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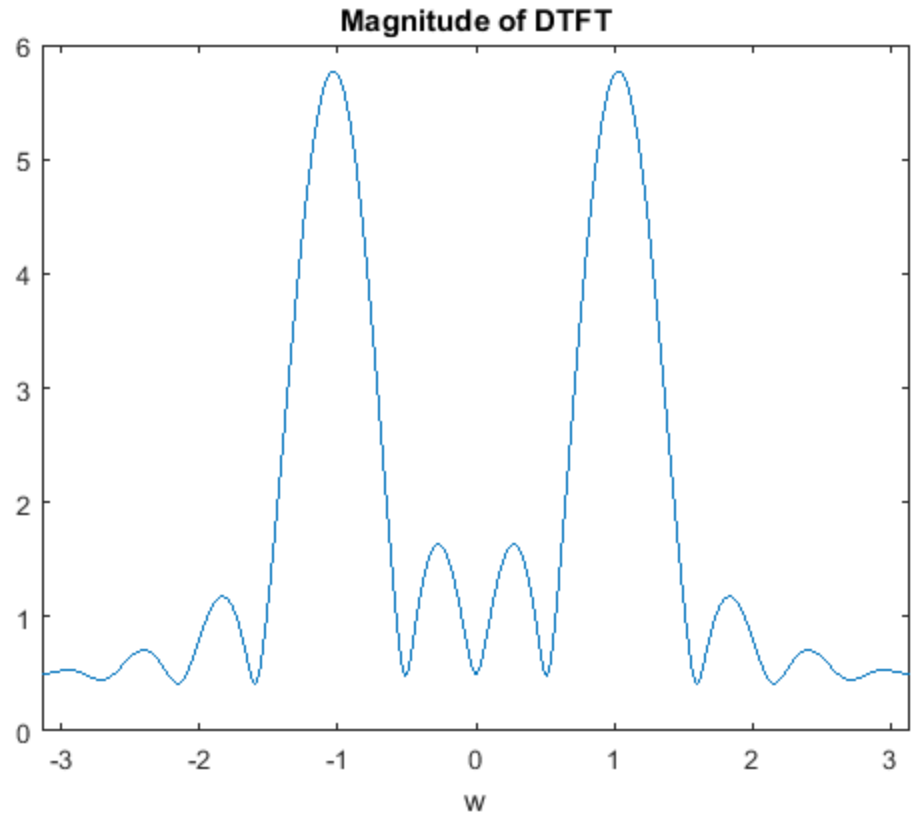
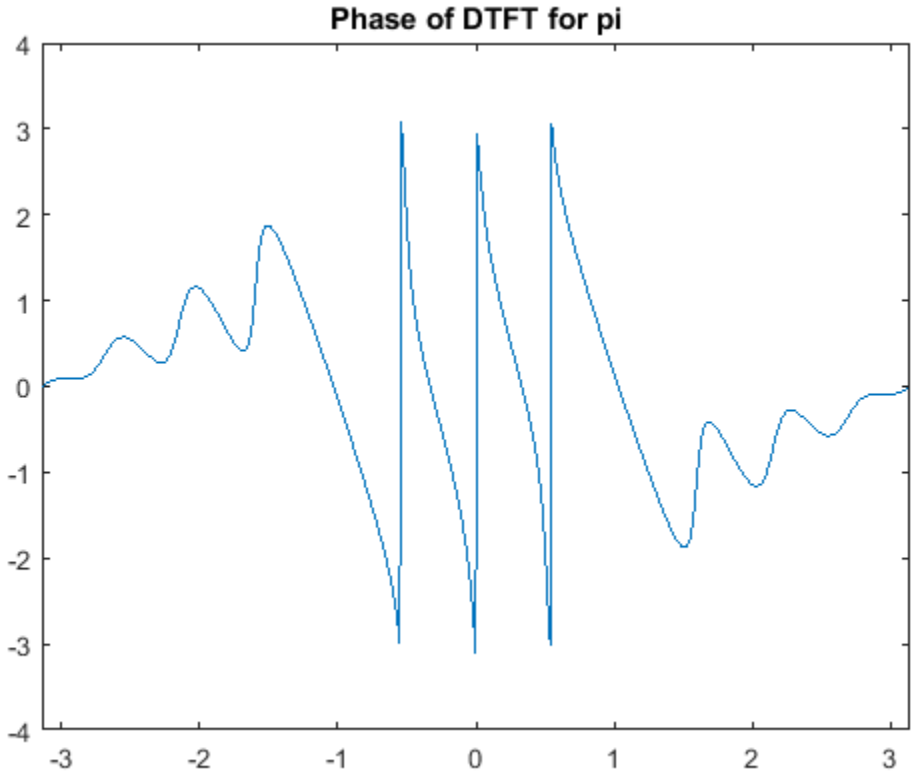
Lab 8 - Section C2 6/30/2017

