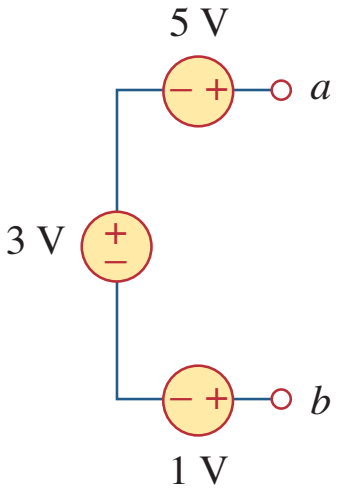
**EE 2010 Circuit Analysis: Quiz 1** **Name (Last, First):**

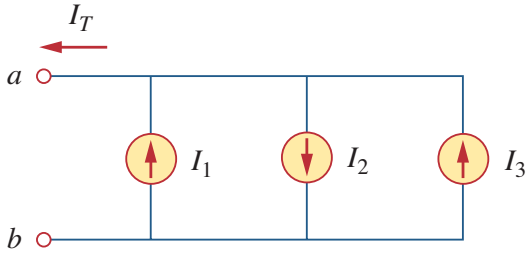
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Find $V_{ab}$




$V_{ab} = 5 + 3 - 1 = 7\,V$

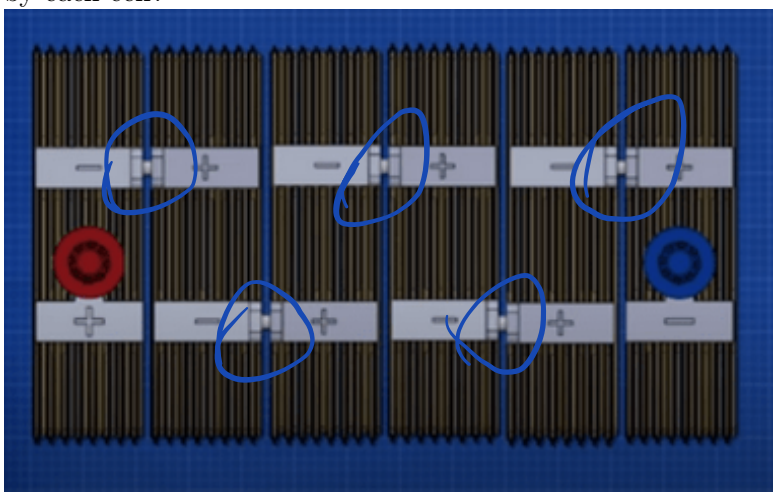
2. Find $I_T$




$I_T = I_1 - I_2 + I_3$

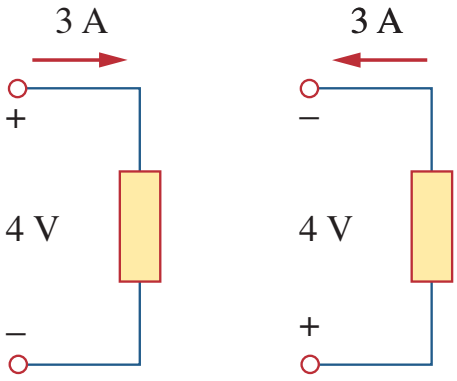
**Score:** _____/20

3. A common 12V lead-acid car battery is composed of 6 cells. Highlight the inter-cell connections and verify that these individual cells are in "series." What is the nominal voltage produced by each cell?



2V/cell

4. Find the power absorbed by the element on the right and by the element on the left:




Which of these conforms to the passive sign convention?

Right

$P = 3A \cdot 4V = 12W$

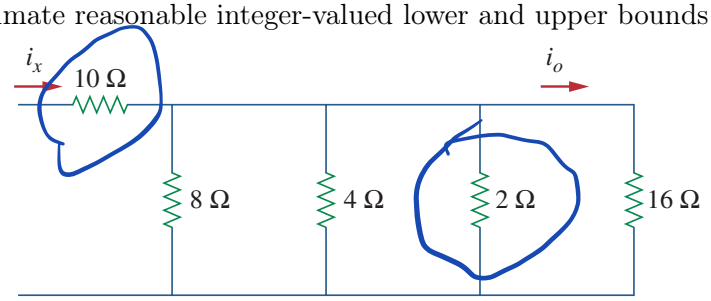
Left

$P = 3A \cdot 4V = 12W$

**EE 2010 Circuit Analysis: Quiz 2** **Name (Last, First):**

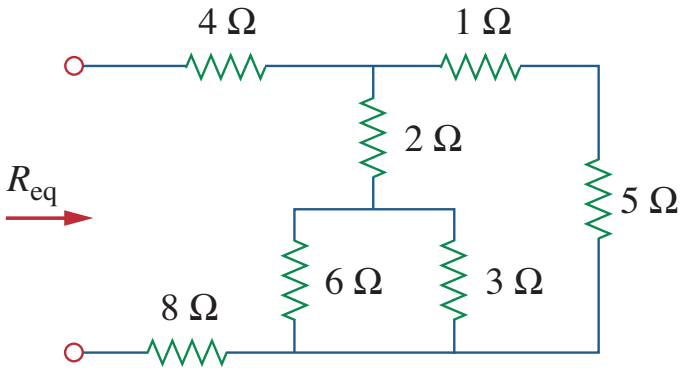
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Estimate reasonable integer-valued lower and upper bounds for the equivalent resistance.




$10 < R < 12$

2. Find the equivalent resistance

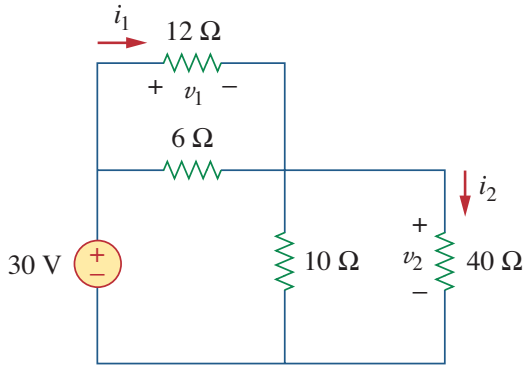



$4 + 2.4 + 8 = 14.4\,\Omega$

4Ω

**Score:** _____/**20**

3. Find $v_1$ and $v_2$

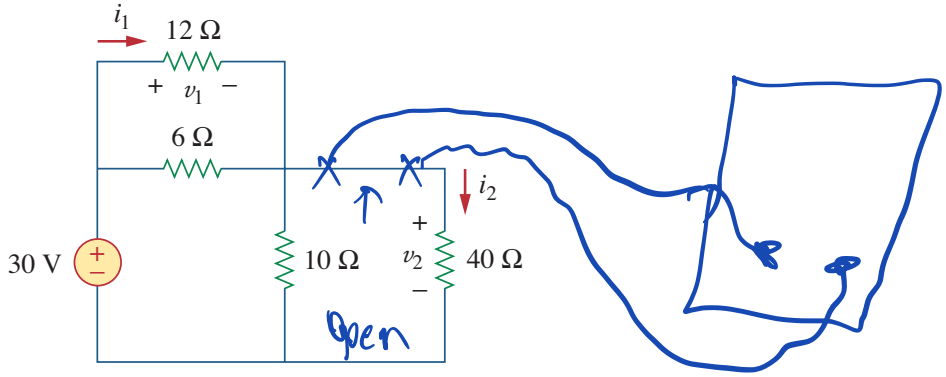



8Ω

$V_1 = \frac{30 \cdot 4}{12} = 10\,V$

$V_2 = \frac{30 \cdot 8}{12} = 20\,V$

4. Sketch a multimeter with leads and illustrate the connection to measure $i_2$

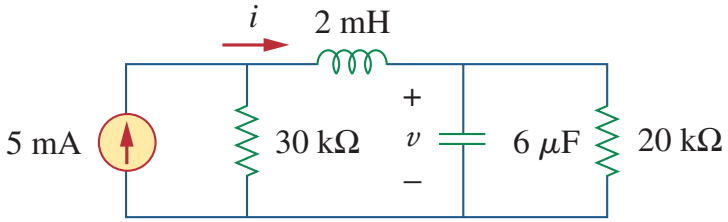



What is the appropriate multimeter dial setting to measure $i_2$? 10A

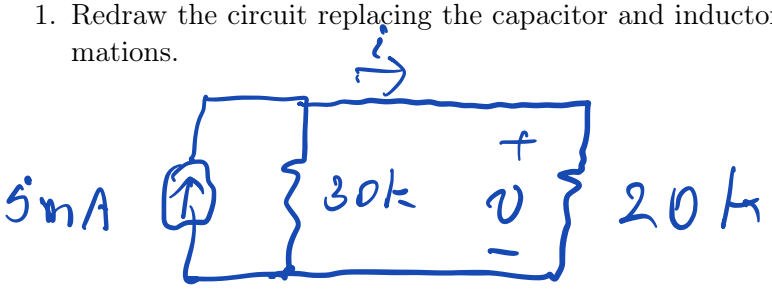
**EE 2010 Circuit Analysis: Quiz 3** **Name (Last, First):**

There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

The circuit below is in DC steady state.




