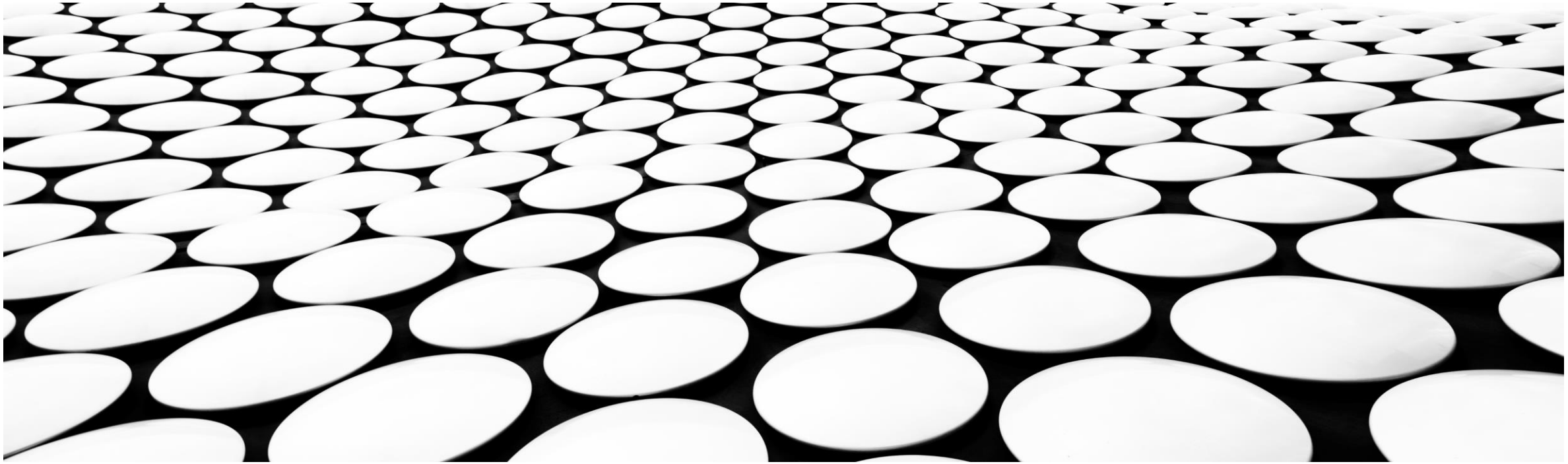
SIGNALS & SYSTEMS

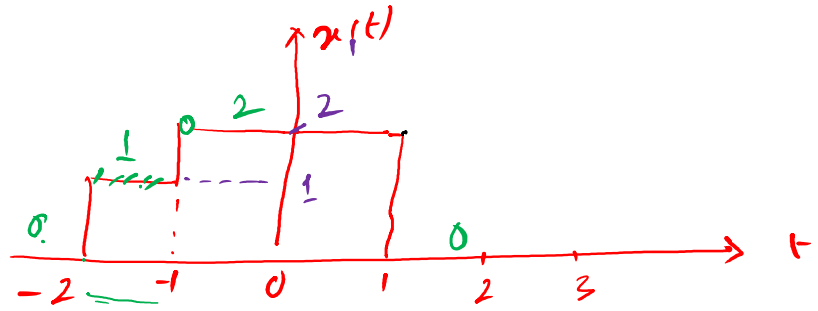
MR. ANKUR JYOTI SARMAH

ASSISTANT PROF., DEPT. OF ELECTRONICS & TELECOM. ENGG.