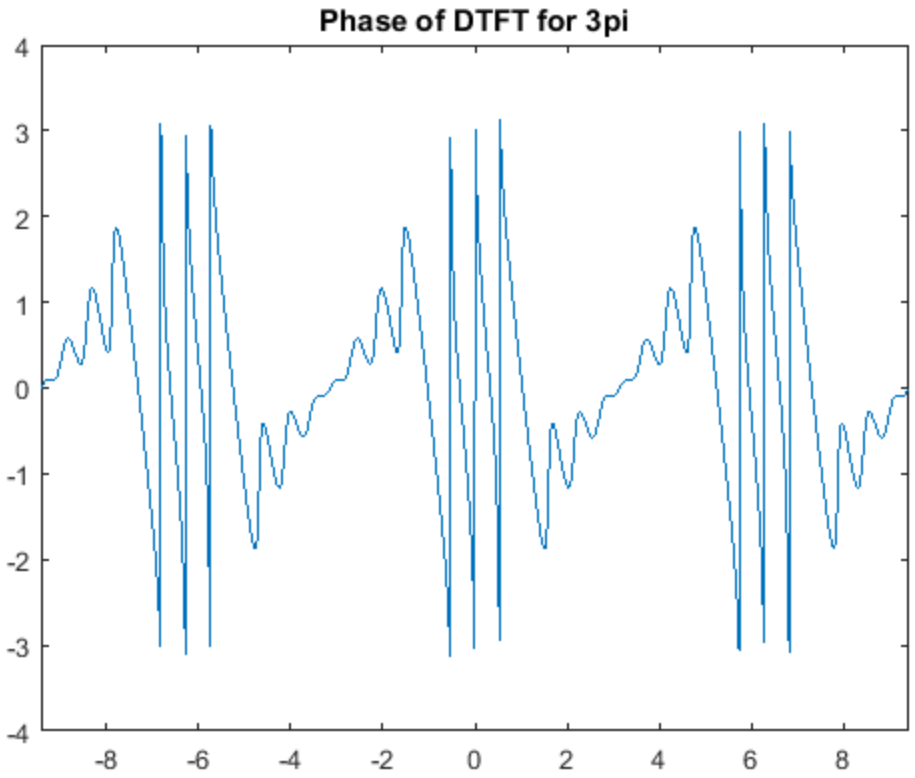
```
close all; clc; clear;
```

Problem 1

```
syms w
n= 0:10;
x= cos(pi*n/3);
X=sum(x.*exp(-j*w*n));
figure;
ezplot(abs(X),[-pi pi])
title('Magnitude of DTFT')
ylim([0 6])

w1=-pi:.01:pi;
XX=double(subs(X,w,w1));
figure;
plot(w1,angle(XX));
xlim([-pi pi])
title('Phase of DTFT for pi')

w1=-3*pi:.01:3*pi;
for i=1:length(w1)
XX(i)=double(subs(X,w,w1(i)));
end
figure;
plot(w1,angle(XX));
xlim([-3*pi 3*pi])
title('Phase of DTFT for 3pi')
```


