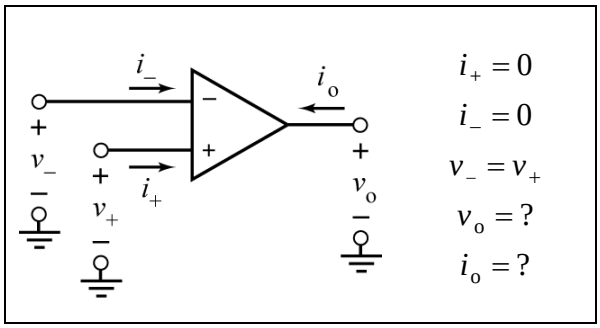
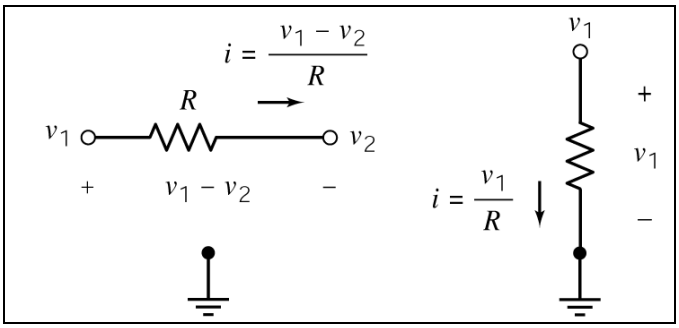




P1

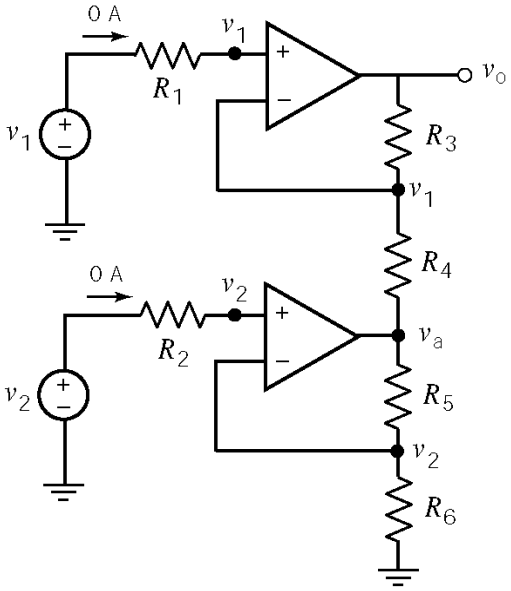
Node equations:

$$\frac{v_a - v_2}{R_5} = \frac{v_2}{R_6} \quad \Rightarrow \quad v_a = \left(\frac{R_5 + R_6}{R_6}\right) v_2$$

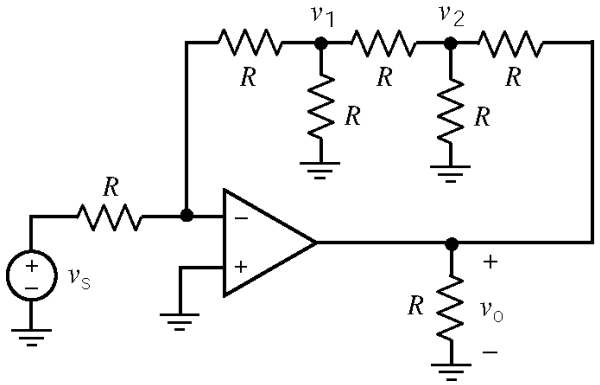
$$\frac{v_o - v_1}{R_3} = \frac{v_1 - v_a}{R_4} \quad \Rightarrow \quad v_o = \left(1 + \frac{R_3}{R_4}\right) v_1 - \left(\frac{R_3}{R_4}\right) v_a$$

Substituting for v_a gives

$$v_o = \left(1 + \frac{R_3}{R_4}\right) v_1 - \left(\frac{R_3}{R_4}\right)\left(\frac{R_5 + R_6}{R_6}\right) v_2$$



P2



Writing node equations:

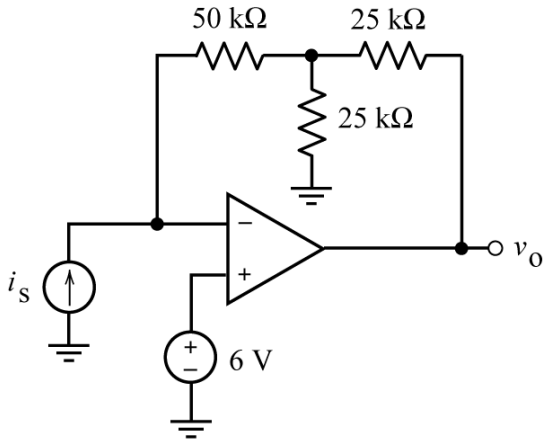
$$\frac{v_s}{R} + \frac{v_1}{R} = 0 \quad \Rightarrow \quad v_1 = -v_s$$

$$\frac{v_1}{R} + \frac{v_1}{R} + \frac{v_1 - v_2}{R} = 0 \quad \Rightarrow \quad v_2 = 3v_1 = -3v_s$$

$$\frac{v_2 - v_1}{R} + \frac{v_2}{R} + \frac{v_2 - v_o}{R} = 0 \quad \Rightarrow \quad v_o = 3v_2 - v_1 = -8v_s$$

P3

The input to this circuit is the voltage source voltage v_s. The output is the node voltage v_o. The output is related to the input by the equation $v_o = m\, i_s + b$ where *m* and *b* are constants. Determine the values of *m* and *b*.



P4

The values of the node voltages v_1, v_2 and v_o in this circuit are $v_1 = 6.25$ V, $v_2 = 3.75$ V and $v_o = -15$ V. Determine the value of the resistances R_1, R_2 and R_3: