Problem 1.4

Consider the circuit of Fig. P1.4.

(a) Determine v_{out} and node voltage V_x.

(b) What is the apparent circuit function?

(c) What circuit modifications (if any) lead to a better design?

mark diagram

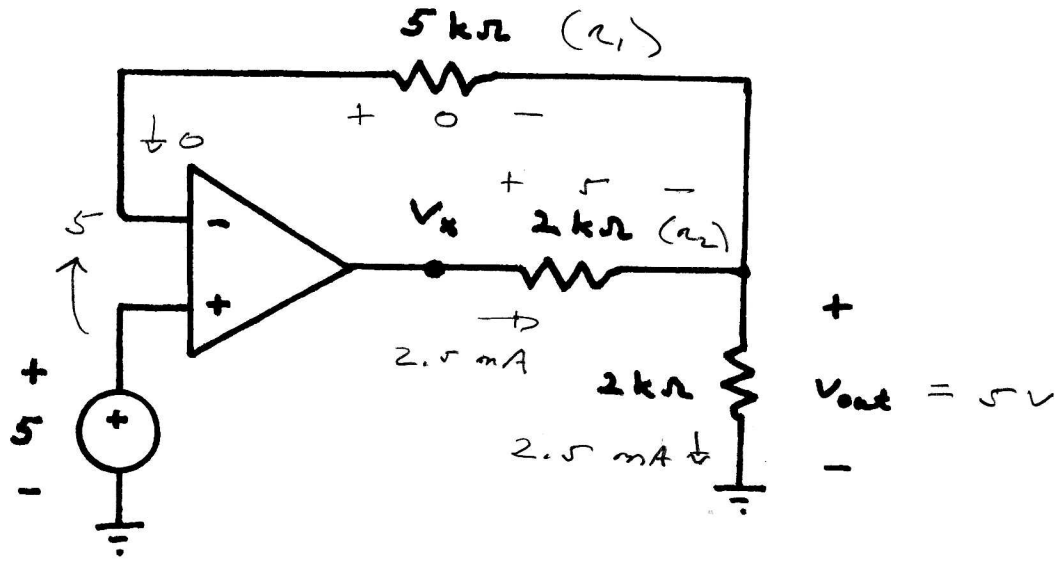

Figure P1.4

$V_x = 5 + 5 = 10$

b) unity-gain buffer, $v_{out} = v_{in}$

no current drawn from input source

c) Eliminate R_1 and R_2 → short

mark diagram

Problem 1.8

Determine node voltages V_a and V_b in the circuit of Fig. P1.8.

