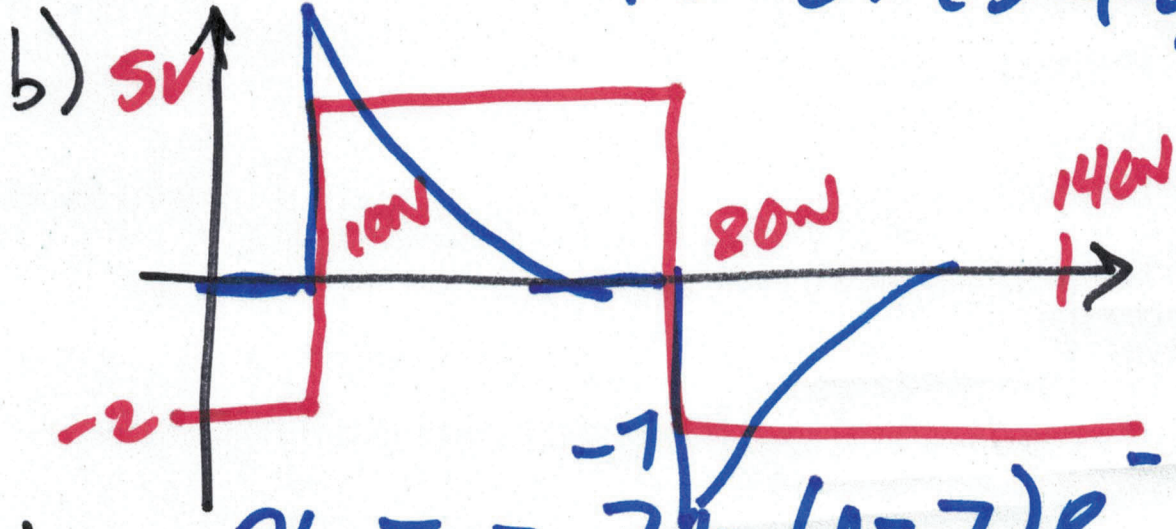
6. Write the equations and sketch along with the input pulse (on the same plot), for each of the input pulse's transitions, for the output of each of the following circuits. (10 points)



$v_i = 7V$
 $T = \frac{10\mu}{1k} = 10ns$



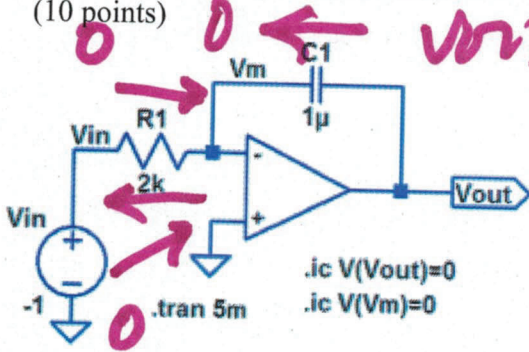
1) $v_{out} = 5 + (-2 - 5)e^{-t/10ns}$
 2) $v_{out} = -2 + (5 - (-2))e^{-t/10ns}$



a) $v_{out} = 7 + (0 - 7)e^{-t/10ns}$
 $-7 + (0 - (-7))e^{-t/10ns}$

$$F = \frac{\text{Coulombs}}{\text{V}} \quad CV = Q$$

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 V_{out} . (10 points)



$$I = C \frac{dV}{dt}$$

$$V = \frac{1}{C} \int I \cdot dt$$

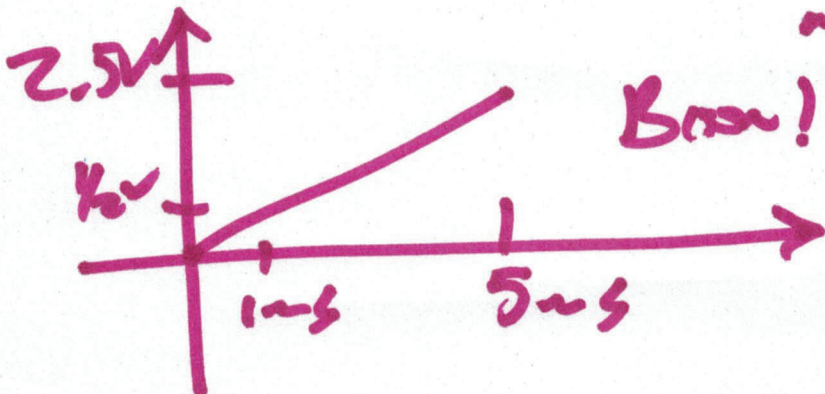
$$\frac{0 - (-1)}{2k} = \frac{1}{2} \mu A$$

