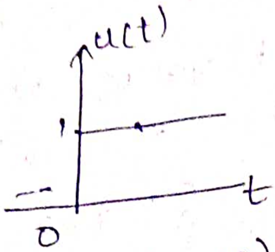
1) Sketch the following signals.

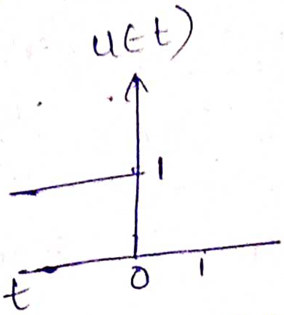
i, $2u(-2t+2)$ ii, $r(-t+2)$ iii, $\mathrm{rect}(t+3)$

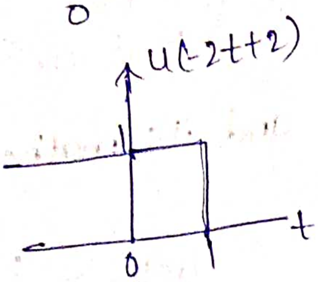
(i) $-2t+2=0$

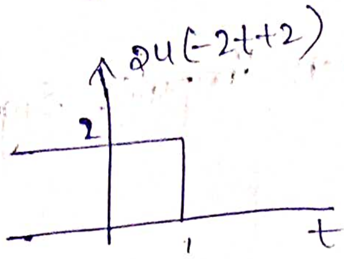
$-2t=-2$

$\boxed{t=+1}$







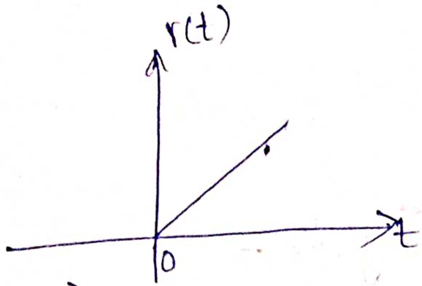


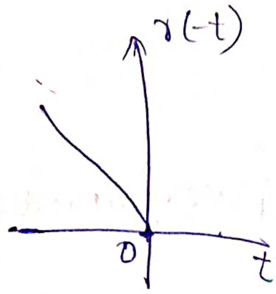
ii, $r(-t+2)$

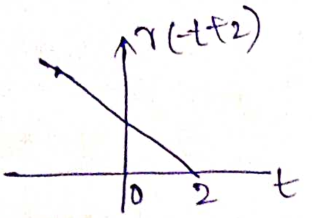
$-t+2=0$

$-t=-2$

$\boxed{t=2}$







iii, $\mathrm{rect}(t+3)$

$t+3=\frac{1}{2}$

$t=\frac{1}{2}-3$

$t=\frac{1-6}{2}$

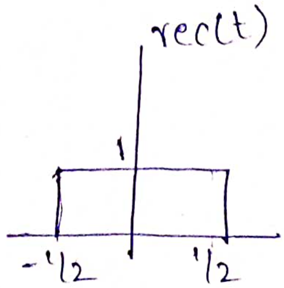
$=-\frac{5}{2}=-2.5$

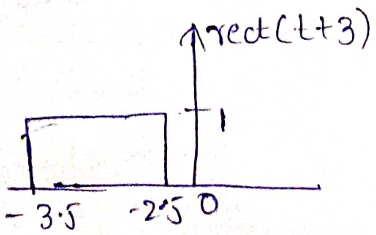
$t+3=\frac{-1}{2}$

$t=\frac{-1}{2}-3$

$t=\frac{-1-6}{2}$

$=\frac{-7}{2}=-3.5$





(2) Non-periodic (or) Periodic

i, $\sin 12\pi t$

$x(t+T)=\sin(12\pi(t+T))$

$=\sin(12\pi(t+\frac{1}{6}))$

$T=\frac{2\pi}{\omega}=\frac{2\pi}{12\pi}$

$=\frac{1}{6}$

$\sin 12\pi t + \sin 12\pi \frac{1}{6}$

$\sin 12\pi t + \sin 2\pi$ $\quad [\because \sin 2\pi = 0]$

$\sin 12\pi t = x(t) \rightarrow$ periodic. f.p is $1/6$

ii) $3\sin e\ 200\pi t + 4\cos 100t$.

$T_1 = \frac{2\pi}{\omega} = \frac{2\pi}{200\pi t} = \frac{1}{100}$

$T_2 = \frac{2\pi}{\omega} = \frac{2\pi}{100} = \frac{\pi}{50}$

$\frac{T_1}{T_2} = \frac{\frac{1}{100}}{\frac{\pi}{50}} = \frac{1}{100} \times \frac{50}{\pi}$

$= \frac{1}{2\pi} \rightarrow$ it is irrational

iii) $e^{j4\pi t}$.

