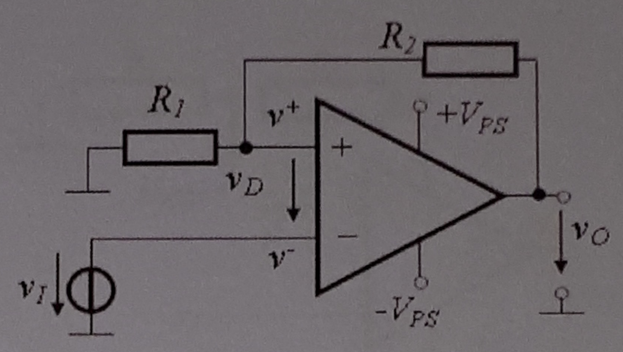
Homework 5 – Hysteresis comparators

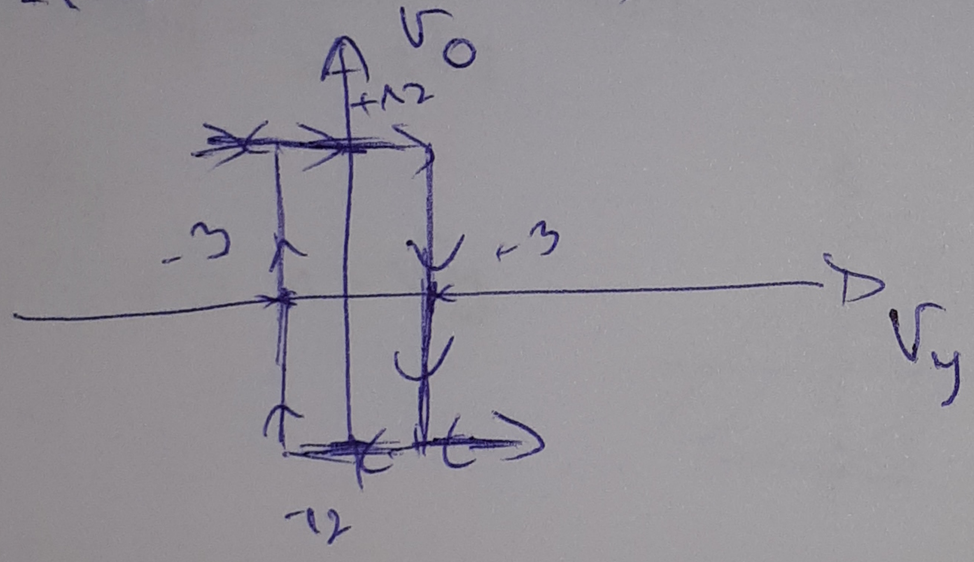


$R_1 = 3k\Omega$, $R_2 = 9k\Omega$, $V_{PS} = \pm 12$ V.

a) Deduce and plot VTC $v_O(v_I)$. What is the application of the circuit?
b) Compute the width of the hysteresis, ΔV_{Th}.
c) Plot $v_O(t)$ for $v_I(t) = 8\sin 1000t$ [V], then for $v_I(t) = 2\sin 1000t$ [V].
d) Modify the circuit so that $\Delta V_{Th} = 10$ V.

a) $V^+ = \frac{R_1}{R_1+R_2} \cdot V_O$; $V^- = V_y$, $V_{Th} = V_y \Big|_{V_I=0} \Rightarrow V_{Th,H} = \frac{R_1}{R_1+R_2} \cdot V_{OH} = +3V$

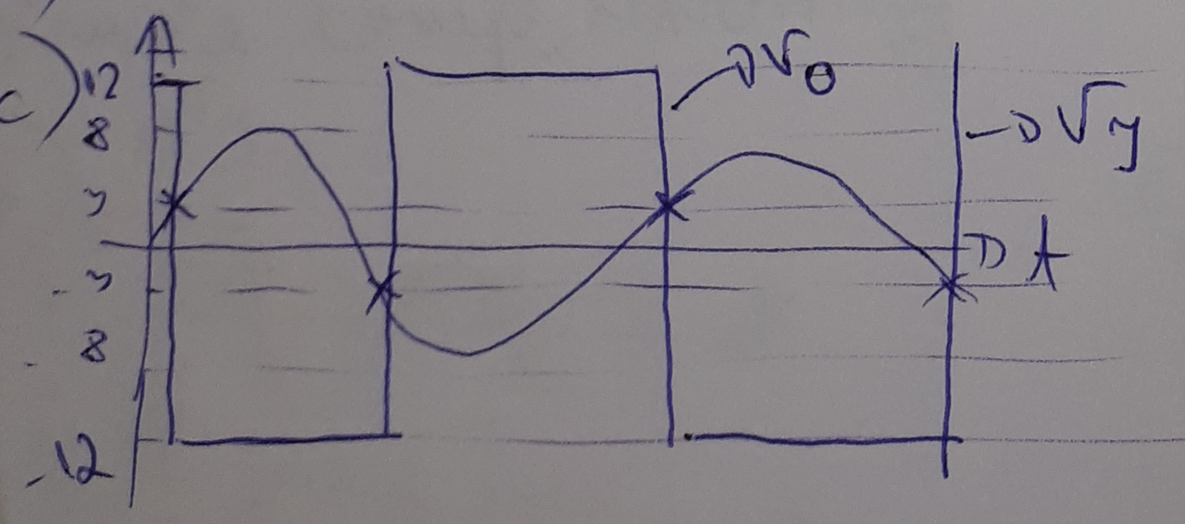
$V_{Th,L} = \frac{R_1}{R_1+R_2} \cdot V_{OL} = -3V$



inverting hysteresis comparator

b) $\Delta V_{Th} = V_{Th,H} - V_{Th,L} = 6V$

c)



$V_y = 2\sin 1000t$ is inside the hysteresis so V_O is either $+12V(dc)$ or $-12V(dc)$ Either result is valid.

d) $\Delta V_{Th} = \frac{R_1}{R_1+R_2}(V_{OH} - V_{OL}) = 10$

If $V_{OH} = 12$, $V_{OL} = -12 \Rightarrow \frac{R_1}{R_1+R_2} = \frac{10}{24}$, $R_1 = 10k$, $R_2 = 14k$