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lab4.m

```
clear
delete(allchild(0));
w = linspace(-pi, pi, 11);
x = sequence([1 4 3 -2 6], -1);
%x = sequence([1 5 2 -1 4 1], -2);
```

Problem #1: Even, Odd

```
test_lab4('even(x)');
test_lab4('odd(x)');
test_lab4('trim(plus(even(x), odd(x)))');
```

even(x): sequence O.K.
Your answer:

z =

sequence with properties:

data: [3 -1 2 4 2 -1 3]
offset: -3

odd(x): sequence O.K.
Your answer:

z =

sequence with properties:

```
data: [-3 1 -1 0 1 -1 3]
offset: -3
```

trim(plus(even(x), odd(x))): sequence O.K.
Your answer:

z =

struct with fields:

```
offset: -1
data: [1 4 3 -2 6]
```

Problem #2: DTFT

```
x = sequence([1 1 1], -1);
test_lab4('dtft(x, w)');
```

% Simple impulse Caution! check your answer for this.
% It should be a sequence.

```
x = sequence(1, 0);
test_lab4('dtft(x, w)');
```

```
%x = sequence([1 4 3 -2 6], -1)
x = sequence([1 3 -1 -4 1], -2);
test_lab4('dtft(x, w)');
```

```
%x = sequence([1 4 3 -2 6], -1)
x = sequence([1+j 0 1-j], -1);
test_lab4('dtft(x, w)-dtft(conj(flip(x)), w)');
```

dtft(x, w): data O.K.
Your answer:

z =

Columns 1 through 7

```
-1.0000    -0.6180     0.3820     1.6180     2.6180     3.0000     2.6180
```

Columns 8 through 11

```
1.6180     0.3820    -0.6180    -1.0000
```

dtft(x, w): data O.K.
Your answer:

z =

1 1 1 1 1 1 1 1 1 1 1

`dtft(x, w): data O.K.`

Your answer:

`z =`

Columns 1 through 4

2.0000 - 0.0000i 0.4271 - 4.1145i -2.3090 - 6.6574i -2.9271 - 6.6574i

Columns 5 through 8

-1.1910 - 4.1145i 0.0000 + 0.0000i -1.1910 + 4.1145i -2.9271 + 6.6574i

Columns 9 through 11

-2.3090 + 6.6574i 0.4271 + 4.1145i 2.0000 + 0.0000i

`dtft(x, w)-dtft(conj(flip(x)), w): data incorrect`

Your answer:

`z =`

Columns 1 through 4

-2.0000 - 1.0000i 1.3209 + 0.3666i 4.1372 + 1.5931i 5.3733 + 2.2111i

Columns 5 through 8

4.5570 + 1.9846i 2.0000 + 1.0000i -1.3209 - 0.3666i -4.1372 - 1.5931i

Columns 9 through 11

-5.3733 - 2.2111i -4.5570 - 1.9846i -2.0000 - 1.0000i

Correct answer:

0 0 0 0 0 0 0 0 0 0 0

Problem #3: Real and Imaginary

```
x = sequence([1 1 1 1 1], -1);
```

```
test_lab4('dtft2(x, w)');
```

```
%x = sequence([1 4 3 -2 6], -1);
```

```
x = sequence([1 2 2 -1 2 1], -2);
```

```
test_lab4('dtft2(x, w)');
```

dtft2(x, w): data O.K.

Your answer:

z =

struct with fields:

```
real: [-1 2.7756e-16 0.3820 1.1102e-16 2.6180 5 2.6180 1.1102e-16 ... ]
imag: [1.2246e-16 -1.1102e-16 -1.1756 2.2204e-16 1.9021 0 -1.9021 ... ]
```

dtft2(x, w): data O.K.

Your answer:

z =

struct with fields:

```
real: [3 2.4271 0.0729 -0.9271 3.4271 7 3.4271 -0.9271 0.0729 2.4271 3]
imag: [-2.4493e-16 -1.7634 -4.0287 -2.8532 0.1388 0 -0.1388 2.8532 ... ]
```

Problem #4: Magnitude and Phase

```
test_lab4('mag_phase(dtft2(x, w))');
```

mag_phase(dtft2(x, w)): data O.K.

Your answer:

z =

struct with fields:

```
mag: [3 3.0000 4.0294 3.0000 3.4299 7 3.4299 3.0000 4.0294 3.0000 3]
phase: [-8.1643e-17 -0.6283 -1.5527 -1.8850 0.0405 0 -0.0405 1.8850 ... ]
```

Problem #5 Plotting

```
w = linspace(-pi, pi, 1001);
```

```
plot_magph(x, w);
```

```
% This is a purely real and even function.
```

```
% What can you say about the phase?
```

```
% Specifically why is it either 0 or pi?
```

```
x = sequence([1 1 1], -1);
```

```
set(fgure, 'Color', 'w');
```

```
plot_magph(x, w);
```

```
% This is a purely real and odd function.
```

```
% What can you say about the phase?
```

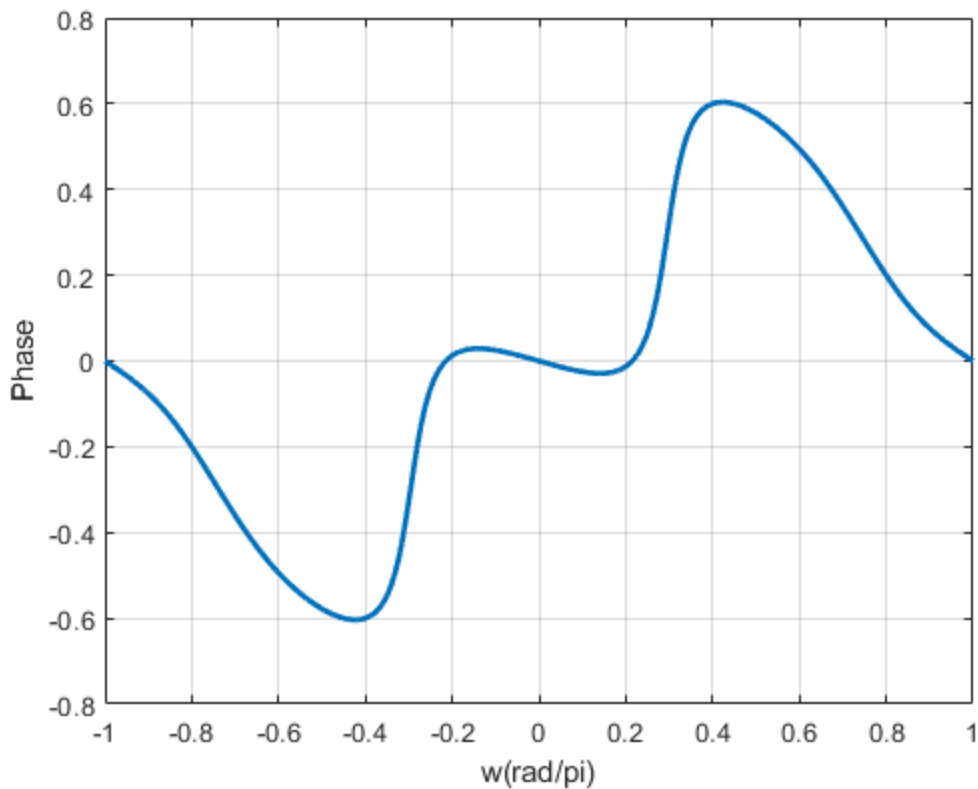
```
% Specifically why is it either +pi/2 or -pi/2?
x = sequence([-1 0 1], -1);
set(gcf, 'Color', 'w');
plot_magph(x, w);

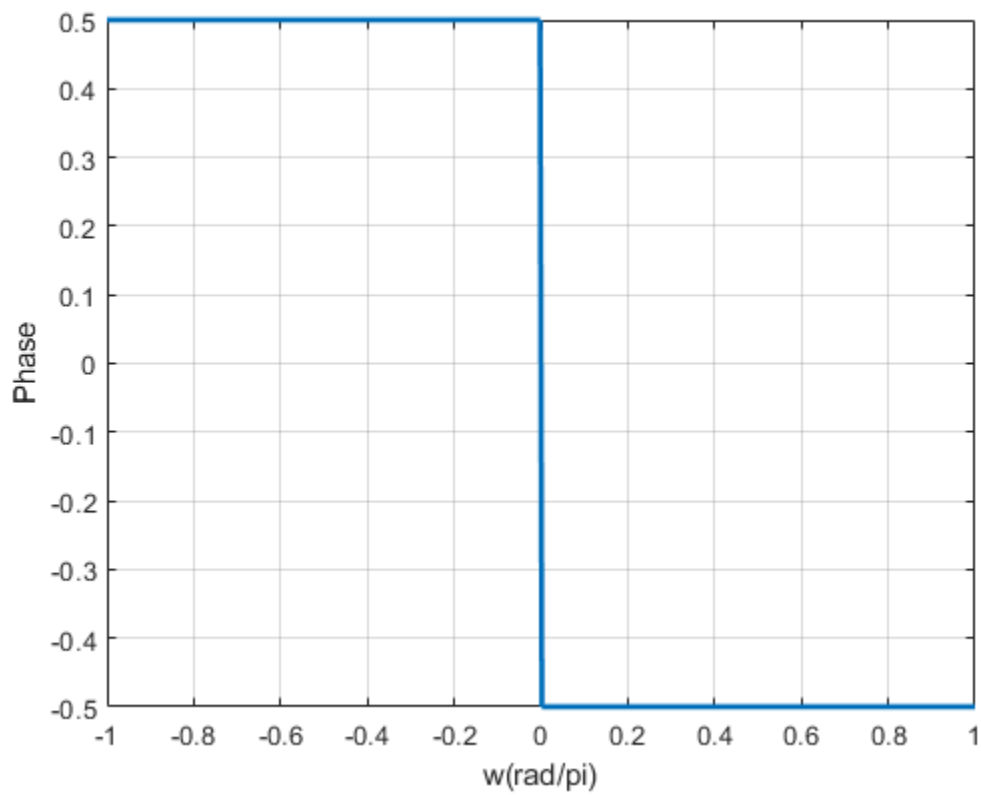
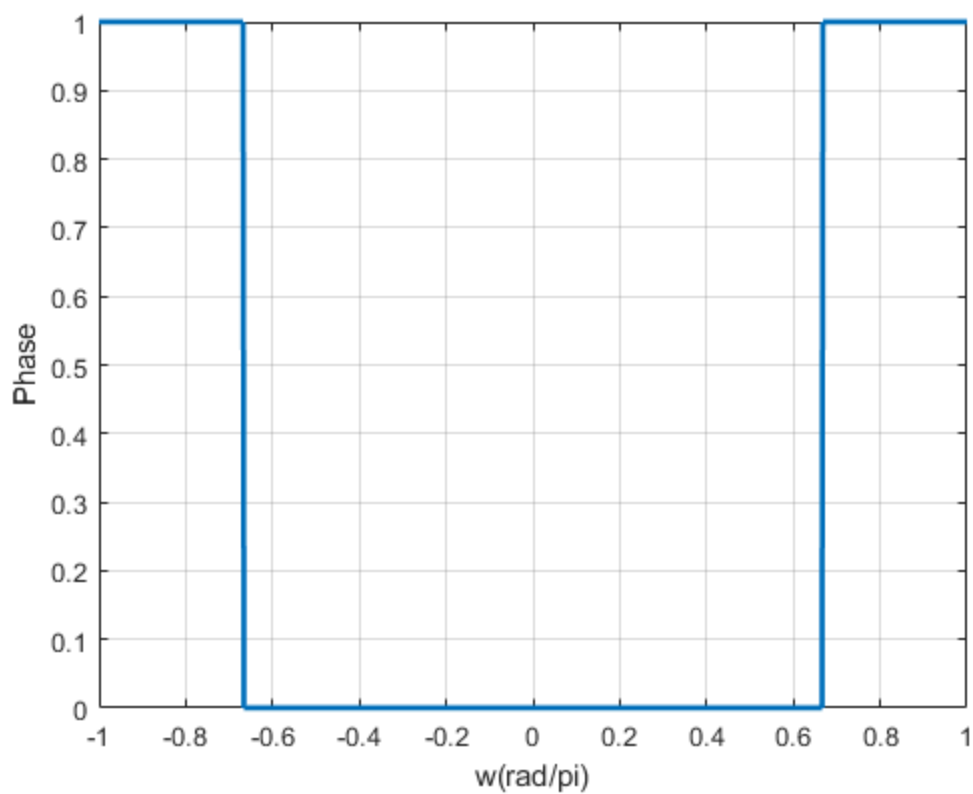
% Here are a series of pulse functions.
% What happens to the magnitude of the transform as the pulse gets broader?
% You may note that the phase 'chatters' between +pi and -pi at some values of
% w.
