Assignment -3

SDC Tutorial

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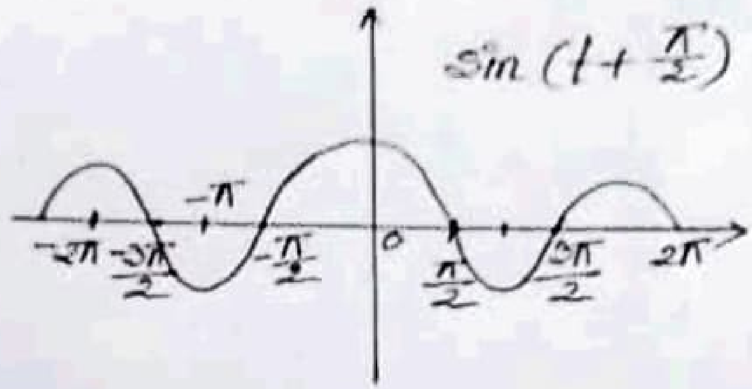
CSE Section B.

2.

a) $\sin(t+\frac{\pi}{2})$

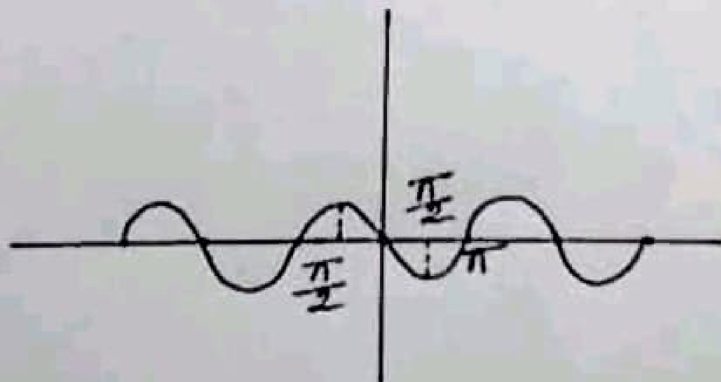
Graph



Since the graph of the function is symmetric about y axis.

$\therefore f(x)$ is even function.

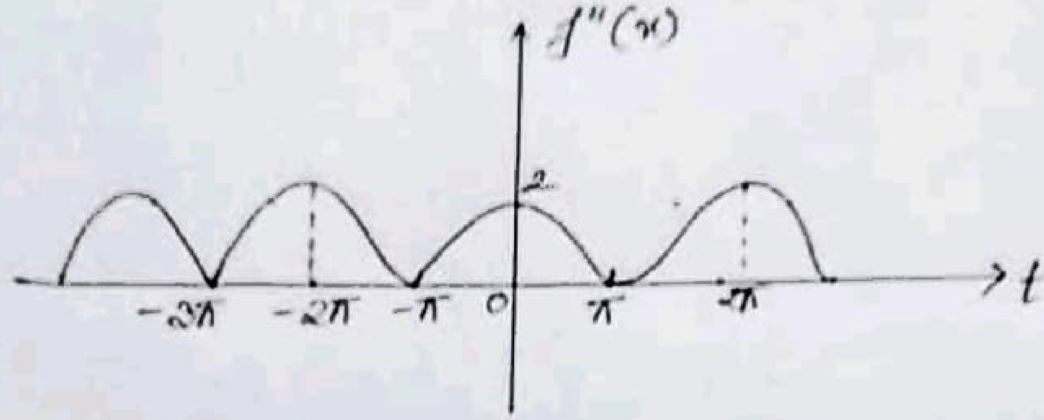
b) $\cos(t+\frac{\pi}{2})$



from the graph

$\therefore f(x)$ is neither odd nor even function.

Also, let us now shift the graph by an amplitude of $f''(x) = (1+\cos t)$.

