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Lab 2 - C2 6/5/2017

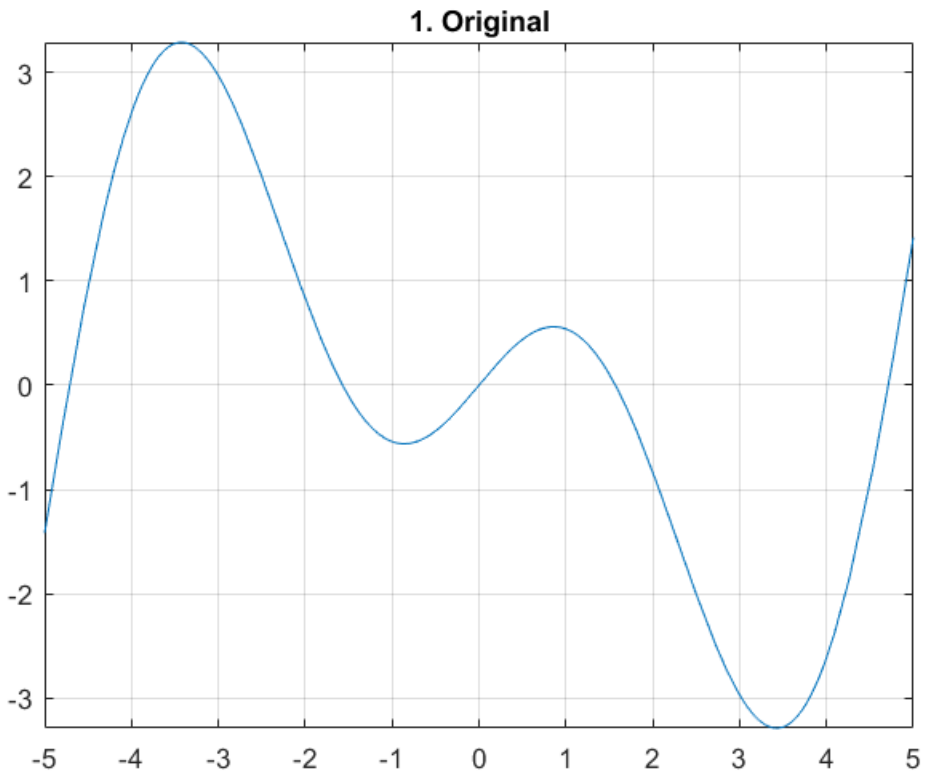
```
close all; clc; clear;
```

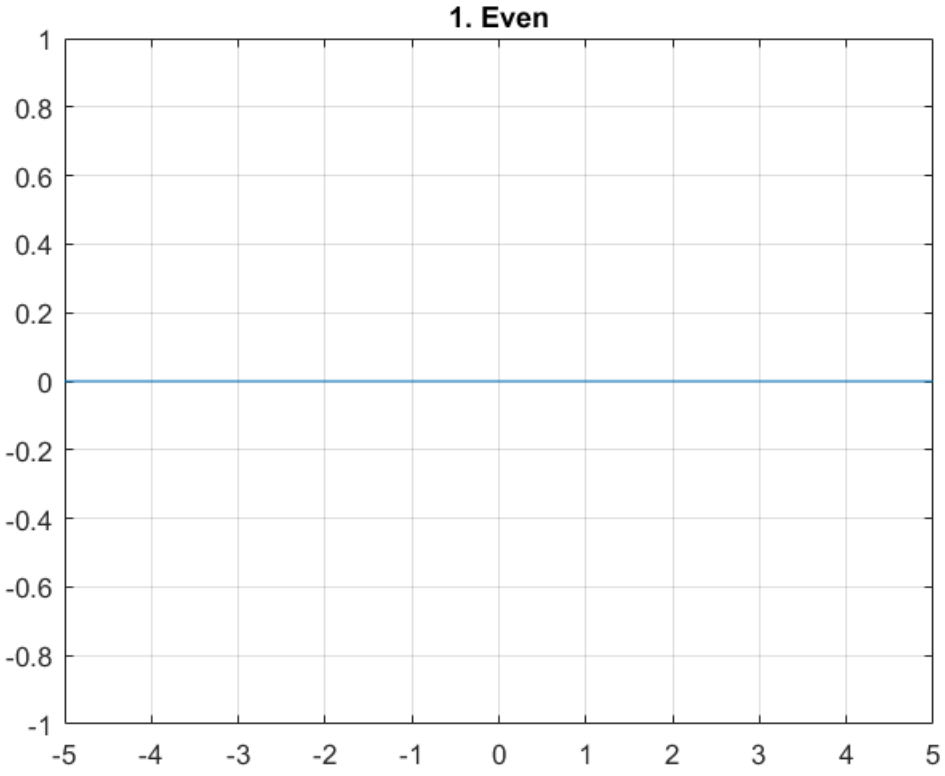
Problem 1

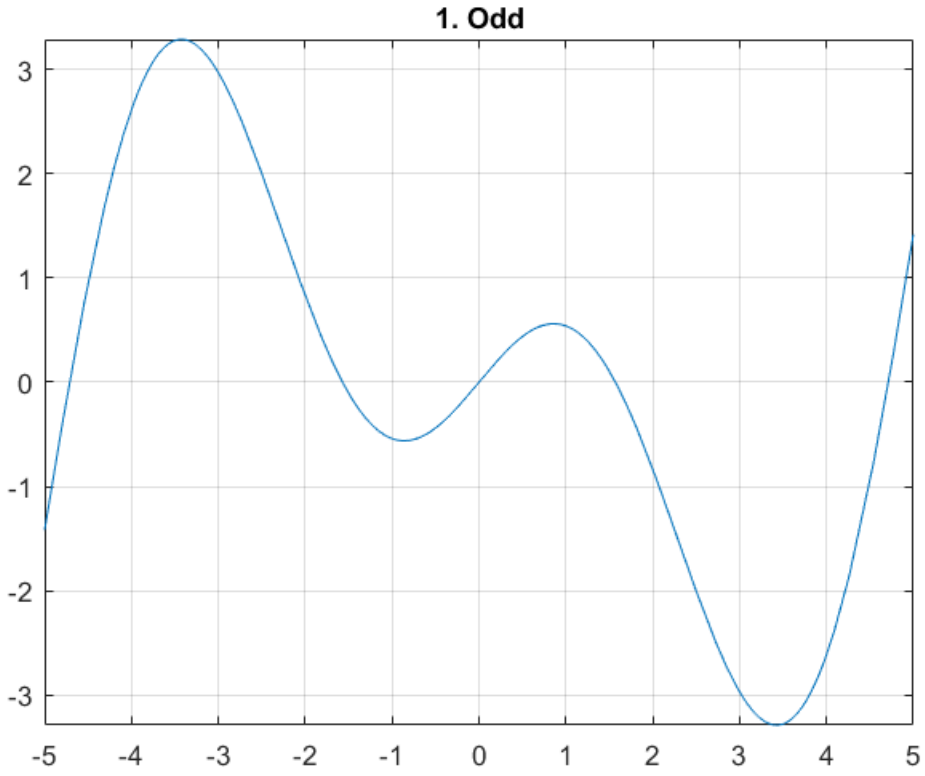
```
syms t
x = t*cos(t)
fplot(x)
title('1. Original')
grid on

xe = (x + subs(x,t,-t))/2
xo = (x - subs(x,t,-t))/2
xs = xe+xo

figure;
fplot(xe)
title('1. Even')
grid on

figure;
fplot(xo)
title('1. Odd')
grid on

figure;
fplot(xs)
title('1. Sum')
grid on

% The signal is odd since it has x & y axis symmetry
% This is also confirmed when the original plot = odd plot = sum plot
% Showing that the even plot has no effect
```

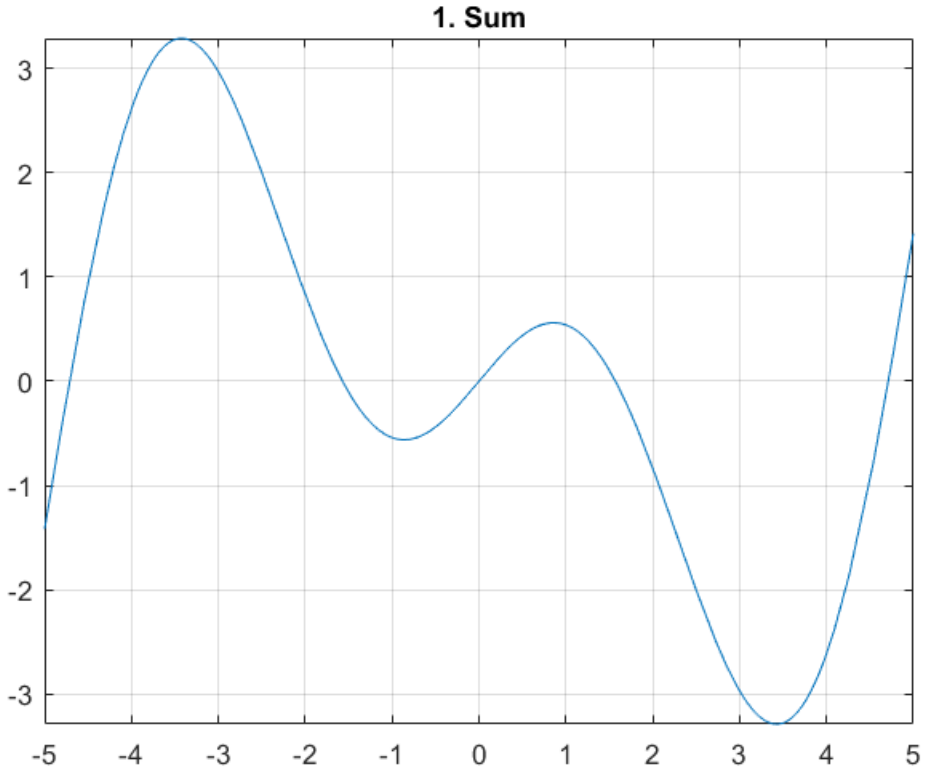
```
x =
```

```
t*cos(t)

xe =

0

xo =

t*cos(t)

xs =

t*cos(t)
```




