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:

$$x[n] = \delta[n] - \delta[n-2] \quad \longrightarrow \quad y[n] = 2\delta[n-1]$$
$$x[n] = \sqrt{3}\cos(\pi n/3) \quad \longrightarrow \quad y[n] = 2\cos(\pi n/3 - \pi/2)$$

(a) Use linearity to find the output when the input $x[n]$ is

$$x[n] = 7\cos(\pi(n-2)/3)$$

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

$$x[n] = 13\delta[n-1] - 13\delta[n-5]$$