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EECS70A / CSE 70A Network Analysis I
Prof. Peter Burke

Homework # 4 solution

Chapter 5, Solution 1.

(a) R_{in} = **1.5 MΩ**
(b) R_{out} = **60 Ω**
(c) $A = 8x10^4$
Therefore $A_{dB} = 20 \log 8x10^4$ = **98.0 dB**

Chapter 5, Solution 9.

(a) Let v_a and v_b be respectively the voltages at the inverting and noninverting terminals of the op amp

$v_a = v_b = 4V$

At the inverting terminal,

$1mA = \frac{4 - v_0}{2k}$ $\quad v_0 = \mathbf{2V}$

(b) Since $v_a = v_b = 5V$,

$-v_b + 2 + v_o = 0$ $\quad v_o = v_b - 1 = \mathbf{3V}$

Chapter 5, Solution 17.

(a) $G = \frac{v_o}{v_i} = -\frac{R_2}{R_1} = -\frac{12}{10} =$ **-1.2**

(b) $\frac{v_o}{v_i} = -\frac{80}{10} =$ **-8**

(c) $\frac{v_o}{v_i} = -\frac{2000}{10} =$ **-200**

Chapter 5, Solution 34.

$$\frac{v_1 - v_{in}}{R_1} + \frac{v_1 - v_{in}}{R_2} = 0 \qquad (1)$$

but

$$v_a = \frac{R_3}{R_3 + R_4} v_o \qquad (2)$$

Combining (1) and (2),

$$v_1 - v_a + \frac{R_1}{R_2} v_2 - \frac{R_1}{R_2} v_a = 0$$

$$v_a\left(1 + \frac{R_1}{R_2}\right) = v_1 + \frac{R_1}{R_2} v_2$$

$$\frac{R_3 v_o}{R_3 + R_4}\left(1 + \frac{R_1}{R_2}\right) = v_1 + \frac{R_1}{R_2} v_2$$

$$v_o = \frac{R_3 + R_4}{R_3\left(1 + \frac{R_1}{R_2}\right)}\left(v_1 + \frac{R_1}{R_2} v_2\right)$$

$$\underline{v_O = \frac{R_3 + R_4}{R_3(R_1 + R_2)}(v_1 R_2 + v_2)}$$

Chapter 5, Solution 39.

This is a summing amplifier.

$$v_o = -\left(\frac{R_f}{R_1} v_1 + \frac{R_f}{R_2} v_2 + \frac{R_f}{R_3} v_3\right) = -\left(\frac{50}{10}(2) + \frac{50}{20} v_2 + \frac{50}{50}(-1)\right) = -9 - 2.5 v_2$$

Thus,

$$v_o = -16.5 = -9 - 2.5 v_2 \longrightarrow \underline{v_2 = 3\,\text{V}}$$