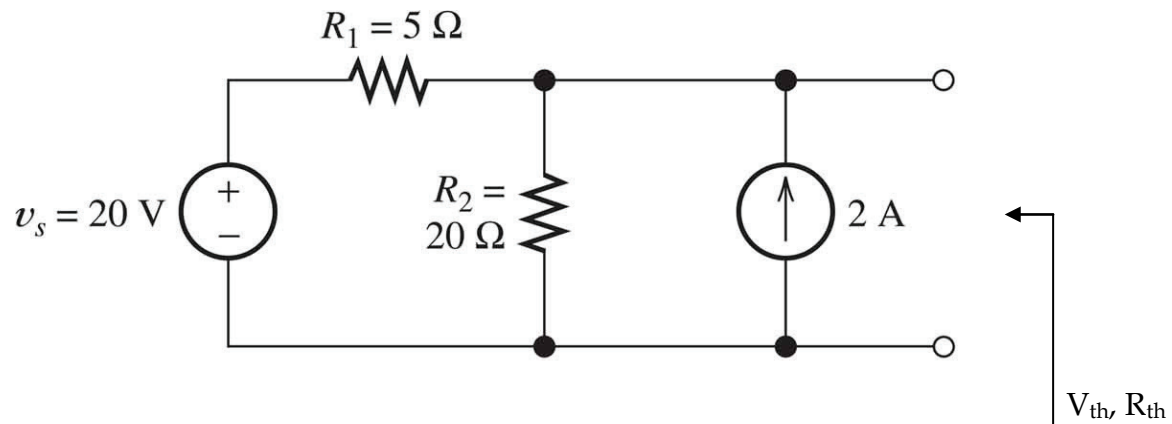


SHOW YOUR WORK: Correct answer with no work shown may not receive credit.

Wrong answer with work shown may receive partial credit.

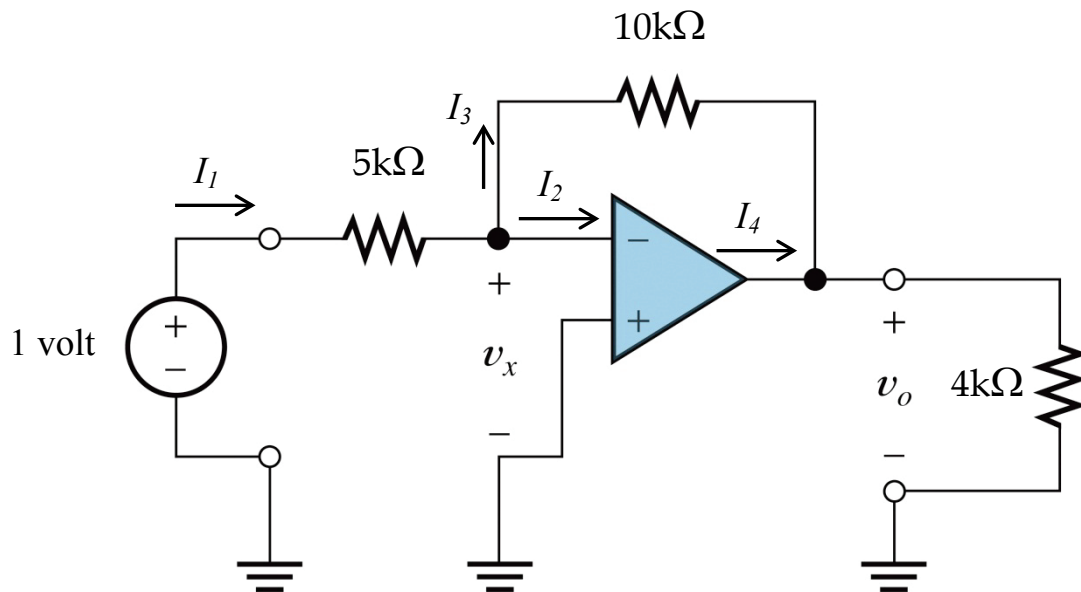
1. (10 points) Find the Thévenin equivalent voltage and resistance for the circuit shown below. Include the proper units.

$V_{th} =$ _____ $R_{th} =$ _____



2. (20 points) Use the ideal op amp model to answer the following questions.

CLEARLY INDICATE YOUR APPROACH!!!!