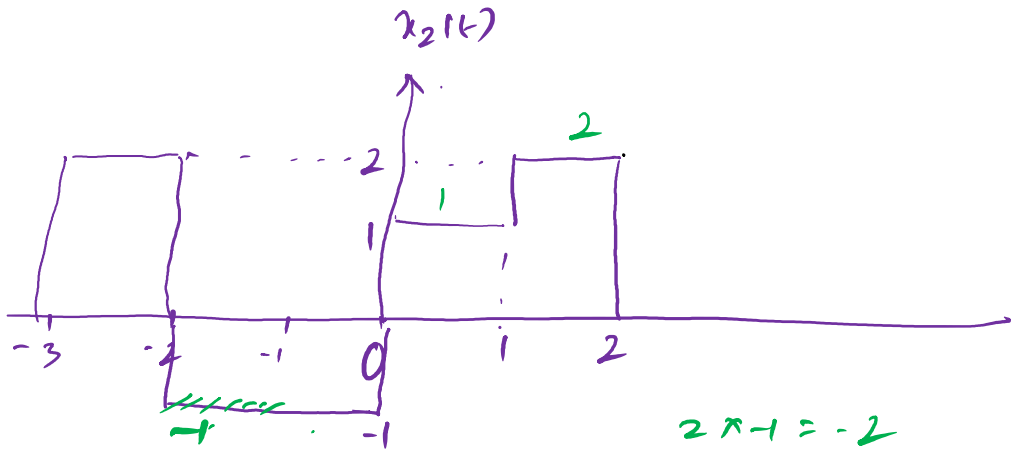
ASSAM ENGINEERING COLLEGE



1) Add the two given signals: -



$0 \times 2 = 0$

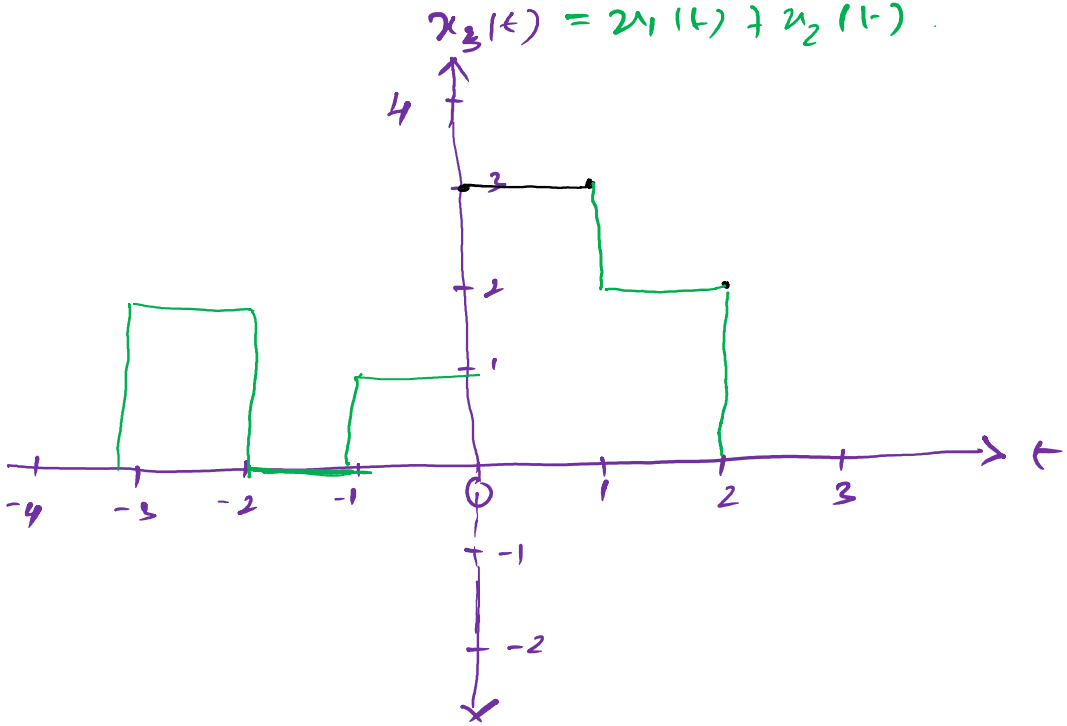


$2 \times -1 = -2$

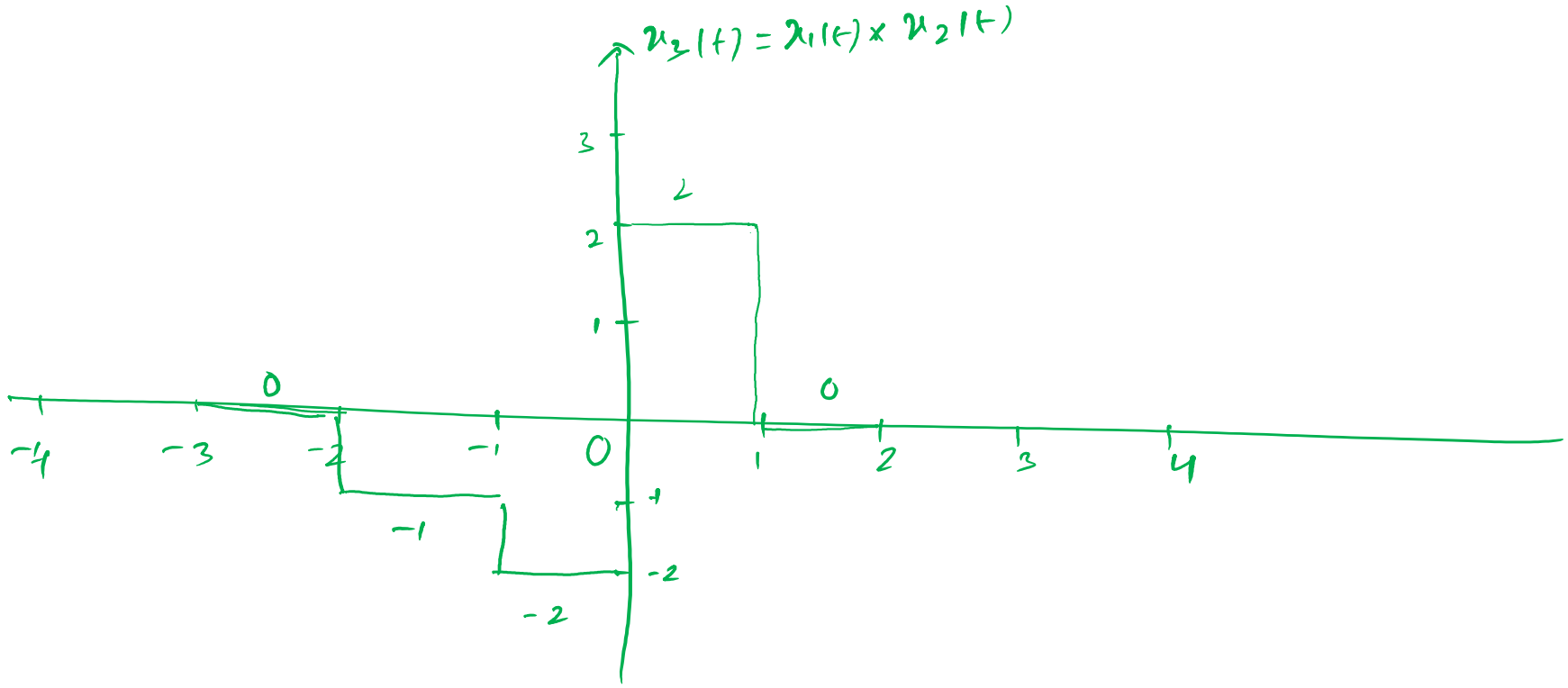
$1 \times -1 = -1$

$2 \times 0 = 0$

$x_3(t) = x_1(t) + x_2(t)$



Multiplying two signals:-



plot $y(t) = Ax\left(\frac{-t - t_0}{a}\right)$

$x(t)$ → Given

$$x(t) = \begin{cases} -2, & t < 0 \\ +2, & t \geq 0 \end{cases}$$ → plot $x(t)$

Step 1:- plot $x(t)$

Step 2:- $Ax(t)$ → Amplitude scaling (4)

Step 3:- $Ax(-t)$ → Time reversal (1)

Step 4:- $Ax(-t - t_0)$ → Time shifting (2) → $Ax\left(-t - \frac{t_0}{a}\right)$ Time shifting. ✓