1. Even
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-5
-4
-3
-2
-1
0
1
2
3
4
5

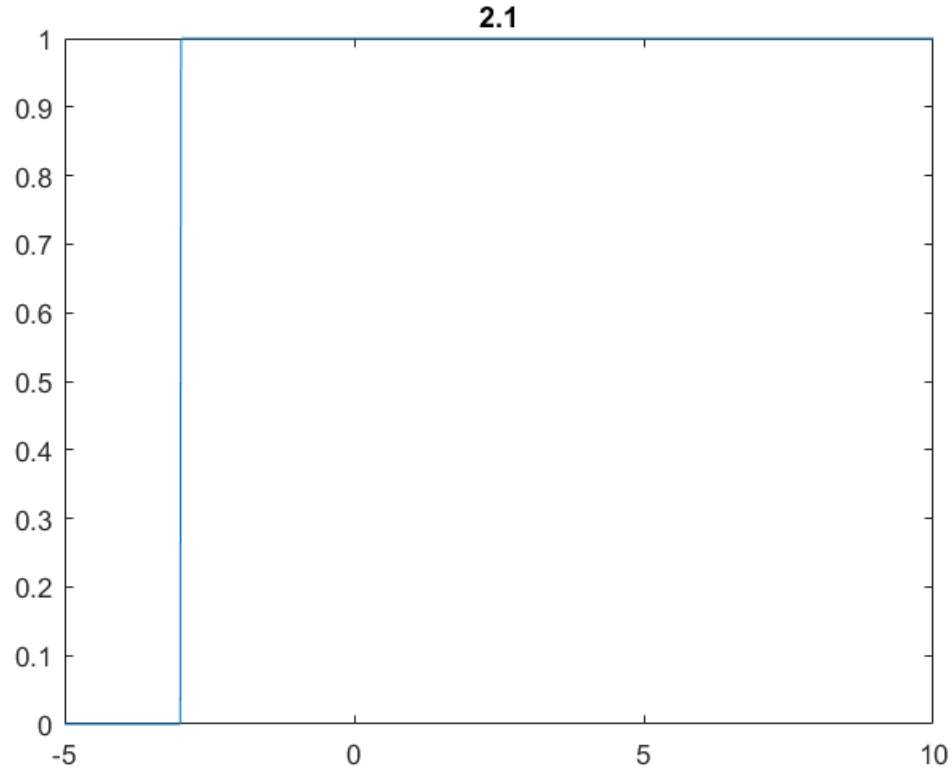

1. Odd
3
2
1
0
-1
-2
-3
-5
-4
-3
-2
-1
0
1
2
3
4
5

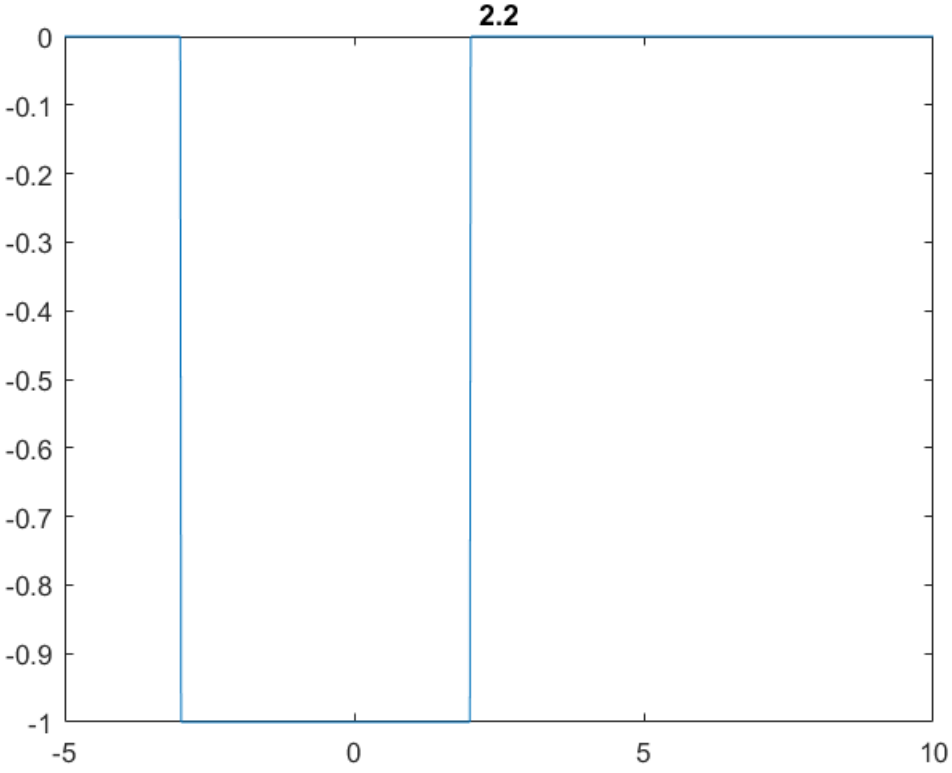


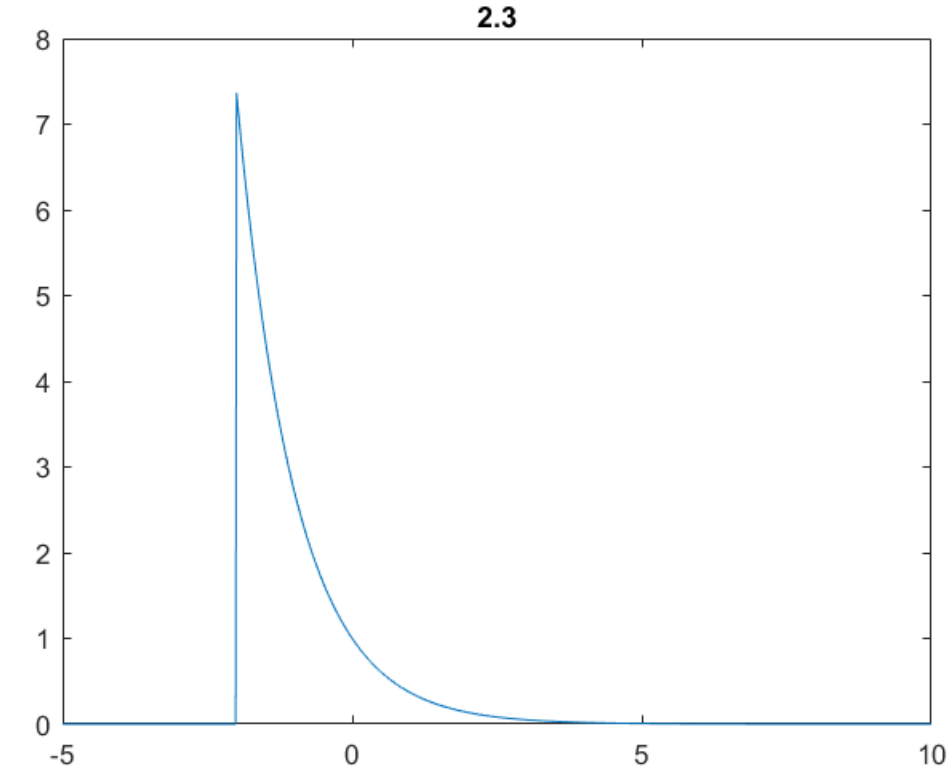
Problem 2

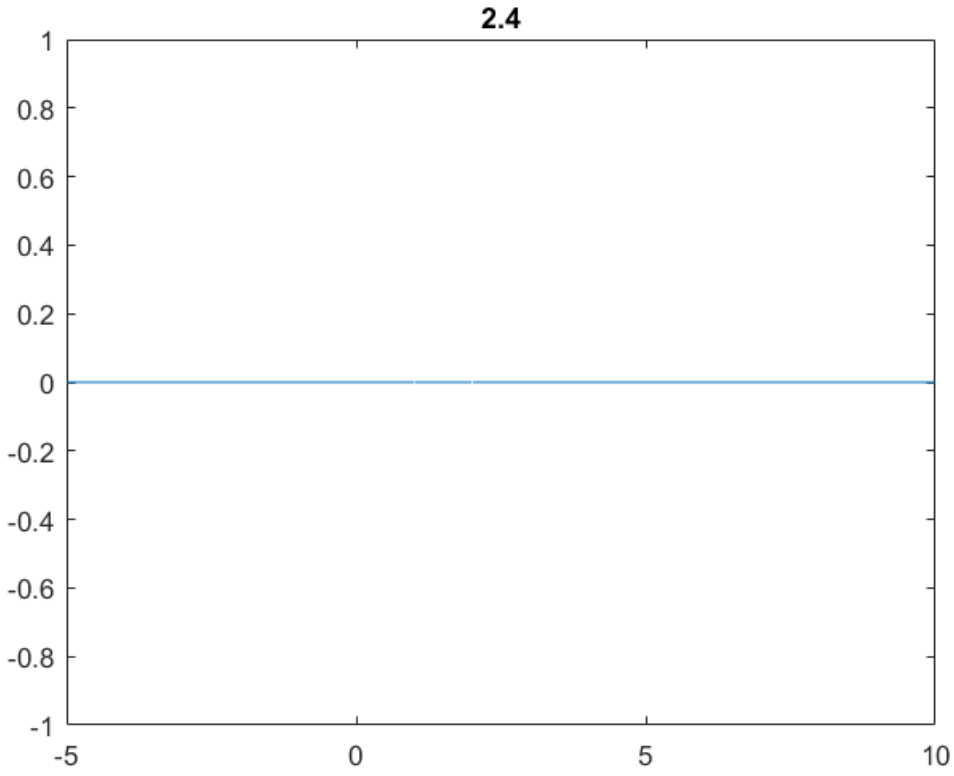
```
t = linspace(-5,10,1000);

%2.1
figure;
u = heaviside(t+3);
plot(t,u);
title('2.1')

%2.2
figure;
u1 = heaviside(t-2);
u2 = u1-u; %using u from 2.1
plot(t,u2)
title('2.2')

%2.3
figure;
u = heaviside(t+2);
plot(t,exp(-t).*u)
title('2.3')

%2.4
figure;
```

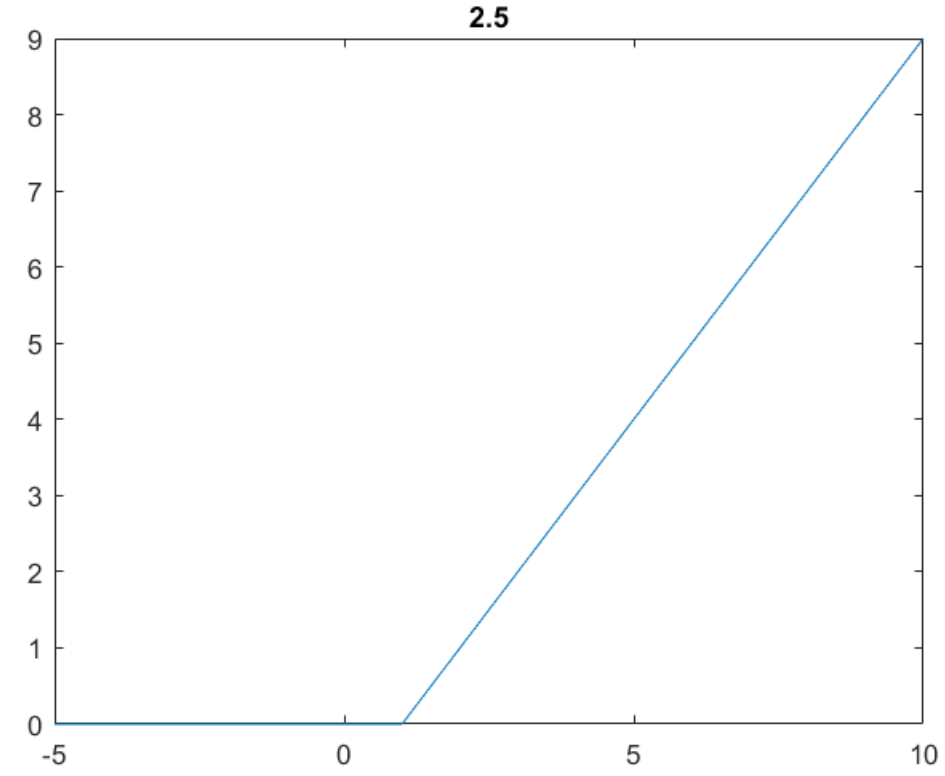
```
t = -5:.01:10;
d1 = dirac(t-1);
d2 = dirac(t-2);
plot(t,d1+d2)
title('2.4')

%2.5
figure;
r = (t-1).*heaviside(t-1);
plot(t,r)
title('2.5')

%2.6
figure;
r0 = t.*heaviside(t);
r1 = (t-2).*heaviside(t-2);
r2 = (t-5).*heaviside(t-5);
r3 = (t-7).*heaviside(t-7);
plot(t,r0-r1-r2+r3)
title('2.6')

%2.7
figure;
T = 4;
p4 = heaviside(t+T/2)-heaviside(t-T/2);
plot(t,p4)
title('2.7')

% [s,t]=gensig('pulse',4,15)
% plot(t-5,s-5) % has to go back -5 to confine t limits
% title('2.7')

%2.8
figure;
T = 2;
p2 = heaviside(t-1+T/2)-heaviside(t-1-T/2);
plot(t,p2)
grid on
title('2.8')
```

