

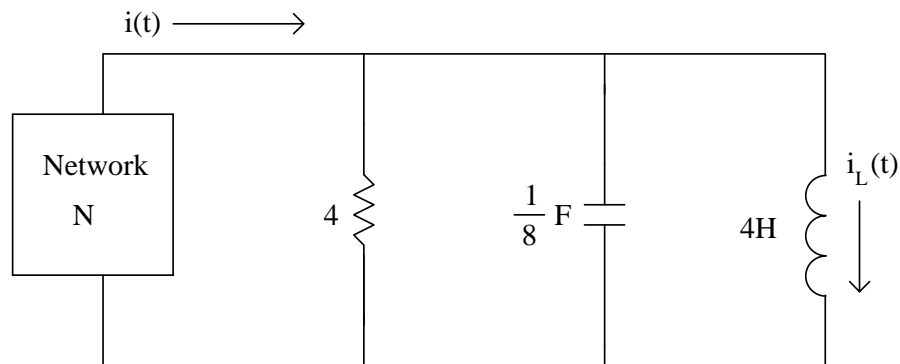
TEST #4
(Take-home Test)

Instructions:

1. This is an open-book, open-notes test. Any books are allowable.
2. The test must be your own work. You may neither give nor receive help of any kind from any person.
3. Problems should be presented neatly with clear solutions.
4. Include a final page with a signed pledge stating the following:
"I pledge that I have neither given help to any other person on this test nor received help from any other person on this test."
5. The test will not be accepted late except in case of emergency (and timely notification).

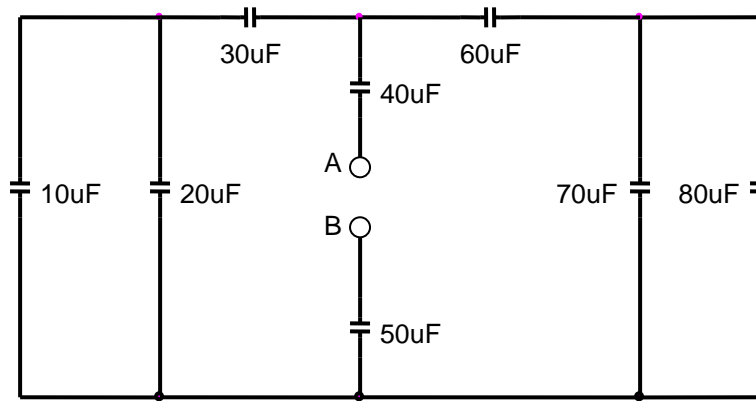
Test Problems:

1. (10 points) If $i_L(t) = (2e^{-t} + 3e^{-4t})$ A in the circuit shown below, determine $i(t)$.



$i(t) =$ _____

2. (6 points) Determine the equivalent capacitance between terminals A-B.

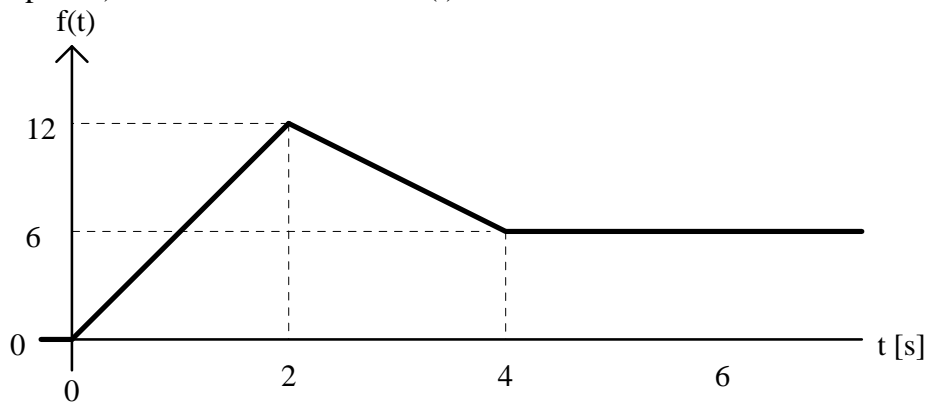


C = _____

3. (16 points) Circle True (T) or False (F) for each part below.

- T F A. A capacitor has a net charge of zero at all times.
- T F B. A capacitor stores energy in a magnetic field.
- T F C. Inductor voltage cannot change instantaneously.
- T F D. A capacitor in steady-state acts like an open-circuit.
- T F E. An ideal capacitor has an infinite leakage resistance.
- T F F. An electrolytic capacitor have the disadvantage of being polarized, but have the advantage of providing larger capacitance values.
- T F G. If the number of turns (i.e., the number of times the wire is wrapped around the core) for a given inductor is doubled, then the inductance is also doubled.
- T F H. If $f(t) = 2u(t+2) + 3u(2-t) + 4u(t-2) + 5u(-t-2) + 6u(4-t) + 7u(t-4)$ then $f(3) = 13$.

4. (16 points) Consider the function $f(t)$ shown below.