$x(t+T) = e^{j4\pi(t+T)}$

$= e^{j4\pi t + j4\pi T}$ $\qquad T = \frac{2\pi}{4\pi} = 1/2$

$= e^{j4\pi t} \cdot e^{j2\pi}$

$= e^{j4\pi t} \cdot (\cos 2\pi + j\sin 2\pi)$ $\qquad \cos 2\pi = 1,\ \sin 2\pi$

$= e^{j4\pi t} = x(t) \rightarrow$ periodic.

$T = \frac{2\pi}{\omega}$ fundamental period is $1/2$

3) $x(t) = 8\cos 4t \cos 6t$.

$= 4[2\cos 4t \cos 6t]$.

$= 4[\cos(4+6)t + \cos(4-6)t]$ $\quad [\because$

$= 4[\cos 10t + \cos(-2)t]$

$= 4(\cos 10t + \cos 2t)$

$x(t+T) = 4[\cos 10(t+T) + \cos 2(t+T)]$

$= 4[\cos(10t + 10T) + \cos(2t + 2T)]$ $\qquad T_1 = \frac{2\pi}{\omega}$

$= \cancel{4\{\cos 10t * \cos 2t\}}$. $\qquad = \frac{2\pi}{10} = \frac{\pi}{5}$

$= 4\left[\cos\left(10t + 10 \cdot \frac{\pi}{5}\right) + \cos(2t + 2\pi)\right]$ $\qquad T_2 = \frac{2\pi}{2} = \pi$

$= 4[\cos(10t + 2\pi) + \cos(2t + 2\pi)]$

$= 4(\cos 10t + \cos 2t) = x(t)$.

It is periodic signals. All periodic signals are Power signals. So, $P = \frac{A_1^2}{2} + \frac{A_2^2}{2} = \frac{16}{2} + \frac{16}{2} = 8+8 = 16$ watts

Energy is infinity $E = \infty$

ii, $x(t) = e^{j[3t+\pi/2]}$

$= \cos(3t+\frac{\pi}{2}) + j\sin(3t+\frac{\pi}{2})$.

$E = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_{-\infty}^{\infty} \left(\sqrt{\cos^2(3t+\frac{\pi}{2}) + \sin^2(3t+\frac{\pi}{2})}\right)^2 dt$.

$= \int_{-\infty}^{\infty} dt = \infty$

$P = \lim_{T\to\infty} \frac{1}{2T} \int_{-T}^{T} dt = \lim_{T\to\infty} \frac{1}{2T}(2T) = 1$

It is a power signal.

Q $y(t) = x(\frac{t}{2})$

i, ~~time variant (or) time invariant~~.

i, y(t). Static (or) dynamic.

Let $t = 1$

$y(1) = x(\frac{1}{2})$

Wrong

It is dynamic. because it doesn't Satisfies Superposition theorem.

ii, linear vs non-linear

4) $y(t) = x(t/2)$

i, Static (or) dynamic.

Let $t = 1 \Rightarrow y(t) = x(1/2)$

it is dynamic. because o/p depends upon past values.

ii, linear vs non-linear.

inputs = $x(t), x_1(t), x_2(t)$; outputs = $y(t), y_1(t), y_2(t)$

$Tx(t) = x(t/2) \to y(t)$

$Tx_1(t) = x_1(t/2) \to y_1(t)$

$Tx_2(t) = x_2(t/2) \to y_2(t)$.

$y_3 = T[a_1x_1(t) + a_2x_2(t)] = T[a_1x_1(t/2) + a_2x_2(t/2)] = y_3$

$\therefore [a_1y_1(t) + a_2y_2(t)] = [a_1x_1(t/2) + a_2x_2(t/2)] = y_4$.

$y_3 = y_4 \to$ it is linear.

it satisfies Superposition theorem.

iii, Time variant vs time invariant.

$\therefore y(t) = x(t/2)$.

$y_3(t) = x(t - K/2)$

$y(t-K) = x\left(\frac{t-K}{2}\right)$

$y_3(t) = y(t-K)$. it is time invariant.

iv, casual vs non-casual.

$y(t) = x(t/2)$

let $x = 1 \Rightarrow y(1) = x(1/2) = x(0.5)$

$x = 2 \Rightarrow y(2) = x(\frac{2}{2}) = x(1)$

$x = 4 \Rightarrow y(4) = x(\frac{4}{2}) = x(2)$

it is non-casual. because it depends upon future i/p.

v, Stable vs unstable.

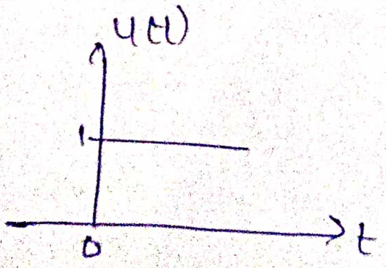
$y(t) = x(t/2)$

if $t = 0$, $y(0) = x(0)$

o/p response $\neq \infty$. so, it is stable.

