

# PASS MOCK EXAM – *FOR PRACTICE ONLY*

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Course: ELEC 2501

Facilitator: Sarah Bruch

Dates and locations of mock exam take-up:

## **IMPORTANT:**

It is **most beneficial** to you to write this mock midterm **UNDER EXAM CONDITIONS**. This means:

- Complete the midterm in 3 hour(s).
- Work on your own.
- Keep your notes and textbook closed.
- Attempt every question.

After the time limit, go back over your work with a different colour or on a separate piece of paper and try to do the questions you are unsure of. Record your ideas in the margins to remind yourself of what you were thinking when you take it up at PASS.

The purpose of this mock exam is to give you practice answering questions in a timed setting and to help you to gauge which aspects of the course content you know well and which are in need of further development and review. Use this mock exam as a ***learning tool*** in preparing for the actual exam.

Please note:

- Come to the PASS session with your mock exam complete. There, you can work with other students to review your work.
- Often, there is not enough time to review the entire exam in the PASS session. Decide which questions you most want to review – the Facilitator may ask students to vote on which questions they want to discuss.
- Facilitators do not bring copies of the mock exam to the session. Please print out and complete the exam before you attend.
- **Facilitators do not produce or distribute an answer key for mock exams.** Facilitators help students to work together to compare and assess the answers they have. If you are not able to attend the PASS session, you can work alone or with others in the class.

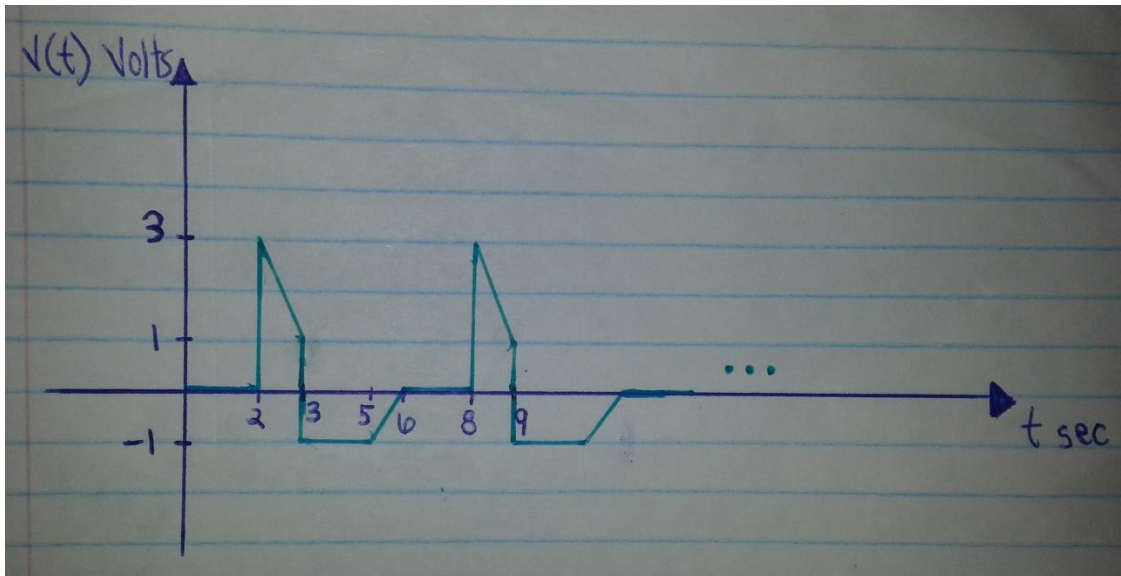
**Good Luck writing the Mock Midterm!!**

**DISCLAIMER:** PASS handouts are designed as a study aid only for use in PASS workshops. Handouts may contain errors, intentional or otherwise. It is up to the student to verify the information contained within.

**PLEASE NOTE: THIS HANDOUT IS NOT TO BE DISTRIBUTED.**

# Q1. RMS Value and Power

a) For the periodic waveform in picture below:



ai) For one representative period, what are the equations for the non-zero parts of the waveform?

