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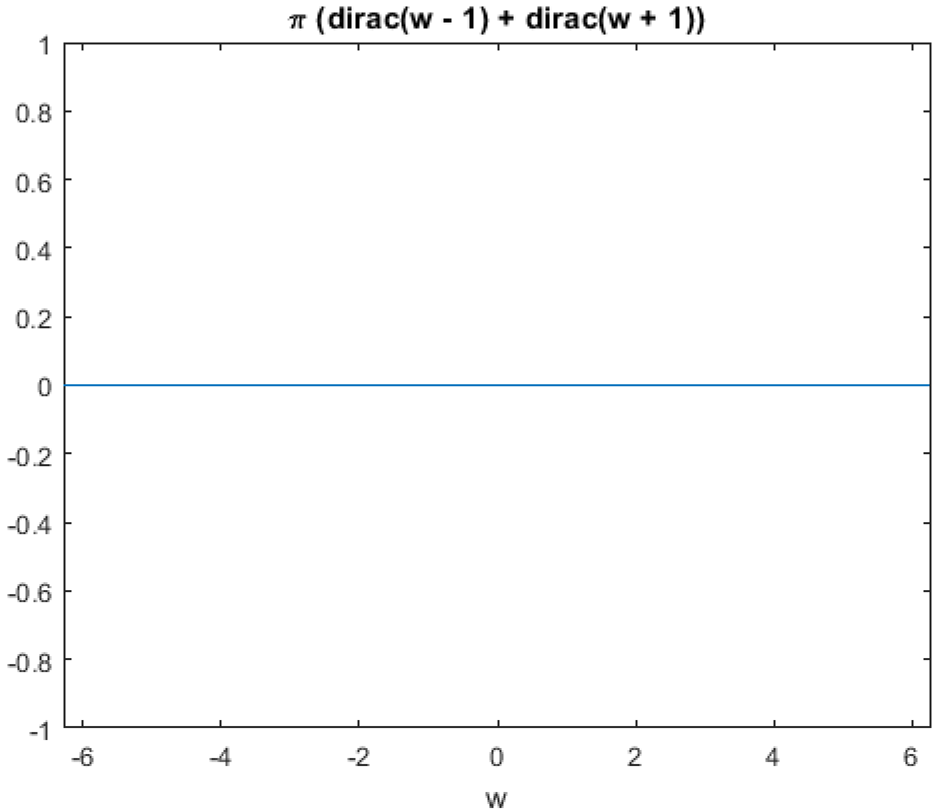
LSS Lab 7 - Summer C2 6/26/2017

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

Problem 1

```
syms t w
x = cos(t);
X = fourier(x,w)
figure;
ezplot(X)
dirac(x)

% Matlab cannot properly plot dirac function since the handle
 expression
% uses dirac(x) = diff(heaviside(x),x). Then it solves an indefinite
% integral, thus part of it extends to infinity. Which requires
 additional
% limiters for it to be plotted. In actuality, there should be two
 lines
% with a magnitude of pi at -1 and 1.
```

