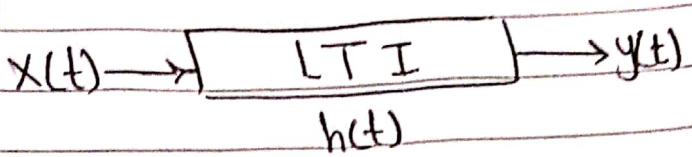
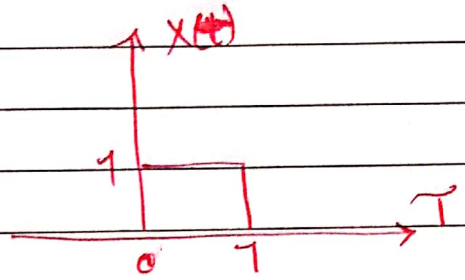


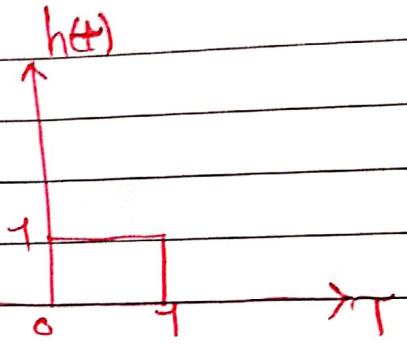
Convolution integral: $y(t) = \int_{-\infty}^{\infty} x(\tau)\, h(t-\tau)\, d\tau$

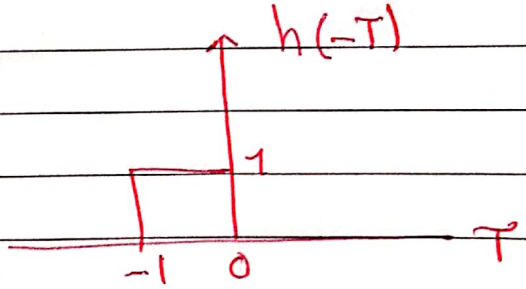
ex: $x(t) = 1 \quad 0 \le t \le 1$
$= 0$ otherwise

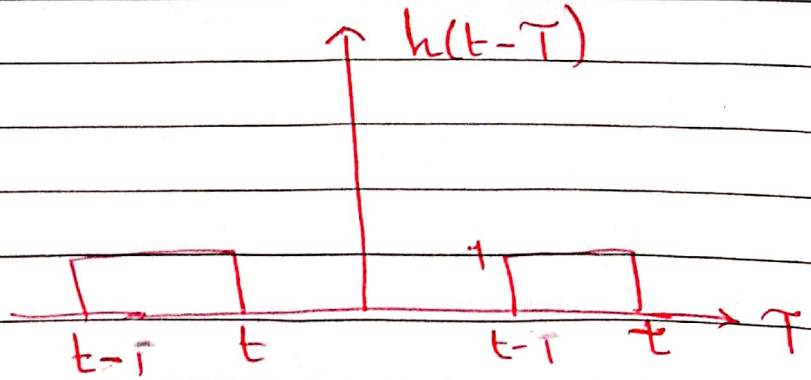
$h(t) = x(t)$
Find & plot $y(t)$.

1] sketch

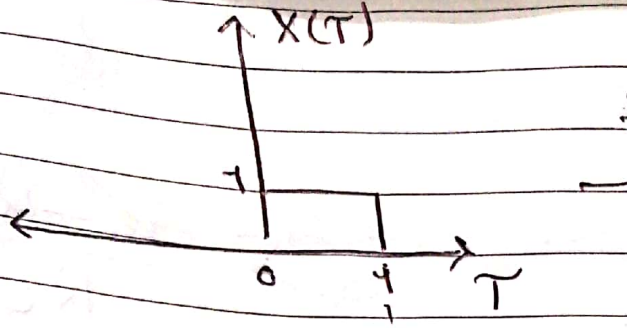








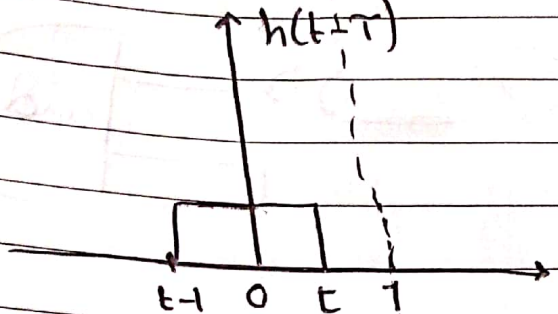
[2]

