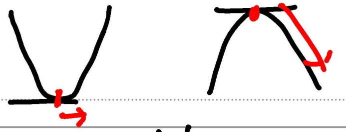
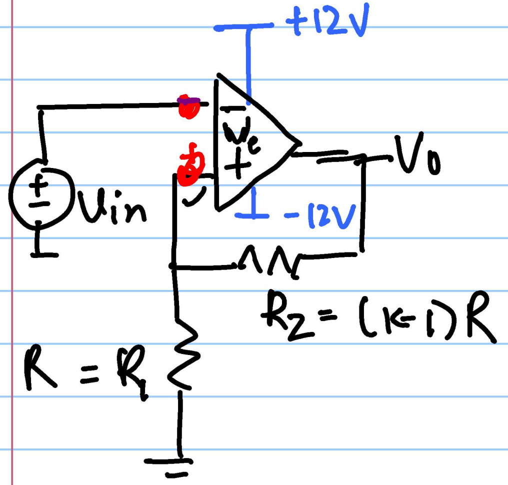
Lecture #9

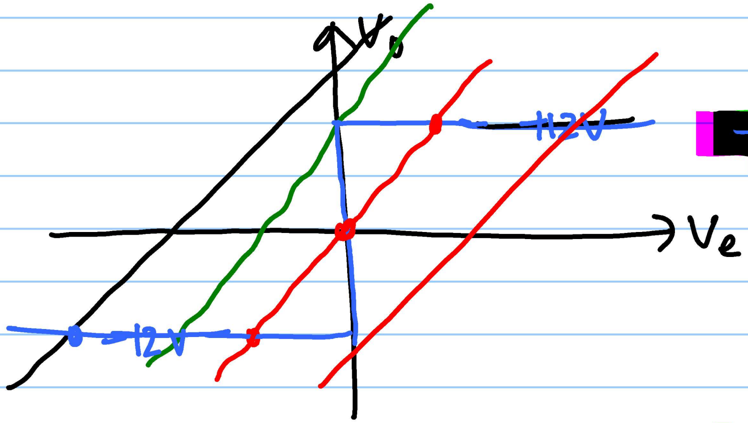
$\frac{dy}{dx} = 0$

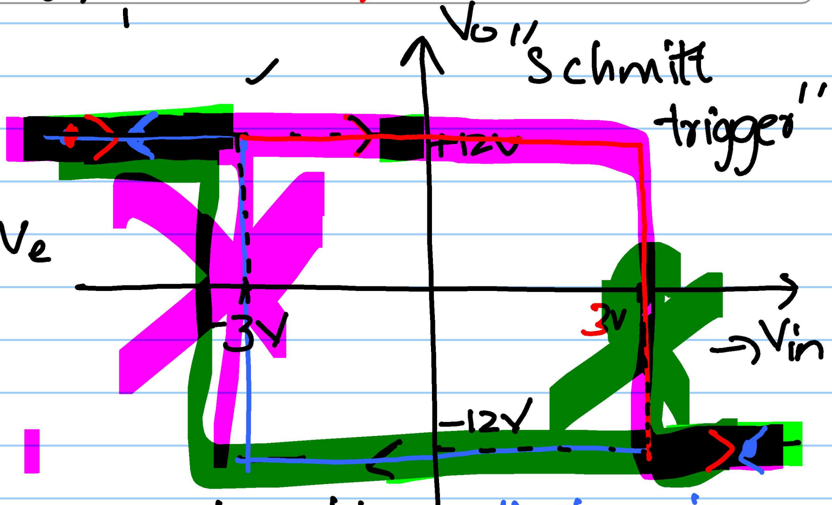




$R_2 = (k-1)R$

$R = R_1$





"Schmitt trigger"

