```
% ECE 313 Linear Systems & Signals
% Tuneup #6

% Copy this file into a Matlab script window, add your code and answers to
% the questions as Matlab comments, hit "Publish", and upload the resulting
% PDF file to this page for the tune-up assignment.  Please do not submit
% a link to a file but instead upload the file itself.
% Late penalty: 2 points per minute late.

% For the linear time-invariant (LTI) system,
% y[n] = x[n] + x[n-1]

% (a) What is(are) the initial condition(s) and what values should they
%     be set to?  Why?

% The initial conditions arise when observing the system for n >= 0.
% y[0] = x[0] + x[-1]
% x[-1] is the initial value for x[n-1] in memory.
% Set x[-1] = 0 to satisfy the necessary conditions for LTI to hold.

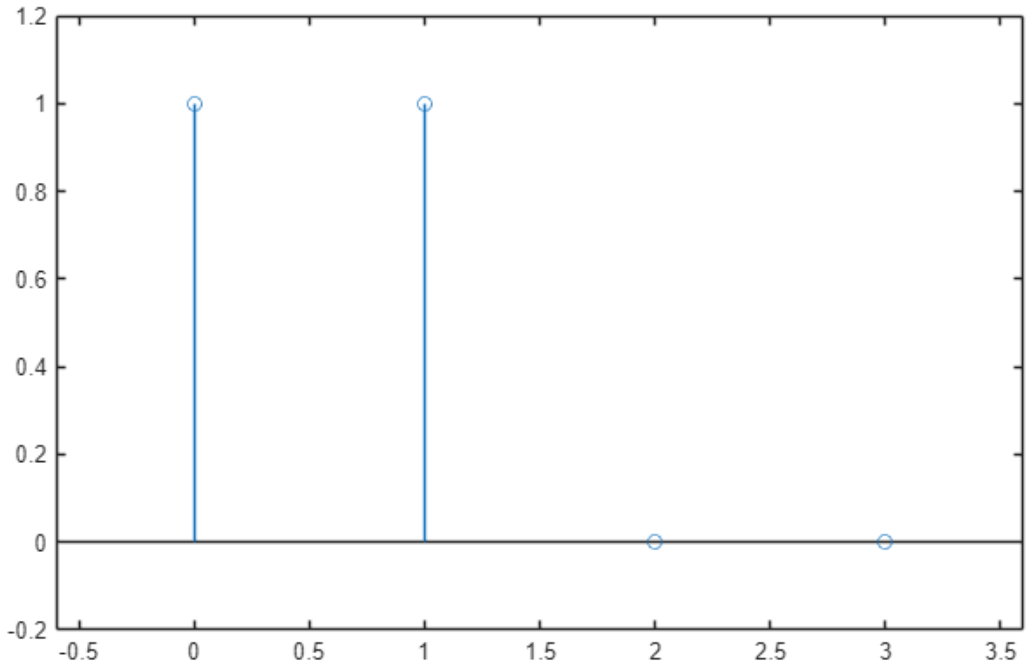
% (b) Plot the following responses.
%      1. impulse response using stem.
%         Impulse response is the response to an impulse d[n].
%         h[n] = d[n] + d[n-1]
h = [ 1 1 0 0 ];
n = [ 0 1 2 3 ];
figure;
stem(n, h);
ylim( [ -0.2 1.2 ] );

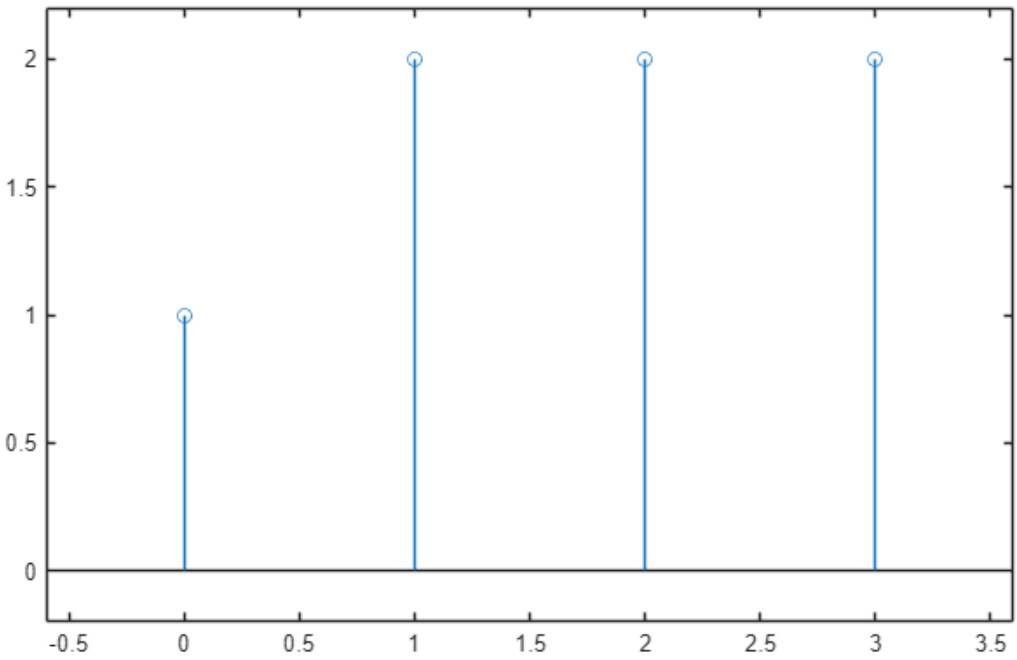
%      2. step response using stem.
%         Let x[n] = u[n]
%         ystep[n] = u[n] + u[n-1]
%         The step response lasts from n = 0 to infinity
%         We'll use the stem command to plot a few samples
unitstep = ( n >= 0 );
unitstepdelayby1 = ( (n-1) >= 0);
ystep = unitstep + unitstepdelayby1;
figure;
stem(n, ystep);
ylim( [ -0.2 2.2 ] );

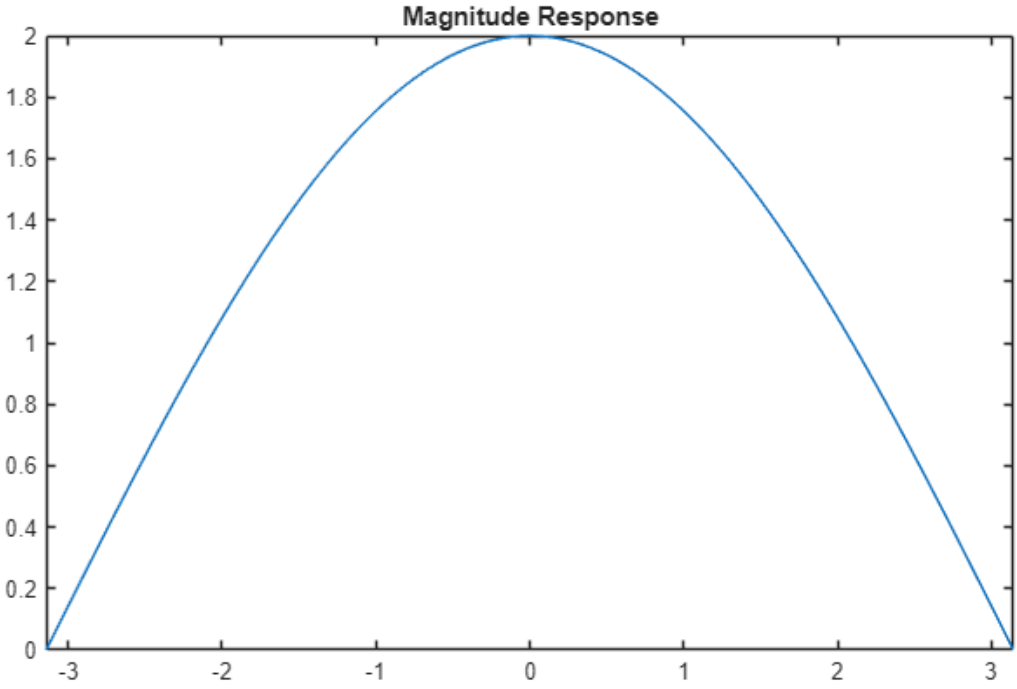
%      3. frequency response using freqz(h);
%         Hfreq(wHat) = 1 + exp(-j wHat)
%         Hfreq(wHat) = exp(-j wHat/2) ( exp(j wHat/2) + exp(-j wHat/2) )
%         Hfreq(wHat) = 2 cos(wHat/2) exp(-j wHat/2)
%         Magnitude response is 2 cos(wHat/2)
%         Phase response is -wHat/2
% Plotting the magnitude response in linear units
% Plotting the phase response in radians
wHat = -pi : 0.01 : pi;
Hmag = 2*cos(wHat/2);
```

