Signals and Systems

Final Project

Part 2

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6287

Group 3 Section 2

Code

```
fs=input('Enter the frequency sampling: ');
n=input('Enter the start of time scale: ');
m=input('Enter the end of time scale: ');
bp_number=input('Enter the number of break points: ');
bpt=zeros(1,bp_number);
signal=zeros(1,0);
t=linspace(n,m,((m-n)*fs));

for i= 1:bp_number
   fprintf('Enter the position of breakpoint %i: ',i);
   bpt(i)=input('');
end

fprintf('\n');
T=[n bpt m];
poly=0;
for j=1:bp_number+1
    fprintf('--------------------------------------------------------------------------\n');
    fprintf('1-DC signal\t 2-Ramp Signal\t3-General Order Polynomial\n4-Exponential Signal\t5-
Sinusoidal Signal\n');
    fprintf('--------------------------------------------------------------------------\n\n');
    fprintf('for the interval %i to %i Enter the type of the signal: ',T(j),T(j+1));
    x=input('');

    switch x
        case 1
            fprintf('Enter the amplitude: ');
            amp=input('');
            fprintf('\n');
            DC=amp*ones(1,(T(j+1)-T(j))*fs);
            signal=[signal DC];
        case 2
            t1=linspace(T(j),T(j+1),(T(j+1)-T(j))*fs);
            fprintf('Enter the slope: ');
            slope=input('');
            fprintf('Enter the intercept: ');
            incpt=input('');
            fprintf('\n');
            ramp=slope*t1+incpt;
            signal=[signal ramp];
        case 3
            t2=linspace(T(j),T(j+1),(T(j+1)-T(j))*fs);
            fprintf('Enter equation in the form a(t^p)+b(t^(p-1))+...+c\n');
            fprintf('Power(p) = ');
            p=input('');
            z=p;
            for k=1:p
                fprintf('enter the coefficient of t^%i: ',z);
                a=input('');
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                poly=poly+(a*(t2.^z));
                z=z-1;
            end
            fprintf('Intercept(c)= ');
            c=input('');
            poly=poly+c;
            signal=[signal poly];
        case 4
            t3=linspace(T(j),T(j+1),(T(j+1)-T(j))*fs);
            fprintf('Enter equation in the form A(e^Pt)\n');
            fprintf('Amplitude(A) = ');
            A=input('');
            fprintf('Power(P) = ');
            P=input('');
            expo=A*exp(P*t3);
            signal=[signal expo];
        case 5
             t4=linspace(T(j),T(j+1),(T(j+1)-T(j))*fs);
             fprintf('Enter equation in the form Asin(wt+phase)\n');
             fprintf('Amplitude(A) = ');
             amplitude=input('');
             fprintf('Frequency(w) = ');
             w=input('');
             fprintf('Phase (in degrees)= ');
             phase=deg2rad(input(''));
             sinusoidal=amplitude*sin((2*pi*w*t4)+phase);
             signal=[signal sinusoidal];
        otherwise
            fprintf('Please enter a valid number\n');
    end
end
plot(t,signal);
grid;

while true
    fprintf('-------------------------------------------------------------------------\n');
    fprintf('\t\t\t\t\t| Operations |\n');
    fprintf('-------------------------------------------------------------------------\n');
    fprintf('1-Amplitude Scaling\t 2-Time Reversal\t3-Time Shift\n4-Expanding the signal\t5-
Compressing the signal\t6-None\n');
    fprintf('-------------------------------------------------------------------------\n\n');
    fprintf('Choose an operation: ');
    y=input('');
    switch y
        case 1
            fprintf('Enter scaling value : ');
            v=input('');
            signal=v*signal;
        case 2
            t=-1*t;
        case 3
            fprintf('Enter time shift value : ');
            shift=input('');
            t=t-shift;
```
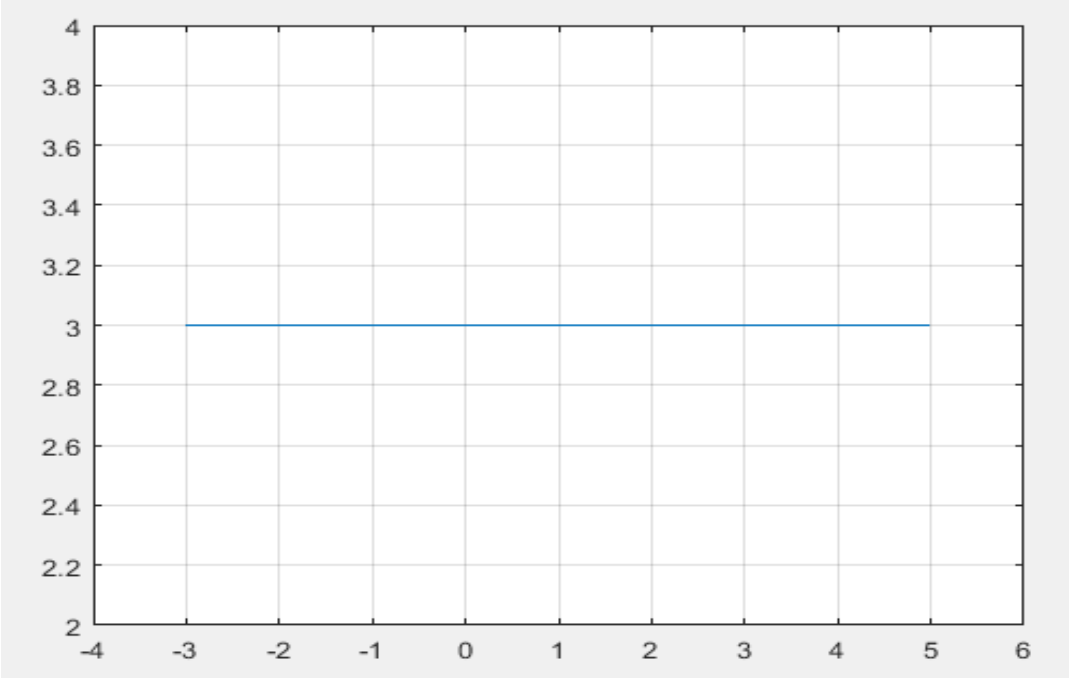

```
        case 4
            fprintf('Enter the expanding value : ');
            k=input('');
            t=t*k;
        case 5
            fprintf('Enter the compressing value : ');
            l=input('');
            t=t/l;
        case 6
            break
        otherwise
             fprintf('Please enter a valid number\n');
    end
    fprintf('Done? 1-Yes  2-No ');
    yn=input('');
    if yn==1
        break
    end
end

plot(t,signal);
grid;
```

