Signal and Systems Final Project

(Matlab)

Part 2

General Signal Generator

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Source Code

```
clc , clear , close all
msg1 =( ' >>General Signal Generator<< ' );
disp (msg1)
frequencySampling = input ( ' Enter the Sampling
Frequency of the signal:  ' );
while (frequencySampling < 0)
        frequencySampling = input ( ' Please Enter a
valid number for the sampling frequency:  ' );
end
startTimeScale = input ( ' Enter the start of the time
scale:  ' );
endTimeScale = input ( ' Enter the end of the time
scale:  ' );
breakPointNumber = input ( ' Enter the number of break
points:  ' );
while (breakPointNumber < 0)
        breakPointNumber = input ( ' Please Enter a
valid number of break points:  ' );
end
start = startTimeScale;
signalTotal = 0;

for i = 1:(breakPointNumber + 1)
    userBreakPoint = endTimeScale;
    fprintf ( ' Created Signal \n ' );

   if (i ~= (breakPointNumber + 1))
       userBreakPoint = ceil(input ( ' Enter the break
point position: ' ));
   end

    fprintf ( ' 1- DC Signal \n 2- Ramp Signal \n 3-
General Order Polynomial \n 4- Exponential Signal \n 5-
Sinusoidal Signal \n ');
    signalType = input ( ' Choose the type of signal
you want: ');
    while (signalType > 5 || signalType < 1)
```

```
        signalType = input ( ' Please Enter a valid
choice: ');
    end
    t = linspace(start,userBreakPoint,(userBreakPoint -
start) * frequencySampling);

    switch (signalType)

        case 1
            amp = input ( ' Enter the amplitude of the
signal: ');
            n = (userBreakPoint - start) *
frequencySampling;
            x = amp*ones(1,n);
        case 2
            slope = input( ' Enter slope: ');
            intercept = input( ' Enter the intercept
with x-axis: ');
            x = slope * (t-intercept);
        case 3
            numberCoefficient = input ( ' Enter the
number of coefficients: ');
            power = numberCoefficient - 1;
            x = 0;

            for j = 1:(numberCoefficient)
                coefficient = input ( ' Enter
coefficient: ' );
                x = x + coefficient * t.^power;
                power = power - 1;
            end


        case 4
             amp = input ( ' Enter the amplitude of the
signal: ');
             exponent = input ( ' Enter the exponent: '
);
             x = amp * exp(exponent * t );
        case 5
```

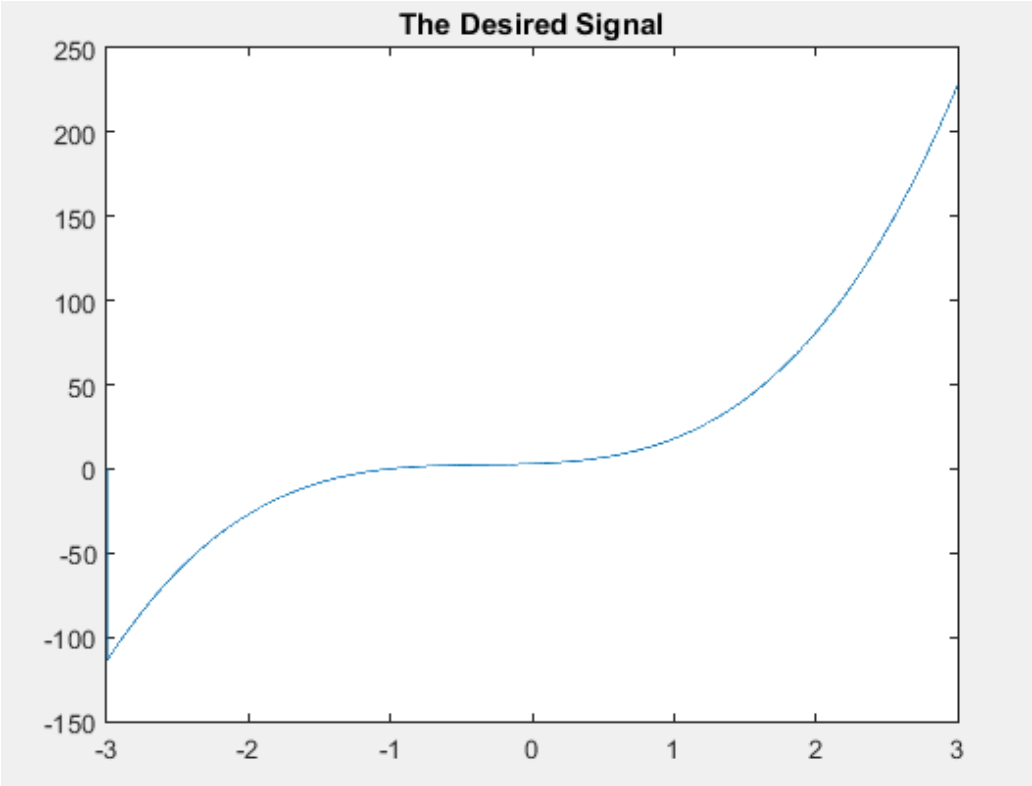
```
            amp = input ( ' Enter the amplitude of the
signal: ');
            frequency = input( ' Enter the frequency:
');
            phase = input( ' Enter the phase: ');
            x = amp * sin((2 * pi * frequency * t) +
deg2rad(phase));


    end

start = userBreakPoint;
signalTotal = [signalTotal x];
end

T =
linspace(startTimeScale,endTimeScale,(frequencySampling
*((endTimeScale-startTimeScale))+1));
figure
plot (T, signalTotal)
title( ' The Desired Signal ' );
msg2 =( ' >Operations on Created Signal< ' );
disp (msg2)
operationNumber = input( ' Enter the number of
operations you want to do: ' );
while (operationNumber < 0)
        operationNumber = input ( ' Please Enter a
valid number of operations:  ' );
end

for k = 1:(operationNumber)

 fprintf ( '1- Amplitude Scaling \n 2- Time Reversal \n
3- Time Shift \n 4- Expanding the signal \n 5-
Compressing the signal \n 6- None \n ');
 option = input( ' Choose the number of the operation
you want: ' );
    while (option > 6 || option < 1)
        option = input ( ' Please Enter a valid choice:
');
```

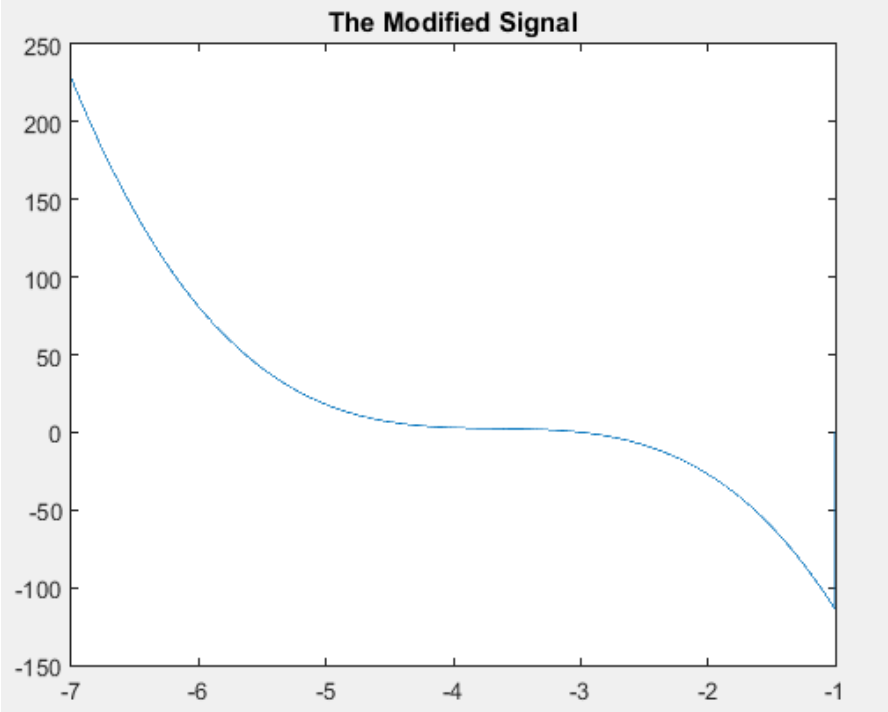
```
    end

 switch (option)

        case 1
            amp = input ( ' Enter the new amplitude of
the signal: ');
            T = amp * T;
        case 2
            T = -T;
        case 3
            phaseShift = input ( ' Enter the value of
the shift: ' );
            T = T - phaseShift;
        case 4
             expansion = input ( ' Enter the value of
expansion: ' );
             T = T * expansion;
        case 5
             compression = input ( ' Enter the value of
compression: ' );
             T = T / compression;
        case 6
            break;
 end

end

    figure
    plot(T,signalTotal)
    title( ' The Modified Signal ' );
    fprintf ( ' >>Thank You<< \n ');
```

