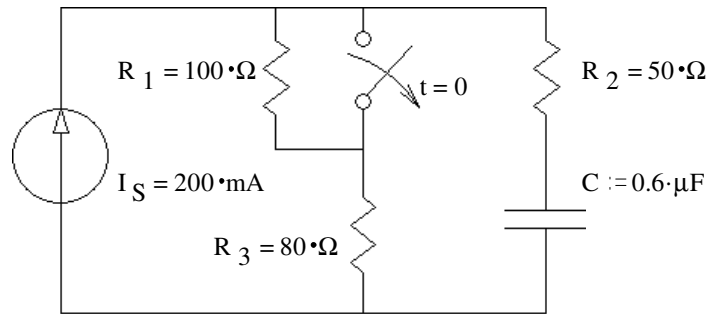


## ECE 2210/00 Exam 2 given: Spring 13 (The space between problems has been removed.)

1. (38 pts) a) The switch has been closed for a long time and is opened (as shown) at time  $t = 0$ .

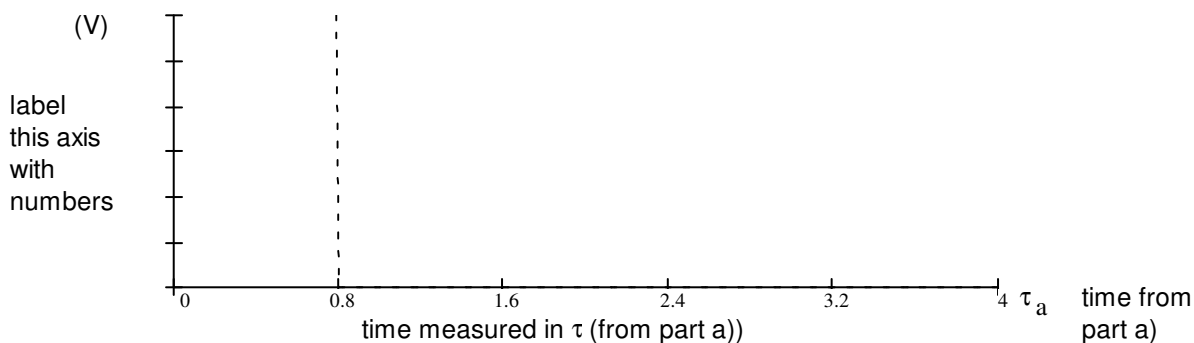


- a) Find the initial and final conditions and write the full expression for  $v_C(t)$ , including all the constants that you find.

- b) What is  $v_C$  when  $t = 0.8\tau$ ?  $v_C(0.8\tau) = ?$

- c) At time  $t = 0.8\tau$  the switch is closed again. Find the complete expression for  $v_C(t')$ , where  $t'$  starts when the switch closes. Be sure to clearly show the time constant.

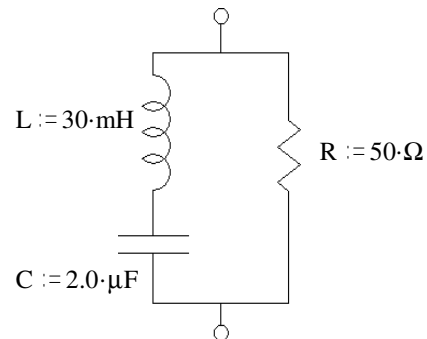
- d) Draw a sketch of the capacitor voltage below. Show values on the vertical scale. The horizontal scale is marked in units of  $\tau$  from part a).



2. (18 pts) Find  $Z_{eq}$  in simple polar form (give me numbers).

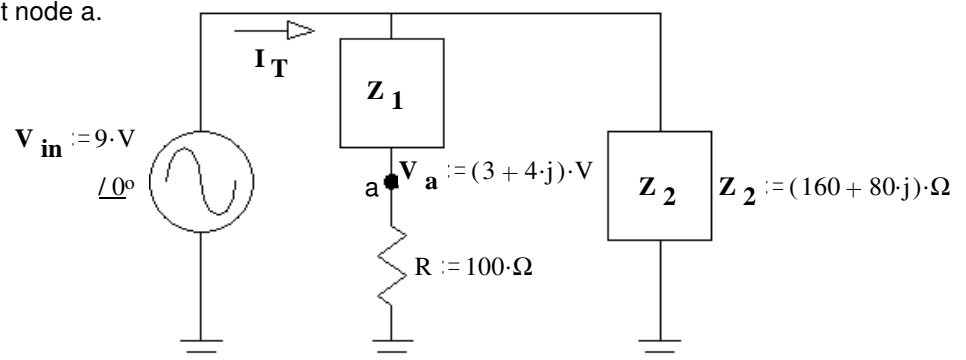
For partial credit, you must show work and/or intermediate results.

$$f = 397.89 \cdot \text{Hz}$$



3. (26 pts)  $V_a$  is the nodal voltage at node a.

- a) Find  $Z_1$ .



- c) Circle 1: i) The source current leads the source voltage ii) The source voltage leads the source current  
d) By how much? I.E. what is the phase angle between the voltage and current?