Answer:  $v(t) =$  \_\_\_\_\_  
\_\_\_\_\_

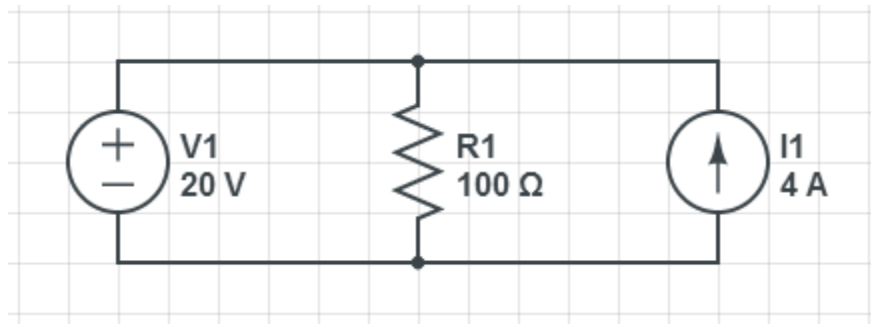
aii) Using the equations above, what is the equation for calculating the RMS value of the waveform?

Answer:  $RMS =$  \_\_\_\_\_

Aiii) What is the RMS value of the waveform?

Answer:  $RMS =$  \_\_\_\_\_

1b) Find the power absorbed or supplied by each of the elements in the following circuit:

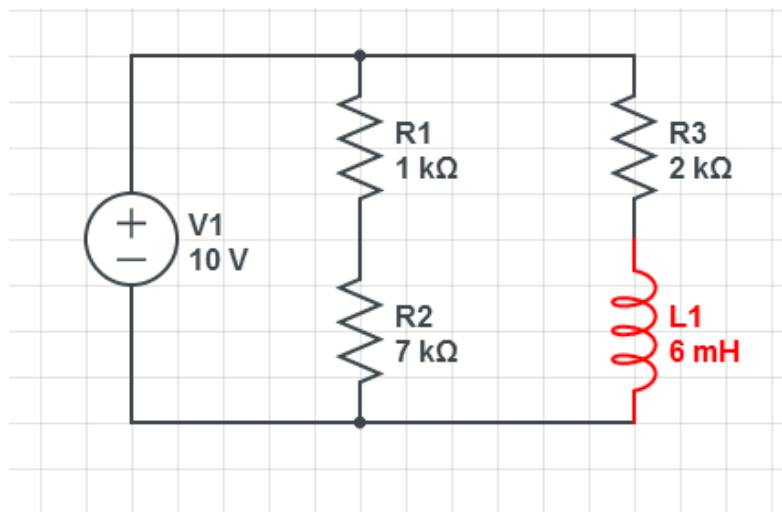


Answer: Power in  $R_1$ : \_\_\_\_\_ watts

Power in  $V_1$ : \_\_\_\_\_ watts

Power in  $I_1$ : \_\_\_\_\_ watts

1c) Given the circuit below:



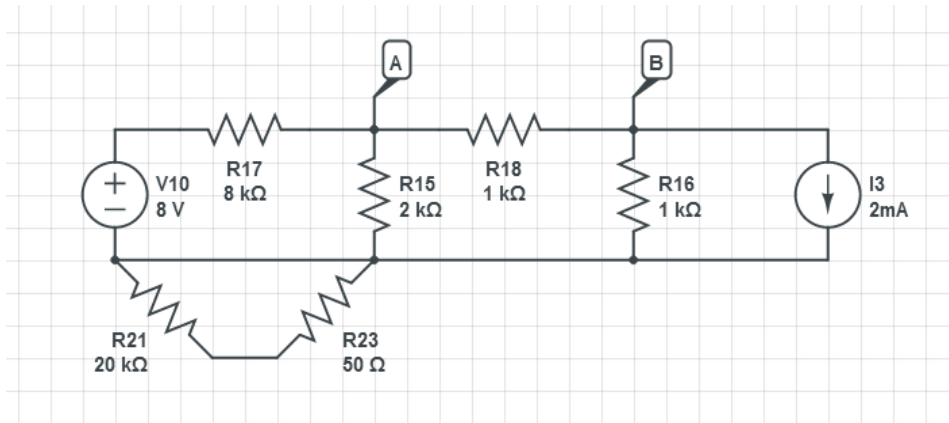
What is the average power dissipated in each of  $R_1$  and  $C$ ?

Answer: Average power in  $R_2$  is \_\_\_\_\_ watts

Average power in  $L$  is \_\_\_\_\_ watts

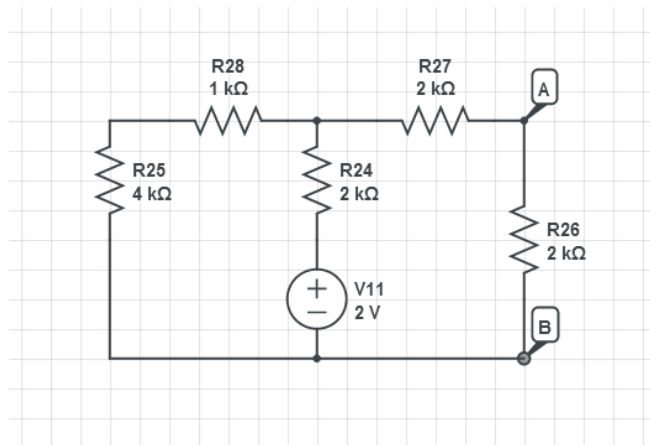
## Q2. Thevenin, Norton, and Superposition.

a) For the circuit below, find the Thevenin equivalent source between terminals A&B.



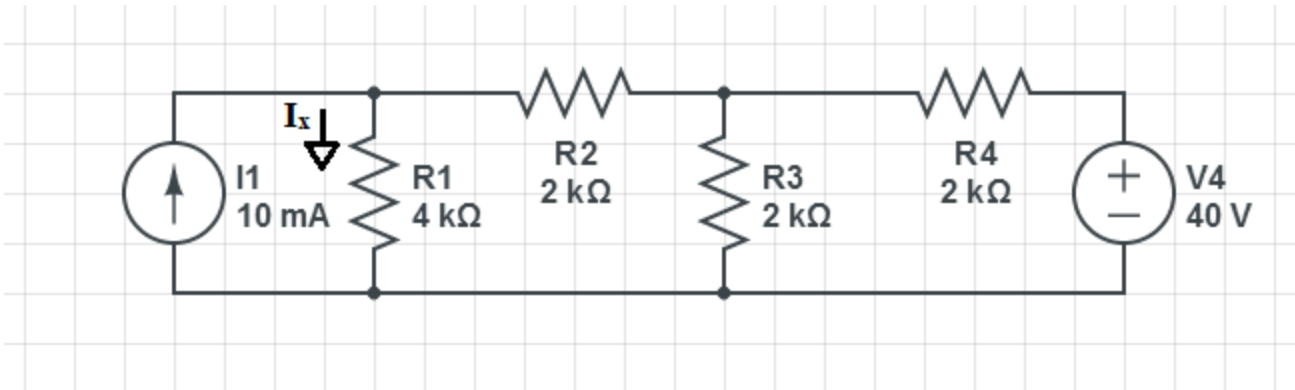
Answer: Thevenin equivalent source:

b) For the circuit below, find the Norton equivalent source between terminals A&B.



Answer: Norton equivalent source:

c) For the circuit shown below:



Use superposition to find the contribution of each source to the current  $I_x$  and then find the total current  $I_x$ .

