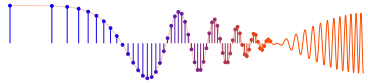

PROBLEM:

Suppose that $\mathcal{S}$ is a linear, time-invariant system whose exact form is unknown. It needs to be tested by running some inputs into the system, and then observing the output signals. Suppose that the following input/output pairs are the result of the tests:

$$
\begin{aligned}
x[n] = \delta[n] - \delta[n-1] \quad &\longrightarrow \quad y[n] = 4\delta[n] - 4\delta[n-4] \\
x[n] = \cos(\pi n/2) \quad &\longrightarrow \quad y[n] = 0 \\
x[n] = \cos(\pi n/3) \quad &\longrightarrow \quad y[n] = 6.93\,\cos(\pi n/3 - \pi/2)
\end{aligned}
$$

(a) Make a plot of the signal: $x[n] = 4\delta[n] - 4\delta[n-4]$.

(b) Use linearity and time-invariance to find the output of the system when the input is

$$x[n] = 3\delta[n] - 3\delta[n-3]$$

(c) Determine the output when the input is $x[n] = 7\cos(\pi(n-2)/3)$.

(d) Determine the output when the input is $x[n] = 9\sin(\pi n/2)$

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.