PASS MOCK EXAM – FOR PRACTICE ONLY

Course: ELEC 2501 ABC Facilitator: Sara Wieringa
Dates and locations of mock exam take-up:
Thursday, November 29 in 402 Library Monday, December 3 in Tory 215
Both take-ups will run from 6:00 p.m. to whenever we finish.

IMPORTANT:

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

1 • Complete the exam in 3 hour(s).
2 • Work on your own.
3 • Keep your notes and textbook closed.
4 • 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.

Question 1: RMS Value and Power

a) For the periodic waveform in Figure 1, answer the following:

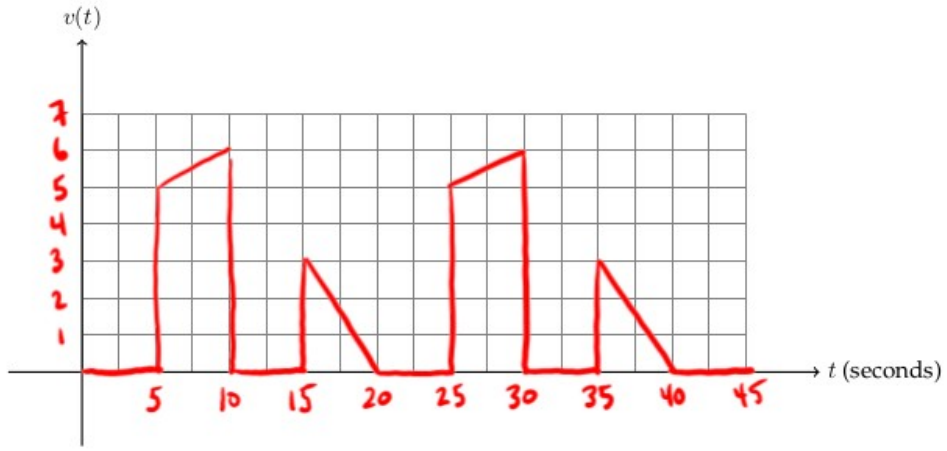


Figure 1: A periodic waveform.

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

Answer: v(t)=_____

_____

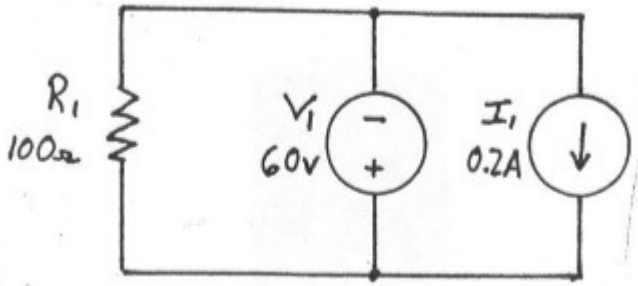
a.ii) Using the equations above, what is the equation for calculating the RMS value of the waveform?

Answer: RMS=_____

a.iii) What is the RMS value of the waveform?

Answer: RMS=_____

1.b) For the following circuit, find the power that is absorbed or supplied by each of the elements:

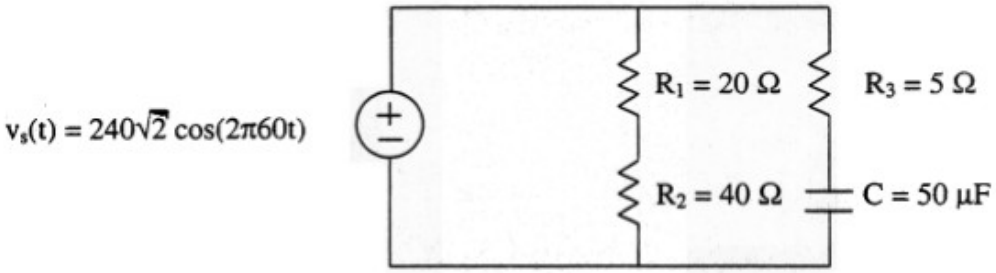


Power in R_1:_____

Power in V_1:_____

Power in I_1:_____

c) Given the circuit below,



c.i) What is the average power dissipated in R_1?

