MATLAB Final Project

Name: Mohamed Ahmed Mohamed Mohamed Morsy

ID: 7514

Group: 3

Section: 2

Due Date: 21/12/2022

Part 1

Question 1:

Code:

```
clc
%Question 1
fs=1000;
figure;
t1=linspace(-2,-1,1*fs);
x1=zeros(size(t1));
t2=linspace(-1,3,4*fs);
x2=ones(size(t2));
t3=linspace(3,4,1*fs);
x3=zeros(size(t3));

Tt1=[t1 t2 t3];
u=[x1 x2 x3];

texp=linspace(-2,4,6*fs);
e=exp((-1*abs(texp))/5);
ft=e.*u;

subplot(2,2,1);
plot(Tt1,ft);
ylim([0,2]);
xlim([-3,6]);
title('y(t)');
y1=3*ft;
subplot(2,2,2);
plot(Tt1,y1);
ylim([0,4]);
xlim([-3,6]);
title('y1(t)');

subplot(2,2,3);
plot((Tt1-2),ft);
ylim([0,2]);
xlim([-5,3]);
title('y2(t)');

subplot(2,2,4);
Tt1=Tt1-4;
Tt1=Tt1/2;
Tt1=fliplr(-Tt1);
y=fliplr(ft);
plot(Tt1,y);
ylim([0,2]);
xlim([-5,5]);
title('y3(t)');
```

Figures:

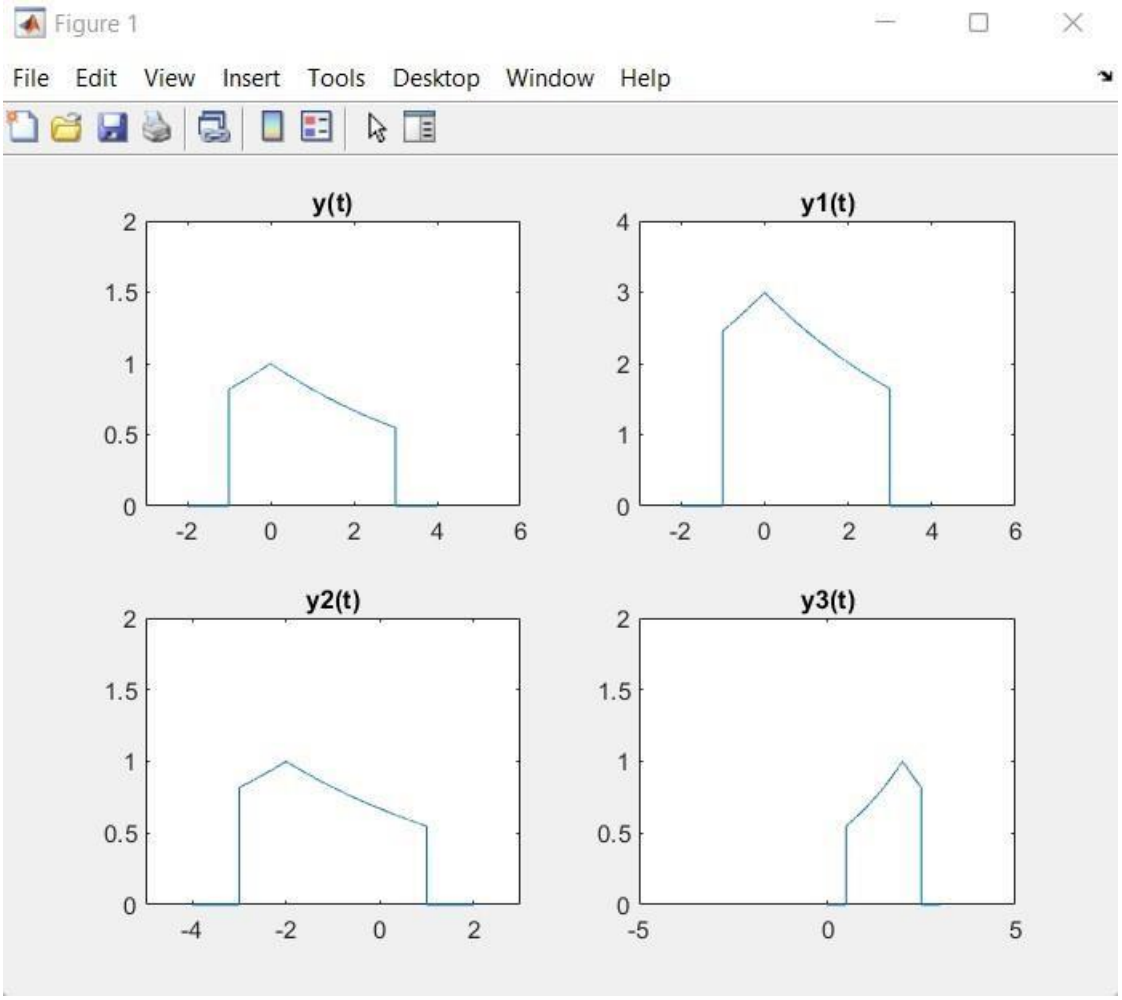
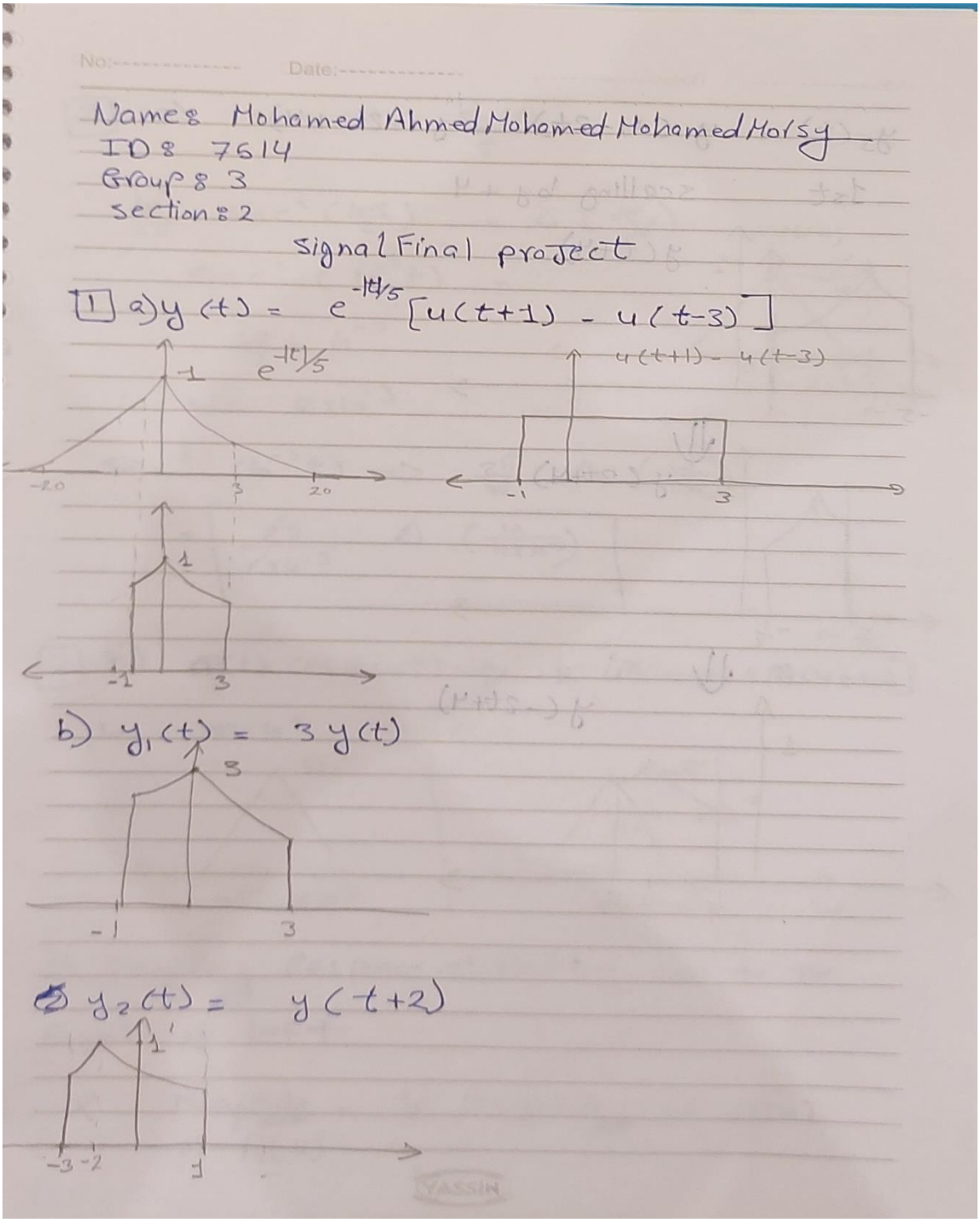


Figure 1
File Edit View Insert Tools Desktop Window Help
y(t)
y1(t)
y2(t)
y3(t)

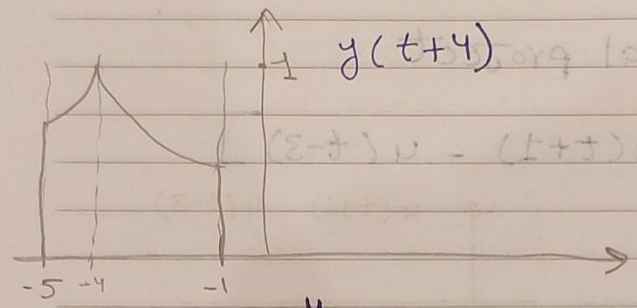
Handwritten:

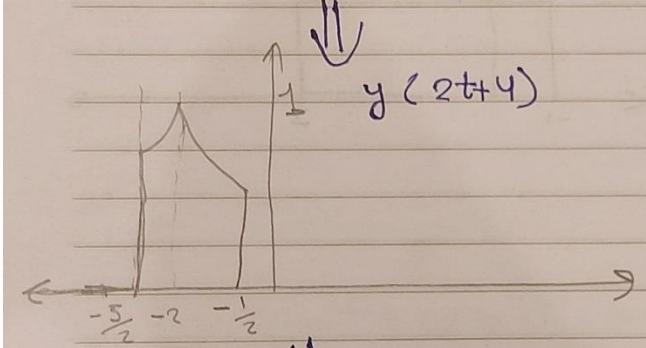


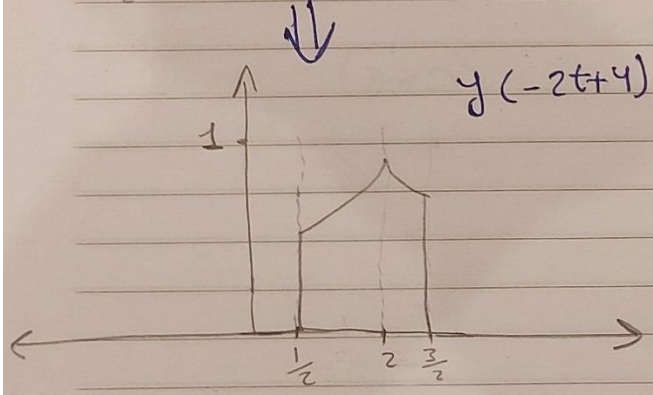
No:---------- Date:----------

$y_3(t) = y(4-2t) = y(-2t+4)$

1st scalling by +4







Question 2:

Code:

```
%Question 2
%a
FS=5;
TS=1/FS;
t=linspace(-100000,100000,200000*FS);
x=(10.^(-3)).*t;
m=(sin(x)./x).^2;
M=TS*fftshift(fft(m));
l=length(m);
freq=(-l/2:l/2-1)*(FS/l);
w=2*pi*freq;
figure;
plot(t,m);
title('sinc(0.001t).^2');
figure;
plot(w,abs(M));
xlim([-0.004,0.004]);
title('M Fourier Transform');
r=m.*cos(2.*pi.*(10.^5).*t);
R=TS*fftshift(fft(r));
ln=length(r);
freq2=(-ln/2:ln/2-1)*(FS/ln);
w2=2*pi*freq2;
figure;
plot(t,r);
title('m*cos(2.*pi.*(10.^5).*t)');
figure;
plot(w,abs(R));
ylim([0,1600])
title('R Fourier Transform');
```

Figures:

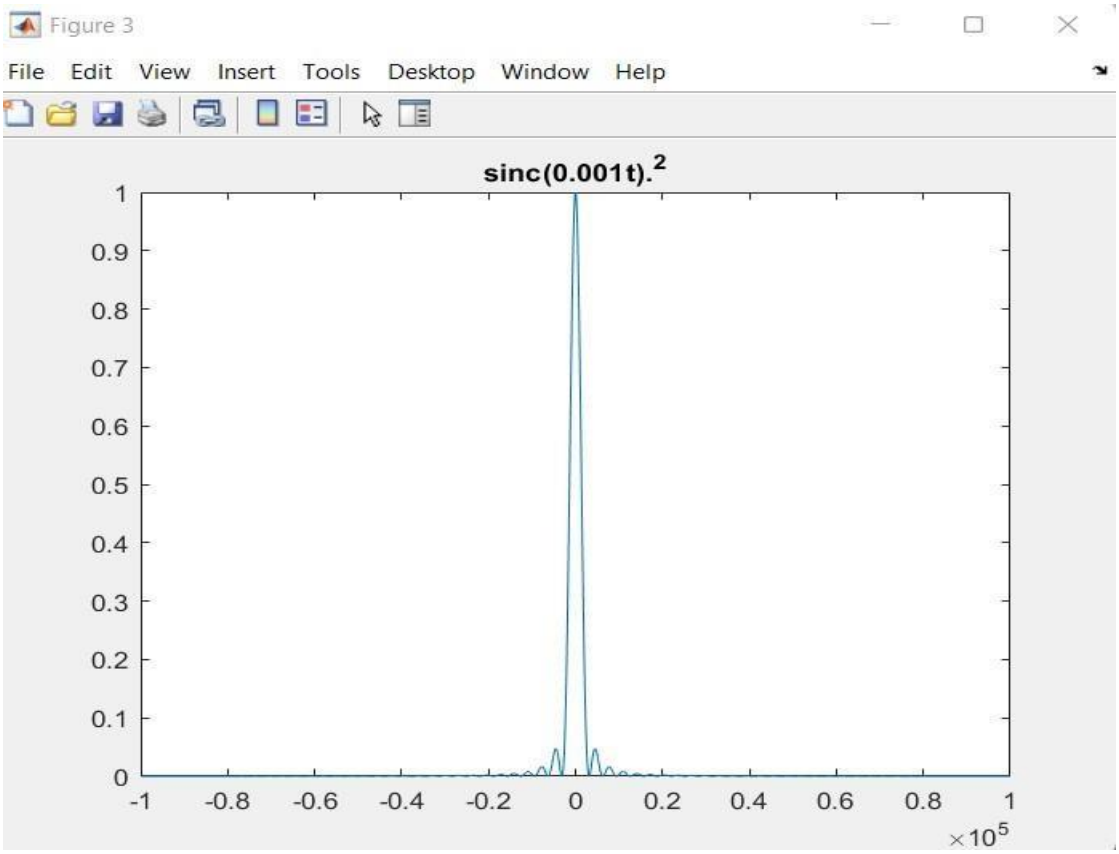


Figure 3
File Edit View Insert Tools Desktop Window Help
sinc(0.001t).^2
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1
×10^5

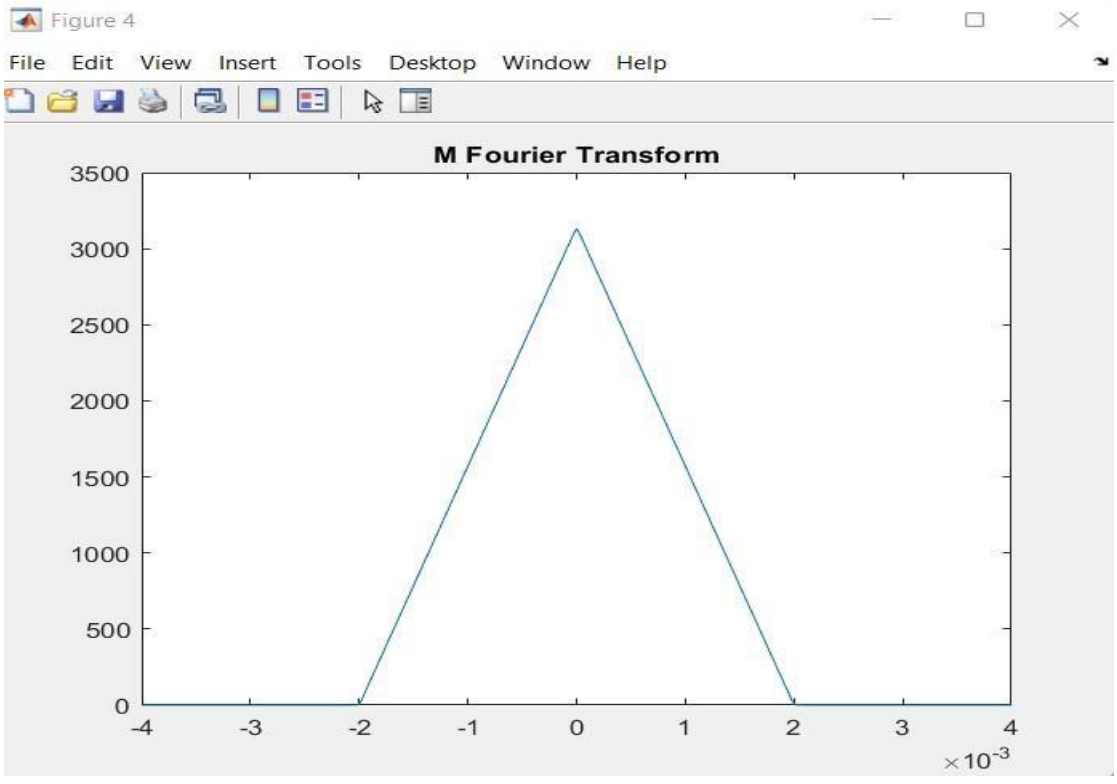


Figure 4
File Edit View Insert Tools Desktop Window Help
M Fourier Transform
3500
3000
2500
2000
1500
1000
500
0
-4 -3 -2 -1 0 1 2 3 4
×10^-3

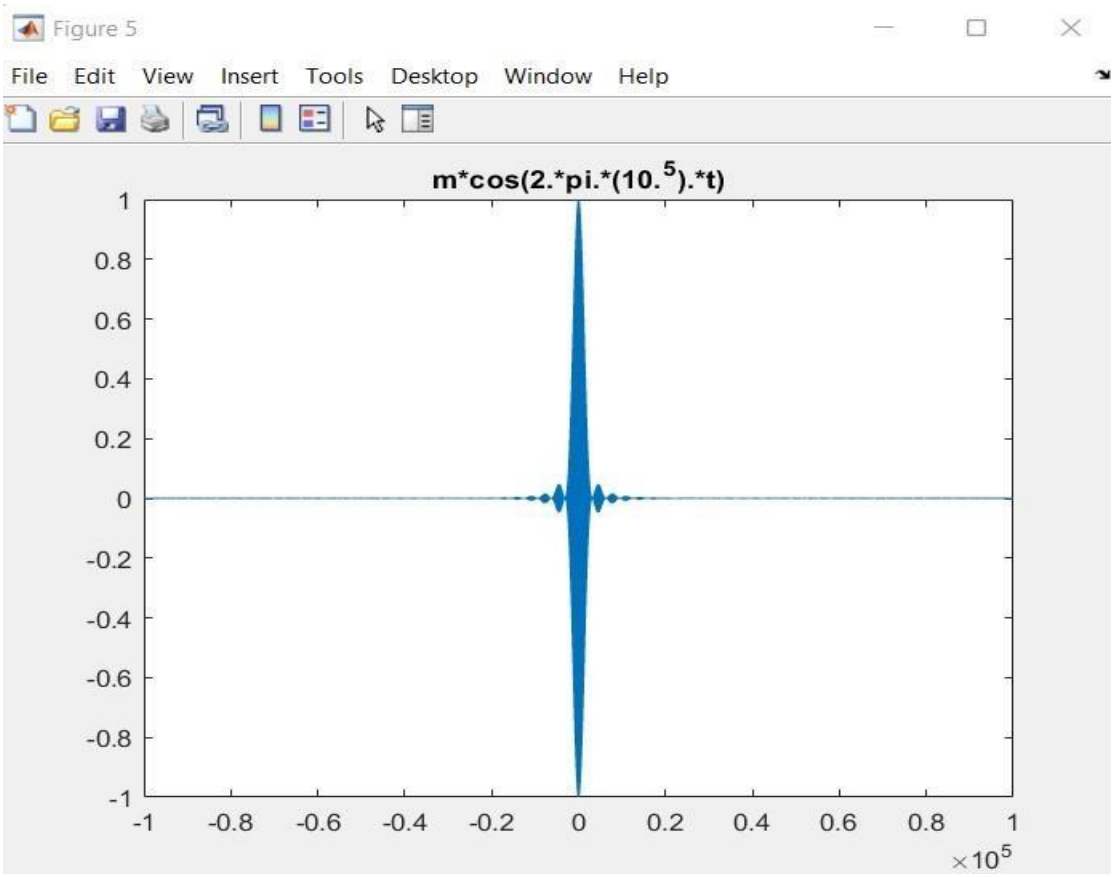


Figure 5
File Edit View Insert Tools Desktop Window Help
m*cos(2.*pi.*(10.^5).*t)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1
×10^5

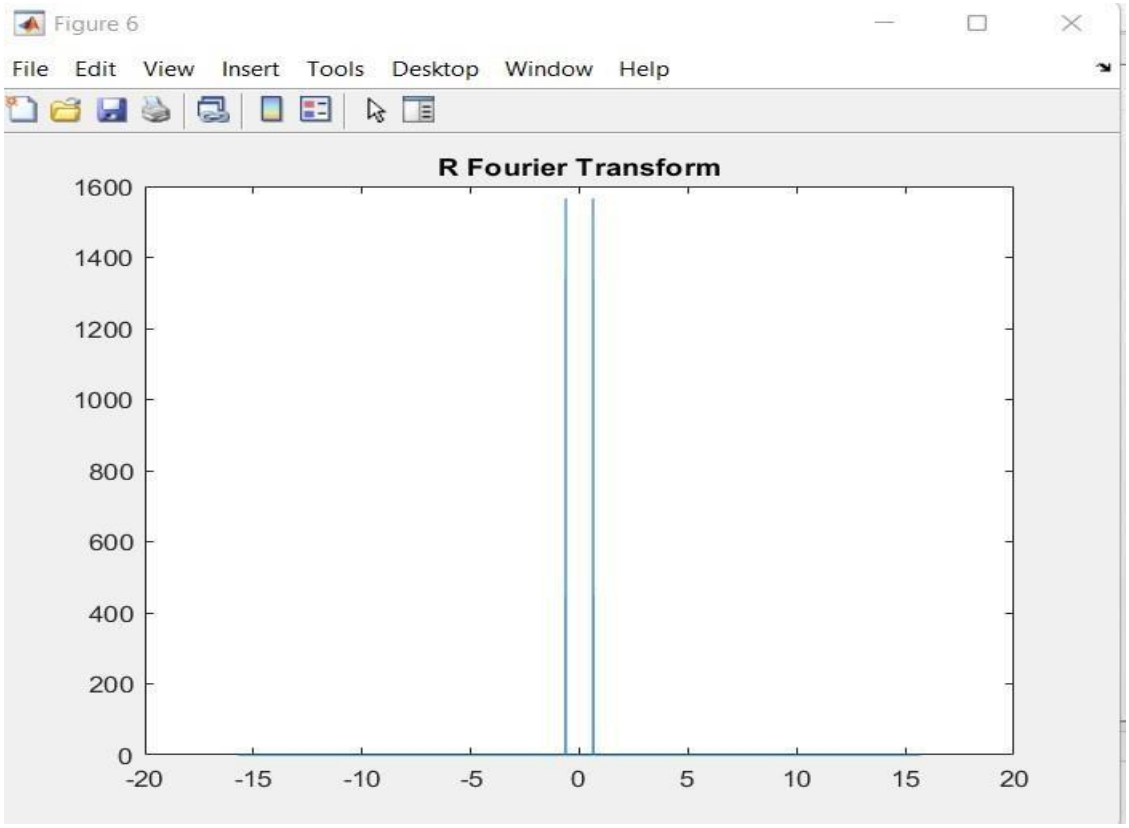


Figure 6
File Edit View Insert Tools Desktop Window Help
R Fourier Transform
1600
1400
1200
1000
800
600
400
200
0
-20 -15 -10 -5 0 5 10 15 20

Handwritten:

No:---------- Date:----------

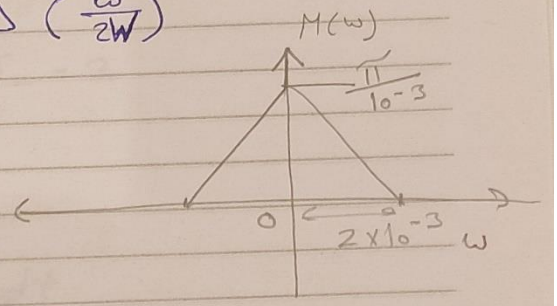
[2] a) $\text{sinc}(t) = \frac{\sin(t)}{t}$

$\frac{W}{2\pi}\ \text{sinc}^2\left(\frac{\omega_0 t}{2}\right) \longrightarrow \Delta\left(\frac{\omega}{2W}\right)$

$\text{sinc}^2\left(10^{-3}t\right) \longrightarrow$

$\frac{\omega}{2} = 10^{-3}$

$\therefore\ \omega = 2\times10^{-3}$

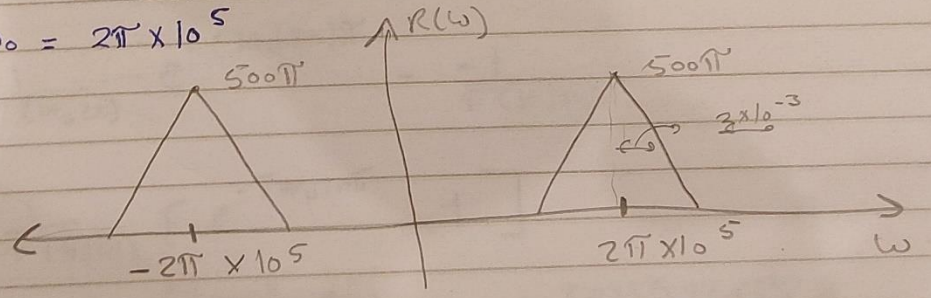


$\text{sinc}^2\left(10^{-3}t\right) \Longrightarrow \frac{2\pi}{W}\ \Delta\left(\frac{\omega}{2W}\right)$

$= \boxed{\frac{2\pi}{2\times10^{-3}}\ \Delta\left(\frac{\omega}{4\times10^{-3}}\right)}$

[2] b) $m(t)\cos(\omega_0 t) \Rightarrow \frac{1}{2}\left[M(\omega-\omega_0) + M(\omega+\omega_0)\right]$

$\omega_0 = 2\pi\times10^5$



c) Frequency Responce shifted by ω_0 to the Right & left

& Magnitude = $\frac{1}{2}$ Magnitude of $M(\omega)$ of $R(\omega)$

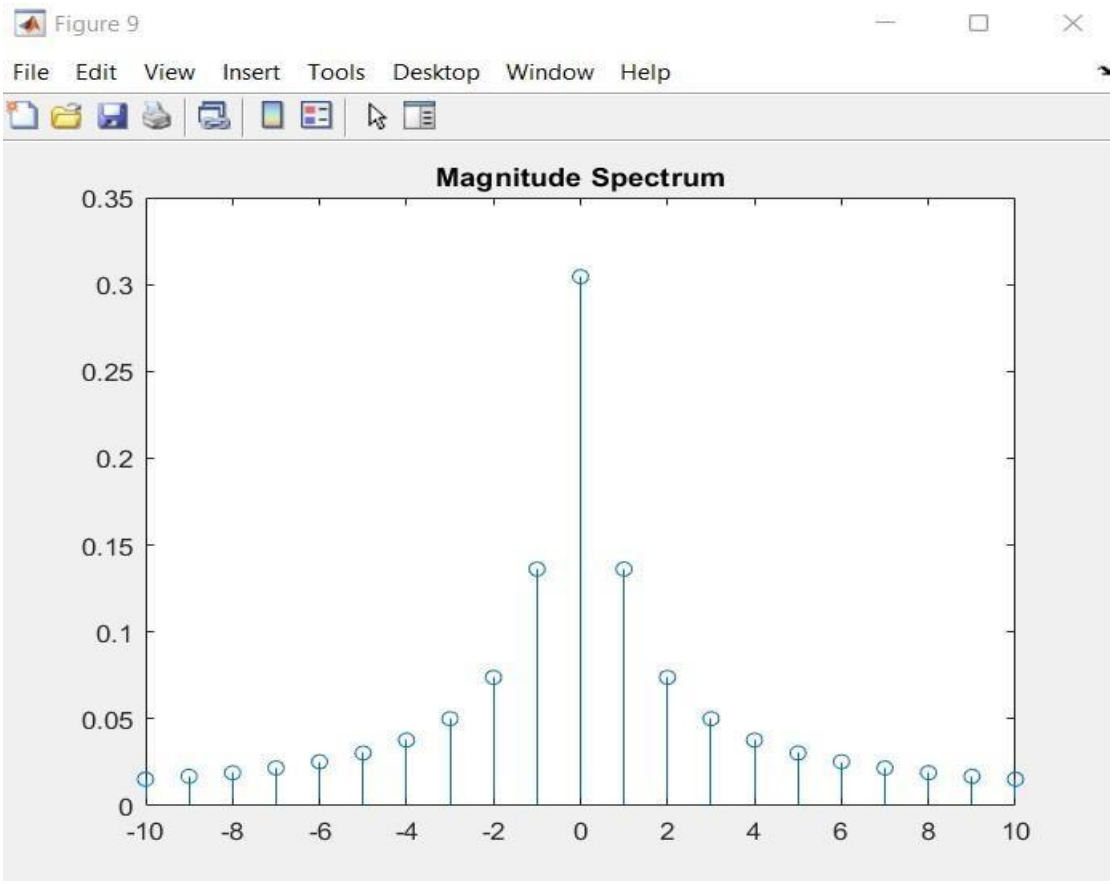
YASSIN

Question 3:

Code:

```
87      %Question 3
88 -     figure;
89 -     nneg= -10 : -1;
90 -     npos= 1 : 10;
91 -     Dnneg=(0.3045./((2*1j*nneg)+1));
92 -     Dnpos=(0.3045./((2*1j*npos)+1));
93 -     D0=0.3045;
94 -     n=[nneg, 0, npos];
95 -     Dn=[Dnneg, D0, Dnpos];
96 -     stem(n, abs(Dn));
97 -     title('Magnitude Spectrum');
98 -     figure;
99 -     stem(n,angle(Dn));
100 -    title('Phase Spectrum');
```

Figures:



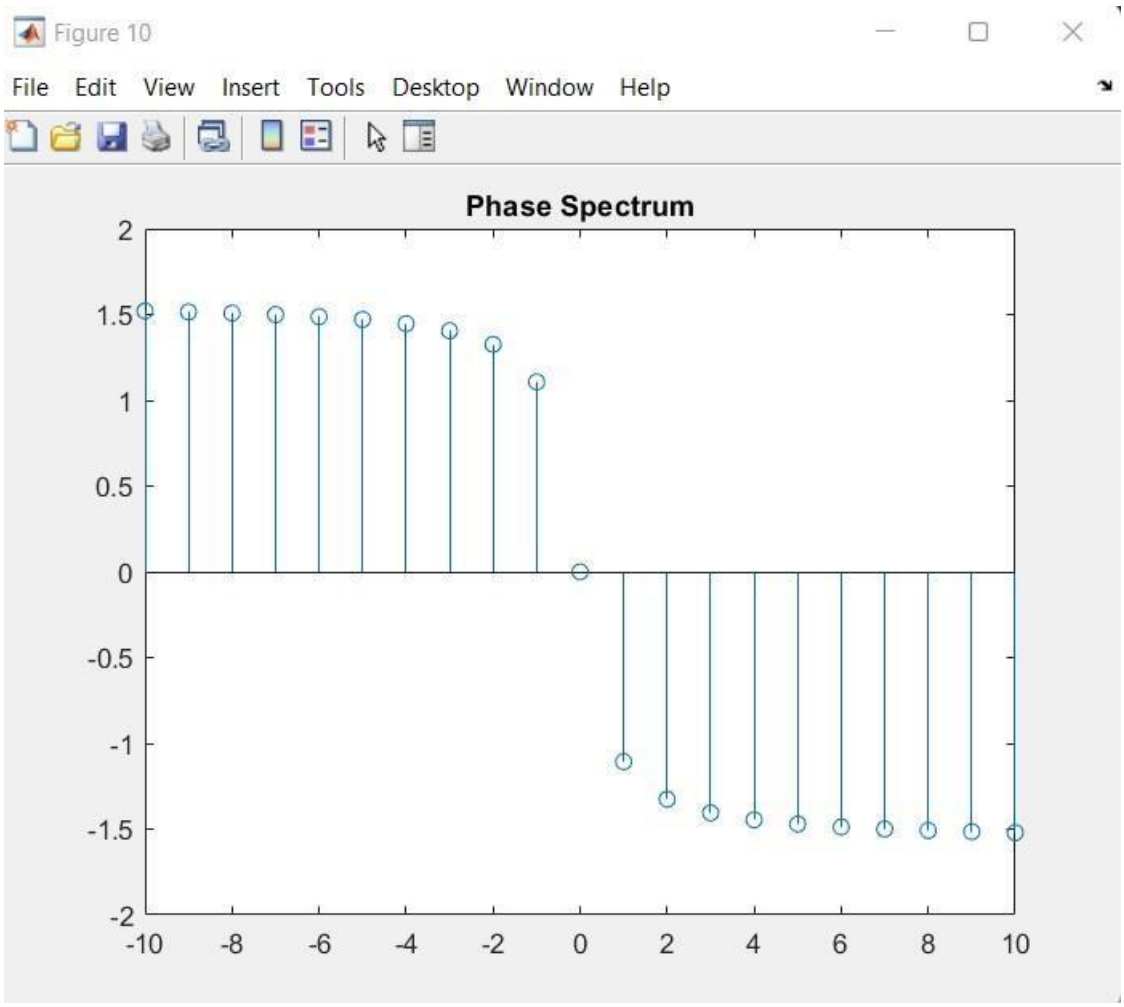
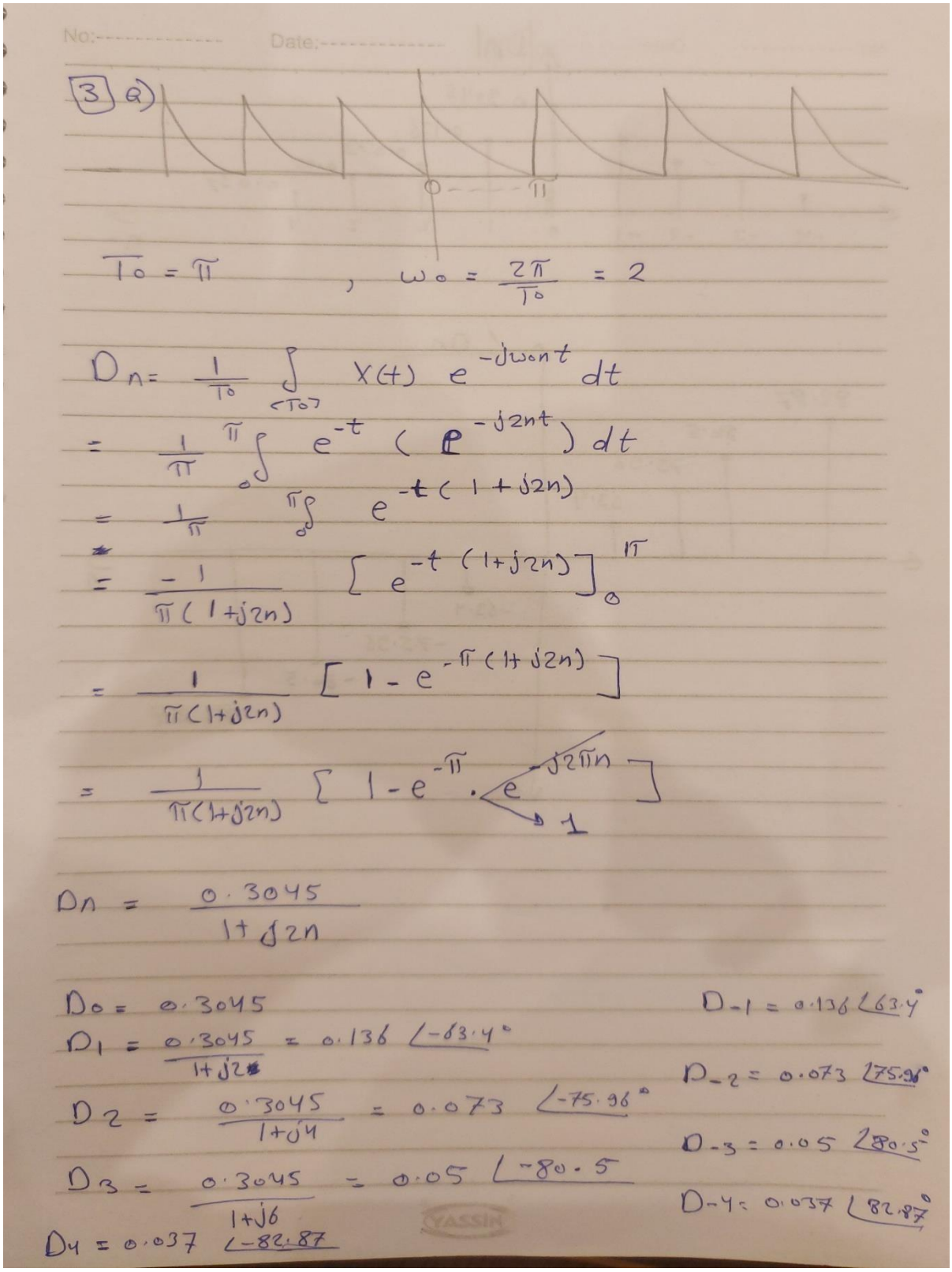
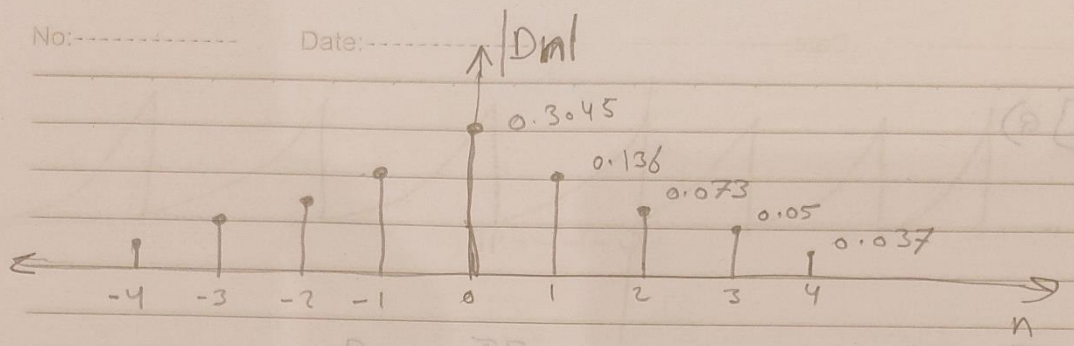


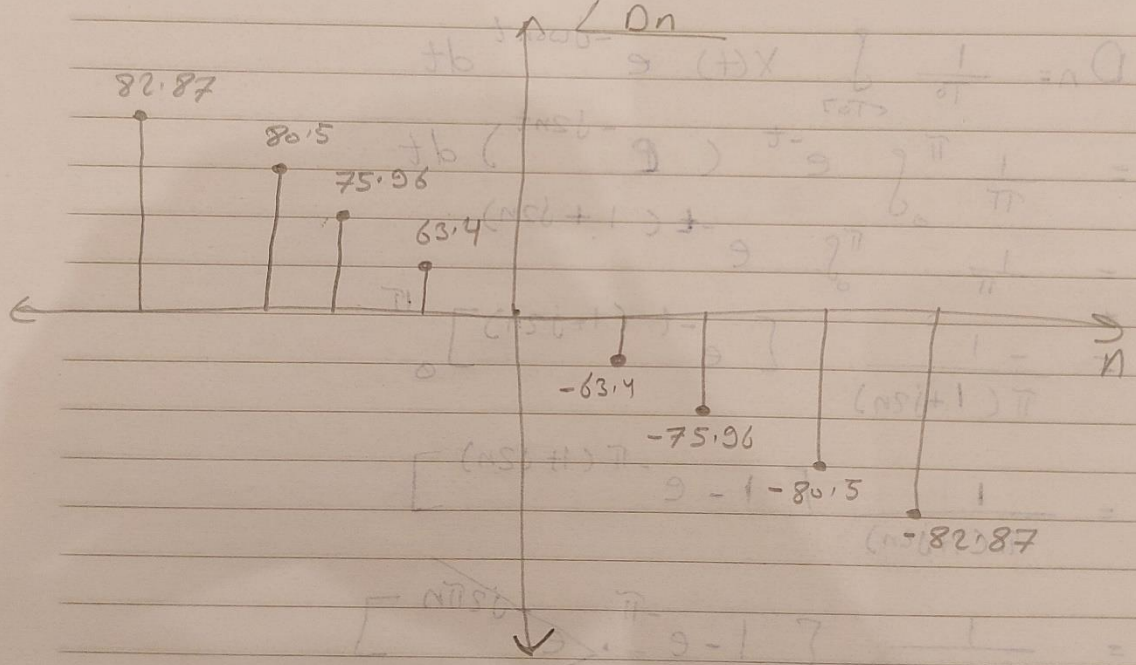
Figure 10
File Edit View Insert Tools Desktop Window Help
Phase Spectrum
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-10 -8 -6 -4 -2 0 2 4 6 8 10

Handwritten:



No:---------- Date:----------


|Dn|
0.3045
0.136
0.073
0.05
0.037
-4
-3
-2
-1
0
1
2
3
4
n


∠Dn
82.87
80.5
75.96
63.4
-63.4
-75.96
-80.5
-82.87
n

Part 2
General Signal Generator

Source code:

```
%------------------------------------------------------------
%Part 2
clc
% get data of signal from user
fs = input('Enter Sampling Frequency of Signal: ');
starttime = input('Enter a Start for Time Scale: ');
endtime = input('Enter an End for Time Scale: ');
breakPointsNumber = input('Enter Number of Break Points: ');
breakPoints = [];
for i = 1:breakPointsNumber
  breakPoints(i) = input(['Enter Position for Break Point ' num2str(i) ' : ']);
end
breakPoints(breakPointsNumber+1)= endtime;

%signal drawing

areaStartTime = starttime;
signal = [];
time = [];
poly = [];

%make signal in each region
for i = 1:breakPointsNumber+1
  Area = strcat(int2str(areaStartTime), '  at breakingPoint ', int2str(breakPoints(i)),' : ');
  disp("1-DC Signal");
  disp("2-Ramp Signal");
  disp("3-General order Polynomial Signal");
  disp("4-Exponential Signal");
  disp("5-Sinosoidal Signal");
  signalType = input(strcat('Choose signal type for region ', Area));
```

```
33 -    no_of_samples = (breakPoints(i)-areaStartTime)*fs;
34 -    t = linspace(areaStartTime, breakPoints(i), no_of_samples);
35
36 -     if signalType==1
37           %DC
38 -         amp = input('Enter the amplitude of DC signal: ');
39 -         s = amp.*ones(1,no_of_samples);
40
41 -     elseif signalType==2
42          %Ramp
43 -        slope = input('Enter the slope of Ramp signal: ');
44 -        intercept = input('Enter its intercept: ');
45 -        s = slope*t + intercept;
46
47 -     elseif signalType==3
48          %General Order Polynomial
49 -        highestPower = input('Enter the highest power of amplitude: ');
50 -        for j=0:highestPower
51 -           power = input(strcat('Enter coefficient of X^' , int2str(j), ' : '));
52 -           polysignal = [polysignal power];
53 -        end
54 -        s = polyval( fliplr(polysignal),t);
55
56 -     elseif signalType==4
57          %Exponential
58 -        amp = input('Enter the amplitude of Exponential signal: ');
59 -        ex = input('Enter its exponent: ');
60 -        s = amp.*exp(ex.*abs(t));
```

```
61
62 -     elseif signalType==5
63          %Sinusoidal
64 -         amp = input('Enter the amplitude of Sinosoidal signal: ');
65 -         freq = input('Enter its frequency: ');
66 -         phase = input('Enter its phase: ');
67 -         s = amp*sin(2*pi*freq*t + phase);
68 -     else
69 -     end
70
71 -     areaStartTime = breakPoints(i);
72      %concatunate signals of each region together
73 -     signal = [signal s];
74      %concatunate the time of regions together
75 -     time = [time t];
76 - end
77 - plot(time,signal);
78 - title('Signal choosen before operation');
```

```
80    %Operations done on the signal
81 - while(1)
82 -   disp("1-Amplitude Scaling");
83 -   disp("2-Time Reversal");
84 -   disp("3-Time Shift");
85 -   disp("4-Expanding the signal");
86 -   disp("5-Compressing the signal");
87 -   disp("0-None");
88 -   disp("Perform Some Operations:");
89 -   operation =input('Choose your operation:');
90 -     operationTime = time;
91 -     operationSignal = signal;
92
93 -  if operation== 1
94        %Amplitude Scaling
95 -       scale = input('Enter value of scaling: ');
96 -       operationSignal = scale*signal;
97 -       disp("Amplitude Scaled..!");
98
99 -  elseif operation==2
100       %Time Reversal
101 -      operationTime = fliplr(-time);
102 -      operationSignal = fliplr(signal);
103 -      disp("Time Reversed..!");
104
```