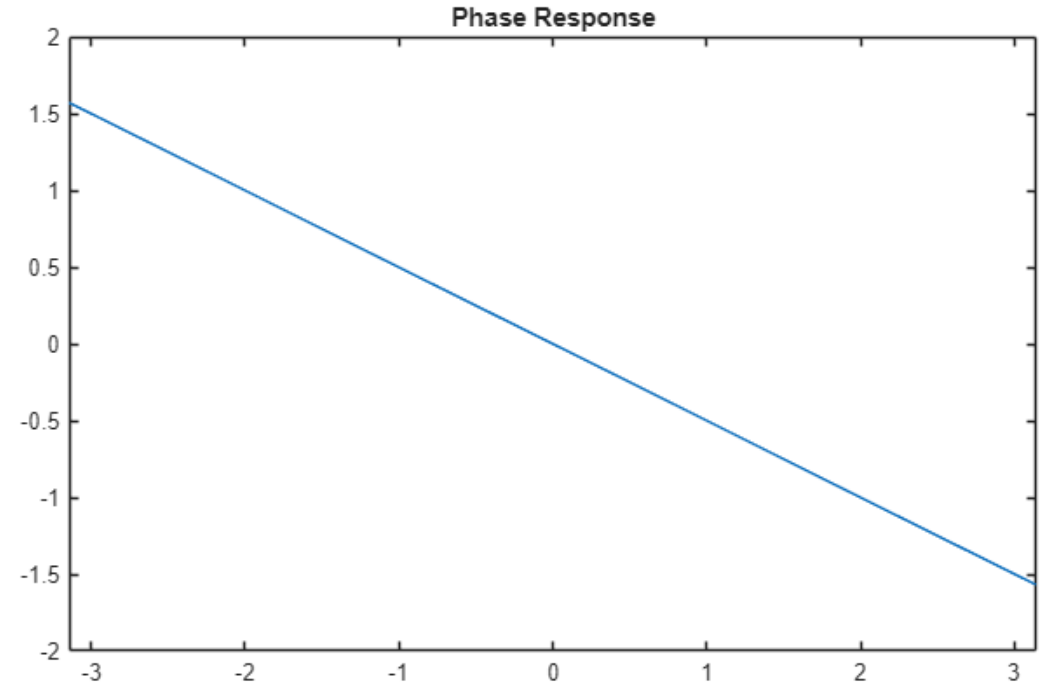
```
Hphase = -wHat/2;
figure;
plot(wHat, Hmag);
title('Magnitude Response');
xlim( [-pi pi] );
figure;
plot(wHat, Hphase);
title('Phase Response');
xlim( [-pi pi] );

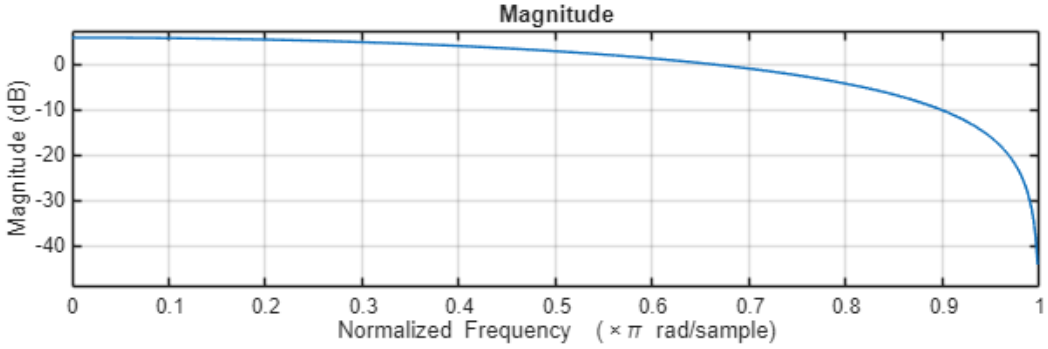
% The built-in freqz command plots the magnitude response in
% decibels (AdB = 20 log |A|) and phase response in degrees
% for wHat from 0 to pi. The responses over negative frequencies can be
% obtained by symmetry:  the magnitude response is even symmetric about
% 0 frequency and the phase response is odd symmetric about
% 0 frequency. Since freqz plots the magnitude response plots in dB,
% 20 log10 | Hfreq(wHat) |, a few observations might help:
% Hfreq(wHat) = 1 corresponds to 0 dB.
% Hfreq(wHat) = 0 corresponds to -infinity in dB.
figure;
freqz(h);
```

