**MONTGOMERY COLLEGE, ROCKVILLE**

**Engineering Department**

 **ENEE 222 – Elements of Discrete Signal Analysis**

 Fall 2015

You must SHOW ALL WORKING for FULL CREDIT

**Test 3**

1. (40) Consider the figure below:



**Note:**









Answer the following questions

DC Yes\_\_\_\_ ao = ? No\_\_\_\_\_ ao = 0

Symmetry

 Even\_\_\_\_ an = ? bn = 0

 Odd\_\_\_\_ an = 0 bn = ?

 Even & Odd\_\_\_\_ an = ? bn = ?

Halfwave symmetry

 Yes\_\_\_\_\_ only odd harmonics

 No\_\_\_\_\_\_ all harmonics

Discontinuities

 Yes\_\_\_\_\_ falls off as 1/n

 No\_\_\_\_\_\_ falls off as 1/n2

Note ? means find that variable.

Comment on the general form of the Fourier series coefficients [an and/or bn.]

Calculate the Fourier Series coefficients [an and/or bn.] and write the Fourier Series expression for f(t). Comment on your prediction

1. (30)Consider the signal s = [1 2 3 4 3 2]
	1. Determine the least-squares approximation s^ of based on v(1), v(3) and v(5)
	2. Compute the squared approximation error ||s^ - s||2
2. (30) An eight-point real-valued signal s has DFT given by S = [5 x1 4j -3-3j 1 x2 x3 1-j]
	1. Compute s[0] - s[1] + s[2] - s[3] + s[4] - s[5] + s[6] - s[7] using one entry of X only.
	2. Determine the values of x1, x2, and x3.
	3. Compute the amplitude and phase spectra of s, displaying each as a vector.
	4. Express s[n] as a linear combination of five real-valued sinusoids.
3. Consider a real-valued sinusoid given by:



1. Which Fourier frequencies (for an eight-point sample) are present in the signal s? (you must show all working for full credit!)
2. Determine the amplitude spectrum of x, displaying your answer in the form [A0 A1 A2 A3 A4 A5 A6 A7]]T. (you must show all working for full credit!)
3. Determine the phase spectrum of x, displaying your answer in the form [φ0 φ1 φ2 φ3 φ4 φ5 φ6 φ7]T (you must show all working for full credit!)
4. Determine the DFT, S[n], of the signal, using (b) and (c) above