

NAME and SURNAME (CAPITAL LETTERS):

Signal Processing Test 1a

1. A harmonic signal is given $x(t)=\sin(10\pi t+\pi/4)$. Plot this signal using a correct time scale. Give the physical frequency in Hz of this signal and its angular frequency value.
2. The ratio of signal powers increases according to a series: 1, 10, 100, 1000, 10000 express this series in a decibel scale. Show the calculations for the middle element of the series.
3. The amplitude of a sinusoidal signal is equal to $A_{in}=10$ Volts. Voltage amplification of the amplifier is 20dB, what is the amplitude A_{out} of the output signal. Show calculations.
4. Plot the frequency spectrum of a Dirac delta function.
5. Compute the DC component and the energy of signal $x(n)=[1, 2, 3, 4]$

6. Show calculations for computing the first two $X(k=0)$, $X(k=1)$ coefficients of the Discrete Fourier Transform of signal $x(n) = [1, 2, 3, 4]$
7. Provided the coefficient $X(k=2) = -0.5$ give absolute values of coefficients, i.e: $|X(k=0)|$, $|X(k=1)|$, $|X(k=2)|$, $|X(k=3)|$ of signal $x(n)$ from question (6) and plot the corresponding amplitude spectrum (hint: you can use the symmetry property of the Fourier coefficients) .
8. We want to obtain a frequency resolution $f_0 = 0.1$ Hz of the Fourier analysis of a signal sampled at a frequency of $f_s = 100$ Hz. How many samples N of this signal we should take for the Fourier analysis?
9. Is the system $y(n) = 3x(n) + 1$ linear? Prove and show calculations.
10. Give the equation defining convolution of discrete time signals $x(n)$ and $h(n)$. Compute convolution of these signals if the signals are: $x(n) = [1, 2, 3]$, $h(n) = [1, 2]$