Test Cases

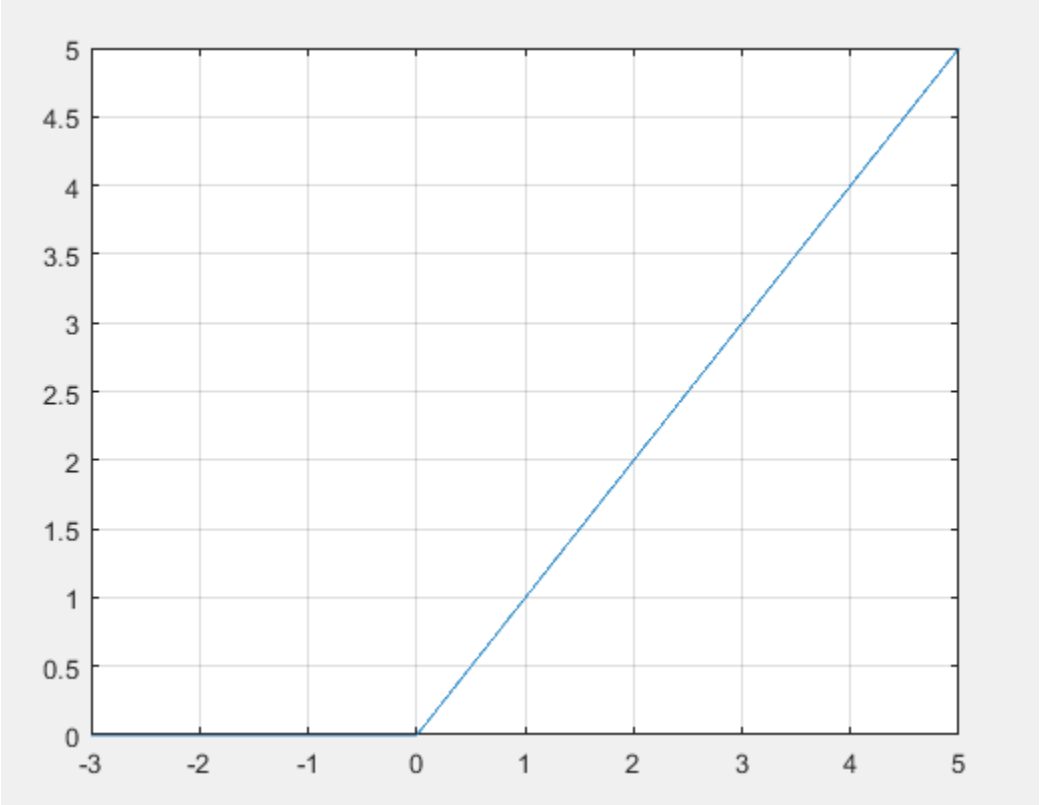
Signal 1



•Y(t)=3(u(t+3) – u(t-5)) , Dc Signal from -3 to 5

1. Fs = 100
2. Start Point: -3
3. End Point: 5
4. Number Of Breakpoints: 0
5. Amplitude: 3

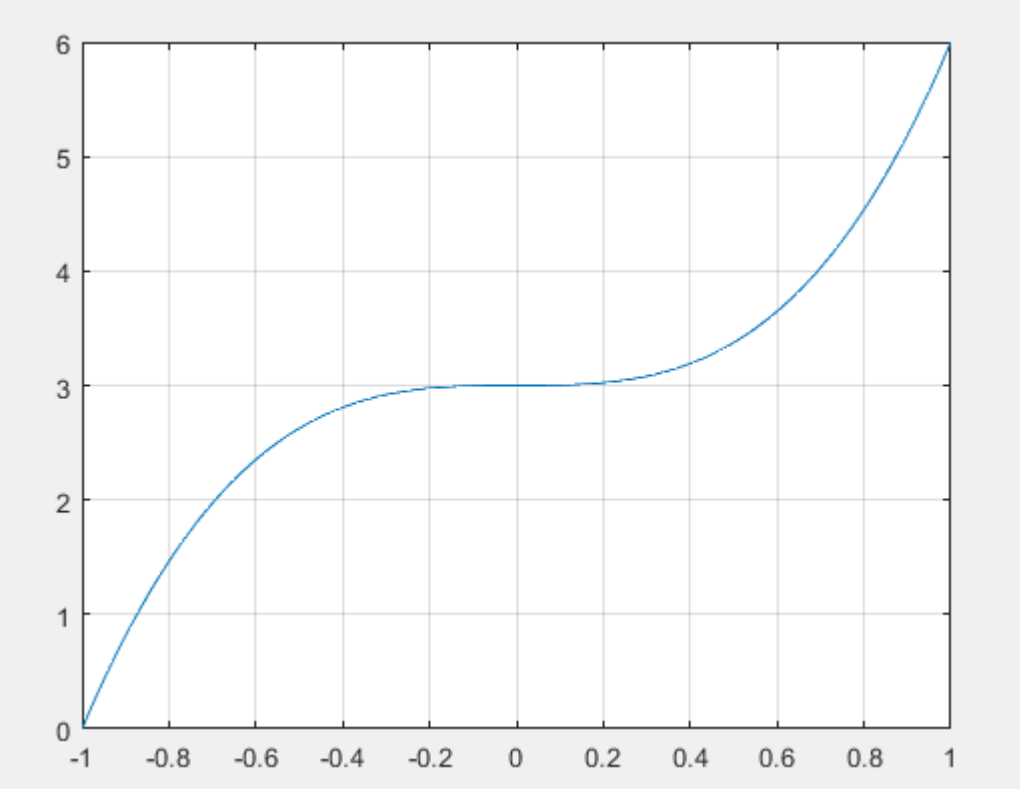
Signal 2



•Y(t)=r(t)-r(t-5)-5u(t-5) , Ramp Signal from 0 to 5

1. Fs = 100
2. Start Point: 0
3. End Point: 5
4. Number Of Breakpoints: 0
5. Slope: 1
6. Intercept: 0