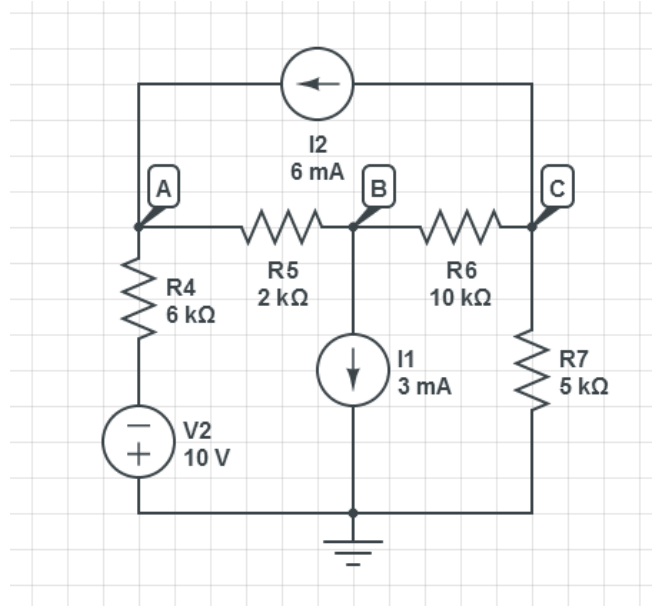
Answer: Contribution to  $I_x$  made by the source  $I_1$ : \_\_\_\_\_

Contribution to  $I_x$  made by the source  $V_2$ : \_\_\_\_\_

Total  $I_x$  using superposition theorem: \_\_\_\_\_

### Q3. Nodal Analysis and Loop Analysis

a) Given the circuit below, write the nodal equations for nodes A, B, C using the convention that currents entering a node are positive. (Do not need to simplify)



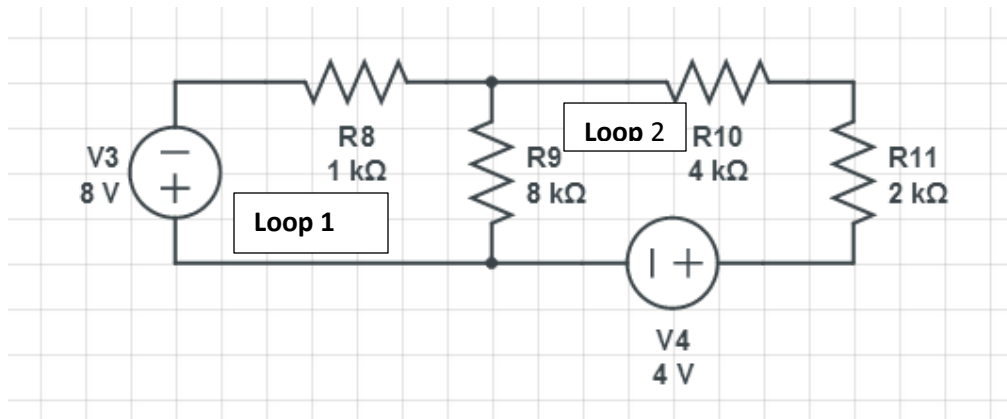
Answer:

At node A: \_\_\_\_\_

At node B: \_\_\_\_\_

At node C: \_\_\_\_\_

b) Given the circuit below:



Write the loop equations for the two loops.

Answer:

