

2024 October 16

$$x[n] = \begin{cases} 4 & n=18 \\ 4 & n=48 \\ 0 & \text{otherwise} \end{cases}$$

$$\begin{aligned} X(\omega) &= \sum_{n=-\infty}^{\infty} x[n] e^{-j\omega n} \\ &= 4e^{-j\omega 18} + 4e^{-j\omega 48} \\ &= 4e^{-j\omega(33-15)} + 4e^{-j\omega(33+15)} \\ &= 4e^{-33j\omega} (e^{-j\omega 15} + e^{j\omega 15}) \\ &= 8 \cos(15\omega) e^{-j33\omega} \end{aligned}$$

Example

$$\begin{aligned} f[n] = \delta[n] &\longleftrightarrow F(\omega) = 1 \\ g[n] = \delta[n-3] &\longleftrightarrow G(\omega) = e^{-3j\omega} \\ h[n] = \delta[n-6] &\longleftrightarrow H(\omega) = e^{-6j\omega} \end{aligned}$$

$$g[n] * g[n] = ? \longleftrightarrow G(\omega) G(\omega) = e^{-6j\omega}$$

$$g[n] * g[n] = \sum_{m=-\infty}^{\infty} g[m] g[n-m] = \begin{cases} 1 & n=6 \\ 0 & \text{otherwise} \end{cases} = h[n]$$

