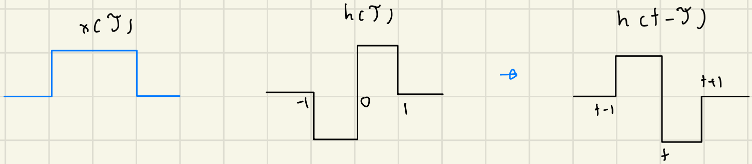
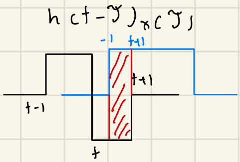
2.1)

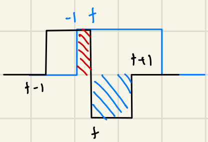


$-2 \le t < -1$



$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = \int_{-1}^{t+1} -1 \, d\tau = -(t+1+1) = -t-2$$

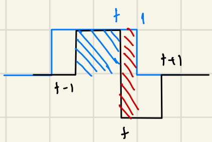
$-1 \le t < 0$



$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = \int_{-1}^{t} 1 \, d\tau + \int_{t}^{t+1} -1 \, d\tau$$

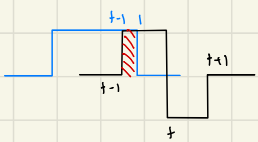
$$= t+1 + (-1) = t$$

$0 \le t < 1$



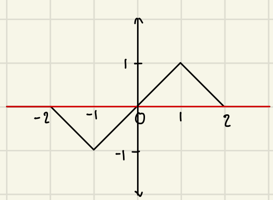
$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = \int_{t}^{1} -1 \, d\tau + \int_{t-1}^{t} 1 \, d\tau = t$$

$1 \le t < 2$

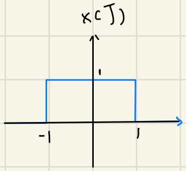


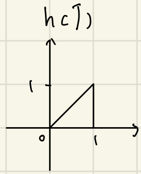
$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau = \int_{t-1}^{1} 1 \, dt = 1-t+1 = -t+2$$

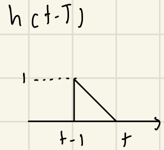
$$\boxed{\begin{cases} -t-2 & -2 \le t < -1 \\ t & -1 \le t < 1 \\ -t+2 & 1 \le t < 2 \\ 0 & \text{otherwise} \end{cases}}$$

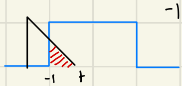


2.2)



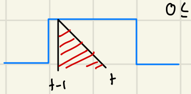






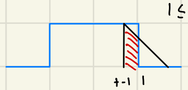
$-1 \le t < 0$

$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,d\tau$$
$$= \int_{-1}^{t} -\tau + t \; d\tau$$
$$= \left[-\tau^2/2 + t\tau\right]_{-1}^{t} = \frac{t^2}{2} + t + \frac{1}{2} = \frac{1}{2}(t+1)^2$$



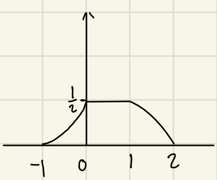
$0 \le t < 1$

$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,dt$$
$$= \int_{t-1}^{t} -\tau + t \, d\tau$$
$$= \left[-\tau^2/2 + t\tau\right]_{t-1}^{t}$$
$$= \cancel{\frac{t^2}{2}} + \left(\cancel{\frac{t^2-2t+1}{2}} \cancel{-t^2} + t\right)$$
$$= \frac{1}{2}$$