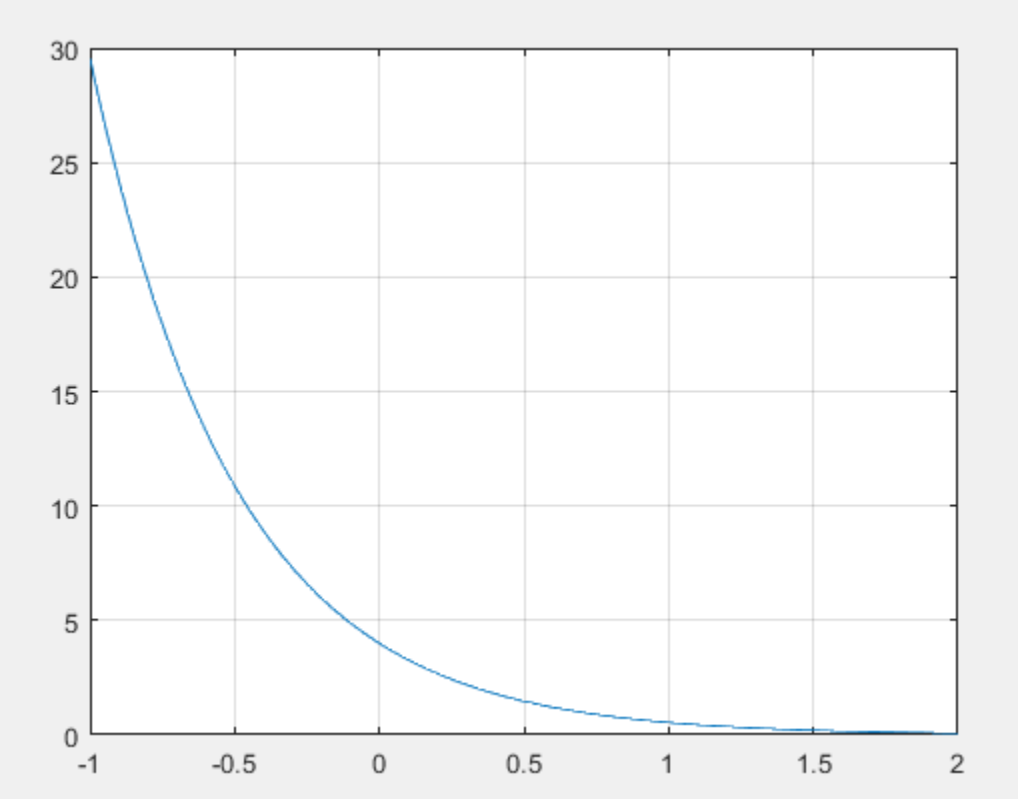
Signal 3



•$Y(t)=3(t^3)+3$, General Order Polynomial

1. Fs = 100
2. Start Point: -1
3. End Point: 1
4. Number Of Breakpoints: 0
5. Coefficient of t^3 : 3
6. Intercept: 3

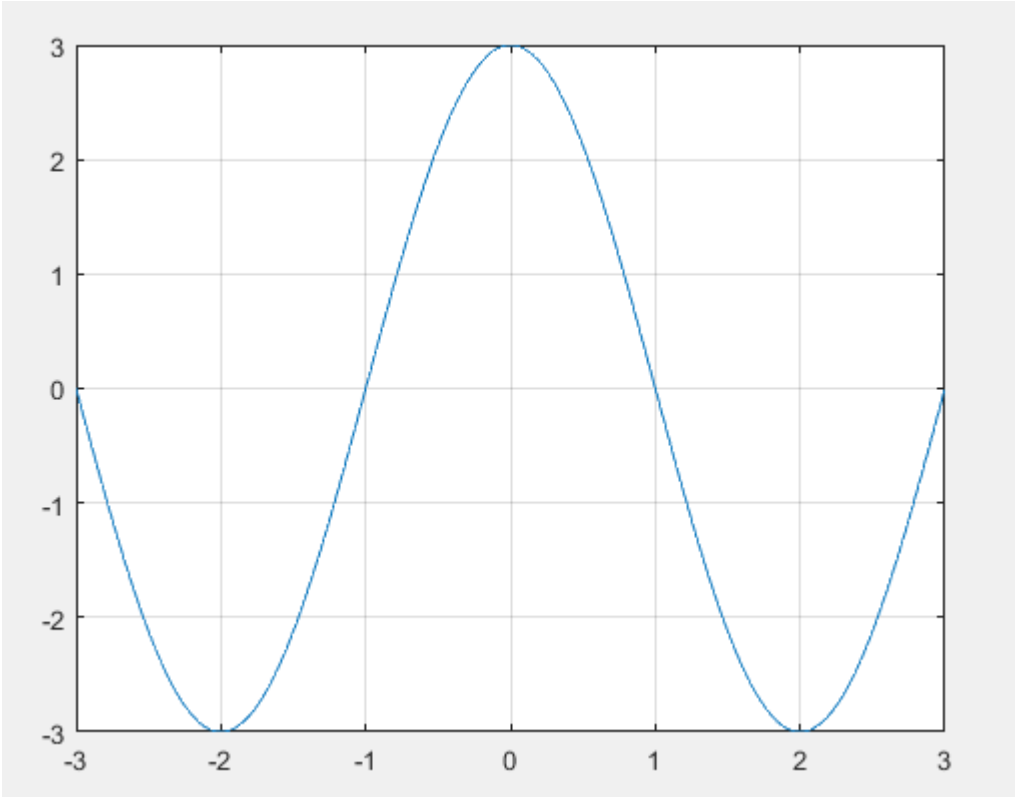
Signal 4



•Y(t)=$4e^{-2t}$, Exponential Signal

1. Fs = 100
2. Start Point: -1
3. End Point: 2
4. Number Of Breakpoints: 0
5. Amplitude : 4
6. Exponent : -2