Magnitude of DTFT
6
5
4
3
2
1
0
-3
-2
-1
0
1
2
3
w

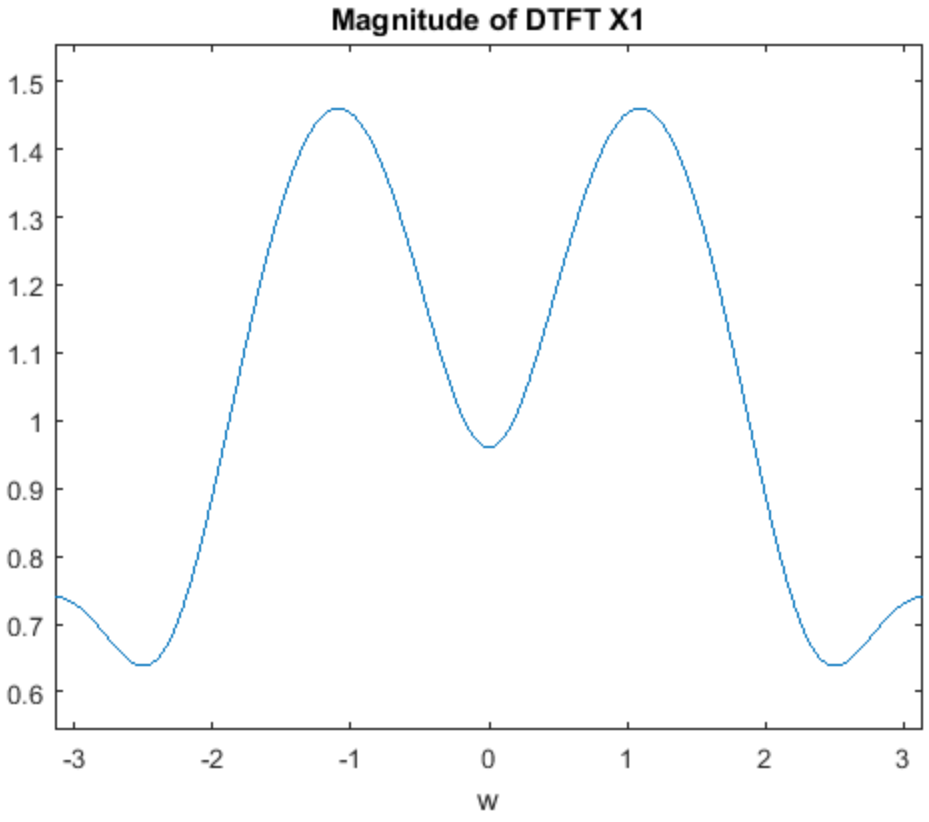

Phase of DTFT for pi
4
3
2
1
0
-1
-2
-3
-4
-3
-2
-1
0
1
2
3

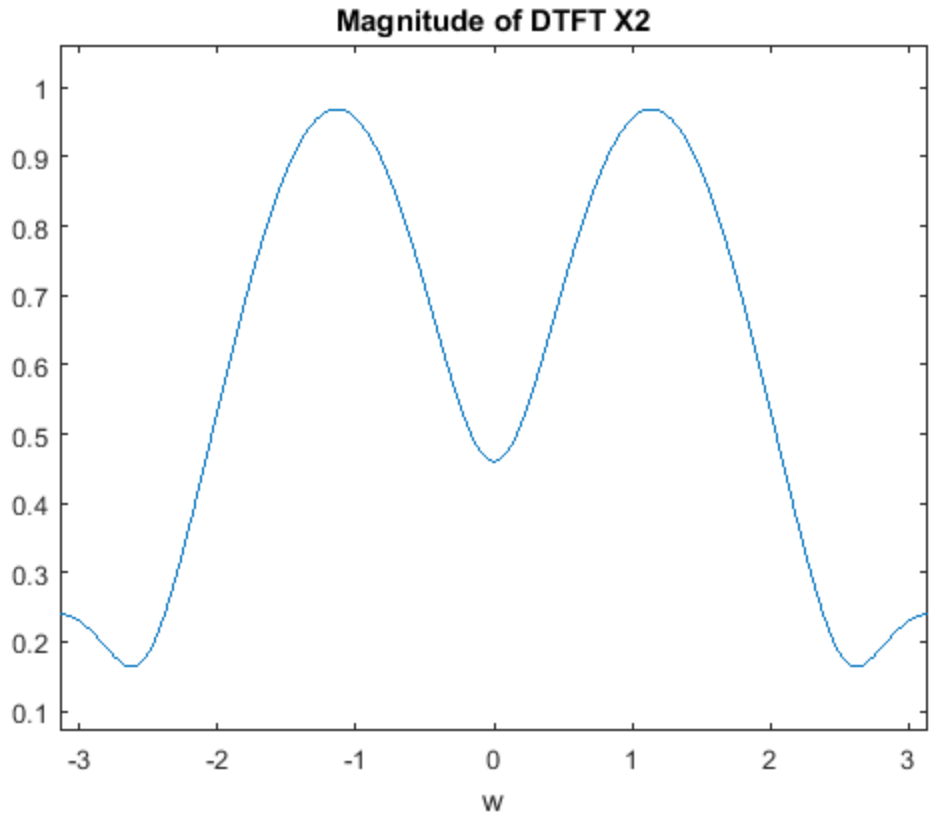


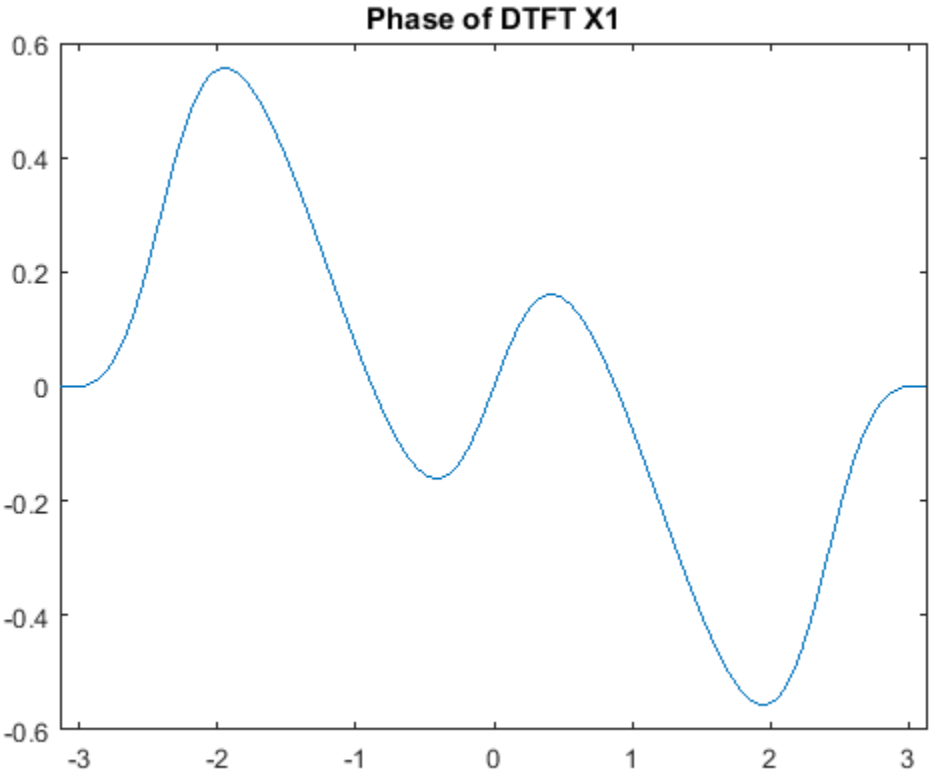
Problem 2

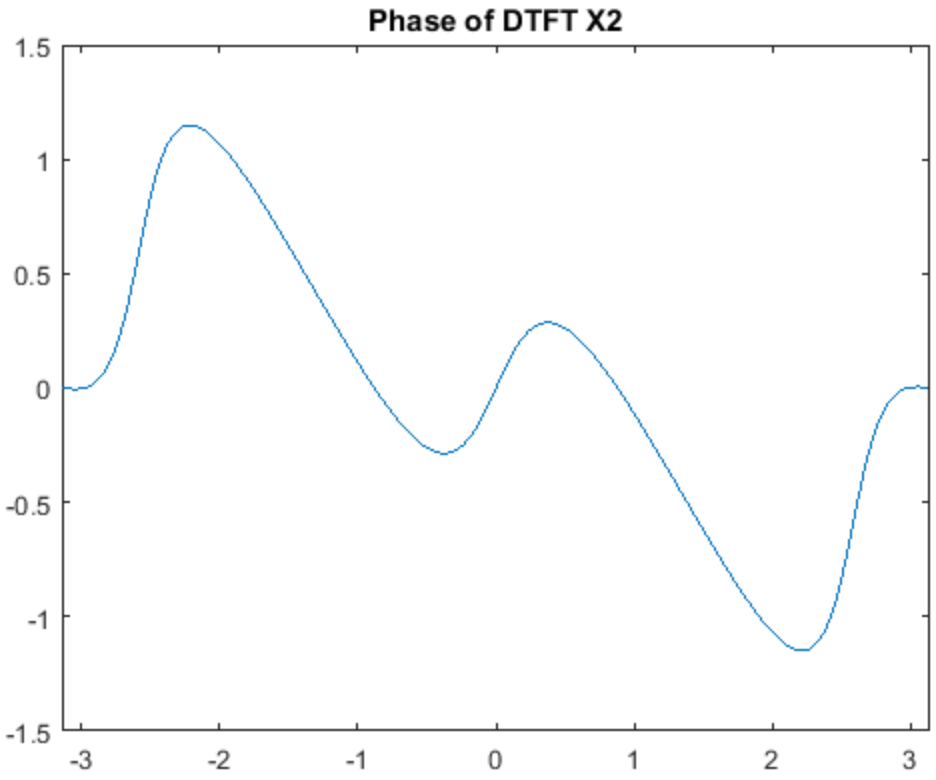
```
syms w
n = 0:3;
x1 = 0.6.^n.*cos(n);
x2 = 0.6.^n.*cos(n).*heaviside(n);
X1 = sum(x1.*exp(-j*w*n));
X2 = sum(x2.*exp(-j*w*n));

figure;
ezplot(abs(X1),[-pi pi])
title('Magnitude of DTFT X1')
figure;
ezplot(abs(X2),[-pi pi])
title('Magnitude of DTFT X2')

w1=-pi:.01:pi;
XX1=double(subs(X1,w,w1));
XX2=double(subs(X2,w,w1));
figure;
plot(w1,angle(XX1));
xlim([-pi pi])
title('Phase of DTFT X1')
figure;
plot(w1,angle(XX2));
```