1. Redraw the circuit replacing the capacitor and inductor with their DC steady state approximations.




2. Next, find $i$ (the current through the 20k $\Omega$ resistor) for the DC steady state approximation circuit.

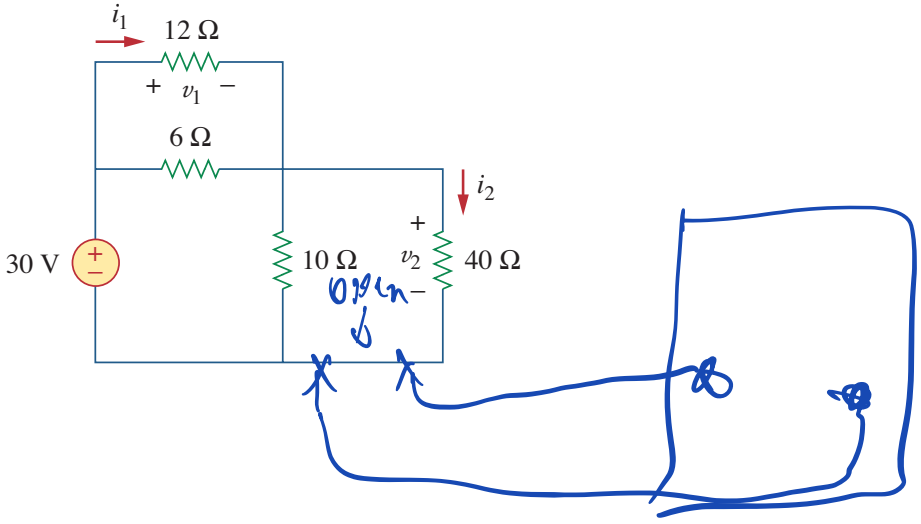
$$i_{20k} = \frac{5\,mA \cdot 30k}{30k + 20k} = 3\,mA$$

**Score:** _____/**20**

3. Which of the dynamic components we have considered stores energy in the form of a *magnetic* field?

Inductor

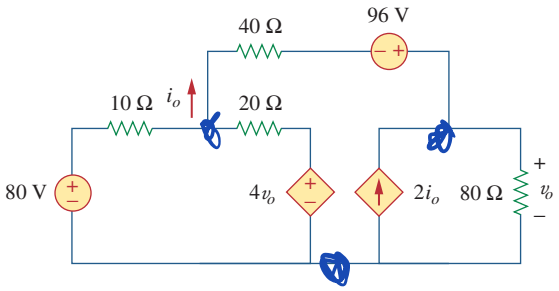
4. Sketch a multimeter with leads and illustrate the proper connection to measure the current $i_2$



**EE 2010 Circuit Analysis: Quiz 4** **Name (Last, First):**

There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Find the number of essential nodes: (0,1,2,3,4)



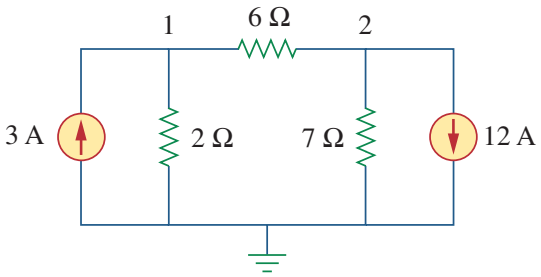

3

2. For the circuit above, find the minimum number of equations (node plus otherwise) needed to describe this circuit: (0,1,2,3,4)

