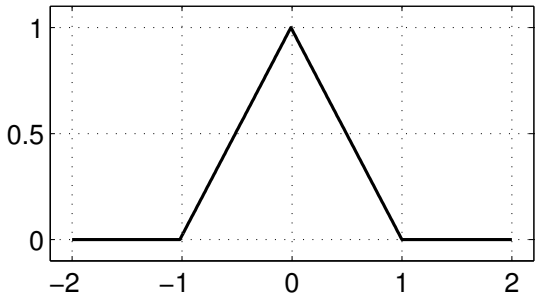
ME565 - Winter 2023 **Due: 5:00:00pm Friday March 3rd, 2023**
Homework 4

Exercise 4-1: Consider the following triangle wave:

$$f(x) = \begin{cases} 0 & x < -1 \\ 1 - |x| & |x| \leq 1 \\ 0 & 1 < x \end{cases}$$



Compute the **Fourier series** by hand for the domain $-2 \leq x < 2$. On a computer, plot the mode coefficients a_n and b_n for the first 100 cosine and sine modes (i.e. for the first $n = 1$ to $n = 100$). Also, plot the approximation using $n = 10$ modes on top of the true triangle wave.

In a few sentences, explain the difference between the Fourier transform and the Fourier series.

Exercise 4-2: Load the image `recorder.jpg`. Convert to grayscale and compress the image using the FFT.

(a) Design a compression threshold to keep exactly 10% of the original Fourier coefficients. Compute the L_2 norm of the error between the new compressed image and the original image. Also compute the L_2 norm of the Fourier transformed versions of the compressed and original images.

(b) Repeat for a compression that only keeps 1% of the original Fourier coefficients.