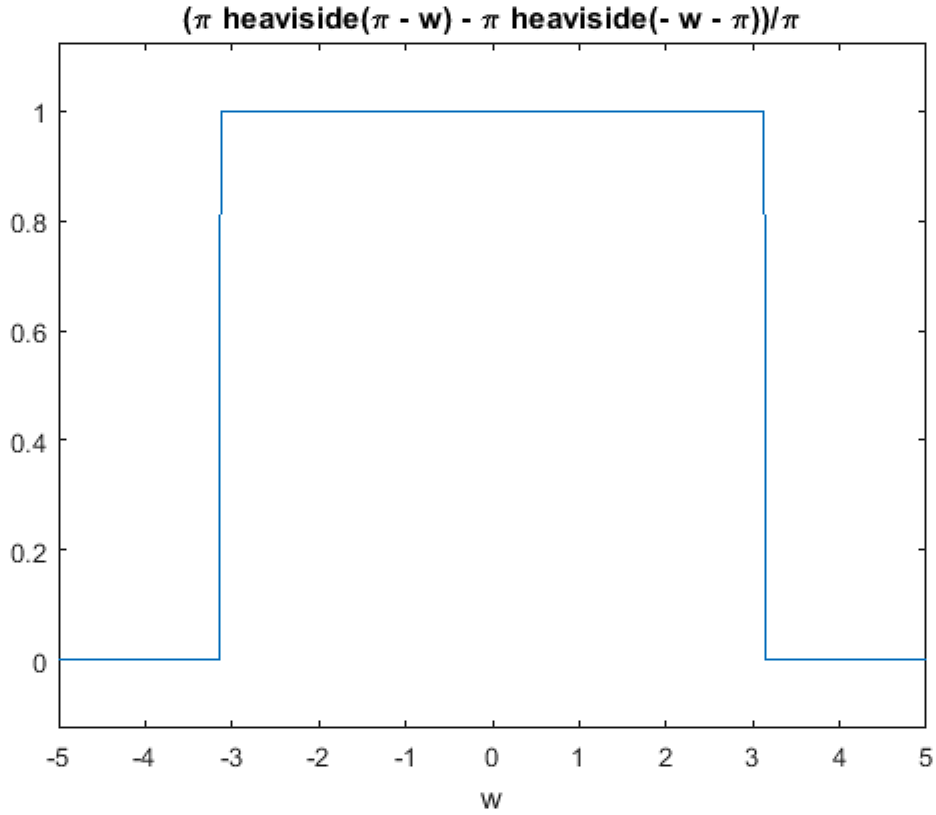
```
X =

pi*(dirac(w - 1) + dirac(w + 1))


ans =

dirac(cos(t))
```



Problem 2

```
syms t w
x = sin(pi*t)/(pi*t);
X = fourier(x,w)
figure;
ezplot(X, [-5 5])
```

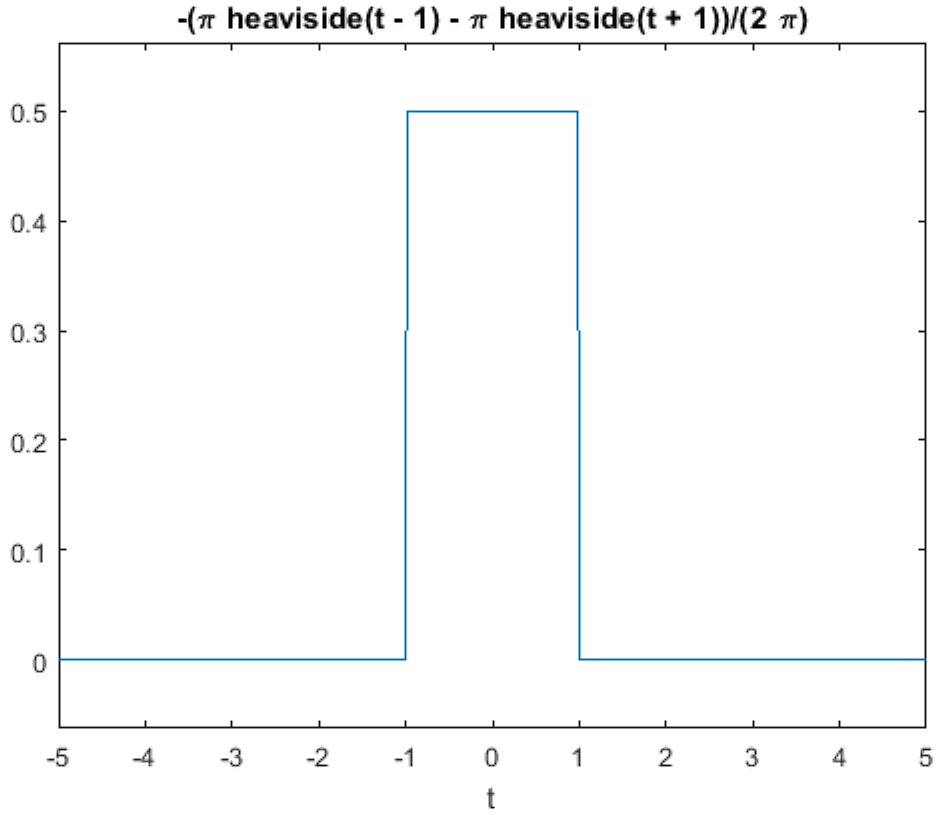
```
X =

(pi*heaviside(pi - w) - pi*heaviside(- w - pi))/pi
```



