

$$\text{sinc}\left(a, \frac{t}{2}\right)$$

$$X(t)$$

$$\frac{1}{a} 2\pi \text{rect}\left(\frac{\omega}{a}\right)$$

$$X(\omega)$$

$$\delta(t)$$

$$1$$

$$u(t)$$

$$\pi \delta(\omega) + \frac{1}{j\omega}$$

$$1$$

$$2\pi \delta(\omega)$$

$$\text{sgn}(t)$$

$$\frac{2}{j\omega}$$

$$e^{j\omega_0 t}$$

$$2\pi \delta(\omega - \omega_0)$$

$$\cos(\omega_0 t)$$

$$\pi [\delta(\omega - \omega_0) + \delta(\omega + \omega_0)]$$

$$\sin(\omega_0 t)$$

$$\frac{\pi}{j} [\delta(\omega - \omega_0) - \delta(\omega + \omega_0)]$$

$$\text{rect}$$

$$\text{sinc}\left(\frac{\omega}{2}\right)$$

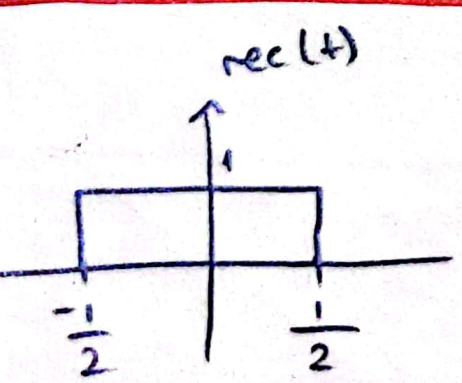
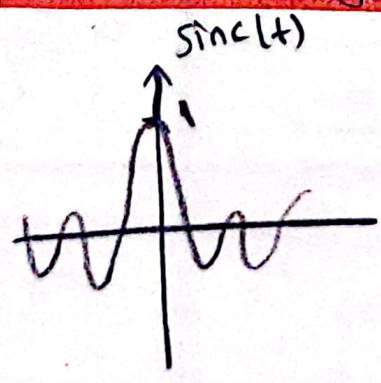
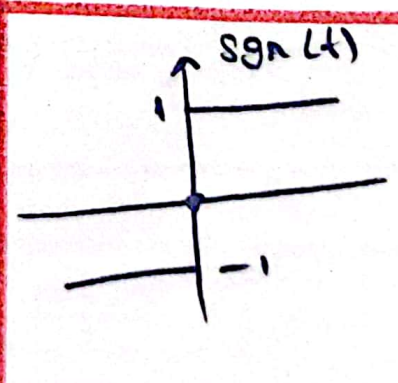
$$\text{rec}\left(\frac{t}{T}\right)$$

$$|T| \text{sinc}\left(\frac{T\omega}{2}\right)$$

$$e^{-at} u(t), \quad 2\pi \{a\} > 0$$

$$\frac{1}{a + j\omega}$$

3'te
3'ide

Özellik	Zaman domaini	Fourier Domaini
Lineerlik:	$a_1 x_1(t) + a_2 x_2(t)$	$a_1 X_1(\omega) + a_2 X_2(\omega)$
Zamanda kaydırma	$x(t - t_0)$	$e^{-j\omega t_0} X(\omega)$
frekansda kaydırma:	$e^{j\omega_0 t} x(t)$	$X(\omega - \omega_0)$
Ölçekleme:	$x(at)$	$\frac{1}{ a } X\left(\frac{\omega}{a}\right)$
Dualite :	$X(t)$	$2\pi x(-\omega)$
Zamanda konv.:	$x_1 * x_2(t)$	$X_1(\omega) X_2(\omega)$ [conv.]
Zamanda Carp:	$x_1(t) \cdot x_2(t)$	$\frac{1}{2\pi} X_1 * X_2(\omega)$
Zamanda Türev:	$\frac{d}{dt} x(t)$	$j\omega X(\omega)$
Frekansda Türev:	$t x(t)$	$j \frac{d}{d\omega} X(\omega)$
Zamanda integ.:	$\int_{-\infty}^t x(\tau) d\tau$	$\frac{1}{j\omega} X(\omega) + \pi X(0) \delta(\omega)$
Parseval :	$\underbrace{\int_{-\infty}^{\infty} x(t) ^2 dt}_{\text{enerji}} = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(\omega) ^2 d\omega$	
		
$X(\omega) = \int_{-\infty}^{\infty} x(t) \cdot e^{-j\omega t} dt$		

$X(n)$ $X(\omega)$

$\delta(n)$

1

$u(n)$

$$\frac{e^{j\omega}}{e^{j\omega} - 1} + \sum_{k=-\infty}^{\infty} \pi \delta(\omega - 2\pi k)$$

1

$$2\pi \sum_{k=-\infty}^{\infty} \delta(\omega - 2\pi k)$$

$\cos(\omega_0 n)$

$$\pi \sum_{k=-\infty}^{\infty} [\delta(\omega - \omega_0 - 2\pi k) + \delta(\omega + \omega_0 - 2\pi k)]$$

$\sin(\omega_0 n)$

$$j\pi \sum_{k=-\infty}^{\infty} [\delta(\omega + \omega_0 - 2\pi k) - \delta(\omega - \omega_0 - 2\pi k)]$$

$a^n u(n), |a| < 1$

$$\frac{e^{j\omega}}{e^{j\omega} - a}$$

$-a^n u(-n-1), |a| > 1$

$$\frac{e^{j\omega}}{e^{j\omega} - a}$$

$a^n, |a| < 1$

$$\frac{1 - a^2}{1 - 2a \cos \omega + a^2}$$

$\frac{B}{\pi} \text{sinc}(Bn), 0 < B < \pi$

$$\sum_{k=-\infty}^{\infty} \text{rect}\left(\frac{\omega - 2\pi k}{2B}\right)$$

$u(n) - u(n-M)$

$$e^{-j\omega(M-1)/2} \left(\frac{\sin(M\omega/2)}{\sin(\omega/2)} \right)$$

$n \cdot a^n u(n), |a| < 1$

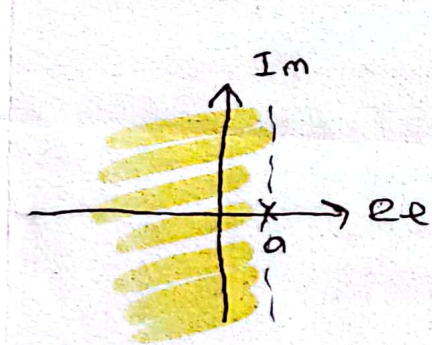
$$\frac{a e^{j\omega}}{(e^{j\omega} - a)^2}$$

Özellik	Zaman domaini	Fourier Domaini
Lineerlik :	$a_1 x_1(n) + a_2 x_2(n)$	$a_1 X_1(\omega) + a_2 X_2(\omega)$
Zamanda kaydırma:	$x(n - n_0)$	$e^{-j\omega n_0} X(\omega)$
frekansta kydr:	$e^{j\omega n_0} \cdot x(n)$	$X(\omega - \omega_0)$
Yukarı örnekleme	$(\uparrow M) x(n)$ yani $x(n/M)$	$X(M\omega)$
Aşağı örnekleme	$(\downarrow M) x(n)$ yani $x(Mn)$	$\frac{1}{M} \sum_{k=0}^{M-1} X\left(\frac{\omega - 2\pi k}{M}\right)$
Konvolüsyon	$x_1 * x_2(n)$	$X_1(\omega) X_2(\omega)$
Çarpma	$x_1(n) \cdot x_2(n)$	$\frac{1}{2\pi} \int_{-\pi}^{\pi} X_1(\theta) \cdot X_2(\omega - \theta) d\theta$
frekansta türev	$n \cdot x(n)$	$j \frac{d}{d\omega} X(\omega)$
fark alma	$x(n) - x(n-1)$	$(1 - e^{-j\omega}) X(\omega)$
Accumulation	$\sum_{k=-\infty}^{\infty} x(k) \rightarrow \frac{e^{j\omega n}}{e^{j\omega n-1}}$	$X(\omega) + \pi X(0) \sum_{k=-\infty}^{\infty} \delta(\omega - 2\pi k)$

