Exercise 1. Consider the signal

\[ x(t) = -e^{-at}u(t) \quad 0 < a < 1 \]

where \( u(t) \) is the causal step function.

A) Derive the energy and the time-averaged power of the signal over \(-\infty < t < \infty\). 

Exercise 2. Consider the following discrete-time signal

\[ x[n] = \cos\left(\frac{3\pi}{5} n\right) \]

A) Determine whether or not \( x[n] \) is periodic. If it is, determine its fundamental period.

Exercise 3. Consider the continuous-time signal

\[ x(t) = \begin{cases} 
3 - |t| & -3 \leq t \leq 3 \\
0 & \text{otherwise}
\end{cases} \]

A) Sketch and label carefully \( 2 \times (3 - 2t) \).

Exercise 4. Consider the discrete-time LTI system with impulse response

\[ h[n] = \begin{cases} 
1 & n = 0, 1, 2, 3 \\
0 & \text{otherwise}
\end{cases} \]

The signal at the system input is

\[ x[n] = a^n \ u[n] \quad 0 < a < 1 \]

where \( u[n] \) is the causal step function.

A) Derive the expression of the signal at the output of the system. Sketch the output signal.

Exercise 5. A continuous-time LTI system has impulse response

\[ h(t) = e^{-at(t+1)} \ u(t+1) \quad 0 < a < 1 \]

where \( u(t) \) is the causal step function.

A) Determine whether or not the system is:

* memoryless
Exercise 6. Consider the LTI system with the following input (x) output (y) relation

\[ y(t) = \int_{-\infty}^{t} 2x(t) \, dt + x(t+1) \]

A) Calculate the impulse response of the system and determine whether or not the system is causal.

Exercise 7. Consider the continuous-time LTI system shown in Fig. 1, where the impulse responses of the
egin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig1}
\caption{Parallel of two LTI subsystems.}
\end{figure}

two subsystems are shown in Fig. 2.

A) Sketch and label carefully the response of the system \( y(t) \) to the input

\[ x(t) = \sum_{k=-\infty}^{+\infty} \delta(t-kT) \]