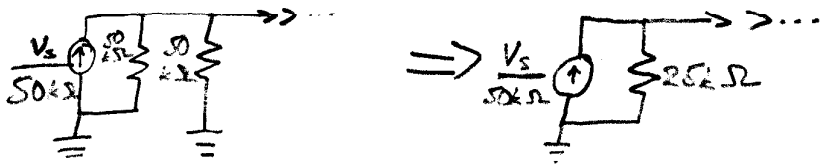
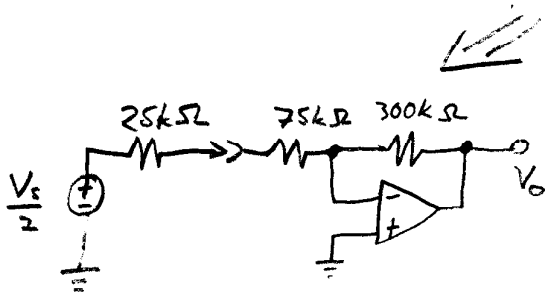
1 & 2
4-21) first, reduce circuit:





with 25kΩ and 75kΩ in series (100kΩ),

Inverter:

$$V_o = K\frac{V_s}{2}$$

$$K = -\frac{300k\Omega}{100k\Omega}$$

$$= -3$$

$$\boxed{V_o = -\frac{3}{2}V_s}$$

3
4-27) since no current into positive terminal, can treat $V_{s1} - V_{s2}$ as voltage divider

$$V_p = V_{s2} + V_{R_2}$$

$$= V_{s2} + (V_{s1} - V_{s2})\frac{R_2}{R_1+R_2}$$

$$= V_{s2}\left(\frac{R_1+R_2}{R_1+R_2} - \frac{R_2}{R_1+R_2}\right) + V_{s1}\left(\frac{R_2}{R_1+R_2}\right)$$

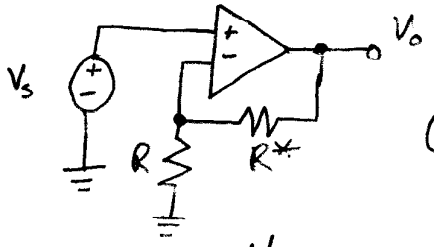
$$= \frac{V_{s1}R_2 + V_{s2}R_1}{R_1+R_2} = V_N$$

again, along top:

$$V_N = V_o \cdot \frac{R_3}{R_3+R_4}$$

$$V_o = \boxed{\frac{R_3+R_4}{R_3}\left(\frac{V_{s1}R_2 + V_{s2}R_1}{R_1+R_2}\right)}$$

4-29) redraw:



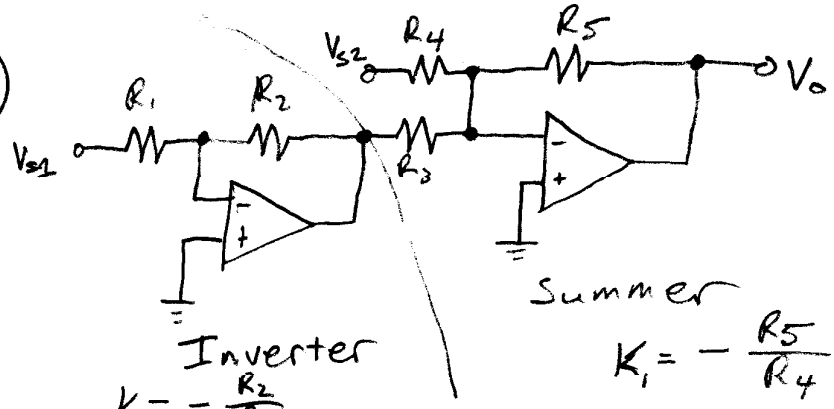
$0 \le R^* \le R$

Noninverter:

gain $\rightarrow K = \frac{R^* + R}{R}$

$$\boxed{1 \le K \le 2}$$

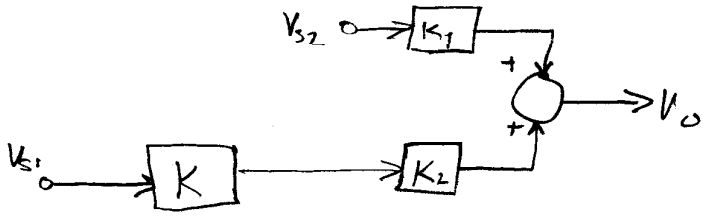
4-30) 5



$K = -\frac{R_2}{R_1}$

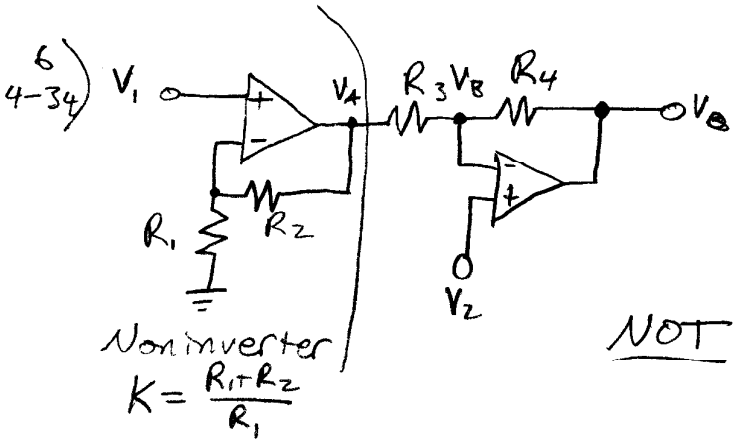
$K_1 = -\frac{R_5}{R_4}$

$K_2 = -\frac{R_5}{R_3}$



$$\boxed{V_o = \frac{R_2 R_5}{R_1 R_3} V_{s1} - \frac{R_5}{R_4} V_{s2}}$$

6
4-34)



Noninverter

$K = \frac{R_1+R_2}{R_1}$

NOT an Inverter

$$V_A = \frac{R_1+R_2}{R_1} V_1 \qquad V_B = V_2$$

Voltage division:

$$V_B - V_A = (V_o - V_A)\left(\frac{R_3}{R_3+R_4}\right)$$

$$V_B - V_A = V_o\left(\frac{R_3}{R_3+R_4}\right) - V_A\left(\frac{R_3}{R_3+R_4}\right)$$

$$V_B + V_A\left(\frac{R_3}{R_3+R_4} - \frac{(R_3+R_4)}{R_3+R_4}\right) = V_o \frac{R_3}{R_3+R_4}$$

$$V_B - V_A \frac{R_4}{R_3+R_4} = V_o \frac{R_3}{R_3+R_4}$$

$$V_o = V_B \frac{R_3+R_4}{R_3} - V_A \frac{R_4}{R_3}$$

$$\boxed{V_o = V_2 \frac{R_3+R_4}{R_3} - V_1 \frac{R_1+R_2}{R_1} \frac{R_4}{R_3}}$$