ECE 35, Fall 2017
Final - Section A

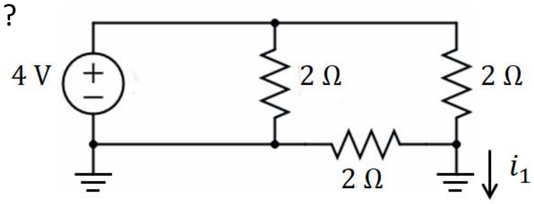
Last name	
First + middle name(s)	
PID	

Instructions:

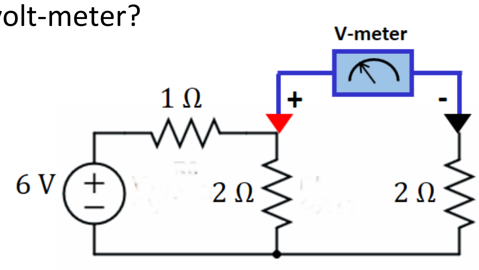
- Read each problem completely and thoroughly before beginning.
- All calculations should to be done in your blue book. It should be clear what question they belong to. Answers without supporting calculations will receive zero credit.
- Write clearly and make sure your answer is structured properly. We will not hunt for your work or answers.
- Write your final answers in the answer boxes on these question pages. Make sure you list units!

(1) Answer the questions below.

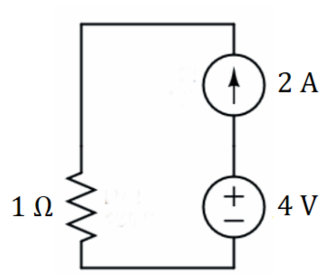
(a) What is the current i_1?



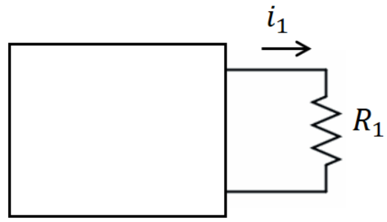
(b) What is the reading from the volt-meter?



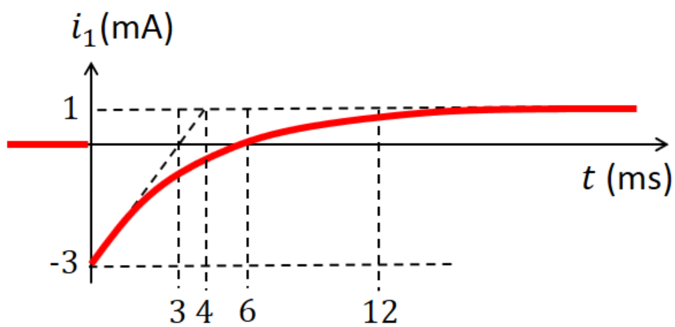
(c) What is the power <u>supplied</u> by the current source?



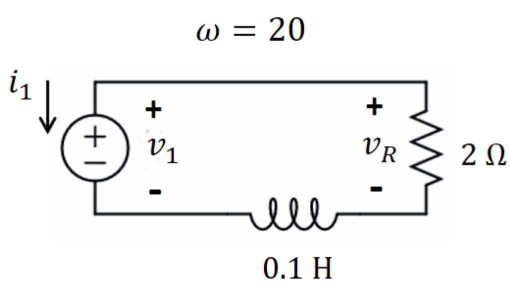
(d) When R_1 = 1 Ω, the current i_1 = 4 A. When R_1 = 2 Ω, the current i_1 = 3 A. When is the current i_1 when R_1 = 3 Ω?

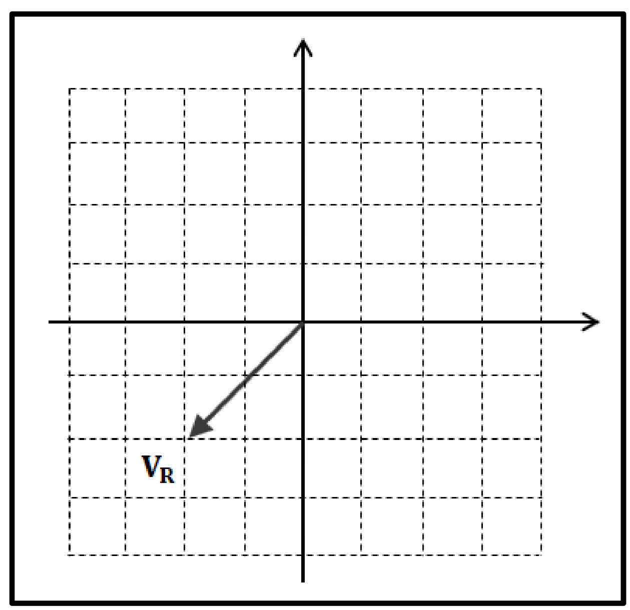


(e) The graph below shows the current in a first order RL circuit. What is the equation of $i_1(t)$ for $t > 0$?

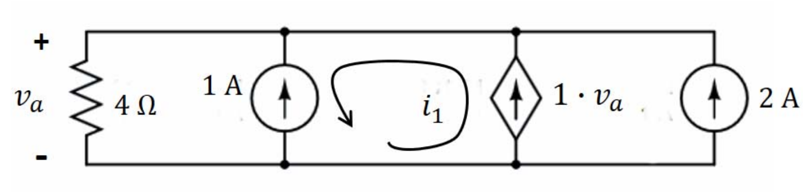


(f) With the phasor $\mathbf{V_R}$ given on right, draw the phasors $\mathbf{V_1}$ and $\mathbf{I_1}$ in the same diagram. You can draw the same scale for A and V (i.e., a 1 A current phasor has the same length as a 1 V voltage phasor).