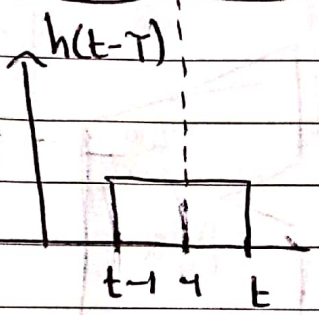


$t \leq 0 \quad y(t) = 0$

$0 \leq t \leq 1$

$$y(t) = \int_0^t (1)\, dT = T$$





$1 \leq t \leq 2 \quad y(t) = \int_{t-1}^{1} (1)\, dT = 2 - T$

$t \geq 2 \quad y(t) = \int_{-\infty}^{\infty} x(T) h(t-T)\, dT$

$= \text{zero}$

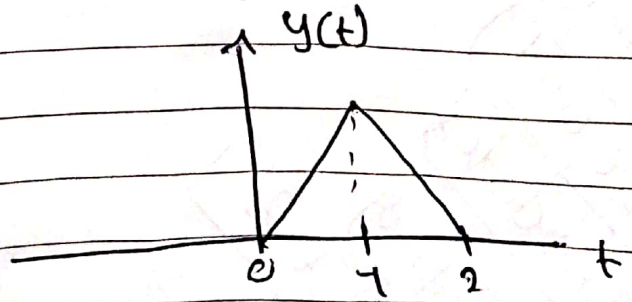
So,

$t \leq 0 \longrightarrow y(t) = 0$

$0 \leq t \leq 1 \longrightarrow y(t) = t$