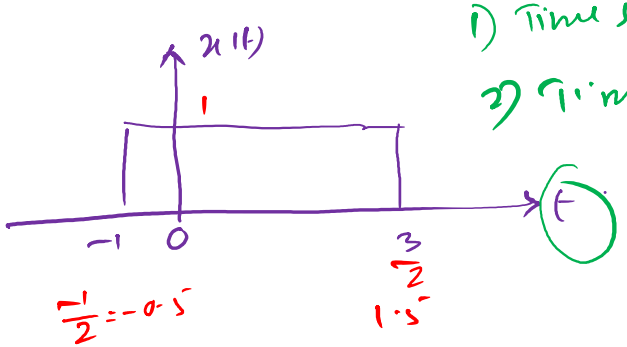
Step 5:- $Ax\left(-\frac{t - t_0}{a}\right)$ → Time scaling (3) → $Ax\left(-\frac{t}{a} - \frac{t_0}{a}\right)$ Time scaling. ✓

$$\frac{-t - t_0}{a} = -\frac{t}{a} - \frac{t_0}{a}$$

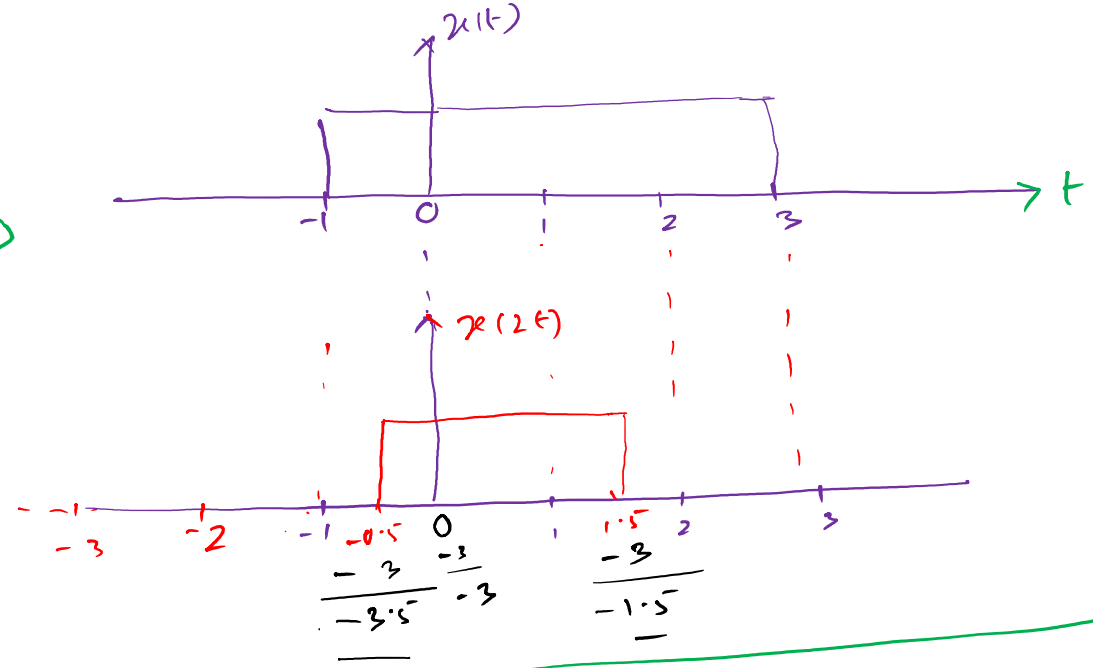
priority order → Time reversal → Time shifting → Time scaling.

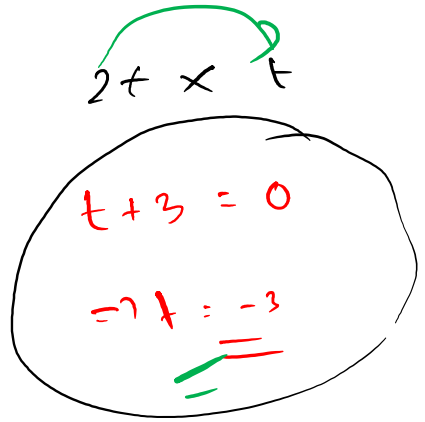
Method 1 :- Time scaling → Time shifting

Put $y(t) = x(2t+3)$



1) Time scaling
2) Time shifting





$2t+3$

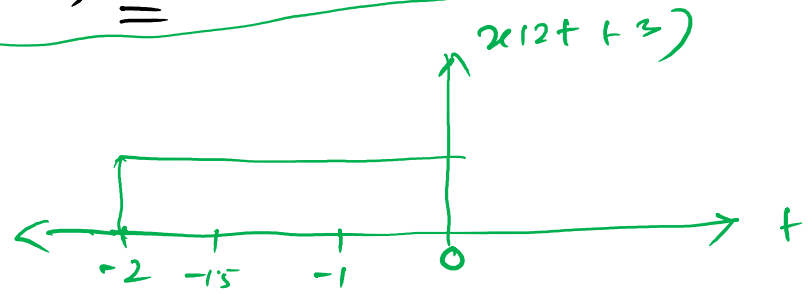
$= 2(t+1.5)$

Time shifting is always performed against the time axis i.e; 't' not '$2t$'

$-0.5 - 1.5 = -2$

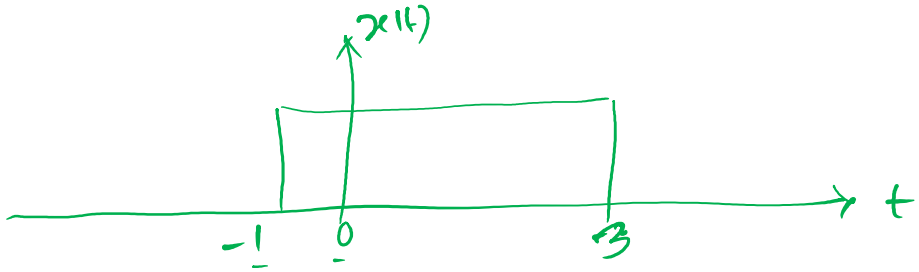
$0 - 1.5 = -1.5$

$1.5 - 1.5 = 0$



Method 2 → Time shifting → Time scaling

$x(2t+3)$



$t+3=0$

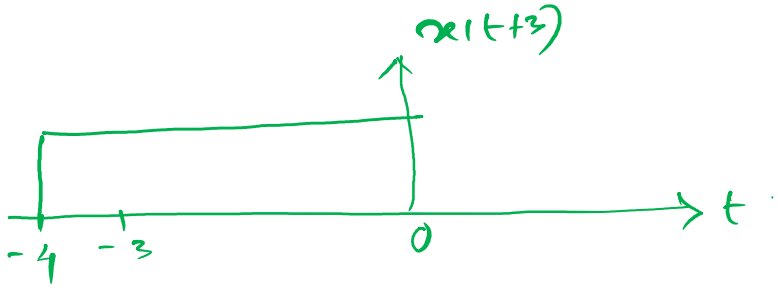
$\Rightarrow t=-3$

$-1-3=-4$

$0-3=-3$

$3-3=0$

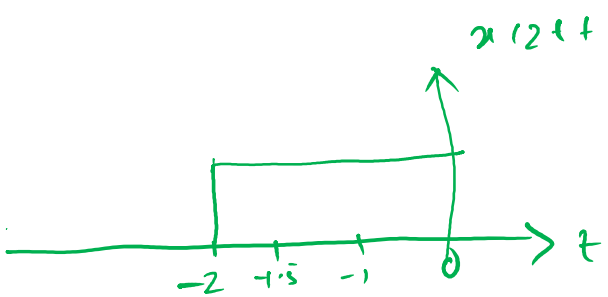
Time shifting



$-4\times\frac{1}{2}=-2$

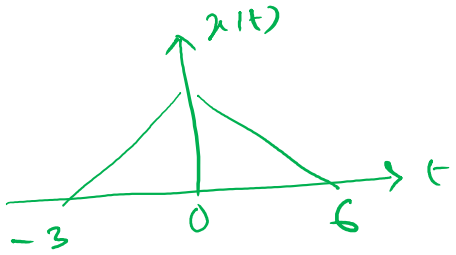
$-3\times\frac{1}{2}=-1.5$