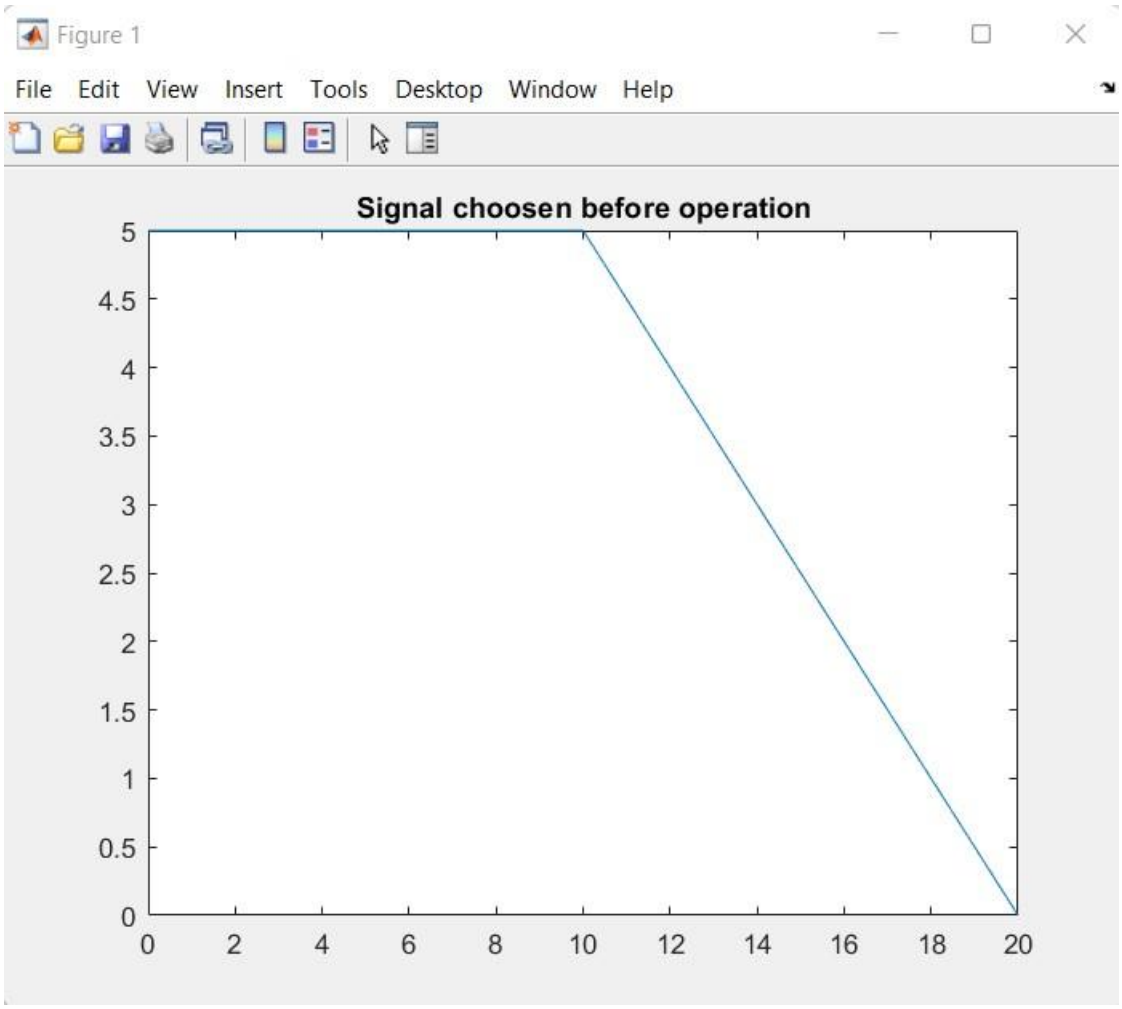
```
elseif operation==3
    %Time Shift
     shift = input('Enter value of shifting: ');
     operationTime = time + shift;
     disp("Time Shifted..!");

elseif operation==4
    %Expanding the signal
     x = input('Enter value of expanding: ');
     if x ~= 0
       operationTime = time*x;
       disp("Signal Expanded..!");
     end

elseif operation==5
    %Compressing the signal
     x = input('Enter value of compressing: ');
     if x ~= 0
       operationTime = time/x;
       disp("Signal Compressed..!");
     end

else
    break;
end
```

```
  plot(operationTime, operationSignal)
  title('Signal after operation');
end
```

Testing Some Signals:

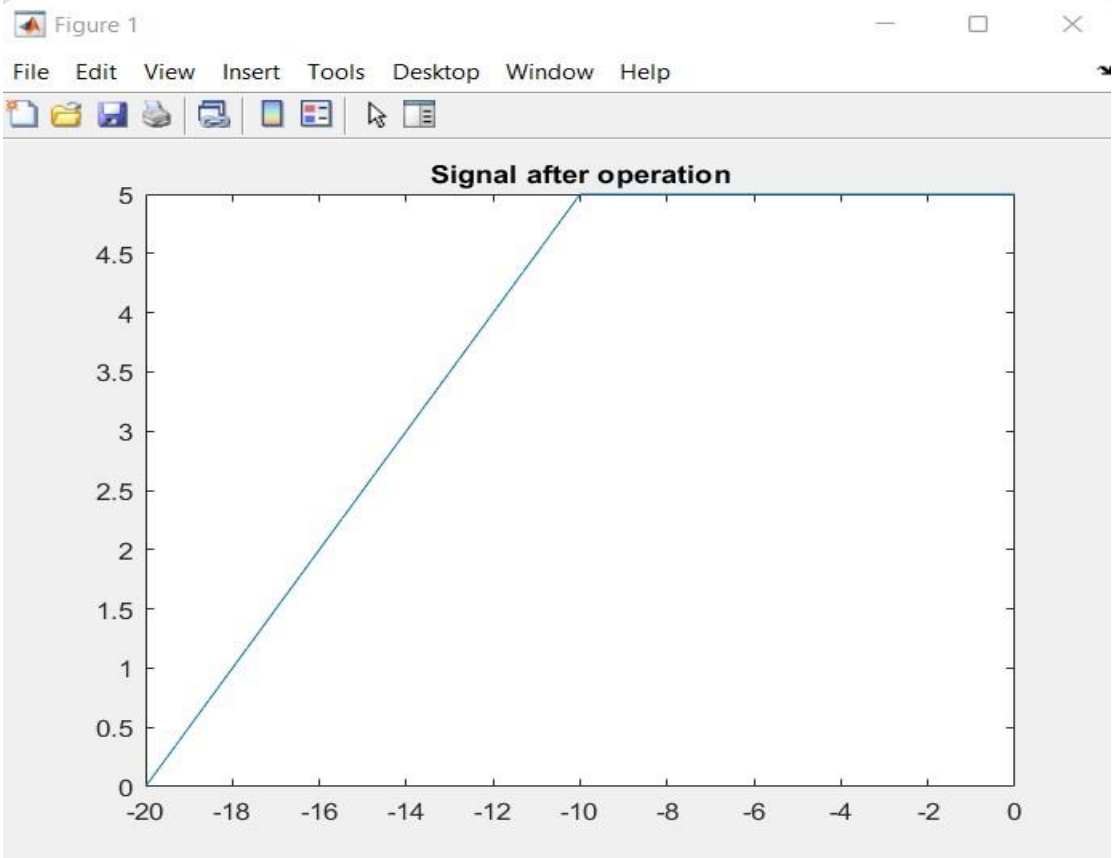
1- DC with Ramp Signal

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 1
Enter Position for Break Point 1 : 10
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint10 :1
Enter the amplitude of DC signal: 5
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region10  at breakingPoint20 :2
Enter the slope of Ramp signal: -0.5
Enter its intercept: 10
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:
```



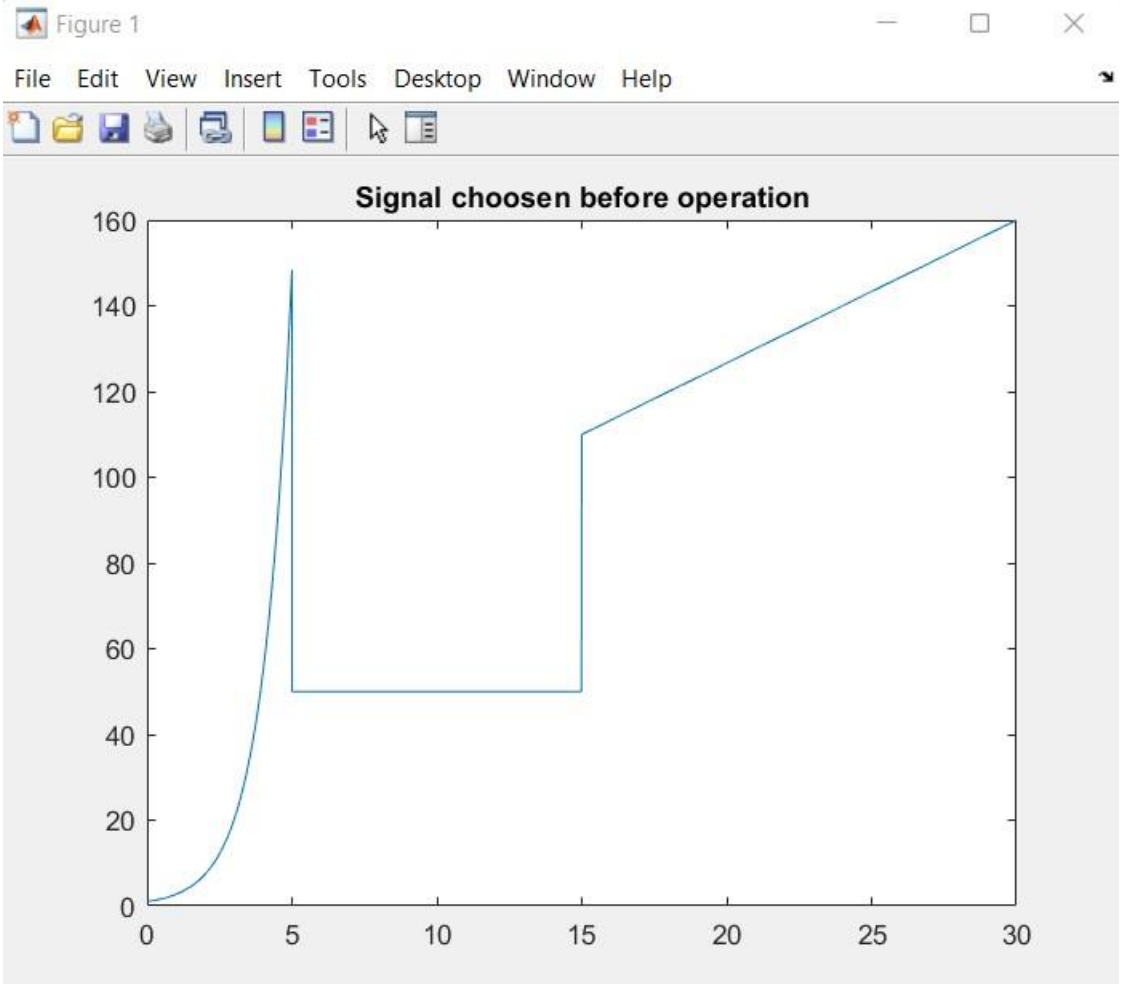
Applying Time Reverse:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:2
Time Reversed..!
```



