1. Consider the LTI system initially at rest and described by the difference equation
\[ y[n] + 2y[n - 1] = x[n] + 2x[n - 2] \]
Find the response of this system to the following input by solving the difference equation recursively.
\[ x[n] = \delta[n + 2] + \delta[n + 1] + \delta[n] + \delta[n - 1] + \delta[n - 2] + \delta[n - 3] \]

2. The following are the impulse responses of LTI systems. Determine whether each system is causal, has memory, and stable. Justify your answer.
   (a) \( h(t) = e^{-4t}u(t - 2) \)
   (b) \( h(t) = e^{2t}u(-1 - t) \)
   (c) \( h(t) = te^{-t}u(t) \)
   (d) \( h[n] = (0.8)^nu[n + 2] \)
   (e) \( h[n] = (-\frac{1}{2})^nu[n] + (1.01)^nu[1 - n] \)
   (f) \( h[n] = u[n] - u[n - 1] \)

3. Consider a system whose input \( x(t) \) and output \( y(t) \) satisfy the first-order differential equation
\[ \frac{dy(t)}{dt} + 2y(t) = x(t) \]
The system also satisfies the condition of initial rest.
   (a) Determine the system output \( y_1(t) \) when the input is \( x_1(t) = e^{3t}u(t) \)
   (b) Determine the system output \( y_2(t) \) when the input is \( x_2(t) = e^{2t}u(t) \)
   (c) Determine the system output \( y_3(t) \) when the input is \( x_3(t) = \alpha e^{3t}u(t) + \beta e^{2t}u(t) \), where \( \alpha \) and \( \beta \) are real numbers. Show that \( y_3(t) = \alpha y_1(t) + \beta y_2(t) \)
   (d) Based on results from (a), (b), and (c) only, can you draw the conclusion that this is a linear system?