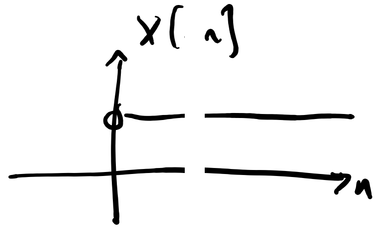
2022oct17

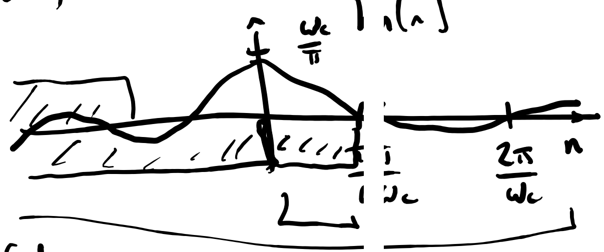
Monday, October 17, 2022 13:40

$$x[n] = \begin{cases} 1 & n \geq 0 \\ 0 & n < 0 \end{cases}$$



$$h[n] = \frac{\omega_c}{\pi} \operatorname{sinc}(\omega_c n)$$

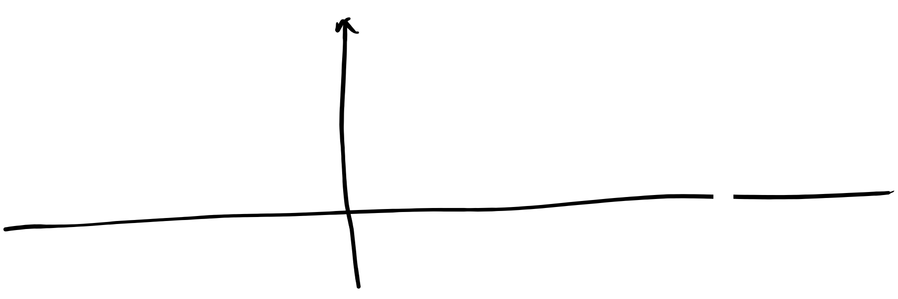
$$= \frac{\omega_c}{\pi} \frac{\sin(\omega_c n)}{\omega_c n}$$



$$y[n] = h[n] * x[n]$$

$$= \sum_{m=-\infty}^{\infty} x[m]\, h[n-m] = \sum_{m=-\infty}^{\infty} h[m]\, x[n-m]$$

$$= \sum_{m=0}^{\infty} h[n-m] = \sum_{m=-\infty}^{n} h[m]$$



CASES

$n \ll 0$: $y[n] = \sum_{m=-\infty}^{n} h[m] \approx 0$

$n \gg 0$: $y[n] = \sum^{n} h[\,] \approx \left[\sum^{\infty} h[\,] \right]$

$n >> 0$, $y[n] = \sum_{m=-\infty} h[m] \approx \boxed{\sum_{m=-\infty} h[m]}$

$$= \sum_{m=-\infty}^{\infty} h[m] e^{j \cdot 0 \cdot m} = \underline{H(\omega) \big|_{\omega=0}}$$

$$= 1$$

$n = 0$: $y[n] = \boxed{\sum_{m=-\infty}^{0} h[m] \approx \frac{1}{2} \sum_{m=-\infty}^{\infty} h[n]}$

Because $h[n]$ is symmetric

$(h[-n] = h[n])$

$y[0] \approx \frac{1}{2}$