Test Cases

Example 1

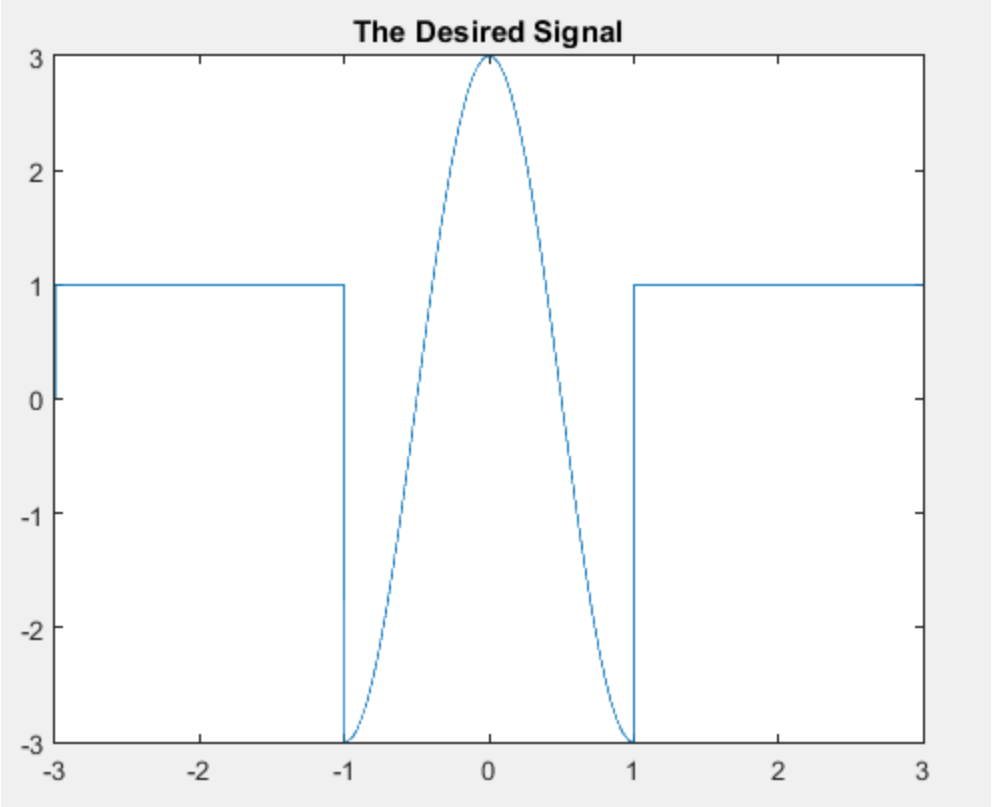
- Fs = 3000
- Start = -3
- end = 3
- break point number (BPN) = 0
- General Order Poly → Number of coefficients = 3 , Coefficients = 1,-6,6
- Operations number (ON) = 2
- Time Reversal
- Time Shift = 4

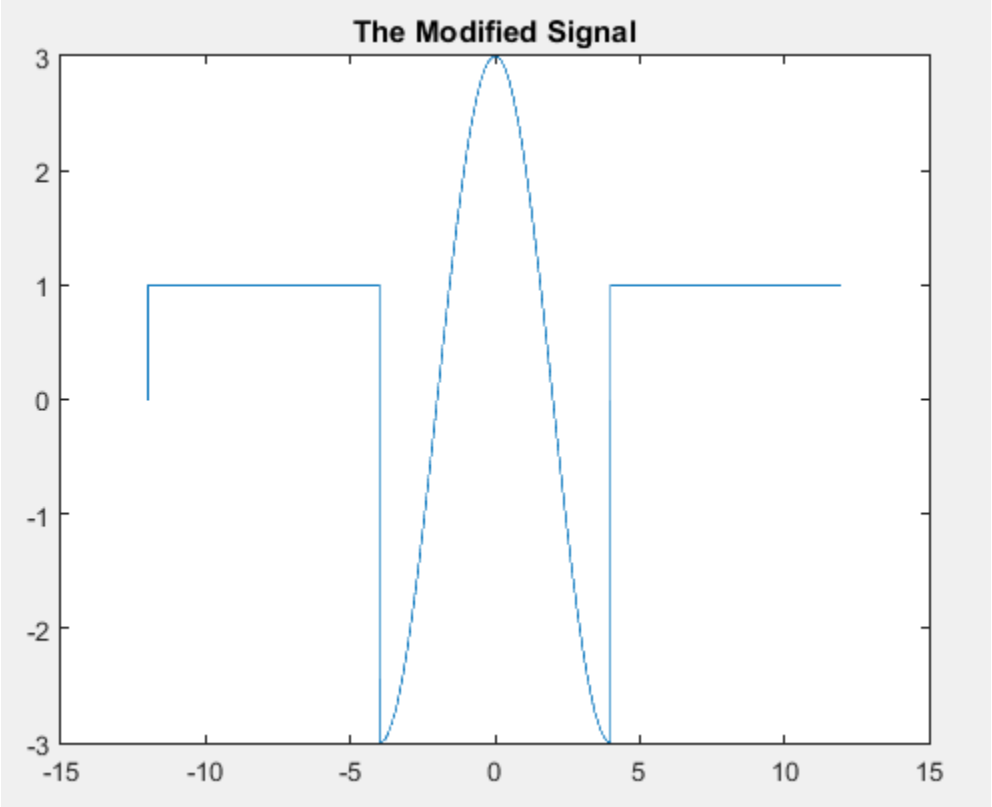




Example 2

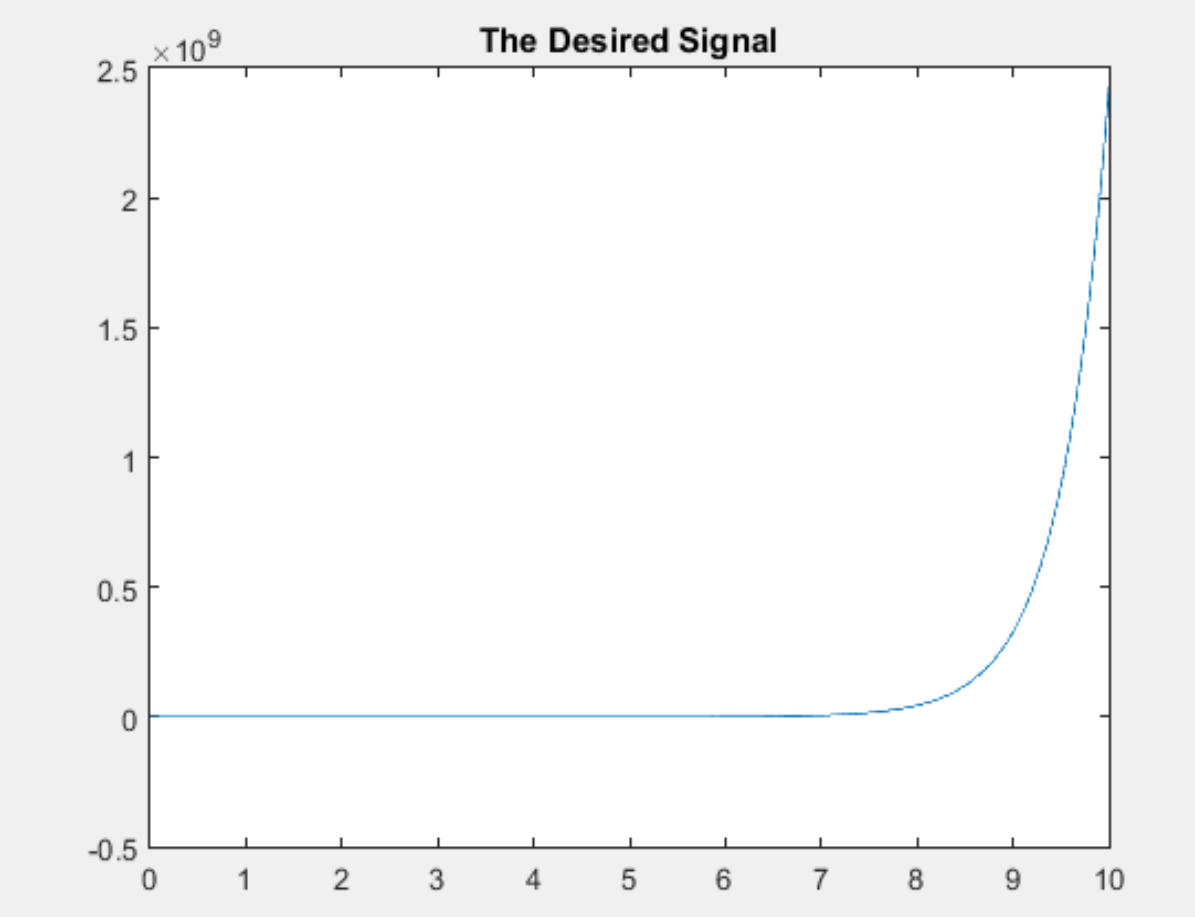
- Fs = 4500
- Start = -3
- end = 3
- break point number (BPN) = 2
- break point position (BPP) = -1,1
- DC → Amplitude = 1
- Sinusoidal → Amplitude = 3 , Frequency = 0.5 , Phase =90
- DC → amplitude = 1
- Operations number (ON) = 1
- Expanding the signal = 4