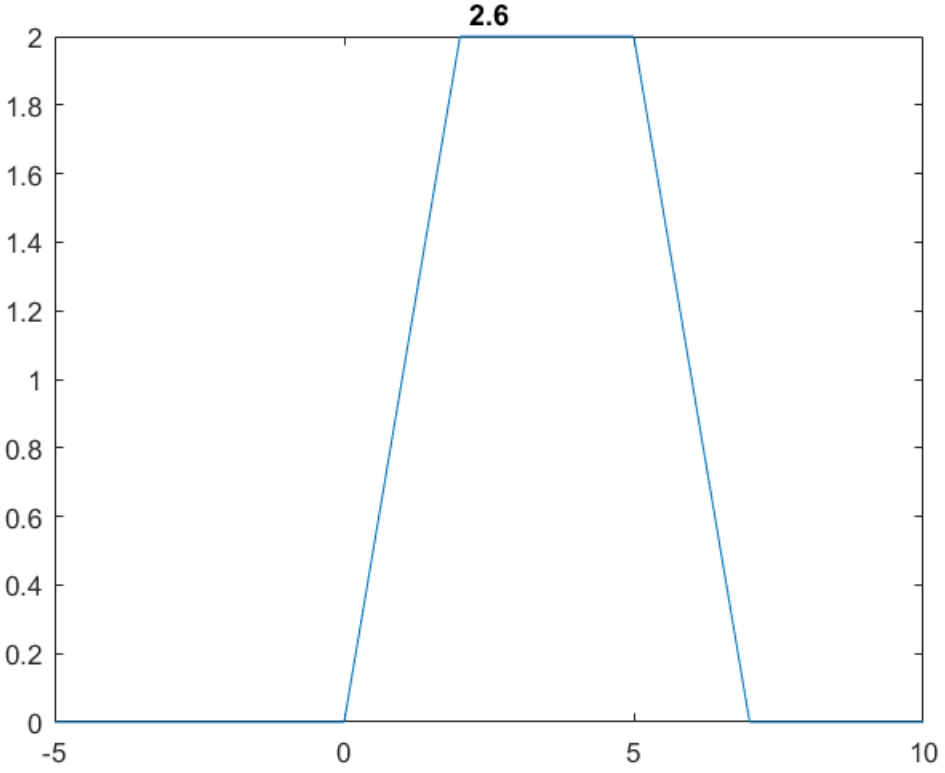

2.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-5
0
5
10

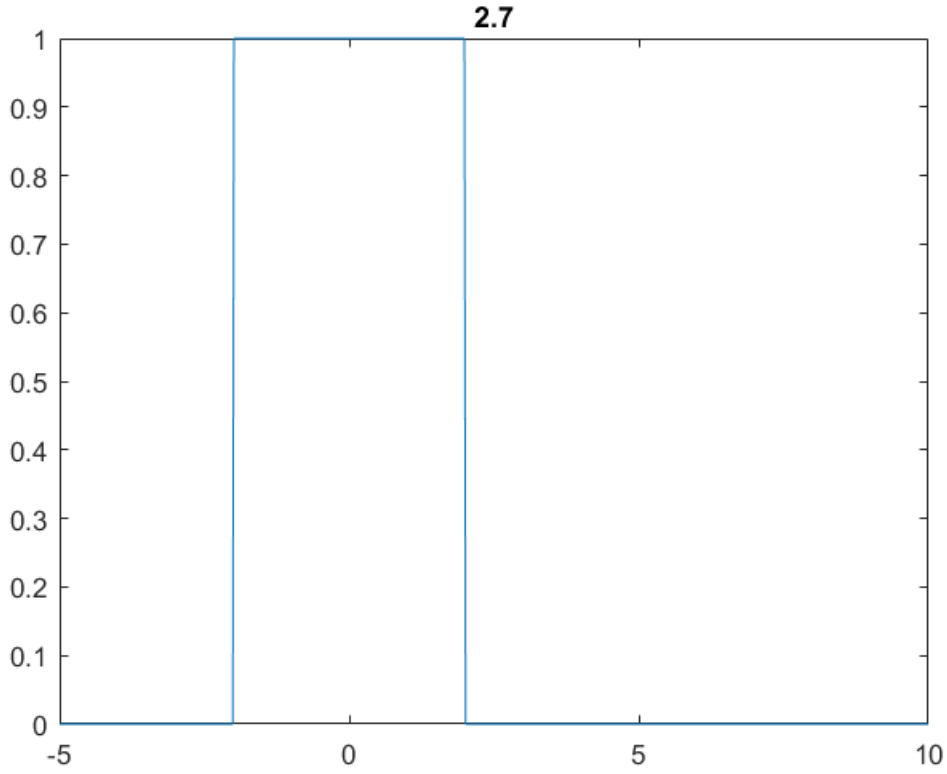

2.2
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
-5
0
5
10

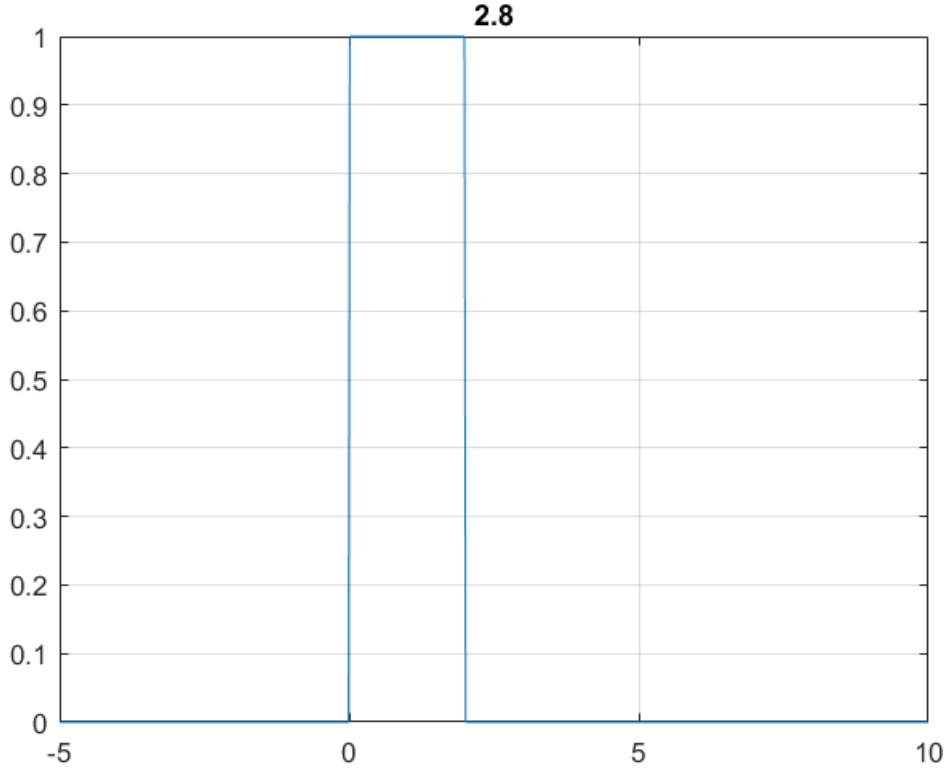

2.3
8
7
6
5
4
3
2
1
0
-5
0
5
10


2.4
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-5
0
5
10


2.5
9
8
7
6
5
4
3
2
1
0
-5
0
5
10


2.6
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-5
0
5
10


2.7
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-5
0
5
10


2.8
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-5
0
5
10

problem 3

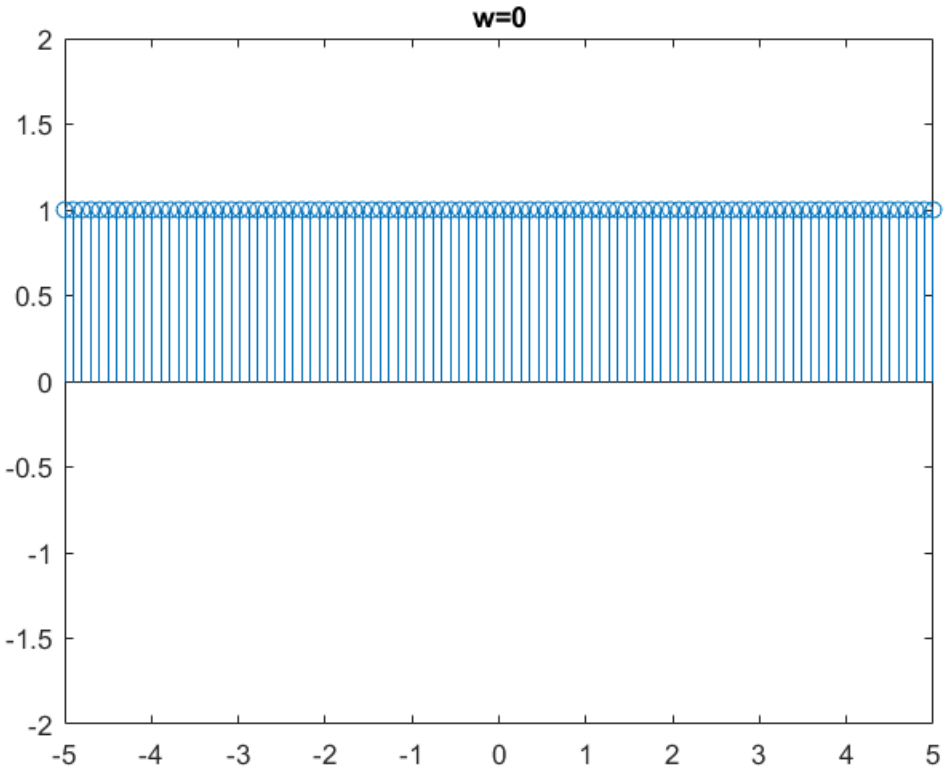
```
syms t T
t = linspace(0,100,100);
x = t.*(heaviside(t)-heaviside(t-8));
d = int(abs(x).^2,-T,T);
Ex = limit(d,T,inf)
Px = limit(.5/T*d,T,inf)

% It is an energy signal since it appears that Ex approaches infinity
```

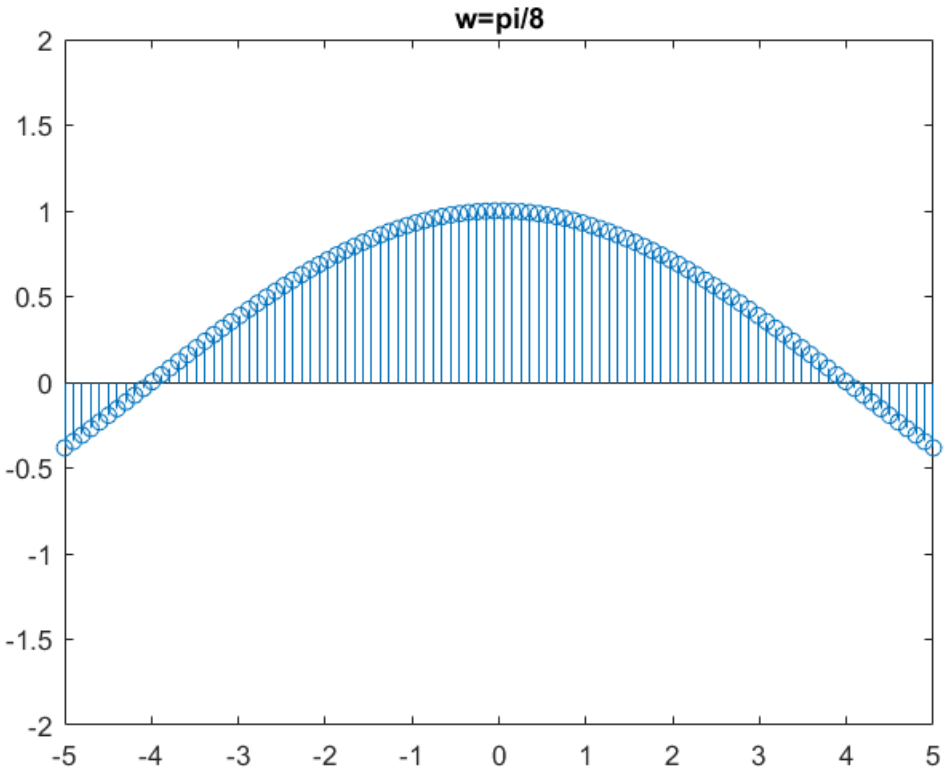
```
Ex =

[ 0, Inf, Inf, Inf, Inf, Inf, Inf, Inf, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]


Px =

[ 0, 10000/9801, 40000/9801, 10000/1089,
 2297520471059329/140737488355328, 7179751472060401/281474976710656,
 40000/1089, 3518078221309597/70368744177664, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```

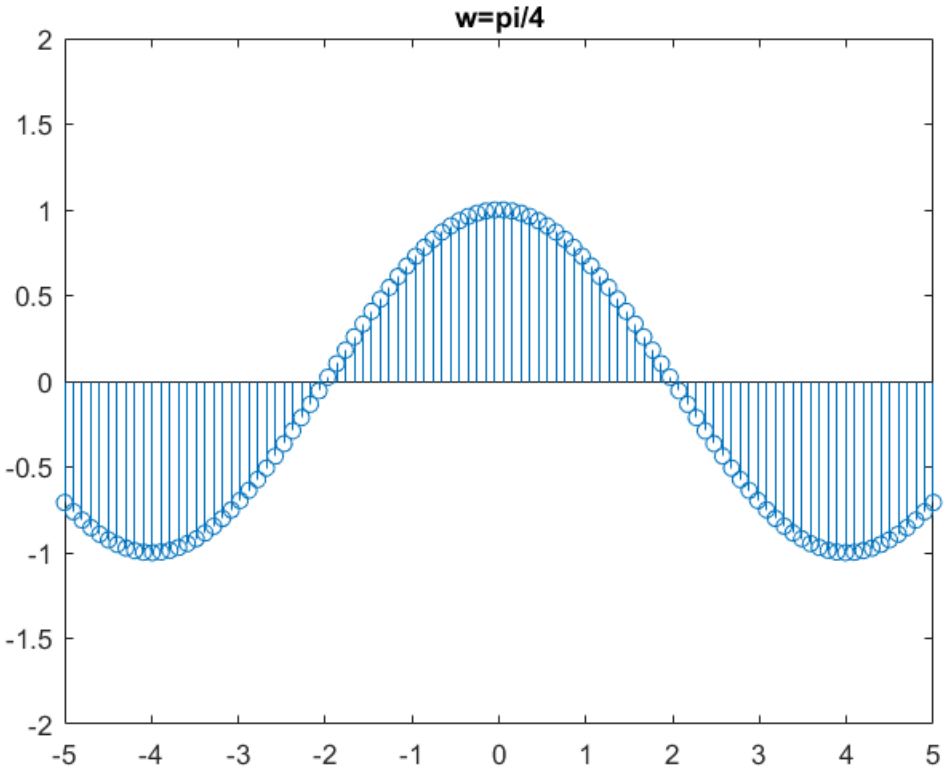
problem 4

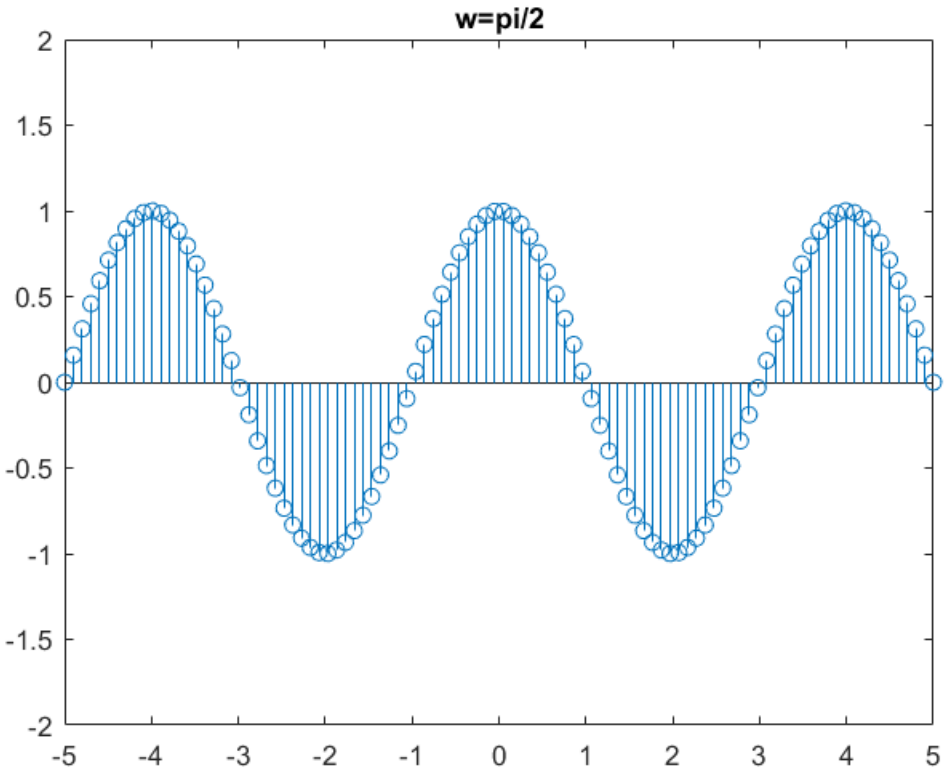
```
n = linspace(-5,5,100);

