

ECE 3040 Microelectronic Circuits Quiz 10

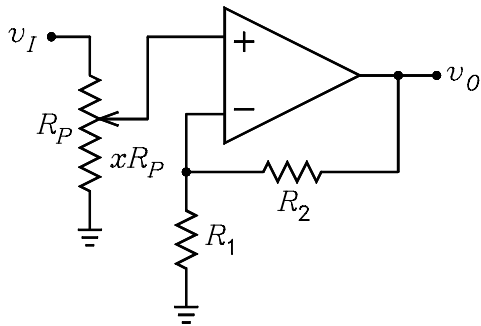
July 21, 2004

Professor Leach

Name _____

Instructions. Print your name in the space above. The quiz is closed-book and closed-notes. The quiz consists of one problem. **Honor Code Statement:** *I have neither given nor received help on this quiz.*
 Initials _____

- The potentiometer has a resistance $R_P = 100\text{ k}\Omega$. The resistance from the potentiometer wiper to ground is labeled xR_P , where $0 \leq x \leq 1$. The voltage gain is a maximum when $x = 1$. It is desired to have $v_O/v_I = 30$ when $x = 1$. When $v_O = 10\text{ V}$, the current through R_2 is $1/3\text{ mA}$.

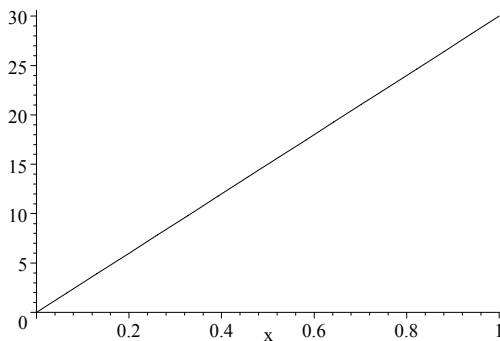


- (a) Solve for R_1 and R_2 .

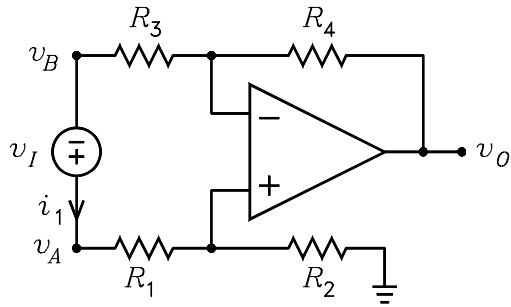
$$\begin{aligned}
 1 + \frac{R_2}{R_1} &= 30 \implies R_1 + R_2 = 30R_1 \\
 10 &= \frac{1}{3}(R_1 + R_2) = \frac{1}{3} \times 30R_1 \implies R_1 = 1\text{ k}\Omega \\
 R_2 &= 30R_1 - R_1 = 29R_1 = 29\text{ k}\Omega
 \end{aligned}$$

- (b) Plot the voltage gain v_O/v_I as a function of x for $0 \leq x \leq 1$. $y = 30x$

$$\frac{v_O}{v_I} = \frac{xR_P}{(1-x)R_P + xR_P} \times 30 = 30x$$



2. For $v_I = 8\text{ V}$, $R_1 = 1\text{ k}\Omega$, $R_2 = 2\text{ k}\Omega$, $R_3 = 3\text{ k}\Omega$, and $R_4 = 4\text{ k}\Omega$, solve for i_1 , v_A , v_B , and v_O .



$$\begin{aligned}
 i_1 &= \frac{v_I}{R_1 + R_3} = 2\text{ mA} & v_A &= i_1 (R_1 + R_2) = 6\text{ V} \\
 v_B &= v_A - v_I = -2\text{ V} & v_O &= i_1 (R_2 + R_4) = 12\text{ V}
 \end{aligned}$$