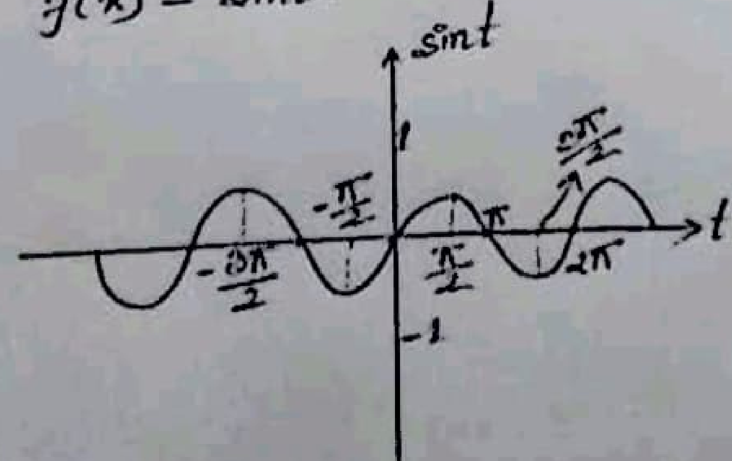


Same as the previous graph, the condition for even symmetry still holds in this amplitude shifted graph.

$\therefore$ Even symmetry of a signal is invariant to time scaling or amplitude shift.

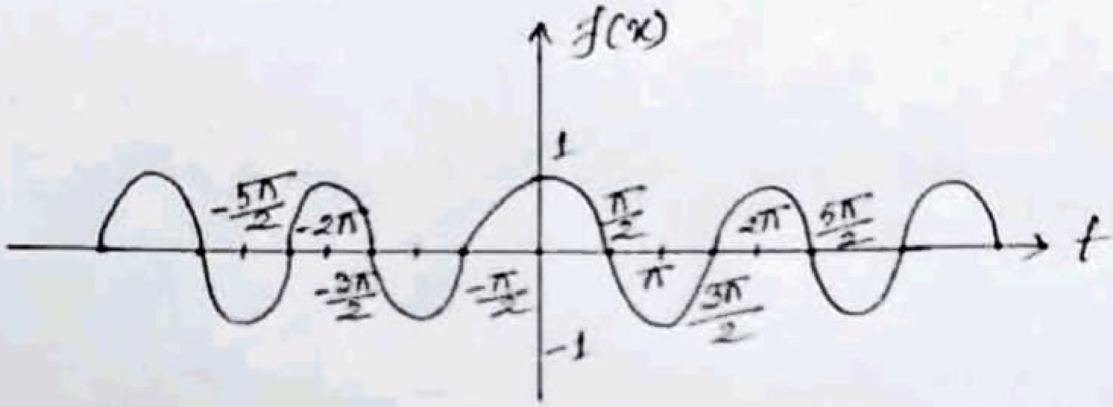
4. Prove that the odd symmetry of a signal is invariant to time scaling as amplitude scaling.

Ans:- To prove this let us take a function
$f(x) = \sin t$.



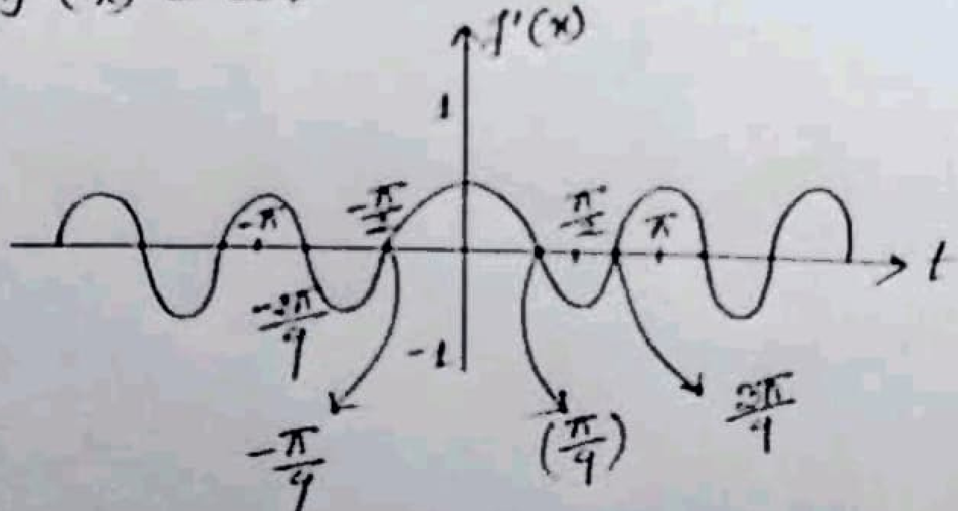
3. prove that even symmetric of a signal is invarient to time scaling & on amplitude shift.