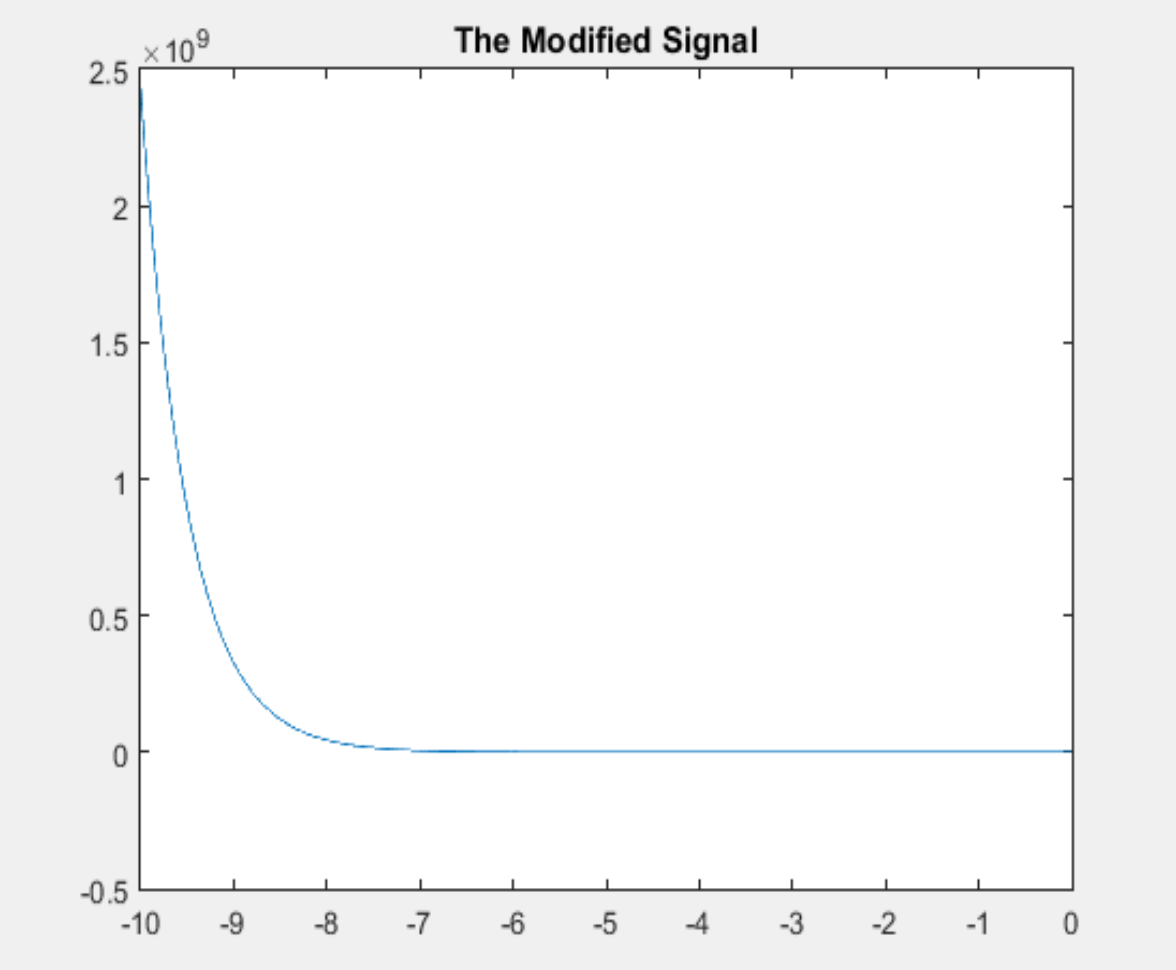

The Desired Signal
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
3


The Modified Signal
3
2
1
0
-1
-2
-3
-15
-10
-5
0
5
10
15

Example 3

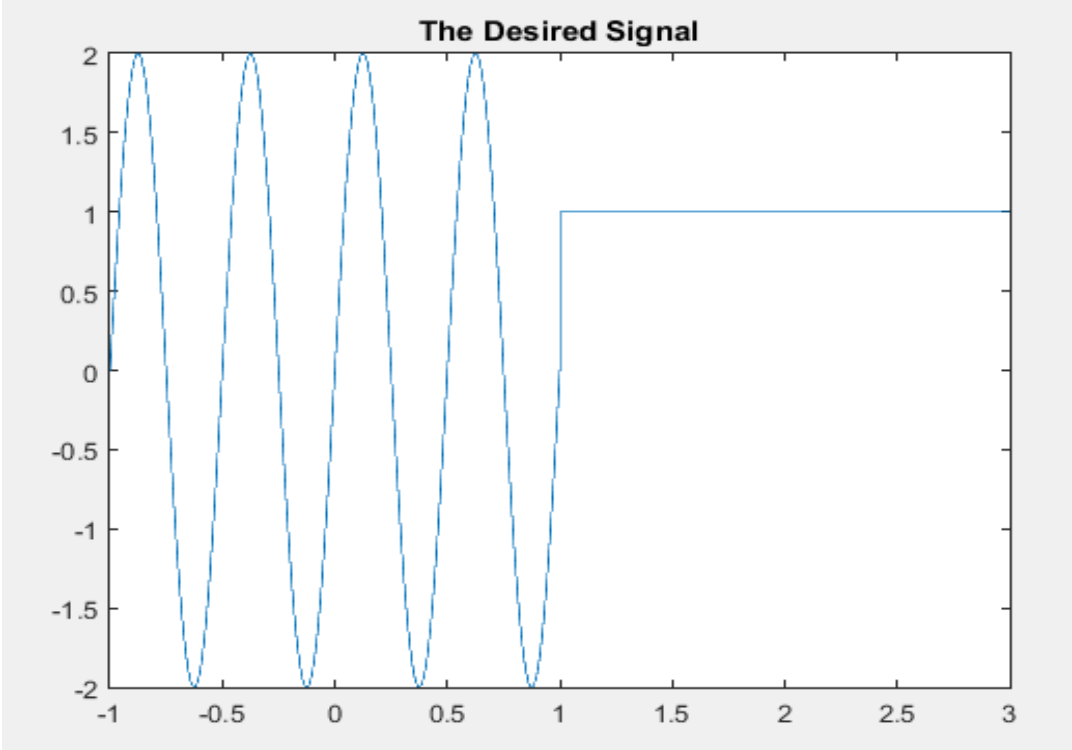
- Fs = 1000
- Start = 0
- end = 10
- break point number (BPN) = 1
- break point position (BPP) = 5
- Ramp → slope = 3 , Intercept (with x-axis) = 2
- Exponential → Amplitude = 5 , Exponent = 2
- Operations number (ON) = 1
- Time Reversal

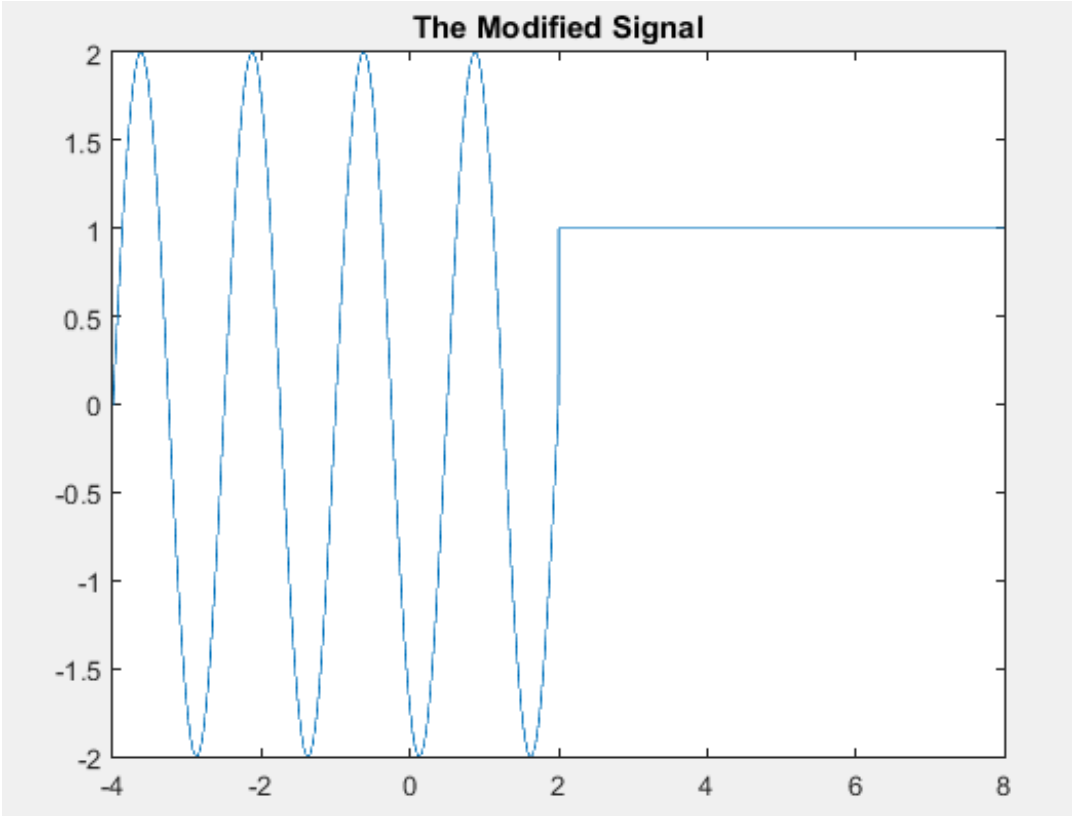




Example 4

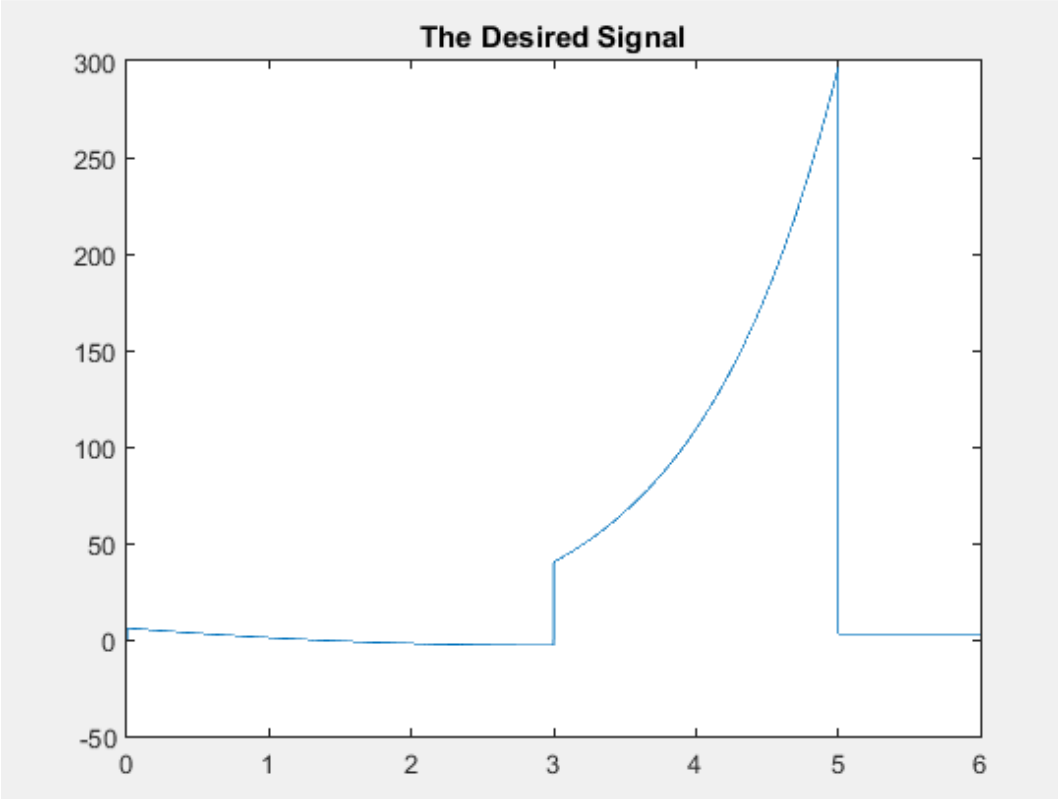
- Fs = 5000
- Start = -1
- end = 3
- break point number (BPN) = 1
- break point position (BPP) = 1
- Sinusoidal → Amplitude = 2 , Frequency = 2 , Phase = 0
- DC → Amplitude = 1
- Operations number (ON) = 2
- Amplitude Scaling = 3
- Time Shift = 1

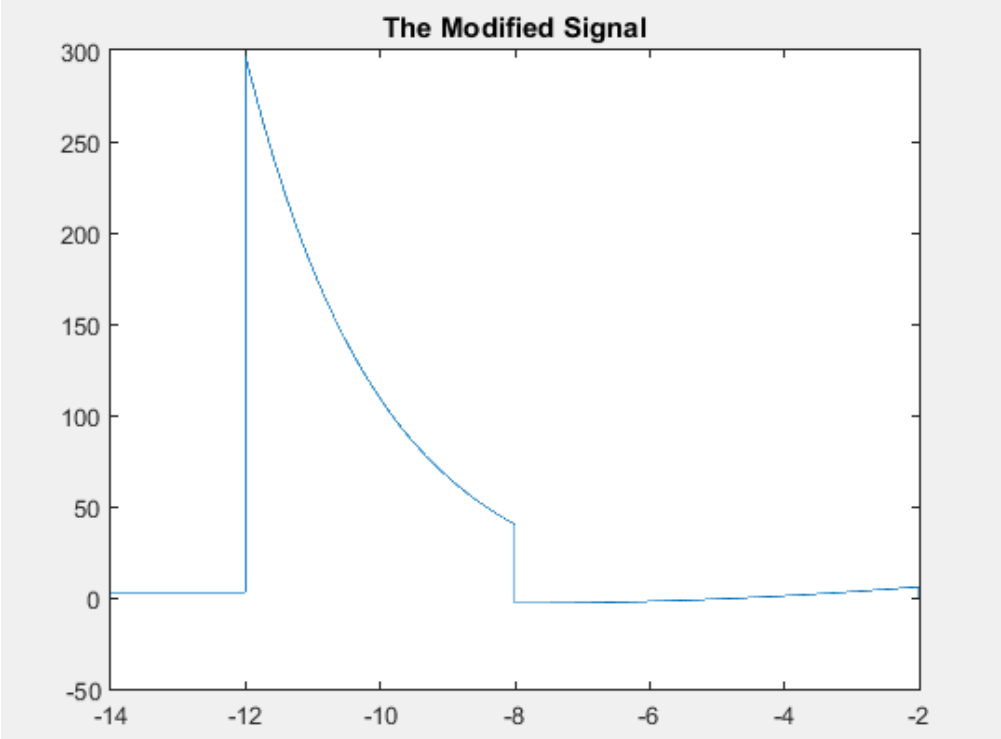

The Desired Signal
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-1
-0.5
0
0.5
1
1.5
2
2.5
3


The Modified Signal
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-4
-2
0
2
4
6
8