inverting- Hysteresis

$V_e = \frac{V_0}{K} - V_{in}$ ✓

$V_0 = A_o v_e$ where $A_0 \to \infty$

$V_{in} = 0 \Rightarrow V_e = \frac{V_0}{K}$

$V_{in} = +$

$V_{in} > 3V \Rightarrow V_0 = -12V$

$V_{in} < -3V, \Rightarrow V_0 = +12V$

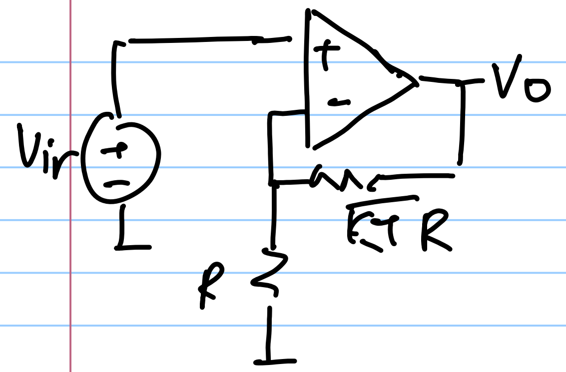
$V_e = \frac{V_0}{K} - V_{in}$

if $V_{in} \gg 3V \Rightarrow V_0 = -12V$

$V_e = \frac{-12}{4} - V_{in} = -3 - V_{in}$ ✓

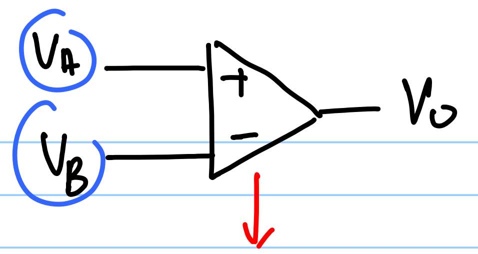
$V_{in} \ll -3V$

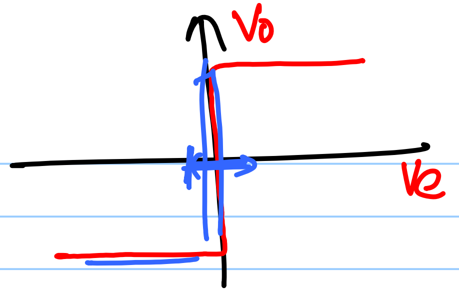
$V_e = \frac{12}{4} - V_{in}$

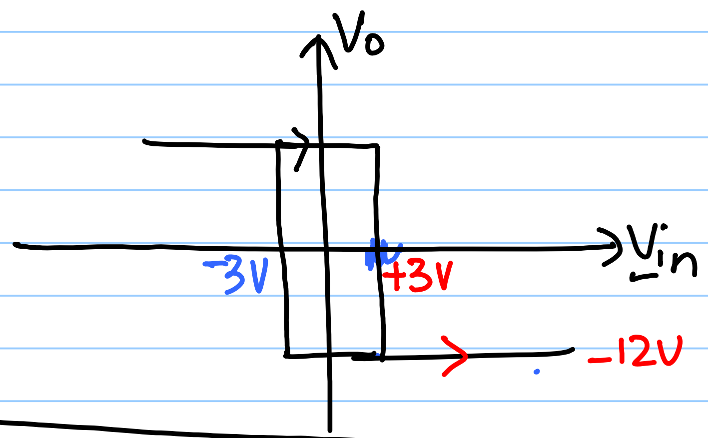


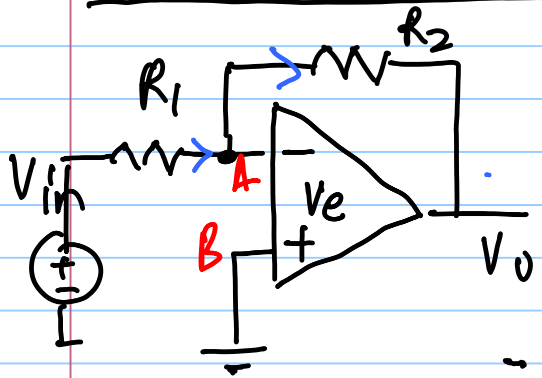
$\frac{V_o}{V_{in}} = k(1+w)$

non-inverting amplifier









$V_e = 0$

$V_A = 0$

$\frac{V_{in}}{R_1} = \frac{-V_o}{R_2}$

$\frac{V_o}{V_{in}} = \frac{-R_2}{R_1}$

$(-ne)$

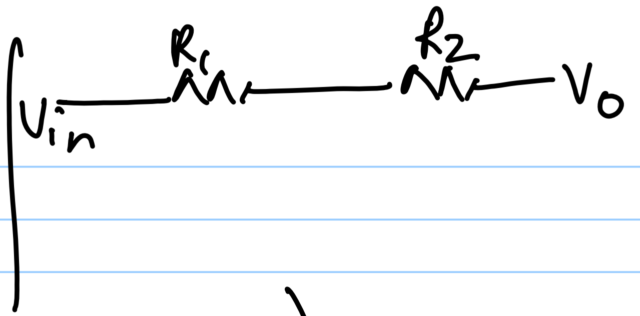
inverting amplifier

$V_e = 0 - \frac{R_1}{R_1+R_2} V_o + \alpha V_{in}$

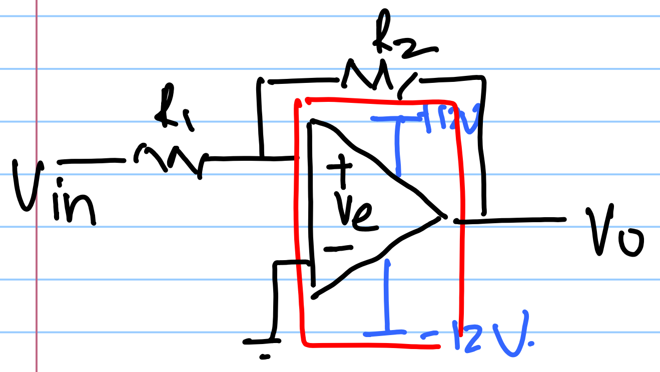
$V_e =$

-ne

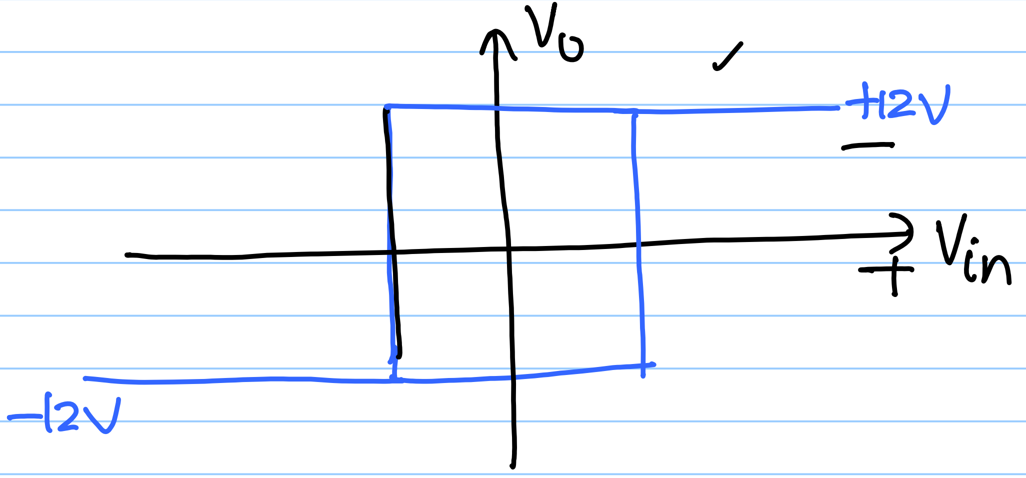
$$V_e = 0 - \frac{R_1}{R_1+R_2} V_o - V_{in} \frac{R_2}{R_1+R_2}$$