- A. If $f(t)$ is the voltage across a $200 \mu\text{F}$ capacitor, determine the capacitor current at time $t = 3$ seconds.

$$i(3) = \underline{\hspace{2cm}}$$

- B. If $f(t)$ is the current through a $200 \mu\text{F}$ capacitor, determine the capacitor voltage at time $t = 3$ seconds. Assume that the capacitor has zero initial stored energy.

$$v(3) = \underline{\hspace{2cm}}$$

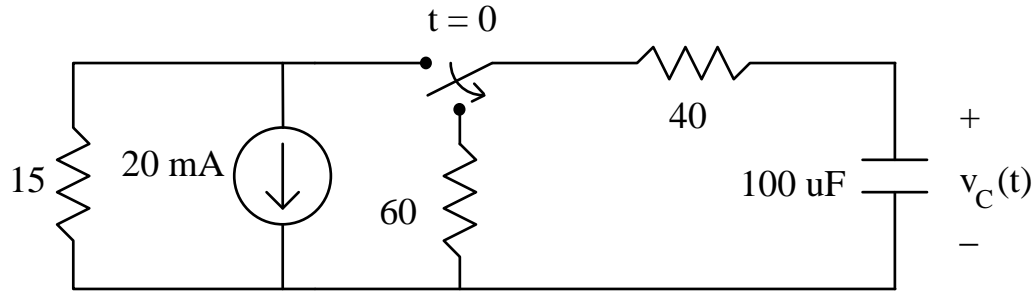
- C. If $f(t)$ is the energy stored in a $200 \mu\text{F}$ capacitor, determine the capacitor voltage at time $t = 3$ seconds.

$$v(3) = \underline{\hspace{2cm}}$$

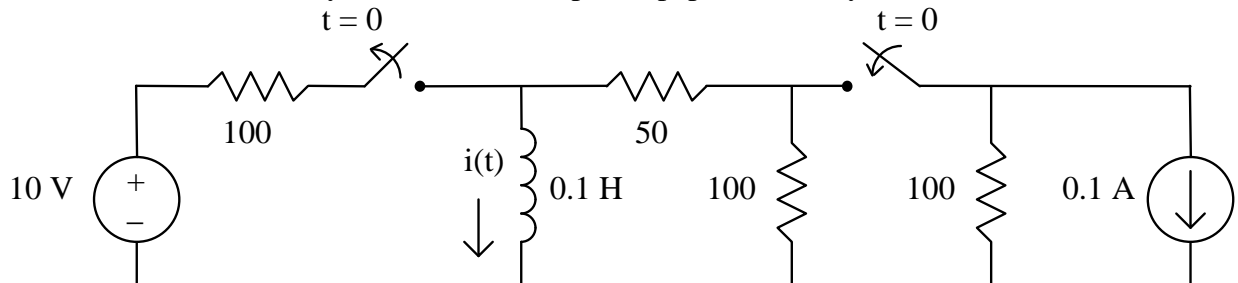
- D. Express $f(t)$ using unit step functions.

$$f(t) = \underline{\hspace{4cm}}$$

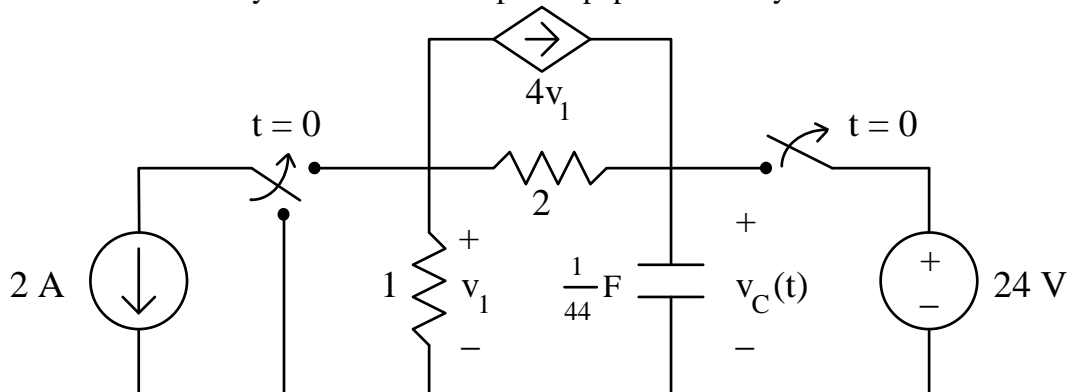
5. (13 points) Determine an expressions for $v_C(t)$ for $t \geq 0$. Assume that the circuit is in steady-state for $t < 0$. Show your solution on separate paper and box your final result.



6. (13 points) Determine an expression for $i(t)$ for $t \geq 0$. Assume that the circuit is in steady-state for $t < 0$. Show your solution on separate paper and box your final result.



7. (13 points) Determine an expression for $v_C(t)$ for $t \geq 0$. Assume that the circuit is in steady-state for $t < 0$. Show your solution on separate paper and box your final result.



8. (13 points) Determine an expression for $i(t)$ for $t \geq 0$. Assume that the circuit is in steady-state for $t < 0$. Show your solution on separate paper and box your final result.

