Discrete-Time Fourier Transforms

Synthesis Equation

\[ x[n] = \frac{1}{2\pi} \int_{2\pi} X(\Omega) e^{j\Omega n} d\Omega \]

Analysis Equation

\[ X(\Omega) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\Omega n} \]
Discrete-Time Fourier Transform

Find the Fourier transforms of the following discrete-time signals.

- \( x_1[n] = \begin{cases} a^n & \text{if } n \geq 0 \\ 0 & \text{otherwise} \end{cases} \)
- \( x_2[n] = x_1[n-n_0] \)
- \( x_3[n] = \text{Symmetric}\{x_1[n]\} \)
- \( x_4[n] = \text{Antisymmetric}\{x_1[n]\} \)
- \( x_5[n] = nx_1[n] \)
Find the Fourier transform of $x_6[n]$:

$$x_6[n] = \begin{cases} 
(\frac{1}{2})^{n/2} & n = 0, 2, 4, 6, 8, \ldots, \infty \\
0 & \text{otherwise}
\end{cases}$$
Inverse Discrete-Time Fourier Transform

Find the signal whose Fourier transform is

\[ X(\Omega) = e^{-j3\Omega} \]