1. Classify or characterize the following systems as to homogeneity, additivity, linearity, time-invariance, BIBO stability, causality, invertibility, and memory.

(a) \( y(t) = x^3(t - 2) \)
(b) \( y(t) = x(\sin(t)) \)
(c) \( y[n] = x[n]x[n - 2] \)
(d) \( y(t) = t^2x(t - 1) \)
(e) \( y(t) = Od\{x(t)\} \)
(f) \( y(t) = x(t - 2) + x(2 - t) \)
(g) \( y(t) = [\cos(3t)]x(t) \)
(h) \( y(t) = x(t/3) \)

2. Let

\[
x[n] = \begin{cases} 
1 & 0 \leq n \leq 9 \\
0 & \text{otherwise}
\end{cases}
\quad \text{and} \quad 
\begin{cases} 
1 & 0 \leq n \leq N \\
0 & \text{otherwise}
\end{cases}
\]

where \( N \leq 9 \) is an integer. Determine the value of \( N \), given that \( y[n] = x[n] * h[n] \) and \( y[4] = 5 \), \( y[14] = 0 \).

3. Consider the cascade interconnection of three causal LTI systems, \( x[n] \rightarrow h_1[n] \rightarrow h_2[n] \rightarrow h_2[n] \rightarrow y[n] \). If \( h_2[n] = u[n] - u[n - 2] \) and the overall impulse response is \( h[n] = \delta[n] + 5\delta[n - 1] + 10\delta[n - 2] + 11\delta[n - 3] + 8\delta[n - 4] + 4\delta[n - 5] + \delta[n - 6] \).

(a) Find the impulse response \( h_1[n] \)
(b) Find the response of the overall system to the input \( x[n] = \delta[n] - \delta[n - 1] \)