5) i, $g(t) = u(t)$

$$u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$$



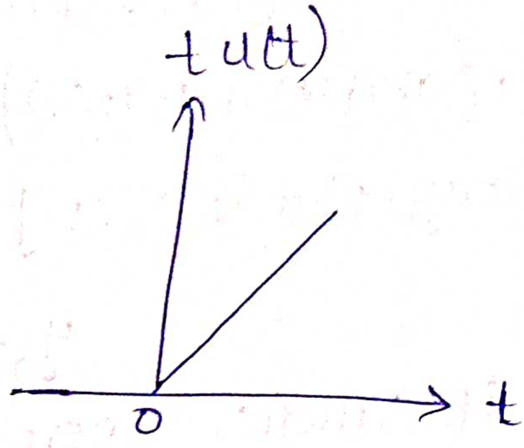
$$E = \int_{-\infty}^{\infty} |x(t)|^2 dt = \int_0^{\infty} dt.$$

$$= (t)_0^{\infty} = \infty$$

$$P = \lim_{T \to \infty} \frac{1}{2T} \int_{-T}^{T} |x(t)|^2 dt.$$

$$= \underset{T\to\infty}{Lt} \frac{1}{2T}\int_0^T dt = \underset{T\to\infty}{Lt} \frac{1}{2\cancel{T}}(\cancel{T}) = 0.5W.$$

ii) $g(t) = t\,u(t)$



$$E = \int_0^\infty t^2\,dt = \left(\frac{t^3}{3}\right)_0^\infty$$

$$= \infty$$

$$P = \underset{T\to\infty}{Lt} \frac{1}{2T}\int_0^T t^2\,dt$$

$$= \underset{T\to\infty}{Lt} \frac{1}{2T}\left(\frac{t^3}{3}\right)_0^T$$

$$= \underset{T\to\infty}{Lt} \frac{1}{2\cancel{T}}\left(\frac{T^{\cancel{3}}}{3}\right) = \underset{T\to\infty}{Lt} \frac{1}{2}\left(\frac{T^2}{3}\right) = \infty$$

1) Write any two Properties of normal distribution?
→ The mean, median and mode are exactly the same.
→ The distribution can be distribution by two values : the mean and std deviation.

2) Define the k^{th} moment of Continuous random variable · X about it mean.

$$\mu_K = \int_{-\infty}^{\infty} x^K f(x)\, dx.$$

3) find the Value of $Z_{0.01}$?

$Z_{0.01} = 2.325 \Rightarrow f(z_\alpha) = 1-\alpha = 1-0.01 = 0.9901.$

$$\boxed{Z_{0.01} = 2.33}$$

4) The mean and varaince of gamma distribution are respectively 16 and 64 · find α, β.

Mean $= \alpha\beta$

Variance $= \alpha\beta^2$

5) What are the mean and Variance of the Beta distribution.

$$\text{Mean } (\mu) = \frac{\alpha}{\alpha+\beta}$$

$$\text{Variance } (\sigma^2) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)}$$

6) for $\alpha = 0.1$, $\beta = 0.5$, find the mean of Weibull distribution.

$\mu = \alpha^{-1/\beta}\,\Gamma\left(1+\frac{1}{\beta}\right) \Rightarrow \mu (0.1)^{-1/0.5}\,\Gamma(3)$

200hrs.

7) If $f(x) = \begin{cases} Kx^2 & \text{for } 0<x<1 \\ 0 & \text{elsewhere.} \end{cases}$ is the probability density function of a random variable.

$f(x) = \begin{cases} Kx^2 & \text{for } 0<x<1 \\ 0 & \text{elsewhere,} \end{cases}$

$= \int_{-\infty}^{\infty} f(x)dx = 1$

$= \int_0^1 Kx^2 dx = 1 \Rightarrow K\left[\frac{x^3}{3}\right]_0^1$

$= K\left[\frac{1}{3} - 0\right] = 1.$

$\frac{K}{3} = 1 \Rightarrow \boxed{K = 3}$

8) When the random variables x and y are said to be independent.

If knowing the value of one of them does not change the probability for the other one.

$\Rightarrow f(x_1, y_2) = f_1(x) \cdot f_2(y) \forall (x, y).$

9) Define marginal densities of Continuous random variables x and y.

let $f(x,y)$ be joint probability distribution, of two random variables x and y. The marginal probability distribution of random variable x is denoted by $f_1(x)$ and defined as, $f_1(x) = \sum_y f(x,y)$

Similarly the marginal probability distribution of random variable y is denoted by, $f_2(y)$ and defined as $f_2(y) = \sum_x f(x,y)$.

10) Define the Conditional Probability distribution of x given Y = y.

The Conditional Probability distribution of x is given Y = y is denoted by $f_1(x,y)$ and is defined as, $f_1(x,y) = \frac{f(x,y)}{f_2(y_2)}$ for all x, y.