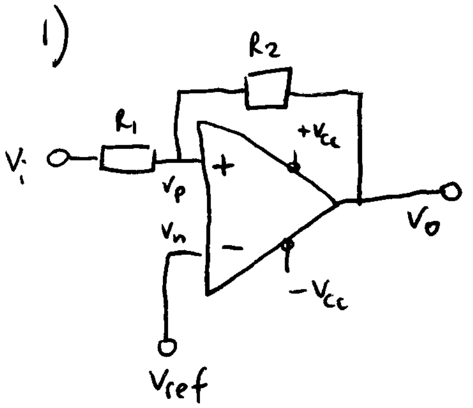
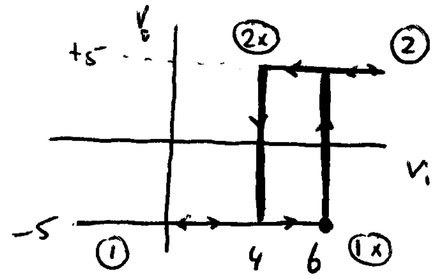
Electrónica III F.P. 7

1)





$-V_{cc} = -5\ V$

$+V_{cc} = +5\ V$

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1 → 1x $\quad V_o = -V_{cc} = -5\ V$

$V_n = V_{ref}$

$$V_p = \frac{R_1}{R_1+R_2} \cdot V_o + \frac{R_2}{R_1+R_2} \cdot V_i$$

em 1x :

$$V_p = \frac{R_1}{R_1+R_2}(-5) + \frac{R_2}{R_1+R_2} \cdot (6)$$

e tambem (aqui!) $V_n = V_p$

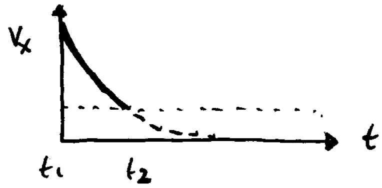
I : $$V_{ref} = \frac{R_1}{R_1+R_2}(-5) + \frac{R_2}{R_1+R_2}(6)$$

2 → 2x : $V_o = +5\ V$, $V_n = V_{ref}$ . . . .

II $$V_{ref} = \frac{R_1}{R_1+R_2}(+5) + \frac{R_2}{R_1+R_2}(+4)$$

Duas equações, tres variaveis ⇒ muitas soluções

exemplo: $R_1 = 1\ k\Omega$, $R_2 = 5\ k\Omega$, $V_{ref} = \frac{25}{6}\ V$



tempo de relax : $\tau = RC$

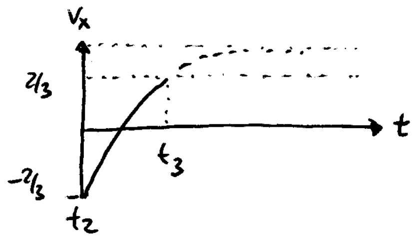
$$\left.\begin{array}{l} t = t_1 \Rightarrow V_x = 5/3 \\ t = \infty \Rightarrow V_x = 0 \end{array}\right\} \Rightarrow$$

$$V_x = 5/3 \exp\left(-\frac{t_2 - t_1}{RC}\right) \Rightarrow$$

em $t = t_2$: $V_x = 1/3 \Rightarrow$ $1/3 = 5/3 \exp\left(-\frac{t_2 - t_1}{RC}\right)$.

$$1/5 = \exp\left(-\frac{T1}{RC}\right)$$

$$\boxed{T1 = RC \ln(5)}$$



tempo de relax $\tau = RC$

$$\left.\begin{array}{l} t = t_2 : V_x = -2/3\, V_{cc} \\ t = \infty : V_x = V_{cc} \end{array}\right\} \Rightarrow$$

$$V_x = 1 - 5/3 \exp\left(-\frac{t - t_2}{RC}\right)$$

em $t = t_3$: $V_x = 2/3 \Rightarrow$ $2/3 = 1 - 5/3 \exp\left(-\frac{t_3 - t_2}{RC}\right)$

$$1/5 = \exp\left(-\frac{T2}{RC}\right)$$

$$\boxed{T2 = RC \ln(5)}$$

$$f = \frac{1}{T1 + T2} = \frac{1}{2\, RC \ln(5)}$$

$f = 10$ kHz $\Rightarrow$ $2\, RC \ln(5) = 10^{-4}$ s

exemplo : $R = 1\,k\Omega \Rightarrow$

$C = 31$ nF