Here are a few basic signals:

**Unit Step Function**

Unit step function is denoted by $u(t)$. It is defined as $u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$

- It is used as best test signal.
- Area under unit step function is unity.

**Unit Impulse Function**

Impulse function is denoted by $\delta(t)$, and it is defined as $\delta(t) = \begin{cases} 1 & t = 0 \\ 0 & t \neq 0 \end{cases}$

$$\int_{-\infty}^{\infty} \delta(t) dt = u(t)$$

$$\delta(t) = \frac{du(t)}{dt}$$

**Ramp Signal**

Ramp signal is denoted by $r(t)$, and it is defined as $r(t) = \begin{cases} t & t \geq 0 \\ 0 & t < 0 \end{cases}$
Area under unit ramp is unity.

**Parabolic Signal**

Parabolic signal can be defined as $x(t) = \begin{cases} \frac{t^2}{2} & t \geq 0 \\ 0 & t < 0 \end{cases}$

\[
\int u(t) = \int 1 = t = r(t)
\]

\[
u(t) = \frac{dr(t)}{dt}
\]

\[
\int u(t)dt = \int r(t)dt = \int tdt = \frac{t^2}{2} = \text{parabolic signal}
\]

\[
\Rightarrow u(t) = \frac{d^2 x(t)}{dt^2}
\]

\[
\Rightarrow r(t) = \frac{dx(t)}{dt}
\]

**Signum Function**

Signum function is denoted as $\text{sgn} t$. It is defined as $\text{sgn} t = \begin{cases} 1 & t > 0 \\ 0 & t = 0 \\ -1 & t < 0 \end{cases}$
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**Exponential Signal**

Exponential signal is in the form of \( xt = e^{\alpha t} \).

The shape of exponential can be defined by \( \alpha \).

**Case i:** if \( \alpha = 0 \) \( \rightarrow \) \( xt = e^0 = 1 \)

**Case ii:** if \( \alpha < 0 \) i.e. -ve then \( xt = e^{-\alpha t} \). The shape is called decaying exponential.

**Case iii:** if \( \alpha > 0 \) i.e. +ve then \( xt = e^{\alpha t} \). The shape is called raising exponential.

**Rectangular Signal**

Let it be denoted as \( xt \) and it is defined as

\[
x(t) = A \text{ rect} \left( \frac{r}{T} \right)
\]

Example: \( 4 \text{ rect} \left[ \frac{r}{6} \right] \)
**Triangular Signal**

Let it be denoted as \( x(t) \)

\[
x(t) = A \left[ 1 - \frac{|t|}{T} \right]
\]

**Sinusoidal Signal**

Sinusoidal signal is in the form of \( x(t) = A \cos(\omega_0 t + \phi) \) or \( A \sin(\omega_0 t + \phi) \)

\[
\text{sinc}(t) = \frac{\sin(\pi t)}{\pi t}
\]

Where \( T_0 = \frac{2\pi}{\omega_0} \)

**Sinc Function**

It is denoted as \( \text{sinc}(t) \) and it is defined as

\[
\text{sinc}(t) = \begin{cases} 
\frac{\sin(\pi t)}{\pi t} & \text{for } t \neq 0 \\
0 & \text{for } t = 0
\end{cases}
\]

= 0 for \( t = \pm 1, \pm 2, \pm 3 \ldots \)
**Sampling Function**

It is denoted as $sa(t)$ and it is defined as

$$sa(t) = \frac{sint}{t}$$

$$= 0 \text{ for } t = \pm \pi, \pm 2\pi, \pm 3\pi \ldots$$