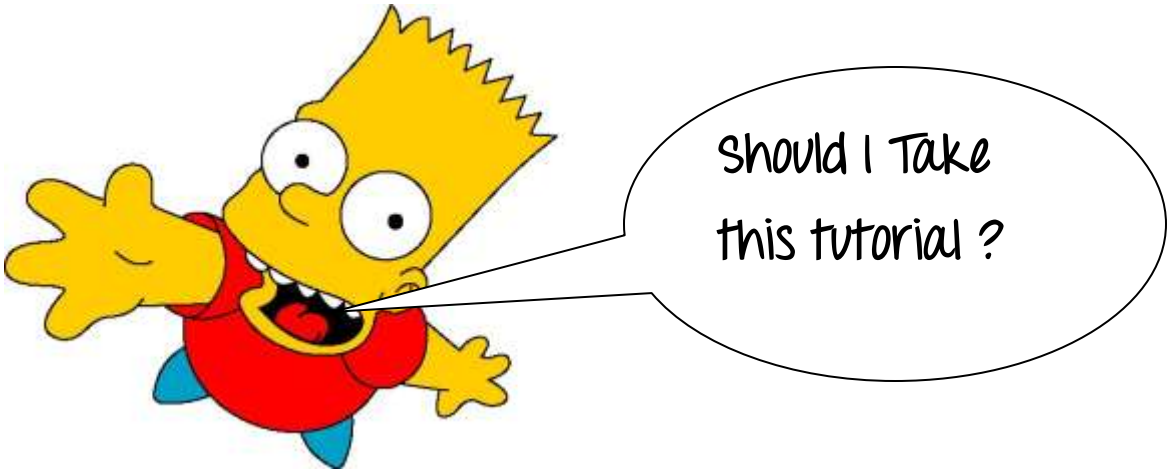
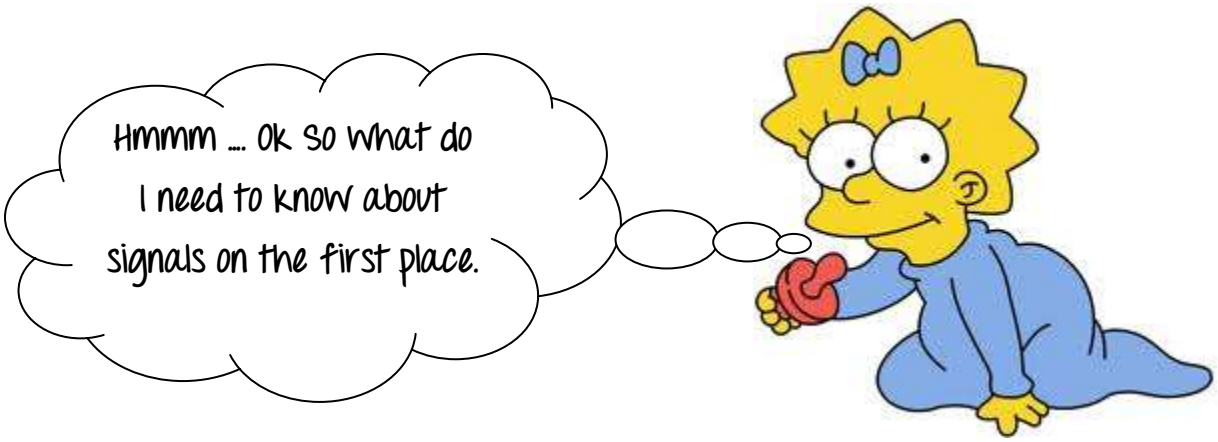
SIGNAL AND SYSTEM : TUTORIAL : LETS MAKE SIGNALS EASY

Work Sheet 1: Ahmad Bilal



This tutorial is for everyone , who needs basic concepts of signals and their operations, especially regarding to

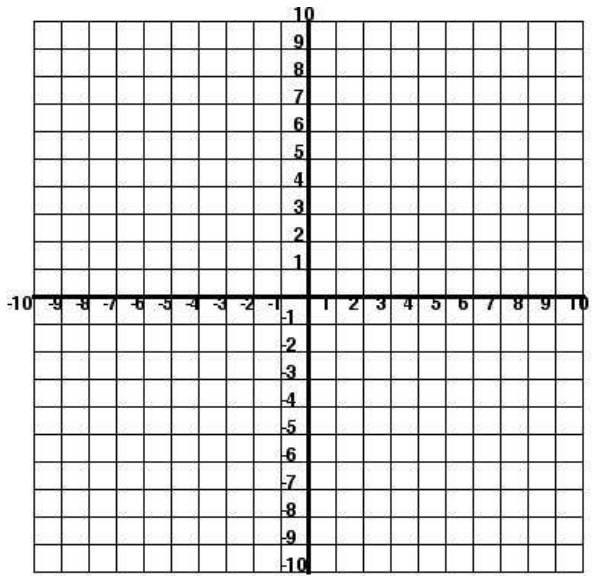
- SHIFTING
- SCALING
- FLIPPING
- ADDITION
- SUBTRACTION
- MULTIPLICATION



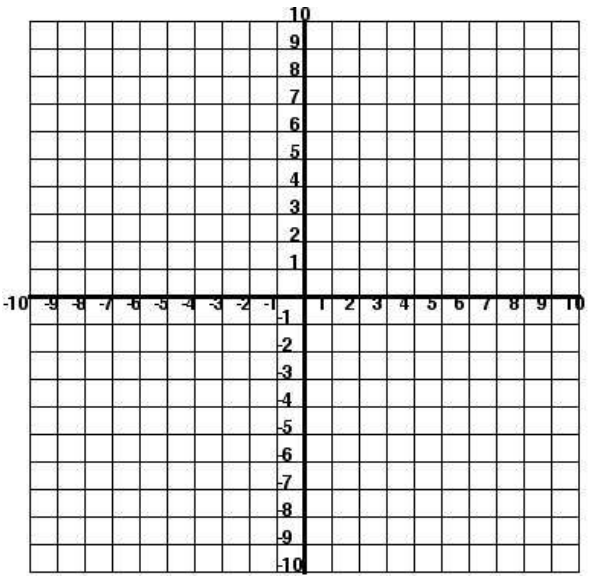
The first thing we need to know about signal is that , there are two type of basic signals : Continuous Signal and Discrete Signals represented by x(t) and x(n).

Q : How can I differentiate between them

Ans : Its very easy . x(t) is a signal that is defined over every point , and x[n] is a signal that is defined only on n values.

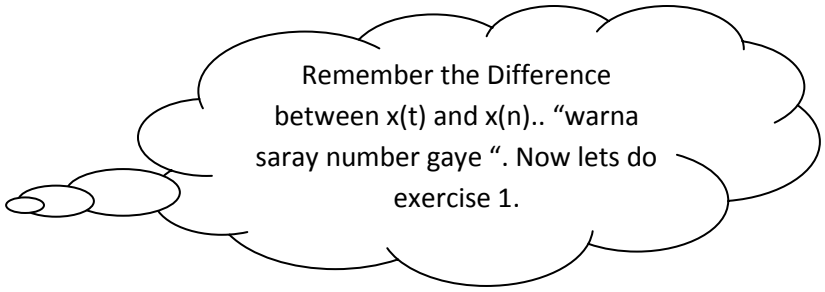


x(t)



x(n) n= -5,-4,-3 to + 5

Convert the above Continuous signal to Discrete time signal

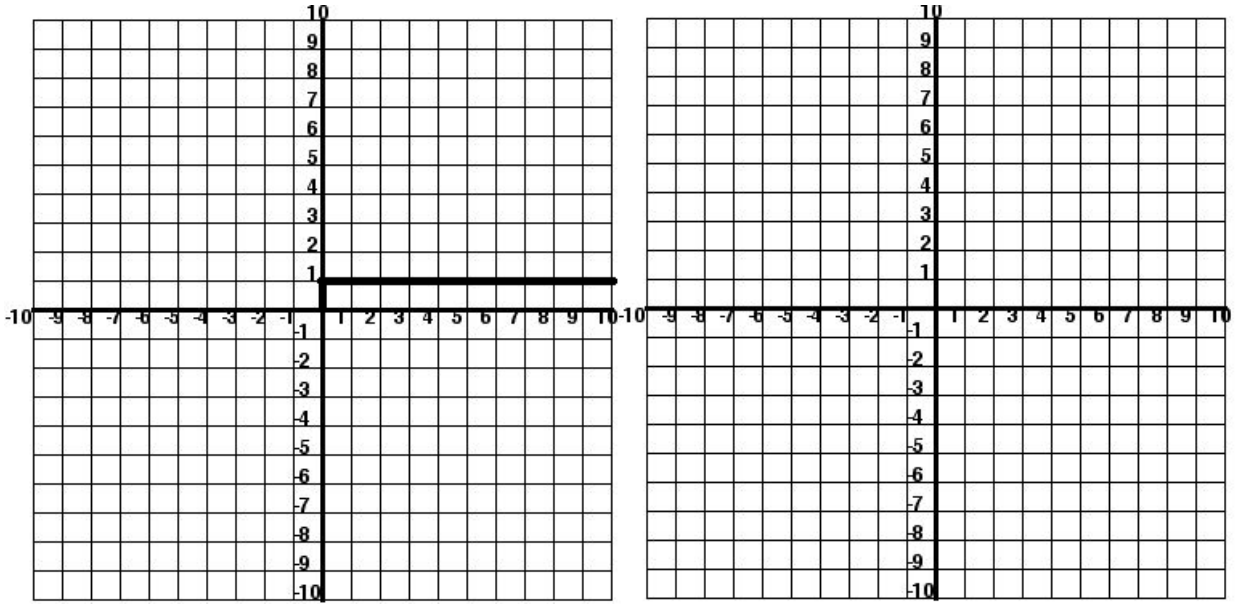


EXERCISE 1 : The Continuous and Discreete Signal

Unit Step

u(t) and u[n]

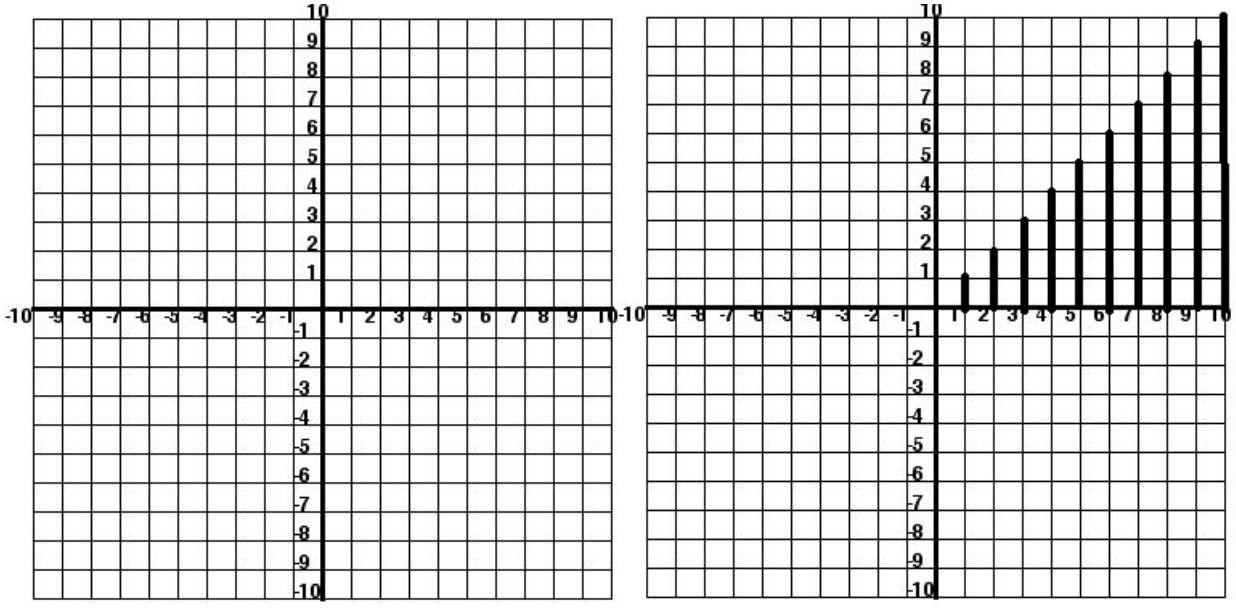
Have value of 1 , and is defined from zero to positive infinity



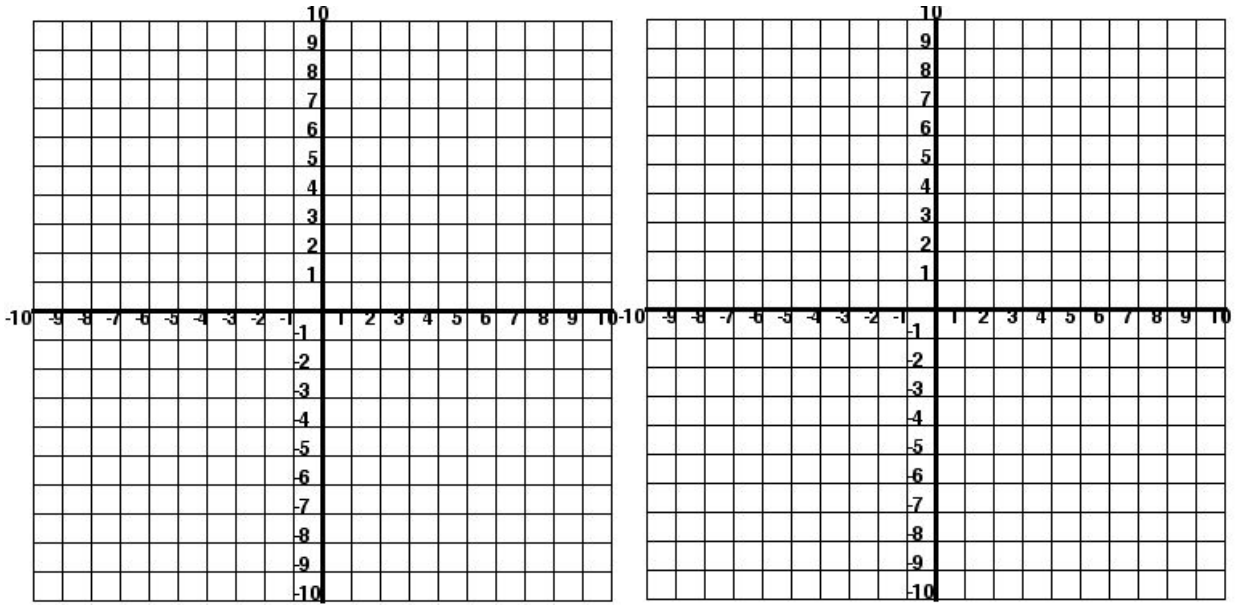
Ramp Functon

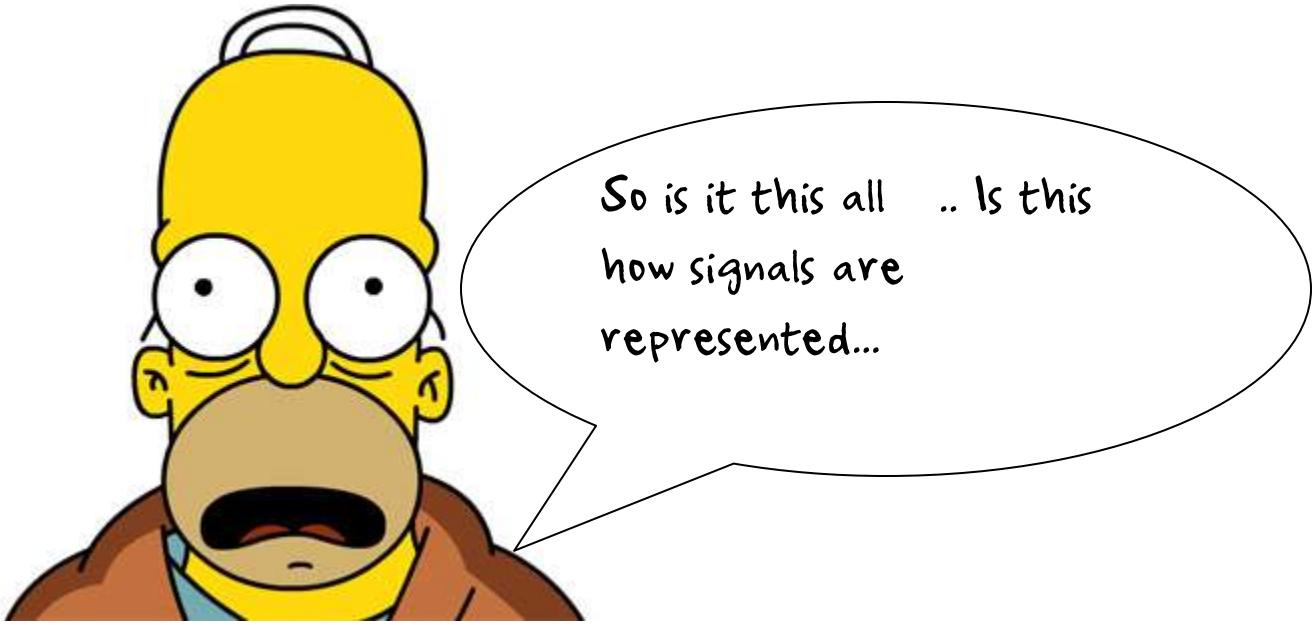
r(t) and r[n]

Value of signal increases as we move forward along t or n axis



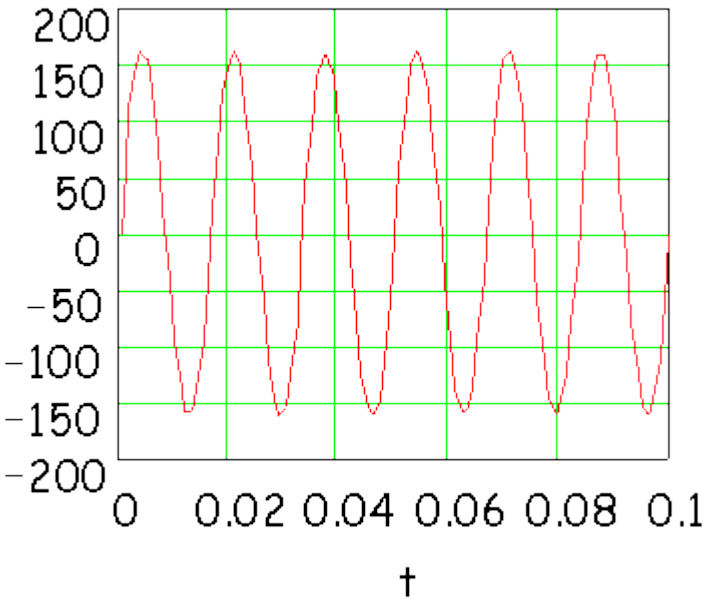
$\delta(t)$ and $\delta(n)$





Ummm.... Not really, these were just type of signals. For looking in to how a signal is represented we , have to go through the following points and keep them in mind.

Signal Representation



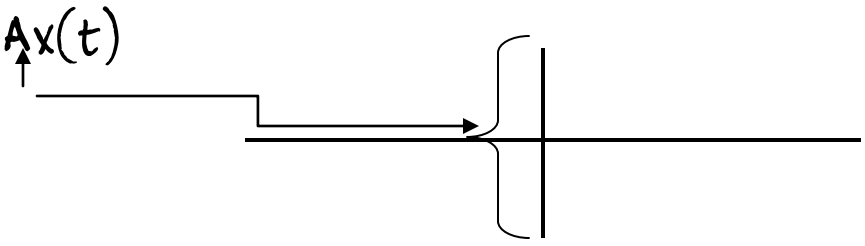
Lets have a look at this signals and observe it

1. The signal exist between 0 and 0.1
2. The amplitude of signal is 155

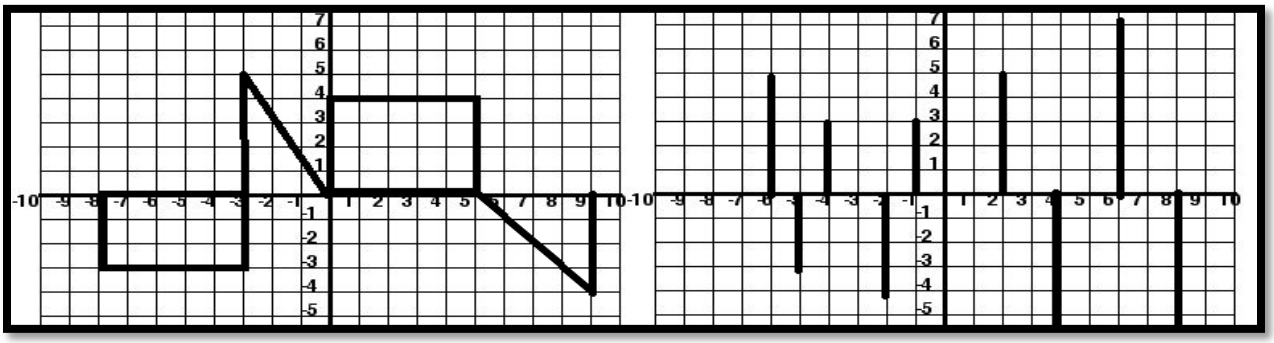
So remember, there are **two** important parameters to sketch the signal

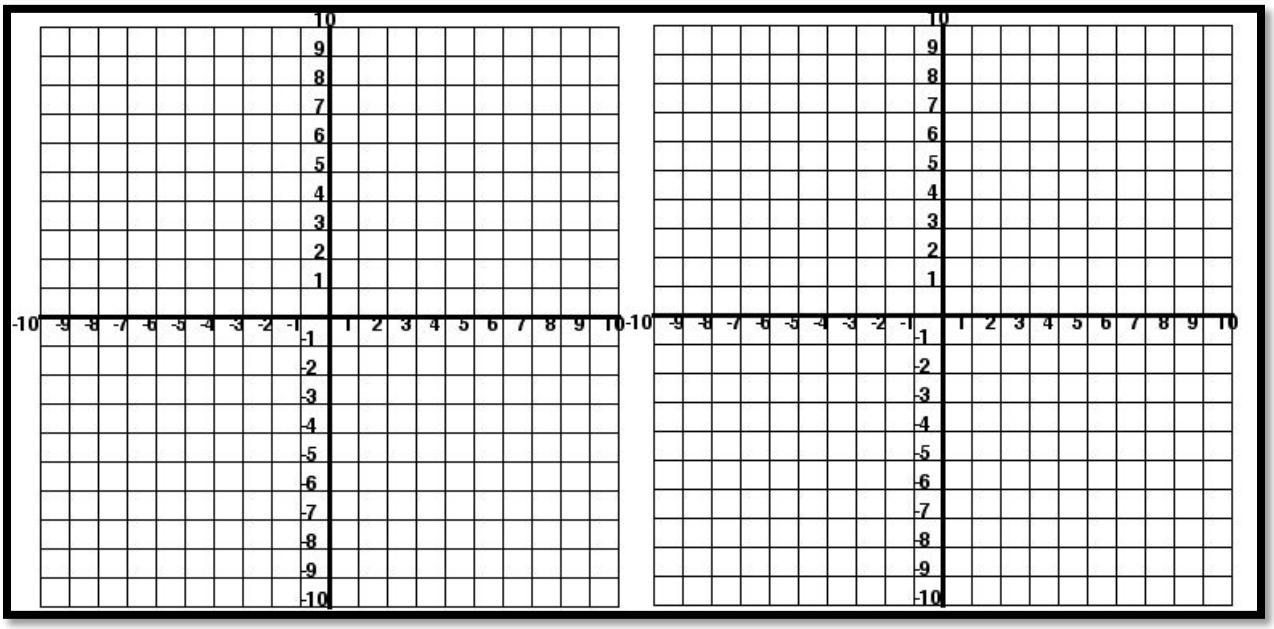
- Horizontal axis → defined by t or n
- Vertical axis → Amplitude value → defined by ummm lets say A

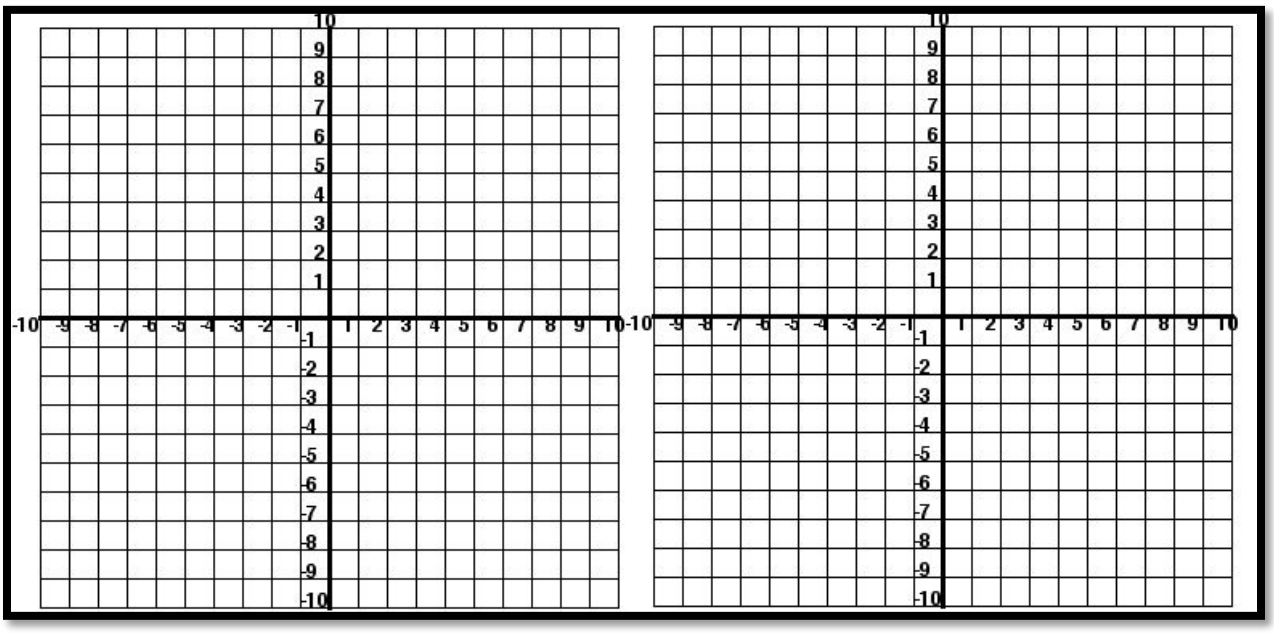
Sketching Signal : Tip of Century : Remember



Exercise 2 : For a signal x(t) and x[n] draw Ax(t) and Ax[n] where A= 2, -1,3



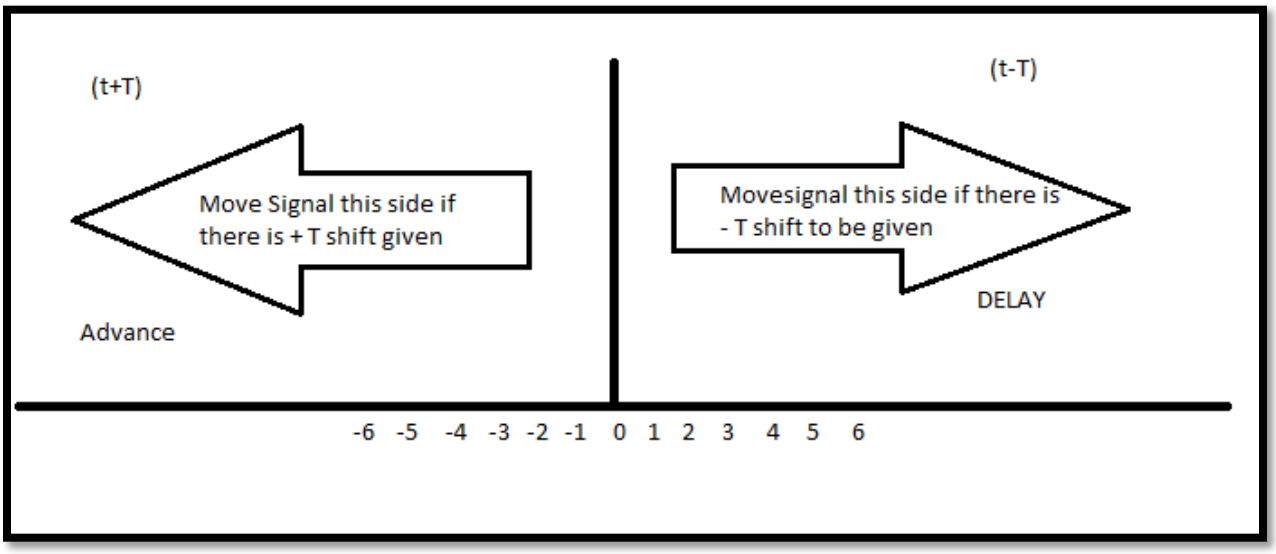




Time Shifting

Shifting is Done when signal is moved left or right , along x axis for making delay or advance :

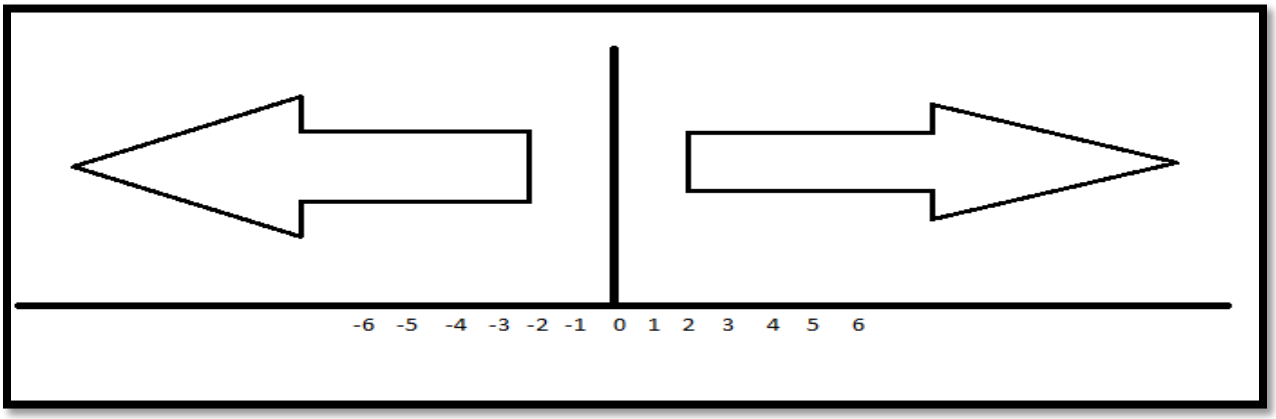
Remember the following Rule



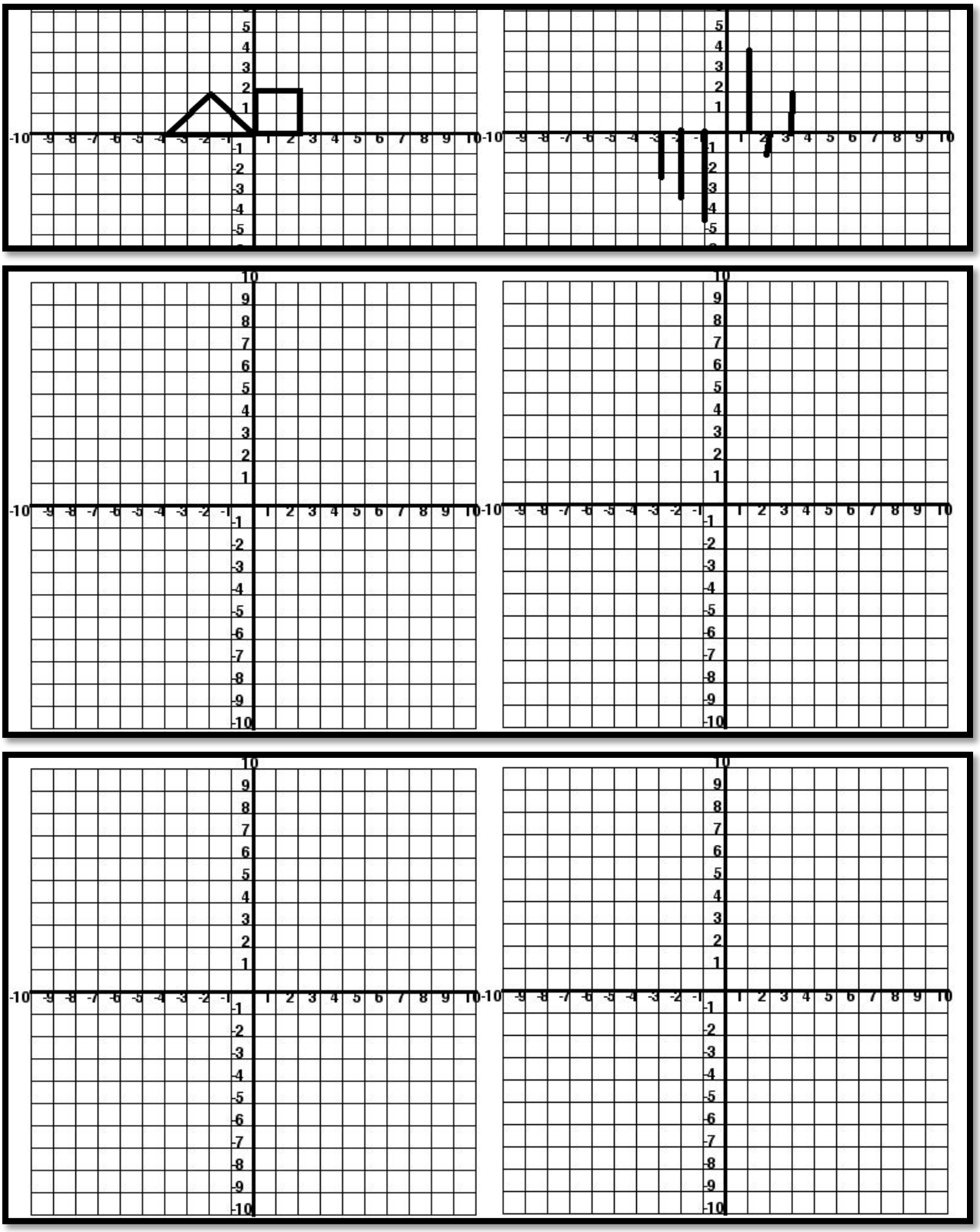
I don't think so I will remember this.....Its to hard to remember

No Problem , I know how to make you rember it.

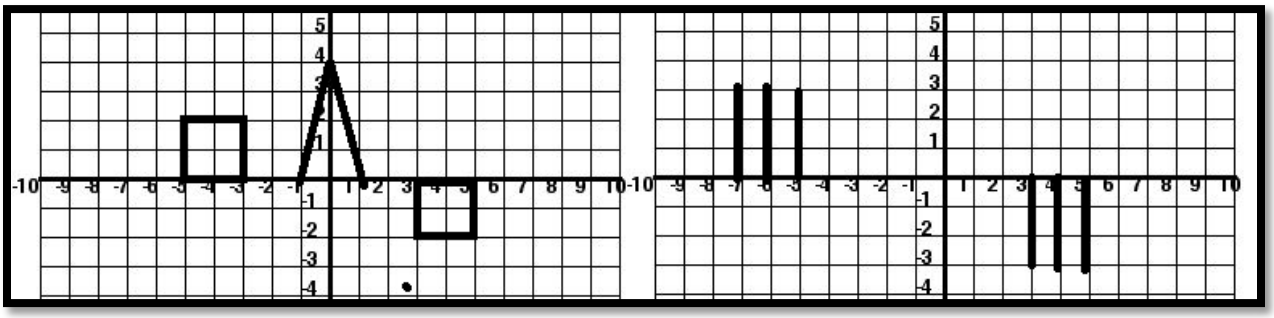
Why don t you draw the above diagram yourself

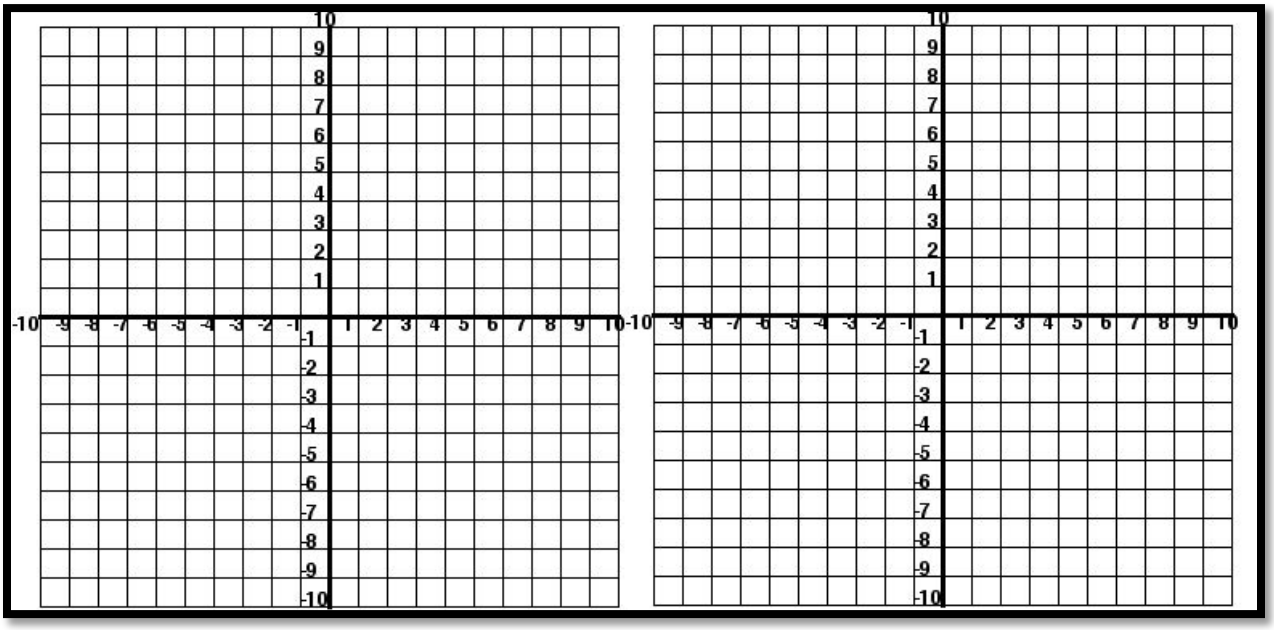


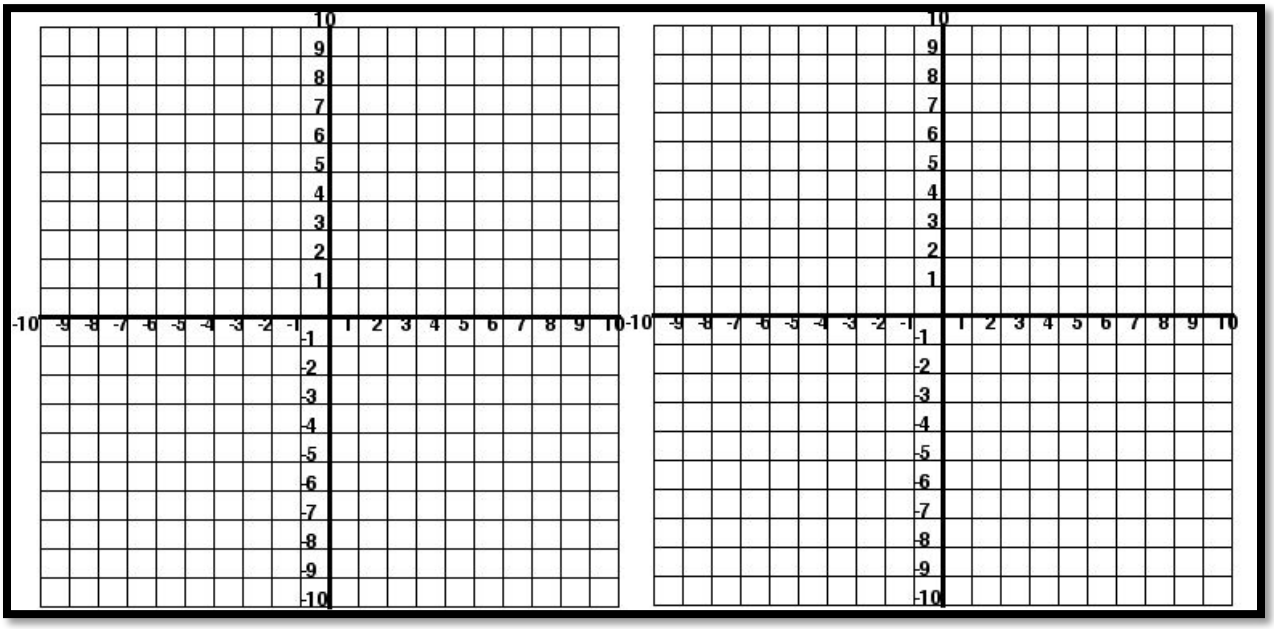
Exercise For a signal x(t) and x[n] draw x(t+2), x[n+2], x(t-4),x[n-4] x(t-3),x(n+3)

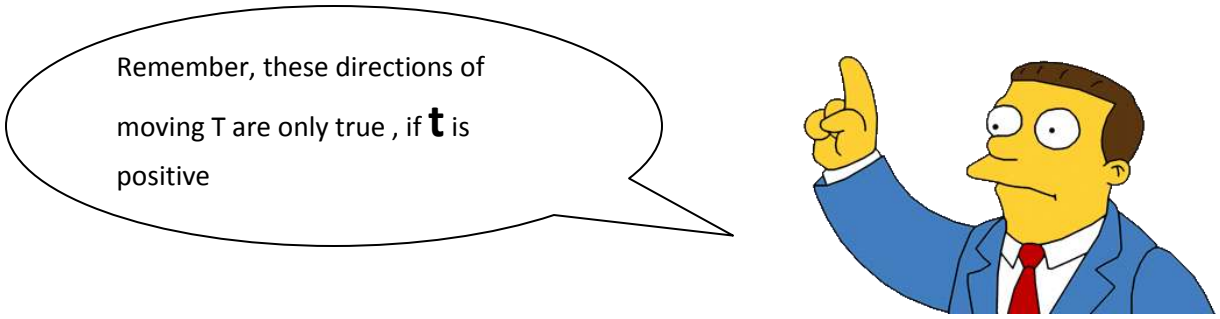


For a signal x(t) and x[n] draw 2x(t+2), 2x[n+2]



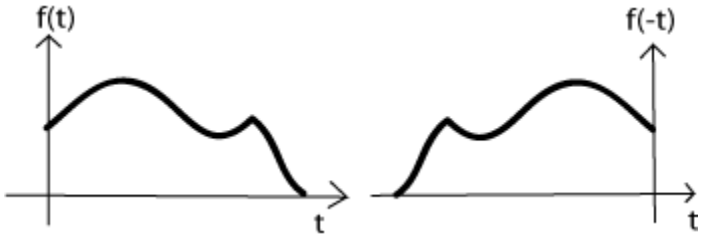




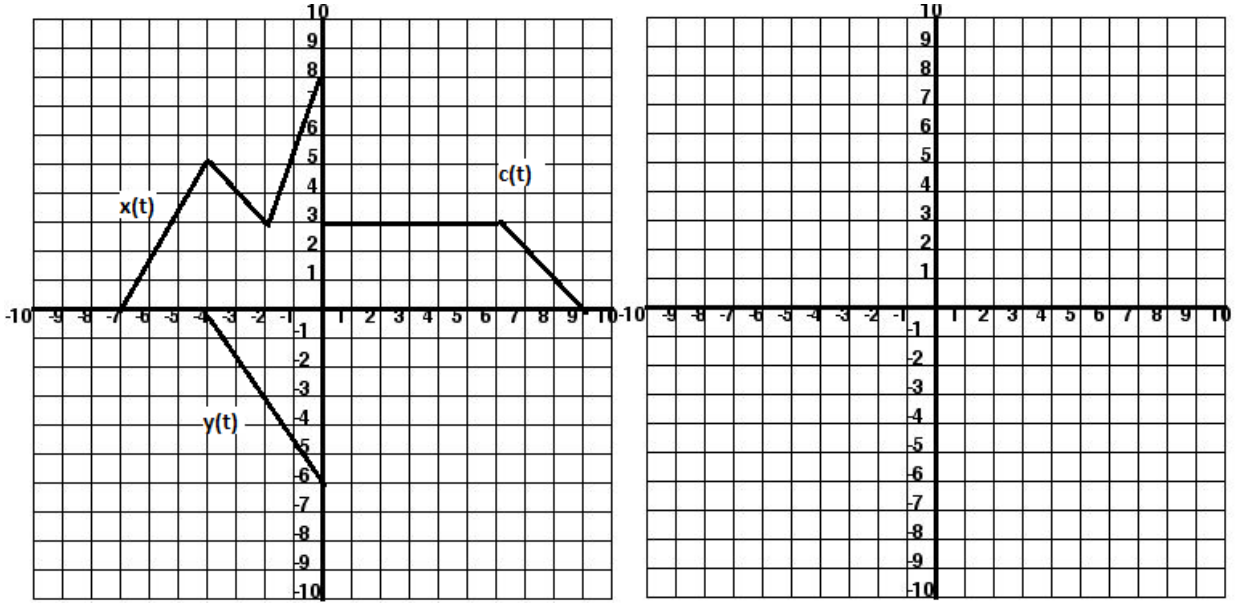


Reflection:

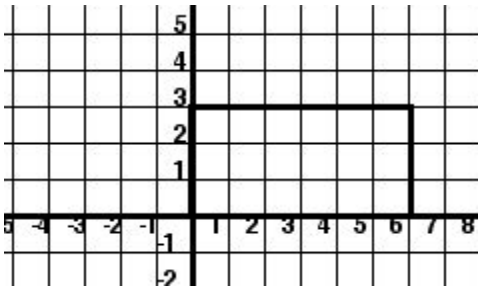
Reflection is simply flipping the signal around 0

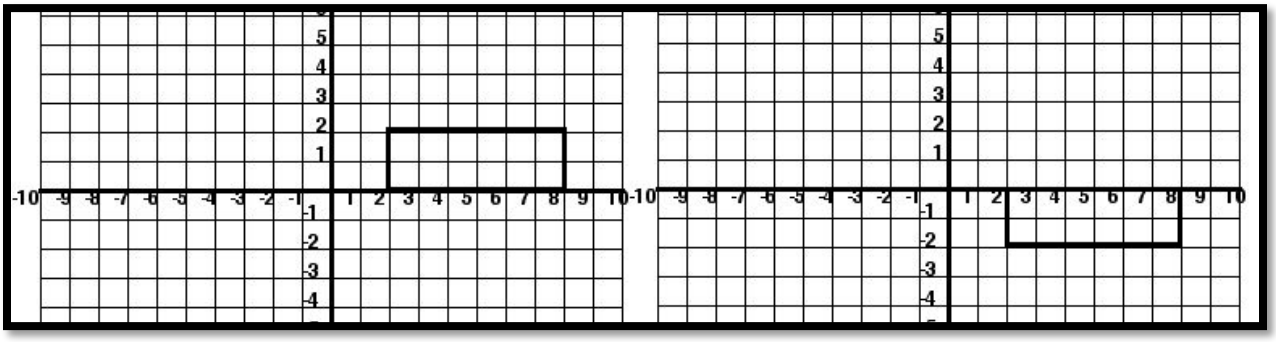


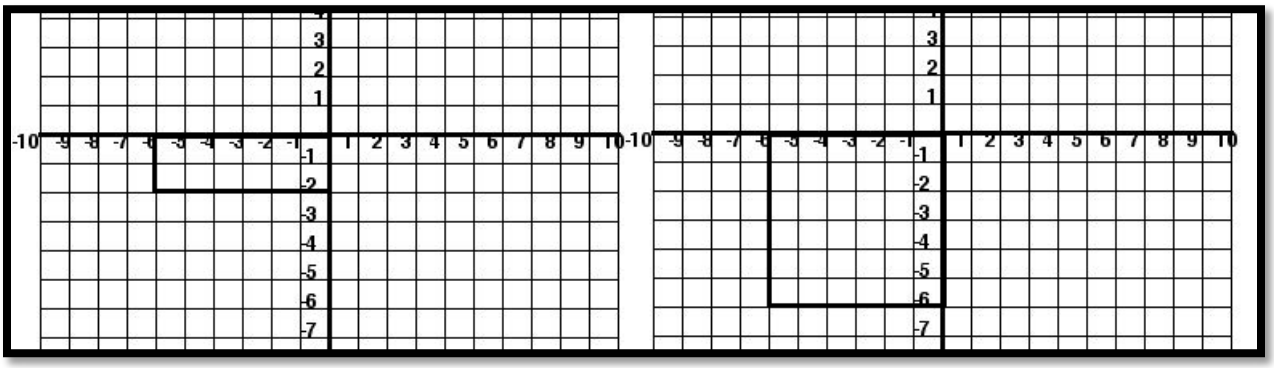
Simple as that.. .. .. .Now Reflect the following Signals

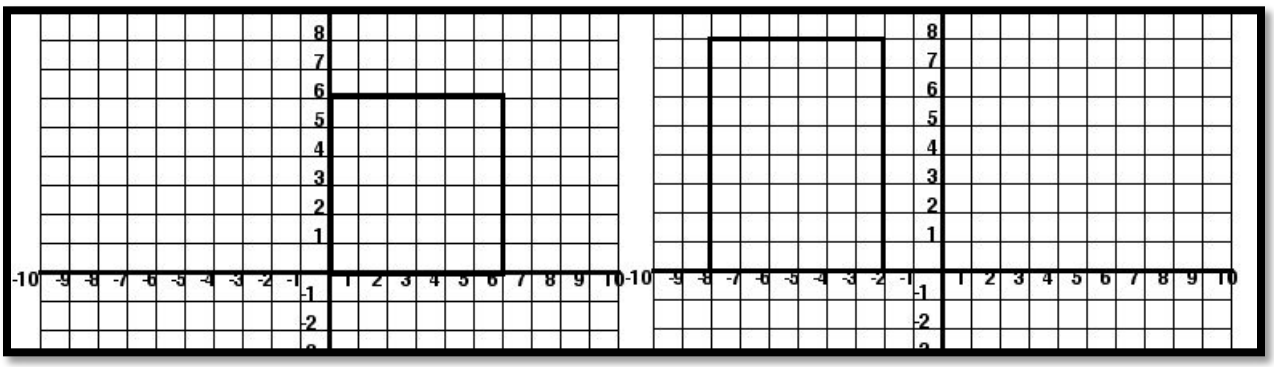


Write down signal Expression for Following , if x(t) is



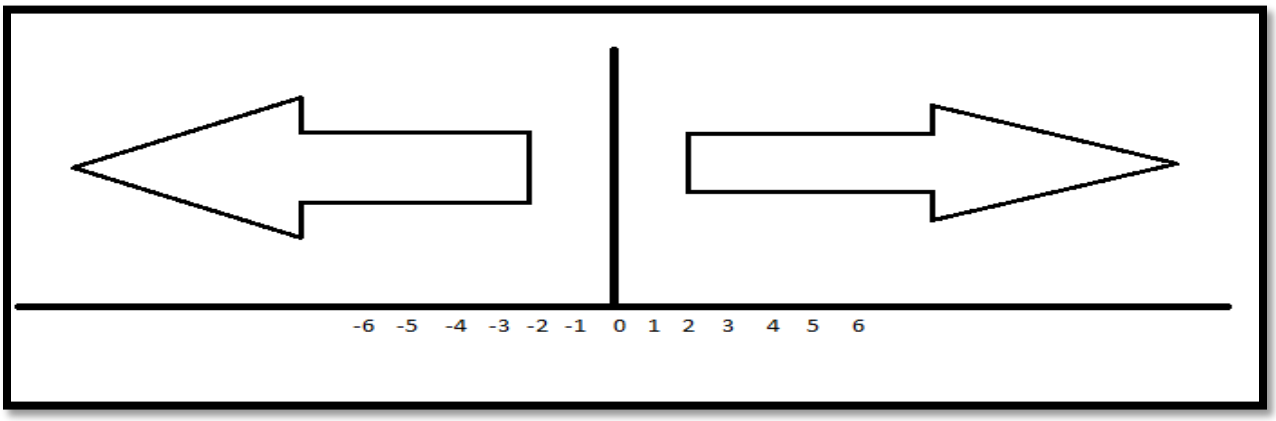






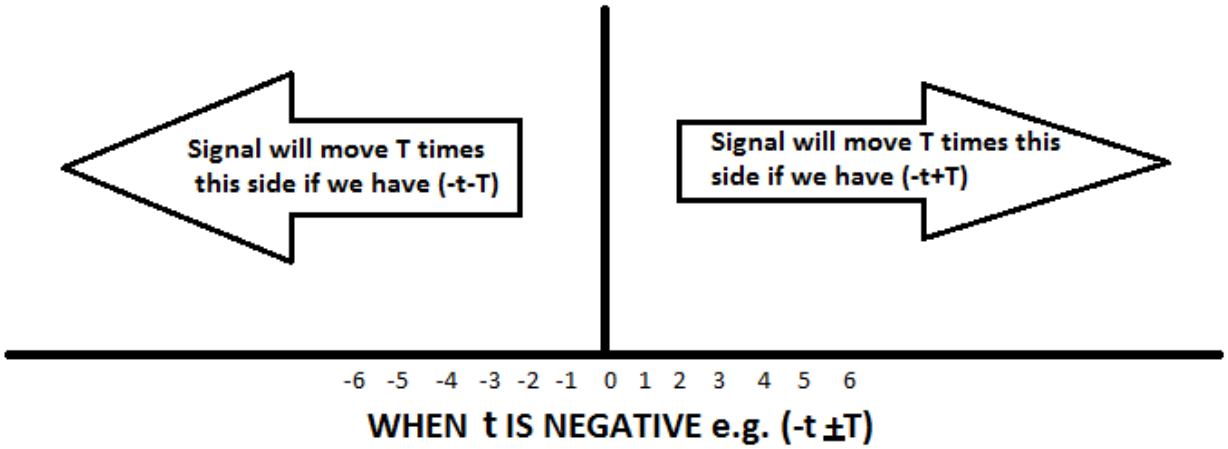
Time Shifting When t/n is negative

Do you remember the diagram , of time shifting, when t was positive. Label it again

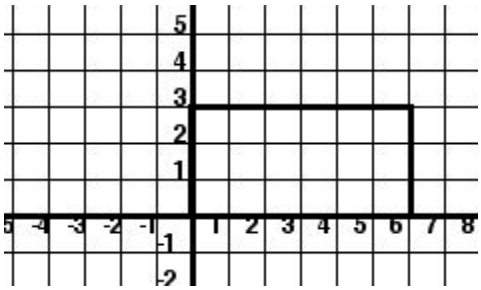


So what the big deal ,if t is with negative sign

Hmmm. . . Well not a big one . We just have to remember few rules. - t means that signal is reflected/folded, and than is shifted . So after reflecting signal , the direction for time shifting will be changed



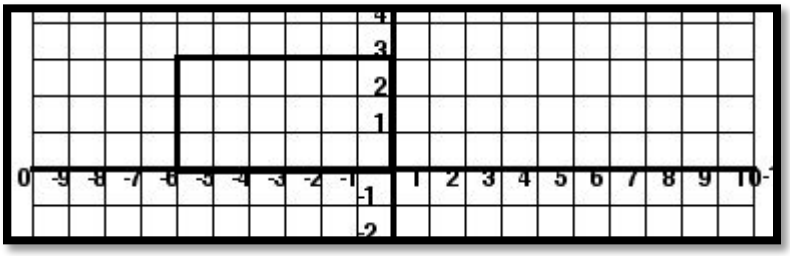
Example : Solve for x(t), sketch x(-t-2), x(-t+3)



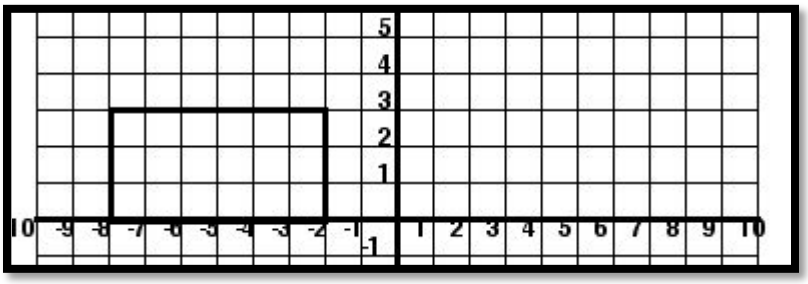
Remember : Always Follow the order --- First Reflection than shifting

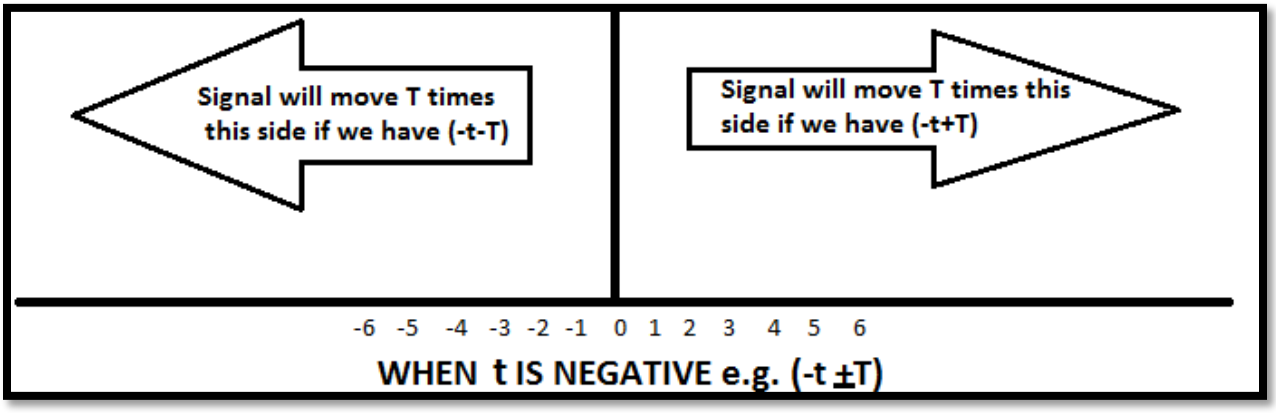
Sketching x(-t-2)

Step 1 : Sketching x(-t)

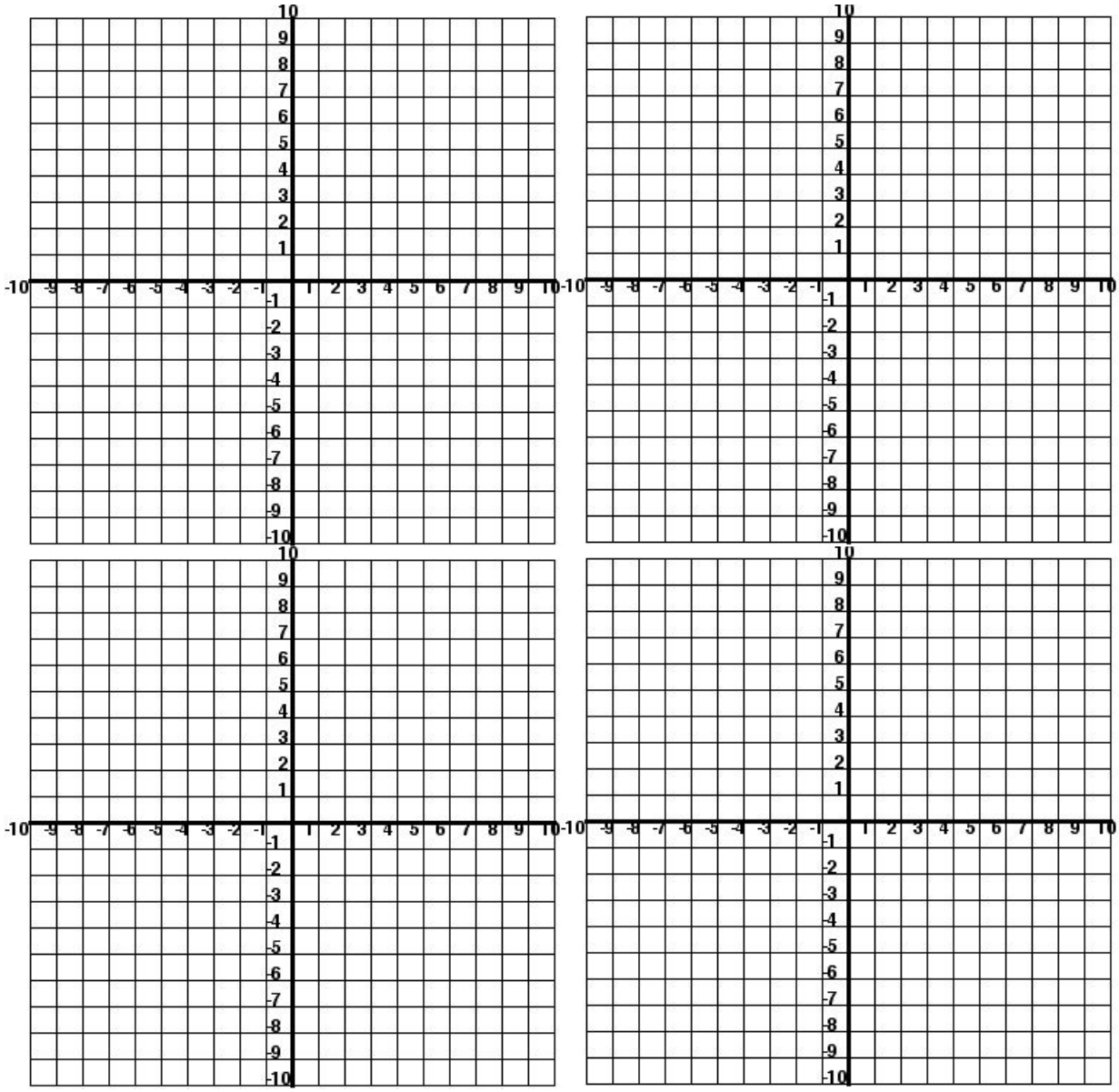


Step 2: Sketching x(-t-2)

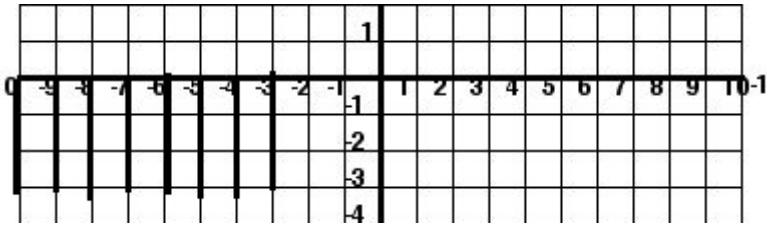




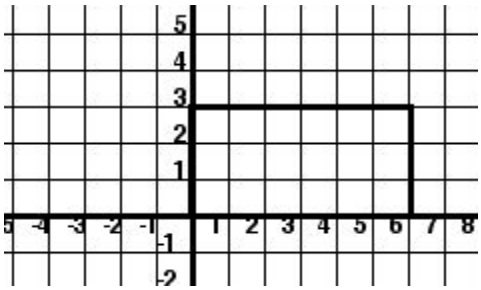
Do Part Two Your self

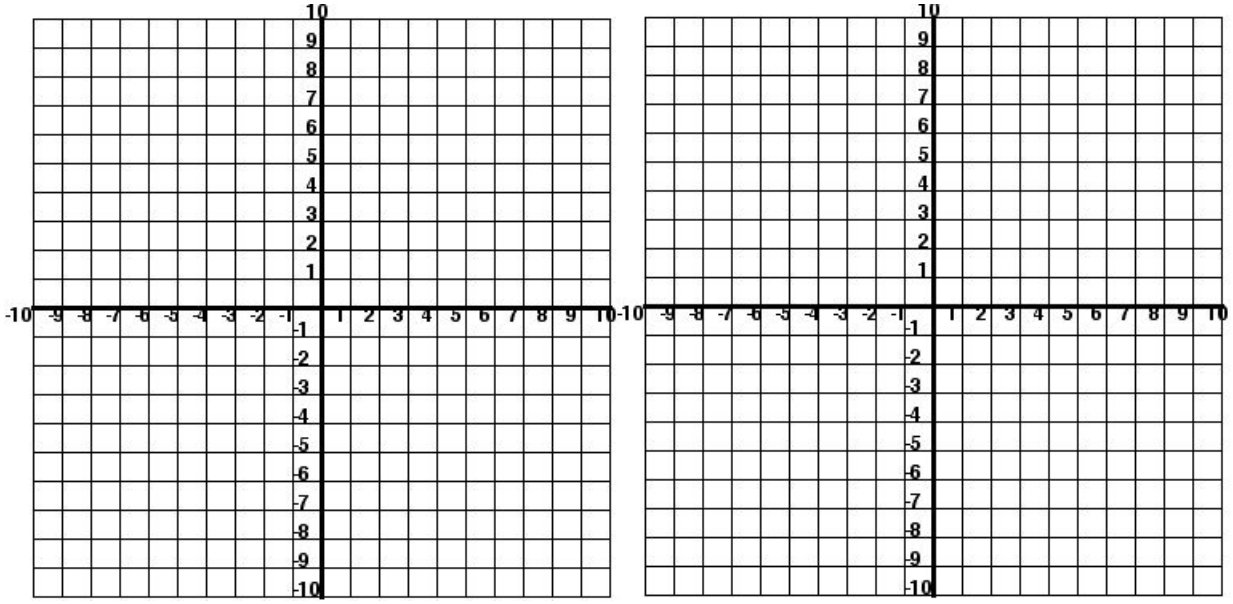


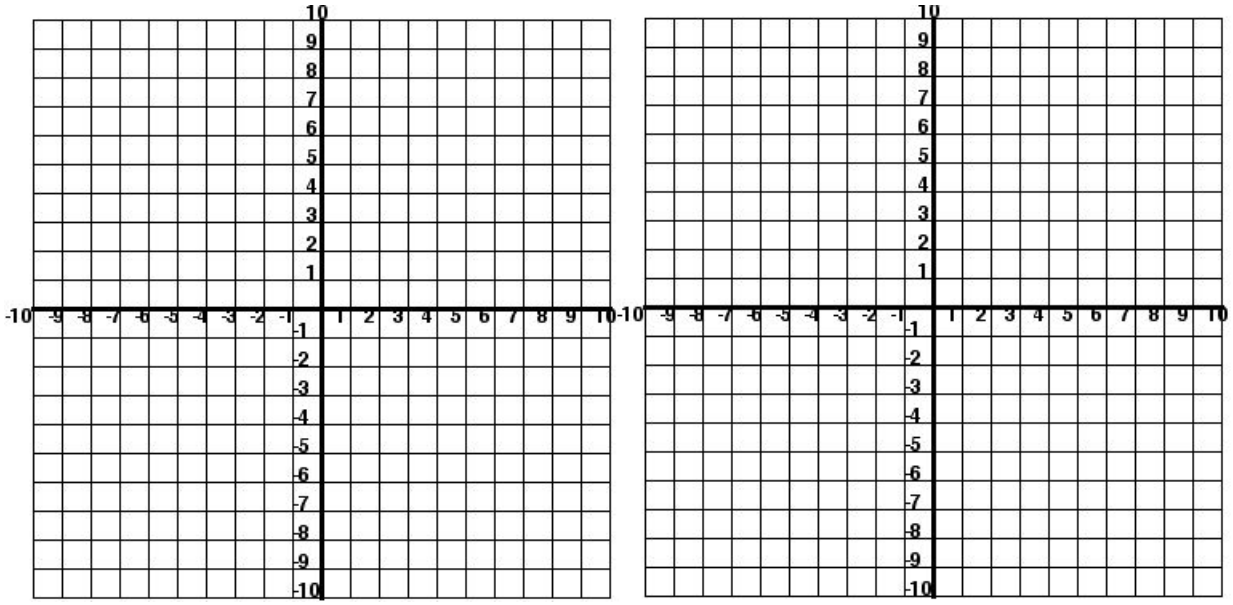
Write an Expression for U[n] such that the expression represents the following signal



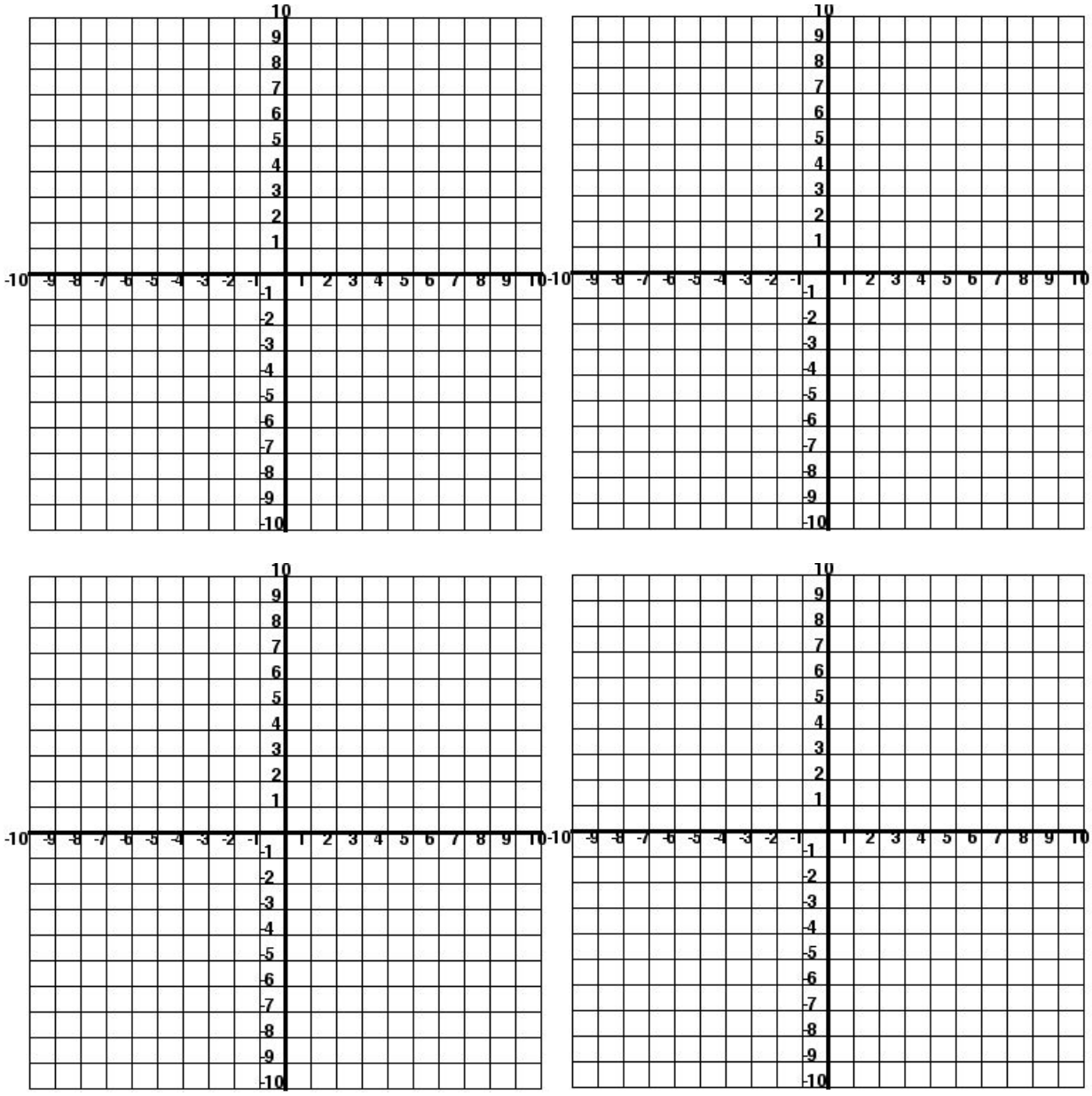
For a given signal x(t) draw 2x(t+2), -1x(-t-2),0.5x(-t+3),3x(-t-2)





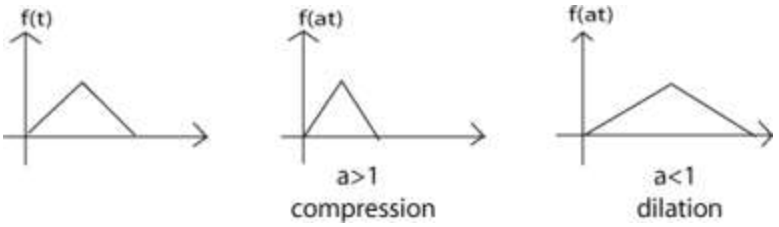


If r[n] represents ramp function , than draw r[n+2],-r[n], -r[-n], -r[-n-2]



Scaling :

Time scaling compresses or dilates a signal by multiplying the time variable by some quantity. If that quantity is greater than one, the signal becomes narrower and the operation is called compression, while if the quantity is less than one, the signal becomes wider and is called dilation.



Hain !!!! Yeh Dilation kahan say a gaya !!!!

Hmmm Well dilation is another name for signal expansion

So few things to be remembered

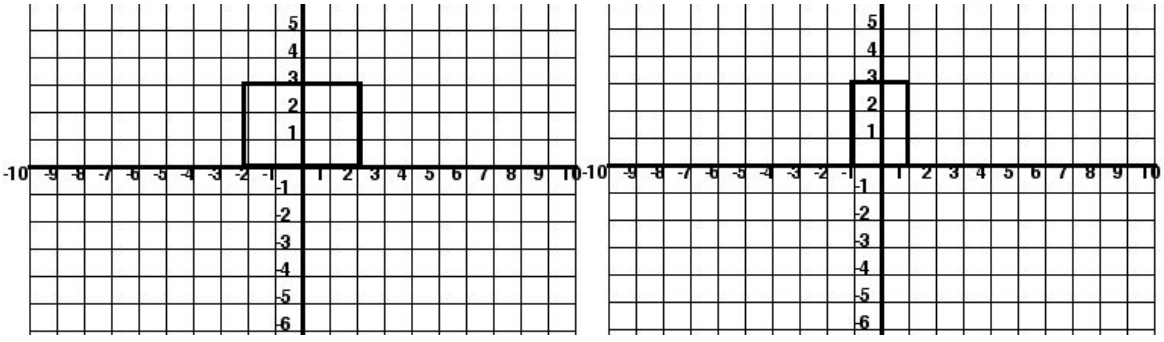
A is always greater then 0 and can be a>1 (compression) or a<1 (expansion)

Golden RULE

Always remember , Perform Reflection first , than shifting and than scaling . Never change the order .

A simple rule of for scaling is that what ever your time limits are, just divide the with the value of alpha , to get new signals

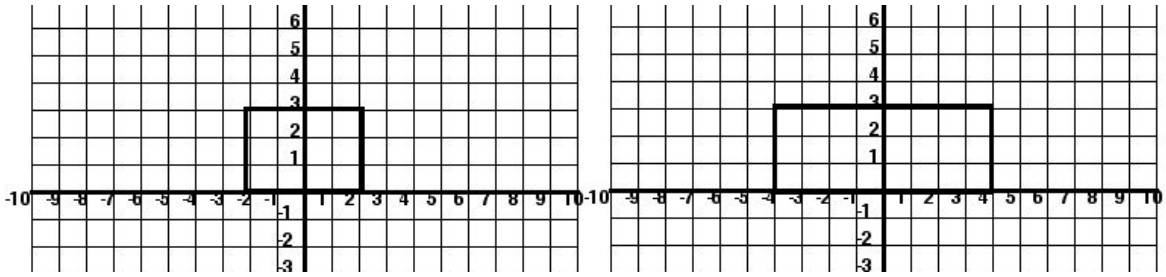
So if I have a signal x(t) and I scaled it to x(2t). What will happen



Again if I have a signal x(t) and I scaled it to x((1/2t). What will happen

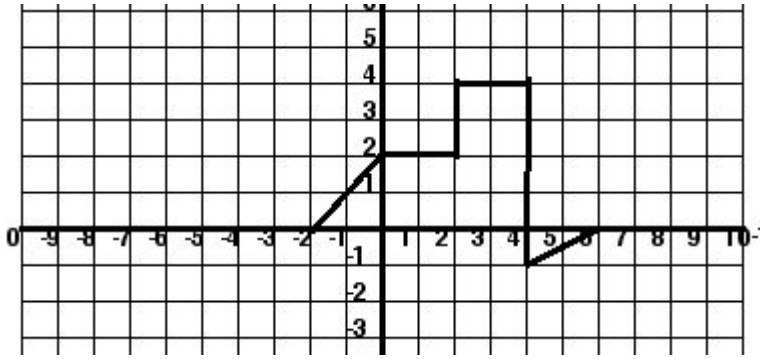
X(1/2t)➔ x(0.25t) so alpha is 0.25

As per rule : dividing alpha with our signal limits

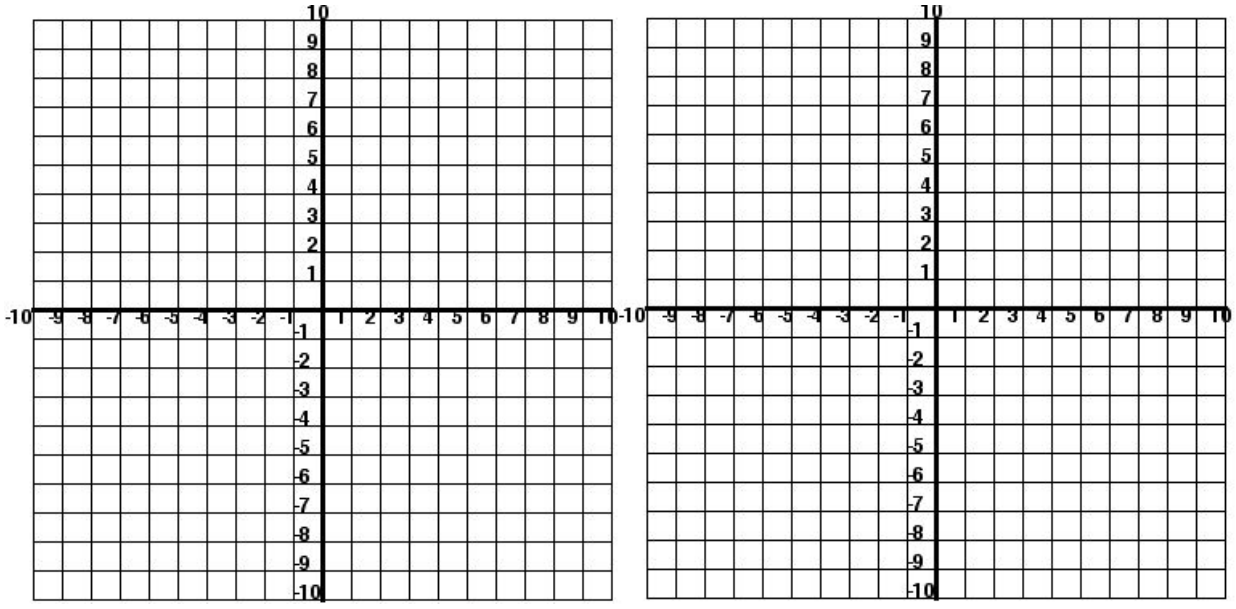


Quick Recap Exercise

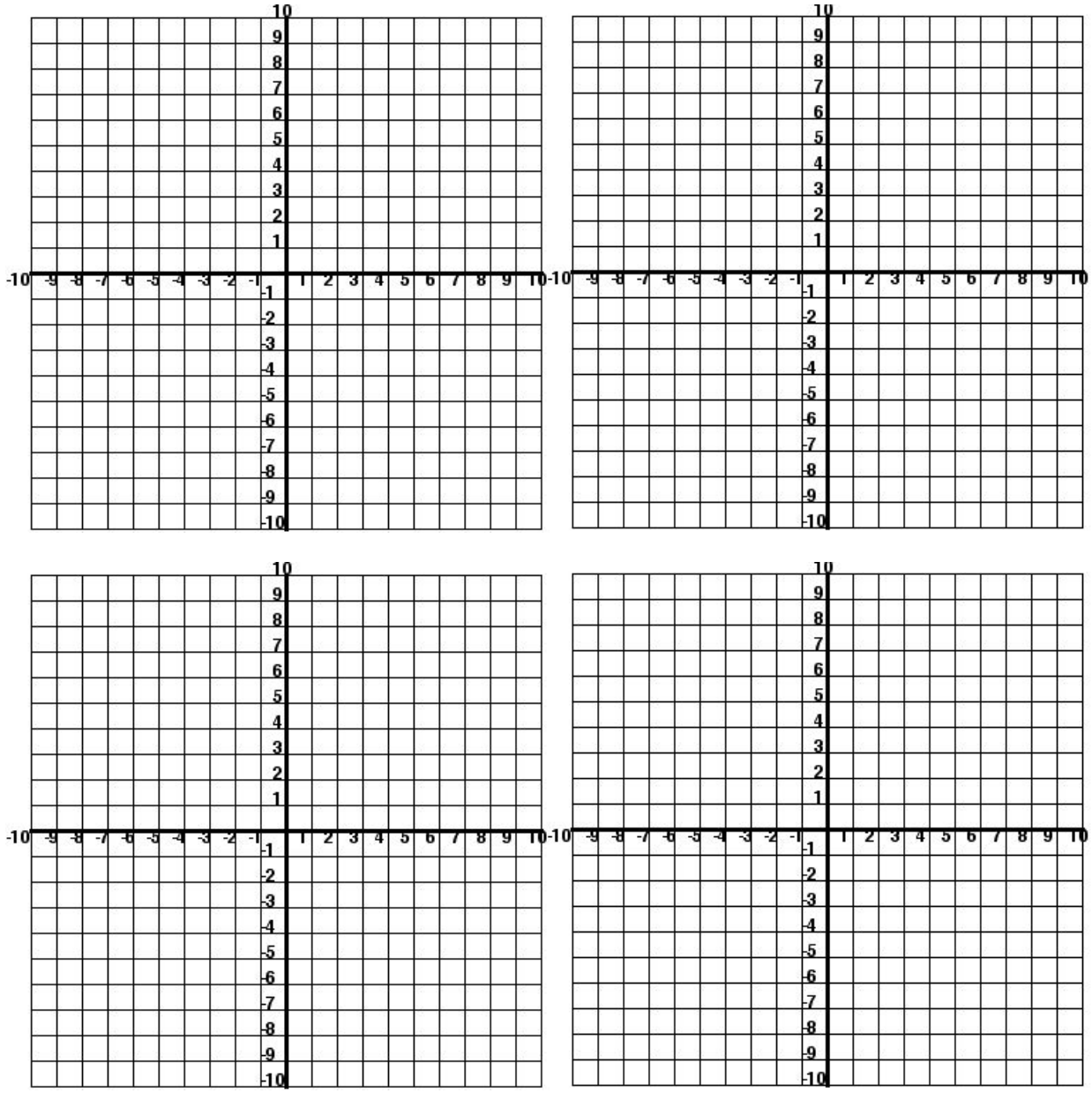
For the Given signal draw



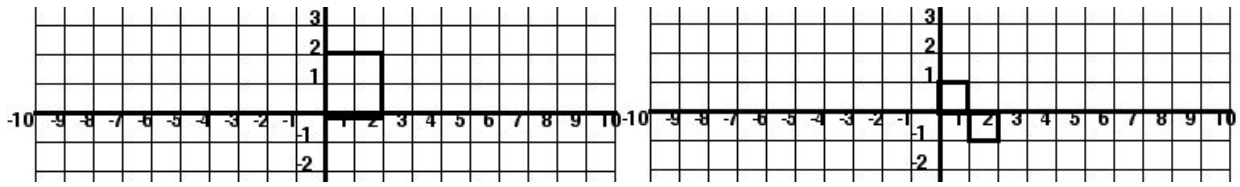
X(-2t-3) , X(-t)



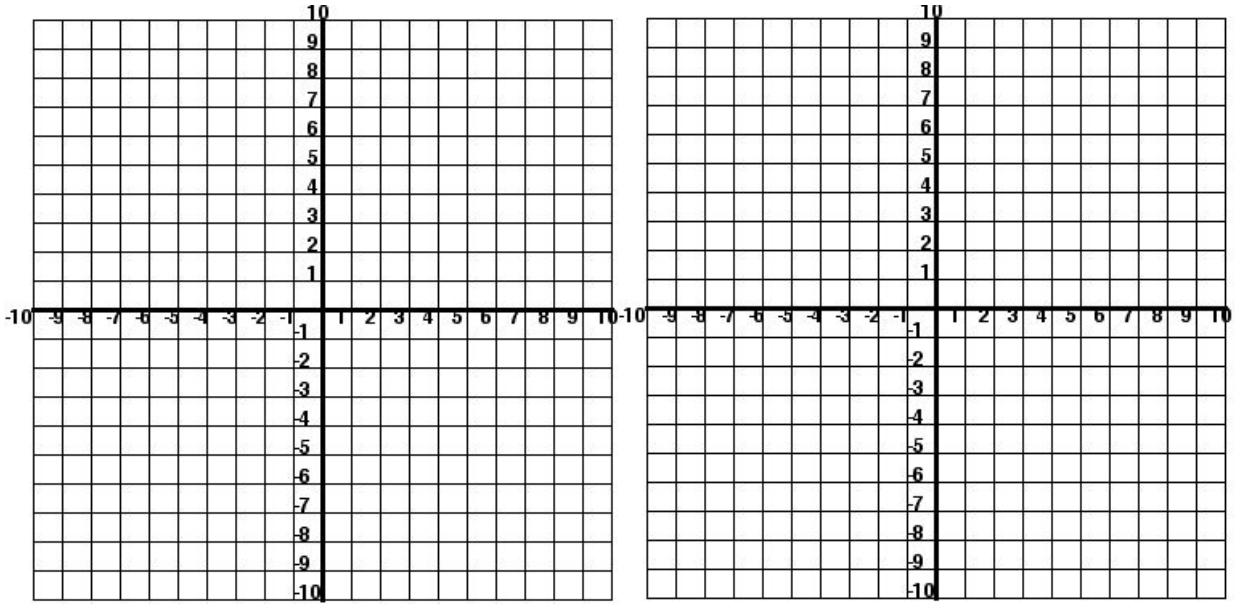
Draw u(t-2), u (t+1),2u(t-1), r(t+2)

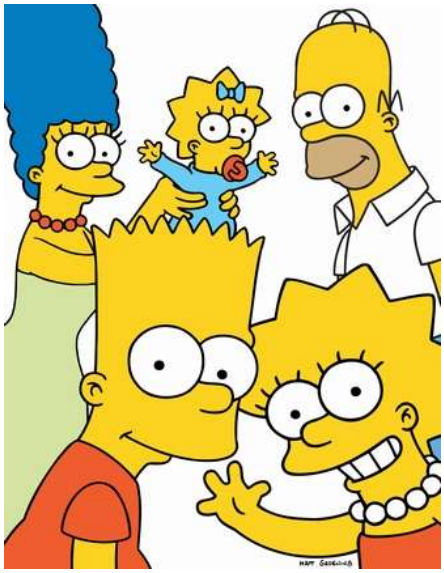


For the following signal x(t) and x2(t) Draw



$0.5x(t)$, $0.5x(2t)$





Well is it all....
Ummm Nops , you will forget all of this , if you wont do the example practice is Dr SK husnain Book . so do go through them at least 10 of them