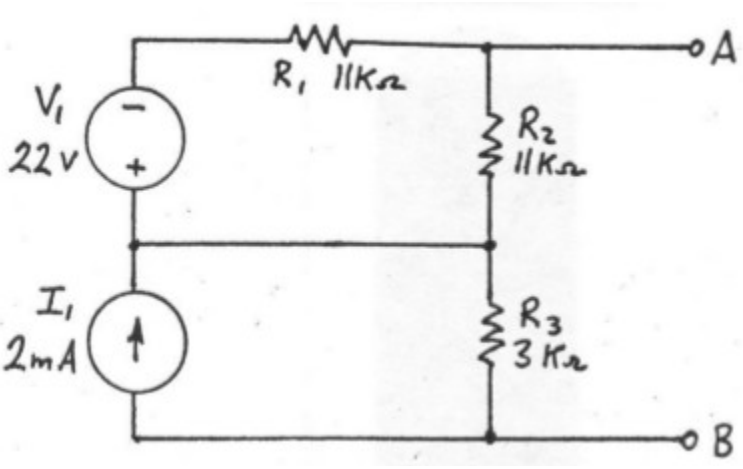
Answer: Average power in R_1:_____

c.ii) What is the average power dissipated in C?

Answer: Average power in C:_____

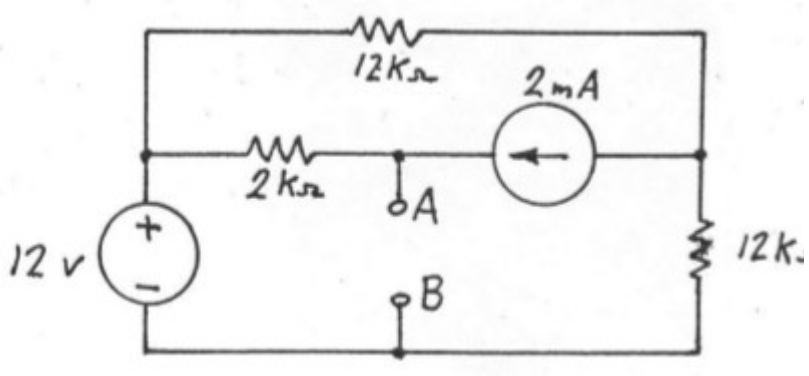
Question 2: Thevenin, Norton, and Superposition

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



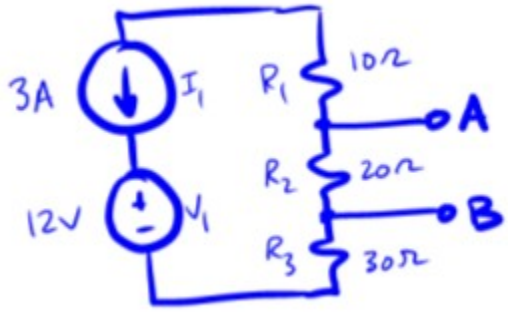
Answer: Thevenin equivalent source:

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



Answer: Norton equivalent source:

c) Use superposition to find the contribution of each source to V_{ab} in the following circuit, and from that find the total V_{ab}.



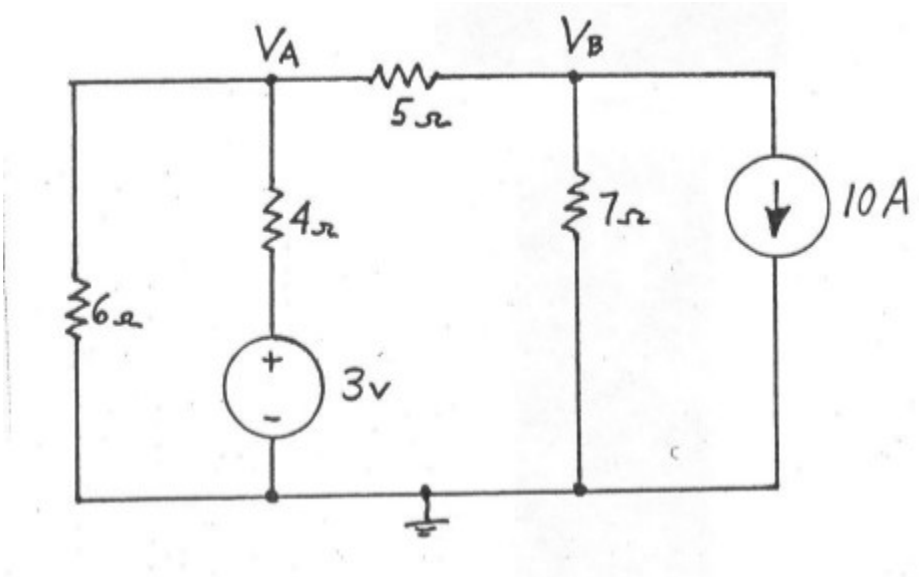
Answer: Contribution of I_1 to V_{ab}:_____