$1 \leq t \leq 2 \longrightarrow y(t) = 2 - t$

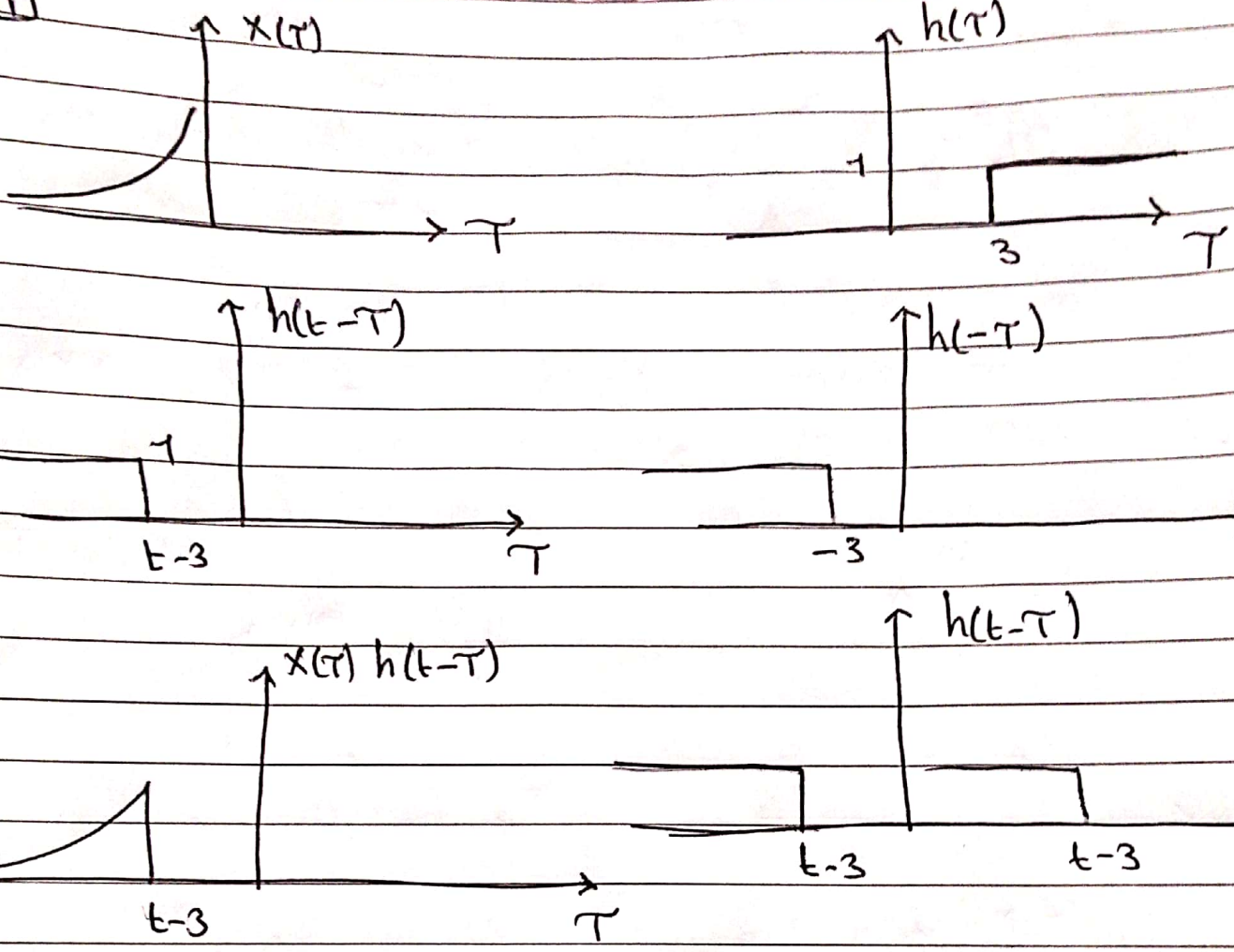
$t \geq 2 \longrightarrow y(t) = 0$



ex: $x(t) = e^{t}\,u(-t)$ $\quad h(t) = u(t-3)$

Find and Plot $y(t)$

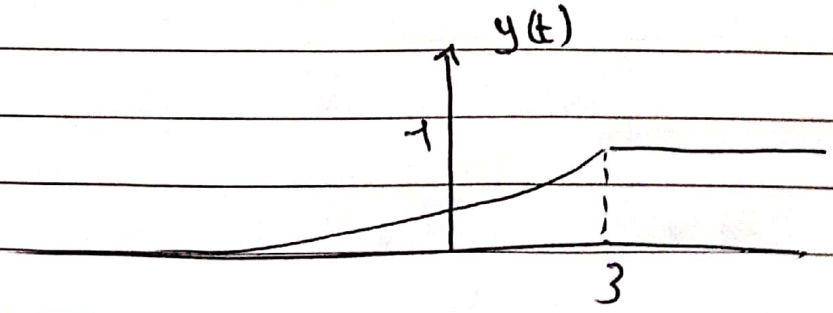
1)



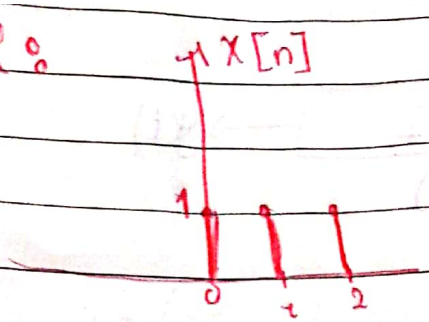
2) $t-3 \le 0 \Rightarrow t \le 3$, $y(t) = \int_{-\infty}^{t-3} e^{\tau}\,d\tau = e^{\tau}\Big|_{-\infty}^{t-3}$

