SIGNALS & SYSTEMS

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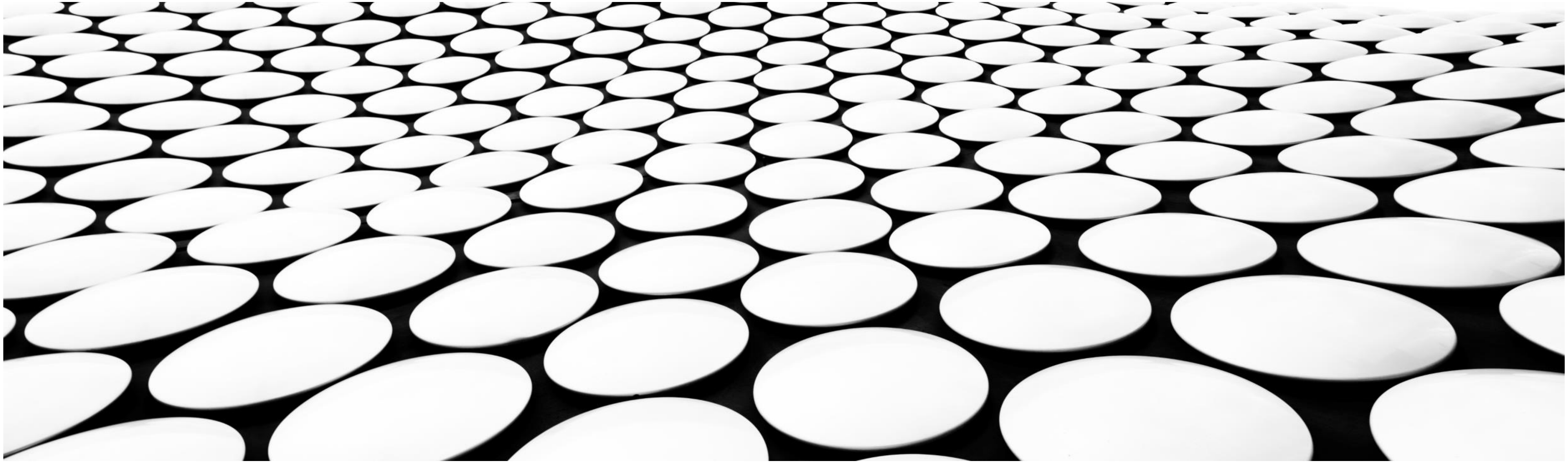
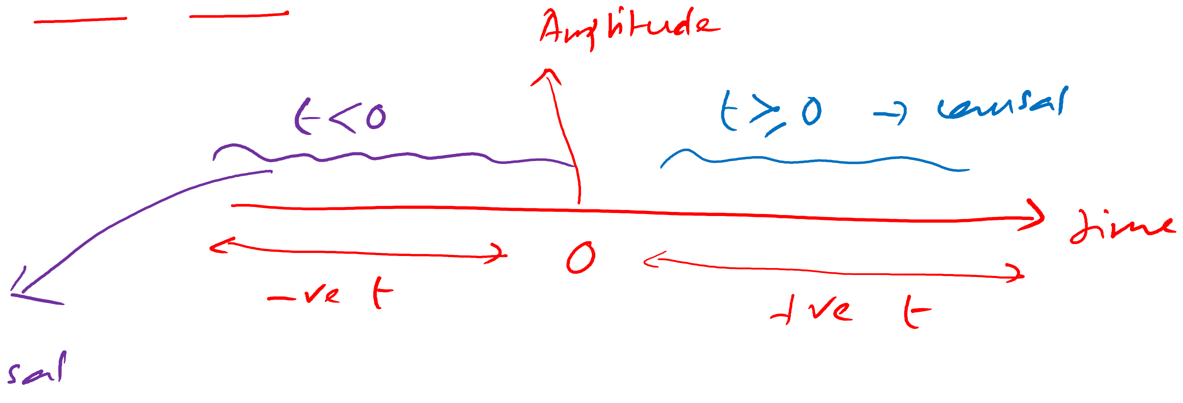


Causal, Non-causal and Anti causal:-

$t \geq 0 \longrightarrow$ causal.

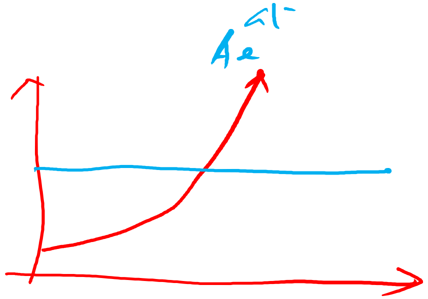


$u(t) \rightarrow$ unit step signal

$$\left.\begin{array}{ll} u(t) = 1 & \text{if } t \geq 0 \\ u(t) = 0 & \text{if } t < 0 \end{array}\right\} \text{always causal signal.}$$

$$x(t) = A e^{at}\, u(t) \qquad = 1$$

Exponential signal



$t<0$ → NC

$x(t) = Ae^{bt}$; it is defined for all values of t. → −ve values of t.

Anti-causal → part of a non-causal signal but it is defined for $t<0$ but also for $t=0$.

Mathematical operations on signals -

Addition   Sub^n . . .   Multi^n — .   division -

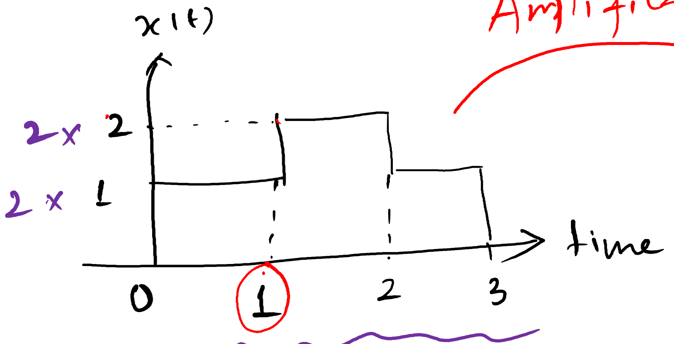
Amplitude sicaling and Time scaling

Multiply the amplitude of the signal by ~~some~~ a constant value.

Q. $x(t)$ is given in fig. below:. Then draw the $2x(t)$ and $0.5x(t)$ ($\frac{1}{2}x(t)$) plot for the given $x(t)$.

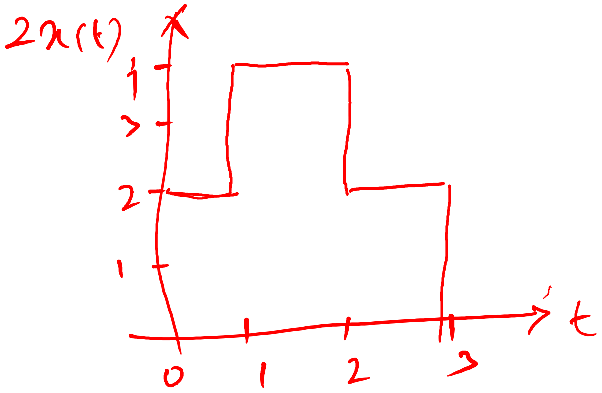
$2[x(t)]$ $\quad$ $1 \xrightarrow{\times 2} 2$

Amplification.



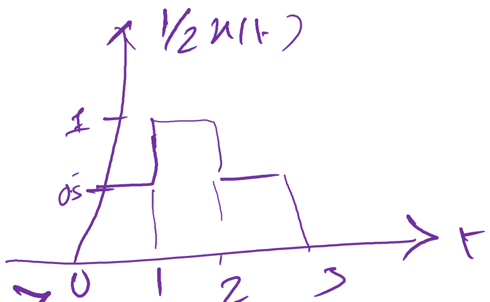
Time doesn't change

Only amplitude varies



$2 \times \frac{1}{2} = 1$

$1 \times \frac{1}{2} = 0.5$



Attenuation.

Time scaling :- Amplitude remains constant

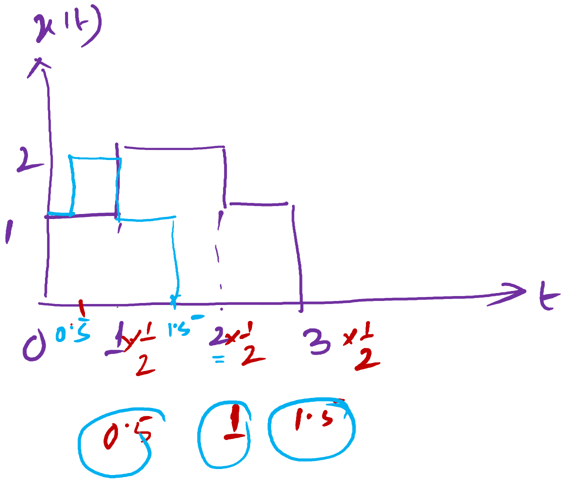
Temper with the time

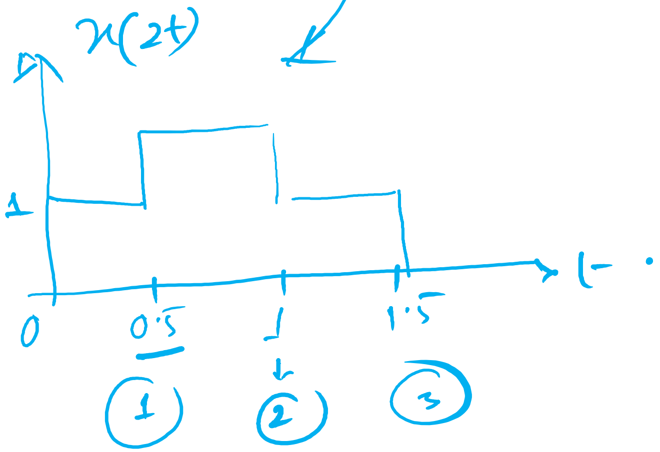
$x(t) \to x(at) \to \frac{t}{a}$

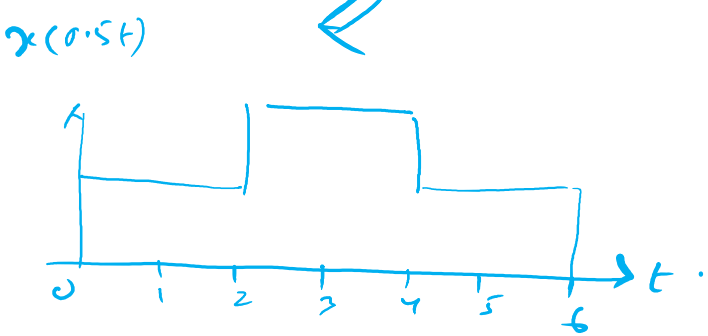
$x(2t) \to$ Time compression $\to 1/2$

$x(\frac{1}{2}t)$ or $x(0.5t)$

Expansion of time







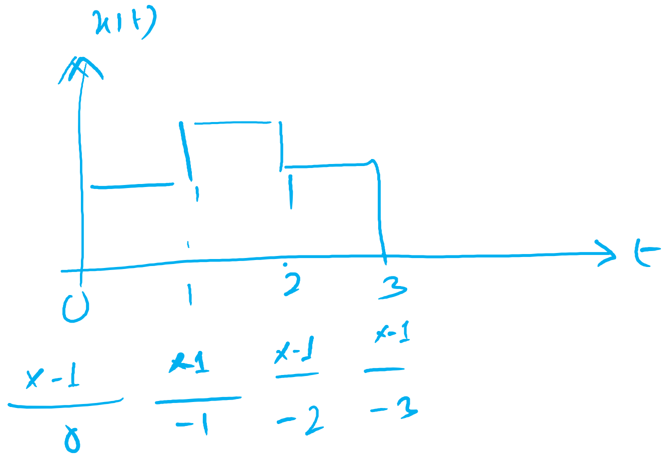
$1 \times 2 = 2$

$2 \times 2 = 4$

$3 \times 2 = 6$

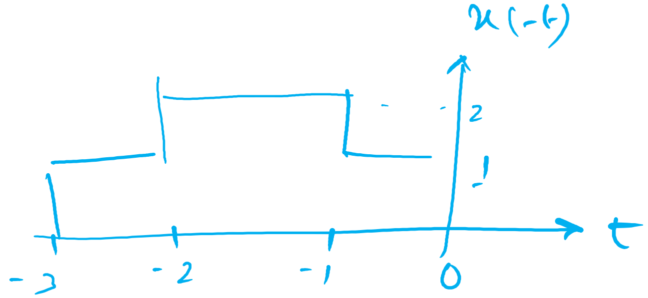
Time folding :- Time Reversal :- Reflection or Transpose :-

$x(t) \longrightarrow x(-t)$



Time folding

$\Rightarrow$

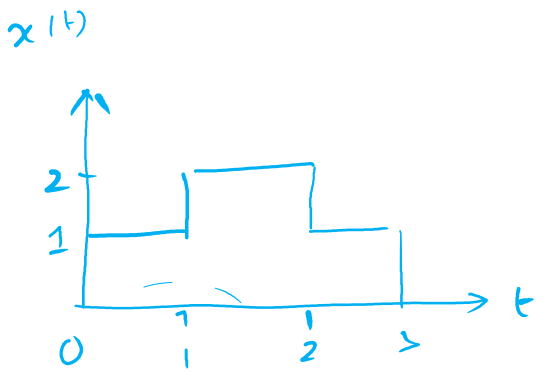


t- seconds

Time shifting :-

t → time is an ind. variable.

shift ~~this~~ t by m → t+m, → t-m



m is +ve

m=10

7 am ↓ 10 mins

7:10 am

7am → 6:50am (10 unit)

Khanapara.

shift towards left

6:50 AM

Advanced.

Shifting towards left

7 Am

Ref

t

7:10 Am

Delayed

shifting towards right.

7:10 — (10)

$x(t) \rightarrow x(t+m)$

$m = 10$

$t+m = 0$

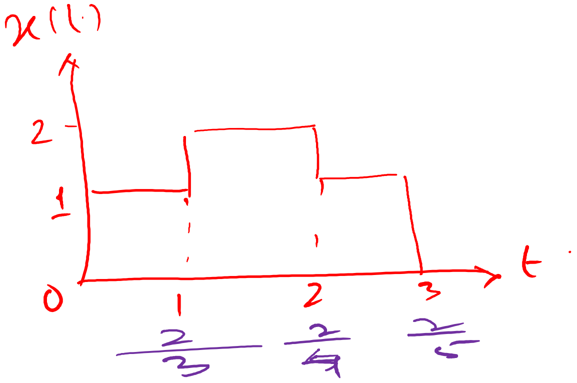
$\Rightarrow t = -m$

$6:50 + 10 \rightarrow 7$

Advanced

$(t-m) = 0$

$\Rightarrow t = m$



→ Delay version

Delay by 2 units.

$x(t-2)$

$t-2=0$

$\Rightarrow t=2$

$t+2$

$t+2=0 \Rightarrow t = \underline{-2} \longrightarrow$ shifting towards left

Advanced of a signal.

$$\begin{array}{r} 1 \\ -2 \\ \hline -1 \end{array} \qquad \begin{array}{r} 2 \\ -2 \\ \hline 0 \end{array} \qquad \begin{array}{r} 3 \\ -2 \\ \hline 1 \end{array}$$