Digital Signal Processing
MATLAB HW - q2

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Clear recent data

```
clear; close all; clc;
```

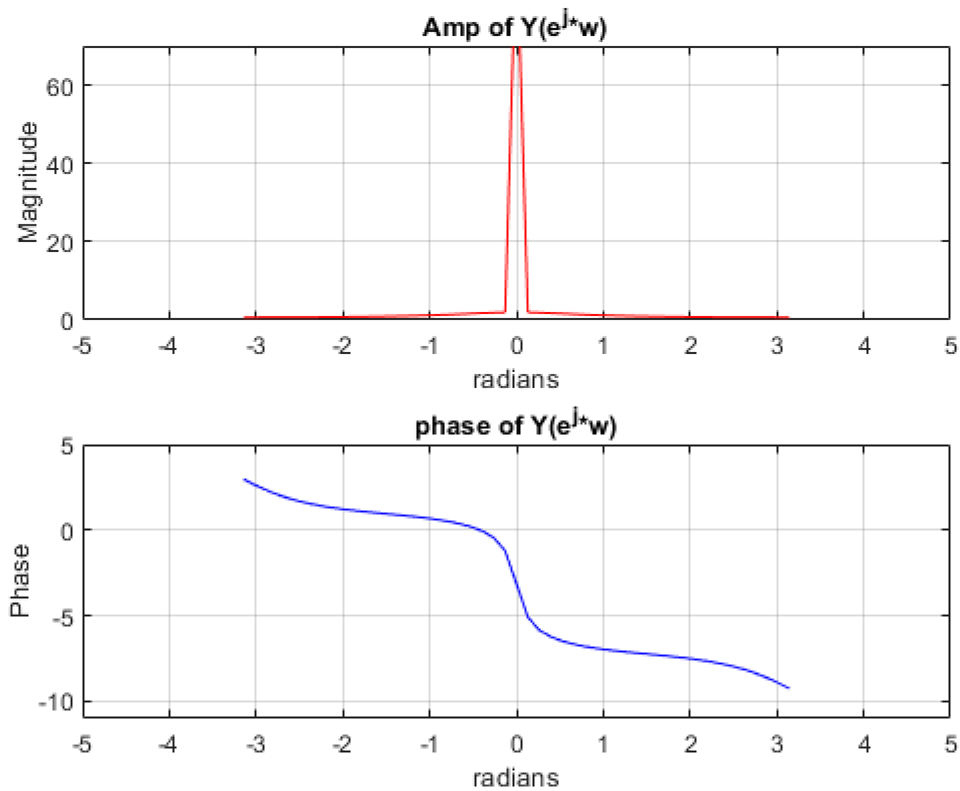
Verifying Variables

```
clc;
n = 0 : 1 : 48; % time defenition
x = 2 + (0.5).^n; % x(n) = [2 + (0.5)^n]*u(n)
b = [0.45 0.4 -1]; %y(n)- 0.4y(n-1)- 0.45y(n-2)
a = [1 -0.4 -0.45]; %0.45x(n)+ 0.4x(n-1)- x(n-2)
%To compute and plot impulse response, MATLAB provides the function
 impz. When invoked by
h = impz(b,a,n);
h = h'; %now h is a row of numbers
w = -pi : pi/24 : pi; %vector of frequencies
```

Part A finding and plotting Y(jw)

```
clc;
X = fftshift(fft(x)); %creating zero phase fft of x(n)
H = fftshift(fft(h)); %creating zero phase fft of h(n)
Y = H.*X; %creating Y(e^jw)

figure(1)
subplot(211)
plot(w, abs(Y),'r')
title("Amp of Y(e^j*w)")
axis([-5 5 0 70])
grid on;
```

