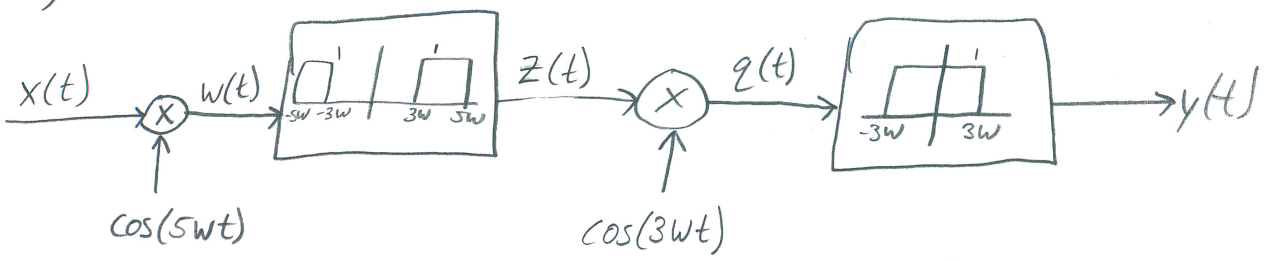
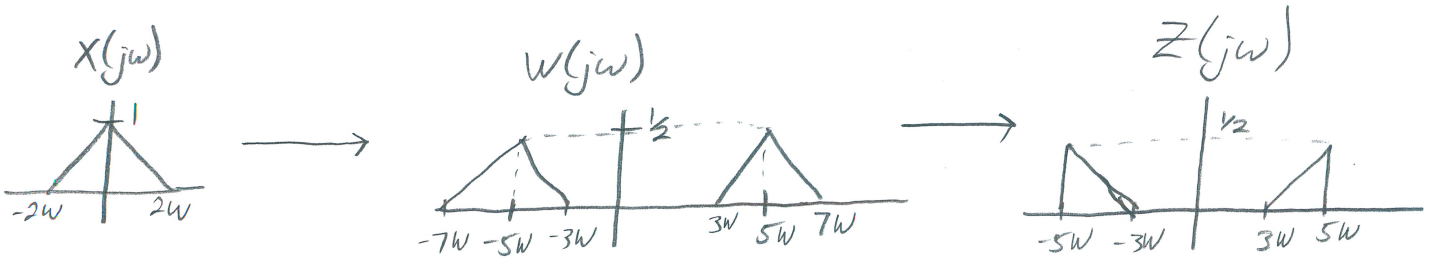
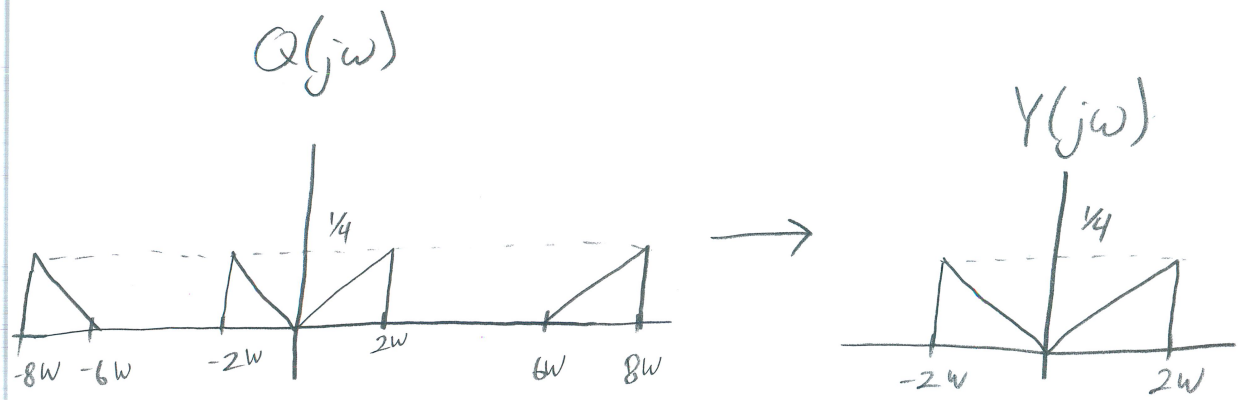
Homework 10 Solutions

Question 92

8.22)