Problem 3

```
syms t W
x = sin(W)/W;
X = ifourier(x,t)
figure;
ezplot(X, [-5 5])
```

```
X =

-(pi*heaviside(t - 1) - pi*heaviside(t + 1))/(2*pi)
```



Problem 4

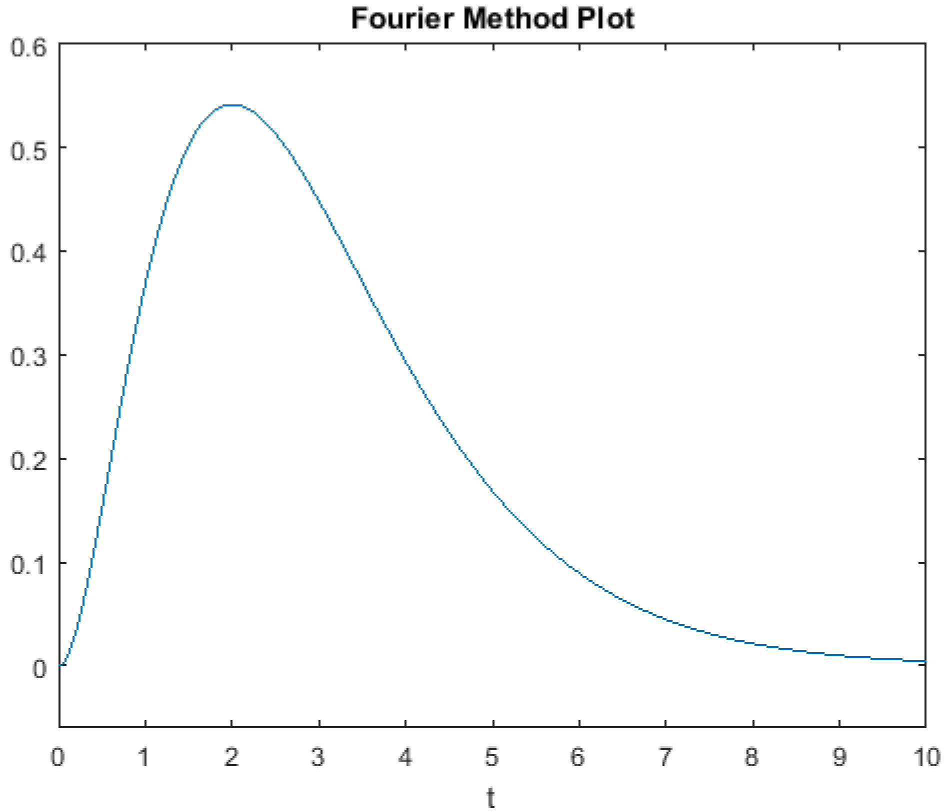
```
syms t w
x = exp(-t)*heaviside(t);
w0 = 3;

% 4a.
Le = cos(w0*t)*x;
Lefta = fourier(Le,w)
X = fourier(x,w);
Righta = (subs(X,w,w+w0)+subs(X,w,w-w0))/2

% 4b.
Le = sin(w0*t)*x;
Leftb = fourier(Le,w)
X = fourier(x,w);
Rightb = (subs(X,w,w+w0)-subs(X,w,w-w0))/(-2*j)

% It is shown that the functions are equal for Part A and B
```

```
Lefta =

1/(2*(w*1i + 1 - 3i)) + 1/(2*(w*1i + 1 + 3i))
```

