

EE10 Final

Department of Electrical Engineering, UCLA

Winter 2014

Instructor: Prof. Gupta

1. Exam is closed book. Calculator and one double sided cheat-sheet is allowed.
2. Cross out *everything* that you don't want me to see. Points will be deducted for everything wrong!
3. Do NOT use Laplace Transforms to solve any problems.
4. No points will be given without proper explanations

Name:

Student ID:

Student on Left:

Student on Right:

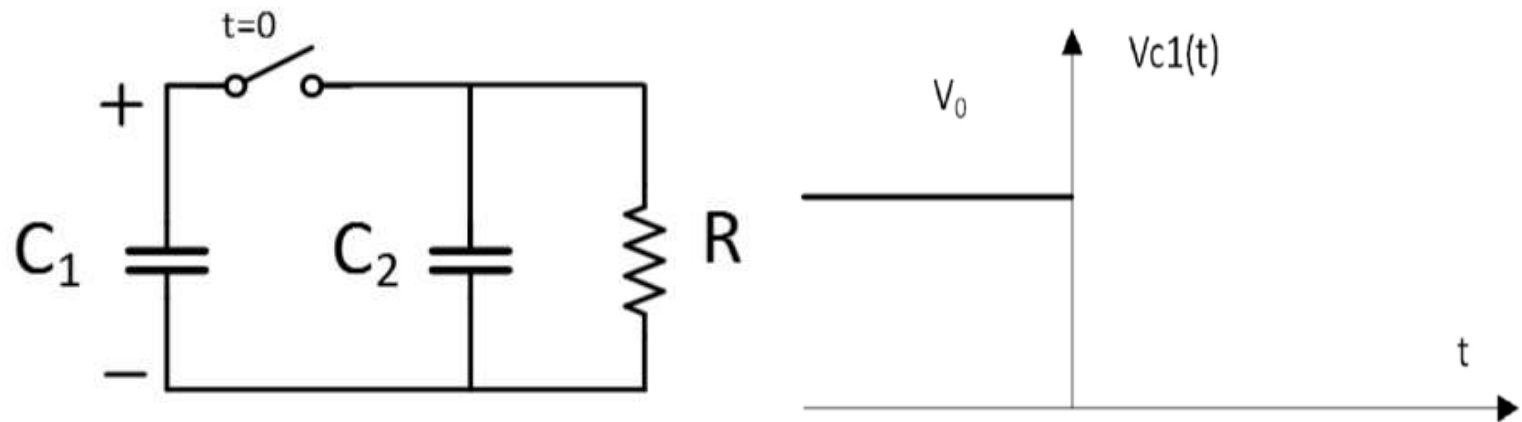
Student in Front:

Time: 135 minutes

Problem	Maximum Score	Your Score
1	6	
2	4	
3	10	
4	10	
5	10	
Total	40	

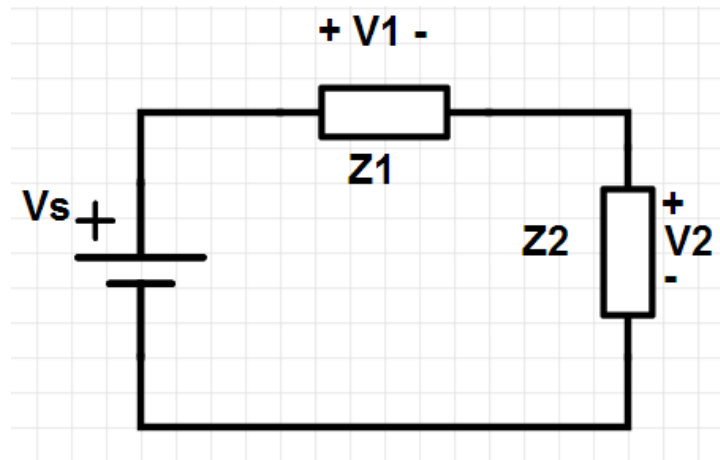
Q1. (6 points) We connect charged capacitor  $C_1$  to a discharged capacitor  $C_2$  and a resistor  $R$  with a switch. The capacitor  $C_1$  is charged to voltage  $V_0$ .

We close the switch at  $t=0$ , derive  $v_{C_1}$  in terms of time and plot it.



Q2. (4 points) In this circuit:  $|V_1| = |V_2|$ ,  $V_s$  leads  $V_2$  by  $30^\circ$

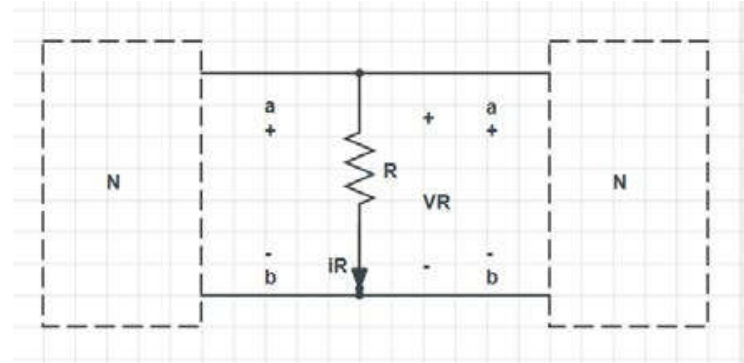
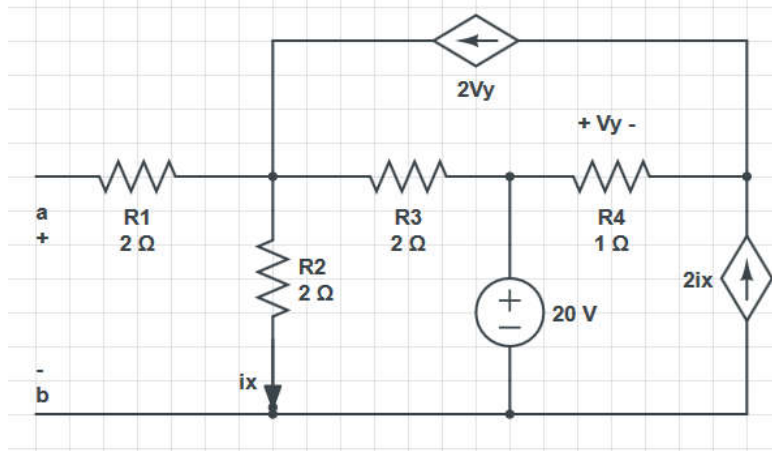
For a  $V_s(t) = 10 \cos 3t$  find  $V_2(t)$  in steady state.



Q3. (6 + 4 = 10 points)

a) Find Thevenin equivalent of the circuit on the left (network N) looking from a & b

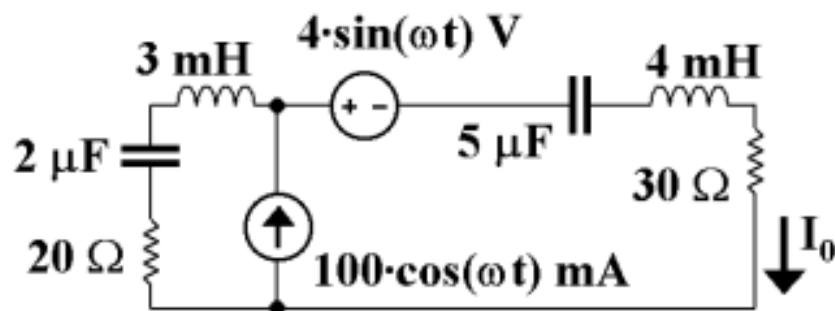
b) If we use network N to implement the circuit on the right what is  $i_R$  if  $V_R = \frac{5}{2} i_R + i_R^2$



Q4. (5 + 3 + 2 = 10 points)

Assume  $\omega = 10^4$  rad/sec.

