EE150 Signal and System
Homework 1

Due on 22 Sep 23:59 UTC+8

Exercies 1. (10 pts)

Determine the energy E_∞ and power P_∞ of those signals. Which are energy signals? Which are power signals?

(a) $x(t) = e^{j(2t+\frac{\pi}{4})}$

(b) $x[n] = \left(\frac{1}{2}\right)^n u[n]$

Exercies 2. (15 pts)

Determine whether or not each of the following signals in periodic. If a signal is periodic, specify its fundamental period.

(a) $x_1(t) = 2e^{j(t+\frac{\pi}{4})}u(t)$

(b) $x_2[n] = e^{j7\pi n}$

(c) $x_3[n] = 3e^{j\frac{3}{5}(n+\frac{1}{2})}$

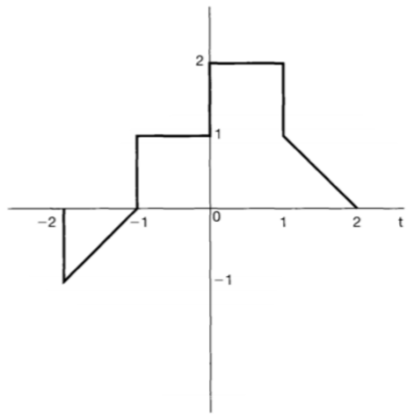
Exercies 3. (15 pts)

Question 1. (7 pts)

A continuous-time signal $x(t)$ is shown in the following. Sketch and label carefully each of the following signals:

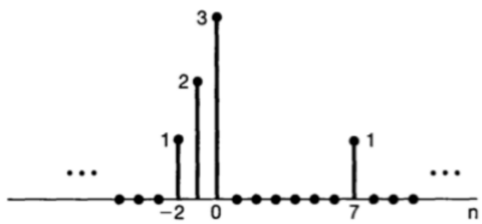
(a) $x(t-1)$

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



Question 2. (8 pts)

Determine and sketch the even and odd parts of the signals depicted in the following. Label your sketches carefully



Exercise 4. (20 pts)

In this chapter, we introduced a number of general properties of systems. In particular, a system may or may not be

- **(1) Memoryless**
- **(2) Time invariant**
- **(3) Linear**
- **(4) Causal**
- **(5) Stable**

Determine which of these properties hold and which do not hold for each of the following continuous-time systems. Justify your anseers. In each example, $y(t)/y[n]$ denotes the system output and $x(t)/x[n]$ is the system input.

- (a) $y[n] = nx[n]$
- (b) $y(t) = \int_{-\infty}^{2t} x(t)dt$

Exercise 5. (40 pts)

(*a*) **Show that the discrete-time system whose input $x[n]$ and output $y[n]$ are related by $y[n] = Re\{x[n]\}$ is additive. Does this system remain additive if its input-output relationship is changed to $y[n] = Re\{e^{j\pi n/4}x[n]\}$? (Do not assume that $x[n]$ is real in this problem)**

(*b*) **In the text, we discussed the fact that the property of linearity for a system is equivalent to the system possessing both the additivity property and homogeneity property. Determine whether the systems defined below is additive and/or homogeneous. Justify your answers by providing a proof for each property if it holds or a counter example if it does not.**

$$y(t) = \frac{1}{x(t)}\left[\frac{dx(t)}{dt}\right]^2$$