Question 93

Task 1

objective 1

- plot of sine wave
- plot of sinc function

objective 2

- plot of US dial tone

objective 3

- $h(t) = \frac{\sin(2\pi 1000 t)}{\pi t}$
- plot of $h(t)$

objective 4

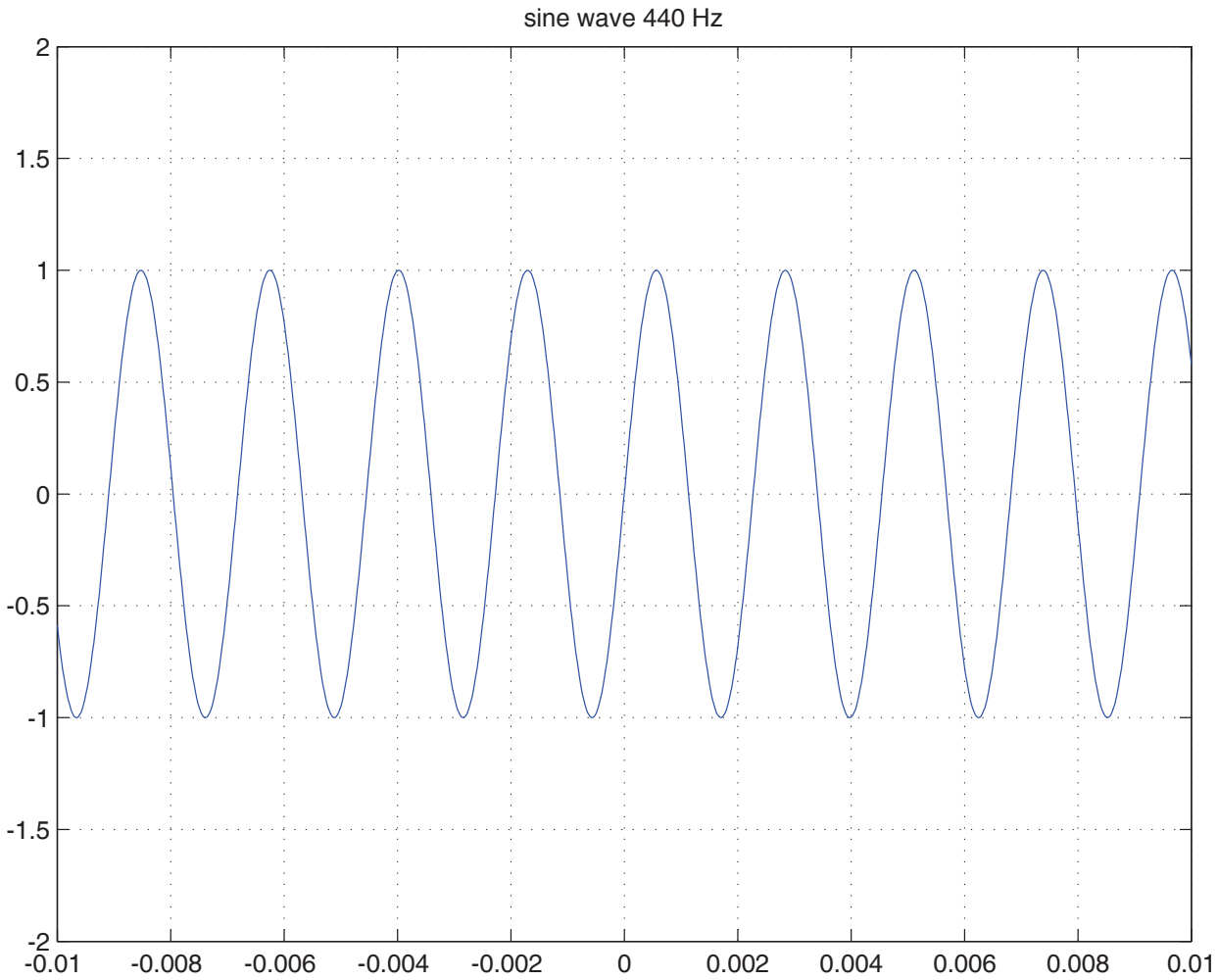
- xL_lpf will be smoother because high frequency content will be blocked by the LPF
- plot of Filtered vs. Unfiltered signal with two windows
- (optional) - nothing to check