Example 5

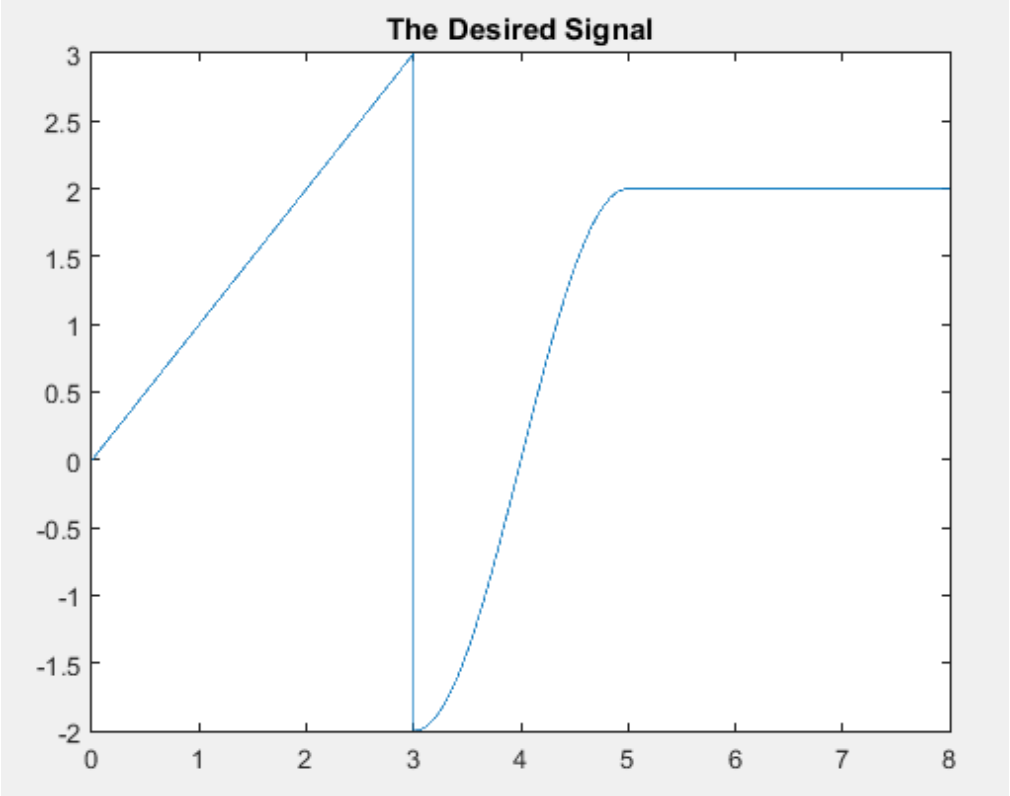
- Fs = 1500
- Start = 0
- end = 6
- break point number (BPN) = 2
- break point position (BPP) = 3,5
- General Order Poly → Number of coefficients = 3 , Coefficients = 1,-6,6
- Exponential → Amplitude = 2 , Exponent = 1
- DC → Amplitude = 3
- Operations number (ON) = 3
- Amplitude Scaling = 2
- Time Shift = -2
- Time Reversal

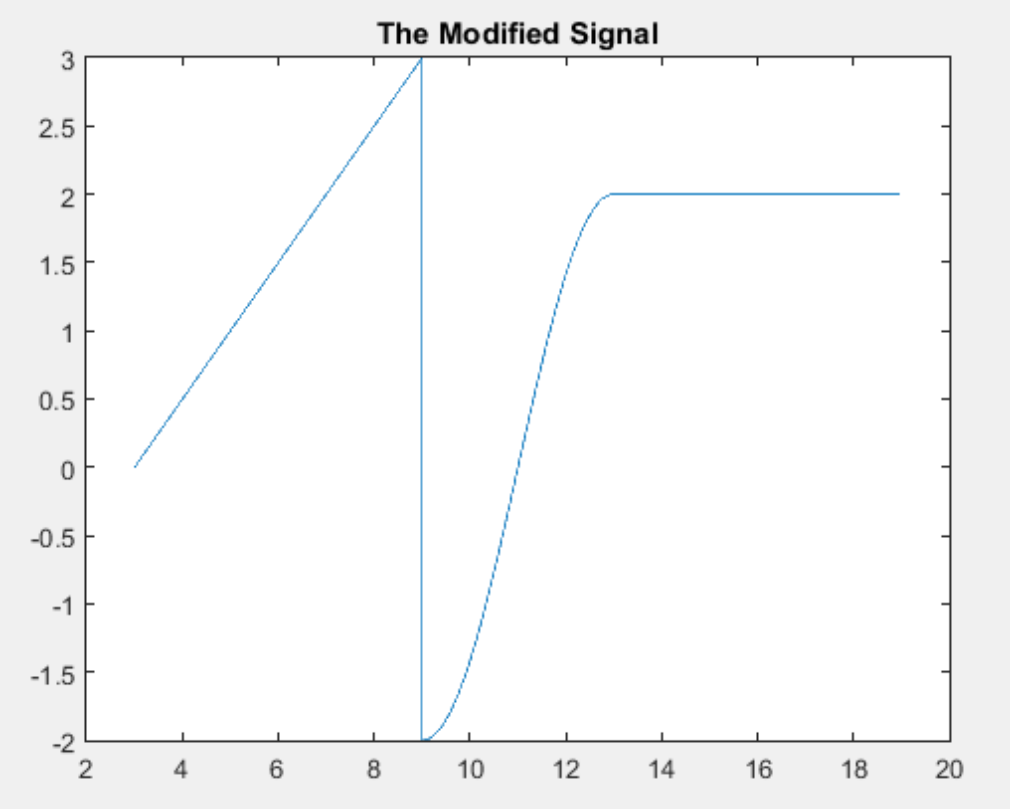




Example 6

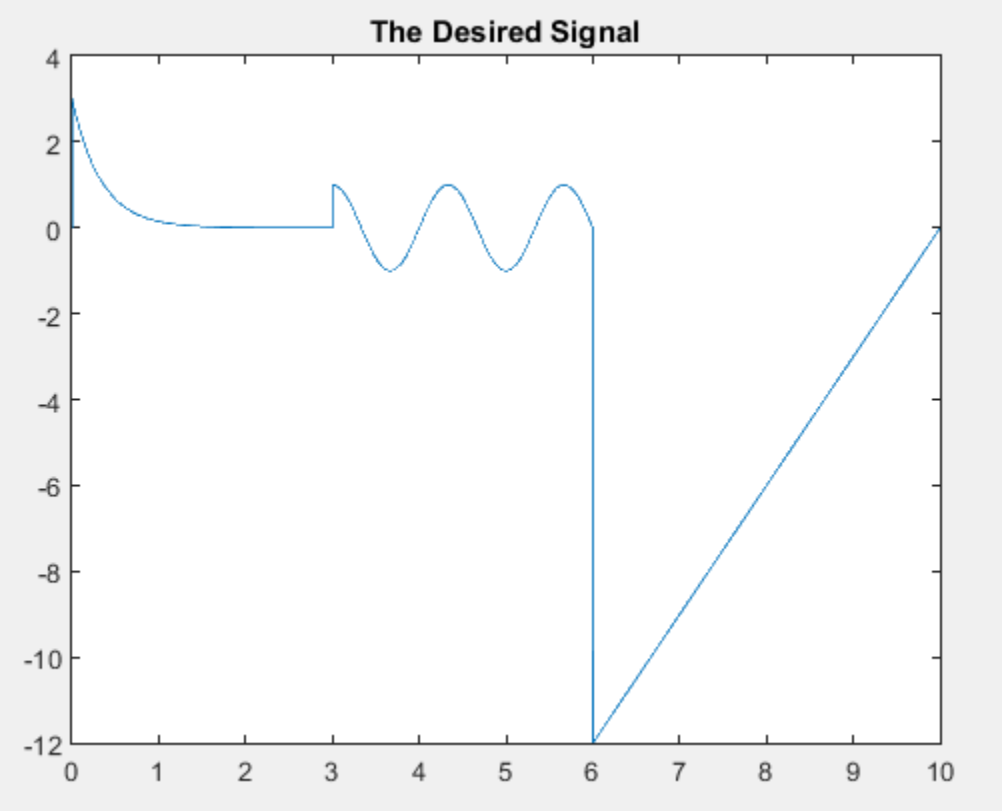
- Fs = 2500
- Start = 0
- end = 8
- break point number (BPN) = 2
- break point position (BPP) = 3,5
- Ramp → Slope = 1 , Intercept with x-axis = 0
- Sinusoidal → Amplitude = 2 , Frequency = 0.25 , Phase = 0
- DC → Amplitude = 2
- Operations number (ON) = 2
- Amplitude Scaling = 2
- Time Shift = -3

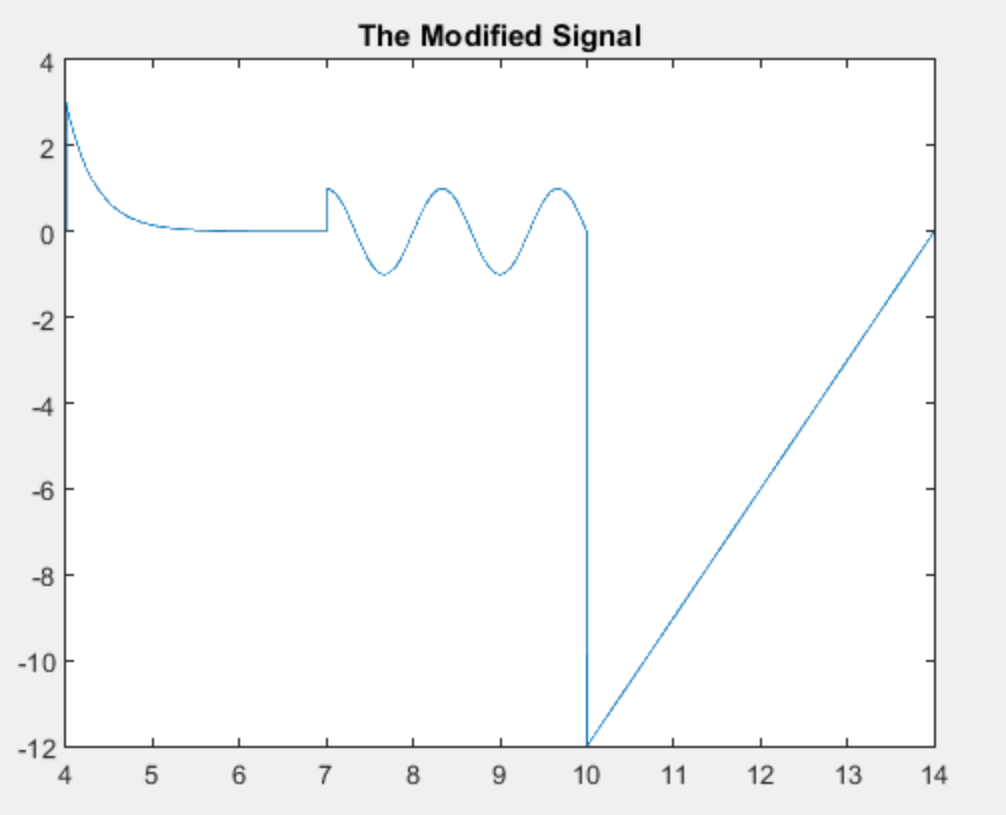

The Desired Signal
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
1
2
3
4
5
6
7
8


The Modified Signal
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
2
4
6
8
10
12
14
16
18
20

Example 7

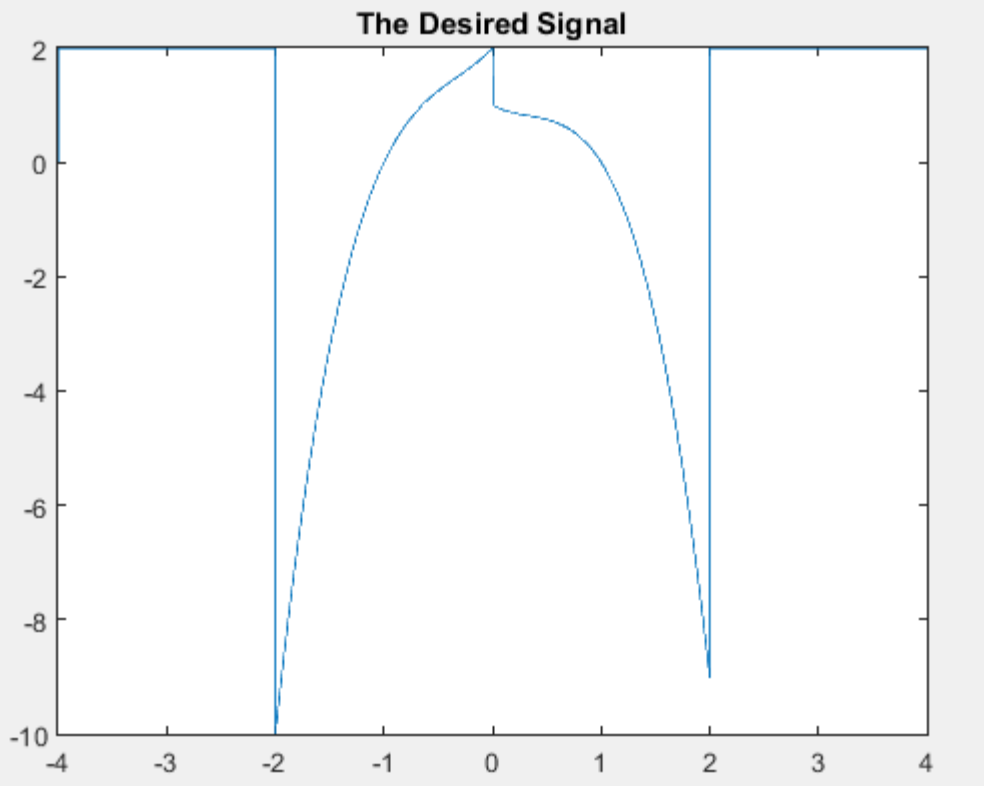
- Fs = 7250
- Start = 0
- end = 10
- break point number (BPN) = 2
- break point position (BPP) = 3,6
- Exponential → Amplitude = 3 , Exponent = -3
- Sinusoidal → Amplitude = 1 , Frequency = 0.75 , Phase = 0
- Ramp → Slope = 3 , Intercept with x-axis = 10
- Operations number (ON) = 3
- Amplitude Scaling = 2
- Time Shift = -4
- Compressing the signal = 2

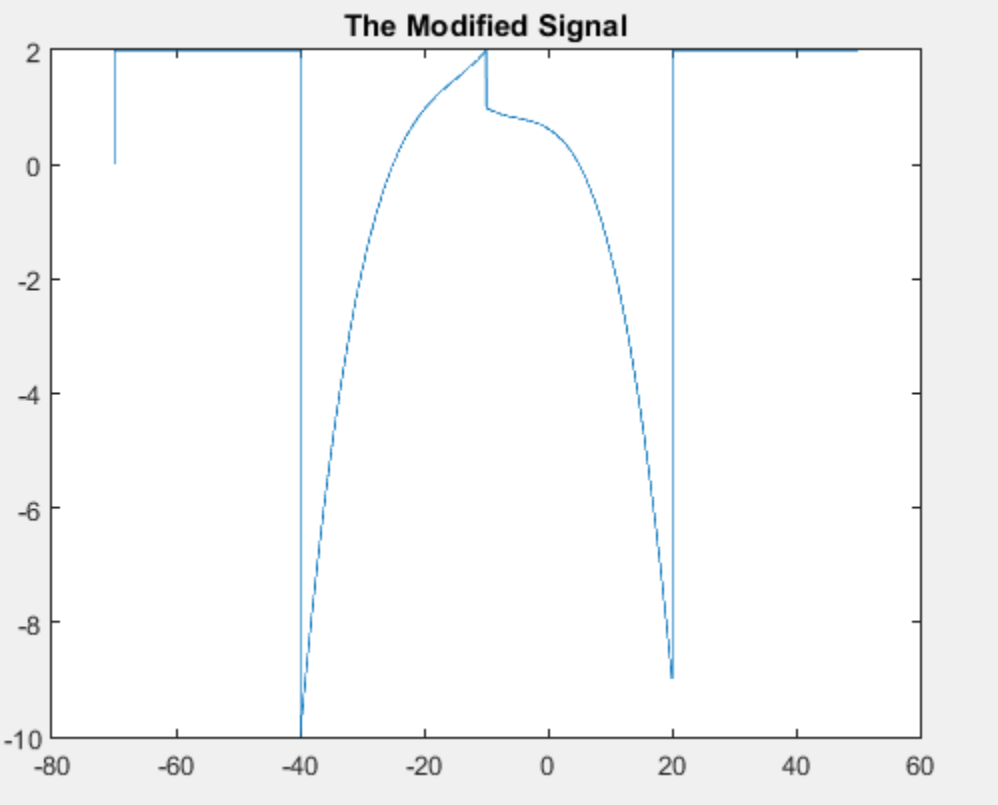




Example 8

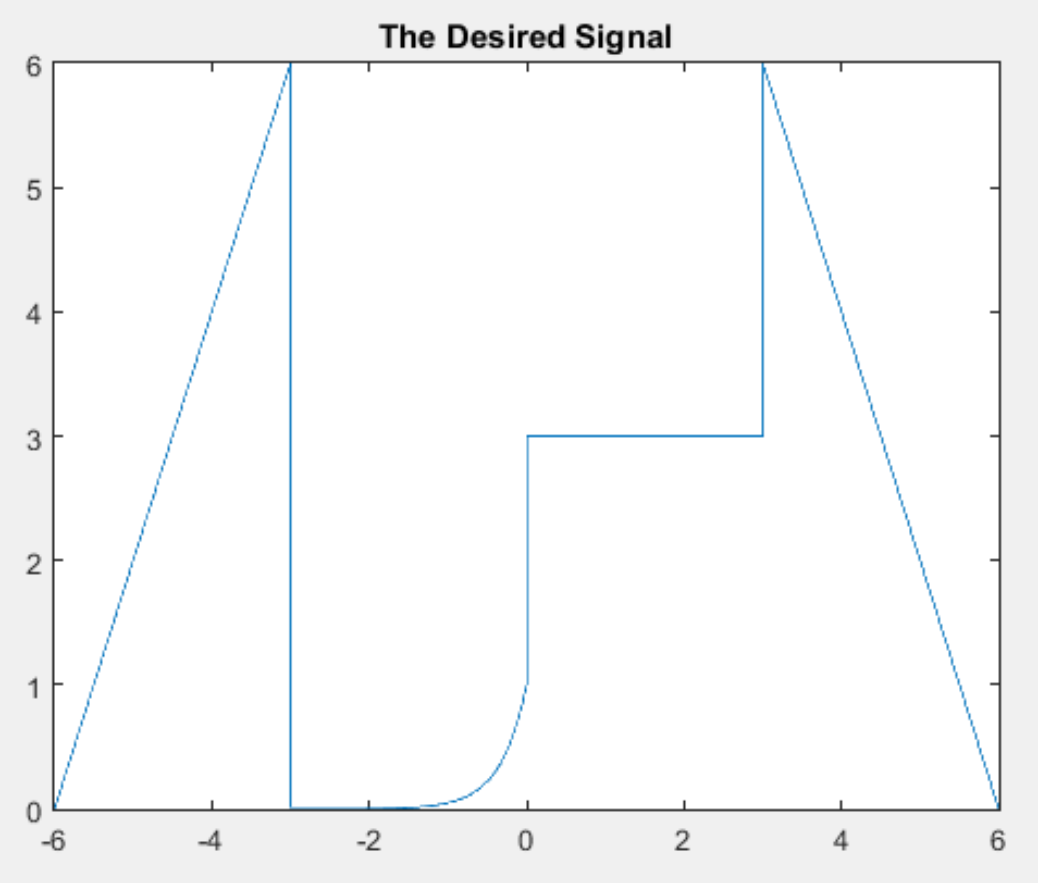
- Fs = 10000
- Start = -4
- end = 4
- break point number (BPN) = 3
- break point position (BPP) = -2,0,2
- DC → amplitude = 2
- General Order poly → Number of coefficients = 4 , Coefficients = 2,2,2,2
- General Order poly → Number of coefficients = 4 , Coefficients = -2,2,-1,1
- DC → amplitude = 2
- Operations number (ON) = 4
- Amplitude Scaling = 3
- Time Shift = 2
- Expanding the signal = 5
- Compressing the signal = 1

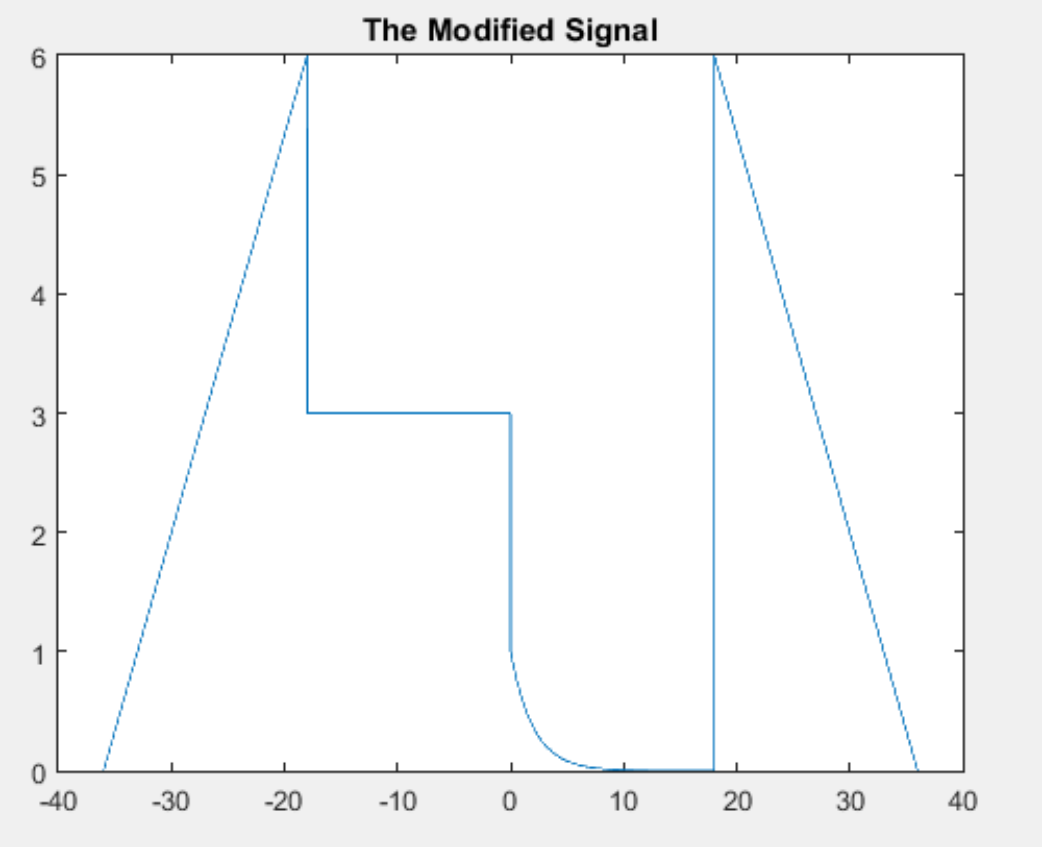

The Desired Signal
2
0
-2
-4
-6
-8
-10
-4
-3
-2
-1
0
1
2
3
4


The Modified Signal
2
0
-2
-4
-6
-8
-10
-80
-60
-40
-20
0
20
40
60

Example 9

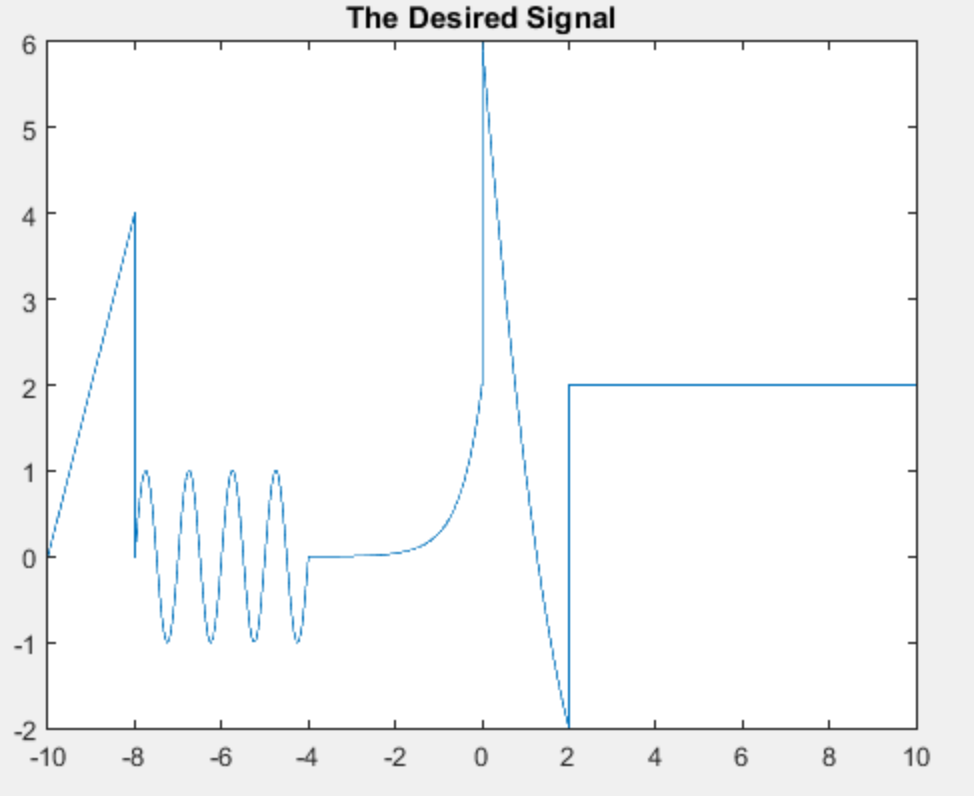
- Fs = 9000
- Start = -6
- end = 6
- break point number (BPN) = 3
- break point position (BPP) = -3,0,3
- Ramp → Slope = 2 , Intercept with x-axis = -6
- Exponential → Amplitude= 1 , Exponent = 3
- DC → Amplitude = 3
- Ramp → Slope = -2 , Intercept with x-axis = 6
- Operations number (ON) = 3
- Amplitude Scaling = 2
- Time Reversal
- Expanding the signal = 3

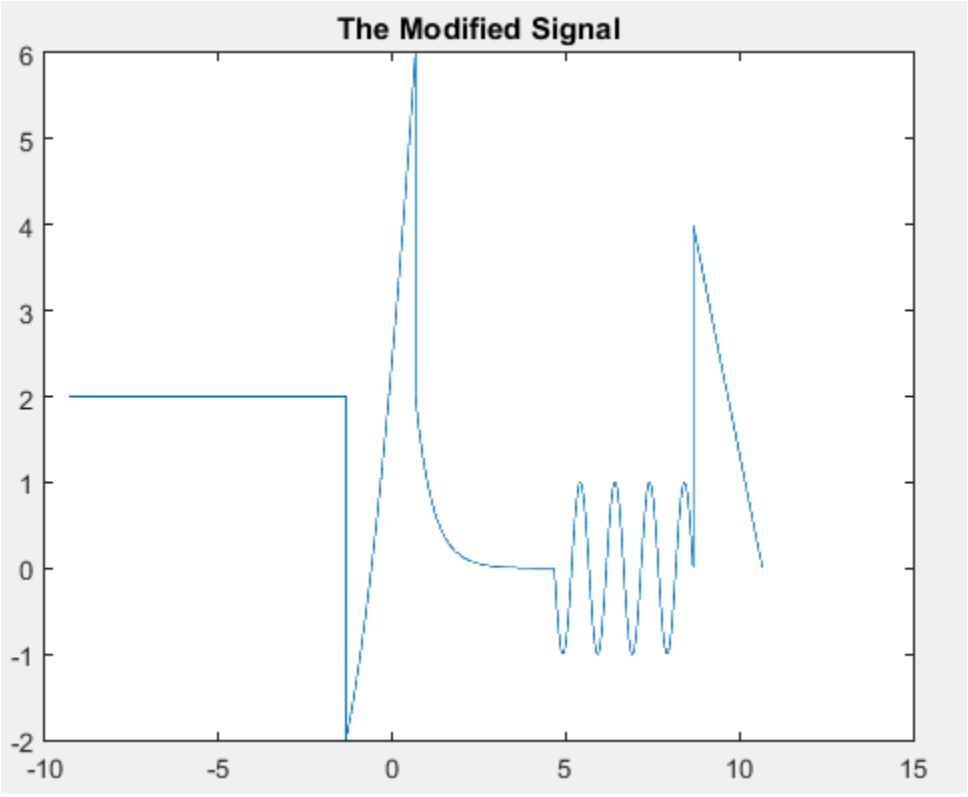




Example 10

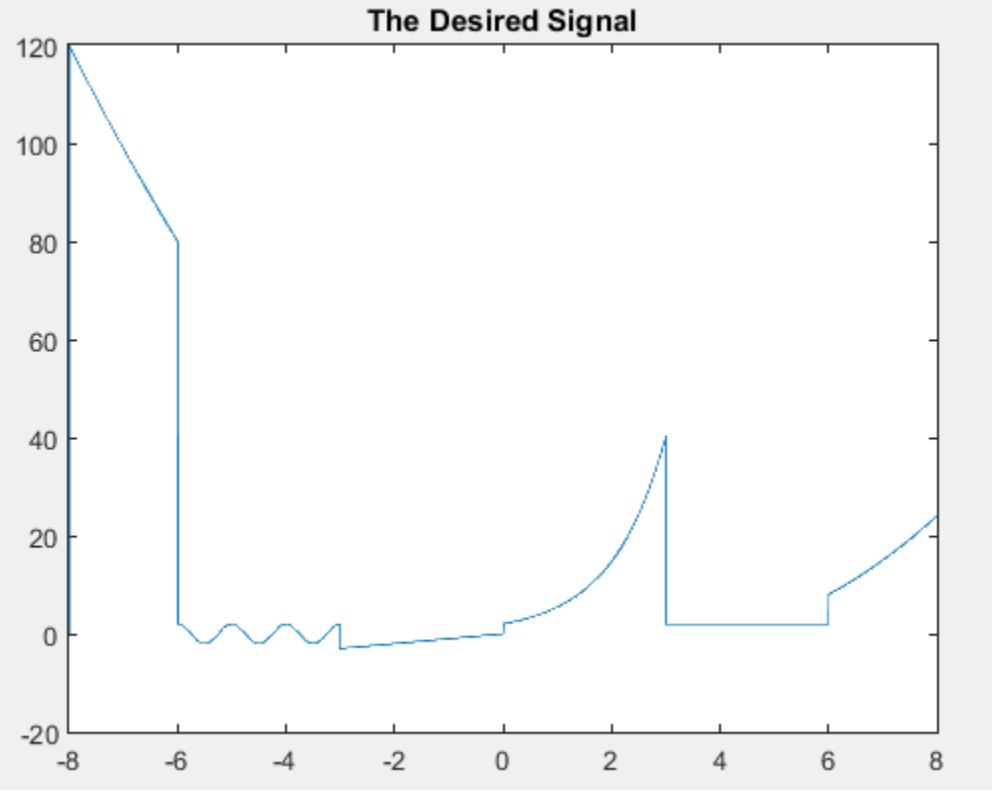
- Fs = 5000
- Start = -10
- end = 10
- break point number (BPN) = 4
- break point position (BPP) = -8,-4,0,2
- Ramp → Slope = 2 , Intercept with x-axis = -10
- Sinusoidal → Amplitude = 1 , Frequency = 1, Phase = 0
- Exponential → Amplitude= 2 , Exponent = 2
- General Order Poly → Number of Coefficients = 3, Coefficients = 1,-6,6
- DC → Amplitude = 2
- Operations number (ON) = 4
- Amplitude Scaling = 3
- Time Reversal
- Time Shift = -2
- Compressing the signal = 3

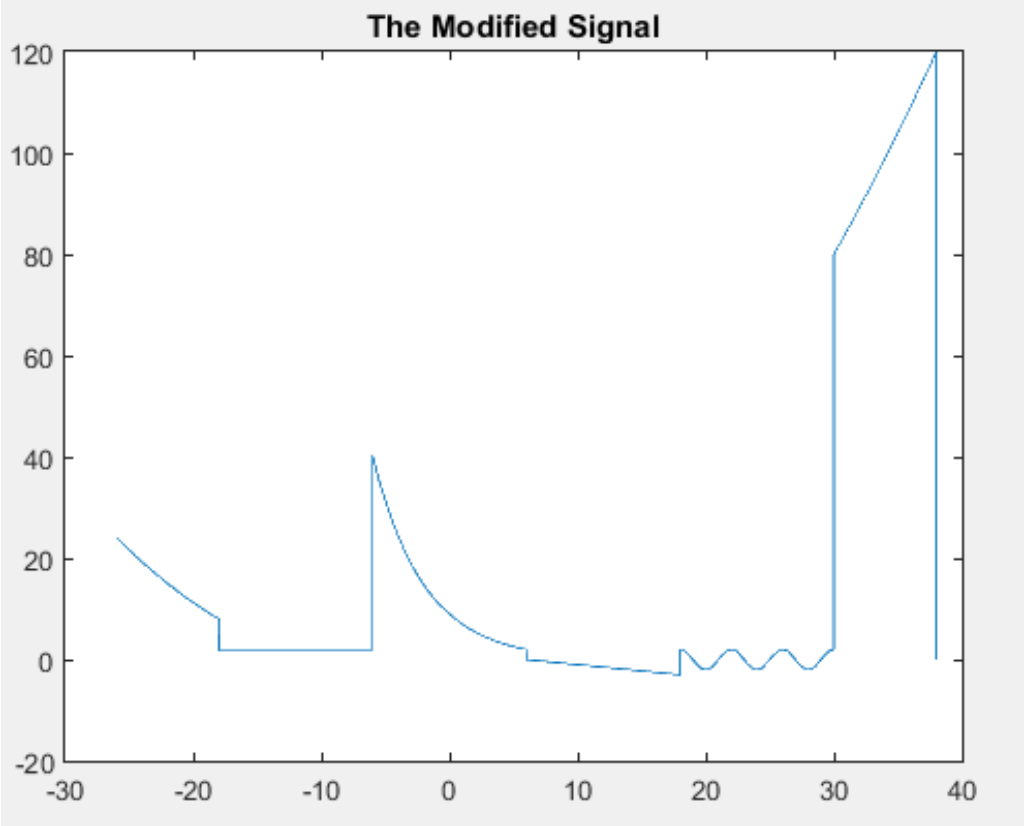

The Desired Signal
6
5
4
3
2
1
0
-1
-2
-10
-8
-6
-4
-2
0
2
4
6
8
10


The Modified Signal
6
5
4
3
2
1
0
-1
-2
-10
-5
0
5
10
15

Example 11

- Fs = 7000
- Start = -8
- end = 8
- break point number (BPN) = 5
- break point position (BPP) = -6,-3,0,3,6
- General Order Poly → Number of Coefficients = 3, Coefficients = 1,-6,8
- Sinusoidal → Amplitude = 2 , Frequency = 1, Phase =90
- Ramp → Slope = 1 , Intercept with x-axis = 0
- Exponential → Amplitude= 2 , Exponent = 1
- DC → Amplitude = 2
- General Order Poly → Number of Coefficients = 3, Coefficients = 1,-6,8
- Operations number (ON) = 4
- Amplitude Scaling = 2
- Time Reversal
- Time Shift = -3
- Expanding the signal = 2




The Modified Signal
120
100
80
60
40
20
0
-20
-30
-20
-10
0
10
20
30
40