What is I_1 ? (5 points)	What is I_2 ? (5 points)	What is I_3 ? (5 points)	What is I_4 ? (5 points)
<input type="checkbox"/> -0.5 mA	<input type="checkbox"/> -0.5 mA	<input type="checkbox"/> -0.5 mA	<input type="checkbox"/> -0.7 mA
<input type="checkbox"/> -0.2 mA	<input type="checkbox"/> -0.2 mA	<input type="checkbox"/> -0.2 mA	<input type="checkbox"/> -0.5 mA
<input type="checkbox"/> 0 mA	<input type="checkbox"/> 0 mA	<input type="checkbox"/> 0 mA	<input type="checkbox"/> 0 mA
<input type="checkbox"/> +0.2 mA	<input type="checkbox"/> +0.2 mA	<input type="checkbox"/> +0.2 mA	<input type="checkbox"/> +0.5 mA
<input type="checkbox"/> +0.5 mA	<input type="checkbox"/> +0.5 mA	<input type="checkbox"/> +0.5 mA	<input type="checkbox"/> +0.7 mA

3. (10 points) Assume the capacitor is fully discharged and the switch has been *open* for a long time prior to $t = 0$; then the switch *closes* abruptly at $t = 0$.

Which of the following plots represents the *current through the capacitor* as a function of time?

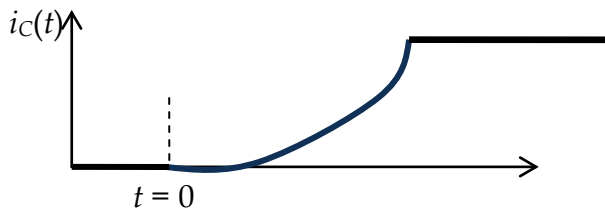
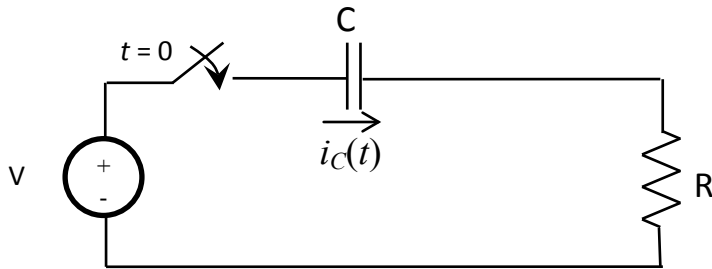


Figure (a)

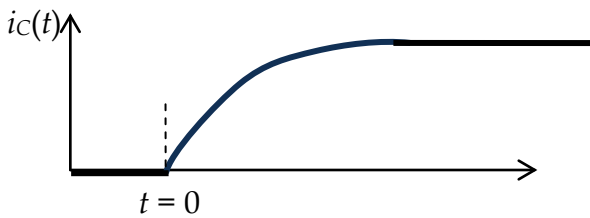


Figure (b)

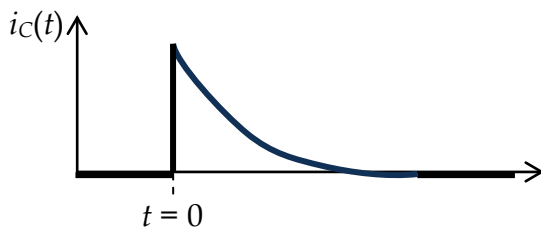


Figure (c)

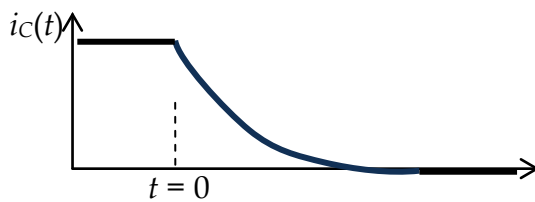
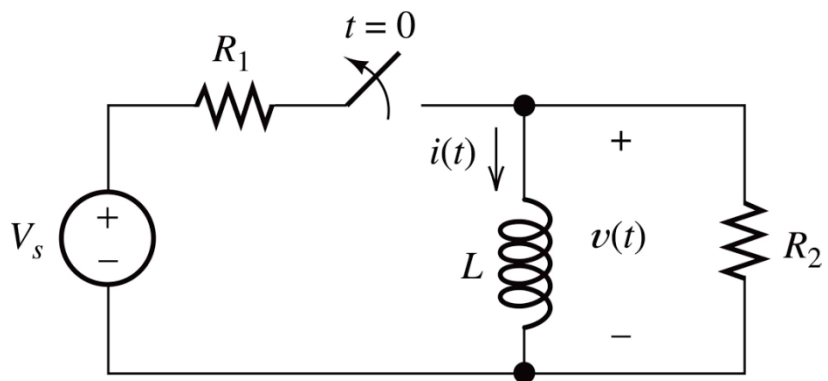


Figure (d)

4. (15 points) SHOW YOUR WORK

The switch in the circuit shown below has been *closed* for a long time prior to $t = 0$, then the switch opens abruptly at $t = 0$.

