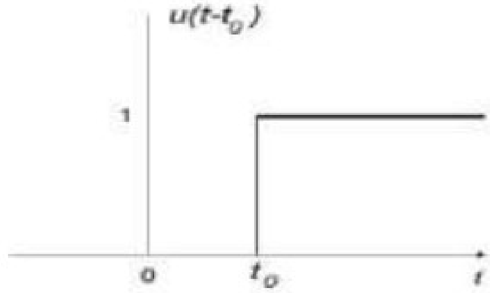
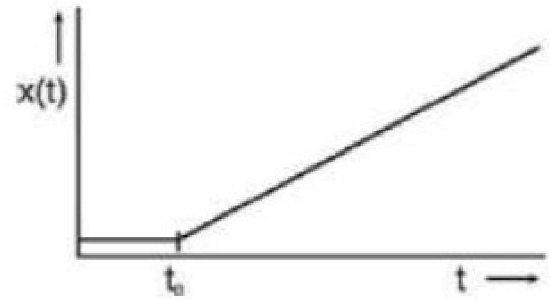
A. **Write a MATLAB program to get the output shown below where t0 = 2.**

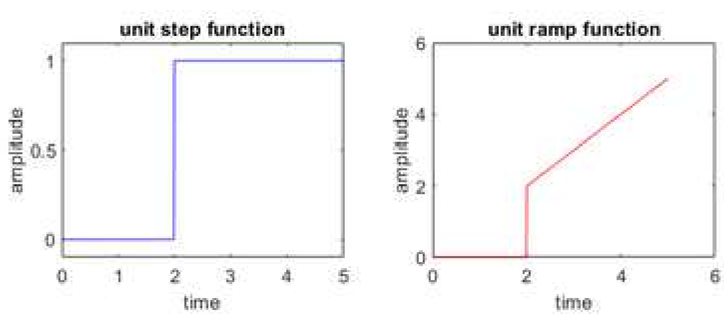




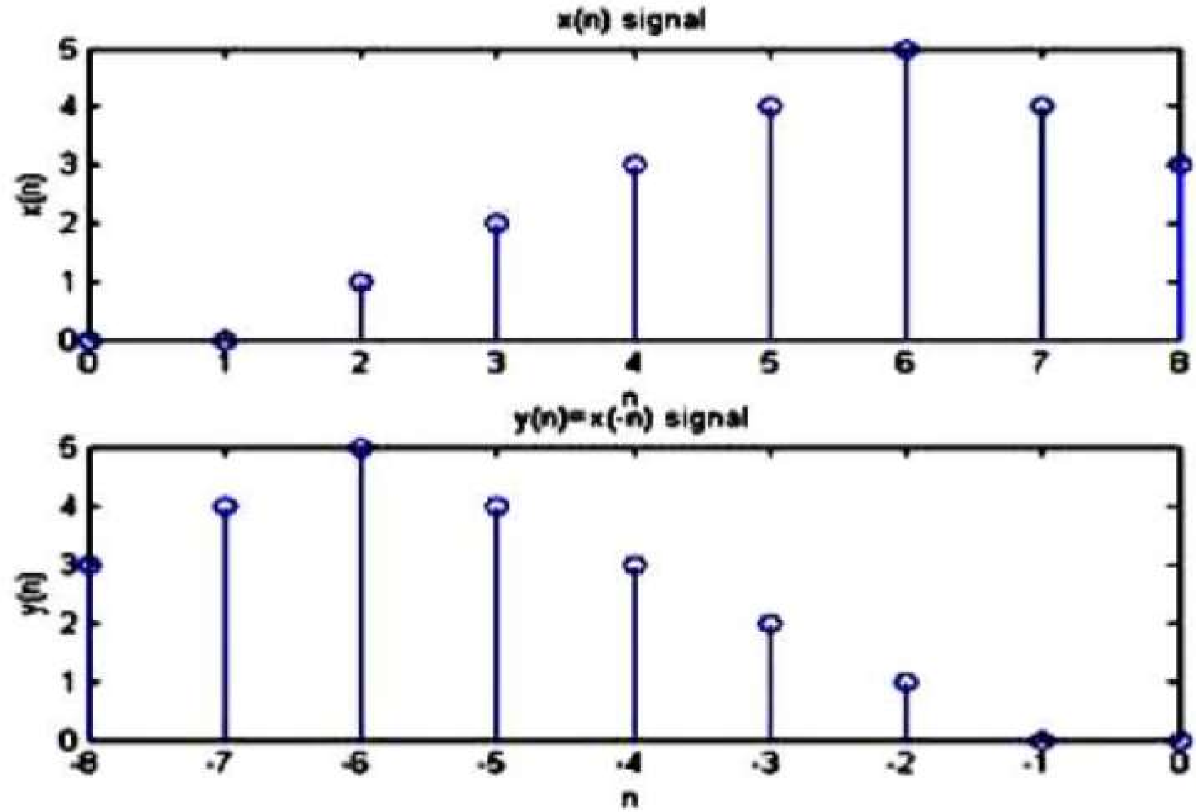
Code:

```
clc;
clear all;
close all;
u = @(t) 1.0.*(t >= 2); % defining unit step function
t = (0:0.01:5);
subplot(2,2,1);
plot(t,u(t),'b');
axis([0 5 -0.1 1.1]); % defining plotting space
xlabel('time');
ylabel('amplitude');
title('unit step function');
r = t.*(t >= 2); % defining ramp function
subplot(2,2,2);
plot(t,r,'r');
%axis([0 5 2 4]);
xlabel('time');
ylabel('amplitude');
title('unit ramp function');
```

Output:



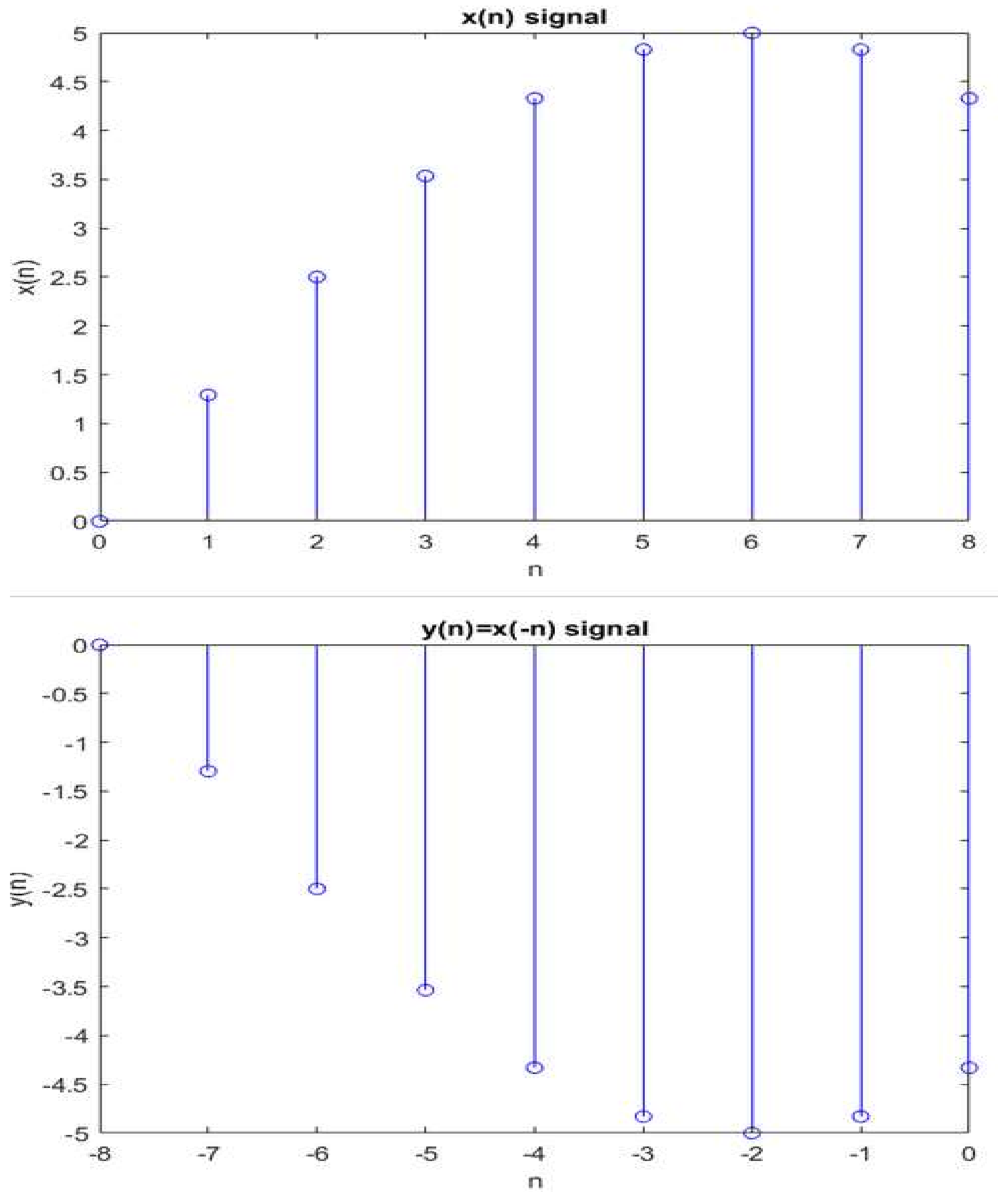
B. **Write a MATLAB program to get the following output.**