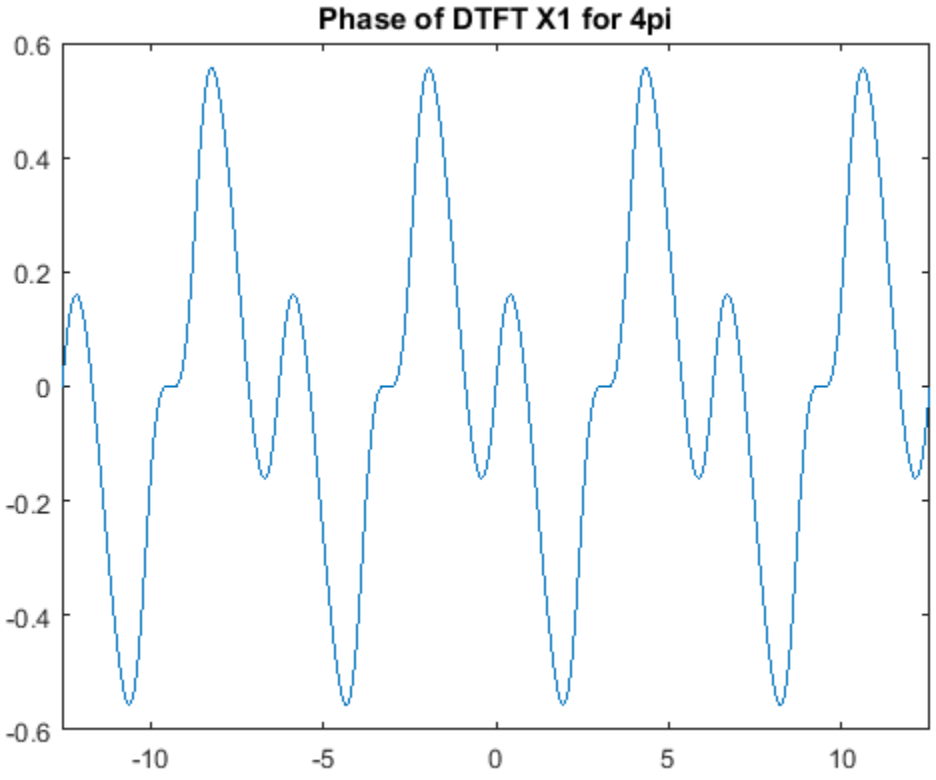
```
xlim([-pi pi])
title('Phase of DTFT X2')

w1=-4*pi:.01:4*pi;
for i=1:length(w1)
XX1(i)=double(subs(X1,w,w1(i)));
XX2(i)=double(subs(X2,w,w1(i)));
end
figure;
plot(w1,angle(XX1));
xlim([-4*pi 4*pi])
title('Phase of DTFT X1 for 4pi')
figure;
plot(w1,angle(XX2));
xlim([-4*pi 4*pi])
title('Phase of DTFT X2 for 4pi')
```

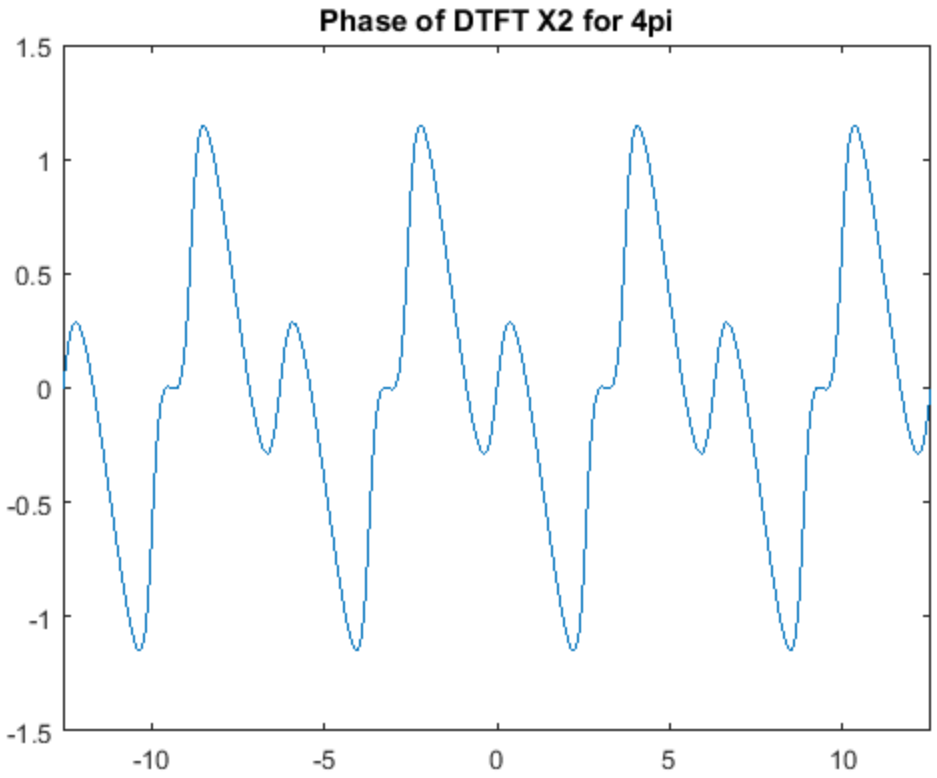



Magnitude of DTFT X2
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-3
-2
-1
0
1
2
3
w


