

## ECE 4435 Quiz 1

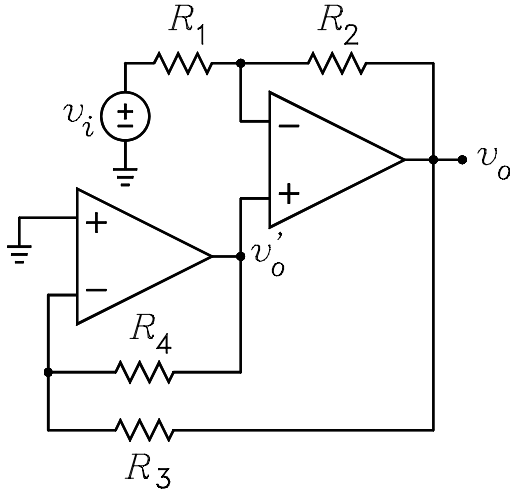
September 15, 2004

Professor Leach

Name \_\_\_\_\_

**Instructions.** Print your name in the space above. Place a box around your answers. Express any numerical answer as a decimal number. **Honor Code Statement:** *I have neither given nor received help on this quiz.* Initials: \_\_\_\_\_

- Using superposition and the gain formulas for the inverting and non-inverting amplifiers to solve for  $v_o/v_i$ . What is the input resistance seen by the source  $v_i$ ?



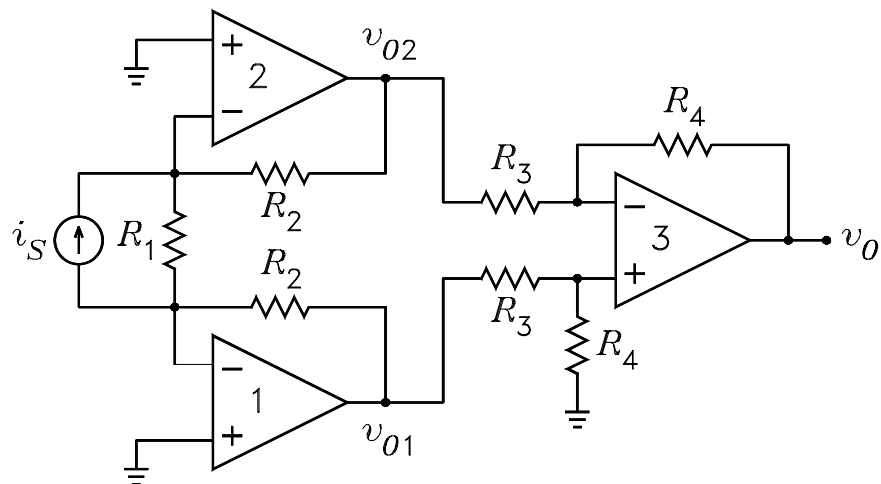
$$v_o = -\frac{R_2}{R_1}v_i + \left(1 + \frac{R_2}{R_1}\right)v'_o = -\frac{R_2}{R_1}v_i + \left(1 + \frac{R_2}{R_1}\right)\left(-\frac{R_4}{R_3}\right)v_o$$

$$\Rightarrow v_o = \frac{-\frac{R_2}{R_1}}{1 + \left(1 + \frac{R_2}{R_1}\right)\left(\frac{R_4}{R_3}\right)}v_i$$

$$i_{in} = \frac{v_i - v'_o}{R_1} = \frac{v_i + \frac{R_4}{R_3}v_o}{R_1} = \frac{1 + \frac{\left(-\frac{R_2}{R_1}\right)}{1 + \left(1 + \frac{R_2}{R_1}\right)\left(\frac{R_4}{R_3}\right)}}{R_1} \times v_i$$

$$\Rightarrow R_{in} = \frac{v_i}{i_{in}} = \frac{R_1}{1 - \frac{\left(\frac{R_2}{R_1}\right)\left(\frac{R_4}{R_3}\right)}{1 + \left(1 + \frac{R_2}{R_1}\right)\left(\frac{R_4}{R_3}\right)}}$$

2. Solve for  $v_{O1}$ ,  $v_{O2}$ , and  $v_O$  as functions of  $i_S$ .



$$v_{O1} = i_S R_2 \quad v_{O2} = -i_S R_2$$

$$v_O = \frac{R_4}{R_3} (v_{O1} - v_{O2}) = \frac{R_4}{R_3} 2i_S R_2$$