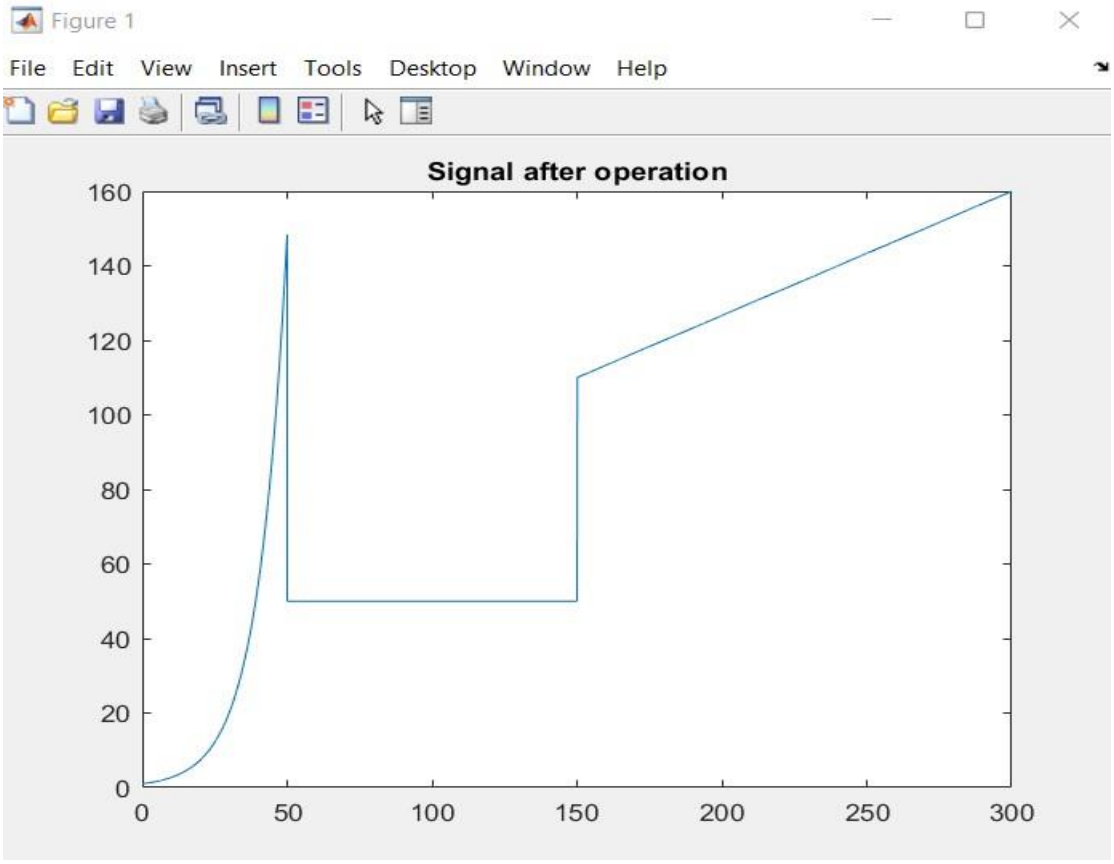
2-Exponential , DC and Ramp

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 30
Enter Number of Break Points: 2
Enter Position for Break Point 1 : 5
Enter Position for Break Point 2 : 15
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint5 :4
Enter the amplitude of Exponential signal: 1
Enter its exponent: 1
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region5  at breakingPoint15 :1
Enter the amplitude of DC signal: 50
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region15  at breakingPoint30 :2
Enter the slope of Ramp signal: 10/3
Enter its intercept: 60
```



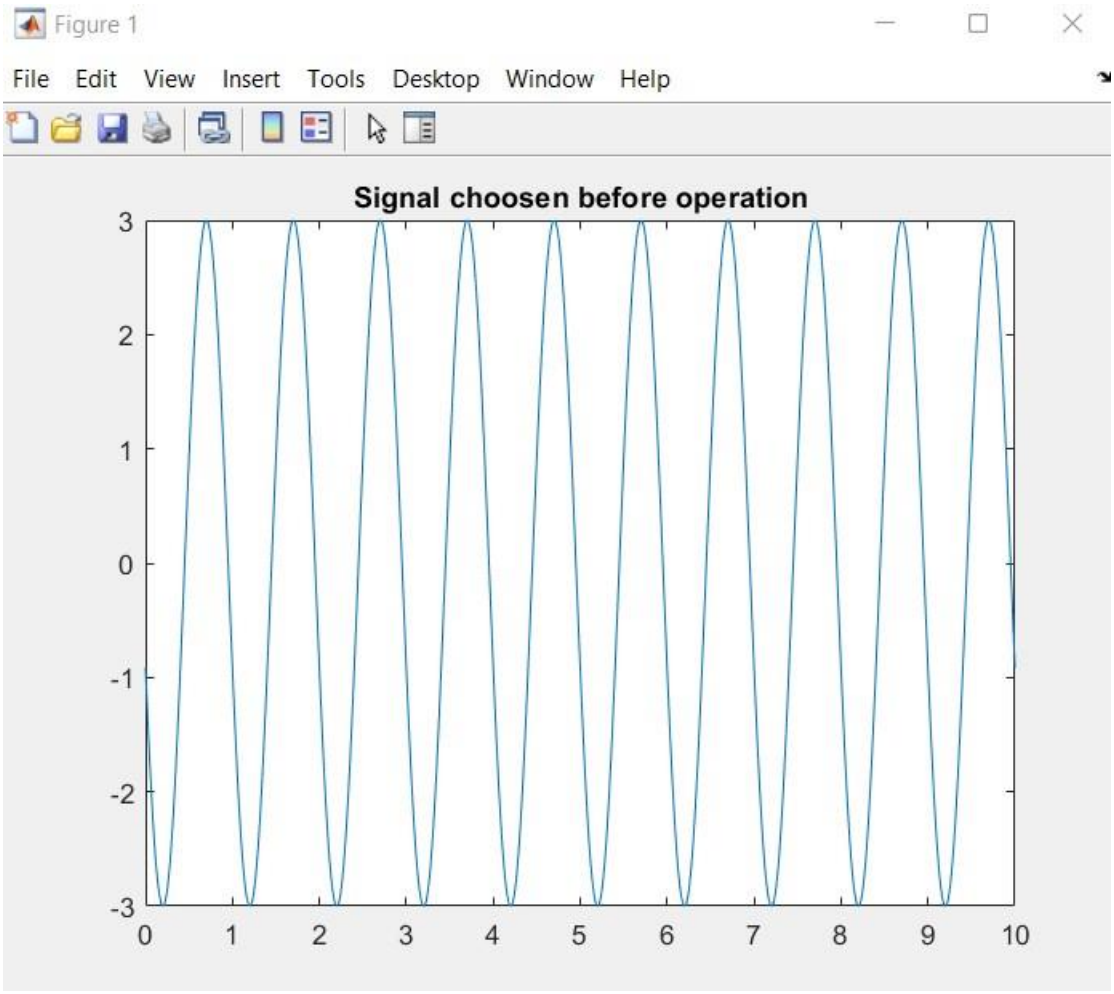
After Expanding the Signal By *10:

```
Perform Some Operations:
Choose your operation:4
Enter value of expanding: 10
Signal Expanded..!
```



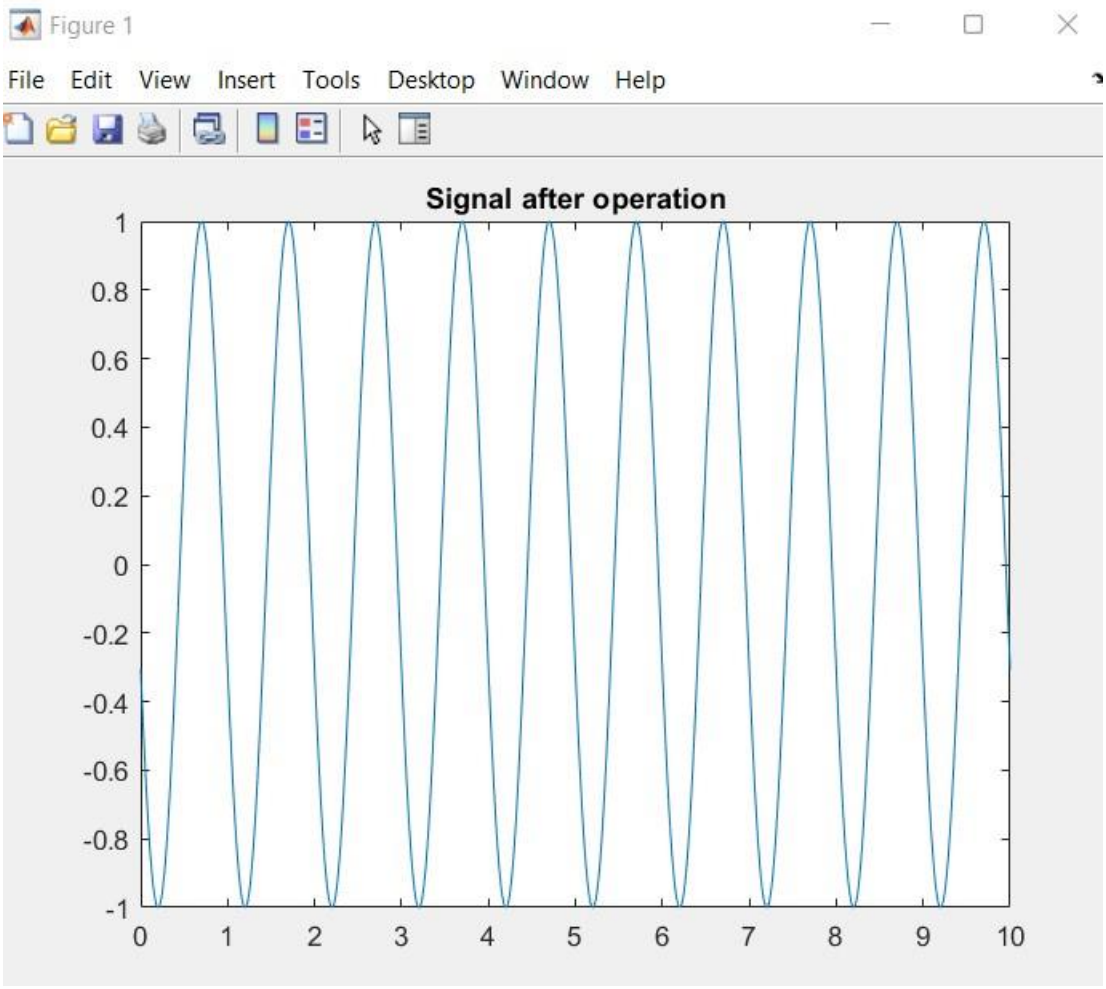
3-Sinosoidal Signal

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 10
Enter Number of Break Points: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint10 :5
Enter the amplitude of Sinosoidal signal: 3
Enter its frequency: 1
Enter its phase: 60
```



After Amplitude Scaling By*1/3:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:1
Enter value of scaling: 1/3
Amplitude Scaled..!
```



4- Polynomial Signal:

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint20 :3
Enter the highest power of amplitude: 3
Enter coefficient of X^0 :-1
Enter coefficient of X^1 :2
Enter coefficient of X^2 :0
Enter coefficient of X^3 :1
```

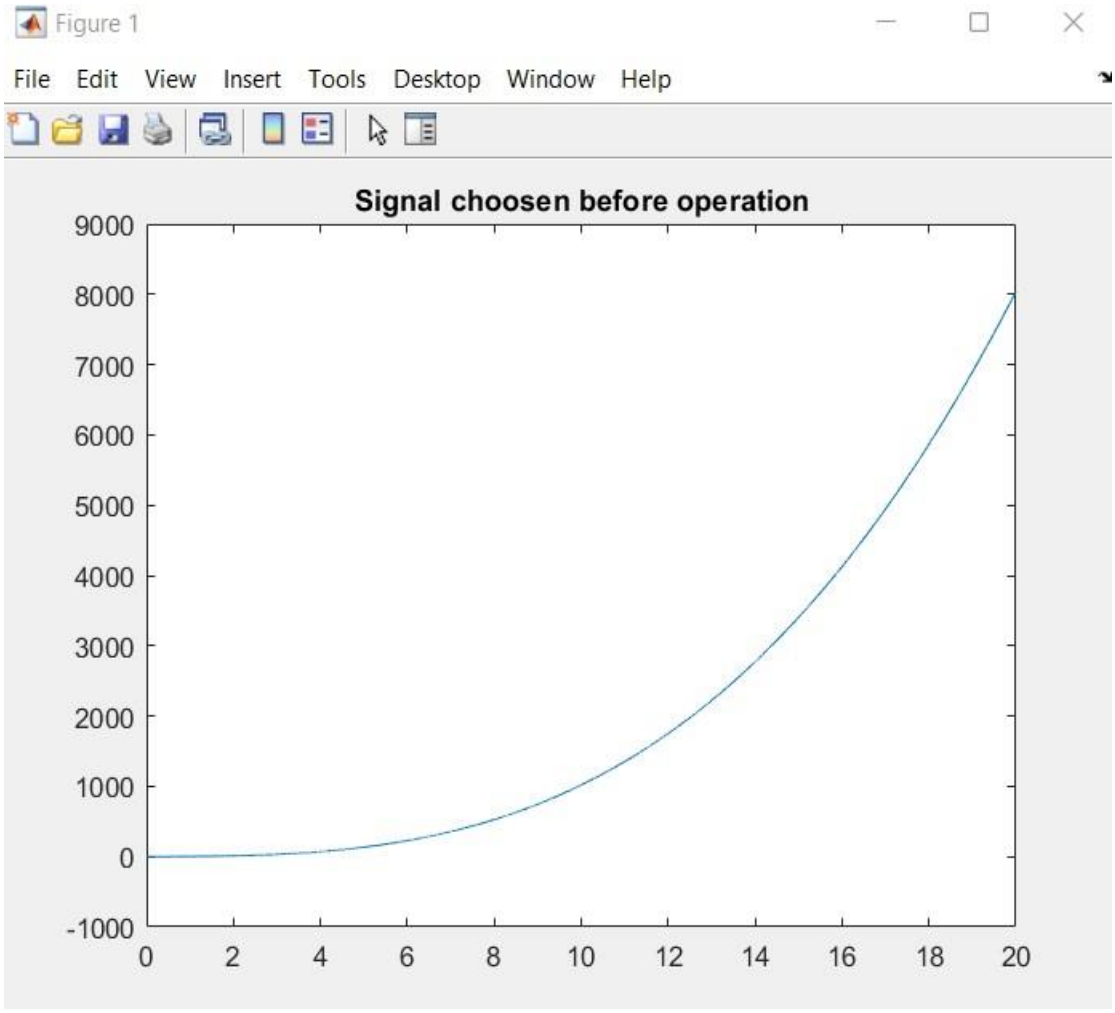
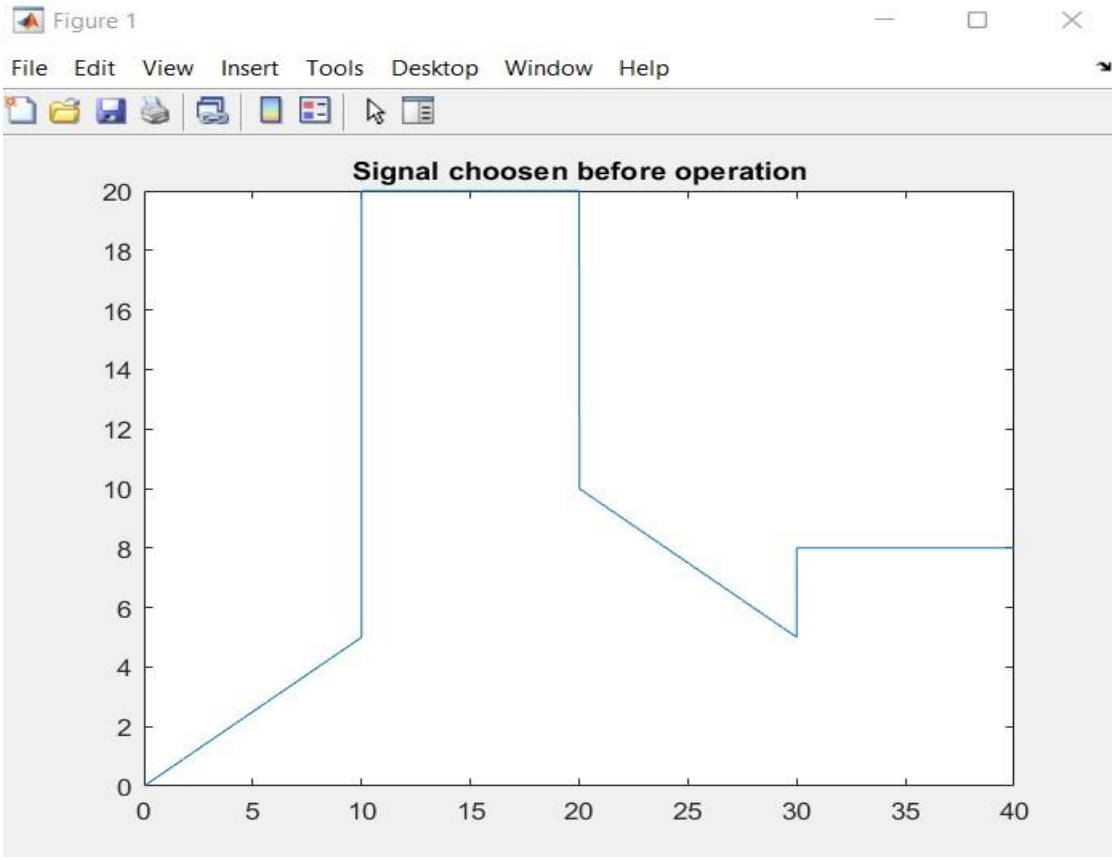


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal choosen before operation
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
0 2 4 6 8 10 12 14 16 18 20

Another Signals:

