Name: _____ (please print)

Signature: _____

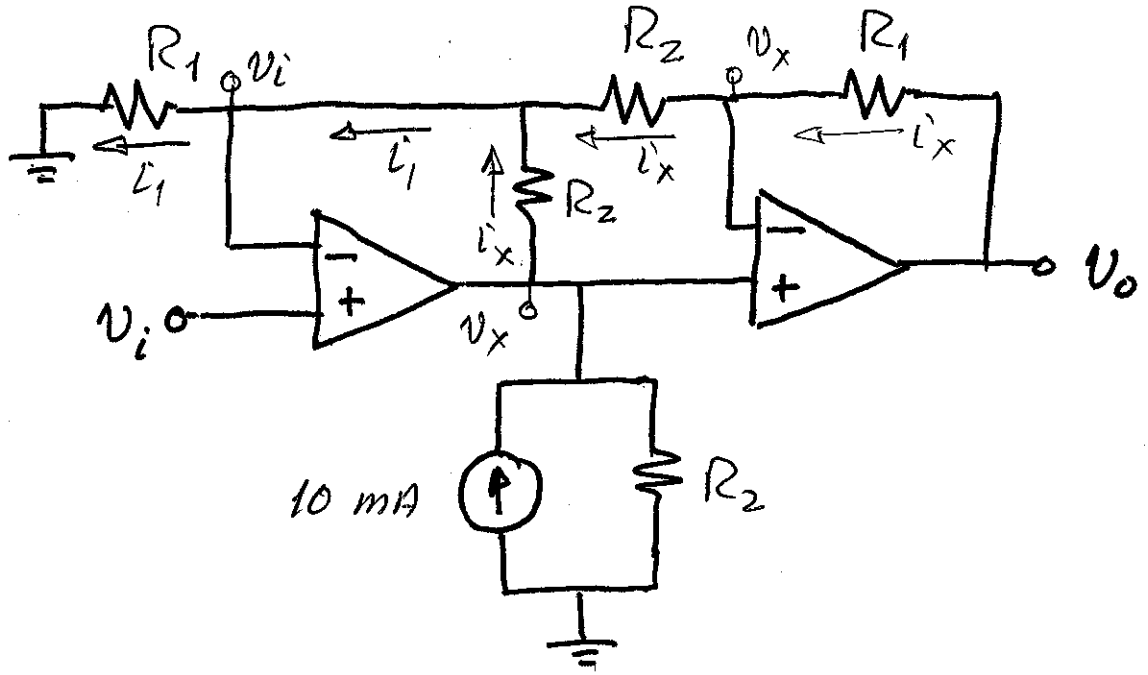
ECE 3455
Quiz #3
October 4, 2007

Quiz duration: 30 minutes

1. You may have one 8 ½ x 11 in. "crib" sheet, written on both sides, during the quiz. You may have any calculator you choose, but no computers. No other notes or materials will be allowed.
2. Show all work necessary to complete the problem on these pages. A solution without the work shown will receive no credit.
3. Show units in intermediate and final results, and in figures.
4. If your work is sloppy or difficult to follow, points will be subtracted.

_____/20

In the figure below, the op amps may be considered ideal. Find v_o if $R_2 = 3R_1$ and $v_i = 1.5\cos(\omega t)$ V.



Although it wasn't required, let's solve for arbitrary R_1, R_2 first. We have defined a few currents, as well as v_x. Since both op amps have negative feedback, we have made use of "virtual shorts" to label other places where v_i and v_x appear.

$$i_1 = \frac{v_i}{R_1} \qquad i_x = \frac{v_x - v_i}{R_2} \qquad \text{But } i_x = \frac{1}{2} i_1 \text{ (KCL)}$$

$$\Rightarrow i_x = \frac{v_i}{2R_1}$$

KVL: $v_x - v_i - i_x R_2 = 0$

$$\Rightarrow v_x = v_i + \frac{v_i}{2R_1} R_2 = v_i \left(1 + \frac{1}{2}\frac{R_2}{R_1}\right)$$

Room for Extra Work

KVL: $v_o - v_x - i_x R_1 = 0$

$$v_o = v_x + i_x R_1 = v_i\left(1 + \frac{1}{2}\frac{R_2}{R_1}\right) + \frac{v_i}{2}$$

$$\therefore \quad v_o = \frac{3}{2}v_i + \frac{1}{2}v_i\frac{R_2}{R_1}$$

So if $R_2 = 3R_1$, $\boxed{v_o = 3v_i}$

So $\underline{\underline{v_o(t) = 4.5\cos(\omega t) \text{ V}}}$