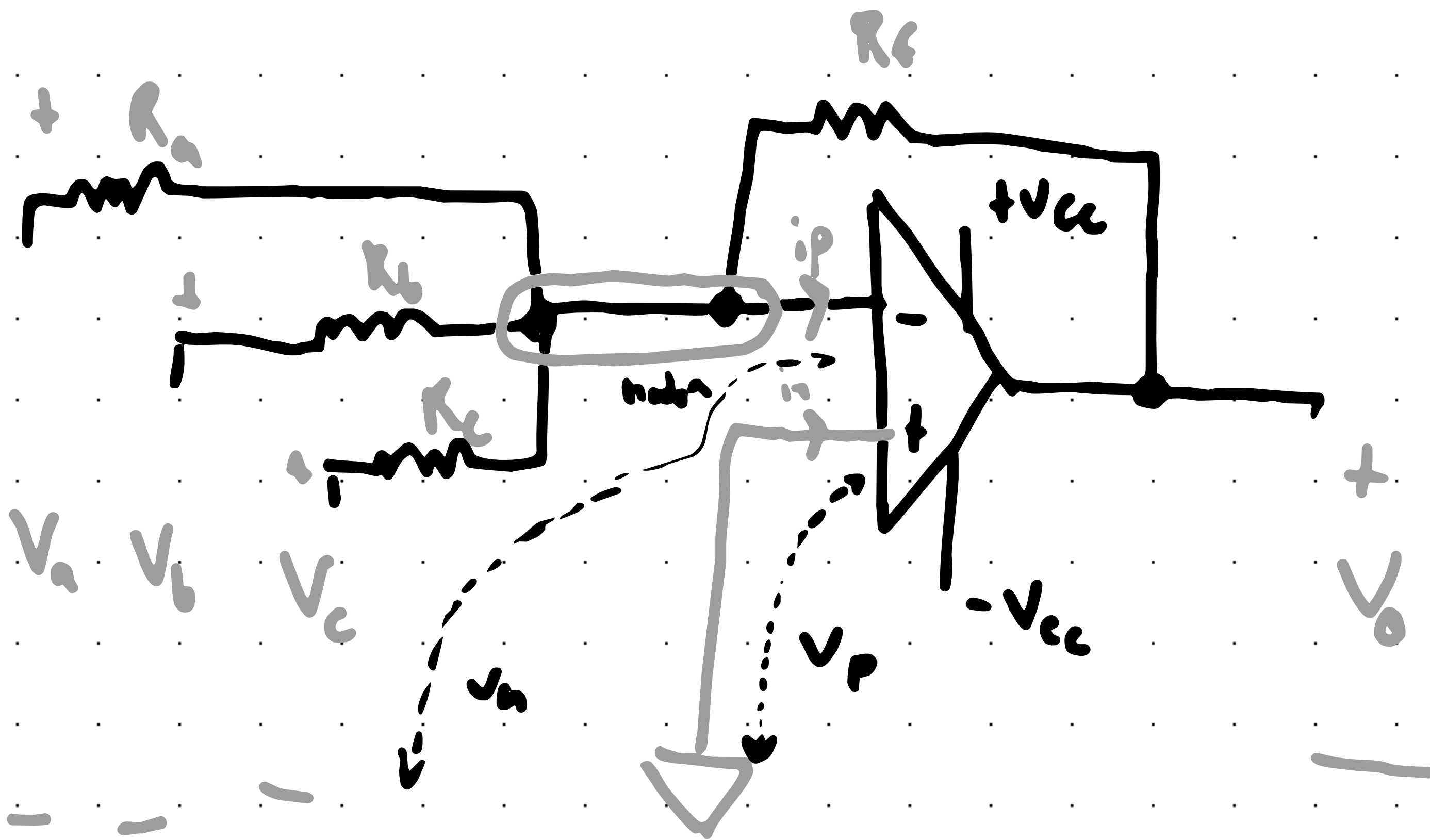
