ECE351: Signals and Systems I - Fall 2023 - Dr. Thinh Nguyen
Homework 1
Due 10/04/2023

1. Carefully sketch the following signals:

   (a) $x[n] = u[n] - u[n-1] + u[n-2]$

   (b) $x(t) = \delta(t+2) + \delta(2t) - 2\delta(t-1)$

   (c) $x[n] = \sum_{k=0}^{\infty} (u[n-k-1] - u[n-k])$

   (d) $x[n] = (\delta[n] + \delta[n-2])(\delta[n-2] - 1)$

   (e) $x(t) = \int_{-\infty}^{\infty} e^{-2\tau}\delta(\tau - t)d\tau$

   (f) $x(t) = \int_{-\infty}^{\infty} e^{-2(t-\tau)}\delta(\tau - t)d\tau$

2. Determine whether the following signals are periodic. If they are periodic, find the fundamental period, frequency, and angular frequency.

   (a) $x(t) = \cos(3\pi t) + 1$

   (b) $x[n] = e^{j\pi n}\sin(\frac{\pi n}{2})$

   (c) $x[n] = \sum_{k=-\infty}^{\infty} \delta[n-3k] + \delta[n-2k]$

   (d) $x(t) = \sum_{n=0}^{n=\infty} 2^{-t}\delta(t-2n)$

   (e) $x[n] = \cos(n) + \sin(n)$

3. Let $x(t) = e^{j\pi t} + \sin(\frac{\pi t}{2})$.

   (a) We sample $x(t)$ with sampling period $T_s = 1$ to obtain $x[n]$. Is $x[n]$ periodic? If so, determine its period and fundamental frequency.

   (b) We sample $x(t)$ with sampling period $T_s = \pi$ to obtain $x[n]$. Is $x[n]$ periodic? If so, determine its period and fundamental frequency.