Ans:- To prove this let us take an example
$f(x) = \cos t$



now let us scale this graph.

$f'(x) = \cos$

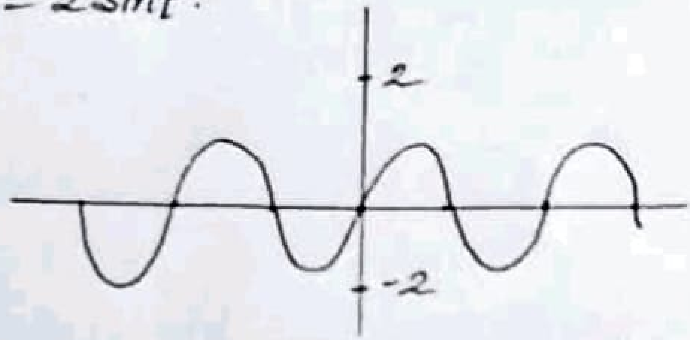


As we can see from the new graph the condition for even function is still satisfied for the second graph.

$\therefore$ Time scaling has no effect on even symmetric of the function.

I. Determine the following signal are energy or power signal.

a) $x(t) = 2\sin t$.



Energy = Area under graph $= \infty$

$$\text{power} = \int_{-T/2}^{T/2} |x(t)|^2 \, dt$$

$$= \int_{-\pi}^{\pi} (2\sin t)^2 \, dt$$

$$= 4\pi$$

$\therefore$ The signal is power signal.

b) $x(t) = \frac{3}{2} \cos 5t \cos \frac{\pi}{3} t$

$$P = \lim_{T_0 \to \infty} \frac{1}{T_0} \int_0^{T_0} [x(t)]^2 \, dt$$

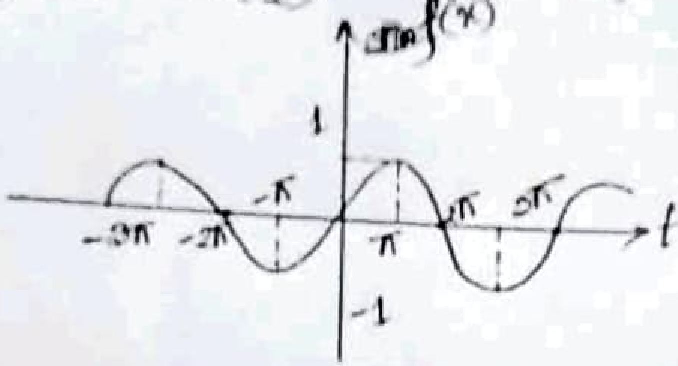
$$= \lim_{T_0 \to \infty} \frac{1}{T_0} \int_0^{T_0} \frac{9}{4} \cos^2 5t \cos^2 \frac{\pi}{3} t \, dt.$$

$$= \lim_{T_0 \to \infty} \frac{9}{4T_0} \int_0^{T_0} \left(\frac{1+\cos 10t}{2}\right) \left(\frac{1+\cos \frac{2\pi}{3} t}{2}\right) dt$$

$$= \lim_{T_0 \to \infty} \frac{9}{4T_0} \times \frac{1}{4} \int_0^{T_0} \left(1 + \cos \frac{2\pi}{3} t + \cos 10t + \cos 10t \cos \frac{2\pi}{3}\right) dt$$

time scaling

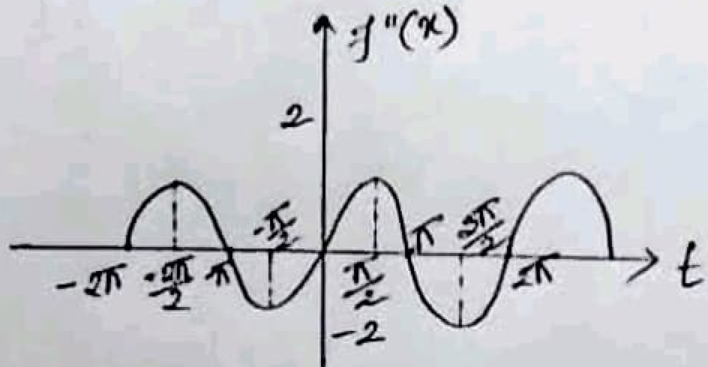
$f'(x) = \sin(\frac{t}{2})$



no effect fon odd symmetry.