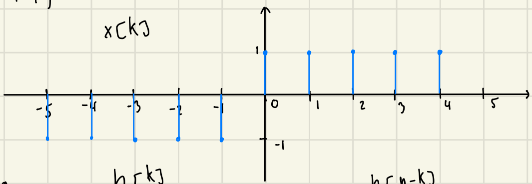
$1 \le t < 2$

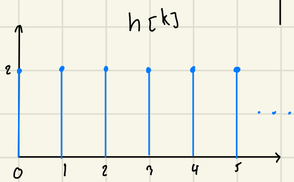
$$\int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,d\tau$$
$$= \int_{t-1}^{1} t - \tau \, d\tau$$
$$= \left[t\tau - \tau^2/2\right]_{t-1}^{1}$$
$$= t - \frac{1}{2} - \left(t^2 - t - \frac{(t^2-2t+1)}{2}\right)$$
$$= t - \cancel{\frac{1}{2}} - t^2 + t + \frac{t^2-2t+\cancel{1}}{\cancel{2}}$$
$$= -\frac{t^2}{2} + t$$
$$= -\frac{t(t-2)}{2}$$

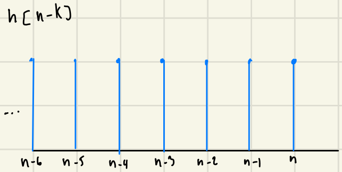


$$\begin{cases} \frac{(t+1)^2}{2} & -1 \le t < 0 \\ \frac{1}{2} & 0 \le t < 1 \\ -\frac{t}{2}(t-2) & 1 \le t < 2 \\ 0 & \text{otherwise} \end{cases}$$

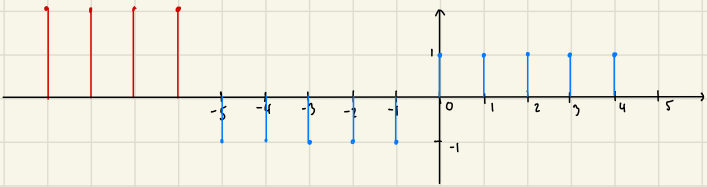
4.1)





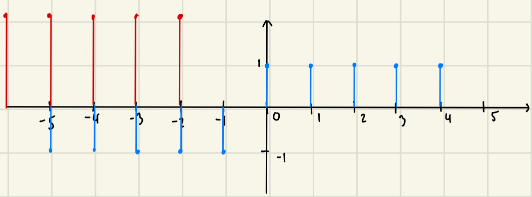


$n < -5$



no overlap $y[n] = 0$ #

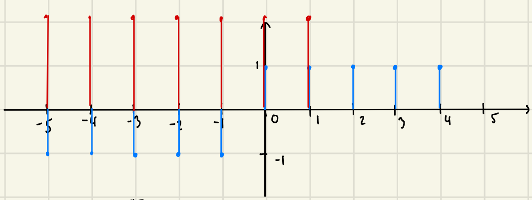
$-5 \leq n < 0$



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

$$= \sum_{k=-5}^{n} -2 = -2(n+6)$$ #

$0 \leq n < 4$

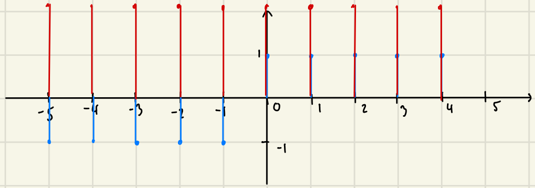


$$y[n] = \sum_{k=-\infty}^{\infty} x[k]\, h[n-k]$$

$$= \sum_{k=-5}^{-1} -2 + \sum_{k=0}^{n} 2 = -10 + 2(n+1)$$

$$= 2n - 8$$ #

$n \geq 5$

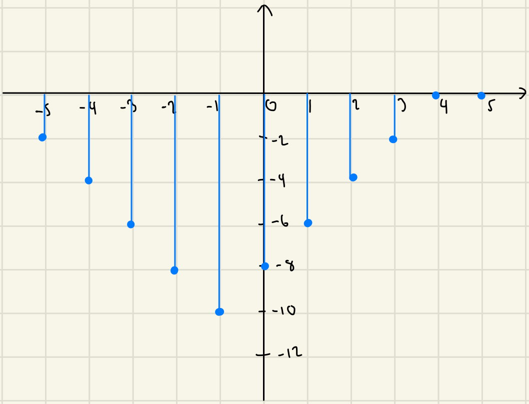


$$y[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

$$= \sum_{k=-5}^{-1} -2 + \sum_{k=0}^{4} 2 = -10 + 10 = 0$$

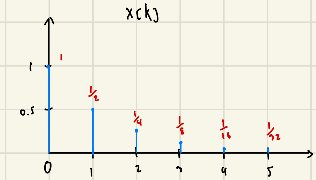
#

$$y[n] = \begin{cases} -2(n+6) & -5 \leq n < 0 \\ 2n-8 & 0 \leq n < 5 \\ 0 & \text{otherwise} \end{cases}$$

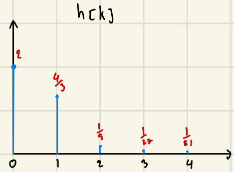


4.2)

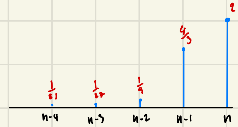
x[k]



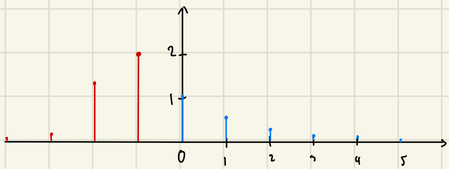
h[k]



h[n-k]

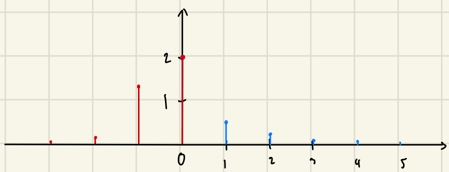


$n<0$



no overlap $y[n]=0$

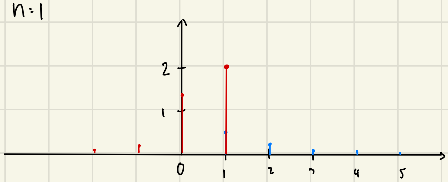
$n=0$



$$y[n]=\sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

$$=2\cdot 1=2$$

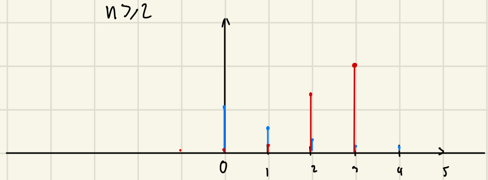
$n=1$



$$y[n]=\sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

$$=2\cdot\frac{1}{2}+1\cdot\frac{4}{3}=\frac{6+8}{6}=\frac{7}{3}$$

$n\geq 2$



$$y[n]=\sum_{k=-\infty}^{\infty} x[k]h[n-k]$$

$$=2\cdot\left(\frac{1}{2}\right)^n+\frac{4}{3}\cdot\left(\frac{1}{2}\right)^{n-1}+\sum_{k=2}^{n}\left(\frac{1}{3}\right)^k\left(\frac{1}{2}\right)^{n-k}$$

$$=2^{1-n}+\frac{2^{3-n}}{3}+\left(\frac{1}{2}\right)^n\sum_{k=2}^{n}\left(\frac{2}{3}\right)^k$$

$$=2^{1-n}+\frac{2^{3-n}}{3}+2^{-n}\cdot\frac{4}{9}\left(1-\left(\frac{2}{3}\right)^{n-1}\right)\cdot 3$$

$$=2^{1-n}+\frac{2^{3-n}}{3}+\frac{2^{2-n}}{3}-\frac{2}{3^n}$$

$$y[n]=\begin{cases} 2 & ;\ n=0 \\ \frac{7}{3} & ;\ n=1 \\ 2^{1-n}+\frac{2^{3-n}}{3}+\frac{2^{2-n}}{3}-\frac{2}{3^n} & ;\ n\geq 2 \\ 0 & ;\ \text{otherwise} \end{cases}$$