3

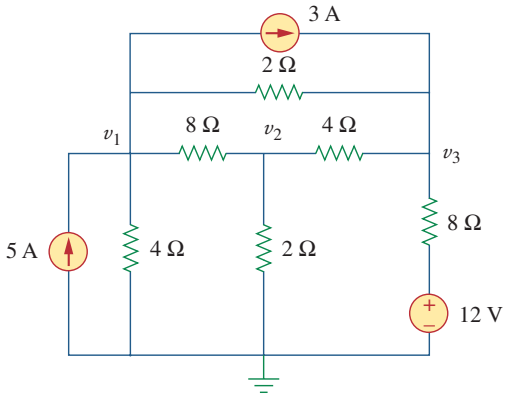
**Score:** _____/**20**

3. Write a node equation at "1" denoting the voltage there as $v_1$.




$$\frac{v_1}{2} - 3 + \frac{(v_1 - v_2)}{6} = 0$$

4. Write a node equation at $v_3$.



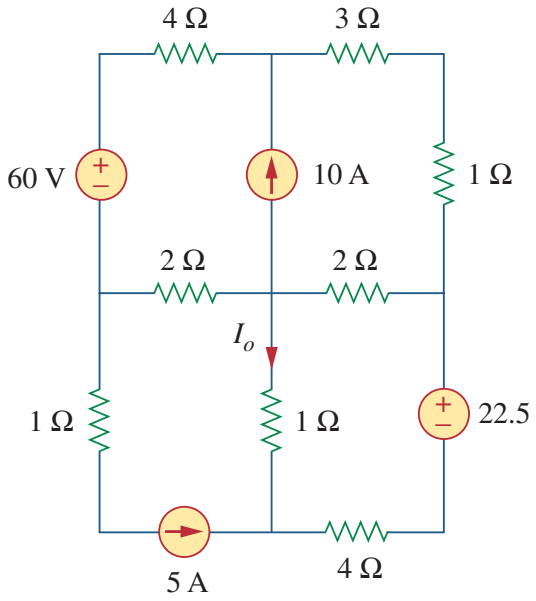

$$\frac{(v_3 - 12)}{8} + \frac{(v_3 - v_2)}{4} + \frac{(v_3 - v_1)}{2}$$

$$- 3 = 0$$

**EE 2010 Circuit Analysis: Quiz 5** **Name (Last, First):**

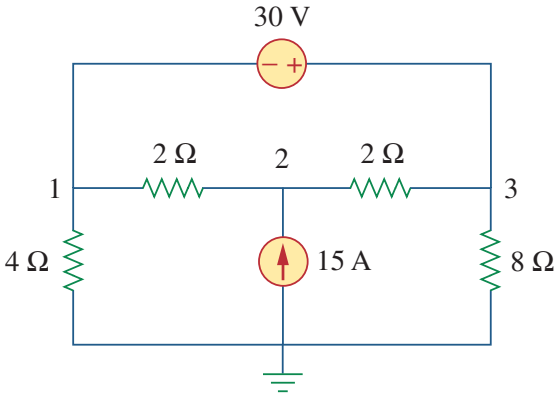
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. How many essential nodes in the circuit below? (Your answer should be a positive integer.)




5

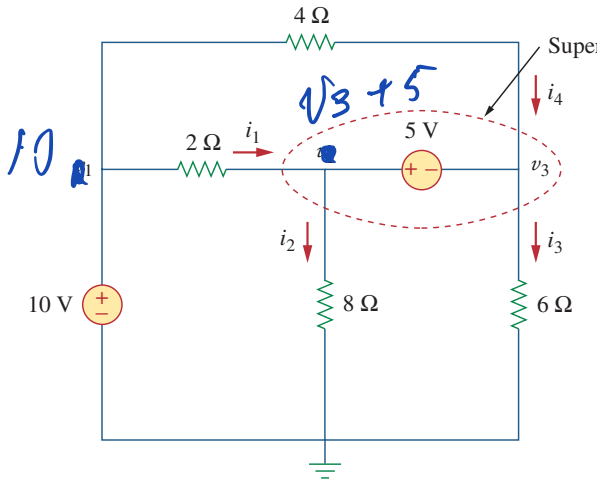
2. What is the *minimum* number of equations *necessary* to find the relevant voltages in this circuit? (Your answer should be a positive integer.)




2

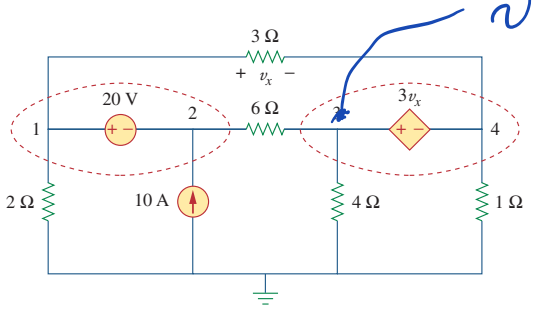
**Score:** _____/20

3. Write a linked-node equation accounting for the currents leaving the region surrounding the 5V source. Please ignore the authors silly current labels. Do not write any other equations.




$$\frac{v_3}{6} + \frac{(v_3 - 10)}{4} + \frac{(v_3 + 5)}{8} + \frac{(v_3 + 5 - 10)}{2} = 0$$

4. Write a linked-node equation accounting for the currents leaving the region surrounding the $3v_x$ source. Do not write any other equations.

