DTFT Table

Time Signal	**DTFT**
$1, \quad -\infty < n < \infty$	$2\pi \sum_{k=-\infty}^{\infty} \delta(\Omega - 2\pi k)$
$\text{sgn}[n] = \begin{cases} -1, & \ldots, -3, -2, -1 \\ 1, & 0, 1, 2, \cdots \end{cases}$	$\dfrac{2}{1 - e^{-j\Omega}}$
$u[n]$	$\dfrac{1}{1 - e^{-j\Omega}} + \pi \sum_{k=-\infty}^{\infty} \delta(\Omega - 2\pi k)$
$\delta[n]$	$1, \quad -\infty < \Omega < \infty$
$\delta[n-q], \quad q = \pm 1, \pm 2, \pm 3, \ldots$	$e^{-jq\Omega}, \quad q = \pm 1, \pm 2, \pm 3, \ldots$
$a^n u[n], \quad \lvert a \rvert < 1$	$\dfrac{1}{1 - ae^{-j\Omega}}, \quad \lvert a \rvert < 1$
$e^{j\Omega_o n}, \quad \Omega_o$ real	$2\pi \sum_{k=-\infty}^{\infty} \delta(\Omega - \Omega_o - 2\pi k), \quad \Omega_o$ real
$p_q[n] = \begin{cases} 1, & n = -q, -q+1, \ldots \\ & , -1, 0, 1, \ldots q \\ 0, & otherwise \end{cases}$	$\dfrac{\sin\left[\left(q + \frac{1}{2}\right)\Omega\right]}{\sin(\Omega / 2)}$
$\frac{B}{\pi} \text{sinc}\left[\frac{B}{\pi} n\right]$	$\sum_{k=-\infty}^{\infty} p_{2B}(\Omega + 2\pi k)$
$\cos(\Omega_o n)$	$\pi \sum_{k=-\infty}^{\infty} \left[\delta(\Omega + \Omega_o - 2\pi k) + \delta(\Omega - \Omega_o - 2\pi k)\right]$
$\cos(\Omega_o n + \theta)$	$\pi \sum_{k=-\infty}^{\infty} \left[e^{-j\theta}\delta(\Omega + \Omega_o - 2\pi k) + e^{j\theta}\delta(\Omega - \Omega_o - 2\pi k)\right]$
$\sin(\Omega_o n)$	$j\pi \sum_{k=-\infty}^{\infty} \left[\delta(\Omega + \Omega_o - 2\pi k) - \delta(\Omega - \Omega_o - 2\pi k)\right]$
$\sin(\Omega_o n + \theta)$	$j\pi \sum_{k=-\infty}^{\infty} \left[e^{-j\theta}\delta(\Omega + \Omega_o - 2\pi k) - e^{j\theta}\delta(\Omega - \Omega_o - 2\pi k)\right]$

DTFT Properties

Property Name	Property	
Linearity	$ax[n]+bv[n]$	$aX(\Omega)+bV(\Omega)$
Time Shift	$x[n-q]$, q any integer	$e^{-jq\Omega}X(\Omega)$, q any integer
Time Scaling	$x(at)$, $a \neq 0$	$\frac{1}{a}X(\Omega/a)$, $a \neq 0$
Time Reversal	$x[-n]$	$X(-\Omega)$ $\overline{X(\Omega)}$ if $x[n]$ is real
Multiply by n	$nx[n]$	$j\dfrac{d}{d\Omega}X(\Omega)$
Multiply by Complex Exponential	$e^{j\Omega_o n}x[n]$, Ω_o real	$X(\Omega-\Omega_o)$, Ω_o real
Multiply by Sine	$\sin(\Omega_o n)x[n]$	$\frac{j}{2}\left[X(\Omega+\Omega_o)-X(\Omega-\Omega_o)\right]$
Multiply by Cosine	$\cos(\Omega_o n)x[n]$	$\frac{1}{2}\left[X(\Omega+\Omega_o)+X(\Omega-\Omega_o)\right]$
Summation	$\sum_{i=-\infty}^{n}x[i]$	$\dfrac{1}{1-e^{-j\Omega}}X(\Omega)+\pi\sum_{k=-\infty}^{\infty}X(0)\delta(\Omega-2\pi k)$
Convolution in Time	$x[n]*h[n]$	$X(\Omega)H(\Omega)$
Multiplication in Time	$x[n]w[n]$	$\dfrac{1}{2\pi}\int_{-\pi}^{\pi}X(\Omega-\lambda)W(\lambda)d\lambda$ (conv.)
Parseval's Theorem (General)	$\sum_{n=-\infty}^{\infty}x[n]\overline{v[n]}=\dfrac{1}{2\pi}\int_{-\pi}^{\pi}X(\Omega)\overline{V(\Omega)}d\Omega$	
Parseval's Theorem (Energy)	$\sum_{n=-\infty}^{\infty}x^2[n]=\dfrac{1}{2\pi}\int_{-\pi}^{\pi}\lvert X(\Omega)\rvert^2 d\Omega$ if $x(t)$ is real $\sum_{n=-\infty}^{\infty}\lvert x[n]\rvert^2=\dfrac{1}{2\pi}\int_{-\pi}^{\pi}\lvert X(\Omega)\rvert^2 d\Omega$	
Using CTFT Table to find Inverse of a DTFT $X(\Omega)$: $x[n]$ = ??	Form $\Gamma(\omega)=X(\omega)p_{2\pi}(\omega)$ and look up $\gamma(t)\leftrightarrow\Gamma(\omega)$ Then get $x[n]=\gamma(t)\rvert_{t=n}$	