Answer: Contribution of V_1 to V_{ab}:_____

Answer: Total V_{ab} using superposition:_____

Question 3: Loop and Nodal Analysis

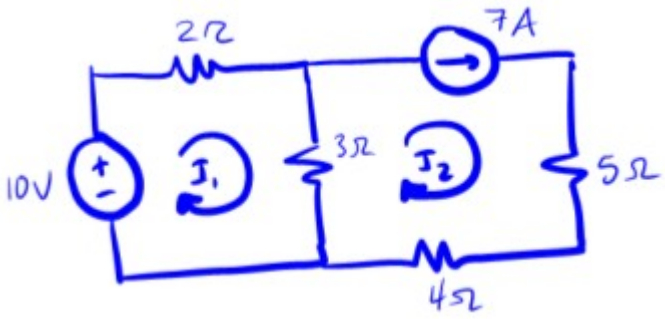
a) Given the following circuit, write the nodal equations at nodes A and B, using the convention that currents entering a node are positive.



Answer: at Node A:_____

at Node B:_____

b) Write the loop equations for loops I_1 and I_2 in the following circuit. There is no need to simplify your equations.

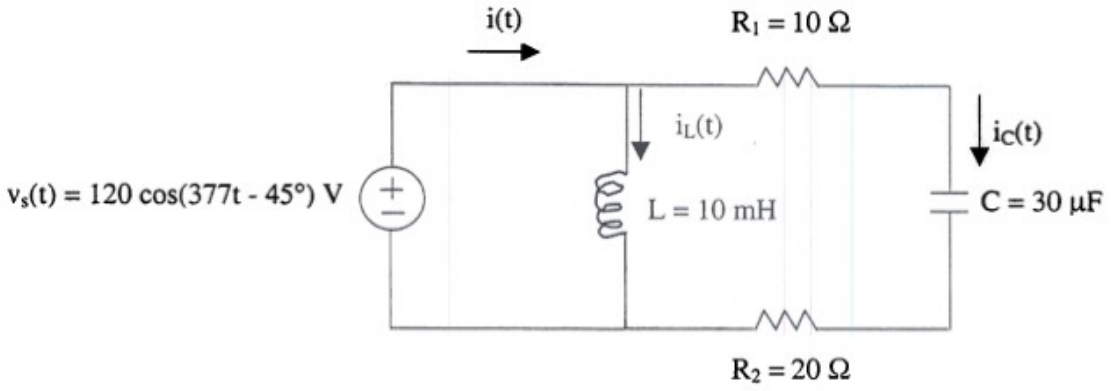


Answer: Loop equation for I_1:_____

Loop equation for I_2:_____

Question 4: Phasor Analysis

a) For the following circuit:



a.i) Find the impedance of the inductor and the capacitor.

Answer: Z_L=_____

Z_C=_____

Find the inductor and capacitor currents as phasors.

Answer: I_L=_____

I_C=_____

Find i(t) by first finding the corresponding phasor, I.

Answer: I=_____

i(t)=_____

b) Given the KVL equation $V_3 = V_1 - V_2$ in which $V_1 = 10\angle 60°$ and $V_2 = 15\angle -45°$

b.i) Calculate V_3 as a phasor

Answer: V_3 = _____

b.ii) For $V_3 = V_1 - V_2$, show that KVL is satisfied using a clear phasor diagram, drawn approximately to scale.

Answer: Phasor diagram showing KVL

c) A series resonant RLC circuit is to have a resonant frequency of 10 MHz and is to use C = 10 μF.

c.i) What value of L is required?

Answer:_____

c.ii) If the series resonant RLC circuit is operated at resonance and the circuit's Q = 5, and the voltage on the inductor is $V_L = j30$ V, what must be the voltage on the capacitor?

Answer:_____

Question 5: Bode Plots

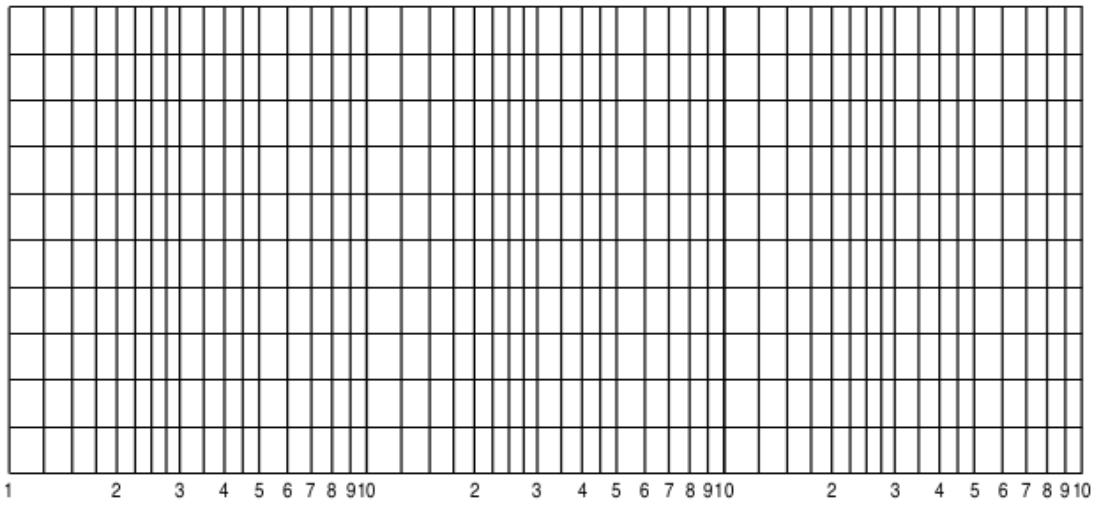
Given the transfer function $H(j\omega)=\frac{j20\,\omega}{1+j0.025\,\omega}$:

a) What is the corner frequency in Hz?

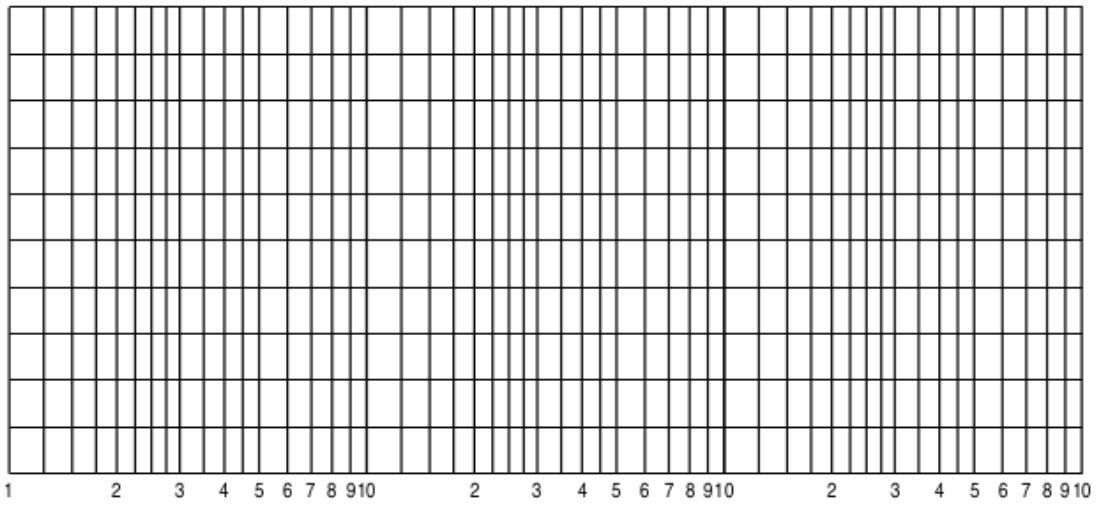
Answer:_____

b) Draw the magnitude and phase plots

b.i) Magnitude Bode plot:

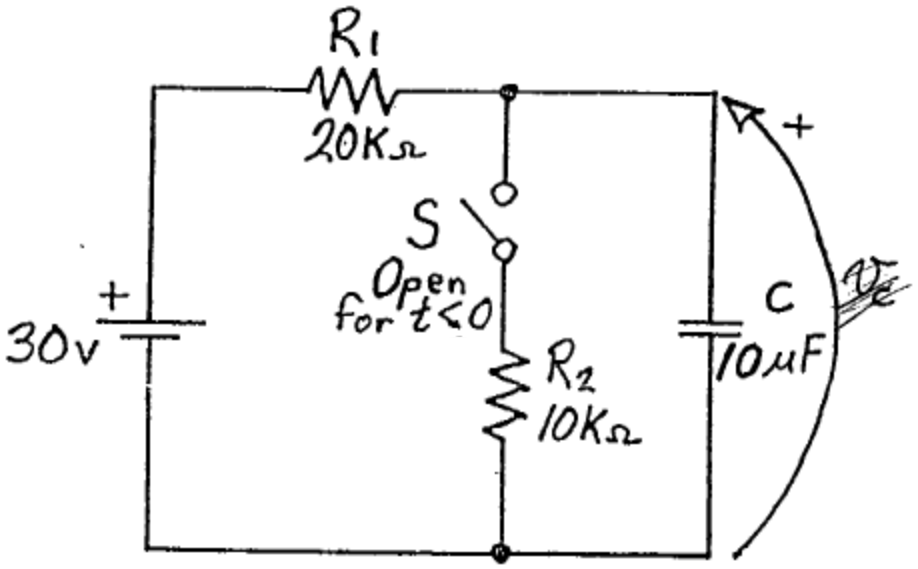


b.ii) Phase Bode plot:



Question 6: Transient Analysis

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



a.i) Find the voltage across the capacitor, v_C, for t<0.

Answer: For t<0, v_C=_____

a.ii) Derive an equation for the voltage across the capacitor, v_C, for t>0.

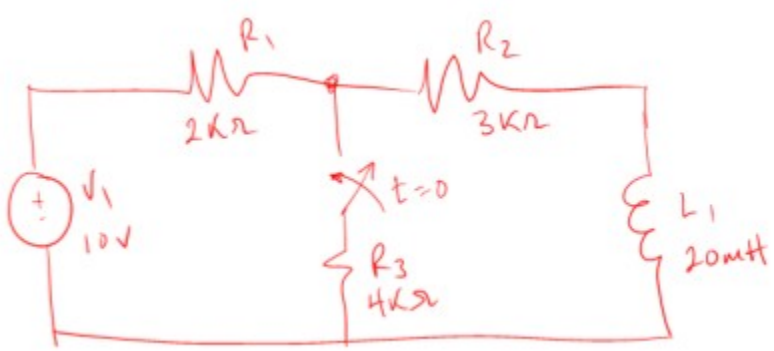
Answer: For t>0, v_C=_____

a.iii) Sketch the waveform $v_C(t)$ from t = -10 msec to t = 100 msec.

a.iv) Suppose the response is interrupted at t = 40 msec by the switch being opened again. Derive a new equation for $v_C(t)$ for t>40 msec.

Answer: For t>40 msec, $v_C(t)$=_____

b) In the circuit shown below, the switch has been open for all time t < 0. At time t = 0, the switch is closed.



b.i) What is the inductor current just before the switch closes (i.e. At time t = 0^-)?

Answer: _____

b.ii) What is the inductor current for t > 0?

Answer: _____

b.iii) What is the time constant of the circuit, taking V_{R2} as the output voltage?

Answer: _____