Around loop1: \_\_\_\_\_

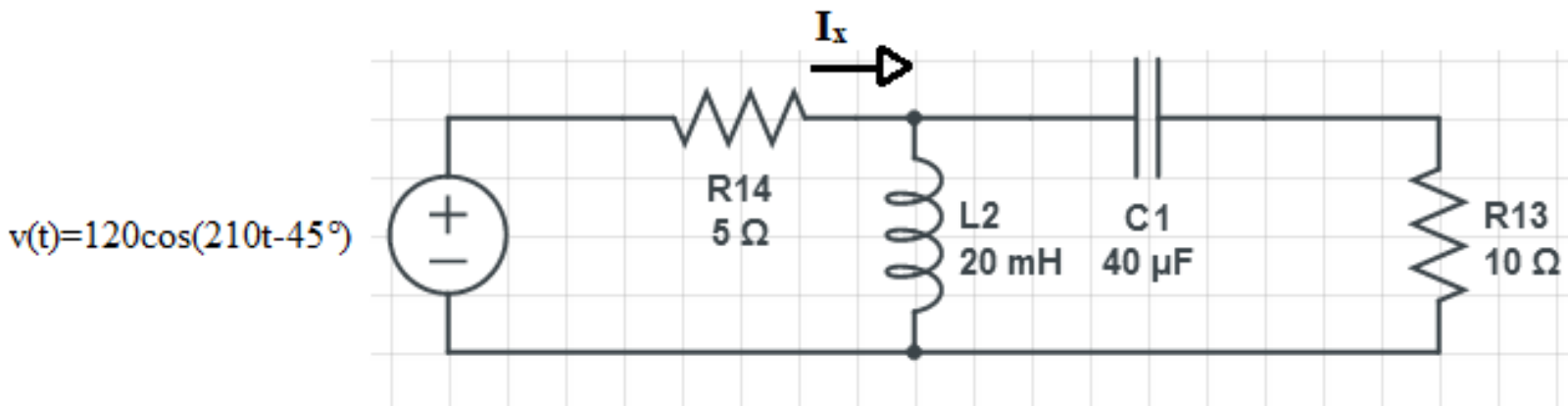
Around loop2: \_\_\_\_\_

#### Q4. Phasor Analysis

Note: Answers may be in either polar or Cartesian form, but still must be simplified,

eg:  $15 \angle 30^\circ$  volts, or e.g.  $30-j27$  ohms.

a) For the circuit given below:



ai) Find the impedance of the capacitor and the impedance of the inductor.

Answer:  $Z_C =$  \_\_\_\_\_

Answer:  $Z_L =$  \_\_\_\_\_

aii) Find the capacitor and inductor currents as phasors.

Answer:  $I_C =$  \_\_\_\_\_

Answer:  $I_L =$  \_\_\_\_\_

aiii) Find the current  $I_x$  as a phasor.

Answer:  $I_x =$  \_\_\_\_\_

b) Given the KVL phasor equation  $V_s = V_1 + V_2$  in which  $V_1 = 10 \angle -45^\circ$  Volts and  $V_2 = 30 \angle +90^\circ$  Volts:

bi) Calculate  $V_s$  as a phasor:

Answer:  $V_s =$  \_\_\_\_\_ volts

bii) For  $V_s = V_1 + V_2$ , show KVL is satisfied in a clear phasor diagram, approximately to scale:

Answer: Phasor diagram showing KVL:

c) A series RLC resonant circuit is to have a resonant frequency of 1KHz and is to use  $C = 0.1 \mu\text{F}$ .

ci) What value of L is required?

Answer:  $L =$  \_\_\_\_\_

cii) If the circuit is to have a  $Q = 60$ , what would the bandwidth (BW) be?

Answer:  $BW =$  \_\_\_\_\_

ciii) If the RLC circuit is operated at resonance and the circuit's  $Q = 60$ , and the voltage on the inductor is  $V_L = j30$  V, what must be the voltage on the capacitor?