$$V_{out} = \frac{1}{1\mu F} \cdot \int_0^{5ms} \frac{1}{2} \mu A \cdot dt$$

$$\frac{\text{Coulombs/s}}{\text{Coulombs/V}}$$

$$V_{out}(t) = \frac{1/2 \mu A \cdot t}{1\mu F}$$

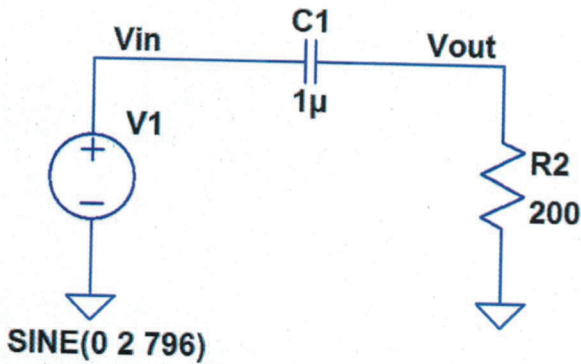
$$= \frac{1/2 V}{ms} \cdot t$$



Brown! done!

10)

8. Using phasor analysis sketch V_{out} and V_{in} , on the same plot, for the following circuit. Show your work (how you calculate the magnitude and phase shift of the output) for credit. Note that the input's peak voltage is 2 V. (10 points)



$$Z_C = \frac{-j}{2\pi \cdot 796 \cdot 10^{-6}}$$

$$= -j200$$

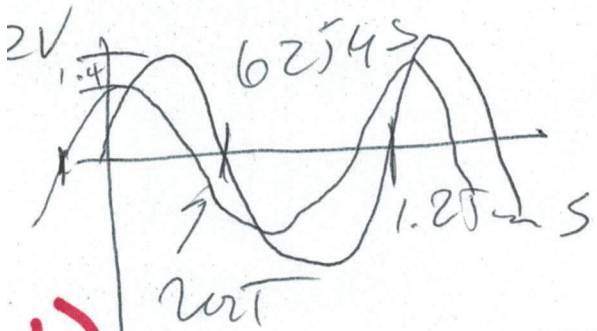
$$Z_{RT} = \frac{200}{200 + j(-200)} \cdot 2 \angle 0^\circ$$

$$|Z_{RT}| = \frac{1}{\sqrt{1^2 + (-1)^2}} \cdot 2 = \frac{2}{\sqrt{2}}$$

$$\angle Z_{RT} = 0 - (-45^\circ) = 45^\circ$$

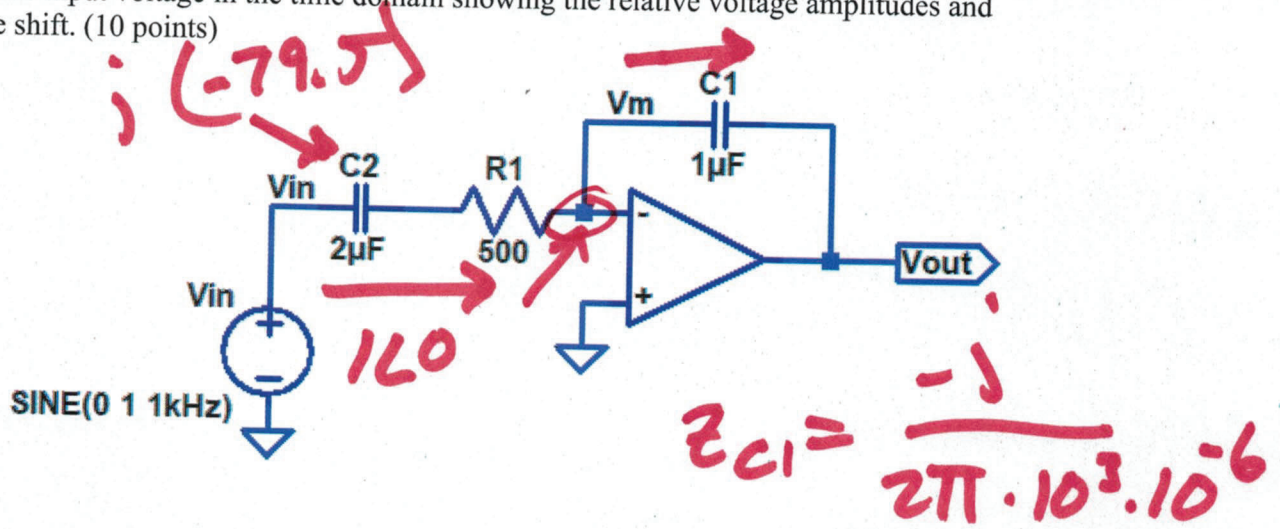
$$t_d = .157 \mu s \quad T = \frac{1}{796} = 1.256 \mu s$$