% This doesn't look nice and it's confusing. How could you fix this in your
% plot_magph
% program so that the phase doesn't chatter? No biggie if you can't.
% (Hint: it has something to do with a very small imaginary part...).

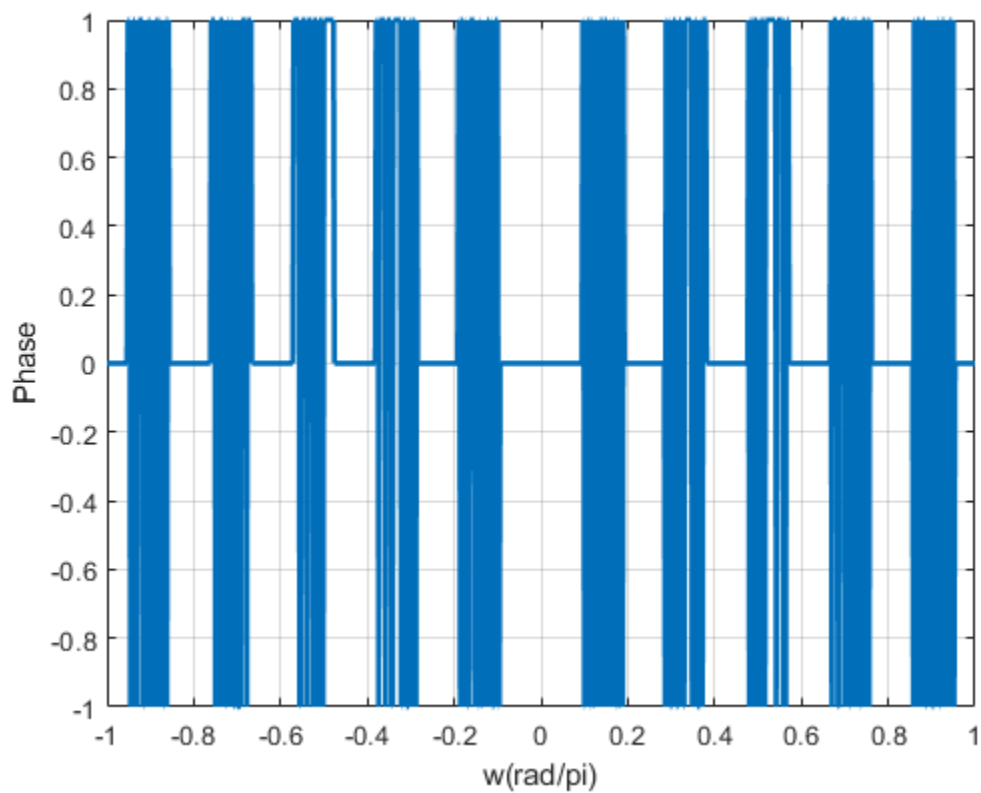
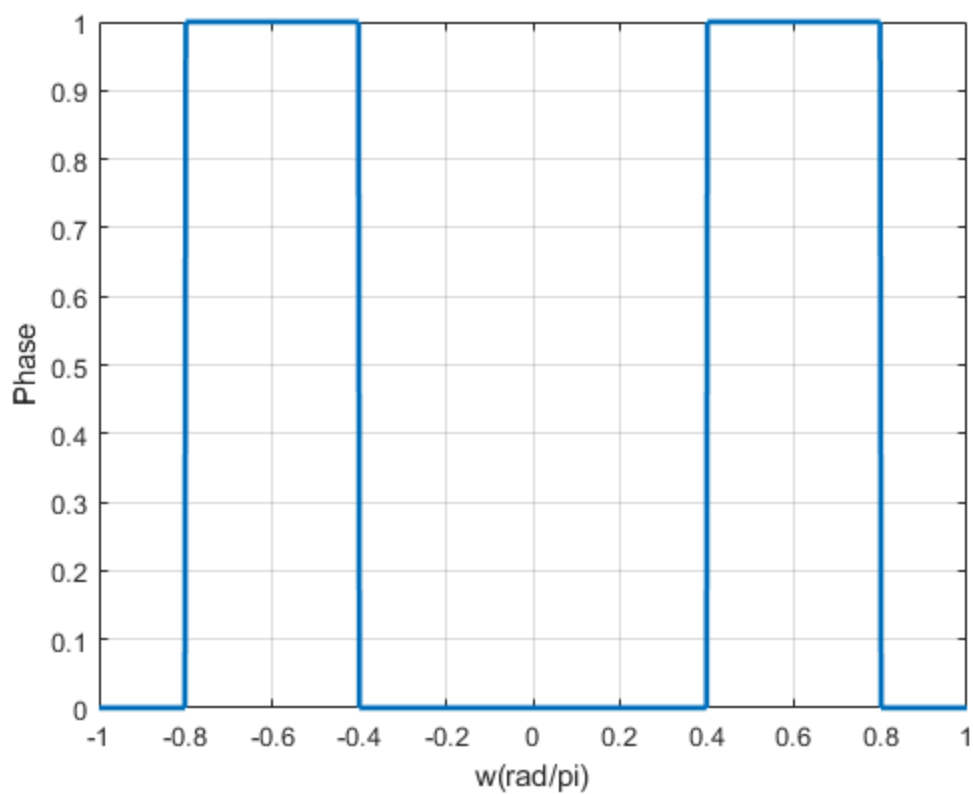
x = sequence(ones(1, 5), -2);
set(gcf, 'Color', 'w');
plot_magph(x, w)

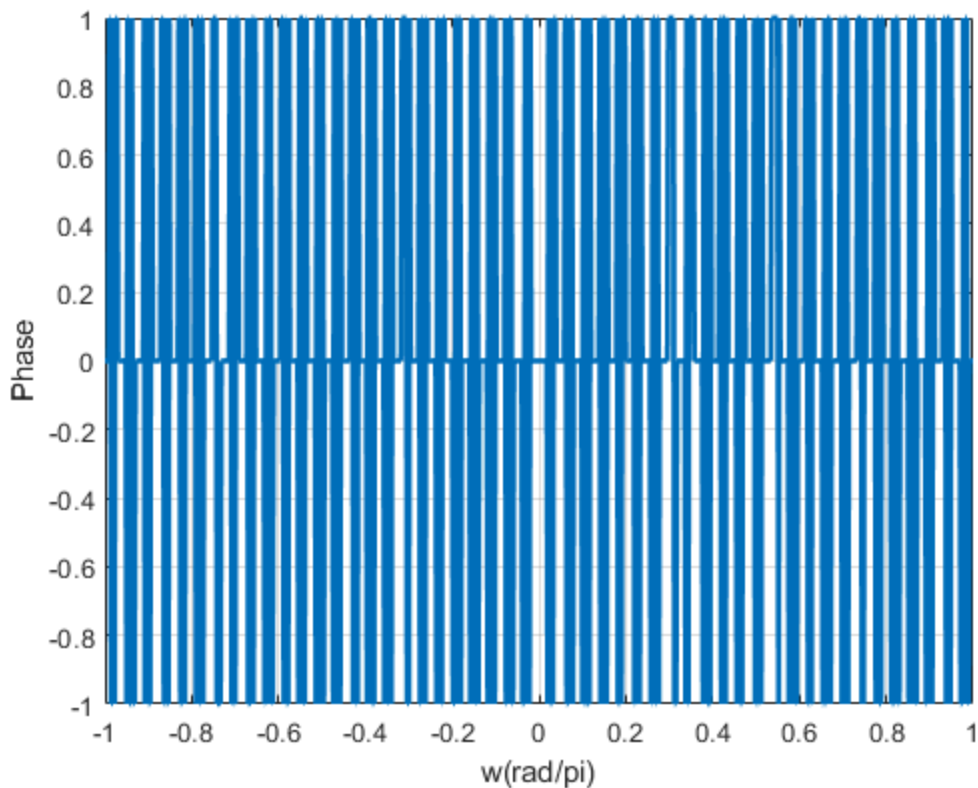
x = sequence(ones(1, 21), -10);
set(gcf, 'Color', 'w');
plot_magph(x, w)

x = sequence(ones(1, 101), -50);
set(gcf, 'Color', 'w');
plot_magph(x, w)
```