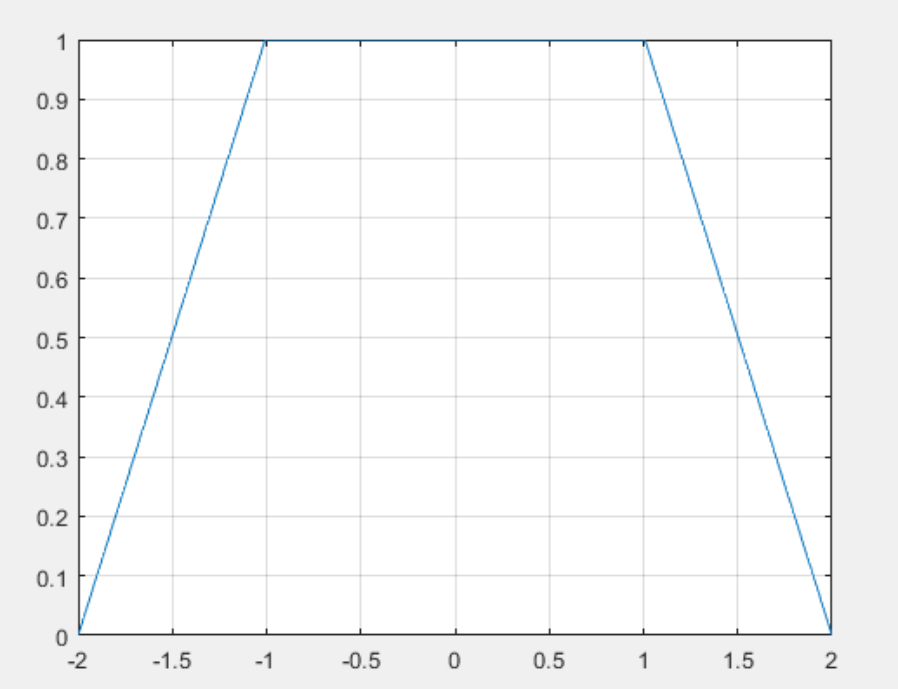
Signal 5



- $Y(t) = 3\ Sin(2 * \Pi * 0.25 * t + \frac{\Pi}{2})$, Sinusoidal Signal

1. Fs = 100
2. Start Point: -3
3. End Point: 3
4. Number Of Breakpoints: 0
5. Amplitude : 3
6. Frequency : 0.25
7. Phase : $\frac{\Pi}{2}$

Signal 6



•Y(t)= r(t+2)-r(t+1)-r(t-1)+r(t-2)

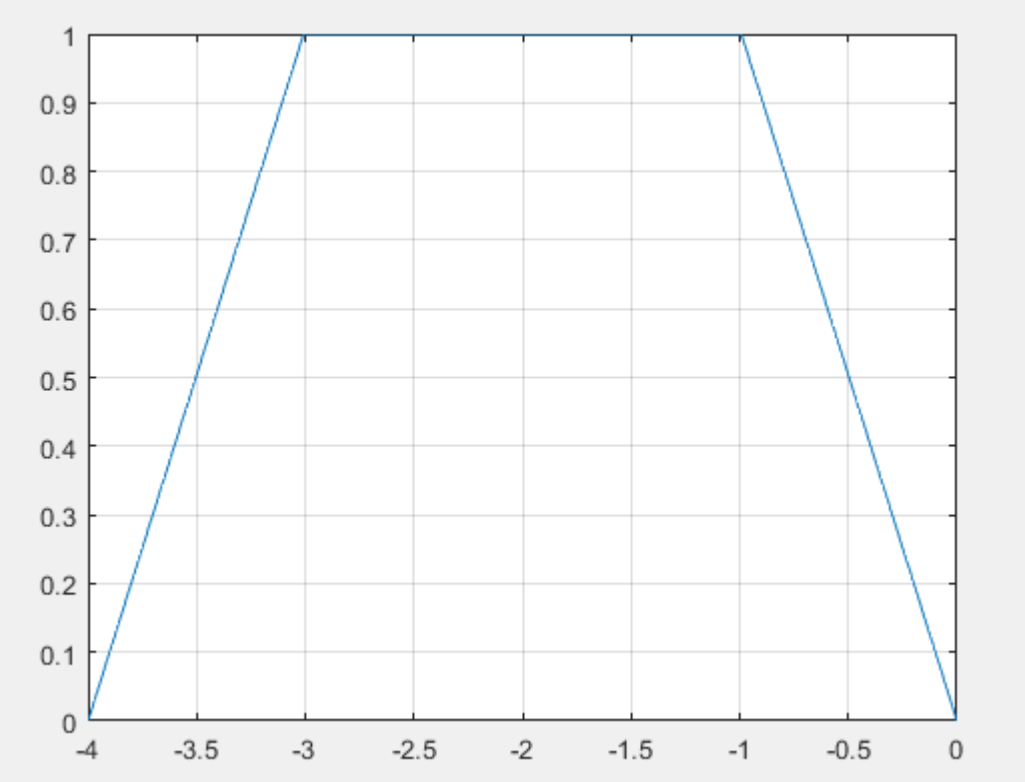
1. Fs = 100
2. Start Point: -2
3. End Point: 2
4. Number Of Breakpoints: 2 {-1,1}

From -2 to -1: Ramp Signal with slope = 1 and intercept = 2

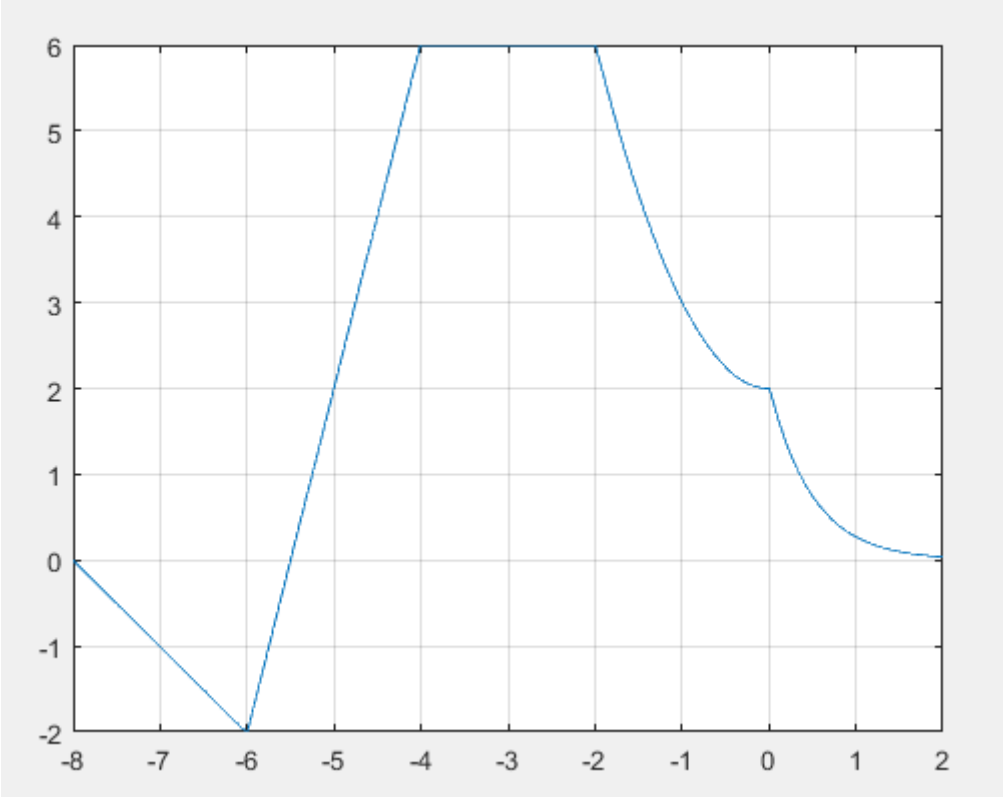
From -1 to 1: DC Signal with Amplitude = 1

From 1 to 2: Ramp Signal with slope = -1 and intercept = 2

-With shift of value 2:



Signal 7



1. Start Point: -8
2. End Point: 2
3. Number Of Breakpoints: 4 {-6,-4,-2,0}

From -8 to -6: Ramp Signal with slope = -1 and intercept = -8

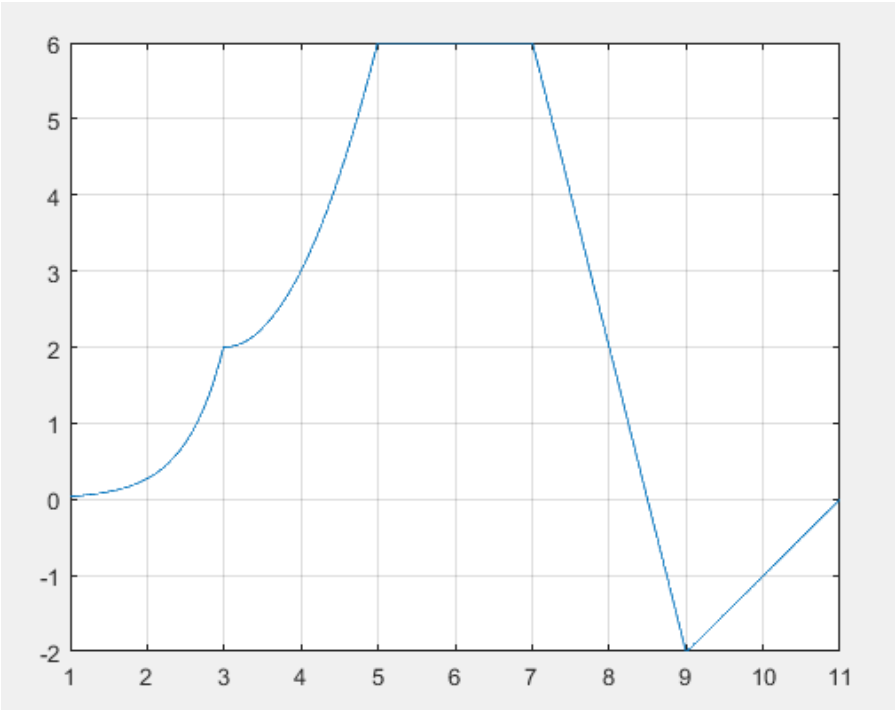
From -6 to -4: Ramp Signal with slope = 4 and intercept = 22