$$\frac{t_d}{T} \cdot 360 = 45^\circ$$



1)

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)



$$\frac{120}{j(-79.5) + 500} = \frac{120}{506 \angle -9^\circ} = \frac{120}{506} \angle -9^\circ$$

$$= \frac{0 - V_{out}}{j(-159)} = \frac{V_{out} \angle 180^\circ}{159 \angle -90^\circ}$$

$$V_{out} = \frac{120 \cdot 159 \angle -90^\circ}{506 \angle -9^\circ \cdot 1 \angle 180^\circ}$$

$$V_{out} = .31 \angle 99^\circ$$

$$T = 1 \mu s$$

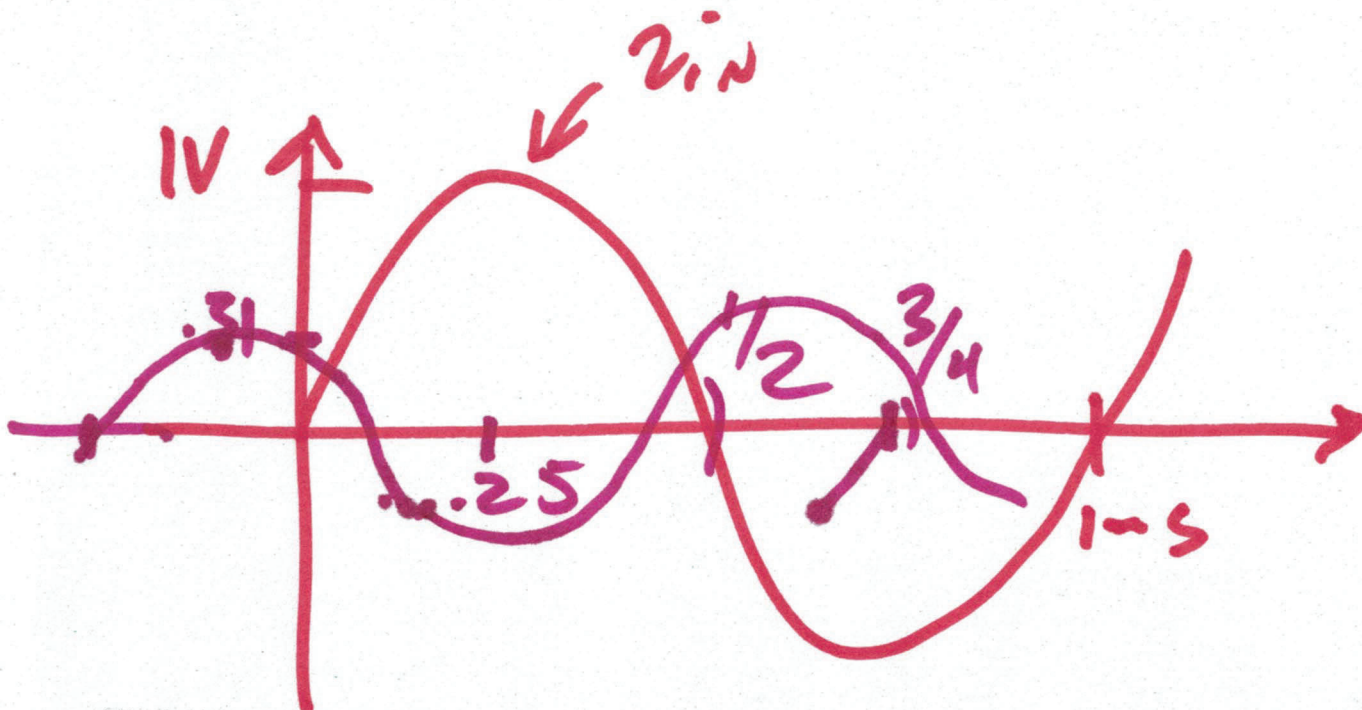
12)

