ECE 35, Fall 2019
Final

Sequence number	
Last name	
First + middle name(s)	
PID	

Grade

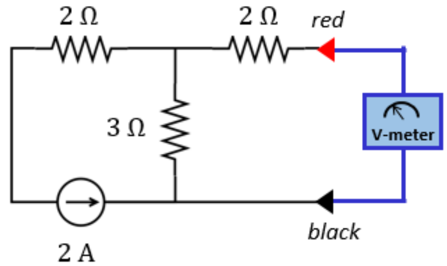
/ 45

Instructions:

- Do not look at the questions or start writing until it is announced you can do so.
- Read each problem completely and thoroughly before beginning.
- All calculations must be done in your blue book. It should be clear which question they belong to. Answers without supporting calculations will receive zero credit. If you are using intuition, write a short explanation.
- 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!
- You must follow the Final Exam Procedures that were posted on TritonEd. If you are unsure of anything, ask. As a reminder:
  - Your phone should be turned off and put inside your bag in the front of the room (or on the table in the front). If you are found to have a phone (or other communication device) on you during the exam, your exam will not be graded.
  - Calculators are not allowed.
  - This is a closed book exam.

(1) (a) What is the volt-meter reading X? *(2 points)*

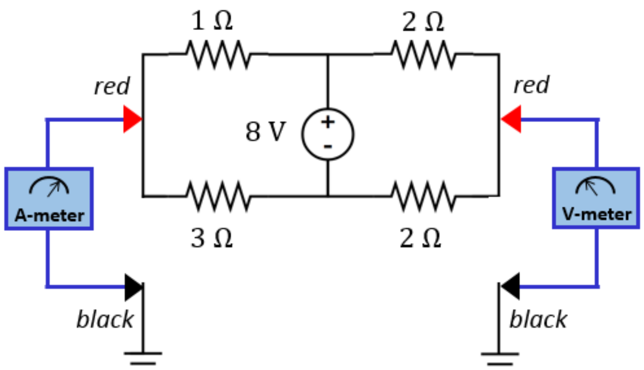
X



(b) Find **volt-meter** reading X and the **ammeter** reading Y.
(2 points)

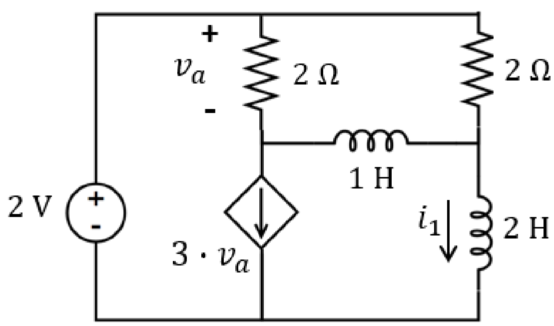
X

Y



(c) The system is in steady state. Find the current $\boldsymbol{i_1}$. *(3 points)*

i_1



(2) For $t < 0$ s, both switches are closed and you may assume the system has reached steady state. Both switches open at time $t = 0$ s (at exactly the same time).

(a) Find $v_a(0^-), v_b(0^-)$ and $v_c(0^-)$. *(2 points)*

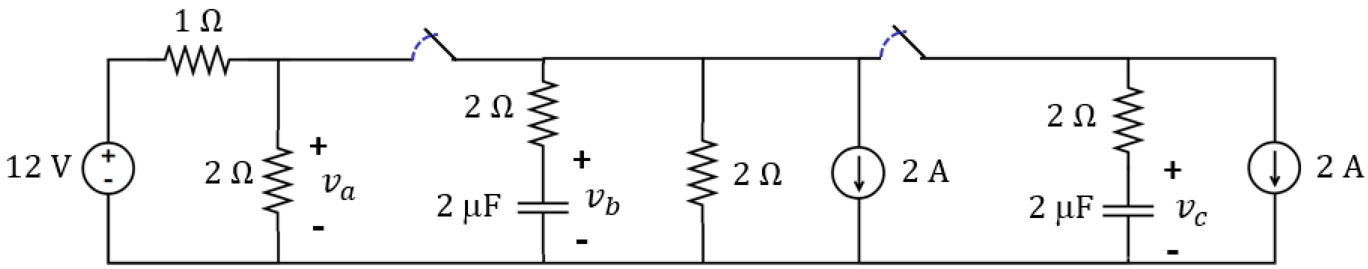
$v_a(0^-)$ $\boxed{}$ $v_b(0^-)$ $\boxed{}$ $v_c(0^-)$ $\boxed{}$

(b) Find $v_a(t), v_b(t)$ and $v_c(t)$ for $t > 0$ s. Also sketch all three waveforms in your blue book (a rough sketch is fine). *(9 points)*