From -4 to -2: DC Signal with amplitude = 6

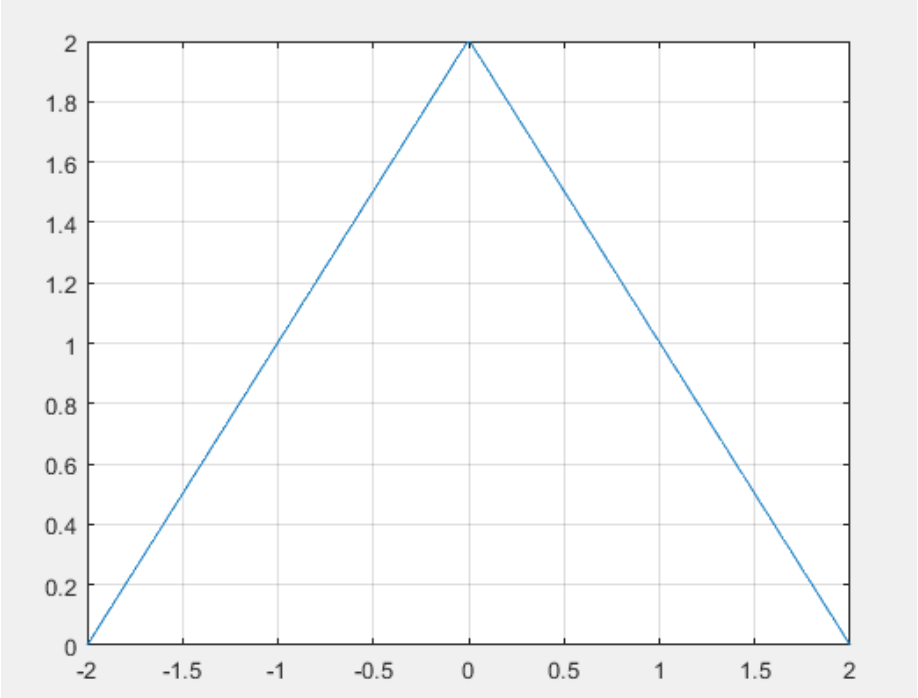
From -2 to 0: Second Order Polynomial $(t^2 + 2)$

From 0 to 2: Exponential Signal with Amplitude = 2 And Exponent = -2

With Time Traversal and Shift with magnitude -3:



Signal 8

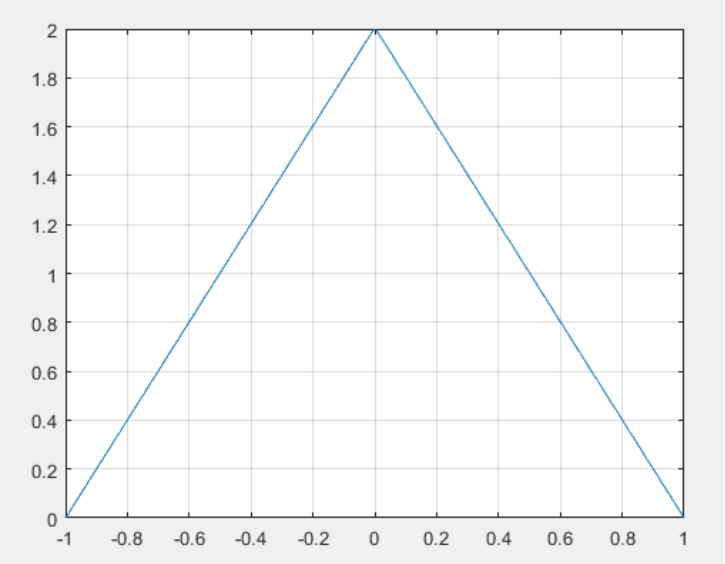


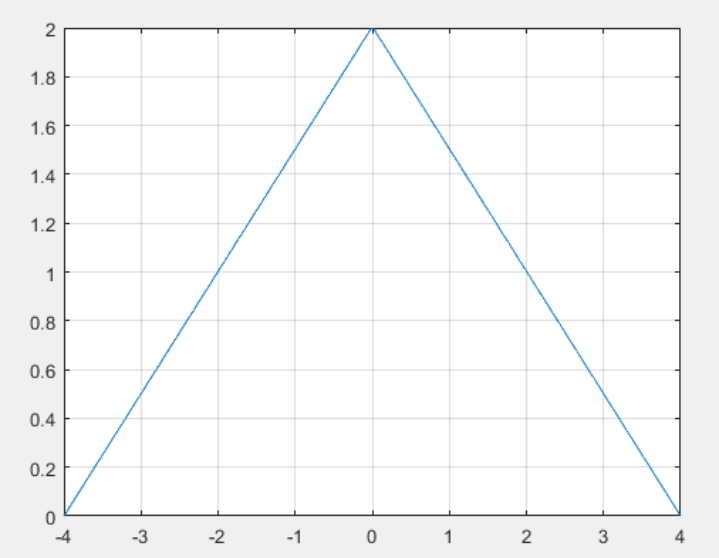
1. Time start: -2
2. Time End: 2
3. Number of Breakpoints: 1 {0}

