- **<u>Step Response:-</u>**

  if the input to system is a unit step u(t), the output is called step response. $\boxed{s[n]=u[n]*h[n]}$

  Its relationship with h(t); $\boxed{h(t) = \frac{ds(t)}{dt}}$ || $\boxed{h[n] = s[n] - s[n-1]}$

  Sometimes it's easier to measure the step response then calculate the impulse response.

- **<u>Causal LTI systems described by differential & difference equations:-</u>**

  Differential equations such as [dy(t)/dt + 2y(t) = x(t)] are solved traditionally by dividing the complete solution to a sum of particular and homogeneous solution; y(t) = yp(t) + yh(t). However, later we'll solve them using Laplace transform.

  If a difference equation is given, we could insert an impulse as an input and find a form for the impulse response. (we'll consider causal systems; their initially at rest).

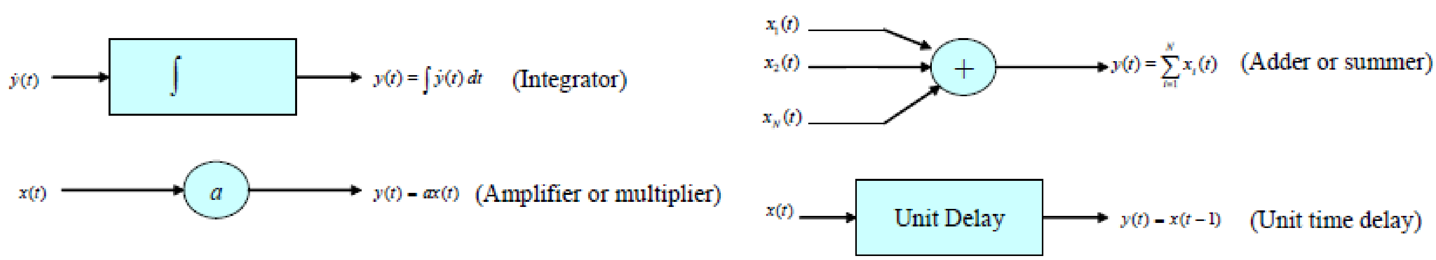
Note:- If we have $\sum_{k=0}^{N} a_k$ y(n-K) = $\sum_{k=0}^{M} b_k$ x(n-k) ;

If N≥ 1; h[n] is called infinite impulse response system (IIR)

If N= 0; h[n] is called finite impulse response system (FIR)

- **<u>Block Diagrams:-</u>**

  It could be used to represent systems or circuits.



Q1] The step response of an LTI system is given. Calculate the impulse response.

a) s(t) = 1 + $e^{-0.5t}$ u(t) b) s(n) = 0.5^n u[n]

Q2] The impulse response of an LTI system is given. Calculate the step response.

a) h(t) = e^{3t} u(t) b) h[n] = $\delta[n] - 0.5\,\delta[n-1]$

Q3] Given the difference equation; y(n) = 2x(n) + (1/3) y(n-1)

Find the impulse response, state whether it's FIR or IIR, and find the response if the input is $2\delta[n-1]$.

Q4] Draw a block diagram for the following LTI systems

a) y[n] – (1/3) y[n-1] = 0.5 x[n] b) y(t) = -0.5 dy(t)/dt + 4x(t)