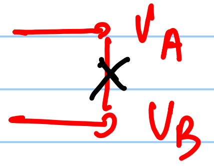
$$V_e = V_B - V_A = 0 - \left(\frac{R_1}{R_1+R_2} V_o + \frac{R_2}{R_1+R_2} V_{in} \right)$$



$$V_e = \underbrace{\frac{R_1}{R_1+R_2}}_{>0} V_o$$

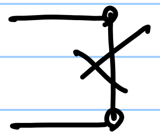


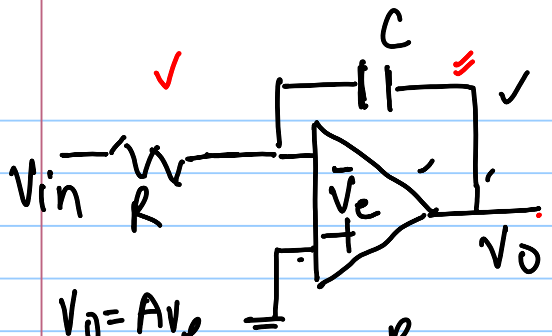
non-inverting hysteresis



$V_A = V_B$

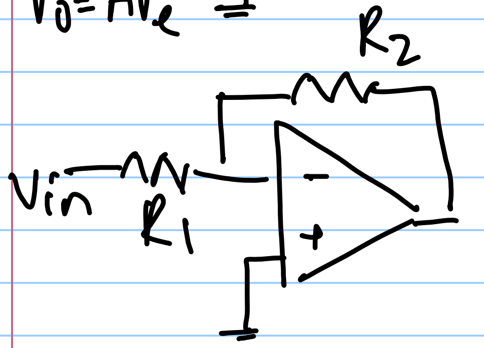
virtually short





$V_0 = AV_e$

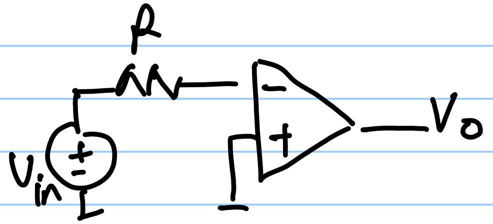
$$\frac{V_o}{V_{in}} = -\frac{(1/sC)}{R_1} = \cancel{\frac{-1}{sCR_1}}$$

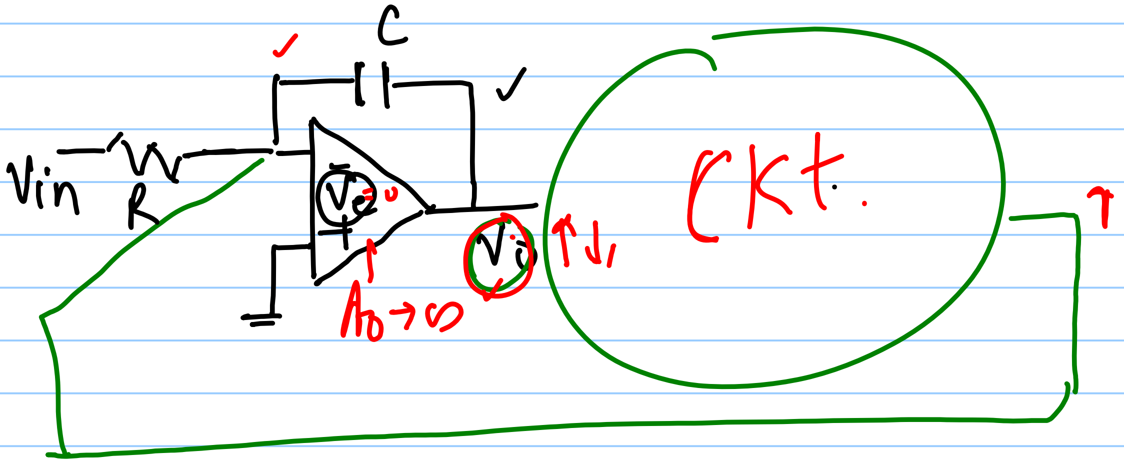


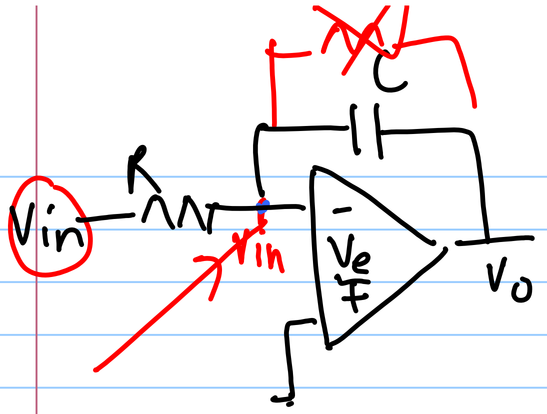
$$\frac{V_0}{V_{in}} = -\frac{R_2}{R_1}$$

$V_e = \beta V_o$

$\beta < 0$

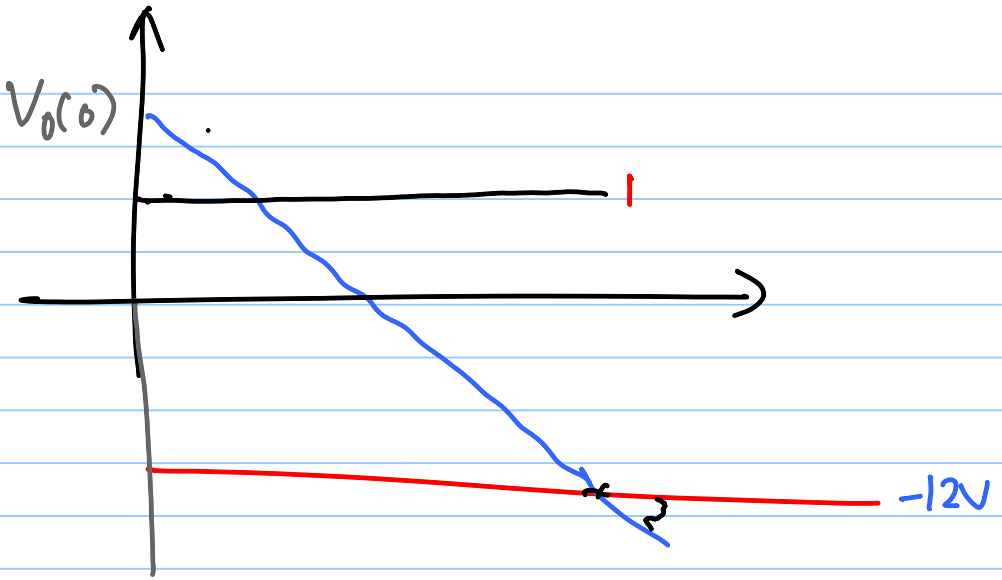


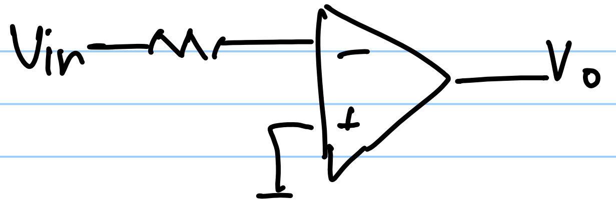




$$\frac{V_{in}}{R} = -C\frac{dV_o}{dt}$$

$$\frac{dV_o}{dt} = \frac{-1}{RC} V_{in}$$





Under approx. that dc negative feedback exists around integrator

$V_e = 0 \Rightarrow \frac{dV_o}{dt} : \frac{-1}{RC} V_{in}$

$$\frac{V_o(s)}{V_{in}(s)} = \frac{-1}{RCs}$$