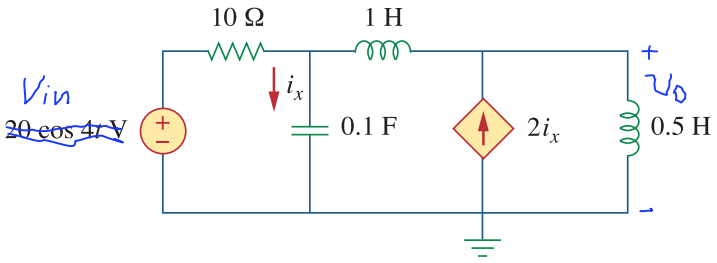



$$\frac{v_4}{1} + \frac{(v_4 - v_1)}{3} + \frac{(v_4 + 3v_x)}{4} + \frac{(v_4 + 3v_x - v_2)}{6} = 0$$

**EE 2010 Circuit Analysis: Quiz 6** **Printed Name (Last, First):**

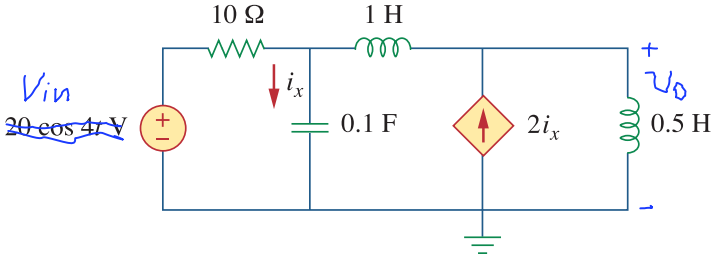
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. How many distinct energy storage devices (dynamic elements) are in the circuit below? (Your answer should be a positive integer.)




3

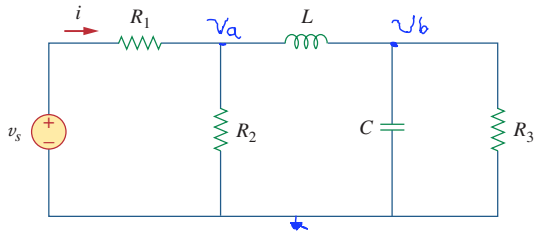
2. We would expect the transfer function of this system $H_{vo}(s) = \frac{vo}{Vin}$ to have denominator polynomial of order _____3_____ ? (Fill in the blank. Your answer should be a positive integer.)




3

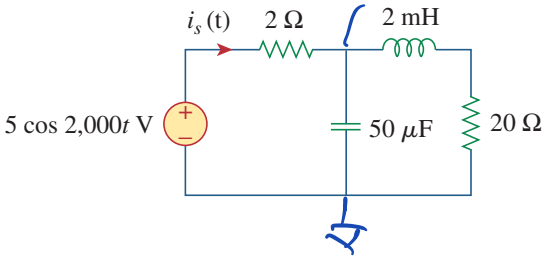
**Score:** _____/20

3. Write a node equation at $v_b$. Please ignore other nodes. Do not write any other equations.




$$\frac{V_b}{R_3} + V_b \cdot Cs + \frac{(V_b - V_a)}{Ls} = 0$$

4. Write a node equation describing this circuit. Do not write any other equations. Do not solve.

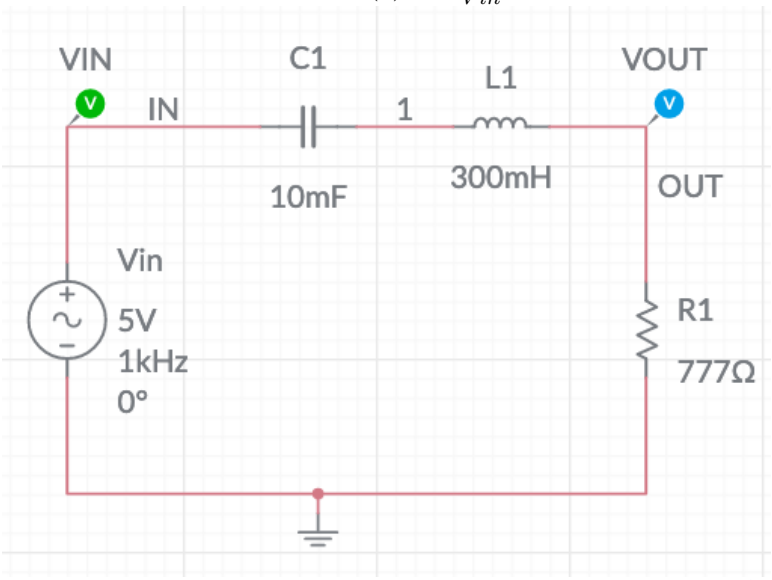



$$V_a \cdot 50e^{-6}s + \frac{(V_a - V_{in})}{2} + \frac{V_a}{2e^{-3}s + 20} = 0$$

