# *Homework 1*

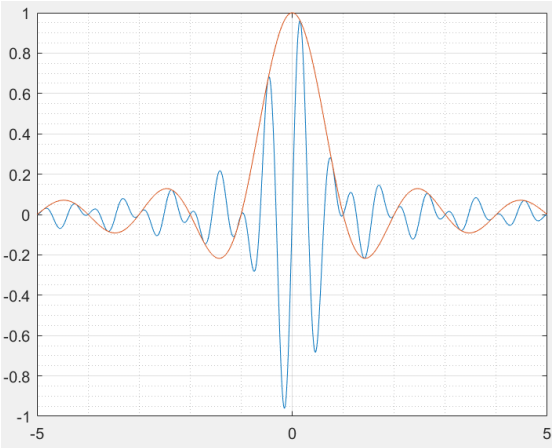
**Problem 1.** **Compute (derive math formulas) the Fourier transform for the following functions:**

a. $f(x) = x\, e^{-\alpha|x|}, \qquad \alpha > 0.$

b. $f(x) = e^{-\,a^2 x^2} \cos(bx).$

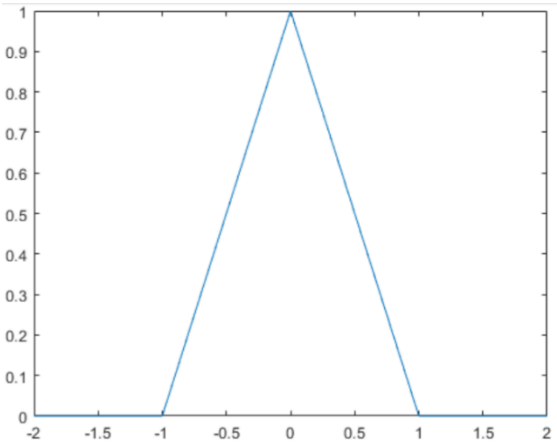
**Problem 2.**

**Compute (derive math formulas) the spectrum of the sine-filled sinc function (picture)**




**Problem 3.**

a. **Compute (derive math formulas) the auto-correlation of the triangular pulse (Picture)**
b. **Calculate the same auto-correlation in MATLAB\Python and plot the result**




**Problem 4.** **Compute (by hands) the convolution of the following signals:**

a. h = [2 3 6 8], x = [1 2 10 1]
b. h = [5 1 3 10], x = [9 6 10 1]

**Problem 5.** **The sinusoidal signal with the frequency 6kHz ….**

a. … is sampled with the frequency 10 kHz. Compute the apparent frequency after the signal reconstruction.
b. … is represented by 4 signal periods sampled with the sample clock frequency 15 kHz. Are these samples enough to reconstruct the initial signal correctly (without ANY error)? Plot the original and the reconstructed signals. Explain the difference.