1. Consider a discrete-time signal \( x \) given by

\[
\forall \ n \in \text{Integers}, \quad x(n) = \sum_{k=-\infty}^{\infty} \delta(n - 2k),
\]

where \( \delta \) is the Kronecker delta function. Sketch this signal.

**Solution:**

![Sketch of the signal](image)

2. For the same signal as in the previous problem, find the Fourier series coefficients \( X_k \) in

\[
x(n) = \sum_{k=0}^{p-1} X_k e^{i\omega_0 kn}.
\]

**Solution:** Note that \( p = 2 \) so \( \omega_0 = \pi \). By inspection, therefore, \( X_0 = X_1 = 1/2 \).

3. Consider a discrete-time LTI system with frequency response \( H \) given by

\[
\forall \ \omega \in \text{Reals}, \quad H(\omega) = |\sin(\omega/2)|.
\]

Sketch this over one period.

**Solution:**

![Sketch of the frequency response](image)

4. Suppose the signal in problem 1 is the input to the system in problem 3. Find the output \( y \) and sketch it. ("Find" means give an expression for \( y(n) \) that is valid for all integers \( n \)).

**Solution:** Since we have the Fourier series for the input, we can just scale each term by the frequency response, as follows:

\[
\forall \ n \in \text{Integers}, \quad y(n) = \sum_{k=0}^{1} X_k H(k\omega_0) e^{i\omega_0 kn}.
\]

This becomes

\[
y(n) = (1/2)H(0) + (1/2)H(\pi)e^{i\pi n} = (1/2)(-1)^n.
\]

Here is a sketch: