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:

$$x[n] = \delta[n] - \delta[n-1] \quad \longrightarrow \quad y[n] = \delta[n] - \delta[n-1] + 2\delta[n-3]$$
$$x[n] = \cos(\pi n/2) \quad \longrightarrow \quad y[n] = 2\,\cos(\pi n/2 - \pi/4)$$

(a) Make a plot of the signal: $y[n] = \delta[n] - \delta[n-1] + 2\delta[n-3]$.

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

$$x[n] = 7\delta[n] - 7\delta[n-2]$$