From -2 to 0: Ramp Function with slope = 1 and Intercept = 2

From 0 to 2: Ramp Function with slope = -1 and Intercept = 2

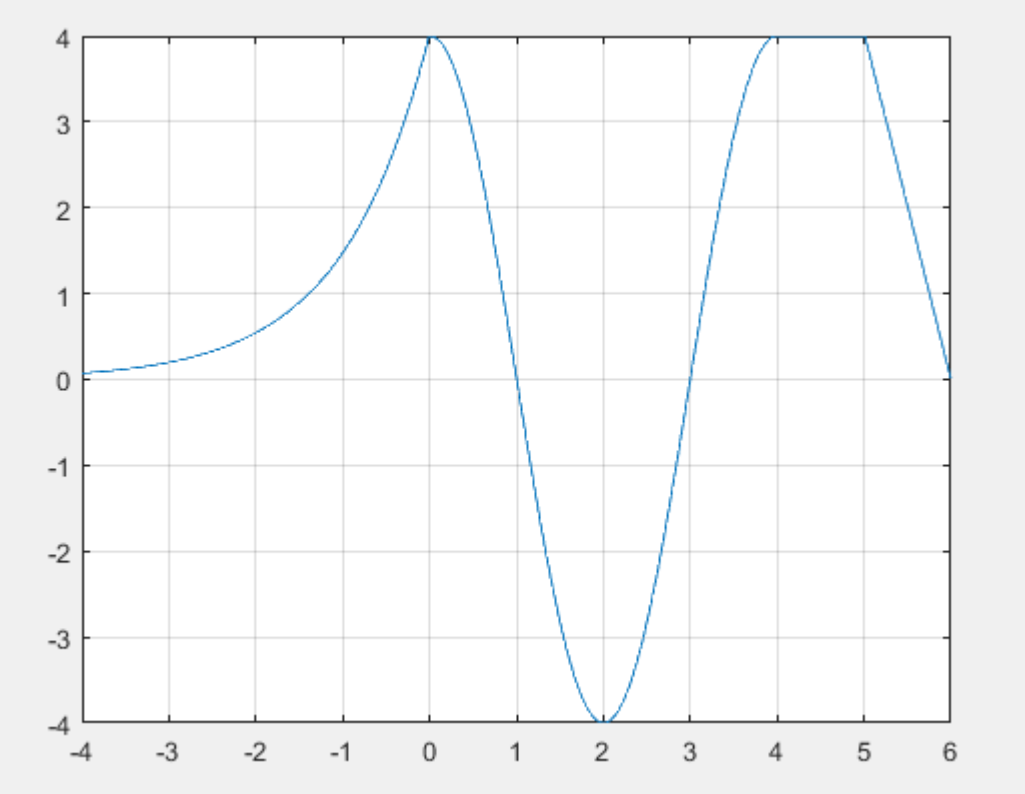
Compression with value of 2:





Expansion with value of 2

Signal 9



1. Time Start: -4
2. Time End: 6
3. Number Of Breakpoints: 3 {0,4,5}

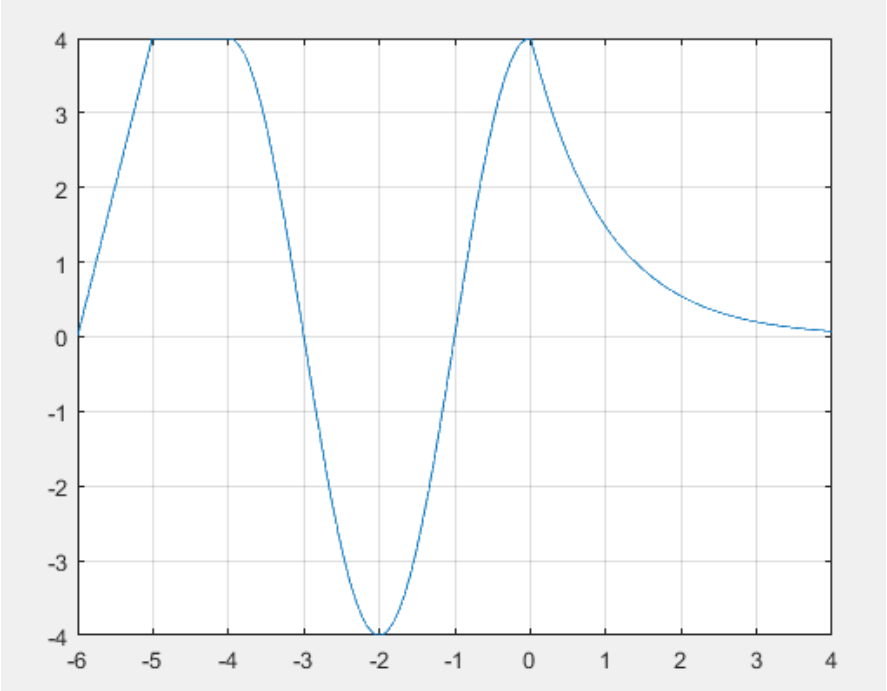
From -4 to 0: Exponential signal with amplitude = 4 and exponent = 1

From 0 to 4: Sinusoidal Signal with Amplitude=4, Freq.=0.25 and Phase = $\frac{\Pi}{2}$

