Problem 1.4

Consider the circuit of Fig. P1.4.

(a) Determine \( v_{\text{out}} \) and node voltage \( V_z \).
(b) What is the apparent circuit function?
(c) What circuit modifications (if any) lead to a better design?

\[
V_X = 5 + 5 = 10
\]

b) unity-gain buffer, \( v_{\text{out}} = v_{\text{in}} \)
no current drawn from input source

c) Eliminate \( r_1 \) and \( r_2 \) \( \rightarrow \) shorts
Problem 1.8

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

![Circuit Diagram]

$V_b = 12$

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

non-inverting amplifier

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

\[ i_{out} = \frac{-bu_i}{(1-a)(R + R_3)} \]

\[ i_{out} = v' \]

\[ v' = v_x - v'_x = -v_i \]

\[ v = a_v x - b v_i \]

\[ a \neq 1, \ b \neq 1 \]