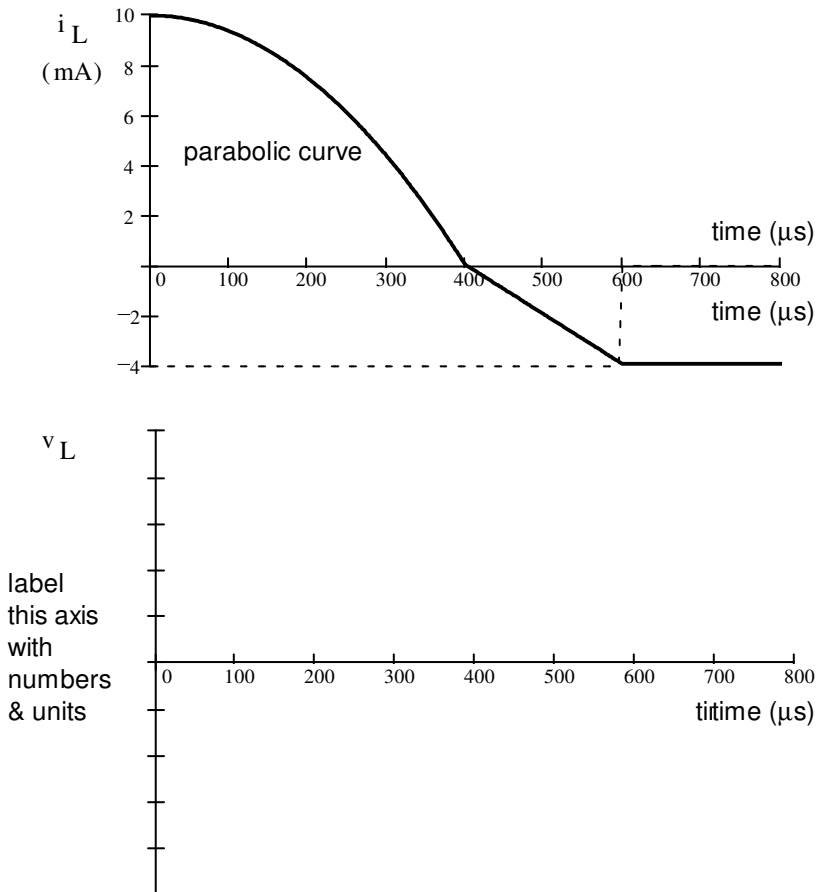
4. 18 pts) The current through an inductor is shown below. Make an accurate drawing of the inductor voltage. Make reasonable assumptions where necessary. Label your graph.

Note: You will be graded on the accuracy of your plot at 0, 0.4, 0.6, and 0.8 ms, so calculate those values and plot or label them carefully. Between those points your plot must simply be the correct shape.

You **MUST SHOW** how you calculate your values starting from the original relationships between voltage and current.

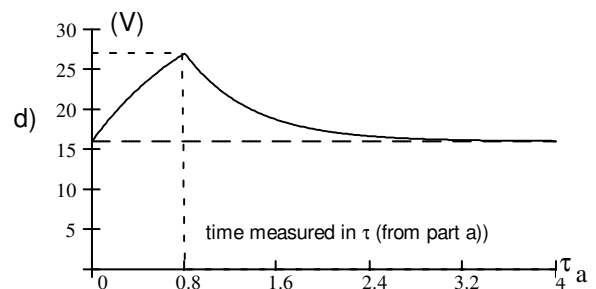
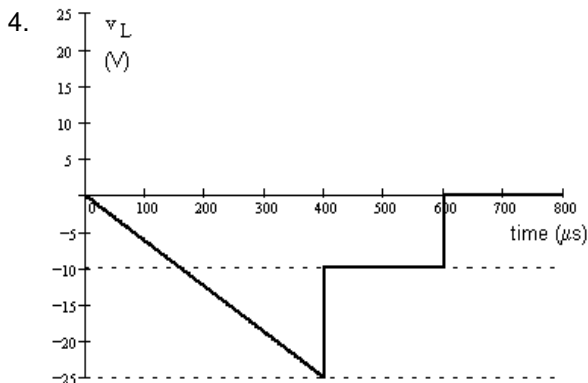
That is: **Start with the interger and/or differential equations for the inductor!**

$$L := 0.5 \cdot \text{henry}$$



### Answers

1. a)  $36 \cdot \text{V} - 20 \cdot \text{V} \cdot e^{-\frac{t}{138 \cdot \mu\text{s}}}$     b)  $27 \cdot \text{V}$     c)  $16 \cdot \text{V} + 11 \cdot \text{V} \cdot e^{-\frac{t'}{78 \cdot \mu\text{s}}}$
2.  $Z_{\text{eq}} = 46.4 \angle -21.8^\circ \Omega$
3. a)  $Z_1 = 144 \Omega \angle -86.8^\circ$     b)  $I_T = 77 \text{mA} \angle 13.1^\circ$     c) i)    d)  $13.1^\circ$



ECE 2210 Exam 2 Arn Stolp

Name \_\_\_\_\_

Scores:

Prob 1 \_\_\_\_\_ of a possible 38 pts

Prob 2 \_\_\_\_\_ of a possible 18 pts

Prob 3 \_\_\_\_\_ of a possible 26 pts

Prob 4 \_\_\_\_\_ of a possible 18 pts