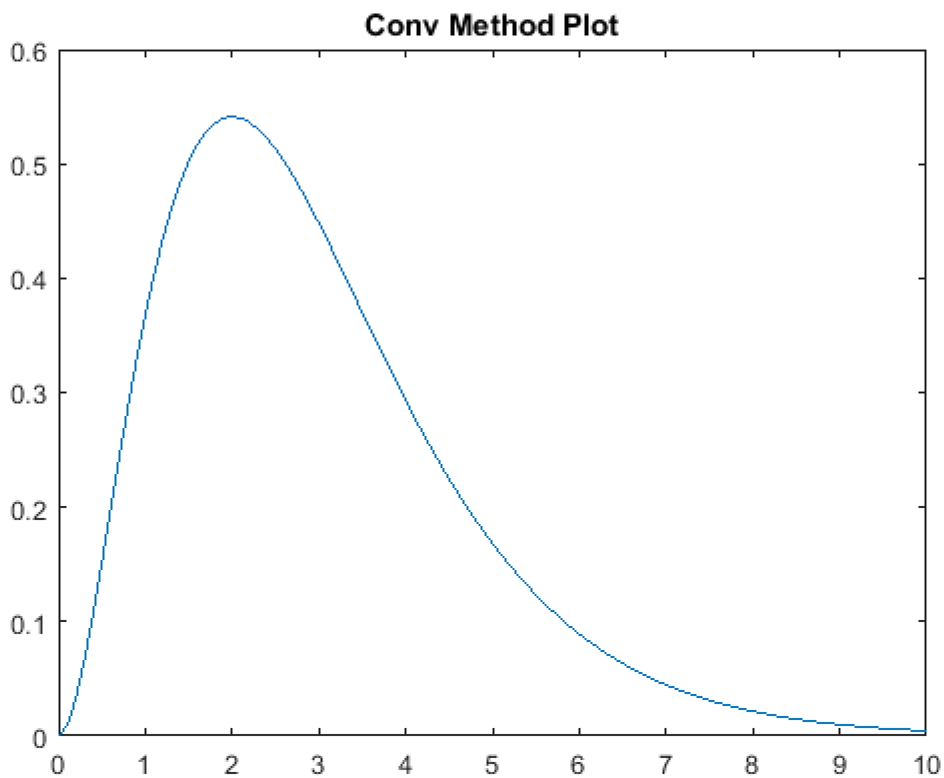
```
Righta =

1/(2*(w*1i + 1 - 3i)) + 1/(2*(w*1i + 1 + 3i))


Leftb =

- 1i/(2*(w*1i + 1 - 3i)) + 1i/(2*(w*1i + 1 + 3i))


Rightb =

- 1i/(2*(w*1i + 1 - 3i)) + 1i/(2*(w*1i + 1 + 3i))
```

Problem 5

```
syms t w
x = 2*exp(-t)*heaviside(t);
h = t*exp(-t)*heaviside(t);

% 5.1
X = fourier(x,w);
H = fourier(h,w);
conv1 = ifourier(X*H,t)
figure;
ezplot(conv1,[0 10])
title('Fourier Method Plot')

% 5.2
t1 = 0:.1:10;
x1 = 2.*exp(-t1).*heaviside(t1);
h1 = t1.*exp(-t1).*heaviside(t1);
conv2 = conv(x1,h1)*.1;
t2 = 0:.1:20;
figure;
plot(t2, conv2);
xlim([0 10]);
title('Conv Method Plot');

% Since the conv method requires non-syms inputs, numerical inputs t2
 was
% created and therefore plots were shown to verify equal results.


conv1 =

(t^2*pi*exp(-t) + t^2*pi*exp(-t)*sign(t))/(2*pi)
```



Fourier Method Plot
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
8
9
10
t



Conv Method Plot
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
8
9
10

Problem 6

```
syms t w
x = t*exp(-t)*heaviside(t);
etime = int((abs(x))^2,t,-inf,inf);
X = fourier(x,w);
efreq = (1/(2*pi))*int((abs(X))^2,w,-inf,inf);
eval(etime), eval(efreq)

% It is shown through Parseval's Theorem that the energy can be found
% in time and frequency domain since the results are the same at
 0.2500.
```

```
ans =

    0.2500


ans =

    0.2500
```

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