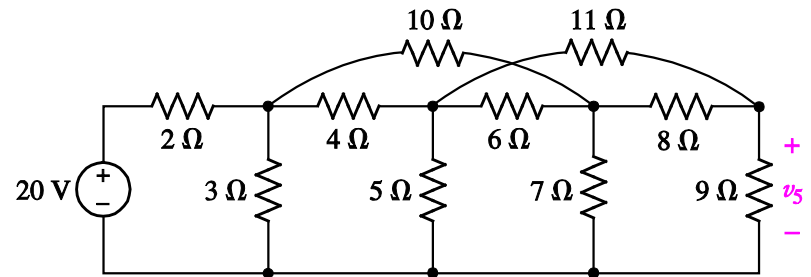
- (a) Use source transformation to obtain the current  $I_0$ . Express your answer in milliamps, both in the phasor notation (rectangular form) and in the time domain.
- (b) Draw a phasor diagram showing the voltage across 30ohm resistor, 4mH inductor, 5uF capacitor.



- (c) A complicated RLC circuit has a steady state current response of  $10\cos(100t + 0.2)$  amperes when a voltage source of  $10\cos(100t)$  volts is applied to it. Now, instead of the original source, a voltage source of  $20\cos(100t + 0.1)$  volts is applied to the circuit. Can you find the new current response? Is this information enough to find it? If yes, find the new current response. If not, give reasons justifying your answer. In either case, explain your answer.

Q5. (4 + 6 = 10 points)

- (a) Label the nodes in this circuit and write down the matrix equation to solve this circuit by node method. You don't need to solve the actual KCL equations.



(b)

Consider the circuit shown in Figure 1(a). The current  $i(t)$ , flowing through the inductor was found to obey the straight-line plot shown in Figure 1(b) for  $0 < t < 4ms$ . Find an expression for  $v(t)$  for  $0 < t < 4ms$  which satisfies the observation and draw a neat plot for it.

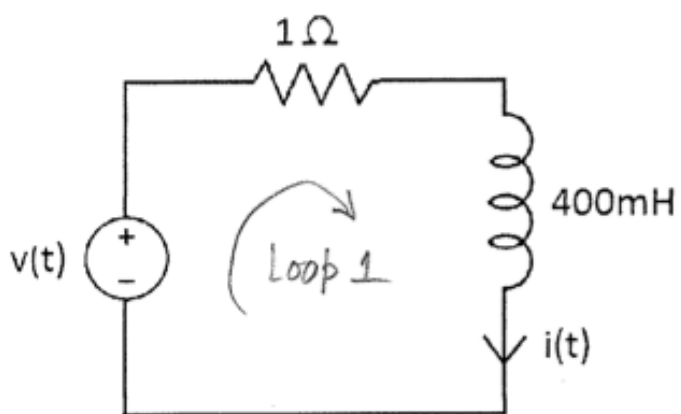


FIGURE 1(a)

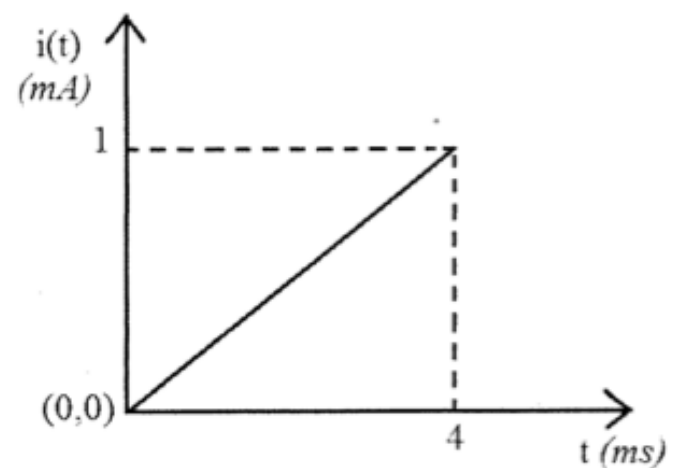


FIGURE 1(b)