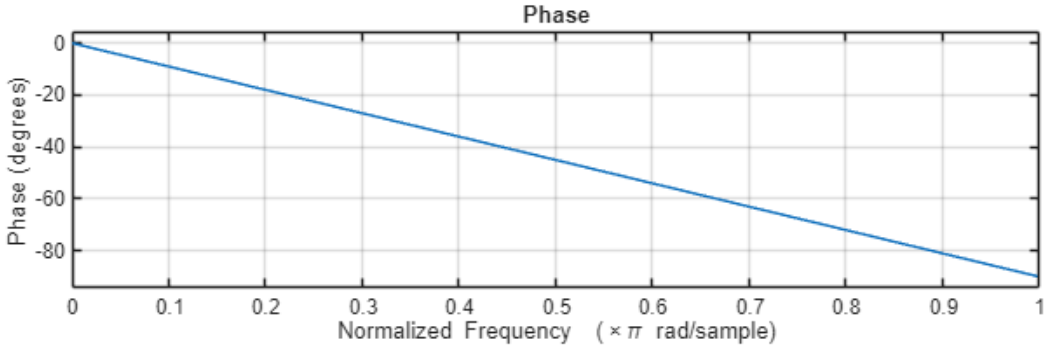



2
1.5
1
0.5
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5


Magnitude Response
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-3
-2
-1
0
1
2
3







Published with MATLAB® R2025b