EE 5527
HW #1

1. Find and sketch the Fourier Transform for the following signal

\[ X(t) \]

\[-5 \quad 0 \quad 5 \quad T \]

2. Find the Fourier coefficients and sketch the Fourier Transform of

\[ x(t) \]

\[-5 \quad 0 \quad 5 \quad \text{A} \]

\[ A = 15, \quad \infty. \]

3. Find and sketch the Discrete-Time Fourier Transform of

\[ x(n) \]

\[ -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad n \]

4. Find and sketch the Discrete Fourier Transform (DFT) of

\[ X(n) \]

\[ 0 \quad 1 \quad 2 \quad \ldots \quad n \]

\[ B \quad \text{zeros,} \]

\[ B = 5 \quad 10 \]
5. Prove that the second PSD definition is equivalent to the first one under

\[ \lim_{N \to \infty} \frac{1}{N} \sum_{k=-N+1}^{N-1} r(k) = 0 \]

6. Consider the cross correlation between two real WSS random sequences \( x(n) \) and \( y(n) \):

\[ \Gamma_{xy}(k) = E \left[ x(n) y(n-k) \right] \]

a) Prove that

\[ \left[ \Gamma_{xy}(0) \right]^2 \leq \Gamma_{xx}(0) \Gamma_{yy}(0) \]

b) Prove that

\[ \Gamma_{xy}(0) \leq \frac{\Gamma_{xx}(0) + \Gamma_{yy}(0)}{2} \]