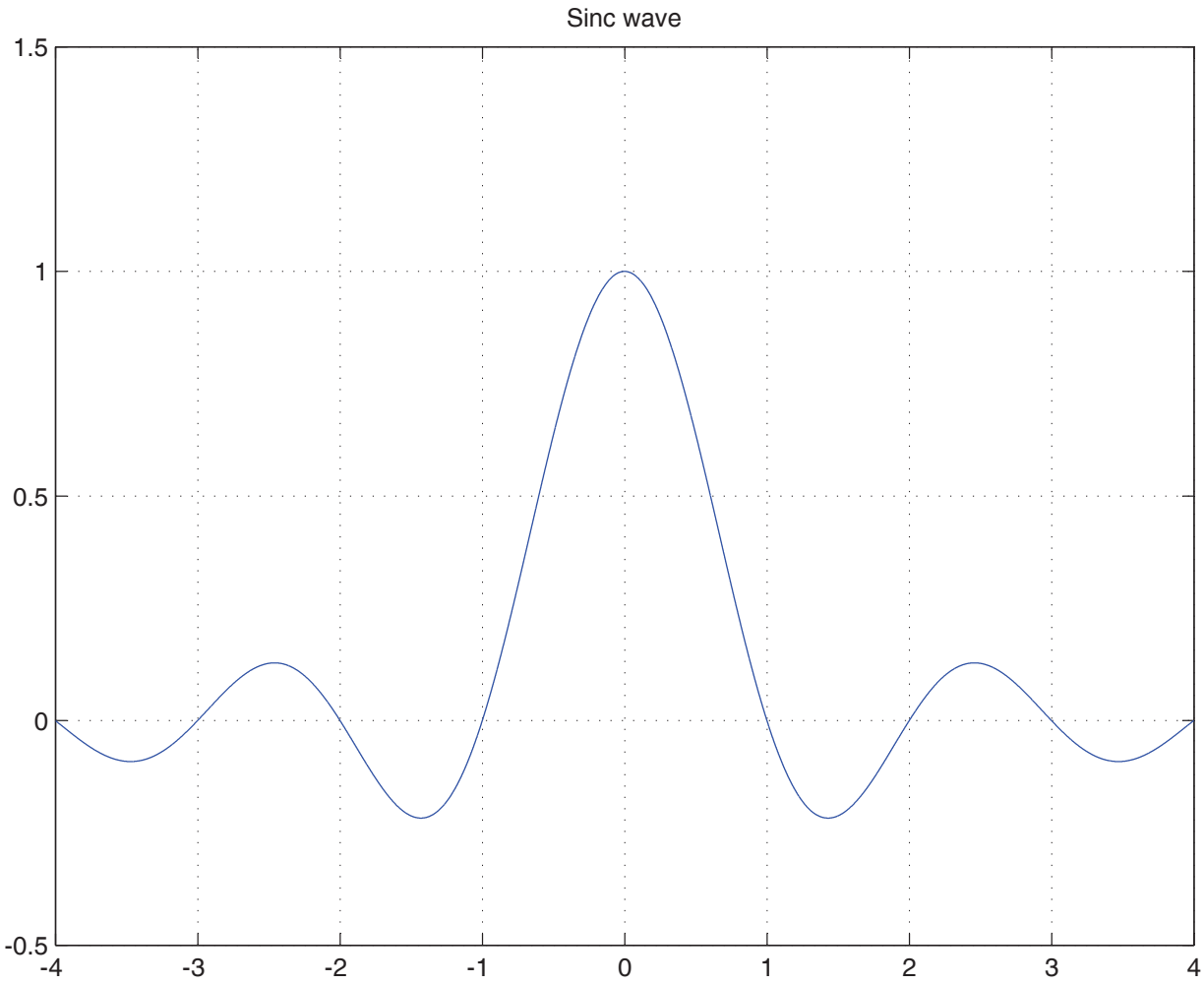
objective 5

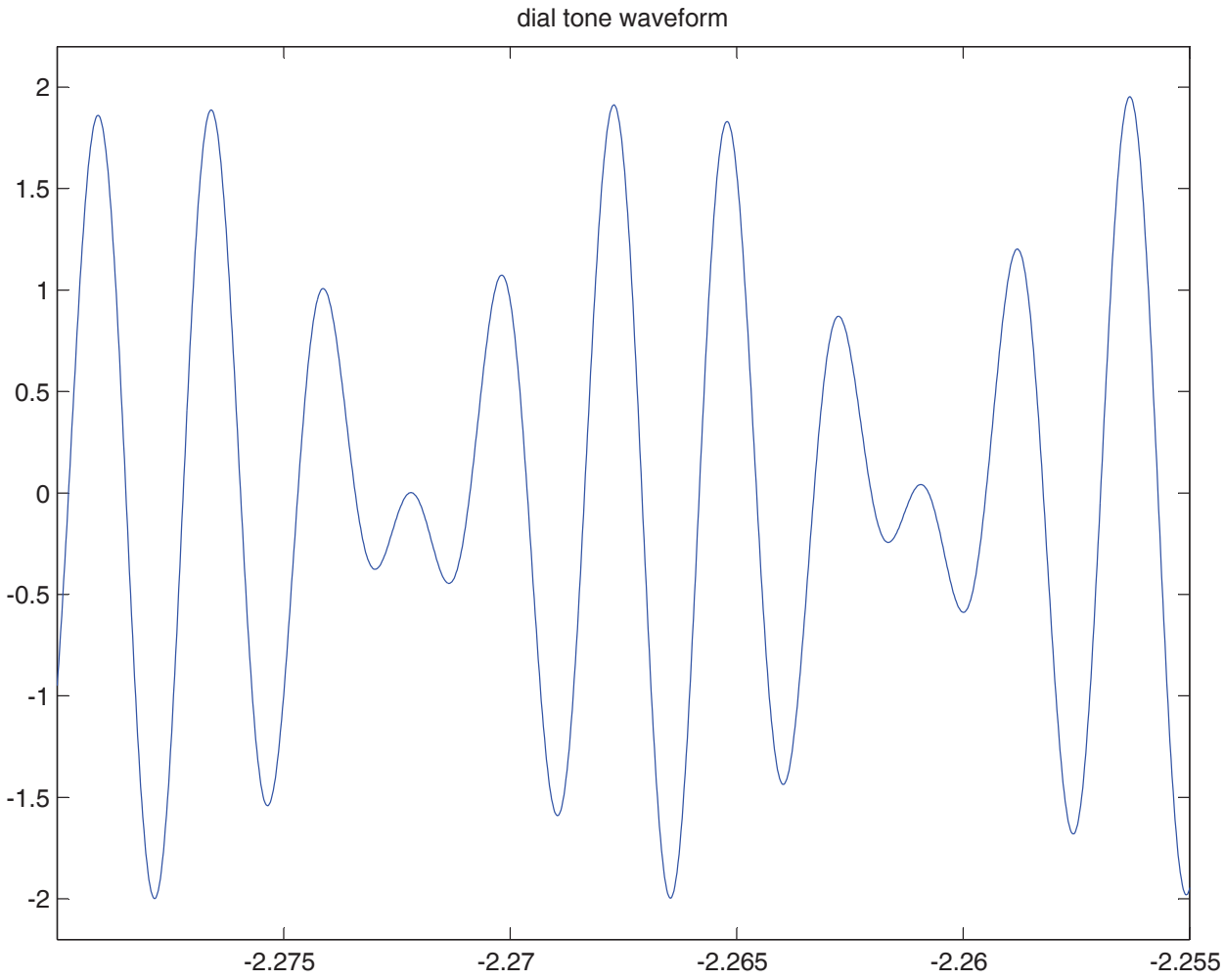
- plot of modulated signal with original signal

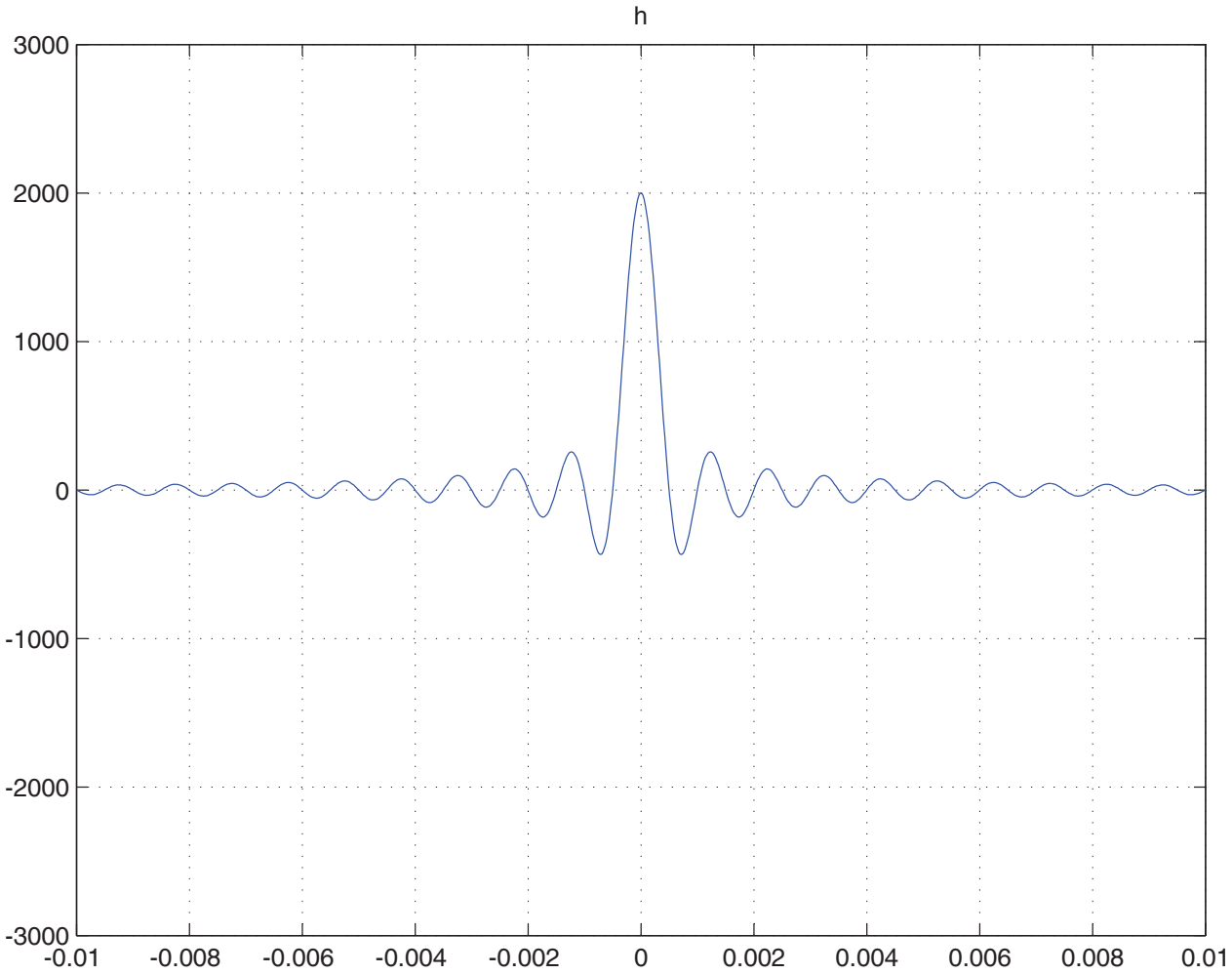
objective 6

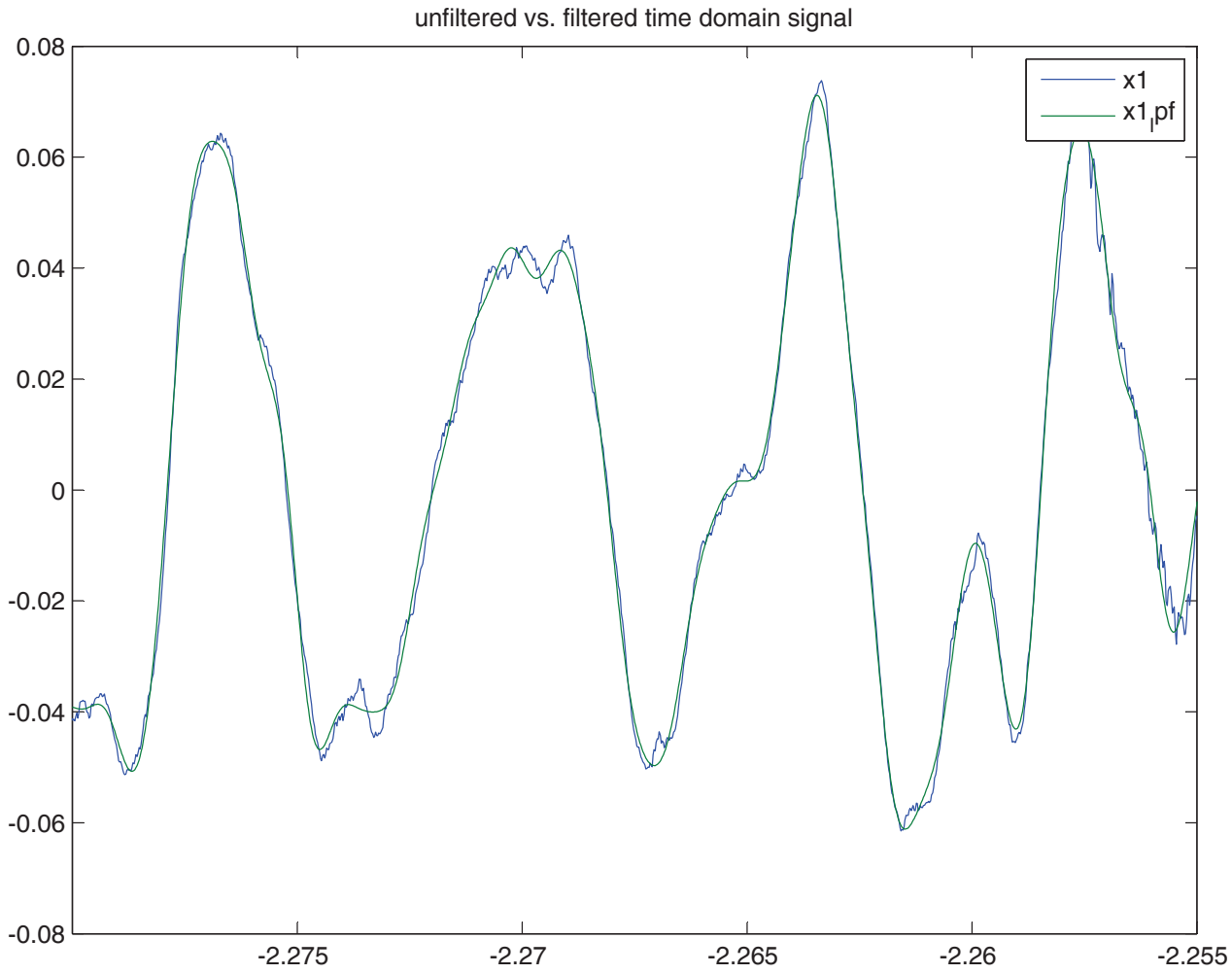
- plot of demodulated signal with original signal

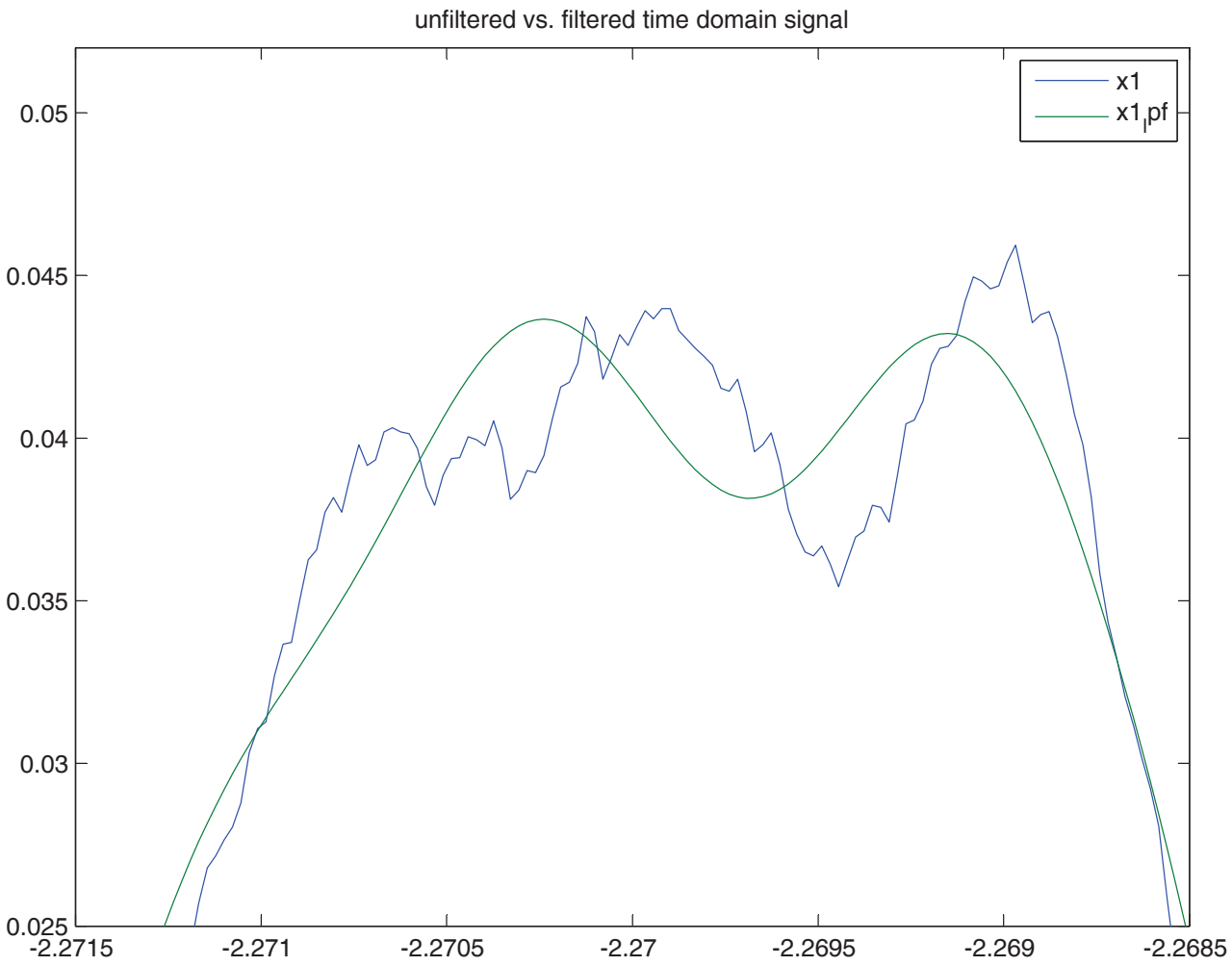

sine wave 440 Hz
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-0.01
-0.008
-0.006
-0.004
-0.002
0
0.002
0.004
0.006
0.008
0.01


Sinc wave
1.5
1
0.5
0
-0.5
-4
-3
-2
-1
0
1
2
3
4

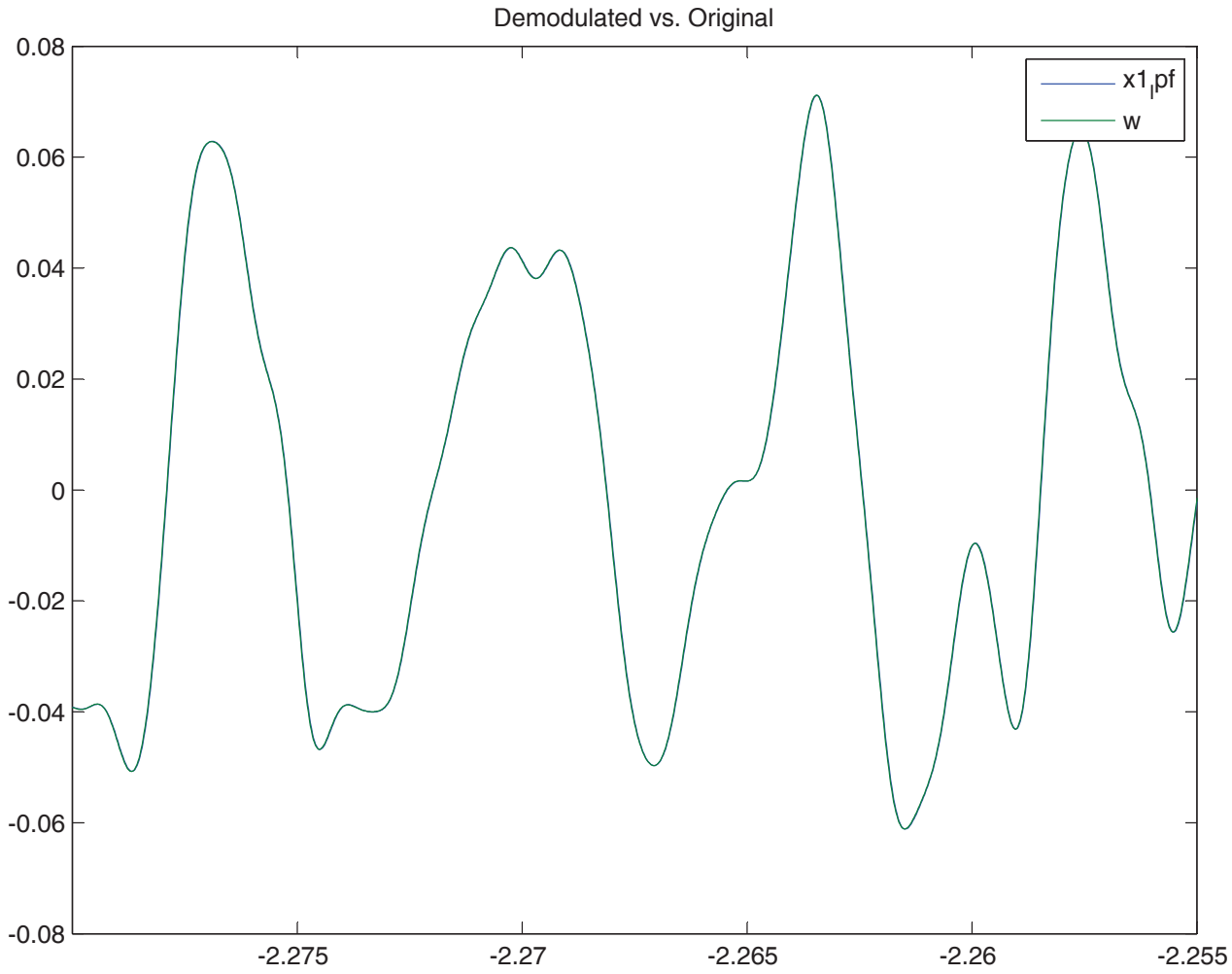

dial tone waveform
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.275
-2.27
-2.265
-2.26
-2.255


h
3000
2000
1000
0
-1000
-2000
-3000
-0.01
-0.008
-0.006
-0.004
-0.002
0
0.002
0.004
0.006
0.008
0.01


unfiltered vs. filtered time domain signal
x1
x1_lpf
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-2.275
-2.27
-2.265
-2.26
-2.255


unfiltered vs. filtered time domain signal
x1
x1_lpf
0.05
0.045
0.04
0.035
0.03
0.025
-2.2715
-2.271
-2.2705
-2.27
-2.2695
-2.269
-2.2685