Phase of DTFT X1
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-3
-2
-1
0
1
2
3


Phase of DTFT X2
1.5
1
0.5
0
-0.5
-1
-1.5
-3
-2
-1
0
1
2
3

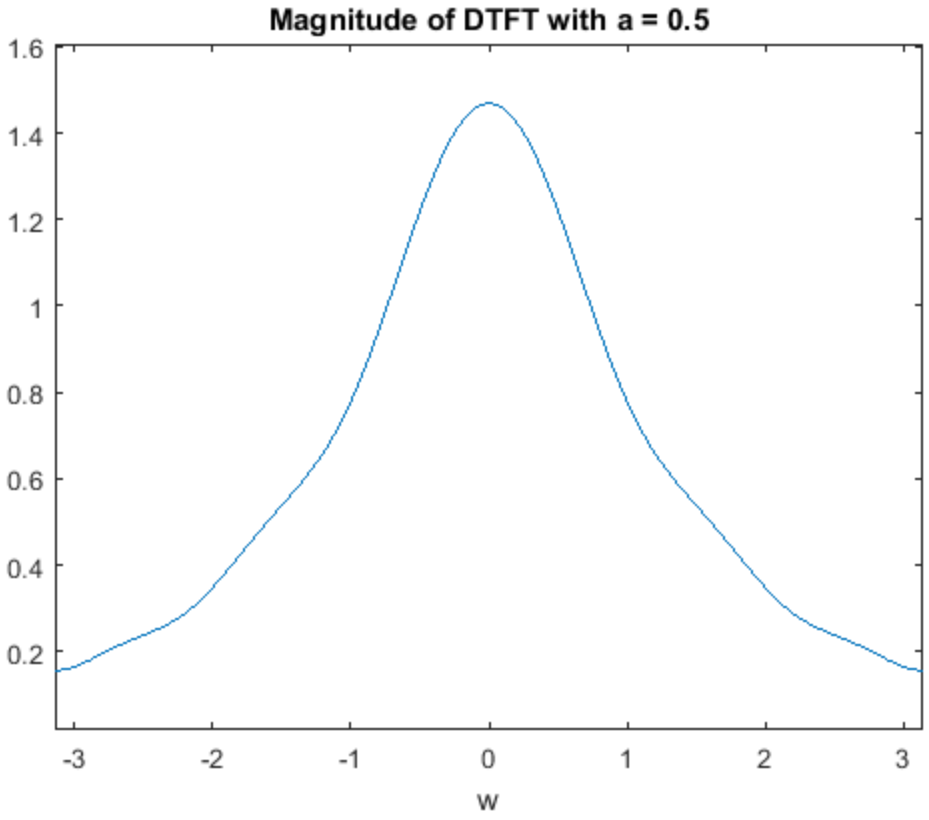

Phase of DTFT X1 for 4pi
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-10
-5
0
5
10