figure;
x = cos(n.*0);
stem(n,x)
ylim([-2 2])
title('w=0')

figure;
x = cos(n.*pi/8);
stem(n,x)
ylim([-2 2])
title('w=pi/8')

figure;
x = cos(n.*pi/4);
stem(n,x)
ylim([-2 2])
title('w=pi/4')
```

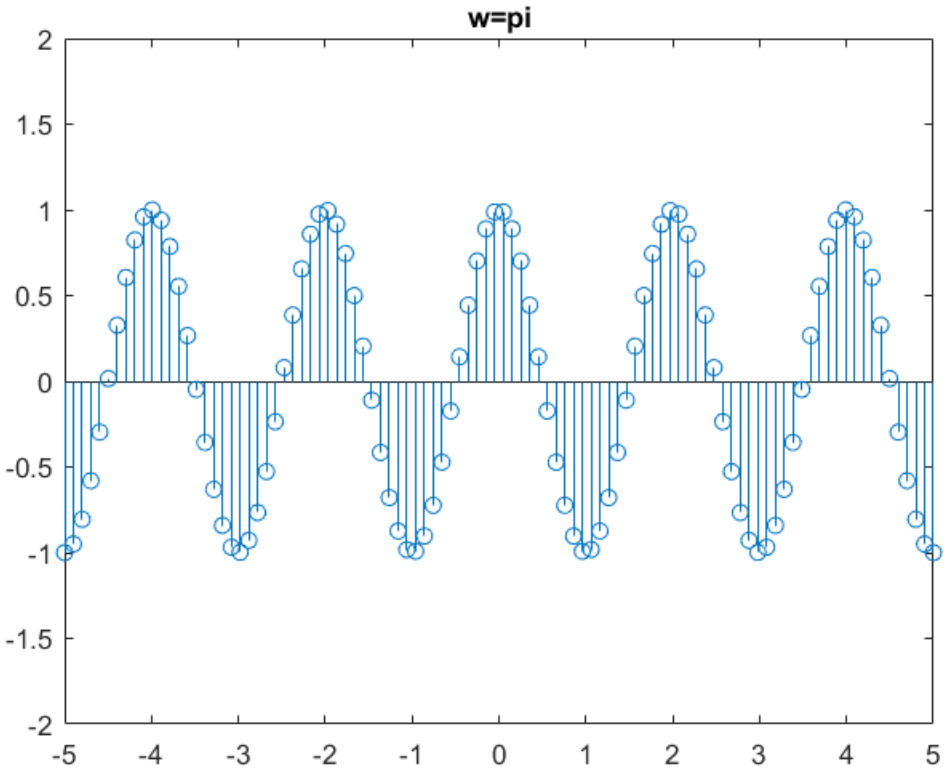
```
figure;
x = cos(n.*pi/2);
stem(n,x)
ylim([-2 2])
title('w=pi/2')

figure;
x = cos(n.*pi);
stem(n,x)
ylim([-2 2])
title('w=pi')

figure;
x = cos(n.*3*pi/2);
stem(n,x)
ylim([-2 2])
title('w=3pi/2')

figure;
x = cos(n.*7*pi/4);
stem(n,x)
ylim([-2 2])
title('w=7pi/4')

figure;
x = cos(n.*15*pi/8);
stem(n,x)
ylim([-2 2])
title('w=15pi/8')

figure;
x = cos(n.*2*pi);
stem(n,x)
ylim([-2 2])
title('w=2pi')

% w = 2pi has the highest frequency
% w = 0 has the lowest frequency
% As w is increasing from 0 -> 2pi, the period is getting smaller
% since the frequency is getting bigger f = w/2pi = 1/T
```

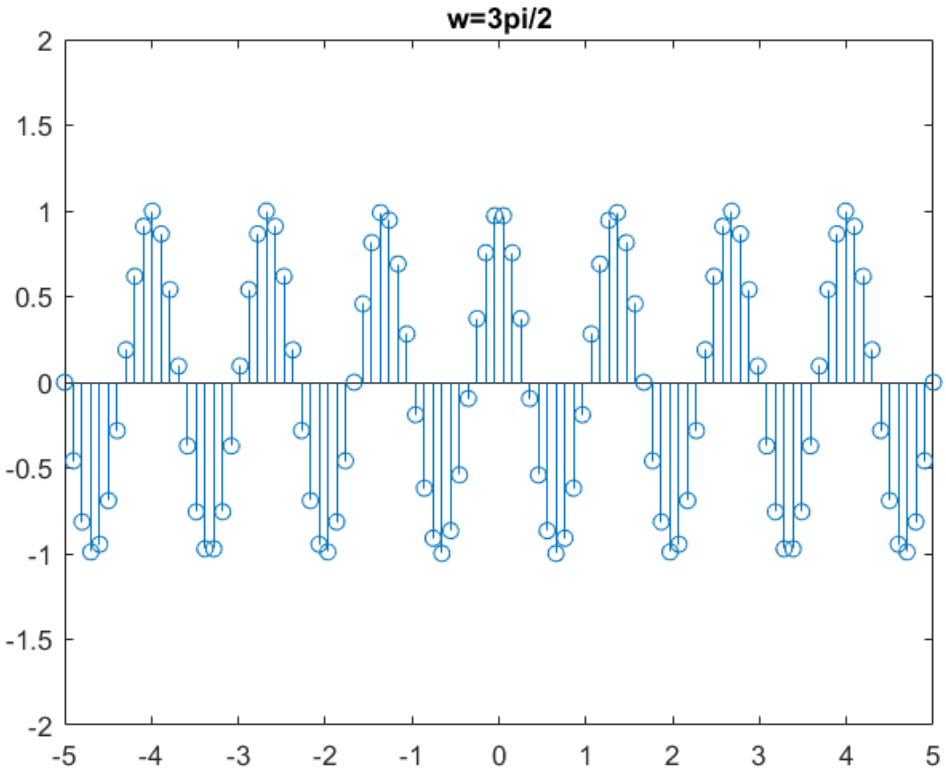

w=0
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5

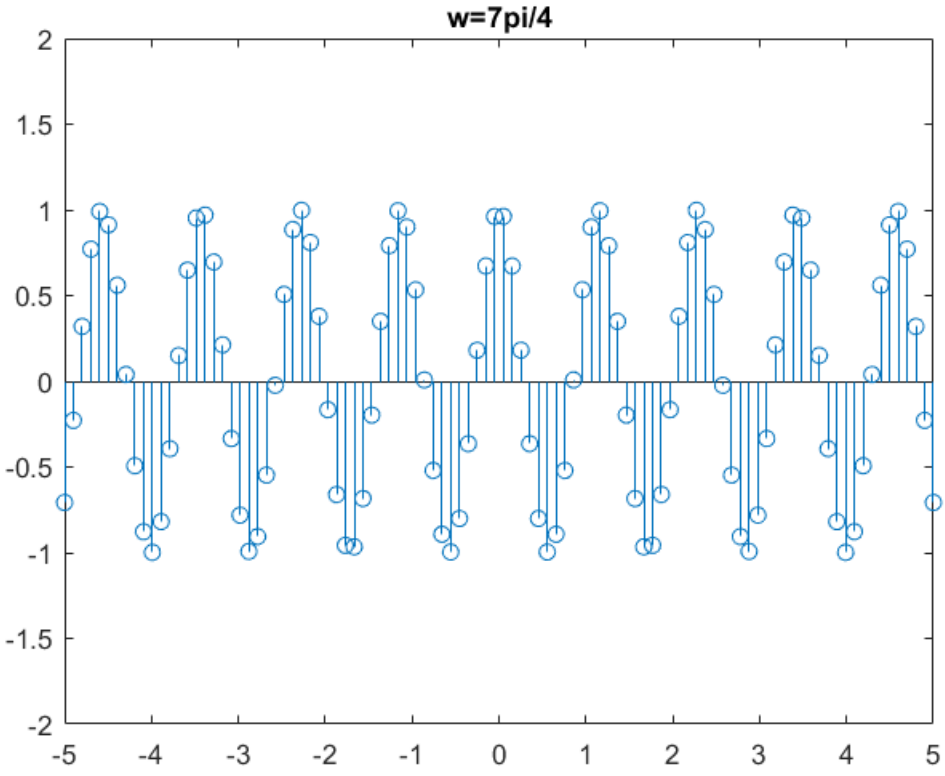

w=pi/8
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5

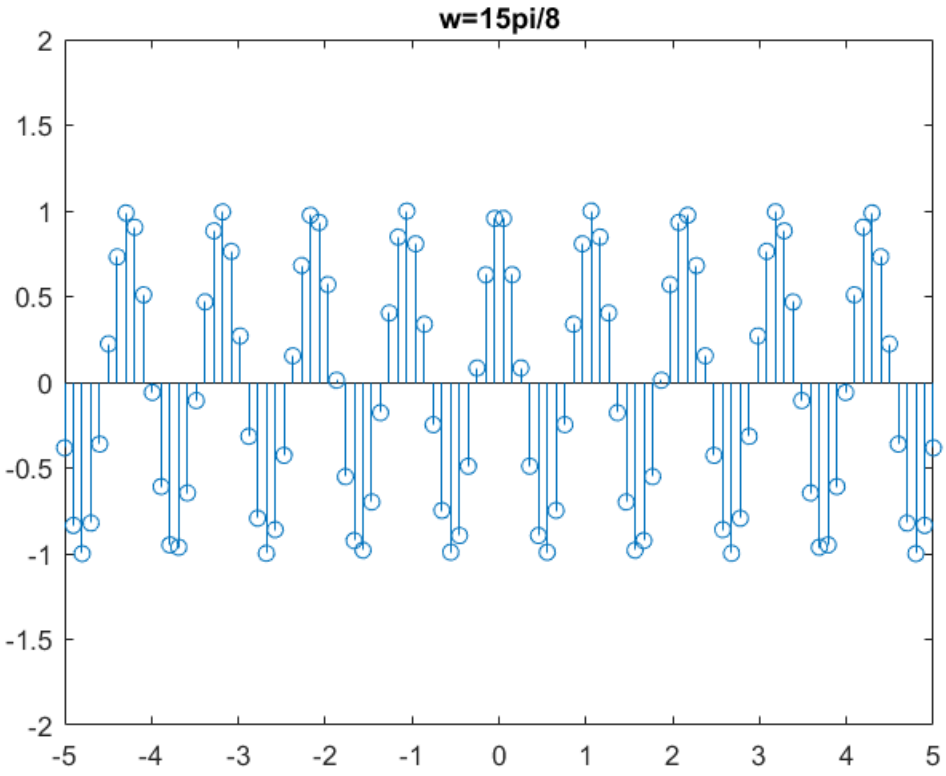

w=pi/4
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5

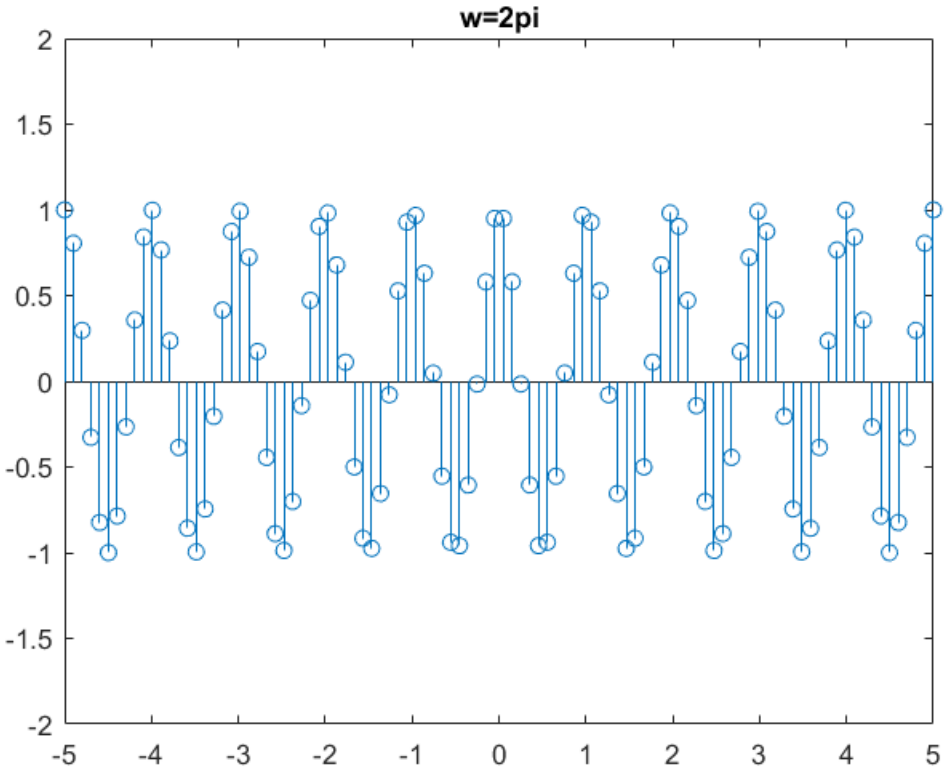

w=pi/2
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5


w=pi
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5


w=3pi/2
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5


w=7pi/4
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5

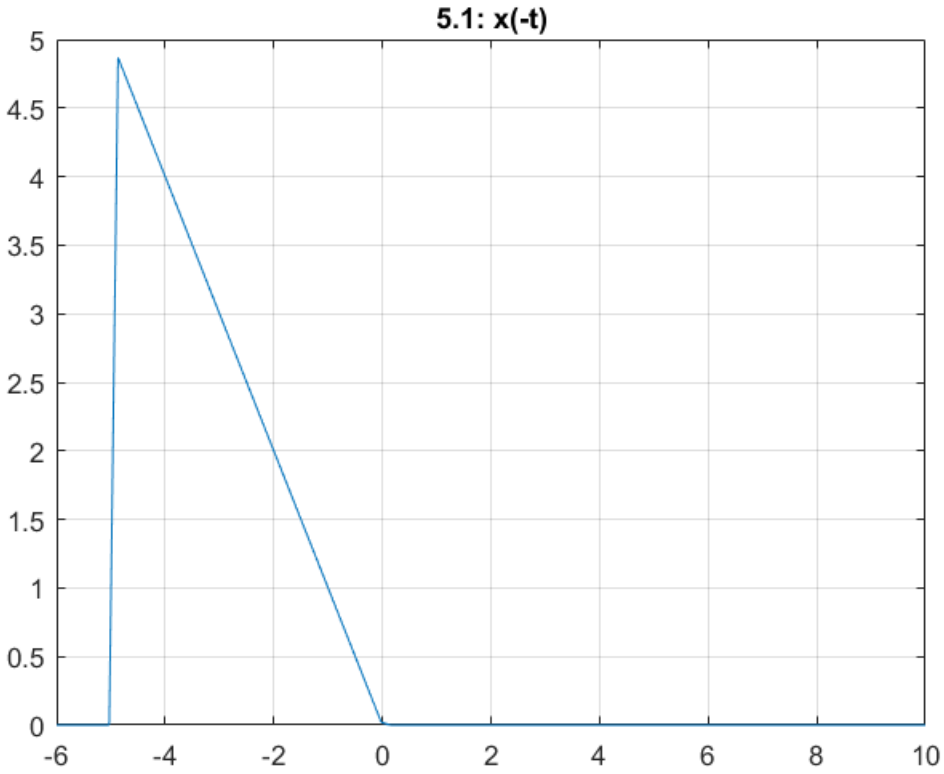

w=15pi/8
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-5
-4
-3
-2
-1
0
1
2
3
4
5

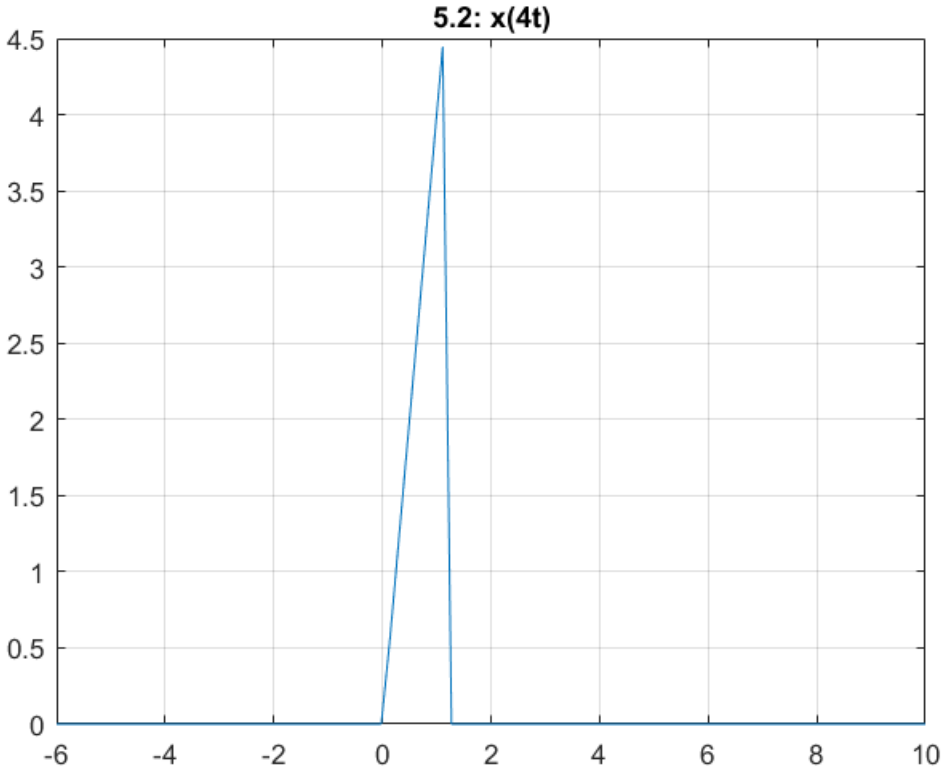


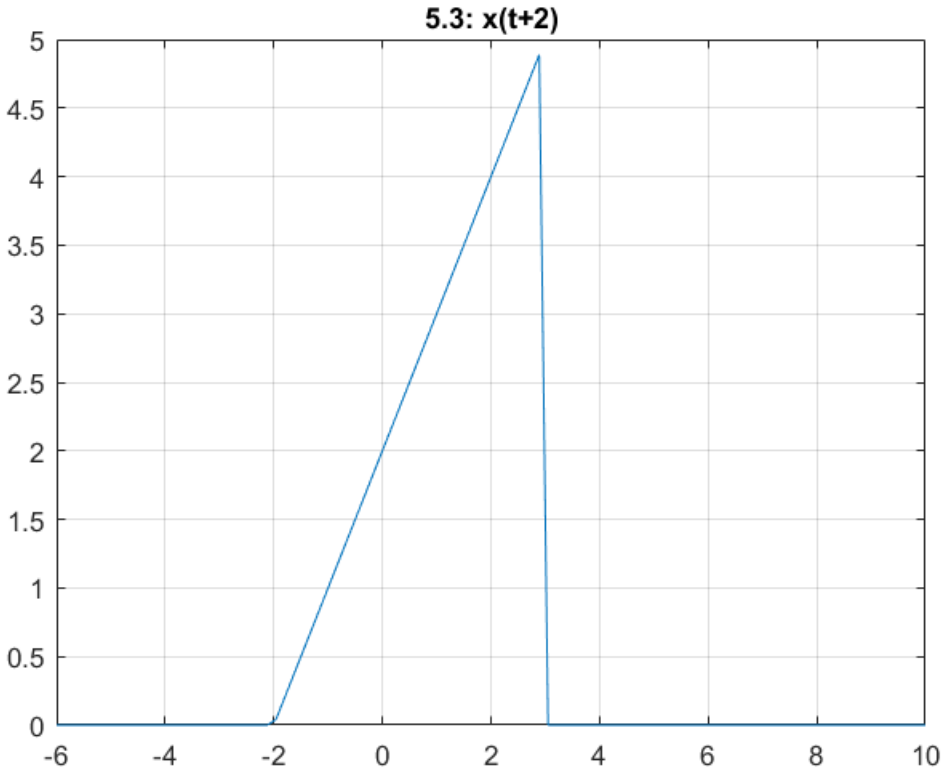
Problem 5

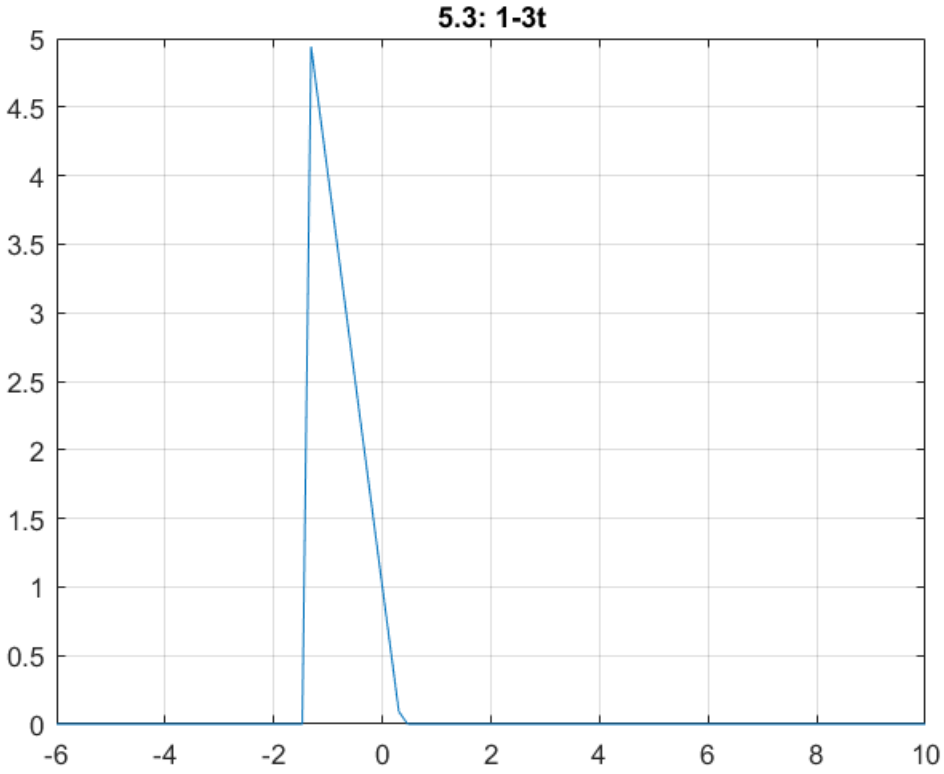
```
syms t x
x = t.*(heaviside(t)-heaviside(t-5));
t1 = linspace(-6,10,100);
% need to leave t undefined as syms t var, but define subbing var t1

