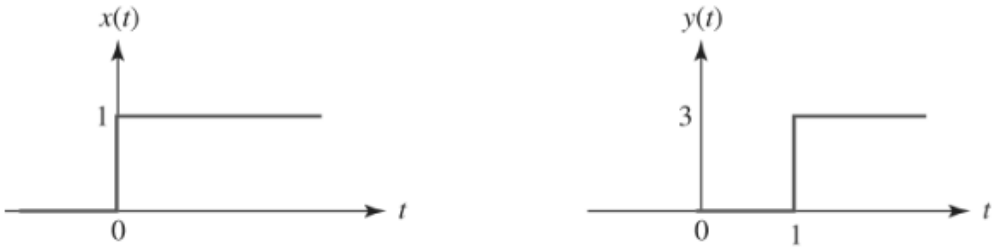


FIGURE 14.67 Math Graphical

77. With respect to the functions $x(t)$ and $y(t)$ as plotted in **Fig. 14.67**, use **Eq. [36]** to obtain (*a*) $x(t) * x(t)$; (*b*) $y(t) * \delta(t)$.

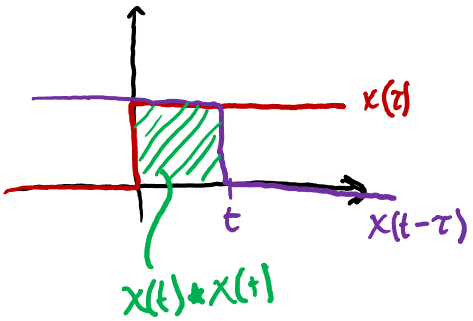
a) $x(t) * x(t) = \int_{-\infty}^{\infty} x(t-\tau)x(\tau)\,d\tau$

$= \int_{-\infty}^{\infty} u(t-\tau)u(\tau)\,d\tau$

$= \int_{0}^{\infty} u(t-\tau)\,d\tau$

$= t\,u(t)$

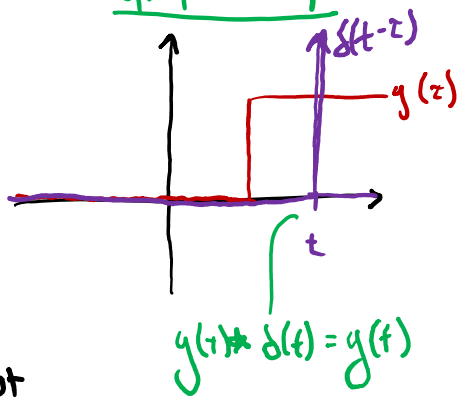
Graphically



(b) $y(t) * \delta(t) = \int_{-\infty}^{\infty} \delta(t-\tau)\,3\,u(\tau-1)\,d\tau$

$= 3u(t-1)$

Graphically



3rd option for (b)

since convolution is commutative, we can consider either signal to be the input to some system, and the other signal is its impulse response. If we assign

$y(t) \rightarrow h(t)$

$\delta(t) \rightarrow$ input

then the output must be $y(t)$, by definition.