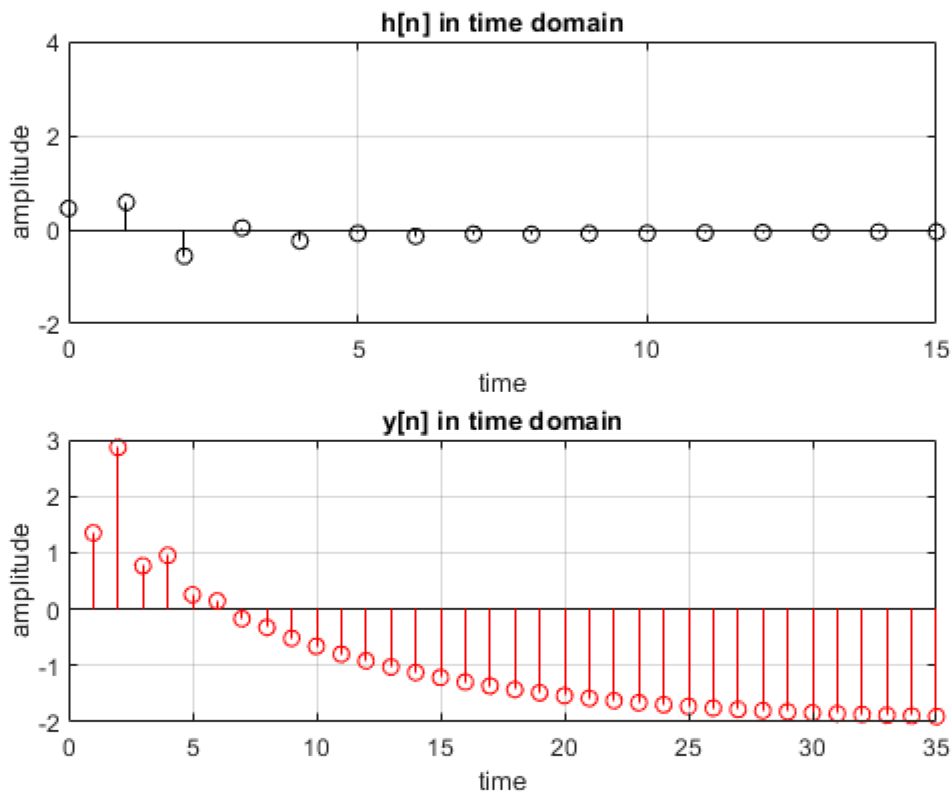
```
xlabel('radians')
ylabel('Magnitude')

subplot(212)
plot(w, phase(Y),'b')
title("phase of Y(e^j*w)")
axis([-5 5 -11 5])
xlabel('radians')
ylabel('Phase')
grid on;
```



Part B : determine and plot h(n) and y(n)

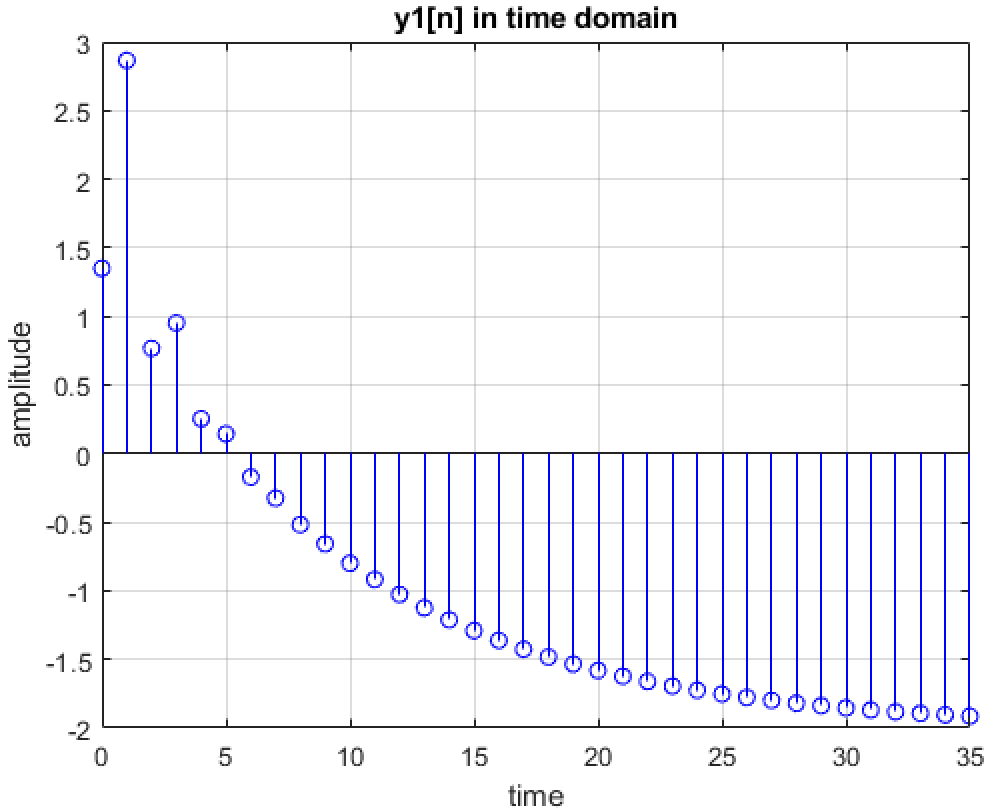
```
figure(2)
subplot(211)
stem(n,h,'k')
title("h[n] in time domain")
grid on;
axis([0 15 -2 4])
xlabel("time")
ylabel("amplitude")

y = conv(x,h); %y(n) = x(n) * h(n)
subplot(212)
stem(y,'r')
title("y[n] in time domain")
```

```
grid on;
axis([0 35 -2 3])
xlabel("time")
ylabel("amplitude")
```



