ELEC 309
Signals and Systems
Homework 1 Assignment

Time-Domain Analysis of Signals

1. Find the even and odd components of each of the following signals:

   (a) $x(t) = \cos(t) + \sin(t) + \sin(t)\cos(t)$

   (b) $x[n] = 1 + n + 3n^2 + 5n^3 + 9n^4$

   (c) $x(t) = 1 + t\cos(t) + t^2\sin(t) + t^3\sin(t)\cos(t)$

   (d) $x[n] = (1 + n^3)\cos^3(10n)$

2. For each of the following signals, determine whether it is periodic, and if it is, find the fundamental period:

   (a) $x(t) = \cos^2(2\pi t)$

   (b) $x(t) = \sin^3(2t)$

   (c) $x(t) = e^{-2t}\cos(2\pi t)$

   (d) $x[n] = (-1)^n$

   (e) $x[n] = (-1)^{n^2}$

   (f) $x[n] = \cos(2n)$

   (g) $x[n] = \cos(2\pi n)$

3. Categorize each of the following signals as an energy signal or a power signal, and find the energy or time-averaged power of the signal:

   (a) $x(t) = 5\cos(\pi t) + \sin(5\pi t)$

   (b) $x(t) = \begin{cases} 5\cos(\pi t) & -1 \le t \le 1 \\ 0 & \text{otherwise} \end{cases}$

   (c) $x[n] = \begin{cases} \sin(\pi n) & -4 \le n \le 4 \\ 0 & \text{otherwise} \end{cases}$

   (d) $x[n] = \begin{cases} \cos(\pi n) & -4 \le n \le 4 \\ 0 & \text{otherwise} \end{cases}$

   (e) $x[n] = \begin{cases} \cos(\pi n) & n \ge 0 \\ 0 & \text{otherwise} \end{cases}$

4. Let

$$x[n] = \begin{cases} n & \text{for } n \text{ odd} \\ 0 & \text{otherwise.} \end{cases}$$
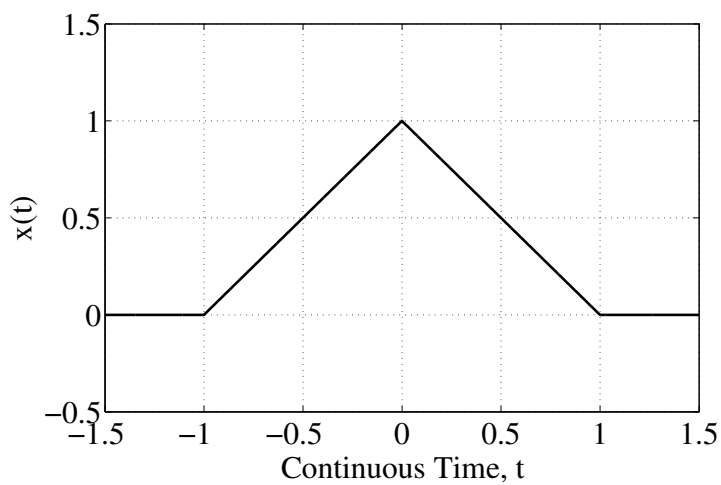
Determine $y[n] = x[2n]$.

Figure 1: Triangular Pulse Signal

5. A triangular pulse signal $x(t)$ is depicted in Figure 1. Sketch each of the following signals derived from $x(t)$:

(a) $x(3t + 2)$

(b) $x(-2t - 1)$