Exercises Week 3

DSP

1. Characterize the following systems with respect to:

   - Memory
   - Linearity
   - Time invariance
   - Causality
   - Stability

   a. $y[n] = n \cdot x[n^2]$
   b. $y[n] = x[n] \cdot cos(\omega_0 n)$
   c. $y[n] = sin(x[n])$
   d. $y[n] = x[n] + n \cdot x[n+1]$

2. Consider the following discrete signal $x[n]$:

$$x[n] = \begin{cases} 1 + \frac{n}{3}, & -3 \leq n \leq -1 \\ 1, & 0 \leq n \leq 3 \\ 0, & elsewhere \end{cases}$$

   a. Write the expression of $x[n]$ based on the signal $\delta[n]$
   b. Write the expression of $x[n]$ based on the signal $u[n]$

3. Compute the convolution of the signals $x_1[n] = \{..., 0, 1, 2, 3, 4, 0, ...\}$ and $x_2[n] = \{..., 0, 2, 2, 3, 3, 0, ...\}$