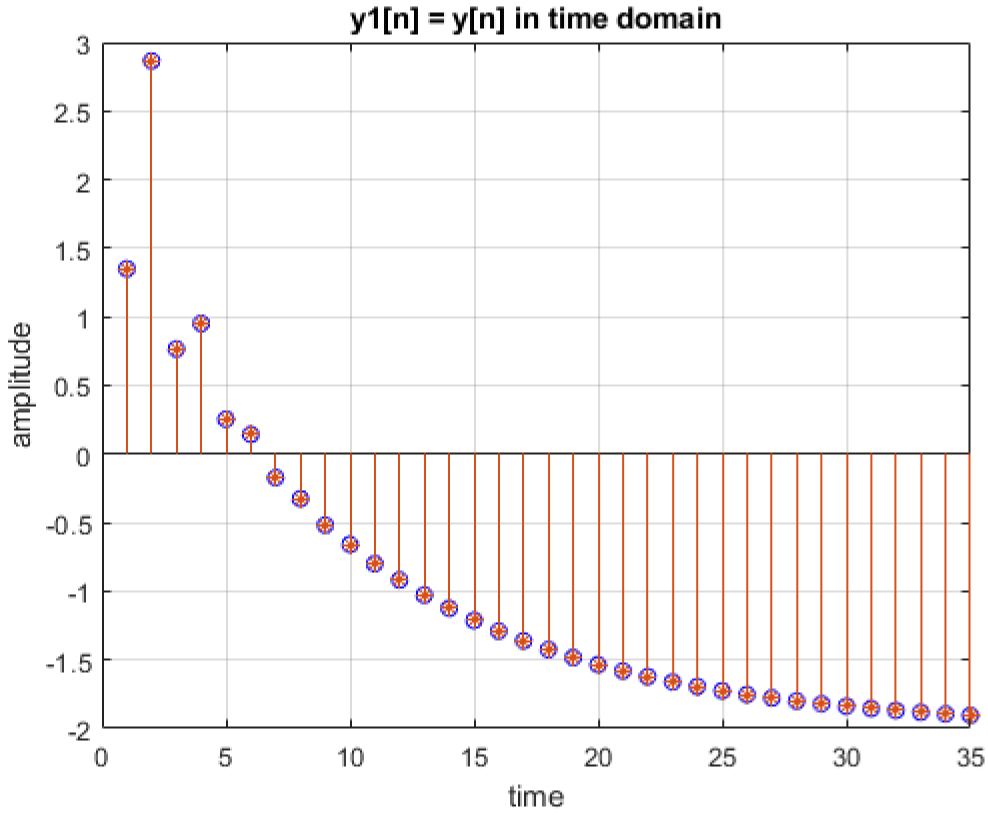
Part C : Determine and plot y(n) with solving difference equation

```
%A function called filter is available to solve difference equations
 numerically,
%given the input and the difference equation coefficients. In its
%simplest form this function is invoked by
y1 = filter(b,a,x); %extra help from book page 49
figure(3)
stem(n,y1,'b')
title("y1[n] in time domain")
grid on;
axis([0 35 -2 3])
xlabel("time")
ylabel("amplitude")
```