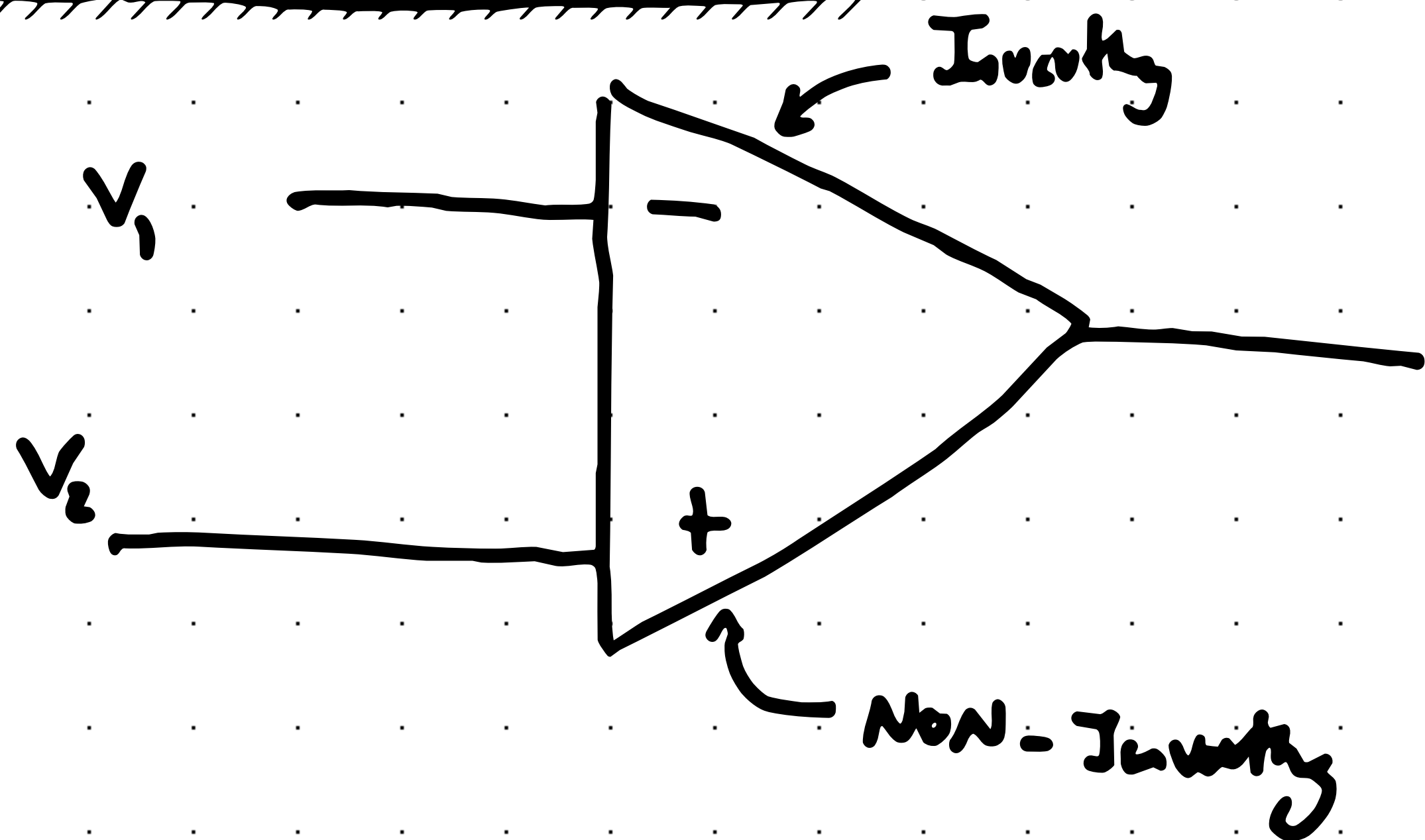


