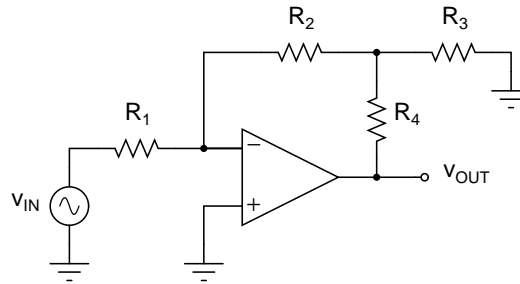


INEI 5207 Analog System Design with Operational Amplifiers  
 Fall 2005 Exam #1 Prof. Manuel Toledo  
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1. Opamps with  $V_{OS} = 1\text{mV}$ ,  $I_B = 100\text{nA}$  and  $I_{OS} = 10\text{nA}$  will be used to construct an amplifier with a  $100\text{V/V}$  gain. Resistors should be selected so that the output error due to the offset current is minimized but making sure that the opamp output current is kept below  $10\text{mA}$ . The opamp outputs saturate at about  $\pm 13\text{V}$ . Design the amplifier:
  - (a) using one stage of the simple non-inverting configuration shown in your textbook's figure 1.7. (10 pts), and
  - (b) using two such stages (10 pts).
  - (c) Find the worse-case output error for your designs in parts (a) and (b). (25 pts)
  
2. For the following circuit, find the gain  $\frac{v_{OUT}}{v_{IN}}$  assuming an ideal opamp. (25 pts)



3. For the following circuit, the box labeled *log. converter* represents a logarithmic amplifier with transfer function  $v_a = K \log_{10}(v_b)$ , where  $K$  is a constant with units of volts.
  - (a) Find an expression for the output voltage  $v_O$  in terms of  $v_i$ . Justify each step. (15 pts)
  - (b) Design the circuit inside the box labeled *log. converter*. (15 pts)

