

HW 4 Errata

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Date: 1 August, 2006

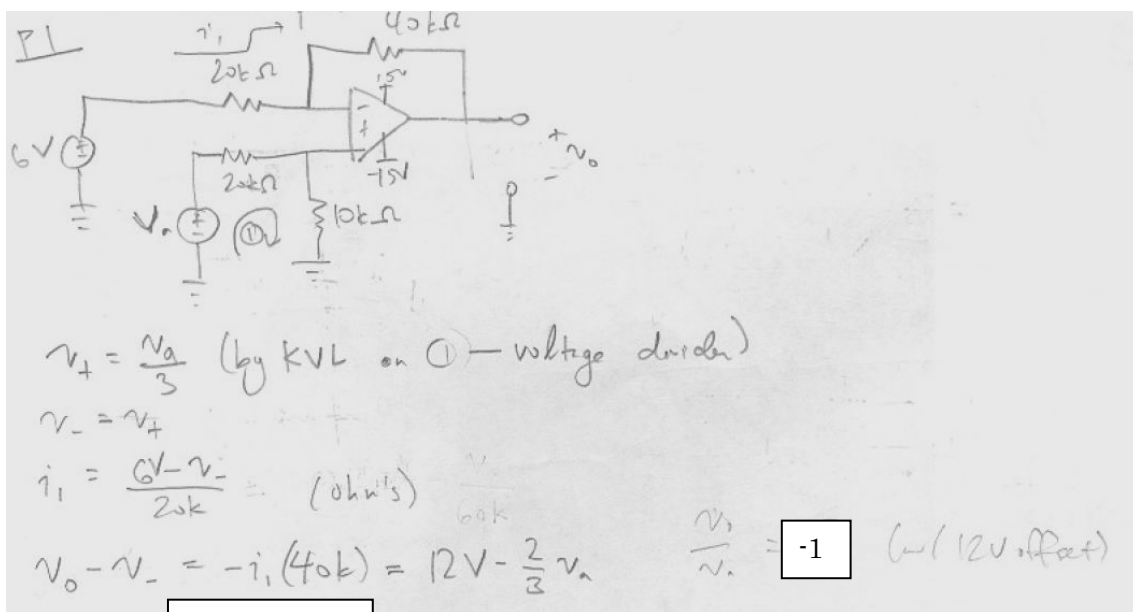
6.81a

P6.81

$$(a) H(f) = \frac{j\omega L + \frac{1}{j\omega C}}{j\omega L + \frac{1}{j\omega C} + R} = \frac{1 - \omega^2 LC}{1 - \omega^2 LC + j\omega RC}$$

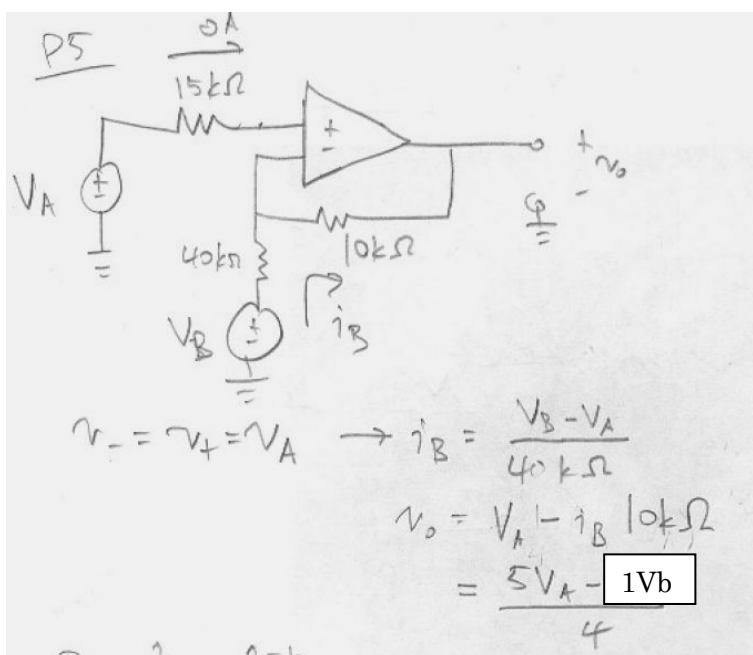
The rest are not needed for this part.

#1



$$V_o = 12V - V_a$$

#5



#7

P7. \therefore it's negative feedback
 \therefore assume the condition of summing-point constraint.
 $\therefore i = 0, V_N = V_P$
 find V_{oc}
 $\therefore V_B = V_C, V_N = V_P = V_{S1} = V_D$
 \therefore KCL @ C:

$$\frac{V_B}{R_1} + \frac{V_B - V_{S1}}{R_2} = 0 \Rightarrow V_B = -\frac{R_1}{R_1 + R_2} V_{S1}$$

 \therefore KCL @ D:

$$\frac{V_{S1} - 0}{R_2 + R_1} + \frac{V_{S1} + V_{S2} - V_A}{R_3} = 0 \Rightarrow V_A = \frac{R_3 + R_2 + R_1}{R_2 + R_1} V_{S1} + V_{S2}$$

$$V_A - V_B = V_{S2} + \frac{(R_2 + R_3)}{(R_1 + R_2)} V_{S1} = \frac{(R_1 + R_2) V_{S2} + (R_2 + R_3) V_{S1}}{(R_1 + R_2)}$$

 find I_{sc}
 KVL @ Loop CDEAF

$$I_{sc} \cdot R_1 + i_3 \cdot R_2 - V_{S2} + i_3 R_3 = 0$$

 \therefore KCL @ C:

$$i_3 = I_{sc} + i_4 = I_{sc} + \frac{-V_C}{R_1} = \frac{V_C - V_{S1}}{R_2} \Rightarrow V_C = \frac{R_1(R_2 I_{sc} + V_{S1})}{R_1 + R_2}$$

$$\therefore i_3 = I_{sc} - \frac{R_2 I_{sc} + V_{S1}}{R_1 + R_2}$$

$$\therefore I_{sc} \cdot R_1 + I_{sc} \cdot R_2 - \left(\frac{R_2 I_{sc} + V_{S1}}{R_1 + R_2} \right) \cdot R_2 - V_{S2} + I_{sc} R_3 - \left(\frac{R_2 I_{sc} + V_{S1}}{R_1 + R_2} \right) \cdot R_3 = 0$$

$$\therefore I_{sc} = \frac{(R_2 + R_3) V_{S1} + (R_1 + R_2) V_{S2}}{R_1(R_1 + 2R_2 + R_3)}$$

$$\therefore R_{th} = \frac{V_{oc}}{I_{sc}} = \frac{R_1(R_1 + 2R_2 + R_3)}{R_1 + R_2}$$

This solution for #7 was written by a student who didn't write any name on the HW. Thanks (whoever) for this beautiful solution. I am shamelessly stealing your solution because my solution is just a mess. =)

-Bill Hung