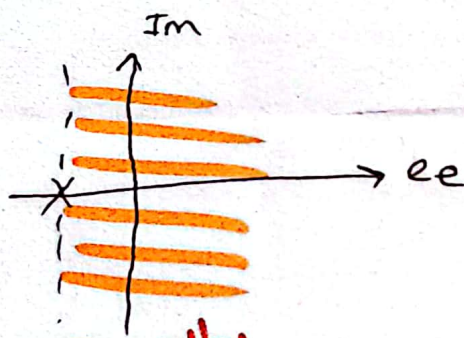
$$X(\omega) = \sum_{n=-\infty}^{\infty} x(n) \cdot e^{-j\omega n}$$

$x(t)$	$X(s)$	ROC
$\delta(t)$	1	$\text{Im } s$
$u(t)$	$\frac{1}{s}$	$\text{Re}(s) > 0$
$-u(-t)$	$\frac{1}{s}$	$\text{Re}(s) < 0$
$t^n u(t)$	$\frac{n!}{s^{n+1}}$	$\text{Re}(s) > 0$
$-t^n u(-t)$	$\frac{n!}{s^{n+1}}$	$\text{Re}(s) < 0$
$e^{-at} u(t)$	$\frac{1}{s+a}$	$\text{Re}(s) > -a$
$-e^{-at} u(-t)$	$\frac{1}{s+a}$	$\text{Re}(s) < -a$
$t^n e^{-at} u(t)$	$\frac{n!}{(s+a)^{n+1}}$	$\text{Re}(s) > -a$
$-t^n e^{-at} u(-t)$	$\frac{n!}{(s+a)^{n+1}}$	$\text{Re}(s) < -a$
$\cos(\omega_0 t) u(t)$	$\frac{s}{s^2 + \omega_0^2}$	$\text{Re}(s) > 0$
$\sin(\omega_0 t) u(t)$	$\frac{\omega_0}{s^2 + \omega_0^2}$	$\text{Re}(s) > 0$
$e^{-at} \cos(\omega_0 t) u(t)$	$\frac{s+a}{(s+a)^2 + \omega_0^2}$	$\text{Re}(s) > -a$
$e^{-at} \sin(\omega_0 t) u(t)$	$\frac{\omega_0}{(s+a)^2 + \omega_0^2}$	$\text{Re}(s) > -a$

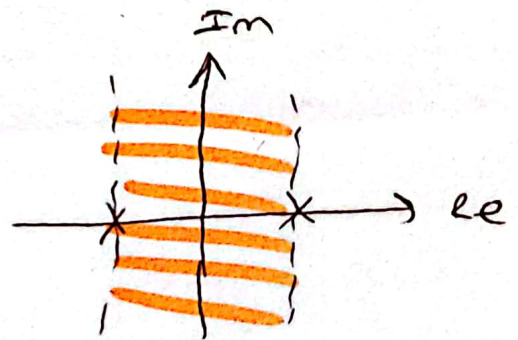
Özellik	Zaman	Laplace	ROC
Doğrusallık	$a_1 x_1(t) + a_2 x_2(t)$	$a_1 X(s) + a_2 X_2(s)$	$R_1 \cap R_2$
Zamanda kaydırma	$x(t - t_0)$	$e^{-st_0} X(s)$	R
s-domaininde kaydırma	$e^{s_0 t} x(t)$	$X(s - s_0)$	$R + R(s_0)$
Ölçekleme	$x(at)$	$\frac{1}{ a } X\left(\frac{s}{a}\right)$	R
Eslenik	$x^*(t)$	$X^*(s^*)$	R
Zamanda türev	$\frac{d}{dt} x(t)$	$sX(s)$	R
s domaininde türev	$-t x(t)$	$\frac{d}{ds} X(s)$	R
Zamanda integral	$\int_{-\infty}^t x(\tau) d\tau$	$\frac{1}{s} X(s)$	$R \cap \{Re(s) > 0\}$



Sol düzlem



Sag düzlem



İki taraflı.

$x(z)$ $X(z)$

ROC

$\delta(n)$

1

$|z| > 1$

$u(n)$

$\frac{z}{z-1}$

$|z| > 1$

$-u(-n-1)$

$\frac{z}{z-1}$

$|z| < 1$

$n u(n)$

$\frac{z}{(z-1)^2}$

$|z| > 1$

$-n u(-n-1)$

$\frac{z}{(z-1)^2}$

$|z| < 1$

$a^n u(n)$

$\frac{z}{z-a}$

$|z| > |a|$

$-a^n u(-n-1)$

$\frac{z}{z-a}$

$|z| < |a|$

$n a^n u(n)$

$\frac{az}{(z-a)^2}$

$|z| > |a|$

$-n a^n u(-n-1)$

$\frac{az}{(z-a)^2}$

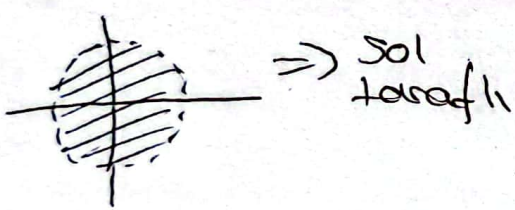
$|z| < |a|$

$\frac{a^n}{n!} a^n u(n)$

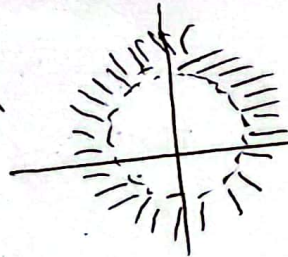
$e^{a/z}$

$|z| > 0$

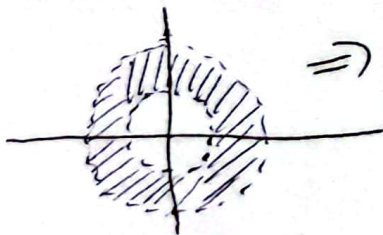
Özellik	Zamana	Z Dönüşümü	ROC
Doğrusallık	$a_1 x_1(n) + a_2 x_2(n)$	$a_1 X_1(z) + a_2 X_2(z)$	$R_1 \cap R_2$
Öteleme	$x(n - n_0)$	$z^{-n_0} X(z)$	R
modülasyon	$a^n x(n)$	$X(a^{-1}z)$	$ a < 1$
zaman da ters çev.	$x(-n)$	$X(1/z)$	R^{-1}
z 'de türev	$n x(n)$	$-z \frac{d}{dz} X(z)$	R
fark alma	$x(n) - x(n-1)$	$(1 - z^{-1}) X(z)$	$R \cap z > 1$
konv.	$x_1 * x_2(n)$	$X_1(z) X_2(z)$	$R_1 \cap R_2$



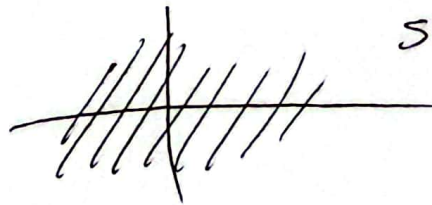
\Rightarrow Sol taraflı



\Rightarrow Sağ taraflı



$\Rightarrow x(n)$ iki taraflı.



sınırlı sürekli ise.