$v_a(t)$ $\boxed{}$

$v_b(t)$ $\boxed{}$

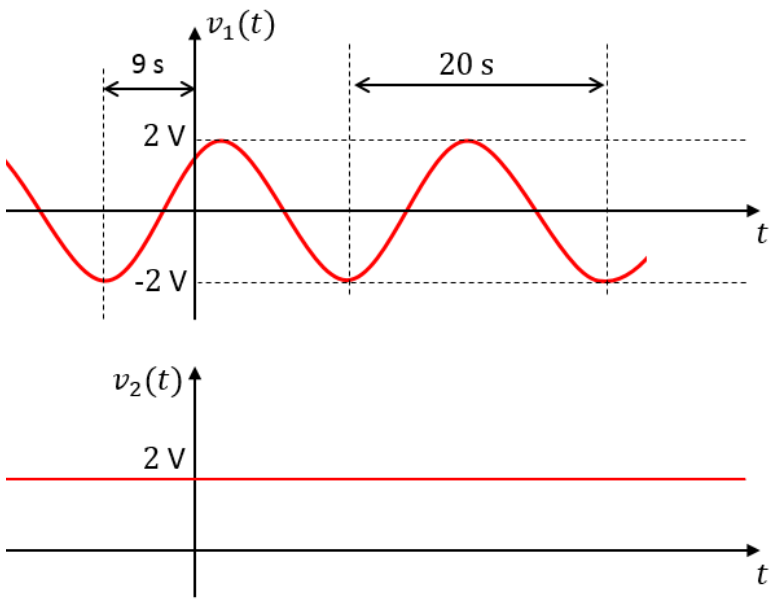
$v_c(t)$ $\boxed{}$



(3) Find the phasors $\mathbf{V_1}$ and $\mathbf{V_2}$ for the waveforms below. You can use polar or cartesian notation. *(5 points)*

$\mathbf{V_1}$

$\mathbf{V_2}$

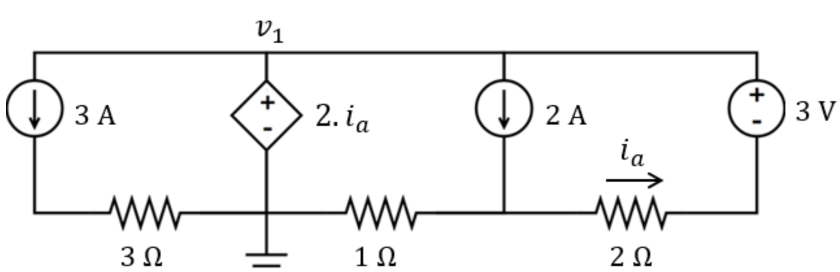


(4) (a) For the circuit below, find node voltage v_1. *(4 points)*

(b) Find the power P **supplied** by the 3 A current source (i.e., the left current source). *(2 points)*

v_1

P

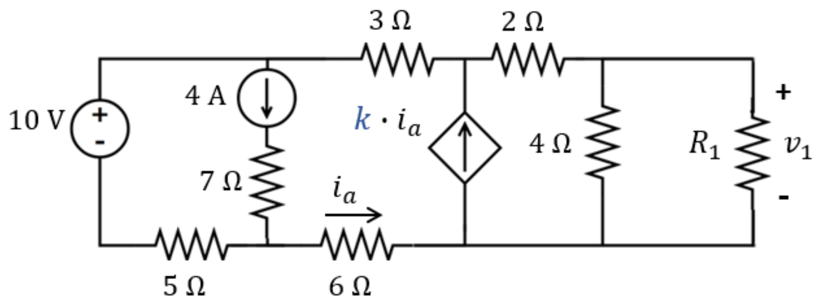


(5) (a) Consider the figure below. Note that *k* of the dependent source is unknown. We make the following measurements:

v_1 ☐

When $R_1 = 1\ \Omega$, we find that $v_1 = 2\ \text{V}$
When $R_1 = 4\ \Omega$, we find that $v_1 = 4\ \text{V}$

Find v_1 when $R_1 = 3\ \Omega$. *(4 points)*

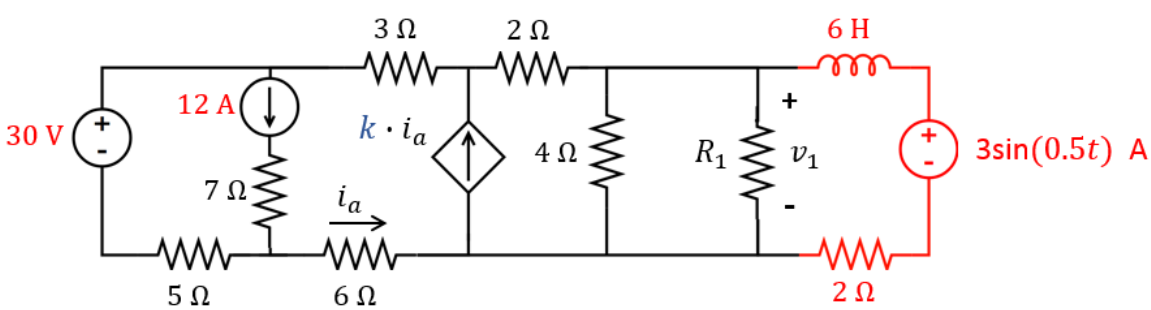


(b) The circuit below is that of part (a), with a few modifications (marked in red): the current and voltage source have a different value, and an extra inductor, resistor and voltage source are attached (on the right). The value of *k* is the same. Furthermore, we set $R_1 = 2\ \Omega$.

$v_1\left(\frac{11\pi}{6}\text{s}\right)$ ☐

Assume the system is in steady state.

Find $v_1\left(\frac{11\pi}{6}\text{s}\right)$, i.e., v_1 at time $t = \frac{11\pi}{6}$ seconds. *(5 points)*



(6) (a) Find the average power P and reactive power Q **received** by the current source. *(5 points)*

P

Q

(b) We replace the 1 Ω resistor with another element (either a resistor, a capacitor or an inductor). The result is that the reactive power Q of the current source is now equal to zero. What is the value X of this new element (so we are looking for the resistance, capacitance or inductance value)? Use the correct units, so we know whether you think it is a resistor, capacitor or inductor (For example, X = 9 Ω). *(2 points)*

X