**EE 2010 Circuit Analysis: Quiz 7** **Printed Name (Last, First):**

There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Find the transfer function $H(s) = \frac{VOUT}{Vin}$. Do not simplify or compute.




$$H(s) = \frac{777}{777 + 300e^{-3}s + \frac{1}{10e^{-3}s}}$$

2. An analysis of a certain circuit yields transfer function $H(s) = \frac{vo}{Vin}$. If

$$Vin(t) = 20\cos(100t + 0.3)$$

and

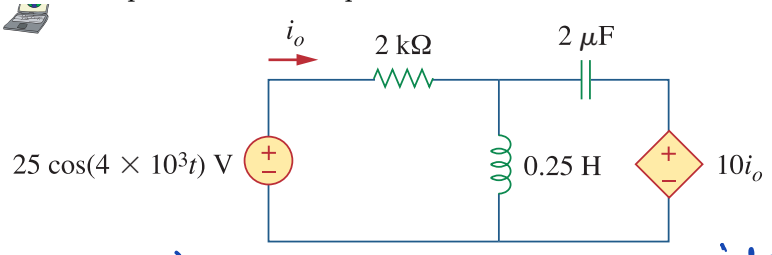
$$H(j * 100) = 0.6\angle 0.2$$

Find $vo(t) =$

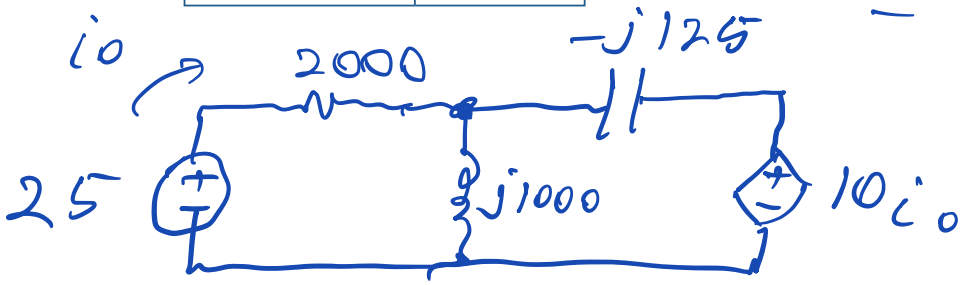
$$V_0(t) = 20 \cdot 0.6 \cos(100t + 0.3 + 0.2)$$

**Score:** _____/20

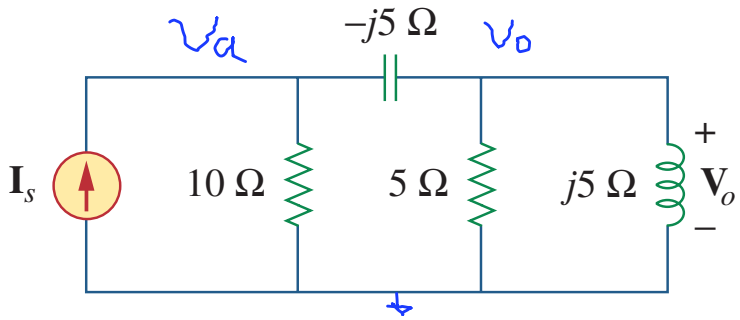
3. Draw the phasor-domain equivalent circuit for the circuit below.




$\frac{-j}{4000 \cdot 2\times10^{-6}} = \frac{-j\,1000}{8}$




4. Write a node equation at $v_o$. Do not write any other equations. Do not solve.



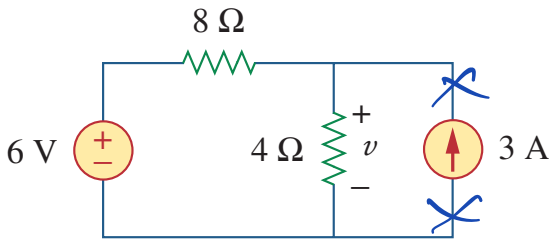

$$\frac{V_o}{5} + \frac{V_o}{j5} + \frac{(V_o - V_a)}{-j5} = 0$$

Sorry about the 5's.