Answer:  $V_C =$  \_\_\_\_\_

**Q5. Frequency Response and Bode Plots**

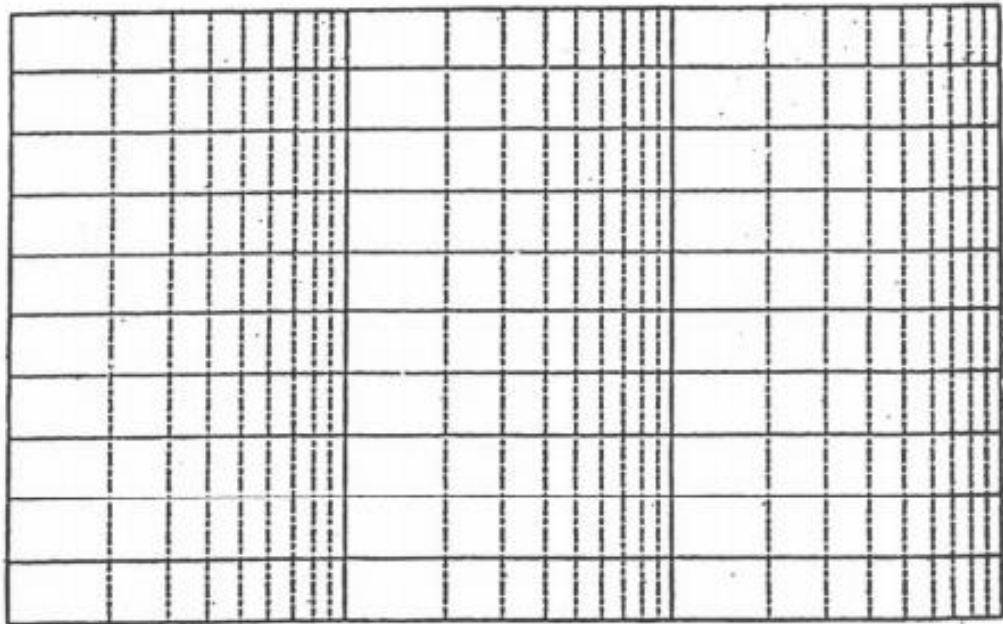
Given the transfer function  $H(j\omega) = \frac{j20\omega}{2+j0.05\omega}$

a) What is the value of the corner frequency in radians per second?

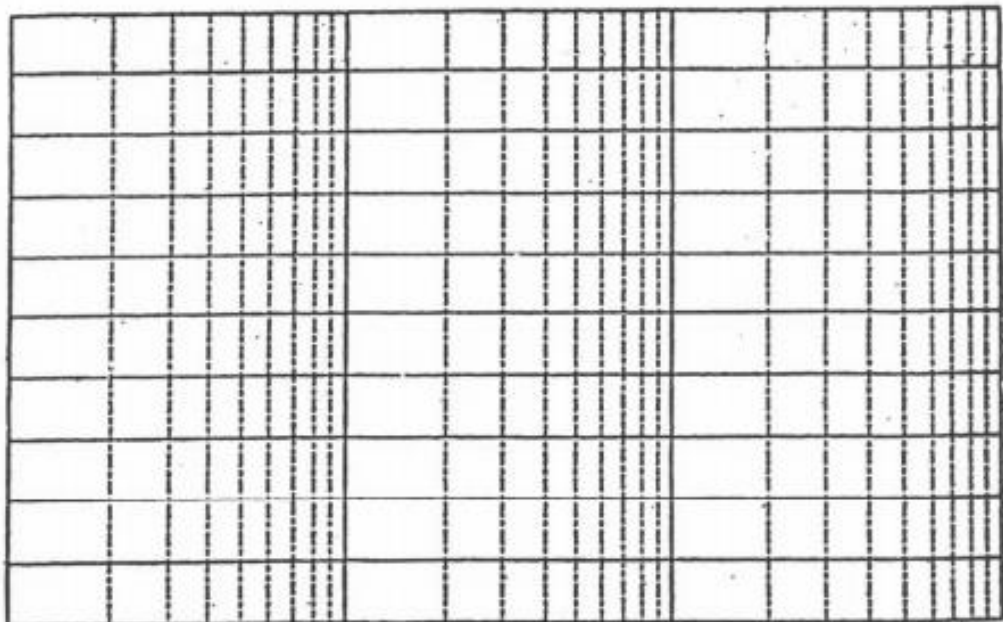
Answer: The corner frequency is \_\_\_\_\_

b) Draw the magnitude and phase Bode plots, clearly indicating the *important values* on each of them.