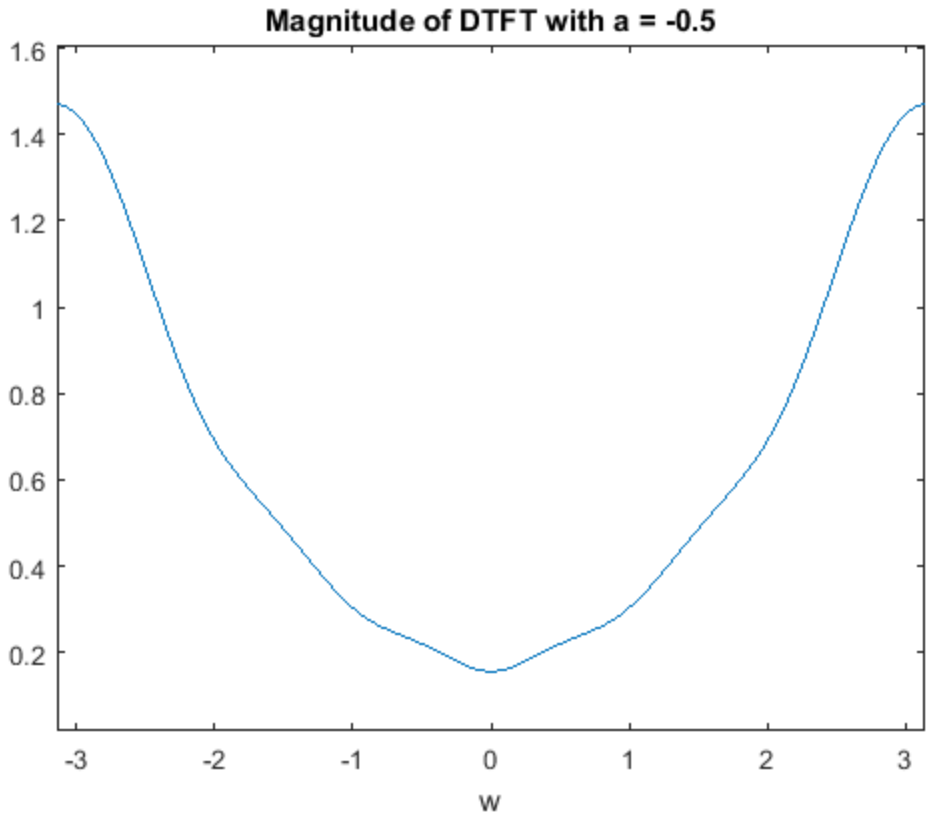


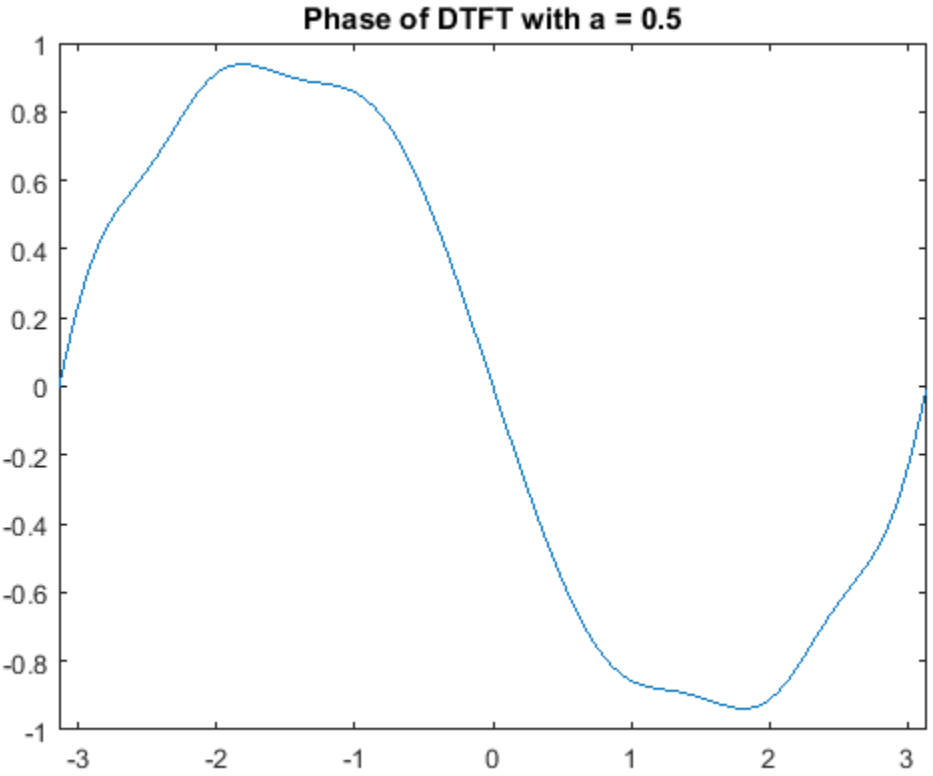
Problem 3

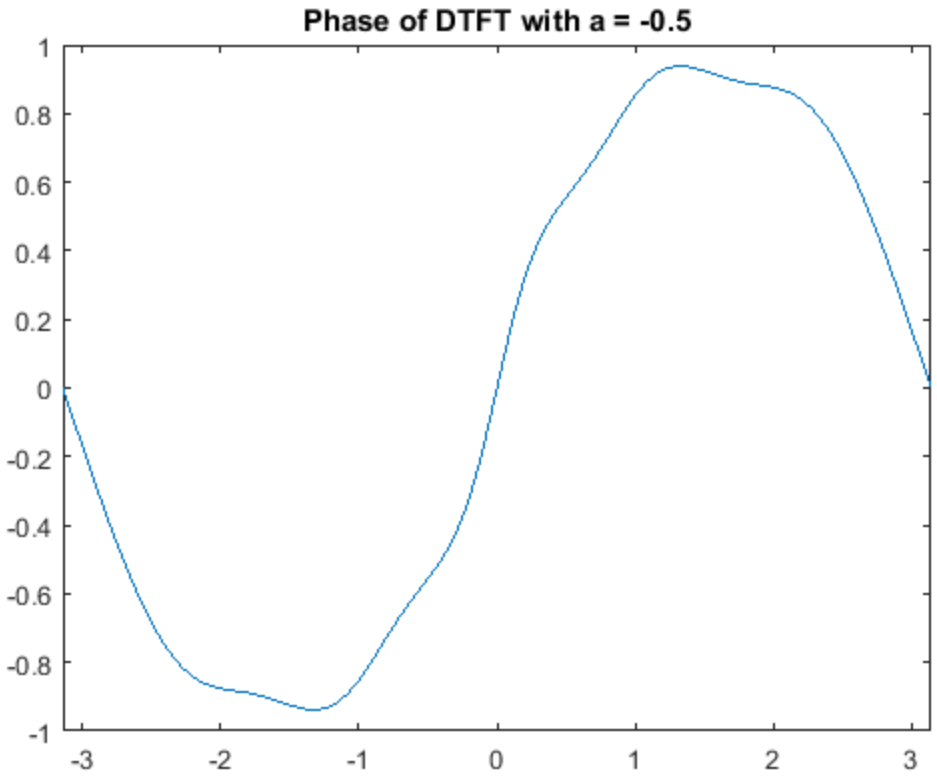
```
syms a w
n = 0:5;
x = a.^n.*heaviside(n);
a1 = 0.5;
a2 = -0.5;
x1 = subs(x,a,a1);
x2 = subs(x,a,a2);
X1=sum(x1.*exp(-j*w*n));
X2=sum(x2.*exp(-j*w*n));

figure;
ezplot(abs(X1),[-pi pi])
title('Magnitude of DTFT with a = 0.5')
figure;
ezplot(abs(X2),[-pi pi])
title('Magnitude of DTFT with a = -0.5')

w1=-pi:.01:pi;
XX1=double(subs(X1,w,w1));
XX2=double(subs(X2,w,w1));
figure;
plot(w1,angle(XX1));
xlim([-pi pi])
```

```
title('Phase of DTFT with a = 0.5')
figure;
plot(w1,angle(XX2));
xlim([-pi pi])
title('Phase of DTFT with a = -0.5')

% Higher n values would create more sampling which results in a
 smoother
% graph, whereas lower n values would result in a rougher graph.
```




Magnitude of DTFT with a = -0.5
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
-3
-2
-1
0
1
2
3
w


Phase of DTFT with a = 0.5
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-3
-2
-1
0
1
2
3