The Summing Amplifier Circuit



$$I_p = I_n = 0, \quad V_p = V_n$$

$$\sum I = 0 \quad \frac{V_i - V_a}{R_a} + \frac{V_i - V_b}{R_b} + \frac{V_i - V_c}{R_c} + \frac{V_i - V_o}{R_f}$$

$$i_{in} = 0$$

$$V_o = - \left[\frac{R_f}{R_a} V_a + \frac{R_f}{R_b} V_b + \frac{R_f}{R_c} V_c \right]$$

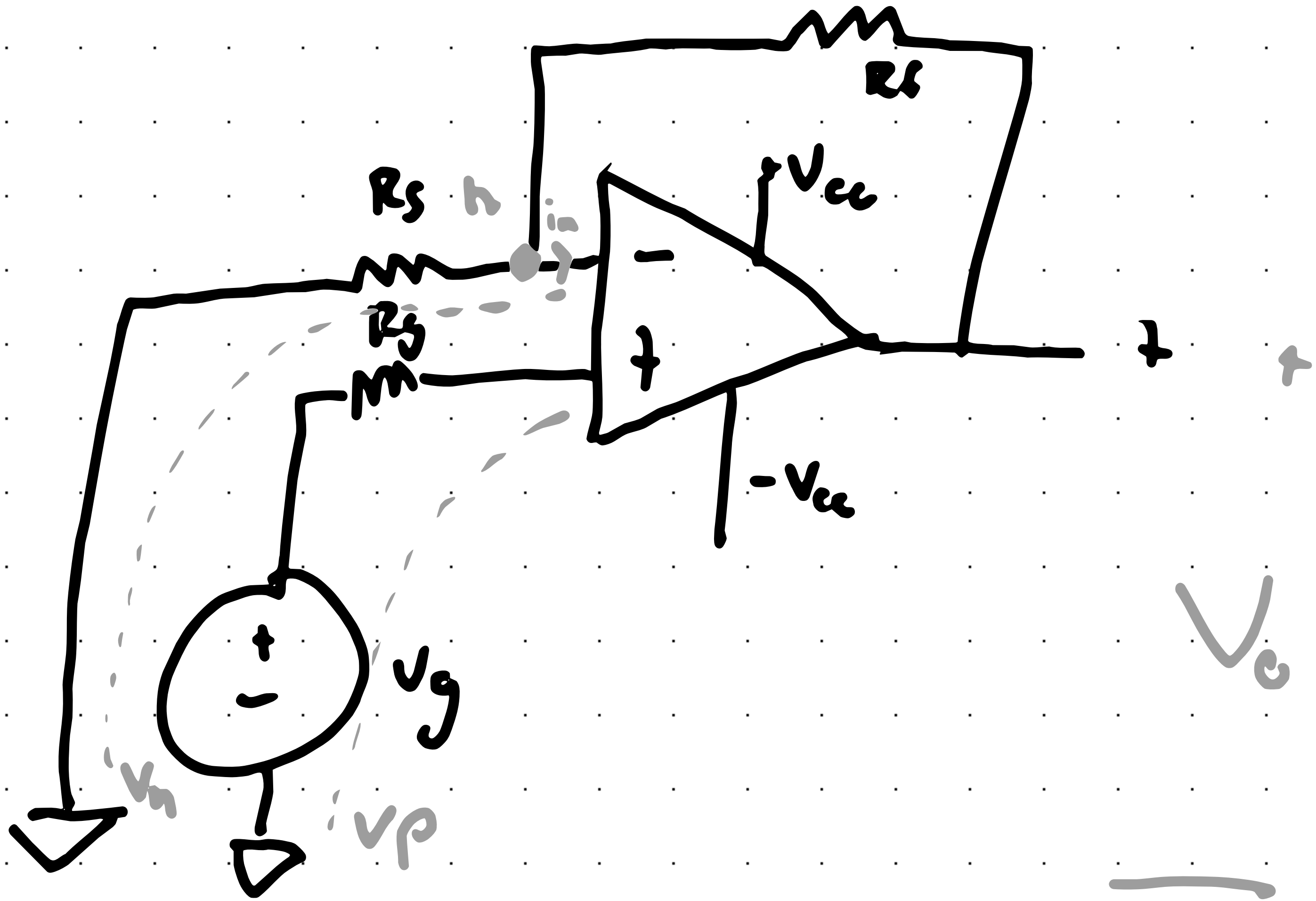
$$\text{If } R_a = R_b = R_c = R_s$$

$$V_o = - \left[\frac{R_f}{R_s} V_a + \frac{R_f}{R_s} V_b + \frac{R_f}{R_s} V_c \right]$$

$$V_o = - \left[\frac{R_f}{R_s} (V_a + V_b + V_c) \right]$$

Summing Inverting OPAMP

Non-Inverting Amplifier Circuit



$$I_p = I_n = 0$$

$$v_n = v_p$$

Since $v_p = v_g$, then

$$v_n = v_g$$

$$\sum I = 0 \quad \text{KCL at } v_n$$

$$\frac{v_n - 0}{R_s} + \frac{v_n - v_o}{R_f} + i_n = 0$$

$$\frac{v_g}{R_s} + \frac{v_n}{R_f} = 0$$

$$\frac{V_g}{R_s} + \frac{V_g}{R_f} - \frac{V_o}{R_f} = 0$$

$$\frac{V_o}{R_f} = V_g \left[\frac{1}{R_s} + \frac{1}{R_f} \right]$$

$$V_o = V_g \left[\frac{R_f}{R_s} + \frac{R_f}{R_f} \right]$$

$$V_o = V_g \left[\frac{R_f}{R_s} + 1 \right]$$

$$V_o = V_g \left[\frac{R_f + R_s}{R_s} \right]$$

Non-Inverting op-Amp

