Example 5 Op-Amp

$$v_a = -\frac{R_2}{R_1} v_2$$

$$v_o = -\frac{R_4}{R_1} v_1 - \frac{R_4}{R_3} v_a =$$

$$= -\frac{R_4}{R_1} v_1 + \frac{R_4}{R_3}\frac{R_2}{R_1} v_2 =$$

$$= -5 v_1 + 3 v_2$$

$$-\frac{R_4}{R_1} = -5 \Rightarrow R_4 = 5R_1 = 50\,K\Omega$$

$$\frac{R_4}{R_3}\frac{R_2}{R_1} = 3 \Rightarrow R_2 = 3\frac{R_3 R_1}{R_4} = 6\,K\Omega$$

Example 6 Op-Amp

$$G_1 = 1 + \frac{12}{3} = 5$$

$$G_2 = 1 + \frac{10}{4} = 3.5$$

$$v_o = G_1 G_2 v_{in} = 5 \times 3.5 \times (20mV) = 350mV$$

$$i_o = \frac{v_o}{14K\Omega} = \frac{350mV}{14K\Omega} = 25\mu A$$

Example 7 Op-Amp

$$G_1 = -\frac{6}{2} = -3 \qquad G_{31} = -\frac{10}{5} = -2$$

$$G_2 = -\frac{8}{4} = -2 \qquad G_{32} = -\frac{10}{15} = -\frac{2}{3}$$

$$v_o = G_1 G_{31} v_1 + G_2 G_{32} v_2 =$$

$$= (-3)(-2)(1V) + (-2)\left(-\frac{2}{3}\right)(2V) =$$

$$= 6V + \frac{8}{3}V = 8.667V$$