ECE 3200 Electronics II
Spring 2020
Exam #1

NAME: _____

INSTRUCTIONS:

1. **THIS EXAM IS CLOSED BOOK AND CLOSED NOTES.**
2. **YOU MAY USE ONE OF THESE CALCULATORS.**
   Circle the one, if any, that you are using:

   Casio fx-115/fx-991

   HP 33s/35s

   TI 30X/36X
3. **All other electronic devices, including watches, must be stowed away**.
4. Work each problem in the provided space.
5. Show ALL work required to arrive at a solution for either full or partial credit.
6. READ the entire question before answering.
7. Have your student ID on your desktop for inspection by the instructor.
8. SIGN the honesty pledge at the bottom of the page. Exams without a signature will receive no credit.

I have neither given nor received assistance from anyone in regards to completion of this exam. I have followed the instructions as provided on this sheet. I HAVE VERIFIED THAT THIS EXAM HAS (9) PAGES.

SIGNATURE: _____ DATE: _____

Maximum exam score is 35/30 points.

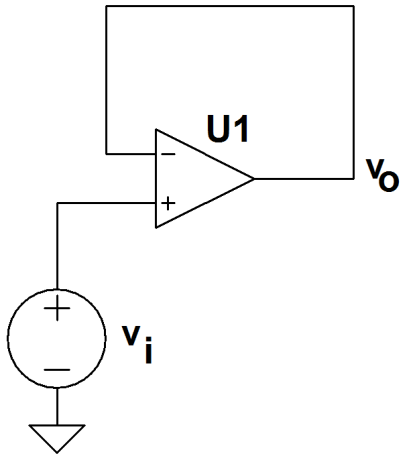
1. (3 points) Name three benefits of using negative feedback in operational amplifier circuit design. Put responses in table.

2. (2 points) A voltage $v_i(t) = \sin(t)$ is applied to a circuit with voltage transfer function

$$T(s) = \frac{1}{s+1}$$

Find the steady-state output voltage $v_o(t)$.

3. Consider the following circuit.
   Hints: Suggest using circuit analysis with the VCVS model of the op-amp and/or model the circuit as a negative feedback system.



   a. (5 points) If the operational amplifier is ideal *except* for an open-loop gain A=10, find the closed-loop voltage gain of this circuit.

b. (5 points) If the operational amplifier is ideal *except* that the open-loop frequency-dependent gain is

$$A(s) = \frac{10}{s+1}$$

find the closed-loop -3db frequency.

c. (5 points) If the operational amplifier is ideal *except* that the operational amplifier has finite gain A and output resistance r_o, find the circuit output (Thevenin) resistance. This will be a symbolic result (not a number).

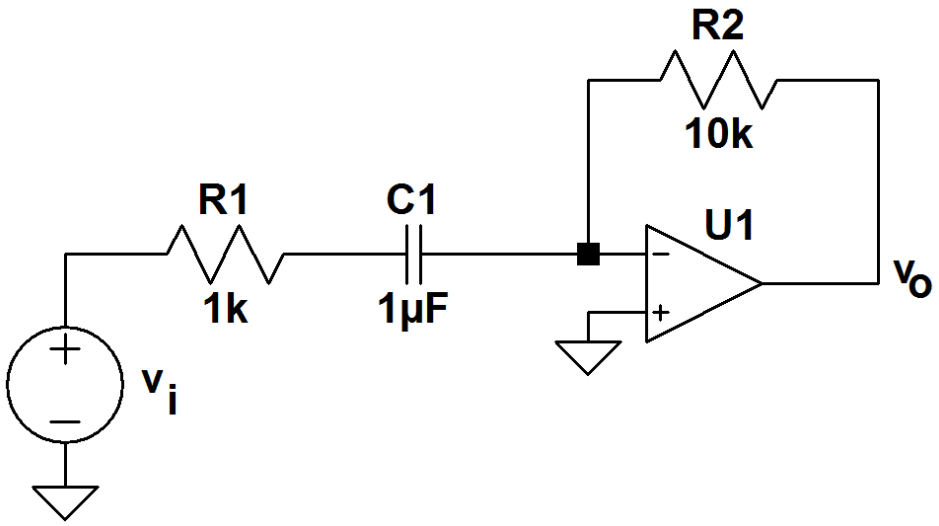
4. The operational amplifier is ideal.

   a. (1 point) Find the low-frequency voltage gain.

   b. (1 point) Find the high-frequency voltage gain.

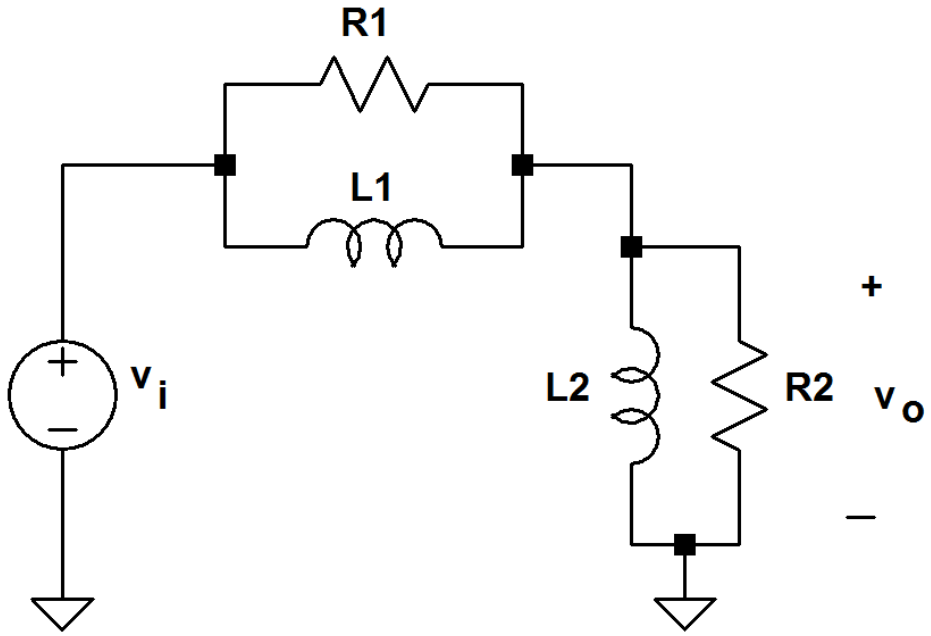
   c. (4 points) Find the transfer function $T(s) = \frac{V_o(s)}{V_i(s)}$.

   d. (4 points) Sketch the Bode magnitude plot of $T(s)$.
   A straight-line approximation is sufficient.



EXTRA WORK SPACE FOR PROBLEM 4

5. (5 points, extra credit) Find non-trivial relationship(s) between the resistors and inductors so that the voltage gain $\frac{V_o(s)}{V_i(s)}$ is independent of frequency.



EXTRA WORK SPACE FOR PROBLEM 5