Code:

```
t=0:1:8;
x=5*sin(2*pi*t/24);
stem(t,x,'b');
title('x(n) signal');
xlabel('n')
ylabel('x(n)')
t=-8:1:0;
y=-x;
stem(t,y,'b');
title('y(n)=x(-n) signal')
xlabel('n')
ylabel('y(n)')
```

Output:



C. Write a MATLAB program to perform the convolution between X (n) = [1 2 3 5] and y (n) = [- 1 – 2].

Code:

```
clc;
close all;
clear all;
%% program for convolution of two sequences
X = [1 2 3 5];
y = [-1 -2];
c = conv(X, y);
disp('The resultant signal is');
```

disp(c)

Output:

```
The resultant signal is
    -1    -4    -7   -11   -10
```

D. Write a MATLAB program to compute the cross correlation between signals and Sequences. x=cos(2*pi*10*t), y=cos(2*pi*15*t) by increasing the amplitude of the signal by 3 times.

Code:

```
clc;
clear all;
close all;
t=0:10
x=3*cos(2*pi*10*t);
y=3*cos(2*pi*15*t);
r=xcorr(x,y)
```

Output:

```
t = 1x11
    0   1   2   3   4   5   6   7   8   9   10

r = 1x21
    9.0000   18.0000   27.0000   36.0000   45.0000   54.0000   63.0000   72.0000   81.0000   90.0000   99.0000   90.0000   81.0000   72.0000   63.0000   54.0000   45.0000   36.0000   27.0000   18.0000   9.0000
```

E. Write a MATLAB program to verify the time invariance property of the following sequencex1= sin(2*pi*1*n); x2= sin(2*pi*2*n), and check whether it satisfies the time invariance property or not.

Code:

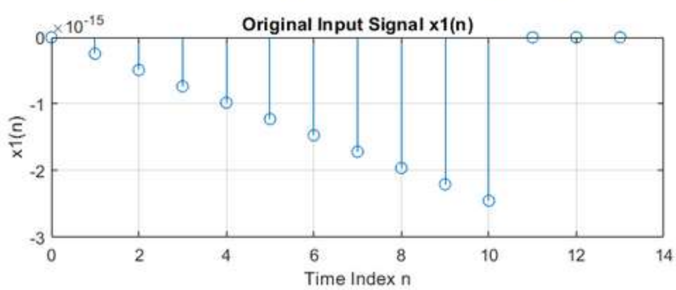
```
clc;
clear all;
close all;
n = 0:10;
% entering two input sequences
x1 = sin(2*pi*1*n);
x2 = sin(2*pi*2*n);
% original response
y = conv(x1, x2);
disp('Enter a Positive Number of Delay');
d = input('Desired Delay of the Signal is: ');
```