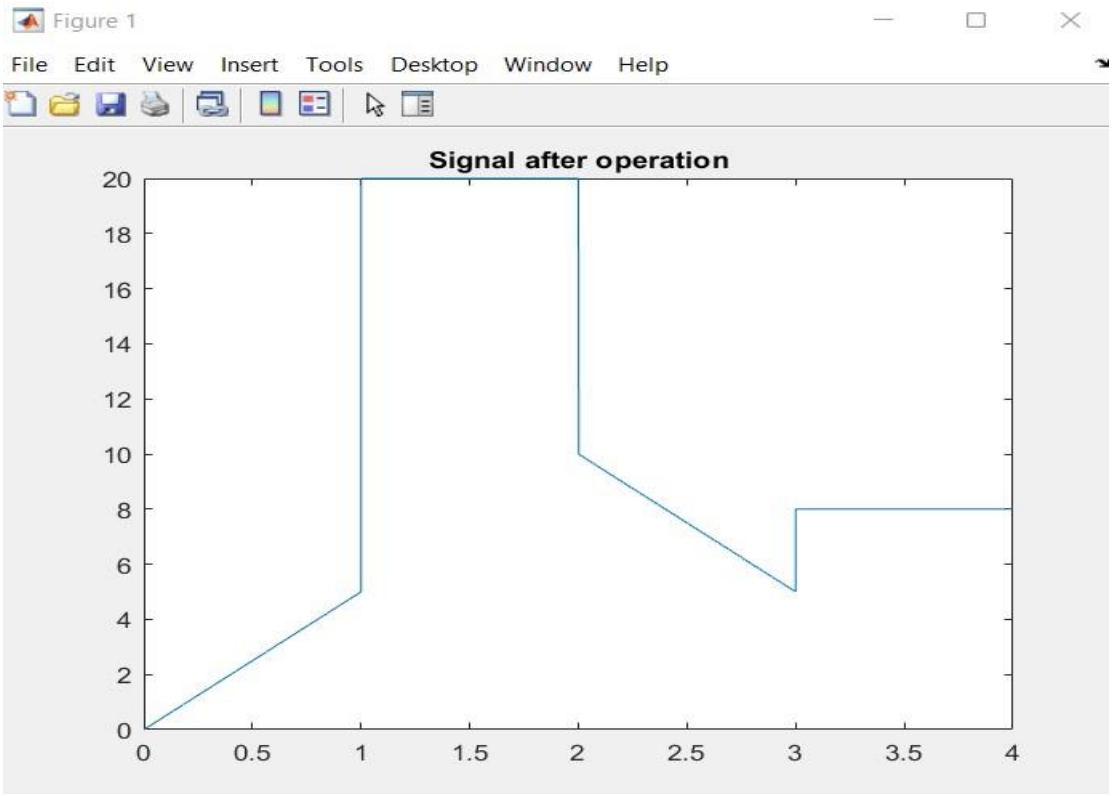
5-

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 40
Enter Number of Break Points: 3
Enter Position for Break Point 1 : 10
Enter Position for Break Point 2 : 20
Enter Position for Break Point 3 : 30
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint10 :2
Enter the slope of Ramp signal: 0.5
Enter its intercept: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region10  at breakingPoint20 :1
Enter the amplitude of DC signal: 20
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region20  at breakingPoint30 :2
Enter the slope of Ramp signal: -0.5
Enter its intercept: 20
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region30  at breakingPoint40 :1
Enter the amplitude of DC signal: 8
```



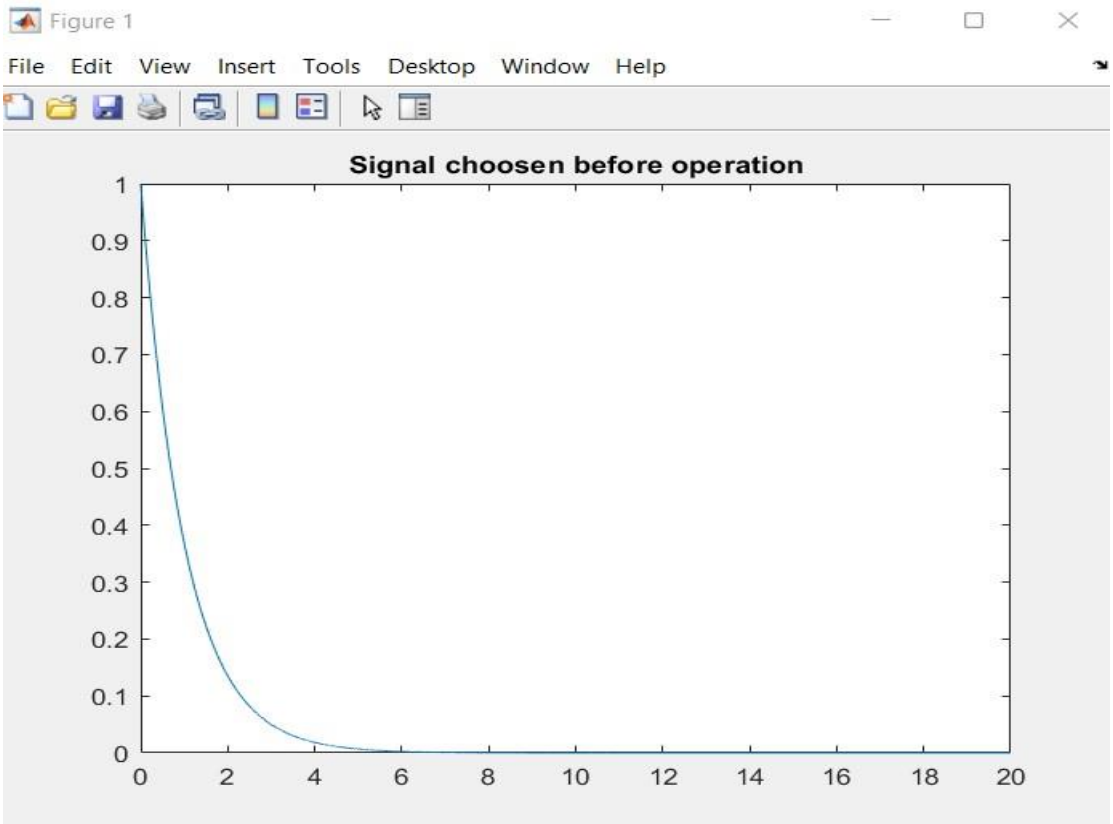
After Time Compression:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:5
Enter value of compressing: 10
Signal Compressed..!
```



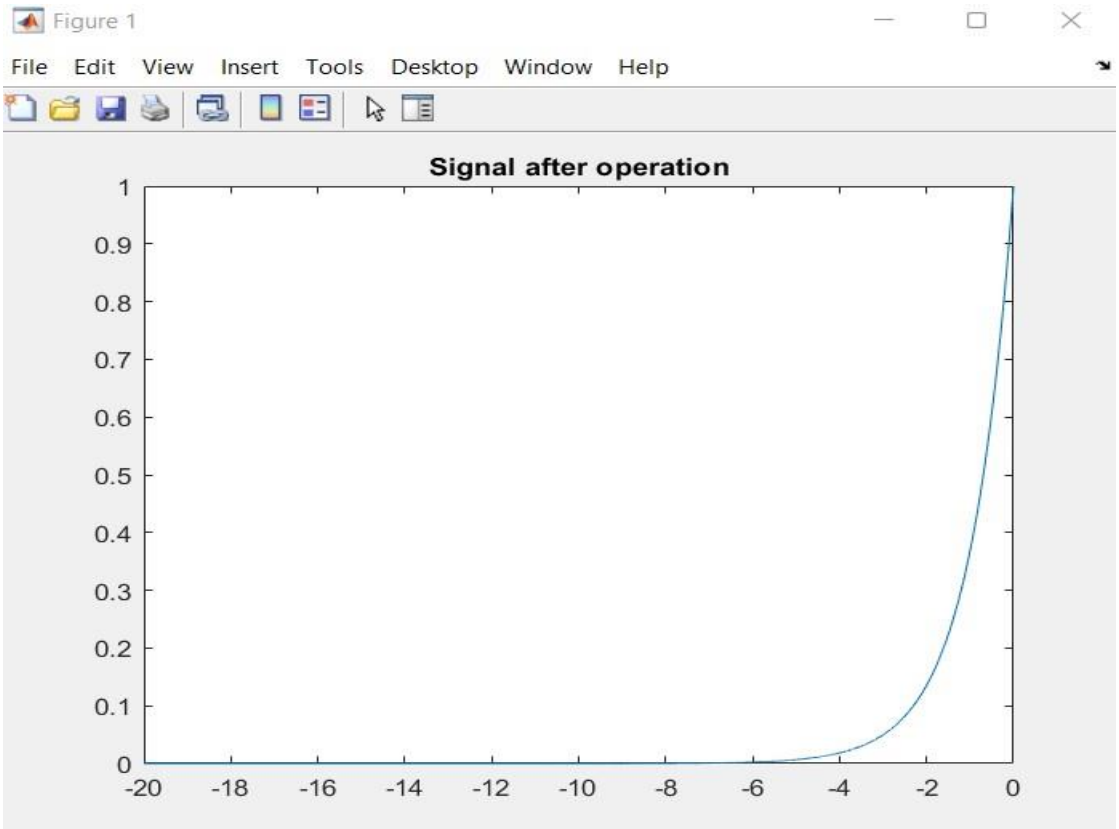
6-Exponential

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint20 :4
Enter the amplitude of Exponential signal: 1
Enter its exponent: -1
```



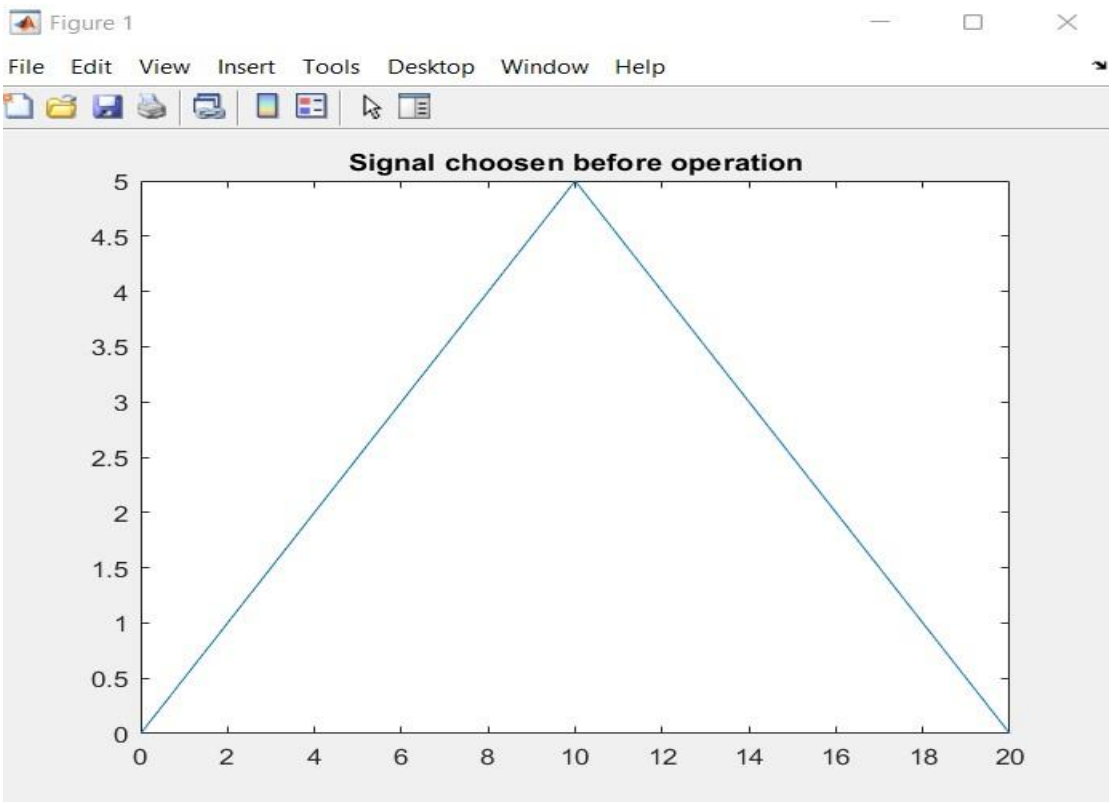
After time Reverse:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:2
Time Reversed..!
```



7-Triangle Signal Using Ramp

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 1
Enter Position for Break Point 1 : 10
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint10 :2
Enter the slope of Ramp signal: 0.5
Enter its intercept: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region10  at breakingPoint20 :2
Enter the slope of Ramp signal: -0.5
Enter its intercept: 10
```



After Time Shift by 10 to Right

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:3
Enter value of shifting: 10
Time Shifted..!
```

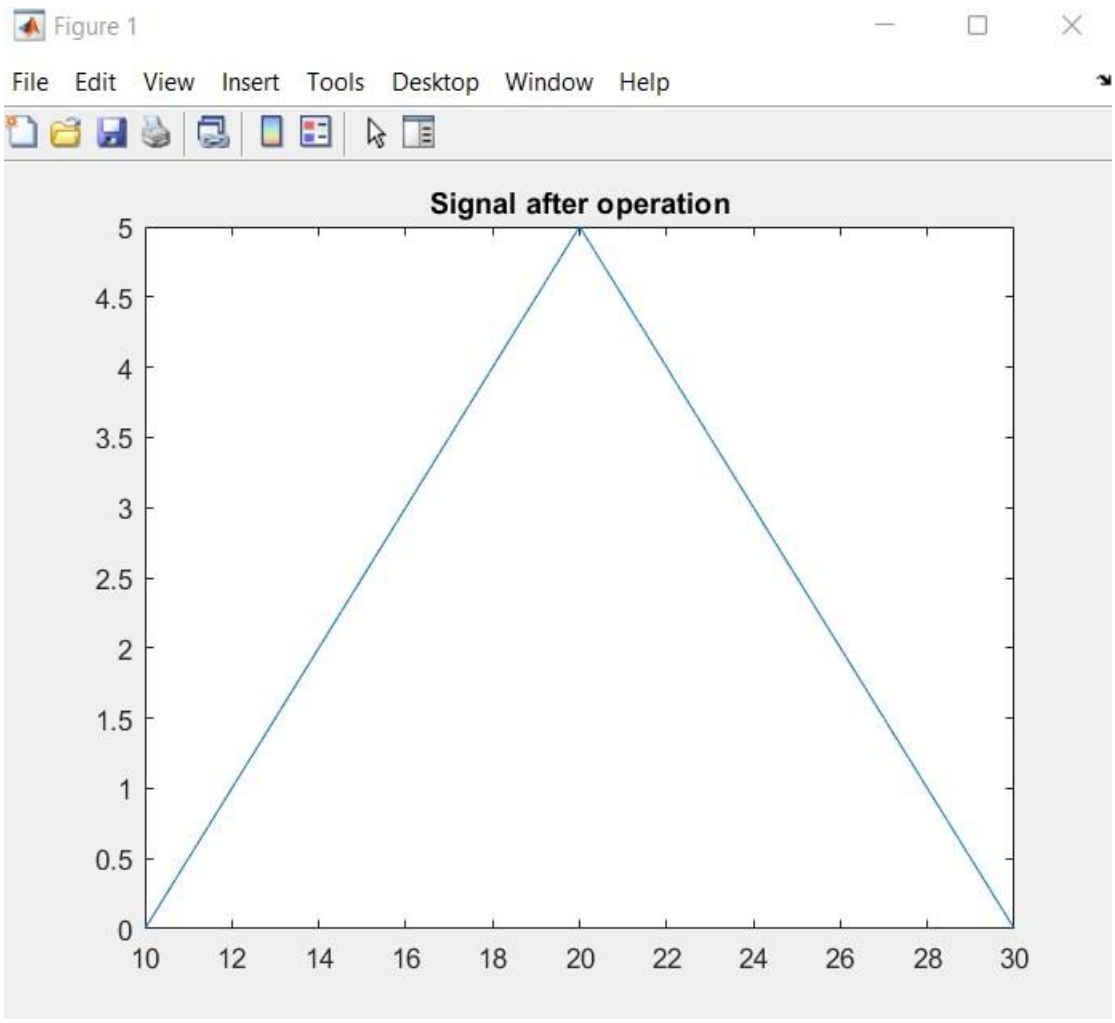
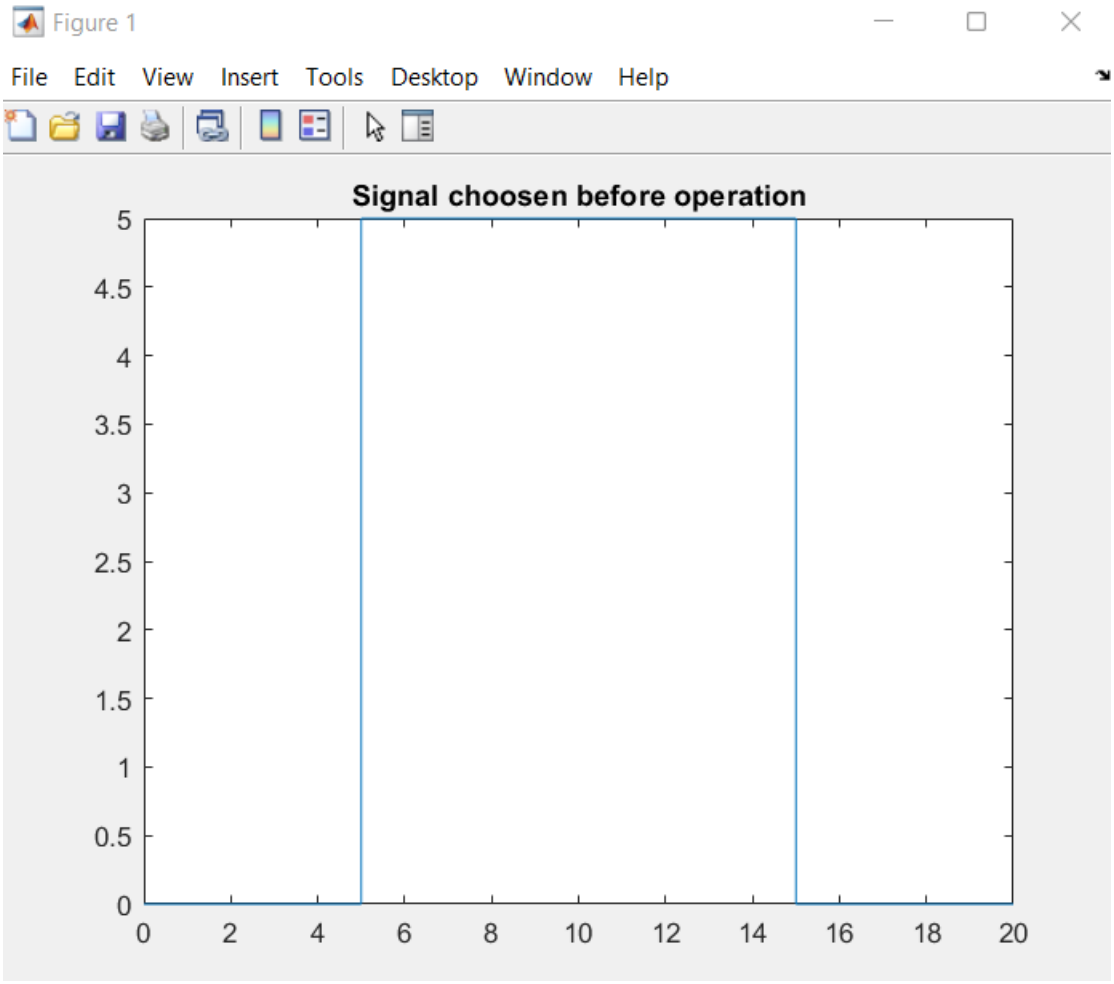