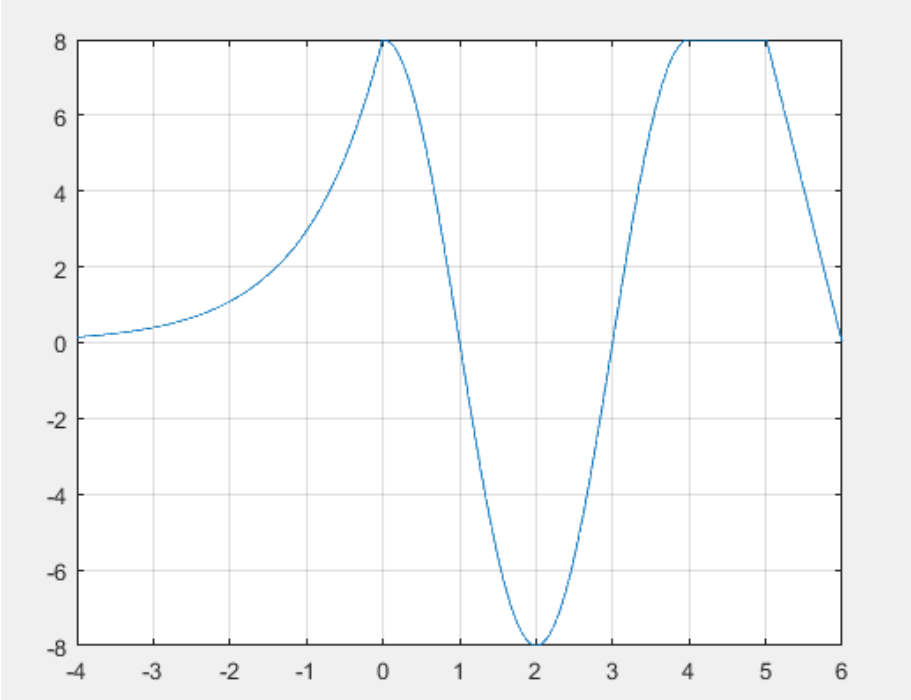
From 4 to 5: DC Signal with Amplitude = 4

From 5 to 6: Ramp Signal with slope = 4 and intercept = 24

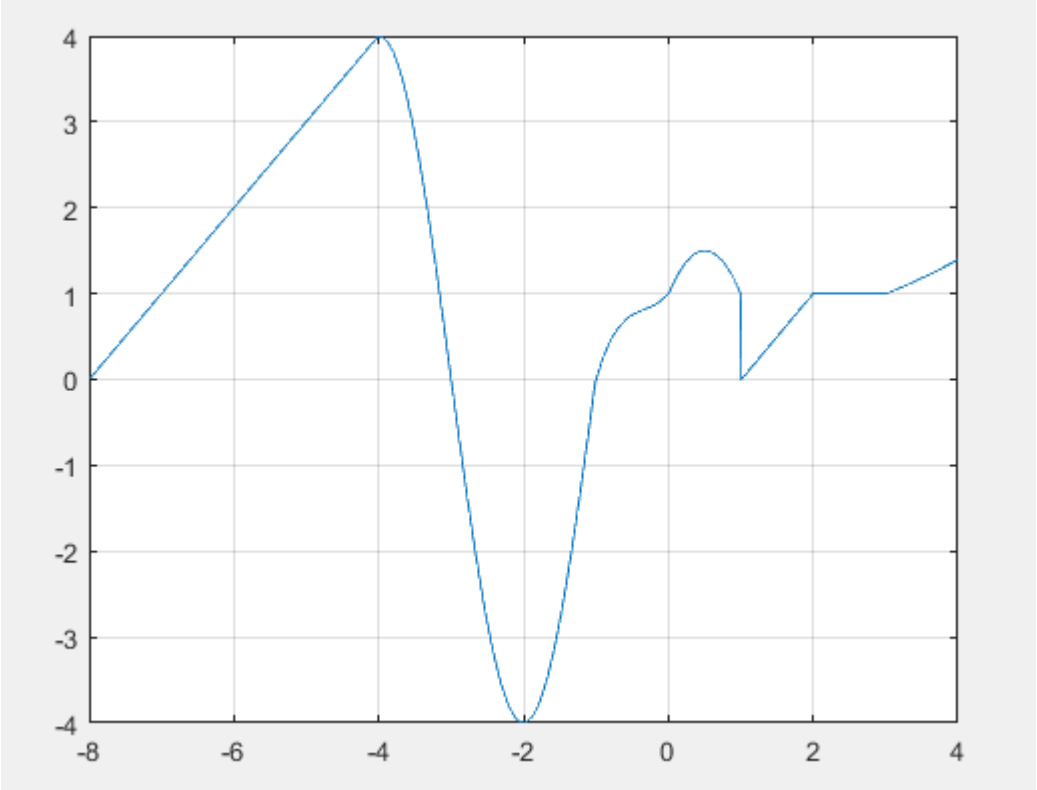
Signal with Time traversal:



Signal with Amplitude Scaling of value 2:



Signal 10



1. Start Time: -8
2. End Time: 4
3. Number Of Breakpoints: 6 {-4,-1,0,1,2,3}

From -8 to -4: Ramp signal with slope=1 and intercept = 8

From -4 to -1: Sinusoidal with Amp=4, freq. =0.25 and phase = $\frac{\pi}{2}$

From -1 to 0: Third order Polynomial $(2t^3 + 2t^2 + t^1 + 1)$

From 0 to 1: Third order Polynomial $(-2t^3 + 2t^2 - t^1 + 1)$

From 1 to 2: Ramp Signal with slope = 1 and intercept = -1

From 2 to 3: DC Signal with amplitude = 1

From 3 to 4: Exponential signal with Amp. = 0.3678 and exponent = $\frac{1}{3}$

Signal after Expansion of value 2, Shift with value 2 and Time traversal: