PROBLEM:
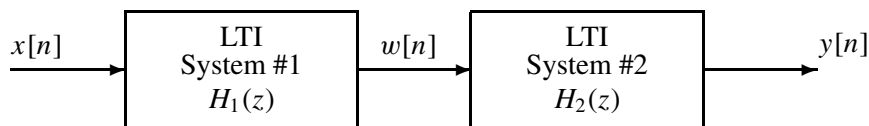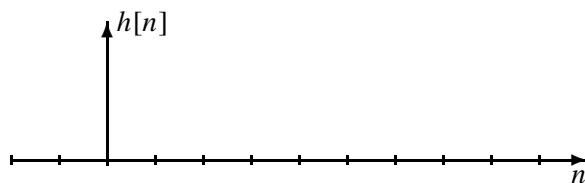
Consider the following cascade system:


where

$$H_1(z) = 3 + 3z^{-2} \quad \text{and} \quad H_2(z) = 1 - \tfrac{2}{3}z^{-1}.$$

(a) Determine the system function $H(z)$ of the overall system. Express your answer as a polynomial in z^{-1}.

(b) Determine and plot the impulse response $h[n]$ of the overall system.

(c) Return to your result in part (a). Express $H(z)$ as the product of a constant and three first-order factors each written in the form $(1 - az^{-1})$. From this, determine the zeros and poles of $H(z)$ and plot them in the z-plane plot below.
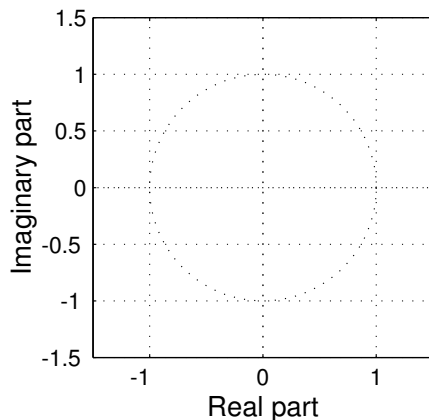
(d) If the input is $x[n] = Ae^{j\phi}e^{j\hat{\omega}_0 n}$ for $-\infty < n < \infty$, for what values of $-\pi \leq \hat{\omega}_0 \leq \pi$ will the output be $y[n] = 0$ for $-\infty < n < \infty$?