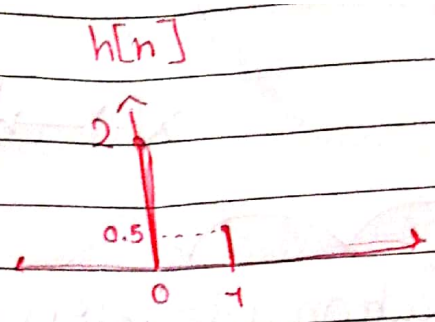
$$= e^{(t-3)}$$

$t \ge 3$ $\quad y(t) = \int_{-\infty}^{0} e^{\tau}\,d\tau = 1$



ex:

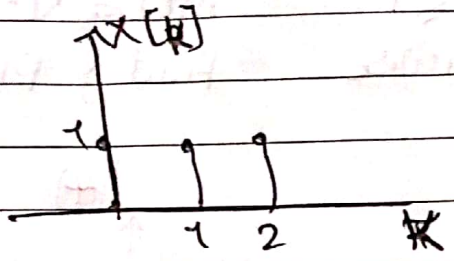


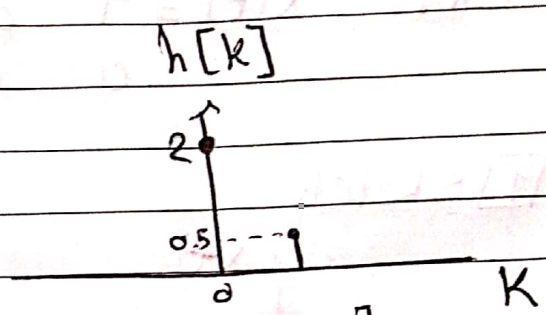


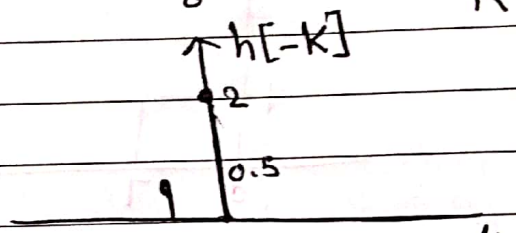
Find & Plot $y[n] = \sum x[n]\, h[n-k]$

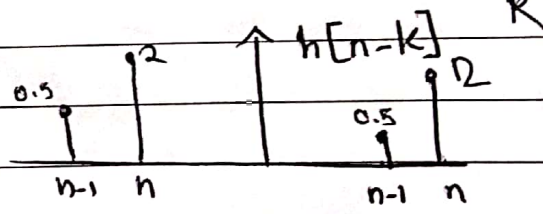
[1] Sketch [2] Multiply [3] Add

[1]

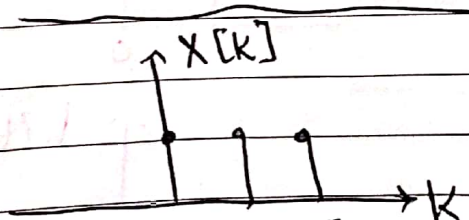


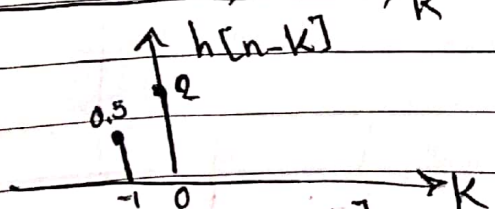


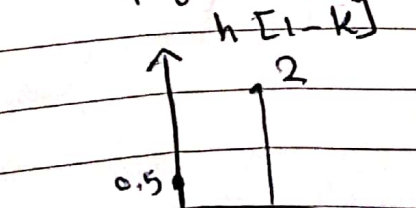


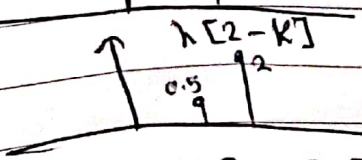


[2]









$n > 3 \quad y[n] = 0$

$n < 0 \quad y[n] = \sum 0 = 0$

$n = 0 \quad y[n] = \sum 0 + 2 + 0 = 2$

$n = 1 \quad y[1] = 2.5$

$n = 2 \quad y[2] = 2.5$

$n = 3 \quad y[3] = 0.5$