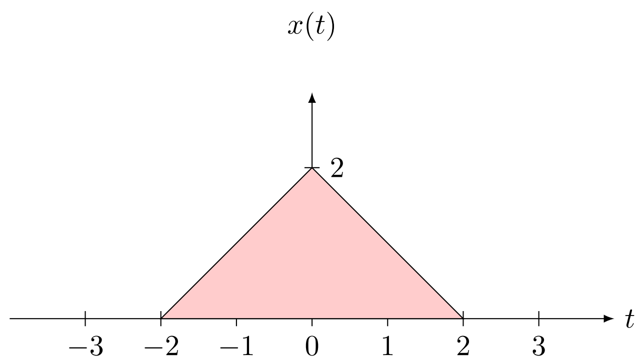
Homework Assignment 1

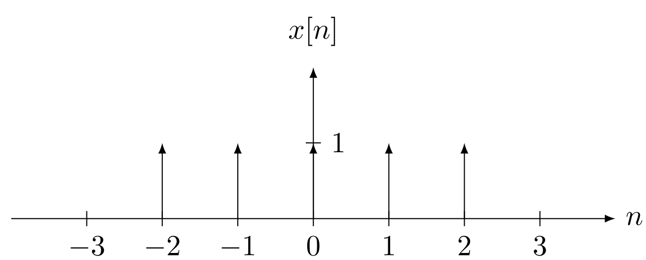
Matlab Review
If you feel you need additional Matlab practice, now is the time to do it. Please review Apendix A (pg. 205) in the course text lab manual (available on the CD or online at the textbook website).

Problem 1-1
A triangle pulse signal $x(t)$ is depicted below. Sketch the following signals derived from x(t):
(a) $x(2t)$ and (b) $x(2t-1)$.



Problem 1-2
Consider the discrete-time signal

$$x[n] = \begin{cases} 1, & -2 \le n \le 2, \\ 0, & |n| > 2. \end{cases}$$



Find and sketch $y[n] = x[2n+2]$.

Problem 1-3
Consider the discrete-time sinusoid given by

$$x[n] = Acos(\omega_0 n + \phi),$$

where $x[n]$ may or may not be periodic. For it to be periodic with a period of N, it must satisfy $x[n] = x[n+N]$ for all integers n. (a) Substitute $n+N$ into the expression for $x[n]$ and determine the relationship between ω_0 and N that must be satisfied in order for $x[n]$ to be periodic. (b) What is the fundamental period of the discrete-time signal $x[n] = cos(2\pi\frac{13}{52}n)$? (c) Use Matlab to verify your answer.

Problem 1-4
A discrete-time signal is defined by

$$x[n] = sin(0.2\pi n).$$

(a) What is the normalized angular frequency? (b) What is the fundamental period? (c) Plot this signal using Matlab (use Matlab function **stem**) to verify.

Problem 1-5
(a) Draw a block diagram representing the input-output relationship

$$y[n] = \frac{1}{3}\left(x[n] + x[n-1] + x[n-2] + x[n-3]\right).$$

(b) Write a mathematical expression for $y[n]$ using the sum operator, and (c) find the output $y[n]$ using Matlab for the input signal in Problem 1-3b using sum index range of $0 \leq n < 24$.

Problem 1-10
In your engineering education you will often read in some mathematical derivation, or hear someone say, "For small α, $\sin(\alpha) = \alpha$." Using Matlab, plot two curves defined by $x = \alpha$, and $y = \sin(\alpha)$ over the range of $\alpha = -\pi/2$ to $\alpha = \pi/2$, and discuss why that statement is valid.