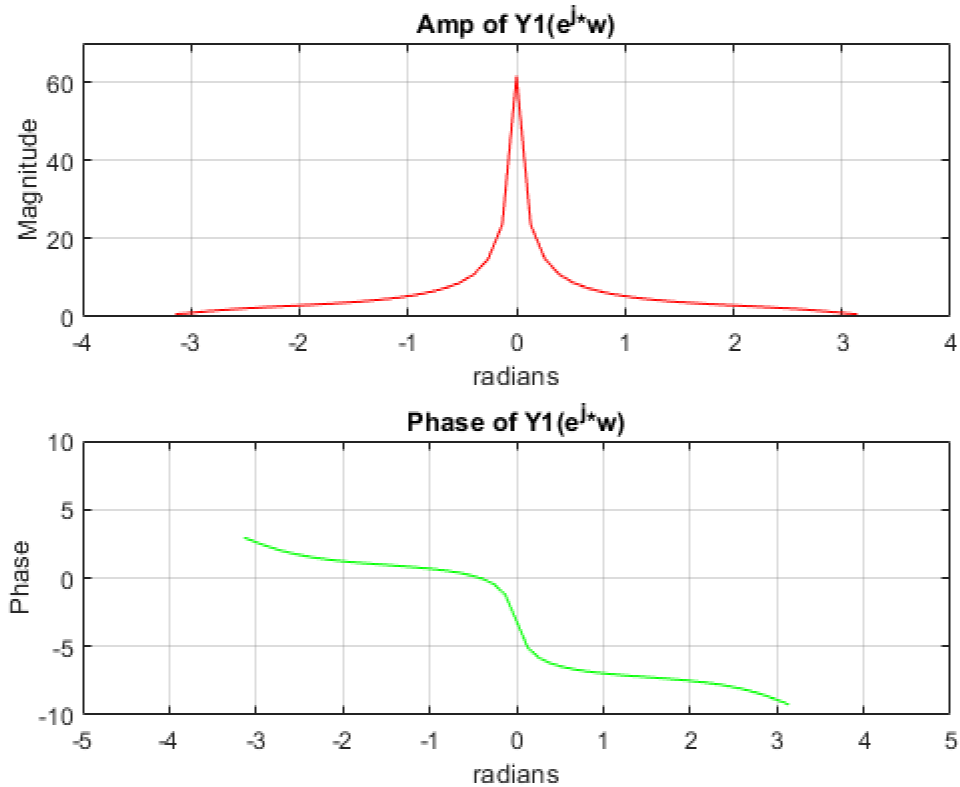
Comprasion between y[n] and y1[n]

```
figure(4)
stem(y1,'b')
hold on;
stem(y,'*')
title("y1[n] = y[n] in time domain")
grid on;
axis([0 35 -2 3])
xlabel("time")
ylabel("amplitude")
```



Part D : Plot DTFT magnitude and phase of y(n) that achieved in last section.

```
Y1 = fftshift(fft(y1));
figure(5)
subplot(211)
plot(w, abs(Y1),'r')
title("Amp of Y1(e^j*w)")
axis([-4 4 0 70])
grid on;
xlabel('radians')
ylabel('Magnitude')

subplot(212)
plot(w, phase(Y),'g')
title("Phase of Y1(e^j*w)")
axis([-5 5 -10 10])
grid on;
xlabel('radians')
ylabel('Phase')
```



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