

1. **(4 pts Total)** Determine the discrete-time Fourier Transform of $x[n] = (0.5)^n u[n] + 8^n u[-n]$.
2. **(10 pts Total)** Given

$$x[n] = \begin{cases} 3 & \text{if } n = 0 \\ -1 & \text{if } |n| = 1 \\ 2 & \text{if } |n| = 2 \\ 0 & \text{if } |n| \geq 3 \end{cases} .$$

(Hint: First plot $x[n]$.)

- (a) **(2 pts)** Is $X(e^{j\omega})$ real, imaginary, or neither? Explain.
 - (b) **(2 pts)** Is $X(e^{j\omega})$ even, odd, or neither? Explain.
 - (c) **(2 pts)** Evaluate $X(e^{j0})$.
 - (d) **(2 pts)** Evaluate $\int_{-\pi}^{\pi} X(e^{j\omega}) d\omega$.
 - (e) **(2 pts)** Evaluate $\int_{-\pi}^{\pi} |X(e^{j\omega})|^2 d\omega$.
3. **(6 pts Total)** A causal LTI system is described by the difference equation:

$$y[n] + (1/12)y[n-1] - (1/12)y[n-2] = x[n].$$

- (a) **(3 pts)** Determine the frequency response, $H(e^{j\omega})$, of the system.
- (b) **(3 pts)** Determine the impulse response, $h[n]$, of the system.