Digital Signal Processing
MATLAB HW1 - q1

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Clear recent data

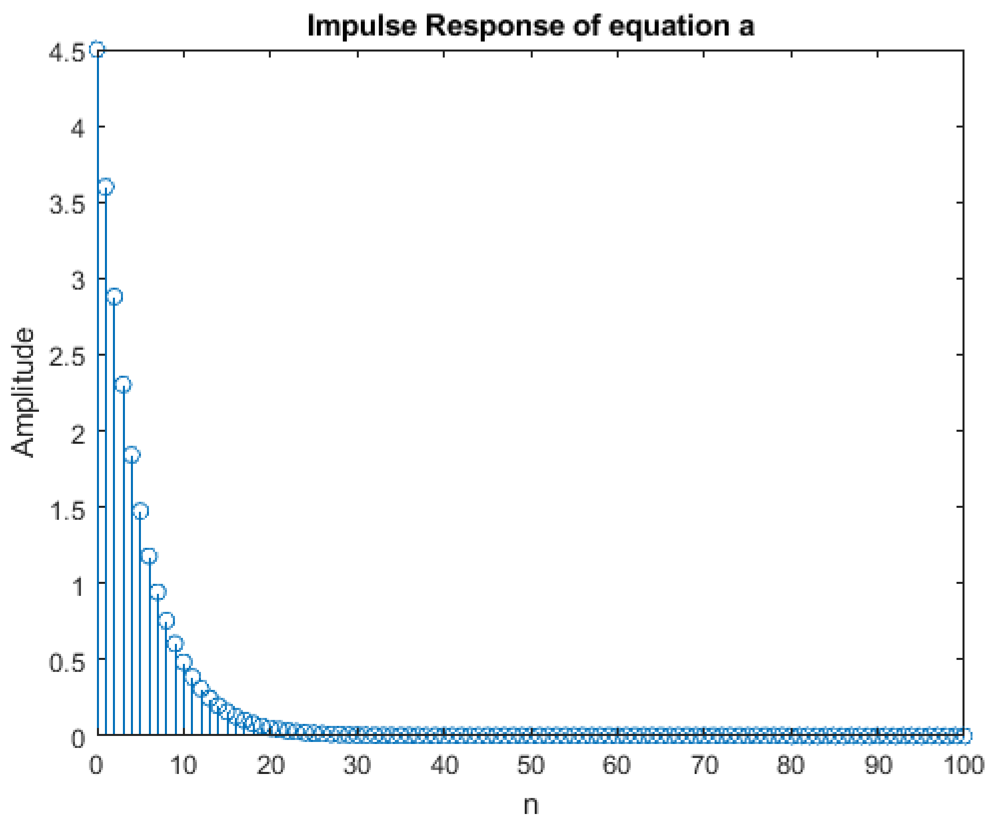
```
clear; close all; clc;
```

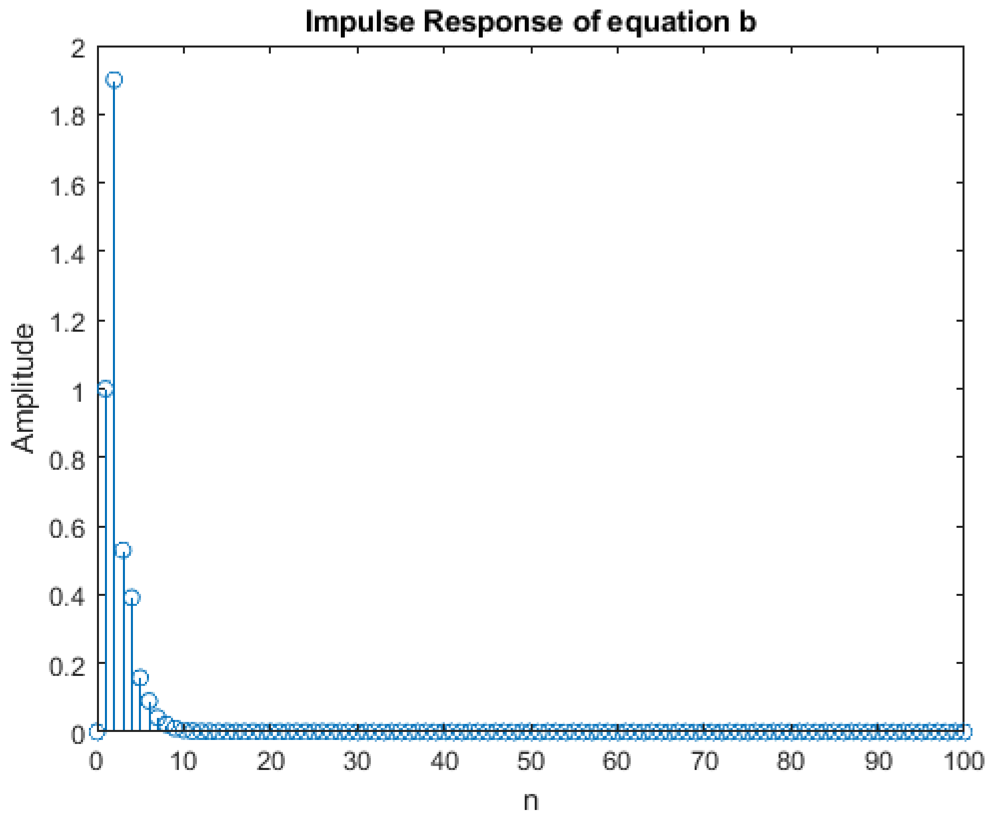
Q1 : IMPULSE RESPONSE

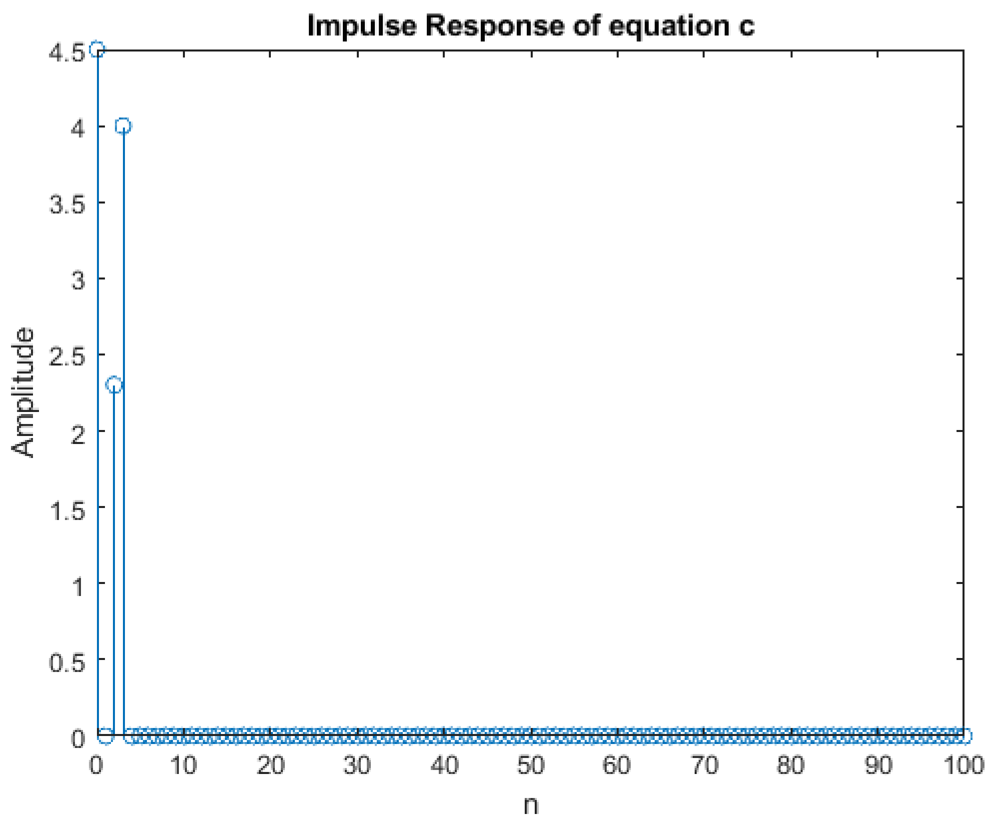
PART1

```
n = [0:100];

% equation A
% y(n) = 4.5*x(n) + 0.8*y(n-1);
aA = [1 -0.8];
bA = [4.5];
impReA = impz(bA, aA ,n);
figure(1);
stem(n , impReA);
xlabel('n');
ylabel('Amplitude');
title('Impulse Response of equation a');

% equation B
% y(n) = x(n-1) + 0.2*y(n-1) + 0.15*y(n-2) + 1.7*x(n-2)
aB = [1 -0.2 -0.15];
bB = [0 1 1.7];
impReB = impz(bB, aB ,n);
figure(2);
stem(n , impReB);
xlabel('n');
ylabel('Amplitude');
title('Impulse Response of equation b');
```

```
% equation C
% y(n) = 4.5x(n) + 2.3x(n-2) +4x(n-4)
aC = [1];
bC = [4.5 0 2.3 4];
impReC = impz(bC, aC ,n);
figure(3);
stem(n , impReC);
xlabel('n');
ylabel('Amplitude');
title('Impulse Response of equation c');
```