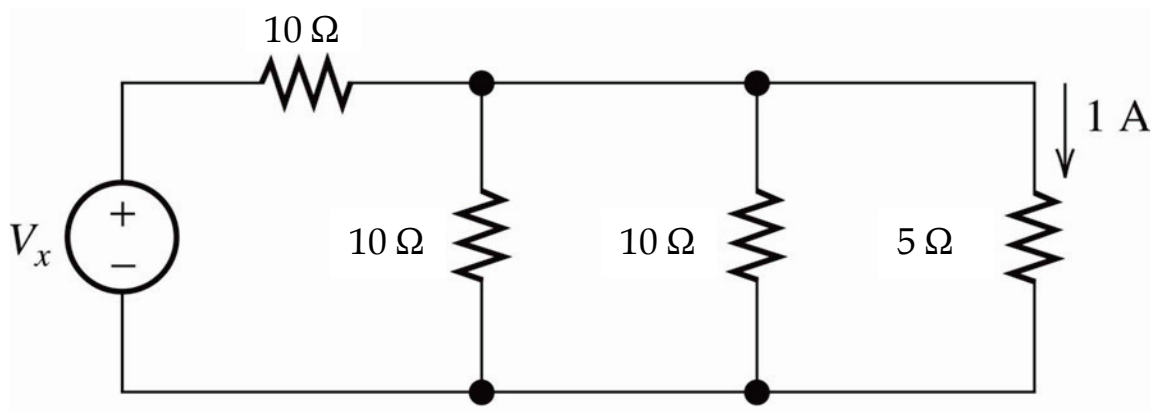


- (a) What is an expression for the inductor current $i(0+)$?
- (b) What is an expression for the inductor current $i(t \rightarrow \infty)$?
- (c) Determine a mathematical expression for the inductor current $i(t)$ for all $t > 0$.

5. (10 points) SHOW YOUR WORK

If the current in the 5Ω resistor is measured to be 1 amp as shown, what is the voltage V_x ?

$$V_x = \underline{\hspace{2cm}}$$

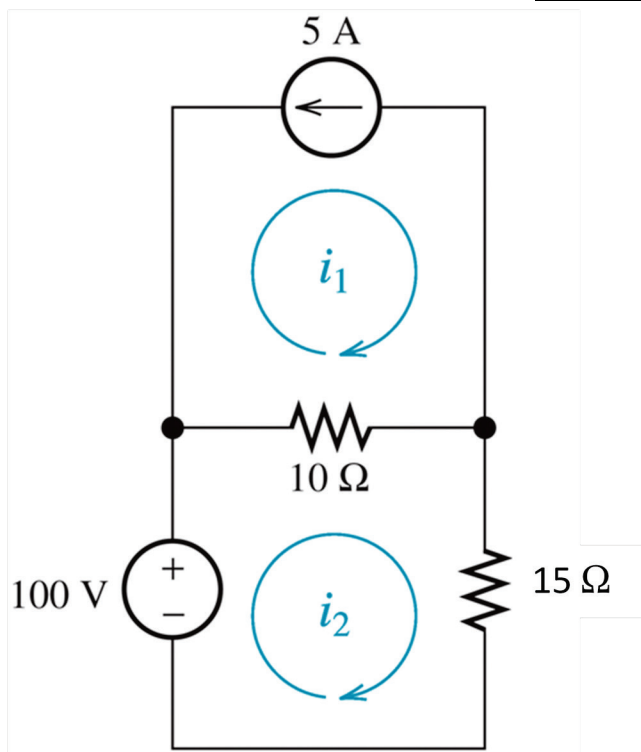


6. (15 points) SHOW YOUR WORK

For the circuit shown below, determine the two indicated mesh currents i_1 and i_2 .

$$i_1 = \underline{\hspace{2cm}}$$

$$i_2 = \underline{\hspace{2cm}}$$



7. (10 points) SHOW YOUR WORK

A DC motor is rated **50-hp**. The motor is powered by a 220 volt DC source. When the motor is at full rated load the input current is found to be 200 amps.

(recall that 1 hp = 746 W)

What is the power efficiency of this motor when under full rated load?

- 50%
- 65%
- 75%
- 85%
- 95%

8. (10 points) SHOW YOUR WORK

The same 50-hp DC motor from Problem 7 is found to run at 1200 rpm with no load, and 1140 rpm when under full-load conditions.

What is the speed regulation of this motor?

- 5.3%
- 15.2%
- 68.3%
- 85.0%
- 95.0%

9. (20 points) SHOW YOUR WORK

For the circuit shown below, determine the indicated Thévenin phasor voltage and phasor impedance.

$$V_{th} = \underline{\hspace{2cm}} \quad Z_{th} = \underline{\hspace{2cm}}$$