Answer: Magnitude Bode Plot:

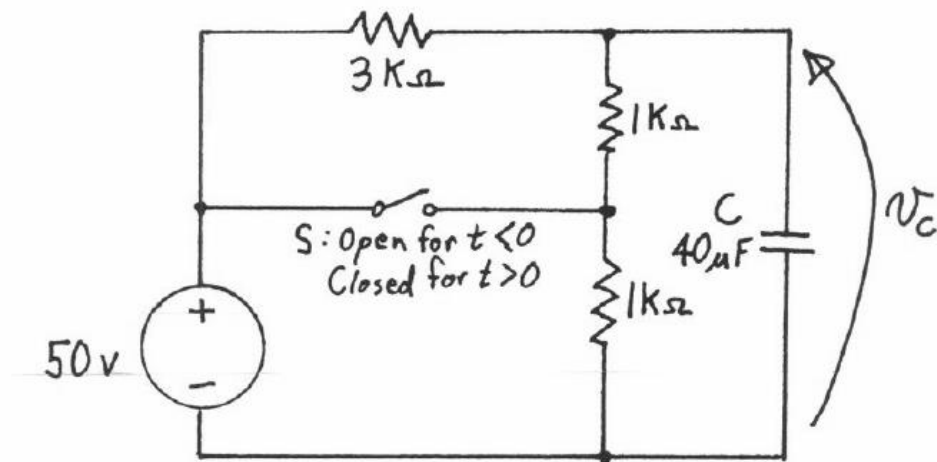


Answer: Phase Bode Plot:



## Q6. Transient Analysis

a) In the circuit below, switch S is closed for all  $t < 0$ . At  $t = 0$  the switch is opened.



ai) Find the voltage across the capacitor,  $v_c$  for  $t < 0$ .

Answer: For  $t < 0$ ,  $V_c =$  \_\_\_\_\_

aii) Derive an expression for the voltage across the capacitor,  $V_C(t)$ , for  $t > 0$ .

Answer: For  $t > 0$ ,  $V_C(t) =$  \_\_\_\_\_

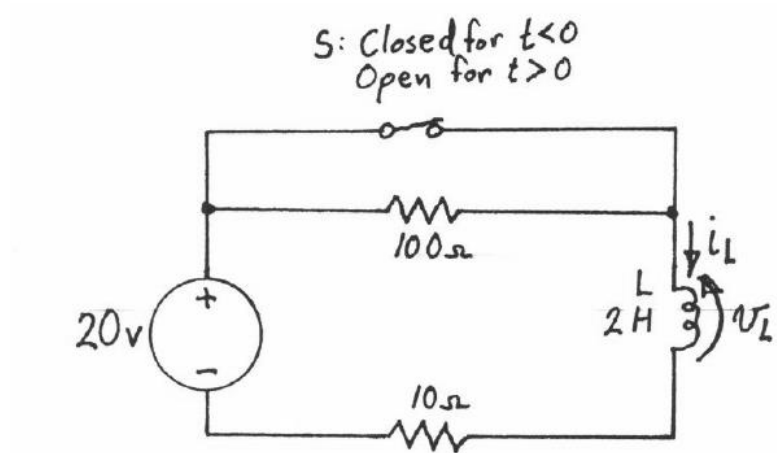
aiii) Sketch  $V_C(t)$  from  $t = -10\text{msec}$ , to  $t = +100\text{msec}$ , clearly showing the time constant and its relationship to the waveform.

Answer: Graph of  $V_C(t)$ :

a iv) If the response above is interrupted at  $t=+30\text{msec}$  by the switch being opened derive a new equation for  $v_c(t)$  for  $t > +30\text{msec}$ .

Answer: For  $t > +30\text{msec}$ ,  $V_c(t) = \underline{\hspace{10cm}}$

b) In the circuit shown below, switch S is closed for all  $t < 0$ . At  $t=0$  the switch is opened.



bi) Find the inductor current,  $i_L$  just before the switch is opened.

Answer  $i_L = \underline{\hspace{10cm}}$

bii) Find  $V_L$  at the instant just after the switch is opened.

Answer  $v_L = \underline{\hspace{10cm}}$

biii) Find the time constant for the response of  $v_L$  for  $t > 0$ .

Answer: Time Constant =  $\underline{\hspace{10cm}}$

**Happy Holidays and Good luck on the Final!! 😊**