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$= \quad * \quad = \int_{-\infty}^{\infty} \quad \tau \quad -\tau \quad \tau$

交换律： $x_1(t)*x_2(t)=x_2(t)*x_1(t)$

结合律： $\left(x_1(t)*x_2(t)\right)*x_3(t)=x_1(t)*\left(x_2(t)*x_3(t)\right)$

分配律： $x_1(t)*\left(x_2(t)+x_3(t)\right)=x_1(t)*x_2(t)+x_1(t)*x_3(t)$

微积分性质：两个信号卷积的导数或积分，就等于其中任一信号的导数或积分与另一信号的卷积。

$$x^{(1)}(t)=\frac{d}{dt}x(t),\quad x^{(-1)}(t)=\int_{-\infty}^{t}x(\tau)d\tau$$

若$y(t)=x_1(t)*x_2(t)$,则有：

$$y^{(1)}(t)=x_1^{(1)}(t)*x_2(t)=x_1(t)*x_2^{(1)}(t)$$

$$y^{(-1)}(t)=x_1^{(-1)}(t)*x_2(t)=x_1(t)*x_2^{(-1)}(t)$$

任意信号与冲激信号的卷积：任意信号$x(t)$与单位冲激信号$\delta(t)$的卷积仍为该信号本身，$x(t)$与$\delta(t-t_0)$的卷积相当于将信号$x(t)$延时t_0。

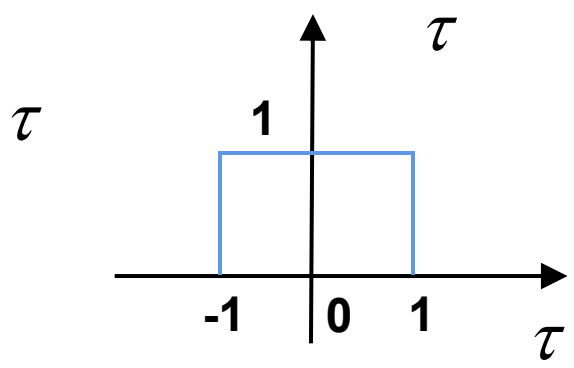
$$x(t)*\delta(t)=x(t)\qquad x(t)*\delta(t-t_0)=x(t-t_0)$$

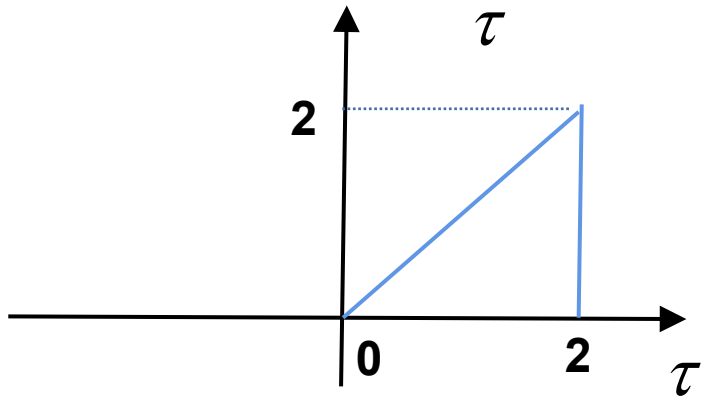
任意信号与阶跃信号的卷积：单位阶跃信号$u(t)$相当于积分器。

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

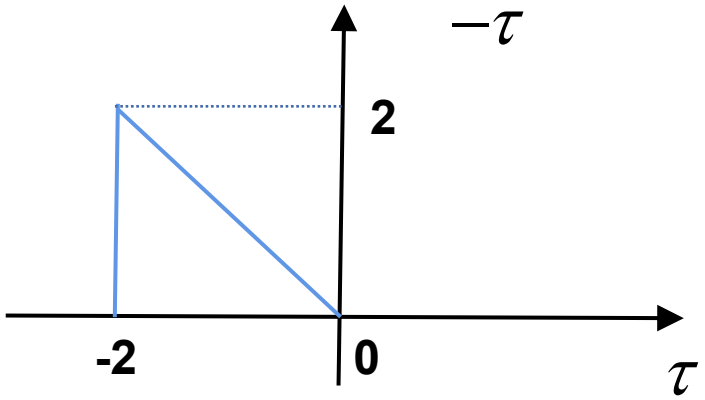
任意信号与冲激偶信号的卷积：冲激偶信号$\delta'(t)$相当于微分器。

$$x(t)*\delta'(t)=x'(t)$$

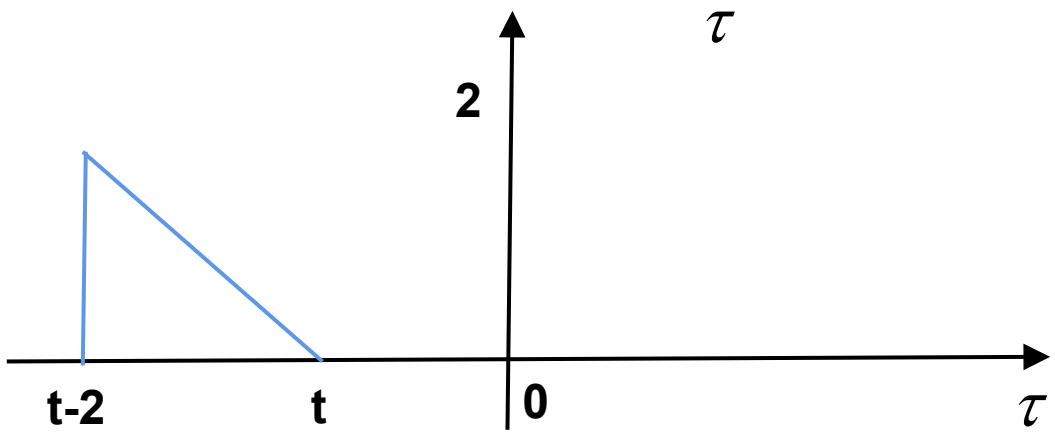


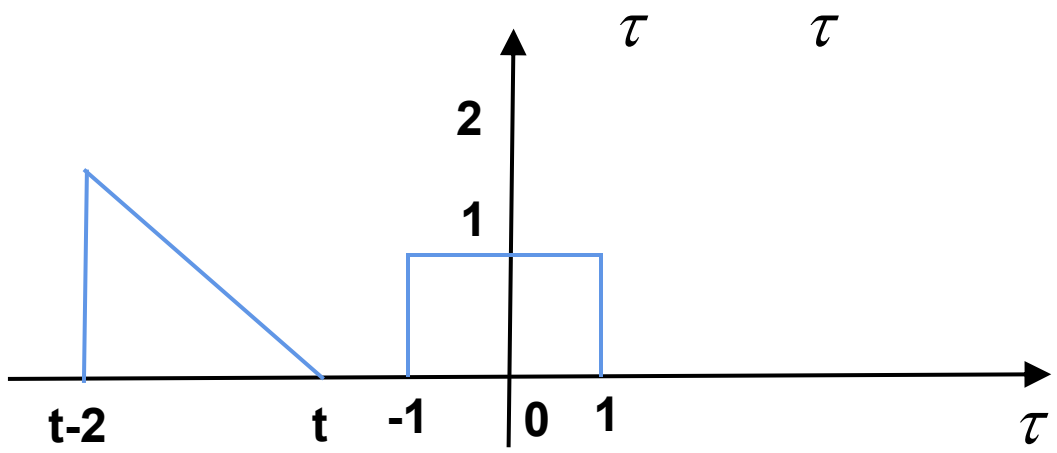


τ −τ

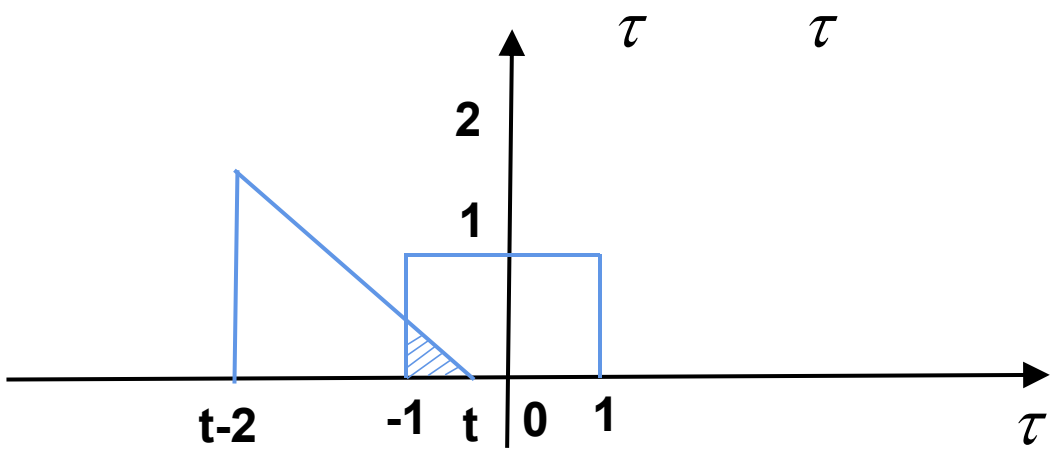


−τ −τ





$\leq -$ $=$ $*$ $=$

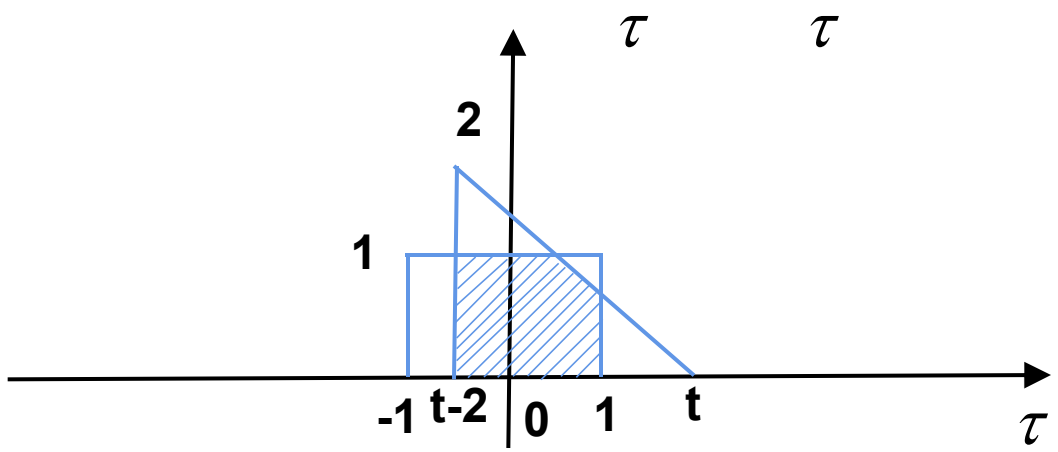


$- \leq <$

$= \quad * \quad \int_{\infty}^{\infty} (\tau) \ (-\tau) \ \tau$

$= \int \times(-\tau) \ \tau = -\frac{(-\tau)}{} \Big|_{-} = +\frac{(+)}{}$

$= \frac{(+)}{}$

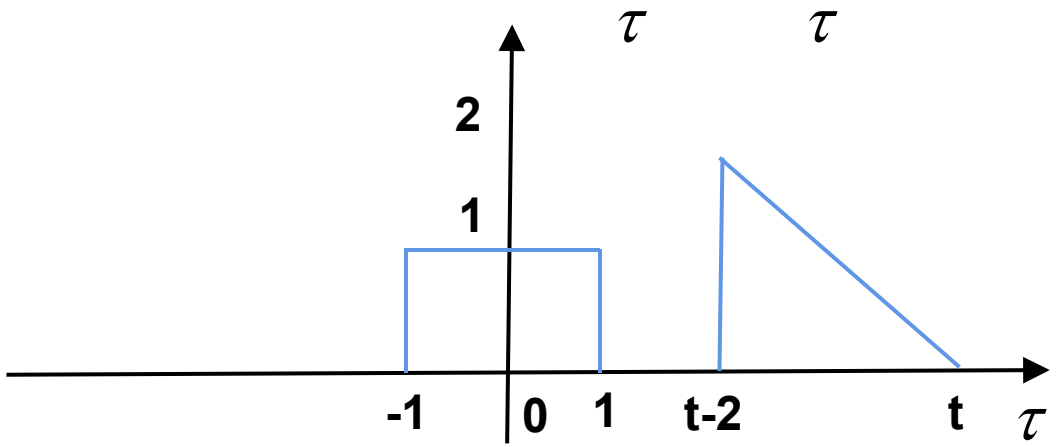


$\leq \quad <$

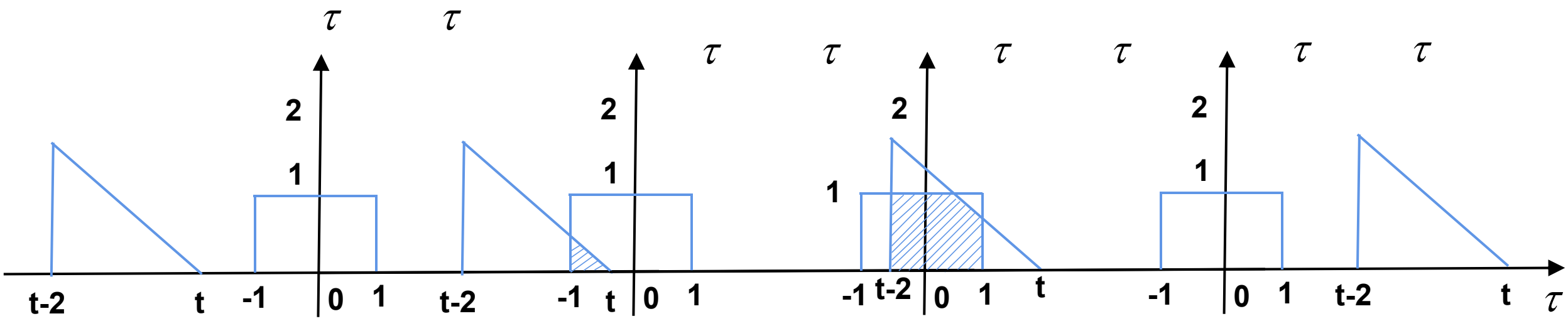
$= \quad * \quad \int_{\infty}^{\infty} (\tau) \ (-\tau) \ \tau$

$= \int_{-} \times(-\tau) \ \tau = -\frac{(-\tau)}{} \Big|_{-} = -\frac{(-)}{} + \frac{(-+)}{}$

$= -\frac{(-)}{}$



$\geq \quad = \quad * \quad =$



$$\therefore \quad = \quad * \quad \begin{cases} & < - \\ -(\ + \ ) & - \ \leq \ < \\ --(\ - \ ) + & \leq \ < \\ & \geq \end{cases}$$