ELEG 3124 Assignment # 7

1. Find the periods and Fourier series coefficients of the following signals
   (a) \( s(t) = \sum_{n=-\infty}^{\infty} \delta(t - n) \).
   (b) \( s(t) = \sum_{n=-\infty}^{\infty} (-1)^n \delta(t - n) \).

2. A voltage \( x(t) \) is applied to the circuit shown in Fig. 2. If the Fourier coefficients of \( x(t) \) are given by
   \[
   c_n = \frac{1}{n^2 + 1} e^{jn\pi} \tag{1}
   \]
   (a) Express the system in the form of a differential equation
   (b) Find the transfer function of the system
   (c) Plot the amplitude and phase of the transfer function with Matlab
   (d) Find the first three non-zero harmonics of \( y(t) \)

![Figure 1: Questions 2, 3, and 4.](image)

3. Repeat Question 3 if \( y(t) \) is the voltage across the resistor instead.

4. For the RC circuit shown in Figure 2, find the voltage \( y(t) \) across the capacitor if the input is
   \[
   x(t) = 1 + 3 \cos \left( t + \frac{\pi}{6} \right) + \cos(2t) \tag{2}
   \]