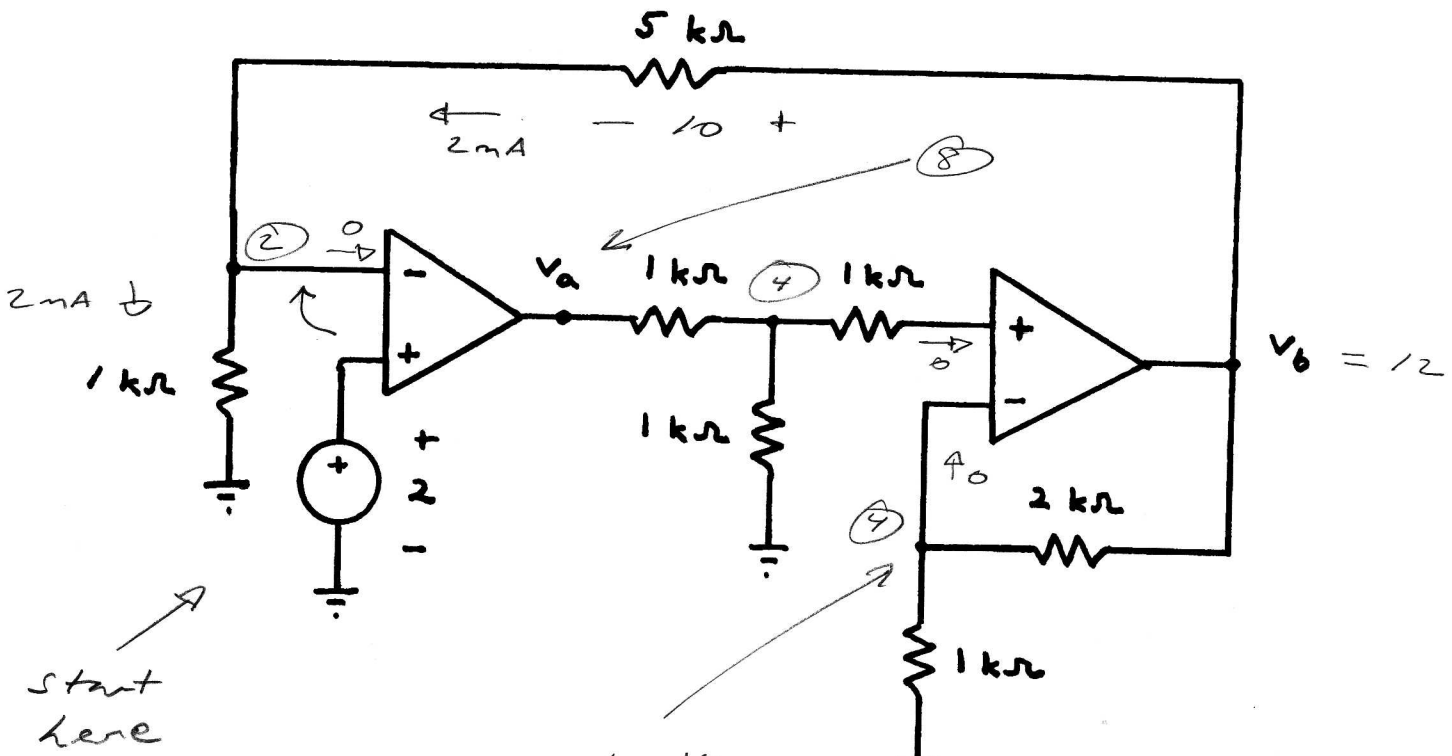

Figure P1.8

$12\left(\frac{1k}{1k+2k}\right) = 4$

non-inverting amplifier

gain $= \left(1+\frac{2k}{1k}\right) = 3$

c.) continued

$i_{out}(R+R_3) = a\,i_{out}R - bV_1$

$i_{out} = \dfrac{-bV_1}{(1-a)R+R_3}$

Problem 1.20

Consider the circuit of Fig. P1.20.

(a) Determine node voltages v_a and v_b in terms of node voltage v_x.

(b) Determine voltage v' and the output current i_{out}.

(c) Show the separate consequences of mismatched R_1 and R_2 resistors.

no R dependence (current source) if $a = 1$

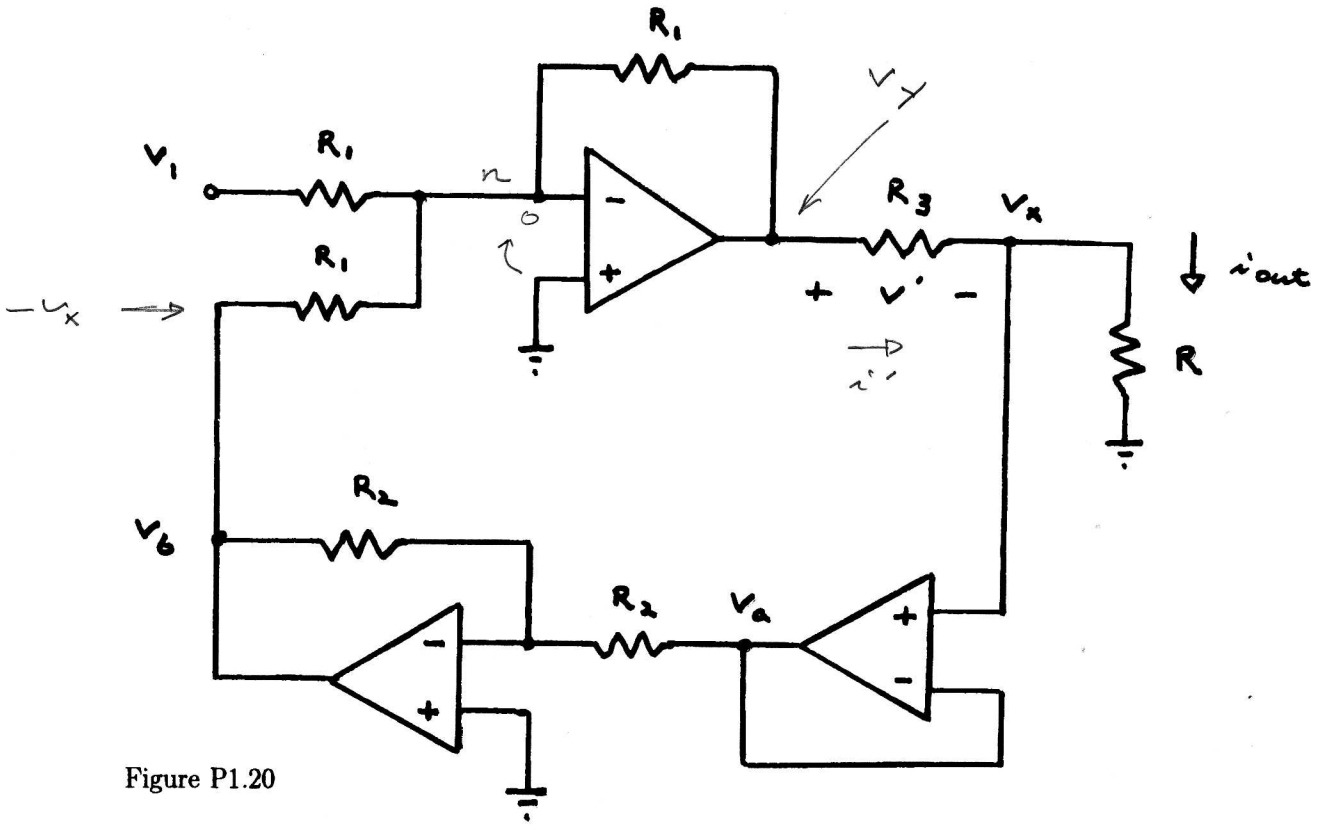

Figure P1.20

a)

$v_b = -v_a = -v_x \qquad v_a = v_x$

b) At node n, $\dfrac{v_1}{R_1} + \dfrac{-v_x}{R_1} + \dfrac{v_y}{R_1} = 0 \longrightarrow v_y = v_x - v_1$

$v' = v_y - v_x = -v_1 \longrightarrow i' = i_{out} = \dfrac{-v_1}{R_3}$

(voltage controlled current source)

c) R_1 or R_2 mismatch $\longrightarrow$ $v_y = av_x - bv_1$ (see top)

$a \neq 1, \; b \neq 1$