

Solutions

P3. Label the node voltages as shown. Apply KCL at the inverting input node of the op amp to get

$$i_s = \frac{6 - v_a}{50000} = 0 \Rightarrow v_a = 6 - (50 \times 10^3) i_s$$

Apply KCL at the top node of the 25 kΩ resistor to get

$$i_s + \frac{v_o - v_a}{25000} = \frac{v_a}{25000}$$

Solving:

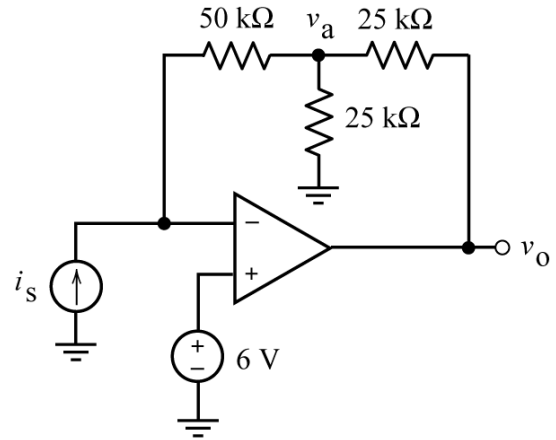
$$(25 \times 10^3) i_s - 2v_a + v_o = 0$$

$$(25 \times 10^3) i_s - 2(6 - (50 \times 10^3) i_s) + v_o = 0$$

$$(125 \times 10^3) i_s - 12 + v_o = 0$$

$$v_o = -(125 \times 10^3) i_s + 12$$

Comparing this equation to $v_o = m i_s + b$, we get $m = -(125 \times 10^3) \text{ V/A}$ and $b = 12 \text{ V}$.



P4 Label the node voltages as shown. Using units of Volts, kΩ and mAmps, the node equations are:

$$\frac{2.5}{20} = \frac{v_1 - 2.5}{R_1}$$

$$\frac{v_1 - v_2}{20} = \frac{v_2}{R_2}$$

and

$$\frac{v_2 - 0}{R_3} + \frac{v_o - 0}{20} = 0$$

Using $v_1 = 6.25 \text{ V}$ gives

$$\frac{2.5}{20} = \frac{6.25 - 2.5}{R_1} \Rightarrow R_1 = 30 \text{ k}\Omega$$

Using $v_1 = 6.25 \text{ V}$ and $v_2 = 3.75 \text{ V}$ gives

$$\frac{6.25 - 3.75}{20} = \frac{3.75}{R_2} \Rightarrow R_2 = 30 \text{ k}\Omega$$

Using $v_2 = 3.75 \text{ V}$ and $v_o = -15 \text{ V}$ gives

$$\frac{3.75 - 0}{R_3} + \frac{-15 - 0}{20} = 0 \Rightarrow R_3 = 5 \text{ k}\Omega$$

