Signals and Systems

Assignment -2

Unit - 3, Unit - 4 and Unit - 5

1. For the following signals $x(t)$, write a *MATLAB* code to find the Fourier coefficients for $k = -7$ *to* 7. Plot the magnitude and phase plot of a_k. Using these Fourier series coefficients a_k, recreate the signal. Plot the estimated and the original signal $x(t)$ on the same plot. Redo the same problem for $k = -25$ *to* 25. Comment on the effect of increasing the number of fourier series coefficients on the reconstructed signal $x(t)$. Given one period of the signal $x(t)$,

   (a)
   $$x(t) = \begin{cases} 1, & -0.5 \leq t \leq 0.5; \\ 0, & 0.5 \leq |t| \leq 1.5 \end{cases}$$
   Assume $T = 3$.

   (b)
   $$x(t) = \begin{cases} 0, & 0 \leq t \leq 1; \\ 1, & 1 \leq t \leq 2 \end{cases}$$
   Assume $T = 2$.

2. Write *MATLAB* code to plot the magnitude and phase spectrum of the signal,
   (a) $x(t) = e^{-at}u(t),\ a > 0.$
   (b) $x(t) = e^{at}u(-t),\ a > 0.$
   (c) $x[n] = (1/2)^n u[n].$
   (d) $x[n] = -a^n u[-n-1]$, a is a real number. Comment on what values of a the fourier transform exists.

3. Verify the time shifting and linearity property of CTFT for the signals shown in fig.Q3(a) and (b).

4. Determine the Z-Transform of a discrete sequence using MATLAB.
   (a) $h[n] = (\frac{1}{4})^n u[n]$
   (b) $h[n] = n\sin(\pi n/2)u[n]$
   (c) $h[n] = 3^{n-2}u[n]$
   (d) $h[n] = u[n]$

5. Write MATLAB code to determine the time domain signals that correspond to the following signals in the frequency domain using Inverse Z-Transform ('iztrans' MATLAB function)
   (a) $H[z] = \frac{z}{z-1}$
   (b) $H[z] = \frac{z^2-3z}{z^2-(3/2)z-1}$
   (c) $H[z] = \frac{1+\frac{7}{6}z^{-1}}{(1-\frac{1}{2}z^{-1})(1+\frac{1}{3}z^{-1})}$

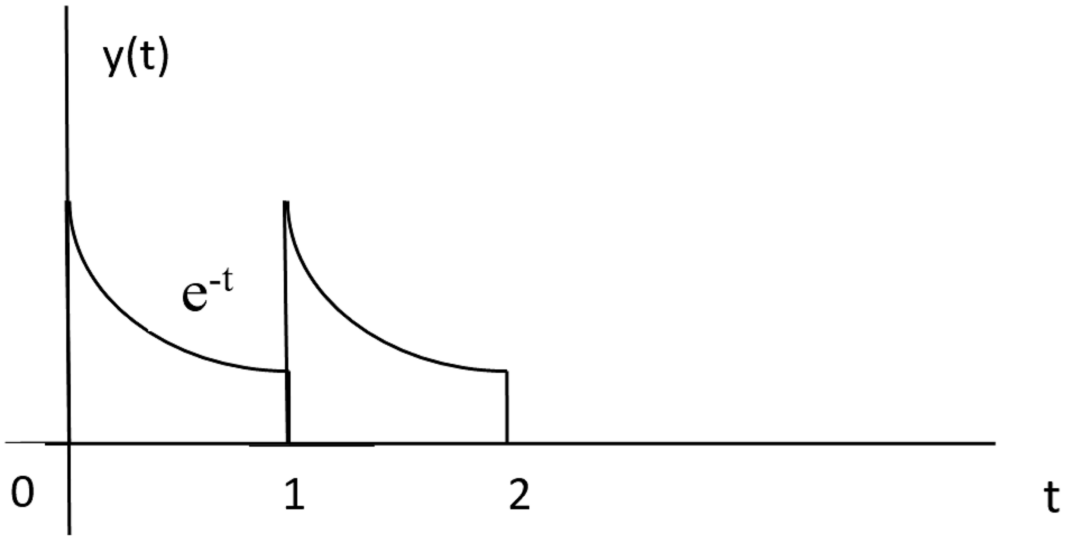

Figure 1: Q3(a)

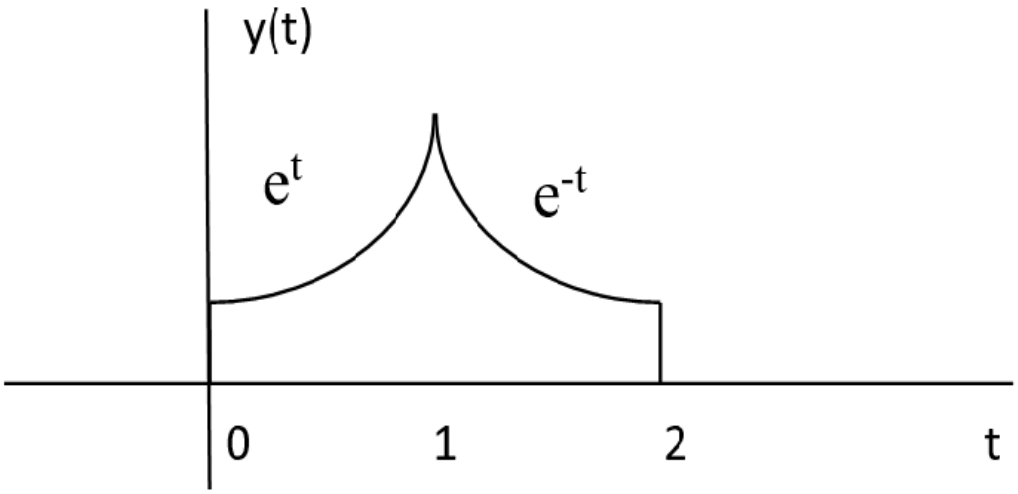

Figure 2: Q3(b)