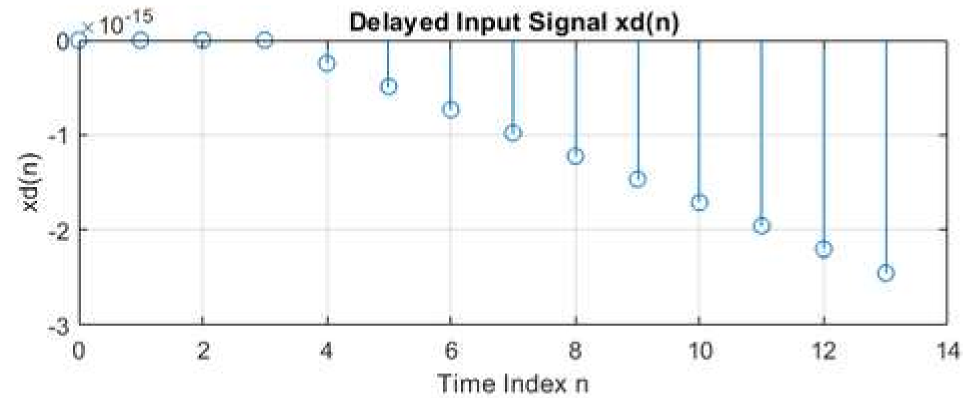
```
% delayed input
xd = [zeros(1,d), x1];
nxd = 0 : length(xd)-1;
%delayed output
yd = conv(xd,y);
nyd = 0:length(yd)-1;
disp(' Original Input Signal x(n) is ');
disp(x1);
disp(' Delayed Input Signal xd(n) is ');
disp(xd);
disp(' Original Output Signal y(n) is ');
disp(y);
disp(' Delayed Output Signal yd(n) is ');
disp(yd);
xp = [x1 , zeros(1,d)];
subplot(2,1,1);
stem(nxd,xp);
grid;
xlabel( ' Time Index n ' );
ylabel( ' x1(n) ' );
title( ' Original Input Signal x1(n) ' );
subplot(2,1,2);
stem(nxd,xd);
grid;
xlabel( ' Time Index n ' );
ylabel( ' xd(n) ' );
title( ' Delayed Input Signal xd(n) ' );
yp = [y zeros(1,d)];
if length(yp) ~= length(yd)
 disp(['time variant'])
else
 figure;
 subplot(2,1,1);
 stem(nyd,yp);
 grid;
 xlabel( ' Time Index n ' );
 ylabel( ' y(n) ' );
 title( ' Original Output Signal y(n) ' );
 subplot(2,1,2);
 stem(nyd,yd);
 grid;
 xlabel( ' Time Index n ' );
 ylabel( ' yd(n) ' );
```

title(' Delayed Output Signal yd(n) ');
end

Output:

```
Enter a Positive Number of Delay
 Original Input Signal x(n) is
   1.0e-14 *

        0   -0.0245   -0.0490   -0.0735   -0.0980   -0.1225   -0.1470   -0.1715   -0.1959   -0.2204   -0.2449
 Delayed Input Signal xd(n) is
   1.0e-14 *

  Columns 1 through 13

        0         0         0         0   -0.0245   -0.0490   -0.0735   -0.0980   -0.1225   -0.1470   -0.1715   -0.1959   -0.2204

  Column 14

   -0.2449
 Original Output Signal y(n) is
   1.0e-28 *

  Columns 1 through 13

        0         0    0.0012    0.0048    0.0120    0.0240    0.0420    0.0672    0.1008    0.1440    0.1980    0.2640    0.3167

  Columns 14 through 21

    0.3551    0.3779    0.3839    0.3719    0.3407    0.2892    0.2160    0.1200
 Delayed Output Signal yd(n) is
   1.0e-42 *

  Columns 1 through 13

        0         0         0         0         0         0   -0.0000   -0.0002   -0.0006   -0.0016   -0.0037   -0.0074   -0.0136

  Columns 14 through 26

   -0.0233   -0.0378   -0.0588   -0.0873   -0.1234   -0.1668   -0.2160   -0.2689   -0.3223   -0.3721   -0.4131   -0.4390   -0.4422

  Columns 27 through 34

   -0.4248   -0.3892   -0.3388   -0.2775   -0.2101   -0.1419   -0.0793   -0.0294
```






```
time variant
```

F. Calculate resonance frequency and plot the response curves for Impedance, reactance and current for series and parallel RLC circuit.

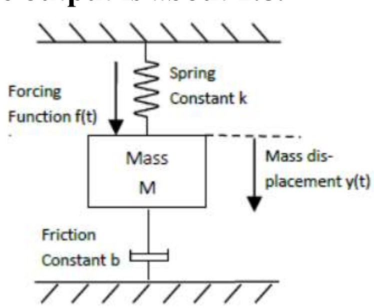
Code:

```
%Resonance frequency
clc;
L=1*10^(-3);
C=2*10^(-6);
rf=1/(2*pi*sqrt(L*C))
```

Output:

```
rf = 3.5588e+03
```

G. Consider the mechanical system depicted in the figure. The input is given by f(t), and the output is given by y(t). Determine the differential equation governing the system and using MATLAB, write a m-file and plot the system response such that forcing function f(t)=1. Let m=10, k=1 and b=0.5. Show that the peak amplitude of the output is about 1.8.