$$v_{in} = 1 \angle 0^\circ, v_{out} = .31 \angle 99^\circ$$

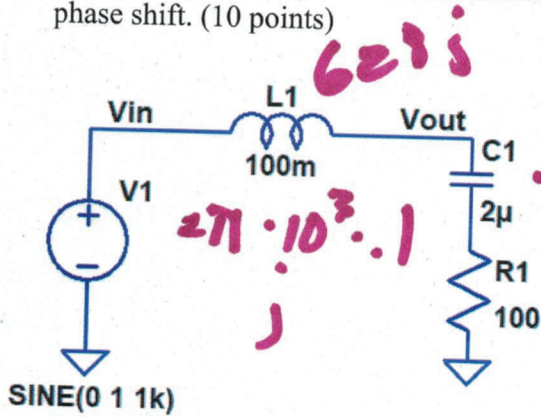
$$99 = \frac{t_d}{T} \cdot 360$$

~~5~~ μs

$$t_d = .275 \mu s$$



10. 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)



548.5

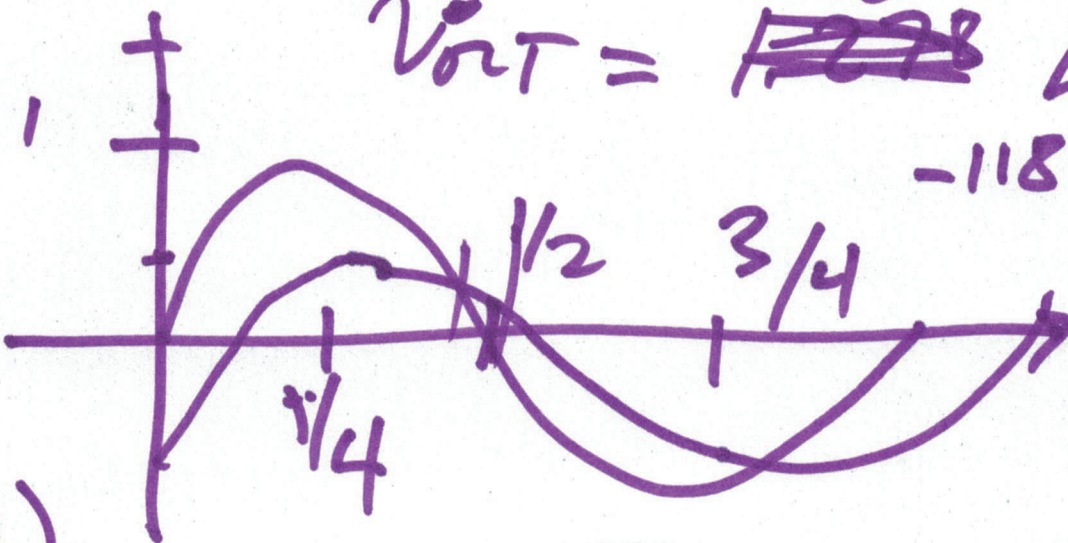
$$V_{out} = 1 \angle 0^\circ \cdot \frac{100 - j79.5}{100 - j79.5 + 628j}$$

$$= 1 \angle 0^\circ \cdot \frac{127.8 \angle -38.5^\circ}{557 \angle 79.6^\circ}$$

$$V_{out} = \frac{.22}{1.778} \angle -118^\circ$$

$$-118 = \frac{t_d}{1\mu s} \cdot 360$$

$$= .327\mu s$$



14)