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal after operation
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10 12 14 16 18 20 22 24 26 28 30

8-Rectangular Signal Using DC Signal

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 2
Enter Position for Break Point 1 : 5
Enter Position for Break Point 2 : 15
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint5 :1
Enter the amplitude of DC signal: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region5  at breakingPoint15 :1
Enter the amplitude of DC signal: 5
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region15  at breakingPoint20 :1
Enter the amplitude of DC signal: 0
```



After amplitude Scaling:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:1
Enter value of scaling: 10
Amplitude Scaled..!
```

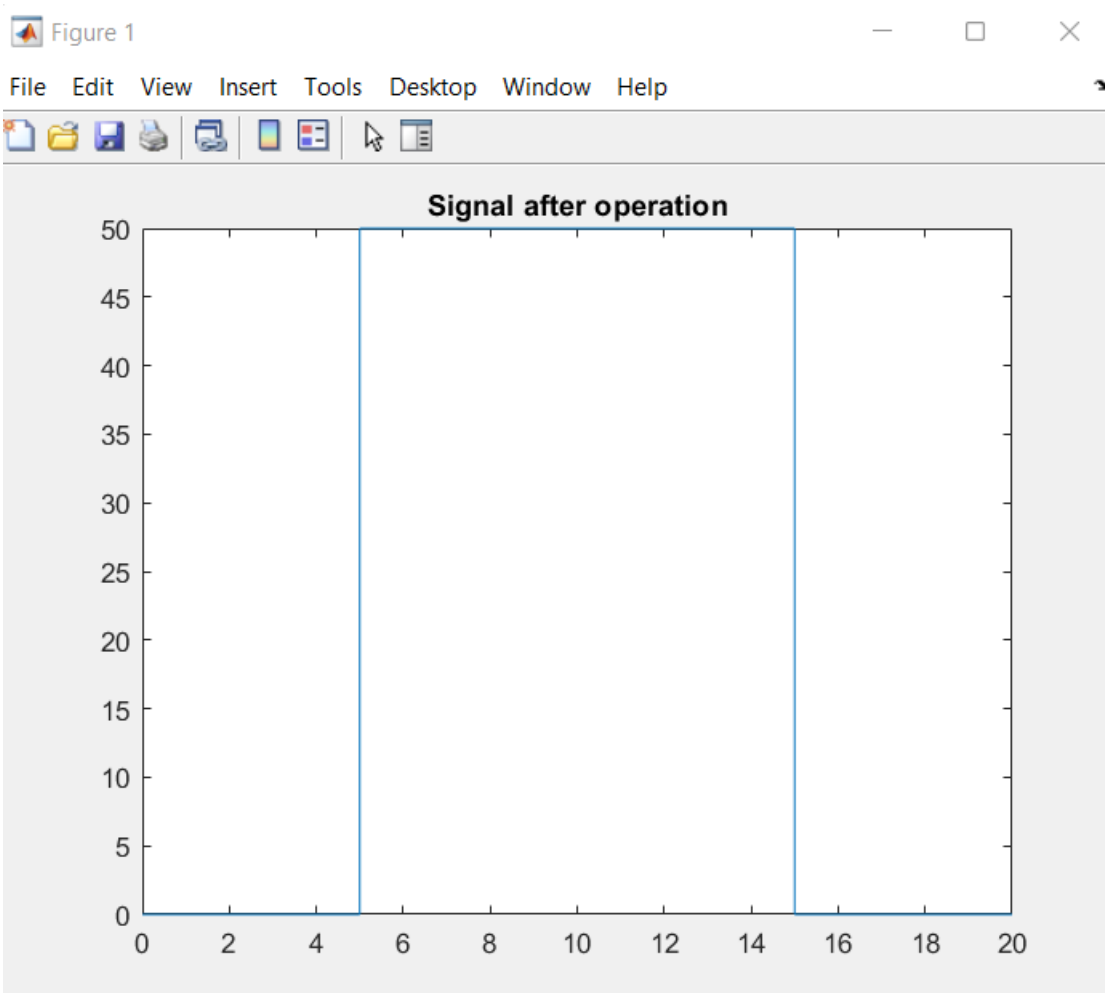
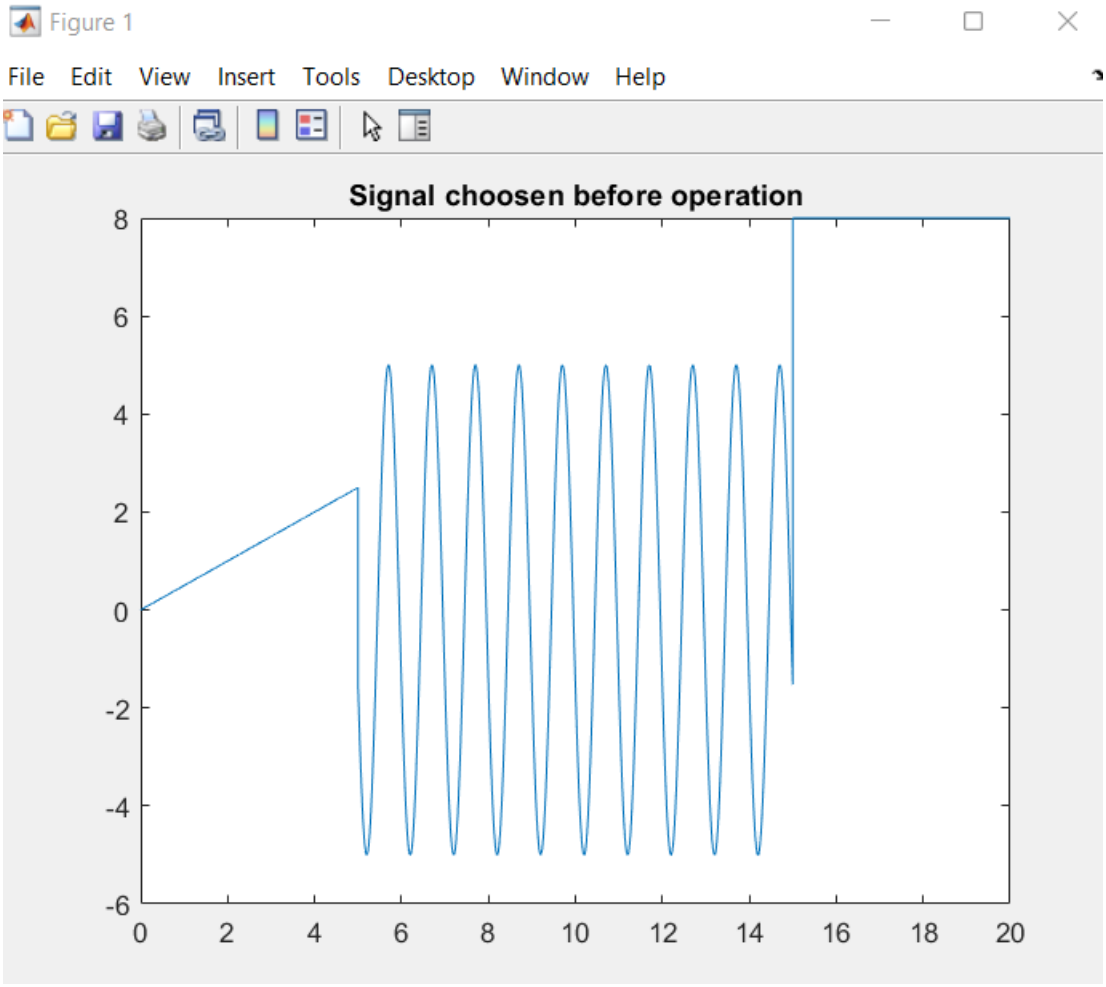


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal after operation
50
45
40
35
30
25
20
15
10
5
0
0 2 4 6 8 10 12 14 16 18 20

9-

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 2
Enter Position for Break Point 1 : 5
Enter Position for Break Point 2 : 15
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint5 :2
Enter the slope of Ramp signal: 0.5
Enter its intercept: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region5  at breakingPoint15 :5
Enter the amplitude of Sinosoidal signal: 5
Enter its frequency: 1
Enter its phase: 60
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region15  at breakingPoint20 :1
Enter the amplitude of DC signal: 8
```



After time Shift by -25:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:3
Enter value of shifting: -25
Time Shifted..!
```

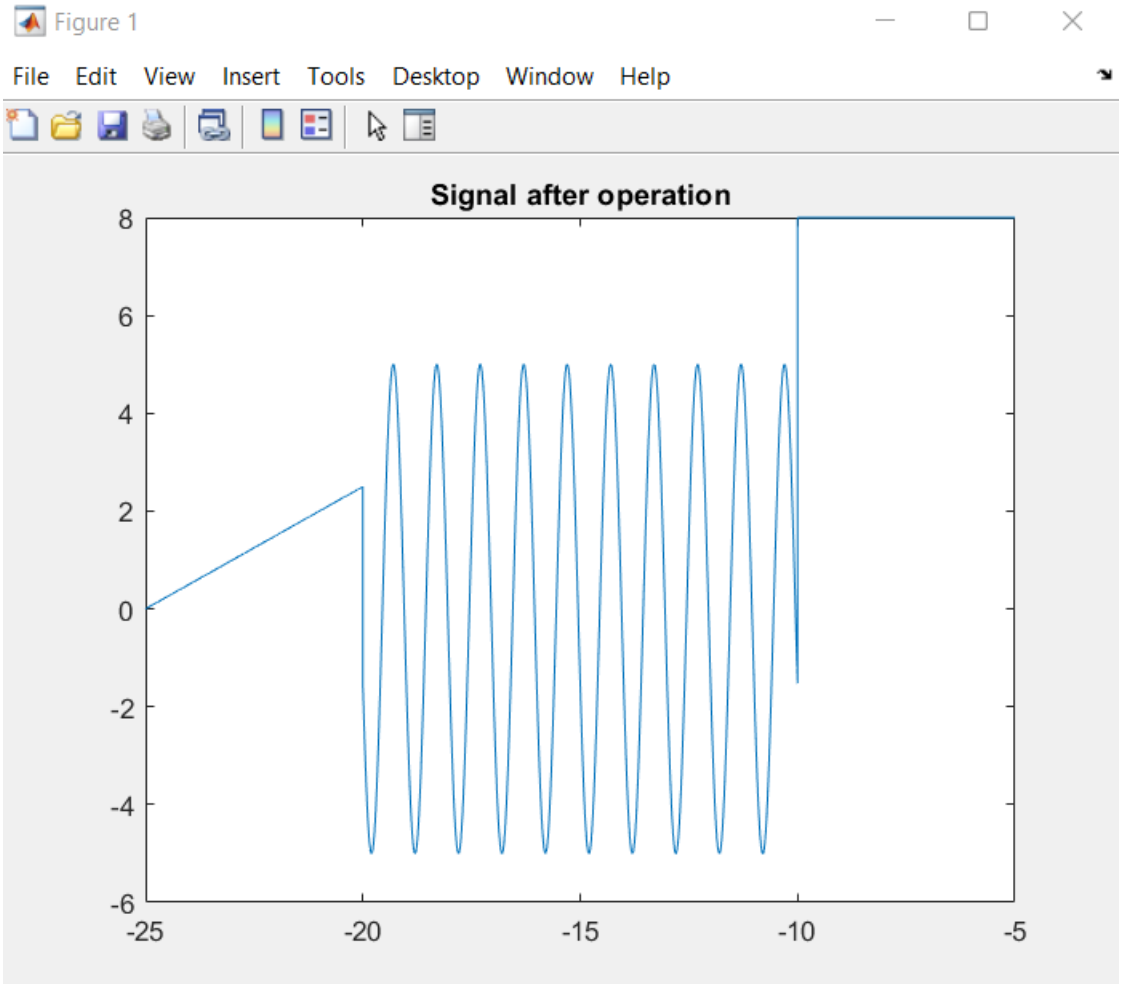
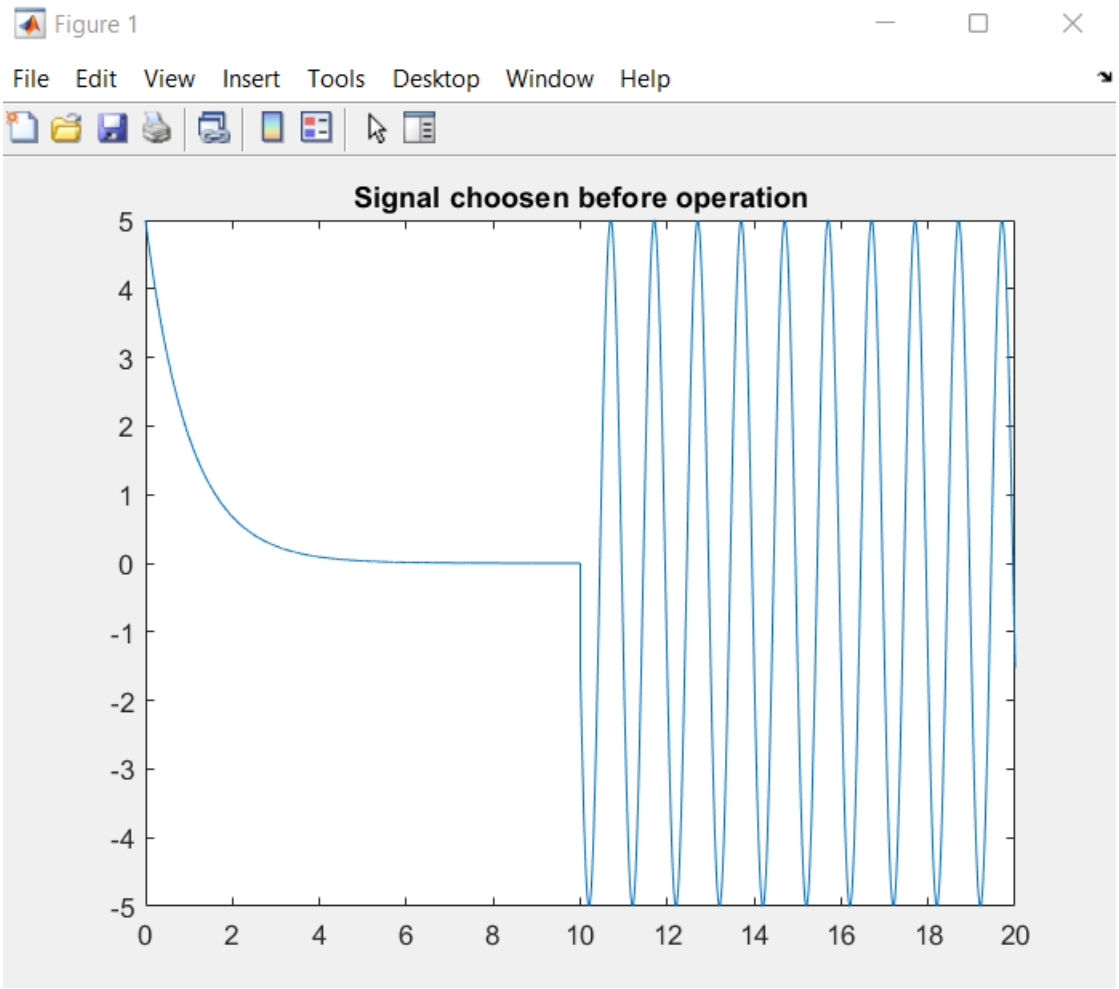