Impulse Response of equation b
Amplitude
n
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
10
20
30
40
50
60
70
80
90
100


Impulse Response of equation c
Amplitude
n
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
0
10
20
30
40
50
60
70
80
90
100

PART2

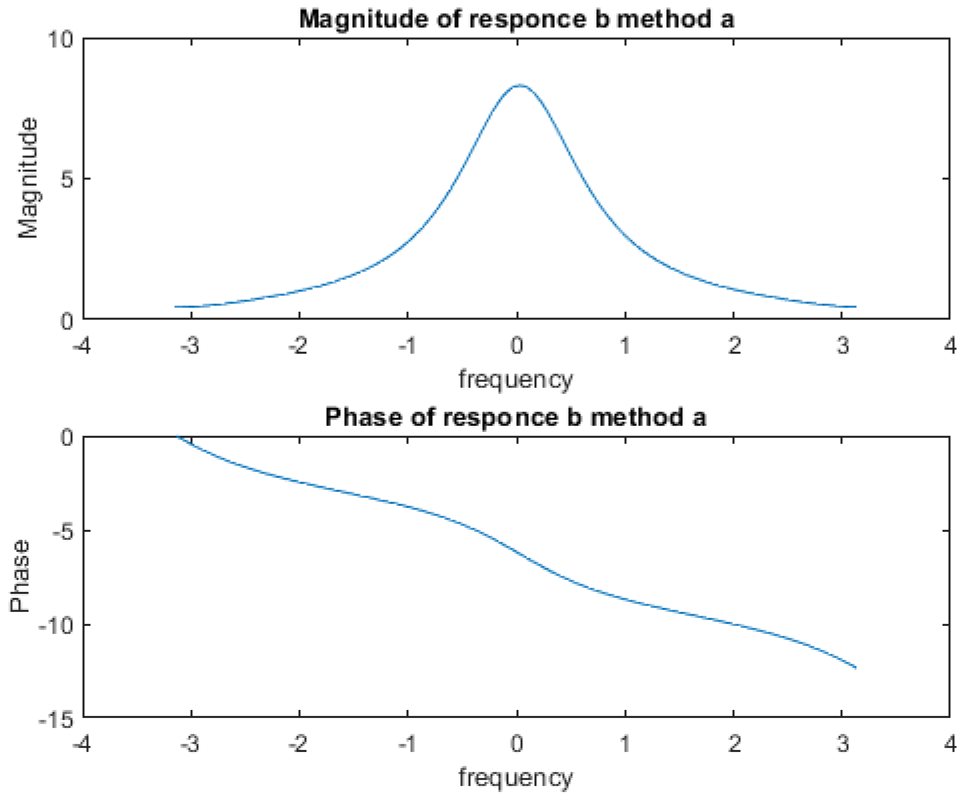
equation C is finite and FIR because has no poles

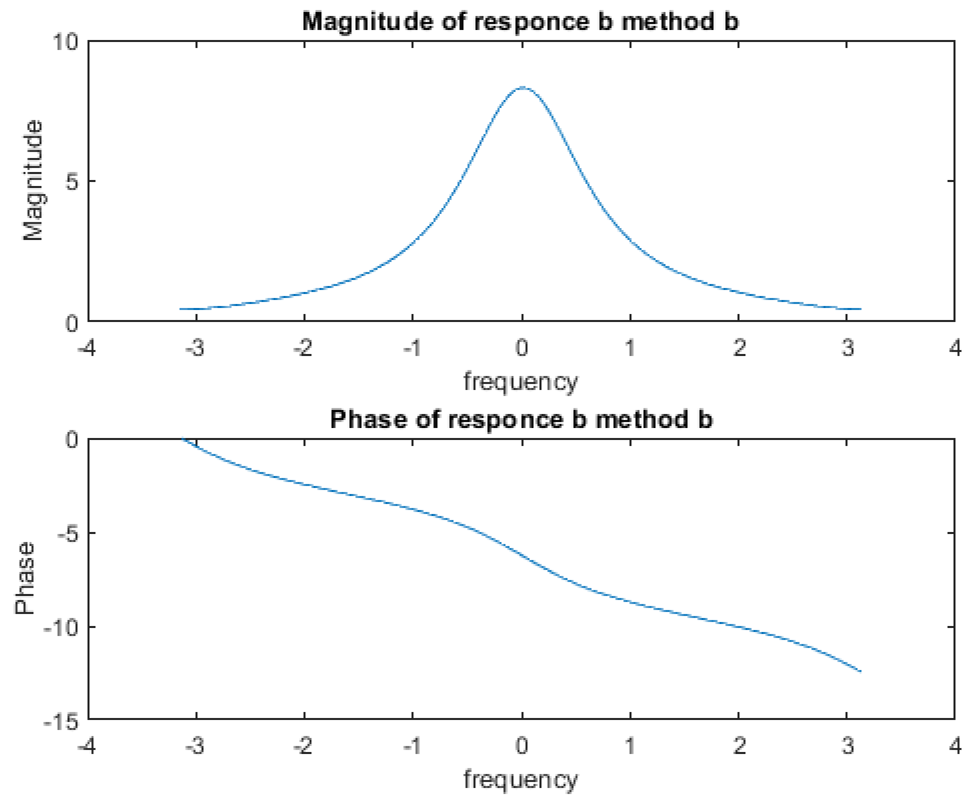
PART3

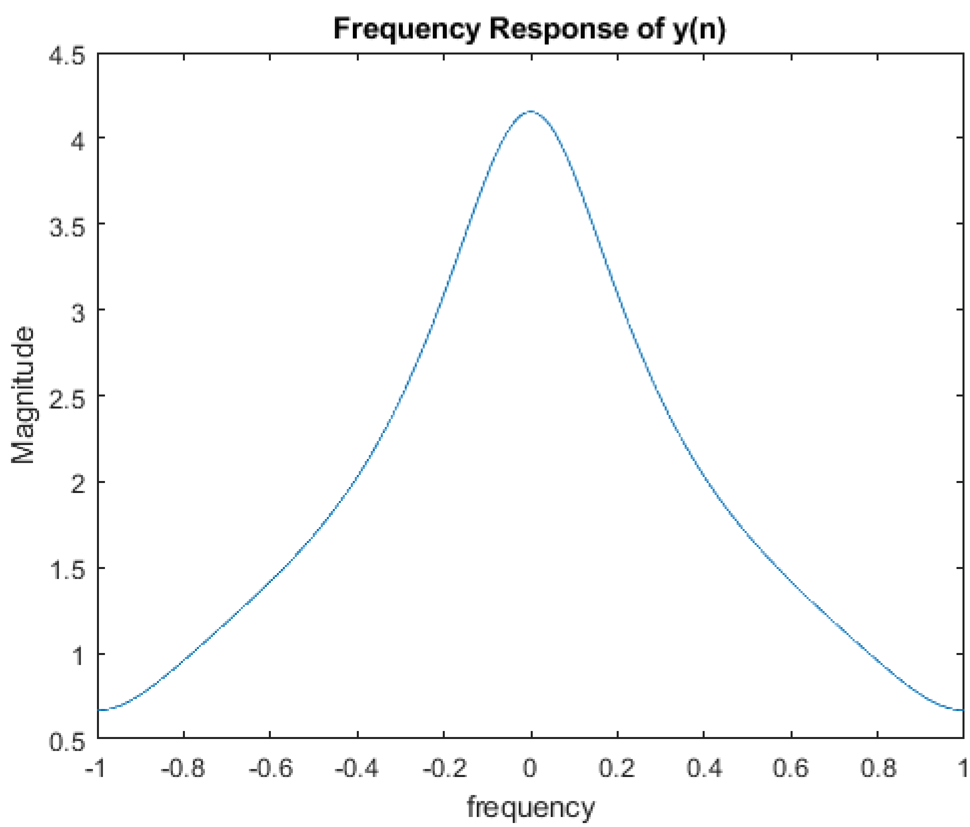
```
n2 = 0:99;
Un = ones(1 , 100);
x = (0.5).^n2 .*Un ;

% method a
y_a = filter(bB, aB, x);
Y_a = fftshift(fft(y_a));
L_a = length(Y_a);
W_a = linspace(-pi,pi,L_a);
figure(4);
subplot(2,1,1);
plot(W_a,abs(Y_a));
xlabel('frequency');
ylabel('Magnitude');
title('Magnitude of responce b method a');
subplot(2,1,2);
plot(W_a,phase(Y_a));
xlabel('frequency');
ylabel('Phase');
title('Phase of responce b method a');

% method b
y_b = conv(x, impReB);
Y_b = fftshift(fft(y_b));
L_b = length(Y_b);
W_b = linspace(-pi,pi,L_b);
figure(5);
subplot(2,1,1);
plot(W_b,abs(Y_b));
xlabel('frequency');
ylabel('Magnitude');
title('Magnitude of responce b method b');
subplot(2,1,2);
plot(W_b,phase(Y_b));
xlabel('frequency');
ylabel('Phase');
title('Phase of responce b method b');

% part c
W = linspace(-pi, pi, 1024);
H_z = freqz(bB,aB,W);
X = freqz([1],[1 -0.5],W);
Y_z = H_z .* X ;
figure(6);
plot(W/pi, abs(H_z));
xlabel('frequency');
```

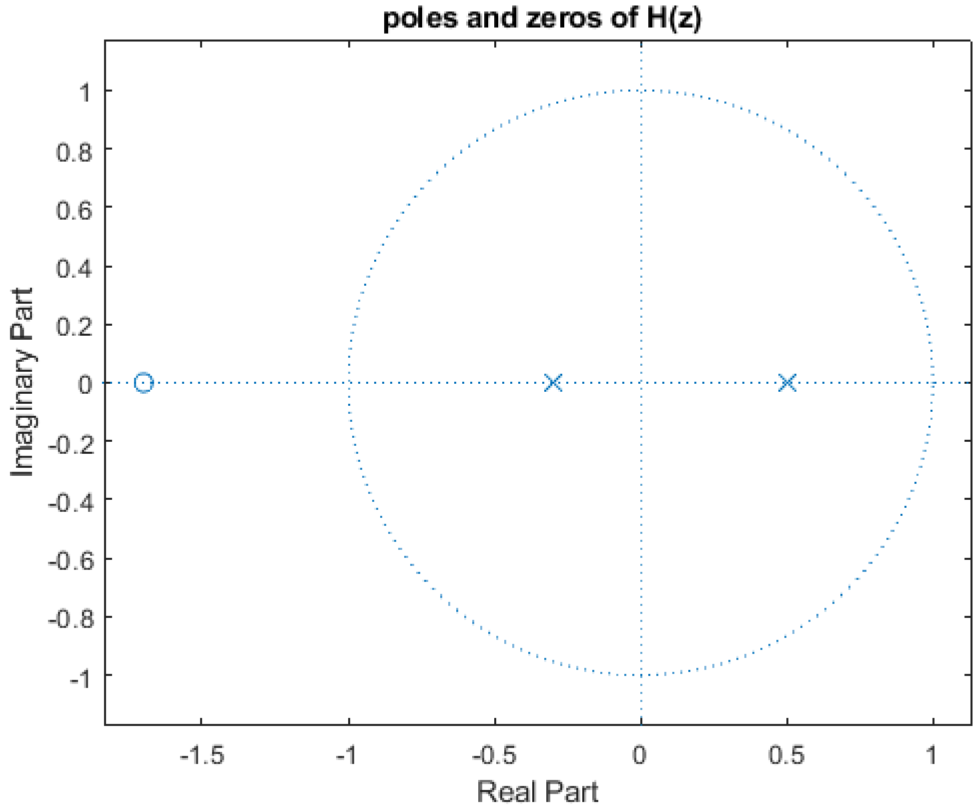
```
ylabel('Magnitude');
title('Frequency Response of y(n)');
syms z;
F = (z+ 1.7)/((z-0.5)*(z+0.3));
y_n = iztrans(F);
pretty(y_n);


% part d
figure(7);
zplane(bB,aB);
title(' poles and zeros of H(z)');
```

```
   / 1 \n      /    3 \n
11 | - |    35 | - -- |
   \ 2 /       \   10 /     34 kroneckerDelta(n, 0)
--------- + ------------ - -----------------------
    2             6                   3
```




Magnitude of responce b method b
Magnitude
frequency
Phase of responce b method b
Phase
frequency


Frequency Response of y(n)
Magnitude
frequency



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