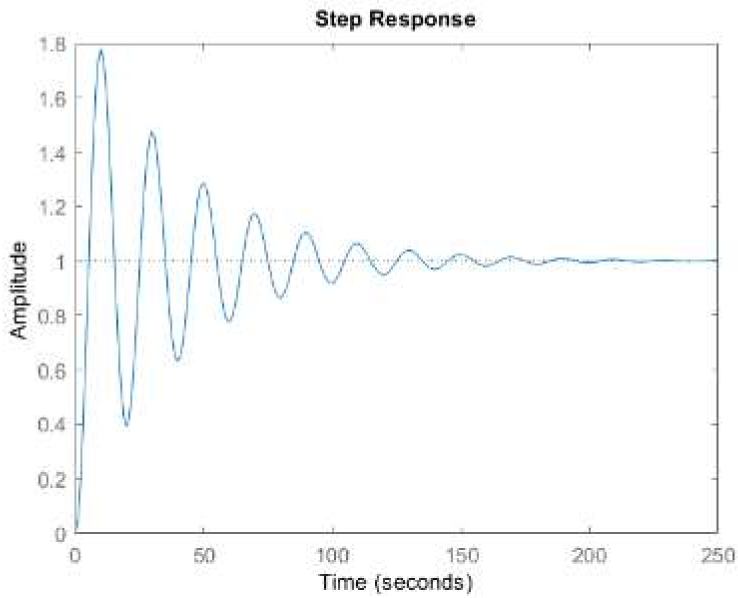


Code:

```
n=[1];
d=[10 0.5 1];
F=tf(n,d);
step(F)
```

```
stepinfo(F)
```

Output:




```
ans = struct with fields:
         RiseTime: 3.5051
     SettlingTime: 151.2867
      SettlingMin: 0.3925
      SettlingMax: 1.7794
        Overshoot: 77.9429
       Undershoot: 0
             Peak: 1.7794
         PeakTime: 9.9346
```

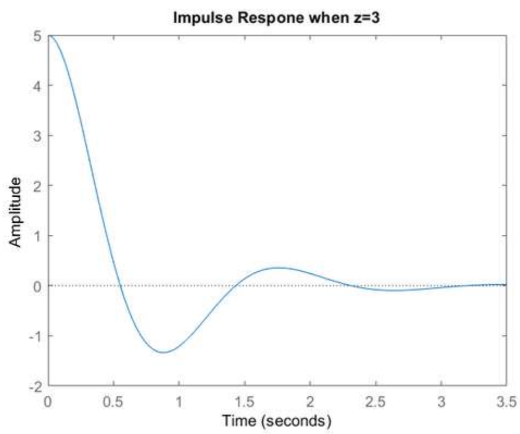
H. A system has a transfer function $X(s)$ $R(s)$ = (15/z)(s+z) s 2+3s+15 . Plot the response of the system when R(s) is a unit impulse and unit step for the parameter z=3, 6 and 12

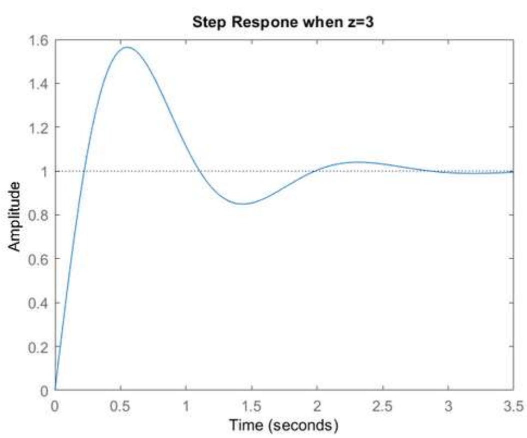
Code:

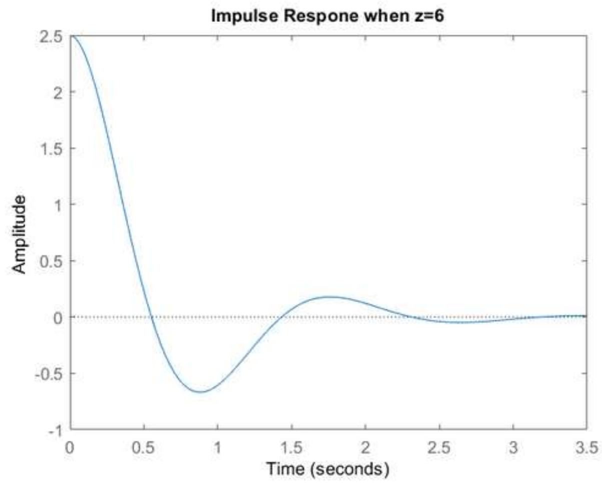
```
%z=3
num=[5 15];
den=[1 3 15];
F=tf(num,den);
clear impulse;
impulse(F)
title('Impulse Respone when z=3')
step(F)
title('Step Respone when z=3')
%z=6
num=[2.5 7.5];
den=[1 3 15];
F=tf(num,den);
clear impulse;
```

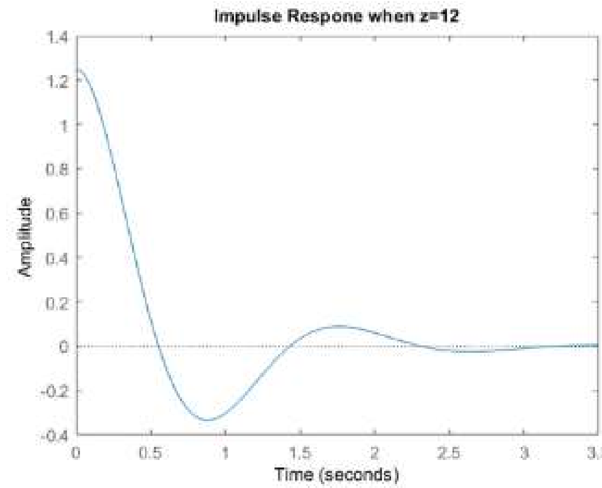
```
impulse(F)
title('Impulse Respone when z=6')
step(F)
title('Step Respone when z=6')
%z=12
num=[1.25 3.75];
den=[1 3 15];
F=tf(num,den);
clear impulse;
impulse(F)
title('Impulse Respone when z=12')
step(F)
title('Impulse Respone when z=12')
```

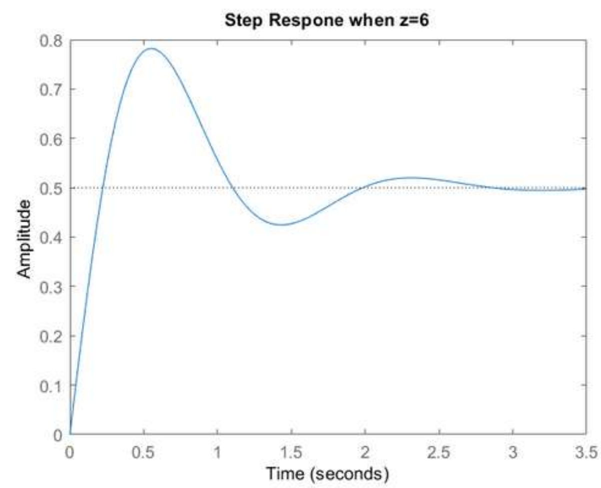
Output:

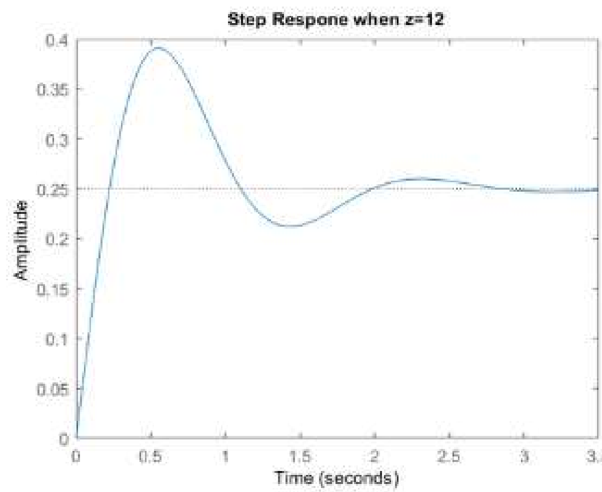





Impulse Respone when z=6
Amplitude
Time (seconds)
2.5
2
1.5
1
0.5
0
-0.5
-1
0
0.5
1
1.5
2
2.5
3
3.5


Impulse Respone when z=12
Amplitude
Time (seconds)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
0
0.5
1
1.5
2
2.5
3
3.5


Step Respone when z=6
Amplitude
Time (seconds)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.5
1
1.5
2
2.5
3
3.5


Step Respone when z=12
Amplitude
Time (seconds)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.5
1
1.5
2
2.5
3
3.5