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal after operation
8
6
4
2
0
-2
-4
-6
-25
-20
-15
-10
-5

10-Exponential with sinusoidal

```
Enter Sampling Frequency of Signal: 500
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 1
Enter Position for Break Point 1 : 10
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint10 :4
Enter the amplitude of Exponential signal: 5
Enter its exponent: -1
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region10  at breakingPoint20 :5
Enter the amplitude of Sinosoidal signal: 5
Enter its frequency: 1
Enter its phase: 60
```



After Amplitude Scaling by 0.5:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:1
Enter value of scaling: 1/2
Amplitude Scaled..!
```

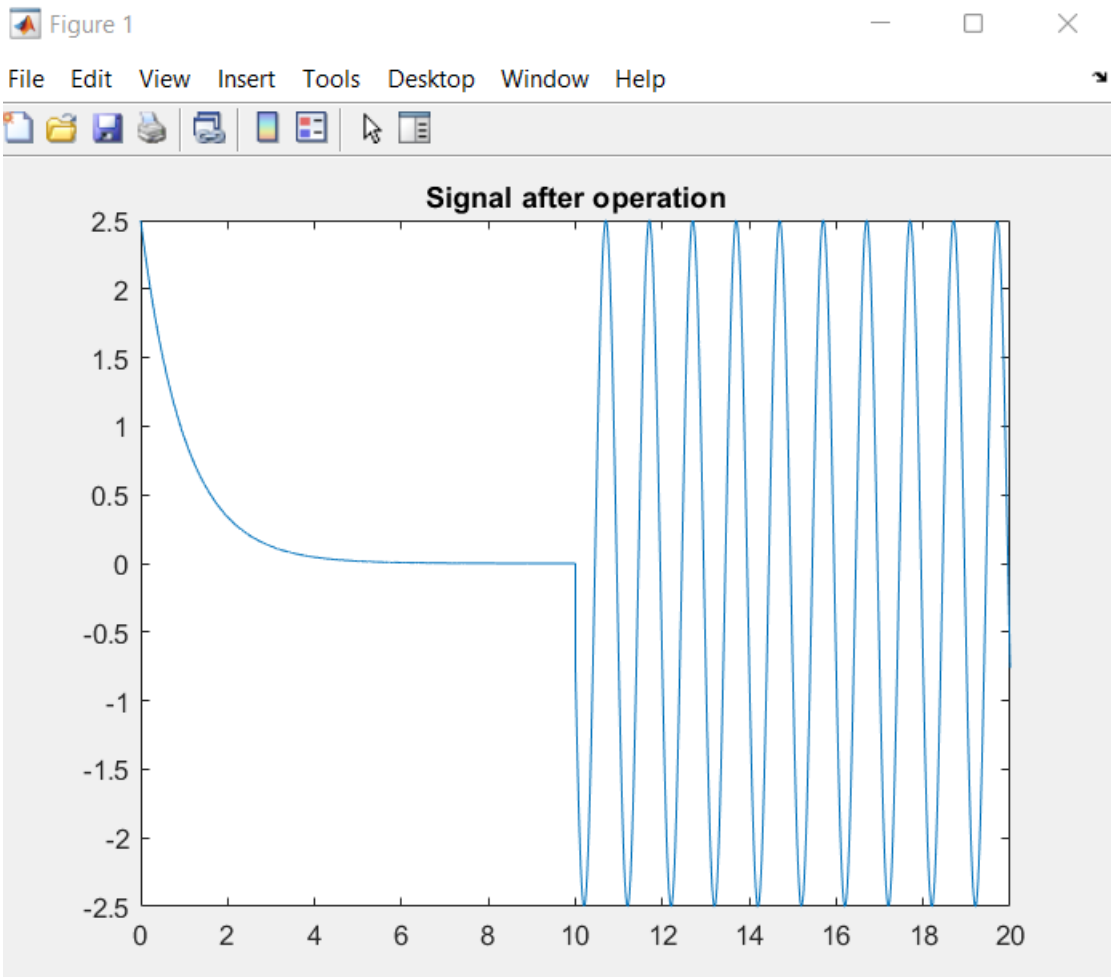
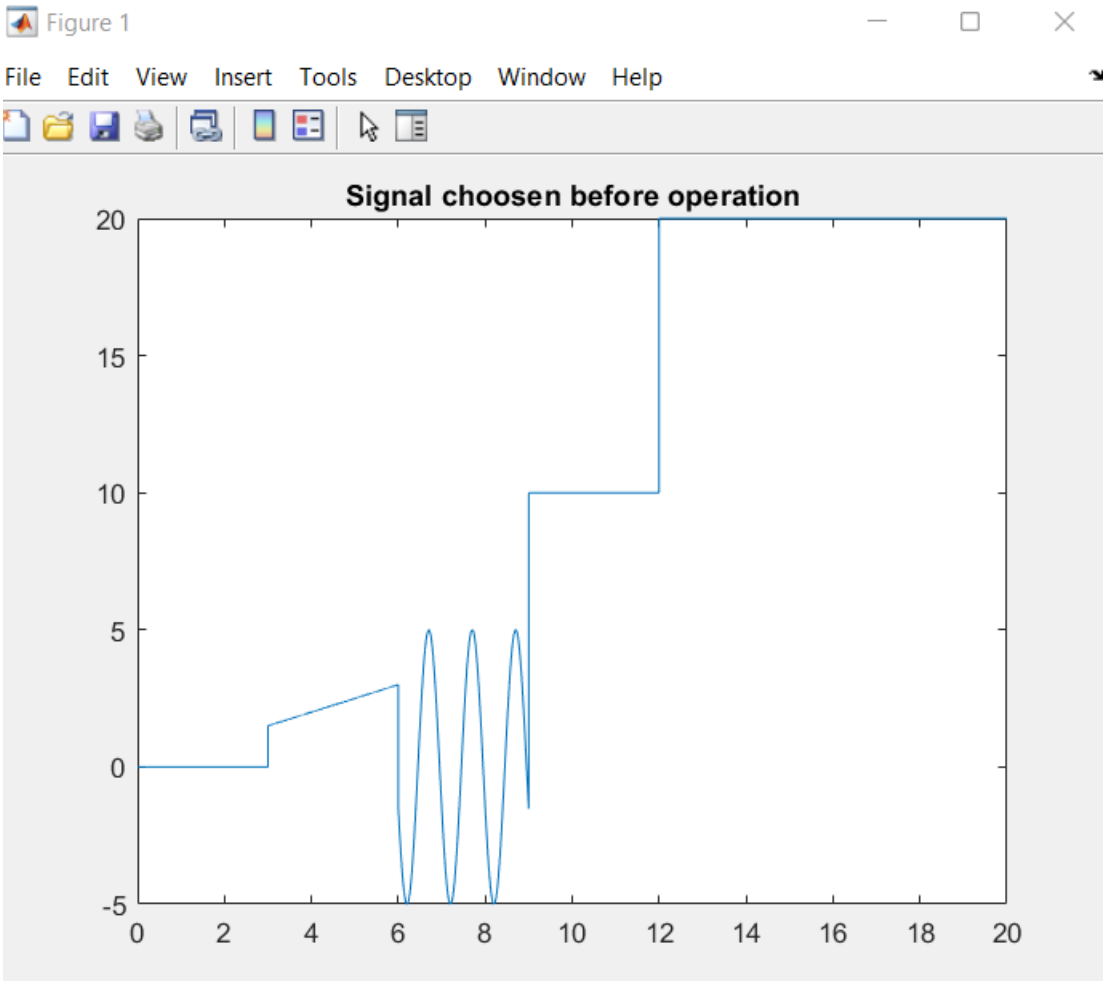


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal after operation
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
0 2 4 6 8 10 12 14 16 18 20

11-

```
Enter Sampling Frequency of Signal: 1000
Enter a Start for Time Scale: 0
Enter an End for Time Scale: 20
Enter Number of Break Points: 4
Enter Position for Break Point 1 : 3
Enter Position for Break Point 2 : 6
Enter Position for Break Point 3 : 9
Enter Position for Break Point 4 : 12
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region0  at breakingPoint3 :1
Enter the amplitude of DC signal: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region3  at breakingPoint6 :2
Enter the slope of Ramp signal: 0.5
Enter its intercept: 0
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region6  at breakingPoint9 :5
Enter the amplitude of Sinosoidal signal: 5
Enter its frequency: 1
Enter its phase: 60
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region9  at breakingPoint12 :1
Enter the amplitude of DC signal: 10
1-DC Signal
2-Ramp Signal
3-General order Polynomial Signal
4-Exponential Signal
5-Sinosoidal Signal
Choose signal type for region12  at breakingPoint20 :1
Enter the amplitude of DC signal: 20
```



After time Reverse:

```
1-Amplitude Scaling
2-Time Reversal
3-Time Shift
4-Expanding the signal
5-Compressing the signal
0-None
Perform Some Operations:
Choose your operation:2
Time Reversed..!
```

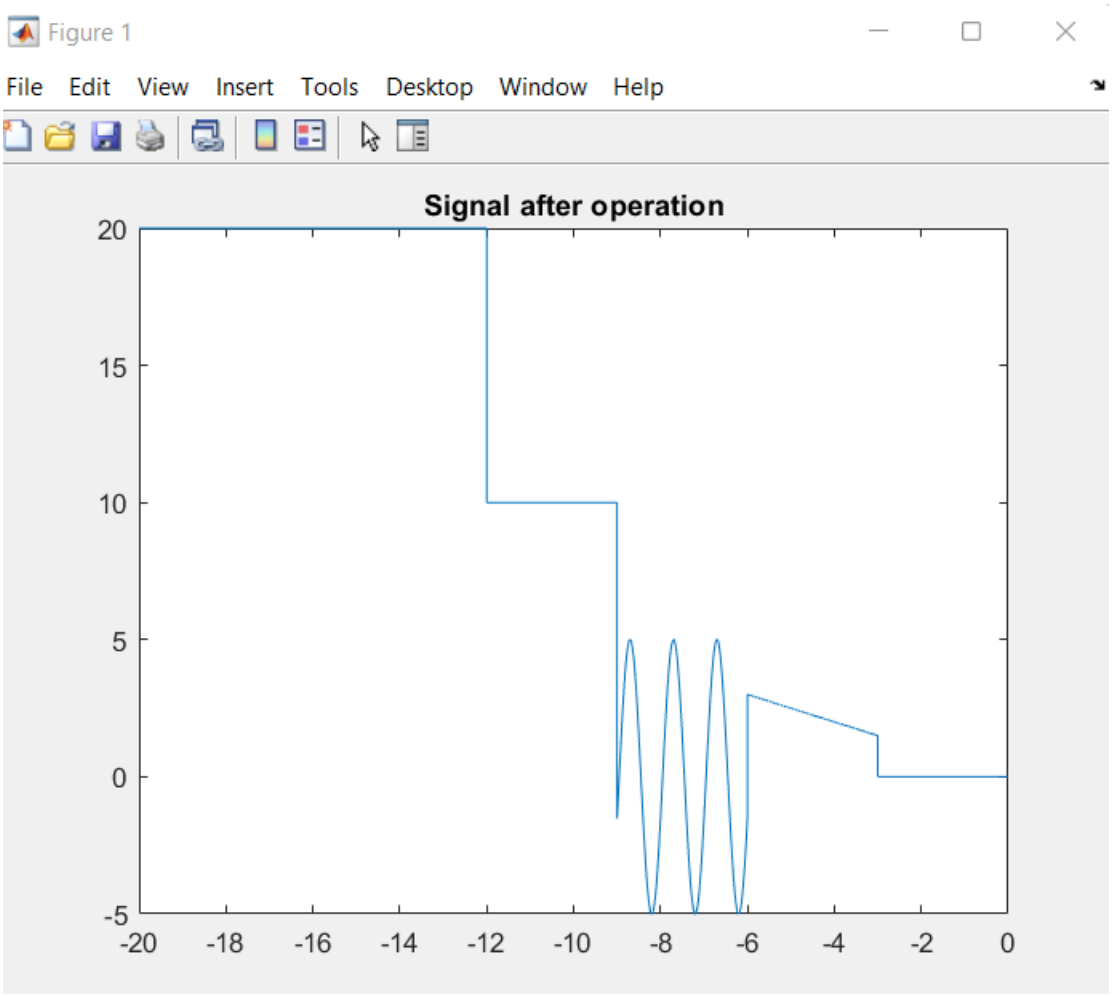


Figure 1
File Edit View Insert Tools Desktop Window Help
Signal after operation
20
15
10
5
0
-5
-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0