%5.1
figure;
x1 = subs(x,t,-t1);
plot(t1,x1)
grid on
title('5.1: x(-t)')

%5.2
figure;
x1 = subs(x,t,4*t1);
plot(t1,x1)
grid on
title('5.2: x(4t)')

%5.3
figure;
x1 = subs(x,t,t1+2);
plot(t1,x1)
```

```
grid on
title('5.3: x(t+2)')

%5.4
figure;
x1 = subs(x,t,1-3.*t1);
plot(t1,x1)
grid on
title('5.3: 1-3t')
```




5.2: x(4t)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-6
-4
-2
0
2
4
6
8
10

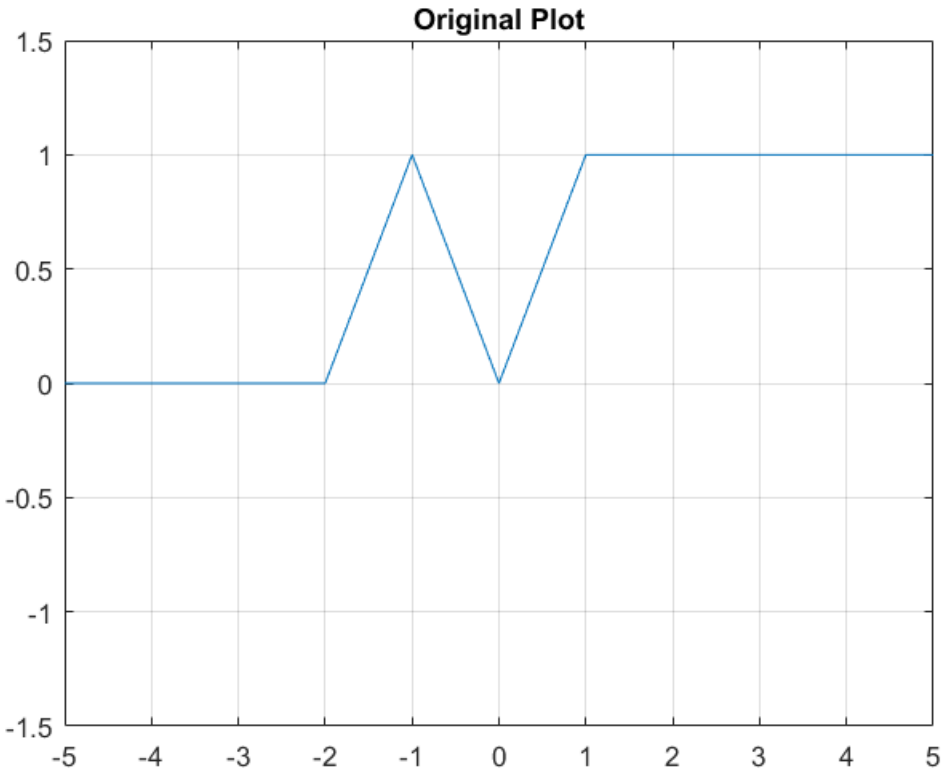

5.3: x(t+2)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-6
-4
-2
0
2
4
6
8
10

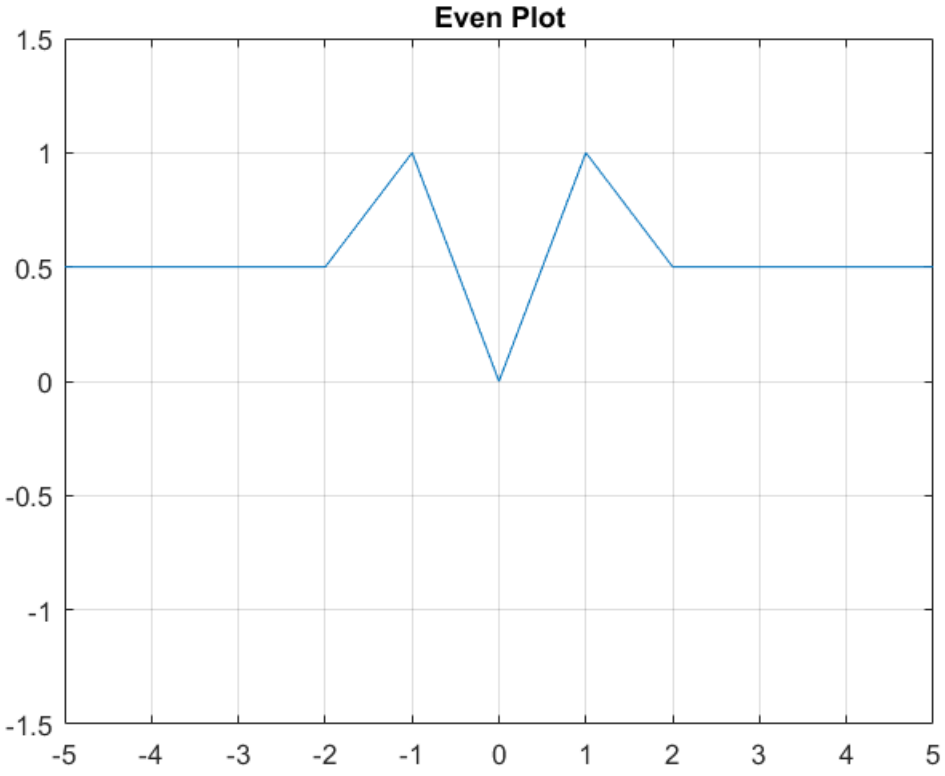


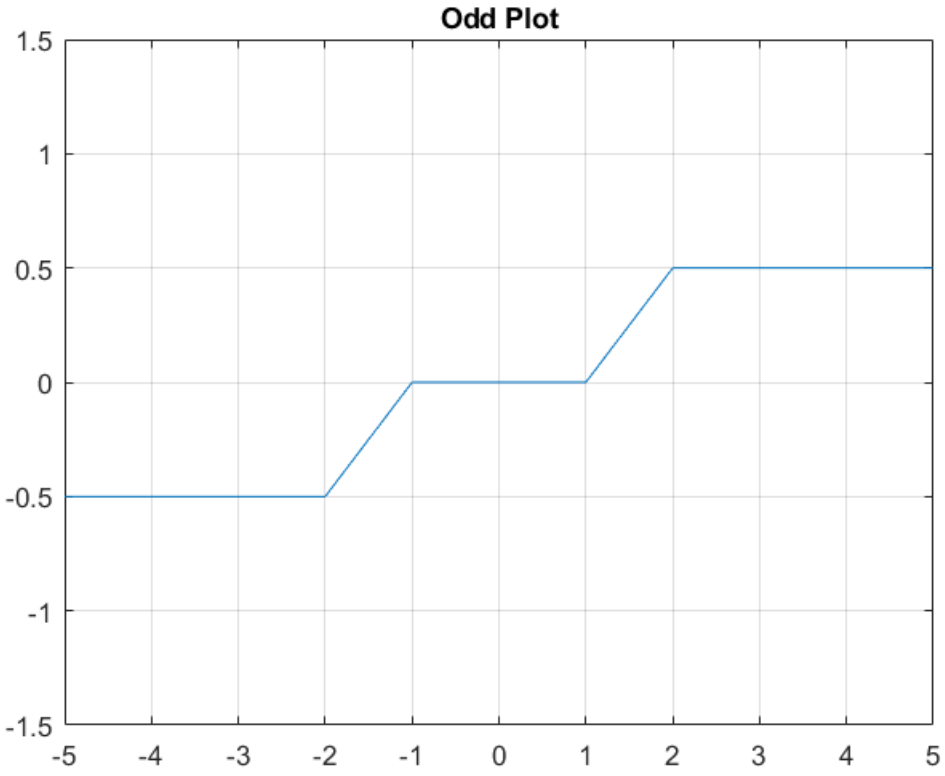
problem 6

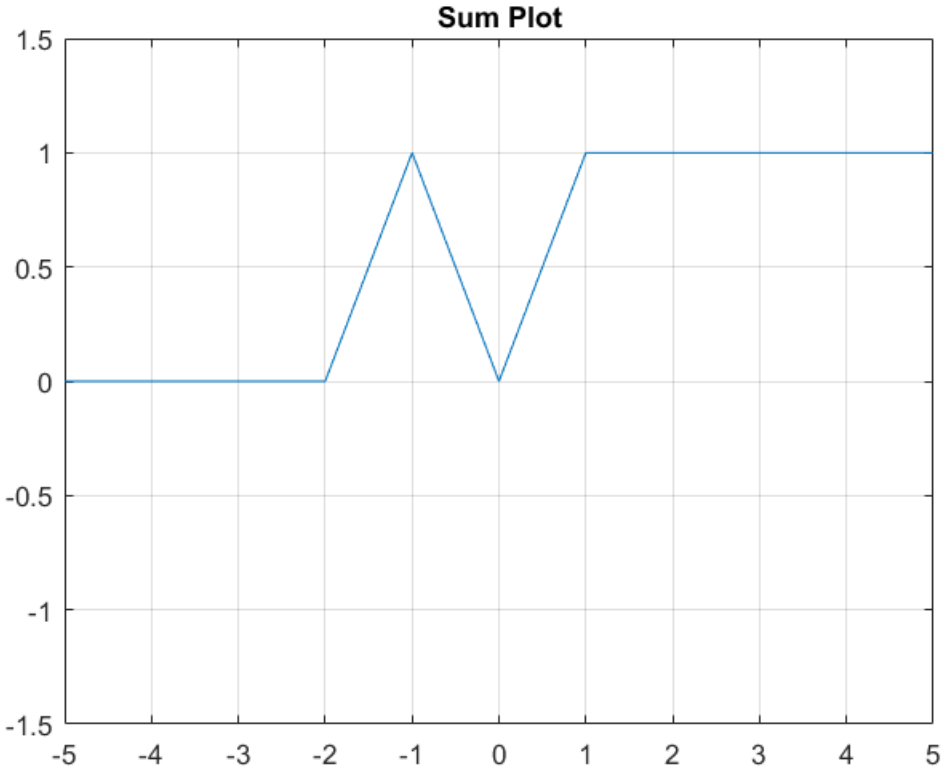
```
syms t;
x = (t+2)*(heaviside(t+2)-heaviside(t+1)) - t*(heaviside(t+1)-
heaviside(t))+t*(heaviside(t)-heaviside(t-1)) + heaviside(t-1);
fplot(x)
ylim([-1.5 1.5])
grid on
title('Original Plot')

xe = (x + subs(x,t,-t))/2;
xo = (x - subs(x,t,-t))/2;

figure;
fplot(xe)
ylim([-1.5 1.5])
grid on
title('Even Plot')

figure;
fplot(xo)
ylim([-1.5 1.5])
grid on
title('Odd Plot')
```

```
figure;
fplot(xe+xo)
ylim([-1.5 1.5])
grid on
title('Sum Plot')
```




Even Plot
1.5
1
0.5
0
-0.5
-1
-1.5
-5
-4
-3
-2
-1
0
1
2
3
4
5


Odd Plot
1.5
1
0.5
0
-0.5
-1
-1.5
-5
-4
-3
-2
-1
0
1
2
3
4
5



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