Print programs

```
disp(' ')
disp('--- dtft.m -----')
type('dtft')
disp('--- dtft2.m -----')
type('dtft2')
disp('--- mag_phase.m -----')
type('mag_phase')
disp('--- plot_magph.m -----')
type('plot_magph')
```

```
--- dtft.m -----
```

```
function y = dtft(x, w)
```

```
n = x.offset: x.offset + length(x.data)-1;
Q = n'*w;
y = x.data*exp(-1i*Q);
```

```
end
```

```
--- dtft2.m -----
```

```
function y = dtft2(x,w)
n = (x.offset:x.offset + length(x.data)-1);
```



```
Q = n'*w;
dtft = x.data*exp(-1i*Q);

    for n=1:length(dtft)
        mag = abs(dtft(n));
        ang = angle(dtft(n));
        y.real(n) = mag*cos(ang);
        y.imag(n) = mag*sin(ang);
    end
end
--- mag_phase.m -----

function y = mag_phase(x)
mag = sqrt((x.real).*(x.real))+(x.imag).*(x.imag));
P = zeros(1,length(x.real));

    for n=1:length(x.real)
        P(1,n) = atan2(x.imag(n), x.real(n));
        y.mag = mag;
        y.phase = P;
    end
end
--- plot_magph.m -----

function plot_magph(x,w)

z = mag_phase(dtft2(x, w));
plot(w/pi,z.mag,'linewidth',2);
grid on;
ylabel('Magnitude');

plot(w/pi, z.phase/pi,'linewidth',2);
grid on;
ylabel('Phase');
xlabel('w(rad/pi)');

end
```

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