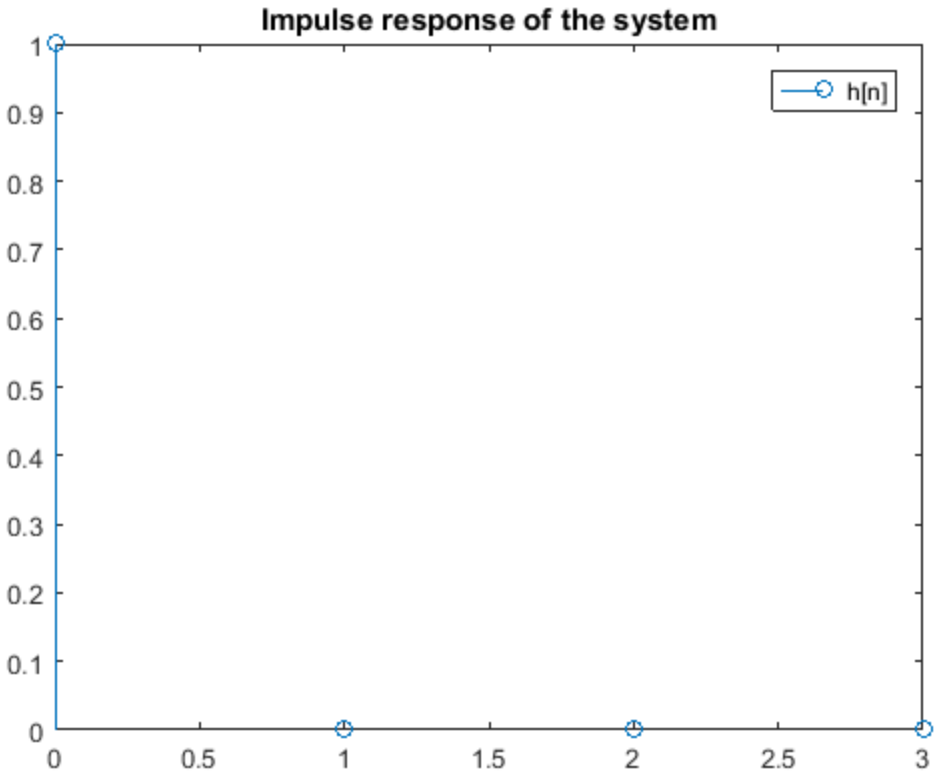


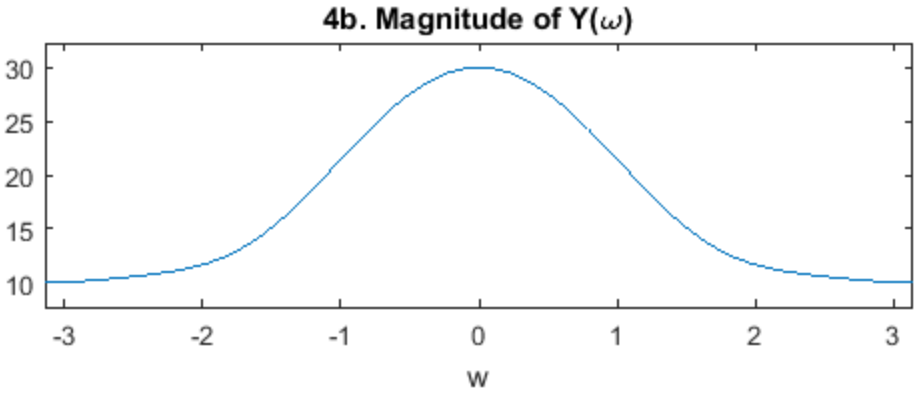
Problem 4

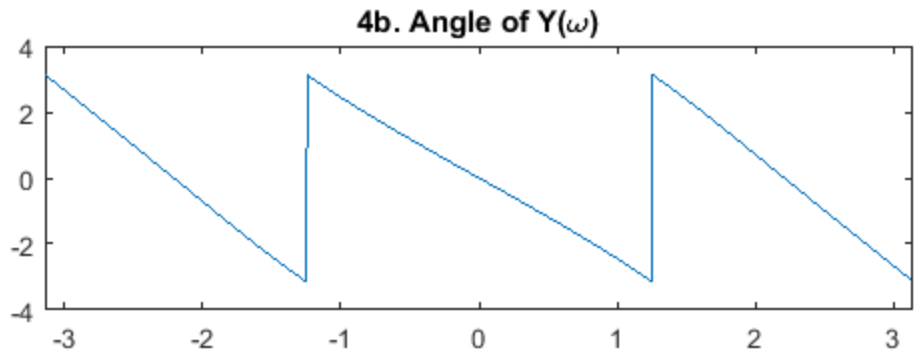
```
% 4a
n = 0:3;
x = dirac(n).^2;
h = subs(x,inf,1)
figure;
stem(n,h)
legend('h[n]');
title('Impulse response of the system')

% 4b
syms w
x = [1,2,3,4];
yb = x.^2
Yb=sum(yb.*exp(-j*w*n))

figure;
subplot(2,1,1);
ezplot(abs(Yb),[-pi pi]);
title('4b. Magnitude of Y(\omega)')
subplot(2,1,2);
w1=-pi:.01:pi; Y1=subs(Yb,w,w1);
plot(w1,angle(Y1));
title('4b. Angle of Y(\omega)');xlim([-pi pi])
```