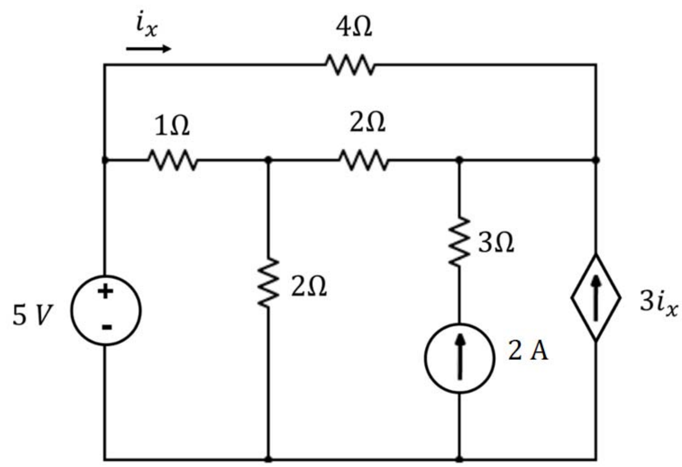


(2) What is the value of mesh current i_1?

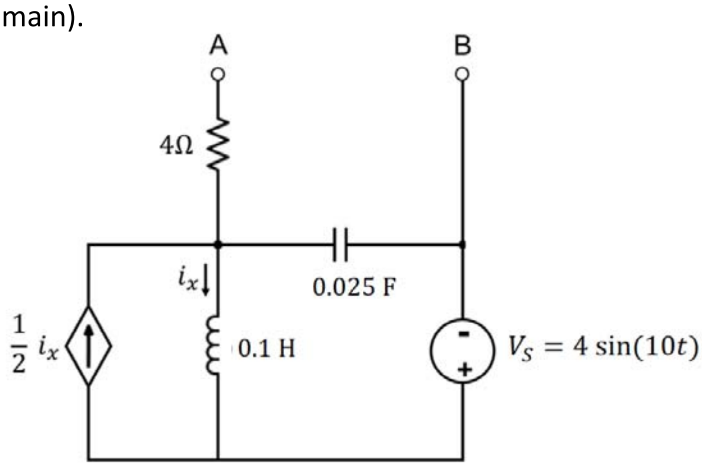


(3) (a) For the circuit below, what is the value of i_x?

(b) What is the power supplied by the dependent source?



(4) What is the Norton equivalent current source I_N (for the Norton equivalent model between A and B). Write your final answer in the time domain (don't leave it in the phasor domain).

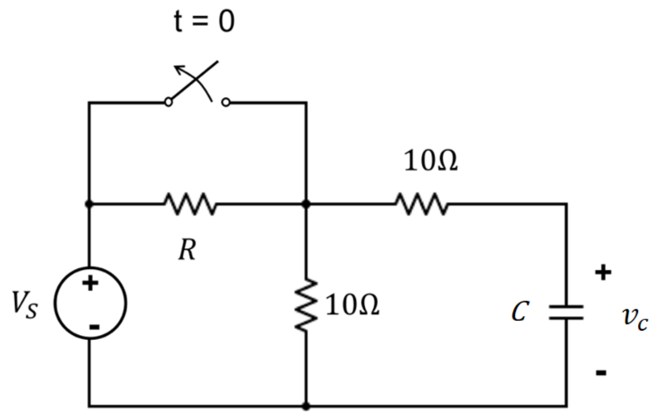


(5) Consider the circuit below. For $t < 0$, the switch is closed and the system has reached steady state. At $t = 0$, the switch opens and it remains open.

We measure that for $t > 0$, $v_C(t) = 2 + 8\,e^{-\frac{t}{12}}$.

(a) What was v_C at time $t = 0^-$ (just before the switch was opened)? $v_C(0^-)$

(b) Find V_S , R and C. V_S R C



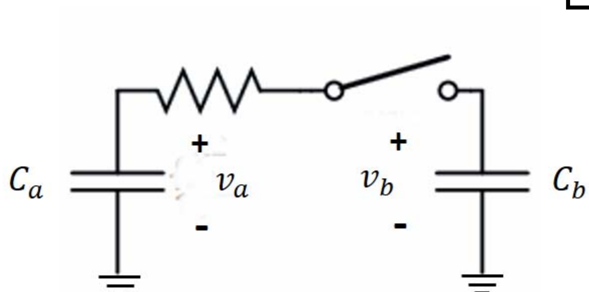
(6) Consider the circuit below. At $t < 0$, the switch is open. At $t = 0$, the switch closes and it remains closed. We are given the capacitor voltage just before the switch closes: $v_a(0^-) = V_1$ and $v_b(0^-) = V_2$.

v_a

(a) What are the capacitor voltages v_a and v_b at time $t = \infty$?

v_b

(b) Find a concise expression of the total energy converted to heat during the transition.



(7) Consider the circuit below, where a load is connected to a power distribution network (consisting of a resistor, an inductor and an AC voltage source). The load itself consists of a resistor R_1 in parallel with a mystery element Z_1, where Z_1 is either a capacitor or an inductor. The goal is to <u>maximize the average power received by the load</u>.

(a) In the mystery element a capacitor or an inductor?

(b) What is the value of the resistor R_1?

What is the value of the capacitor or inductor that makes up Z_1?

(c) If Z_1 is removed from the circuit and R_1 is chosen to be 1 Ω. If the voltage source is $v_S(t) = 2\cos\left(10t + \frac{\pi}{2}\right)$, what is the complex power of the inductor?