Amplitude scaling

$f''(x) = 2\sin t$



no effect on odd symmetry
hence proved.

$$= \lim_{T_0 \to \infty} \frac{9}{16T_0}\left[[t]_0^{T_0} + \left[\frac{\sin\frac{2\pi}{3}t}{\frac{2\pi}{3}}\right]_0^{T_0} + \left[\frac{\sin 10t}{10}\right]_0^{T_0} + \int_0^{T_0} \cos 10t \cos\frac{2\pi}{3}t \, dt \right]$$

$$= \lim_{T_0 \to \infty} \frac{9}{10T_0}\left[T_0 + \frac{3}{2\pi}\sin\frac{2\pi}{3}T_0 + \frac{\sin 10T_0}{10} + \frac{\sin(10+\frac{2\pi}{3})}{2(10+\frac{2\pi}{3})} + \frac{\sin(10-\frac{2\pi}{3})T_0}{2(10-\frac{2\pi}{3})} \right.$$

$$= \frac{0}{16} + \text{finite number}$$

$\therefore x(t)$ is power signal.

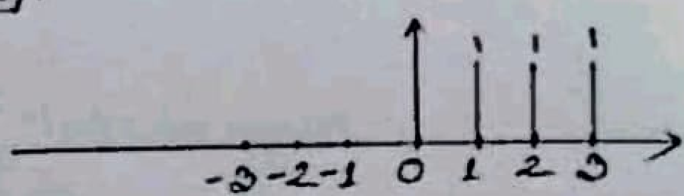
c) $x[n] = 6\cos 2(\frac{\pi}{3}n) - 6\cos \pi n$

period of $x[n] = \frac{2\pi}{\pi} = 2$

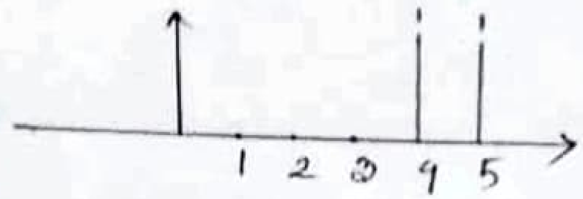
All periodic signals are power signal therefore $x[n]$ is a power signal.

d) $x[t] = u[n-3] - u[n-10]$

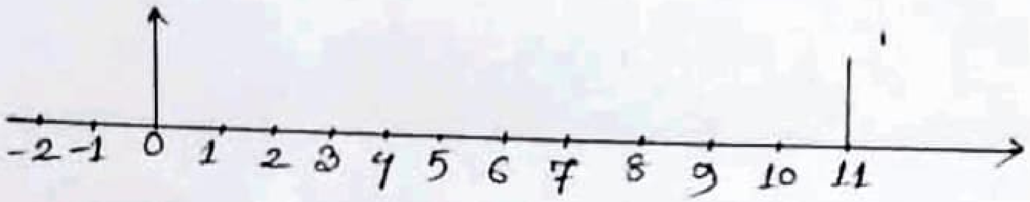
$u[x]$.



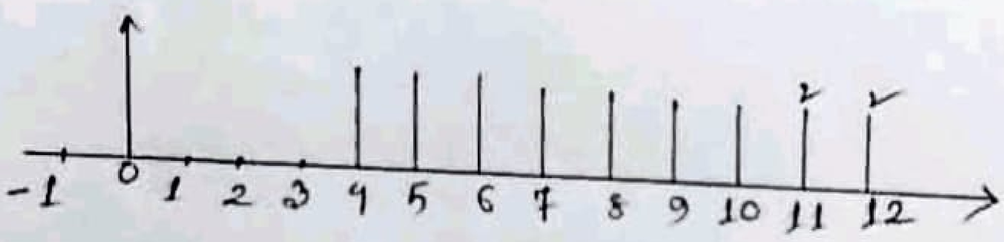
$u[n-3]$



$u[n-10]$



Adding.



Since the amplitude is limit at to any instant of time.

$\therefore x[t]$ is power signal.