**EE 2010 Circuit Analysis: Quiz 8** **Printed Name (Last, First):**

There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Find $v$ due only to the 6V source.




$$v = \frac{6 \cdot 4}{4+8} = 2\,V$$

2. The analysis of a certain circuit yields

$$v_o = \frac{11}{5} I_{in} + \frac{13}{5} V_{in}$$

Execution of the code below:

```
vx5A = eval(subs(vx, [Iin, Vin], [0, 10]))
```

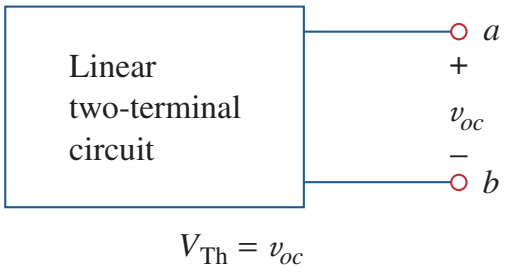
yields what result?

$$V_0 = \frac{11}{5} \cdot 0 + \frac{13}{5} \cdot 10$$

$$= 26\,V$$

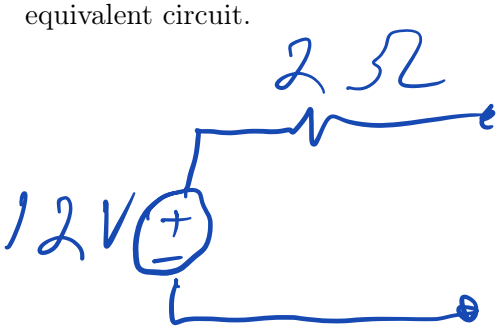
**Score:** _____/20

3. For the system shown, it is found that $v_{oc} = 12V$.



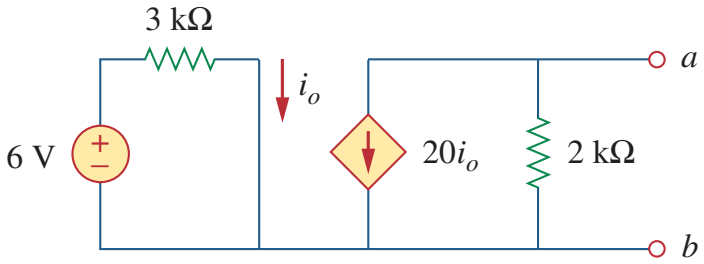

$V_{\text{Th}} = v_{oc}$

When a 4 Ω load is connected to $\{a, b\}$, $v_{ab}$ is found to be 8V. Find and sketch the Thevenin equivalent circuit.




$$\frac{12 - 6}{6/4} = 2$$

4. Find the Thevenin voltage for the circuit below:




$V_{th} = -80\ V$

$i_o = \frac{6V}{3000} = 2mA$

$20 i_o = 40mA$

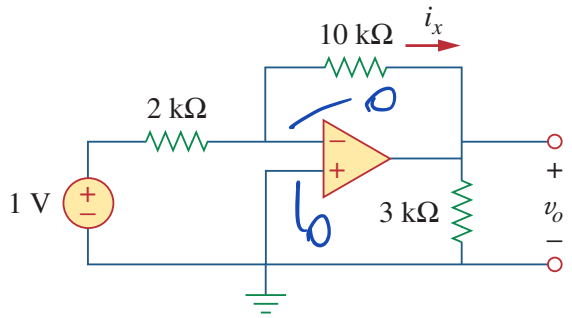
$V_{ab} = -40mA \cdot 2000$

$= -80$

**EE 2010 Circuit Analysis: Quiz 9** **Printed Name (Last, First):**

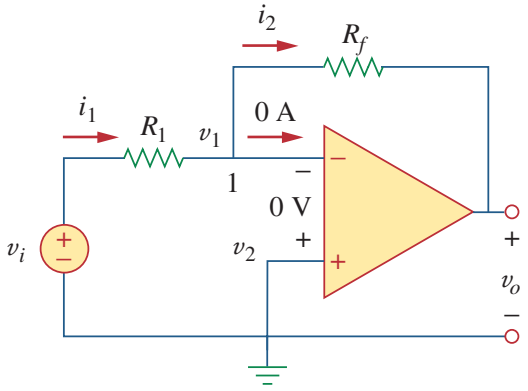
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Write a node equation you would use to find $v_o$.




$$\frac{0-1}{2000} + \frac{0-V_o}{10000} = 0$$

2. Find the transfer function, $\frac{v_o}{v_I} =$

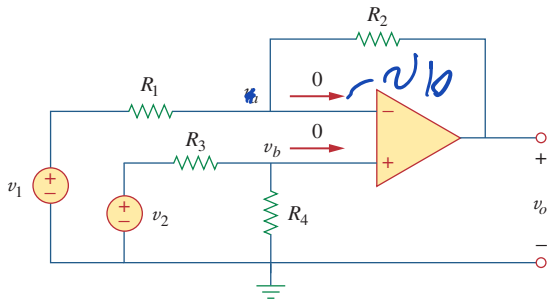



$$V_o = V_i\left(-\frac{R_f}{R_1}\right)$$

$$H(s) = -\frac{R_f}{R_1}$$

**Score:** _____/20

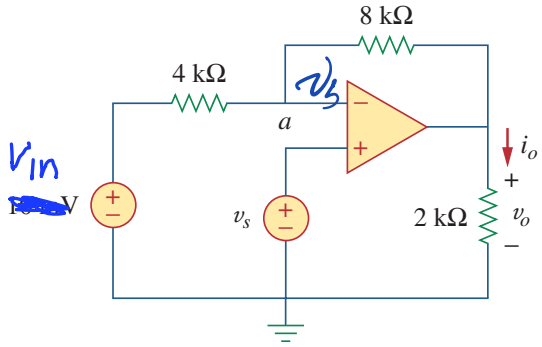
3. Write a node equation you would use to find $v_o$. Include any conveniently-labeled voltages. Do not simplify or solve.




$$\frac{(V_b - V_1)}{R_1} + \frac{(V_b - V_o)}{R_2} = 0$$

$$V_b = \frac{V_2 \cdot R_4}{R_3 + R_4}$$

4. Find $v_o =$. Do not simplify.




$$\frac{V_s - V_{in}}{4k} + \frac{V_s - V_o}{8k} = 0$$

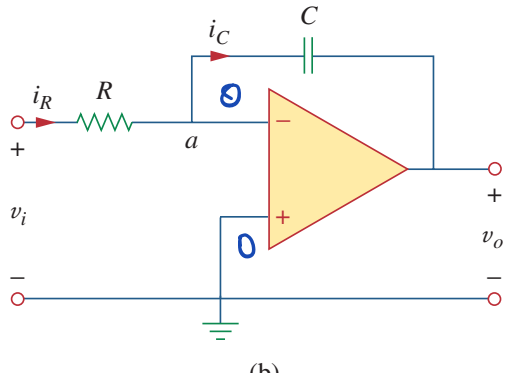
$$V_o = V_s + \frac{(V_s - V_{in})}{4k} \cdot 8k$$

$$V_o = 3V_s - 2V_{in}$$

**EE 2010 Circuit Analysis: Quiz 10** **Printed Name (Last, First):**

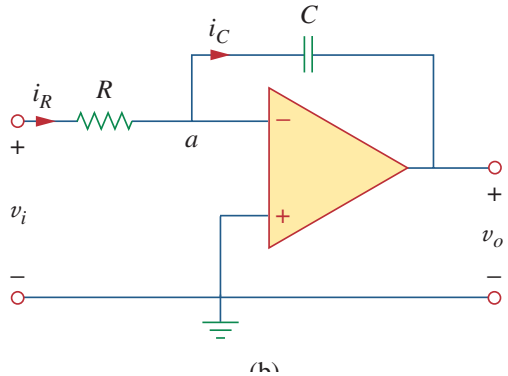
There are 4 problems. Please address each question with a boxed, short, neatly-written answer.

1. Write a node equation you would use to find $v_o$. Ignore the authors current labels. Do not simplify or solve.




$$\frac{(0 - v_i')}{R} + (0 - v_o) \cdot Cs = 0$$

2. Find the transfer function, $H(s)$.

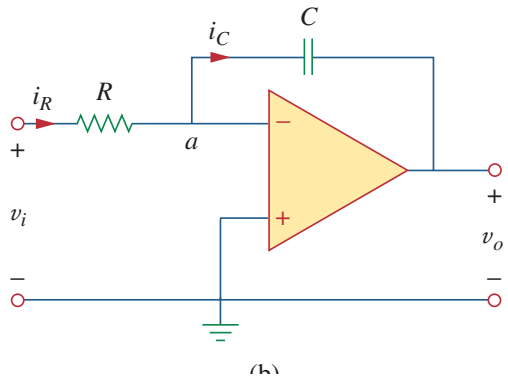



$$v_o = -\frac{v_i'}{RCs}$$

$$H(s) = \frac{-1}{RCs}$$

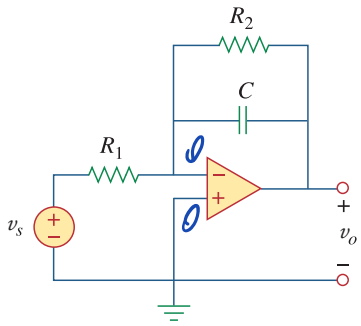
**Score:** _____/20

3. This circuit is a realization of (choose one): a) High-pass filter, b) Low-pass filter, c) Band-pass filter.




(b)

4. Write a node equation you would use to find $v_o$. Do not simplify or solve.




$$\frac{(0-V_s)}{R_1} + \frac{(0-V_0)}{R_2} + (0-V_0)\cdot Cs = 0$$