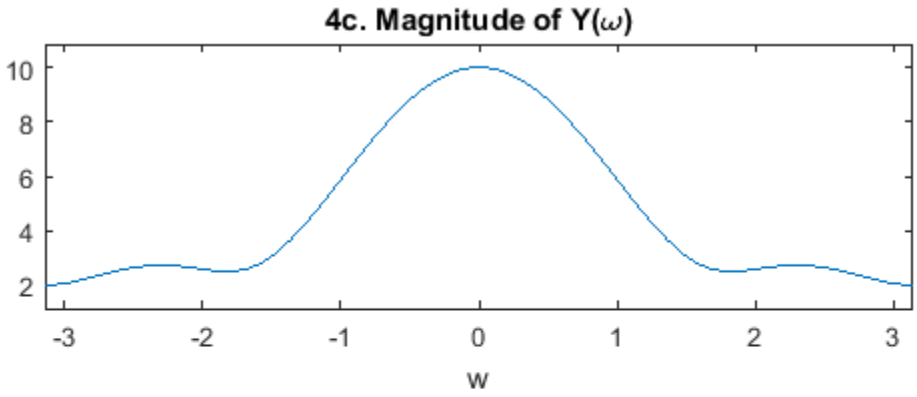
```
% 4c
h = eval(h);
yc = conv(h,x)
n1=0:6;
Yc=sum(yc.*exp(-j*w*n1))

figure;
subplot(2,1,1);
ezplot(abs(Yc),[-pi pi]);
title('4c. Magnitude of Y(\omega)')
subplot(2,1,2);
w1=-pi:.01:pi; Y1=subs(Yc,w,w1);
plot(w1,angle(Y1));
title('4c. Angle of Y(\omega)');xlim([-pi pi])

% 4d
n1 = 0:6;
w1 = -pi:.01:pi;
xx = [x 0 0 0];
hh = [h 0 0 0];
X=sum(xx.*exp(-j*w*n1));
H=sum(hh.*exp(-j*w*n1));
Yd=X.*H

figure;
subplot(2,1,1);
ezplot(abs(Yd),[-pi pi]);
title('4d. Magnitude of X(\omega)H(\omega)')
subplot(2,1,2);
Y1=subs(Yd,w,w1);
plot(w1,angle(Y1));
title('4d. Angle of X(\omega)H(\omega)')
xlim([-pi pi])

% It is shown that the responses in 4c and 4d are the same.
% However, 4b is different since it feeds x[n] directly into the
% system. This results in 4b. being more exact, whereas 4c. and 4d.
% are close approximates.


h =

[ 1, 0, 0, 0]


yb =

     1     4     9    16


Yb =

4*exp(-w*1i) + 9*exp(-w*2i) + 16*exp(-w*3i) + 1
```

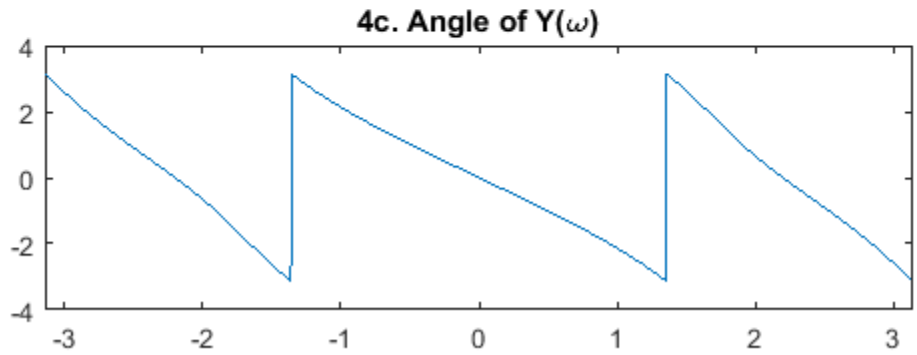
```
yc =

     1     2     3     4     0     0     0

Yc =

2*exp(-w*1i) + 3*exp(-w*2i) + 4*exp(-w*3i) + 1

Yd =

2*exp(-w*1i) + 3*exp(-w*2i) + 4*exp(-w*3i) + 1
```

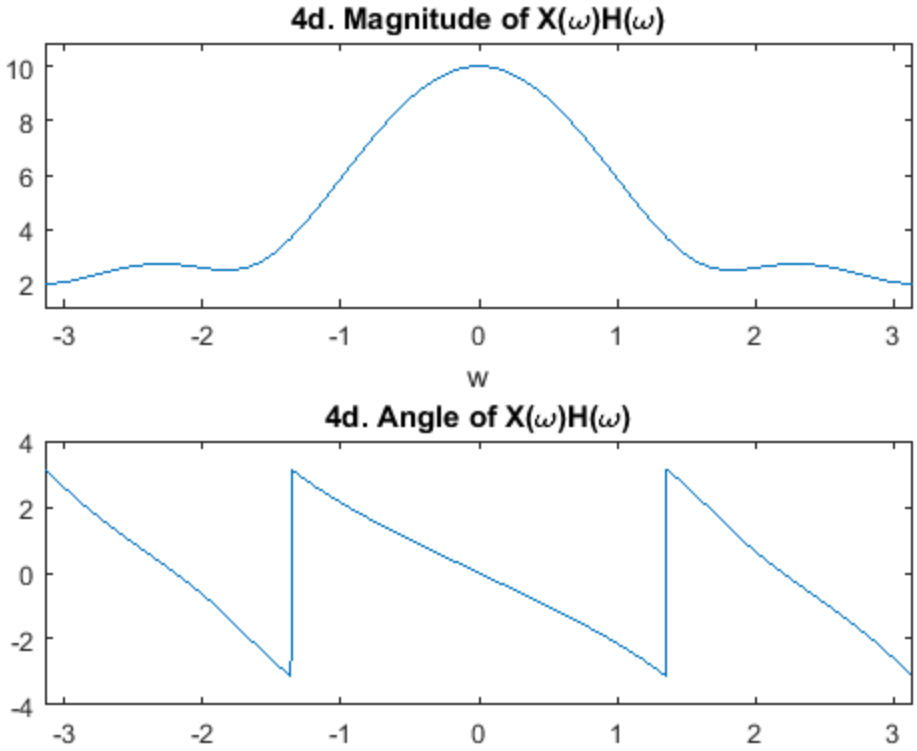



4b. Magnitude of Y(ω)
30
25
20
15
10
-3
-2
-1
0
1
2
3
w


4b. Angle of Y(ω)
4
2
0
-2
-4
-3
-2
-1
0
1
2
3


4c. Magnitude of Y(ω)
10
8
6
4
2
-3
-2
-1
0
1
2
3
w


4c. Angle of Y(ω)
4
2
0
-2
-4
-3
-2
-1
0
1
2
3



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