$0\times\frac{1}{2}=0$



Problem 2

$x(t)$



Draw $y(t) = x(-2t+1)$

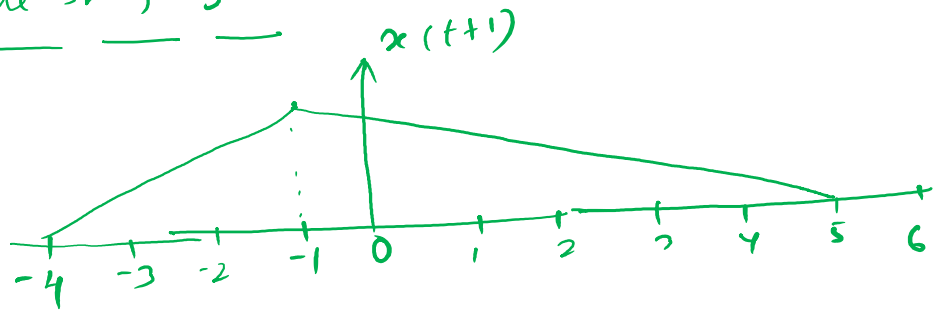
$t+1 = 0 \Rightarrow t = -1$

$-3-1 = -4 \times \frac{1}{2} = -2 \times -1 = 2$

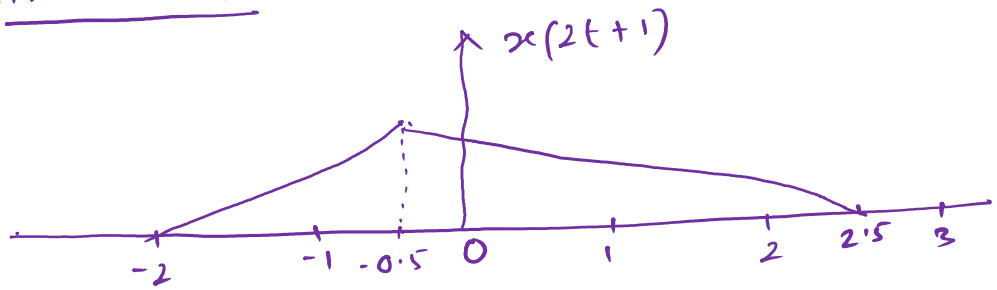
$6-1 = 5 \times \frac{1}{2} = 2.5 \times -1 = -2.5$

$0-1 = -1 \times \frac{1}{2} = -0.5 \times -1 = 0.5$

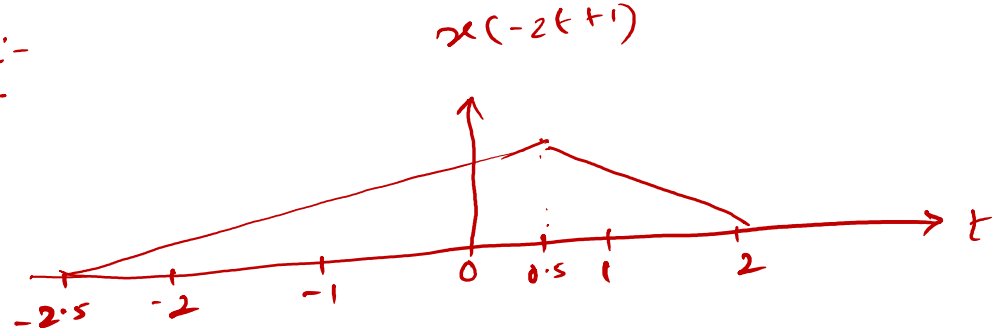
Time shifting:-



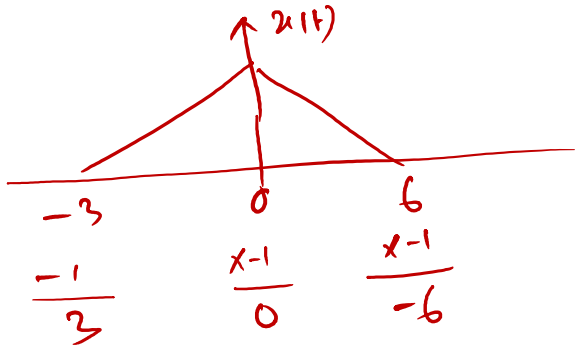
Time scaling:-



Time Reversal:-



Time reversal → Time shifting → Time scaling



$-t+1=0$

$\Rightarrow t=1$

$-t+1=0$

$\Rightarrow t=-1$