Modulated vs. Original
x1_lpf
y
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-2.275
-2.27
-2.265
-2.26
-2.255


Demodulated vs. Original
x1_lpf
w
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-2.275
-2.27
-2.265
-2.26
-2.255

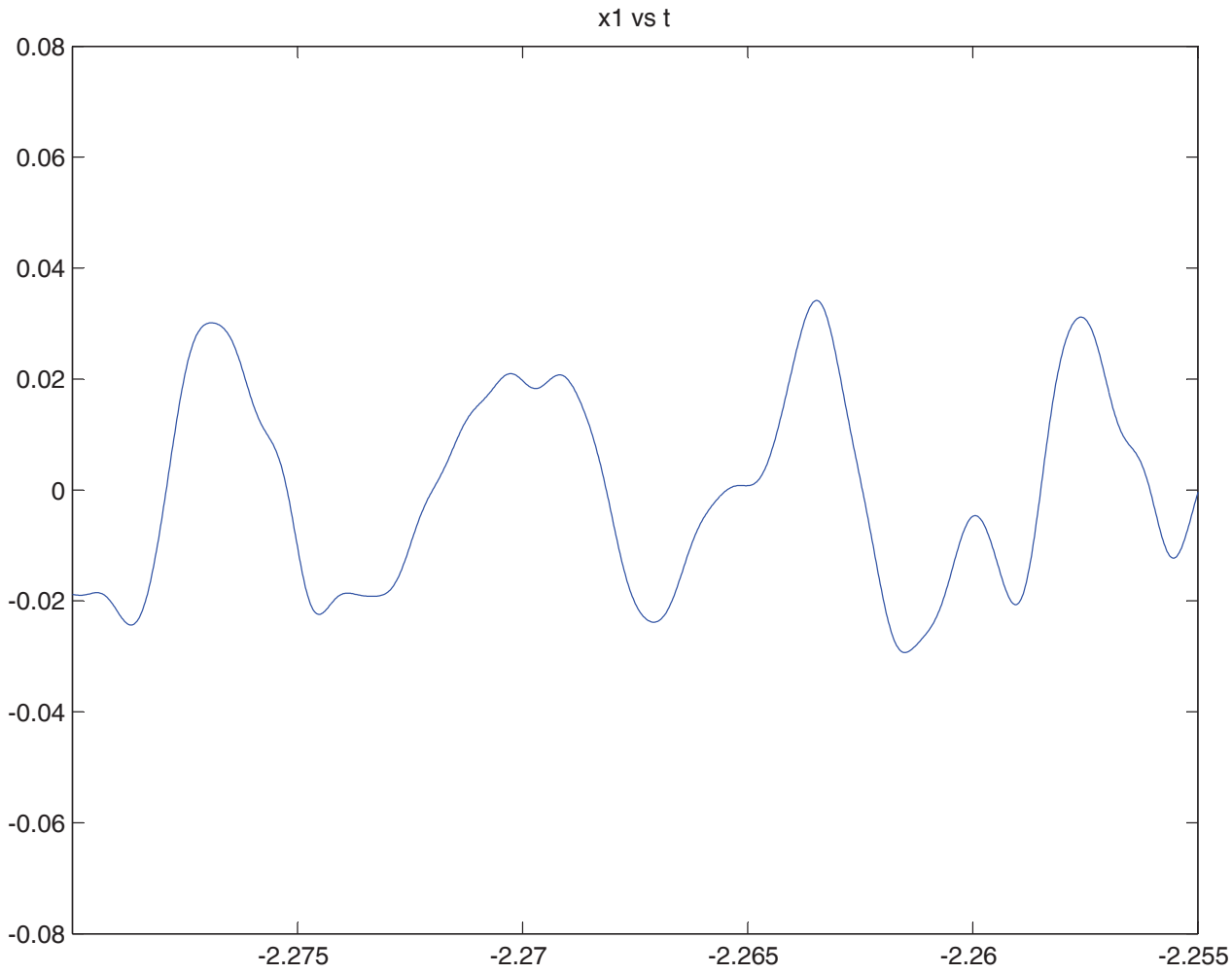
Question 3

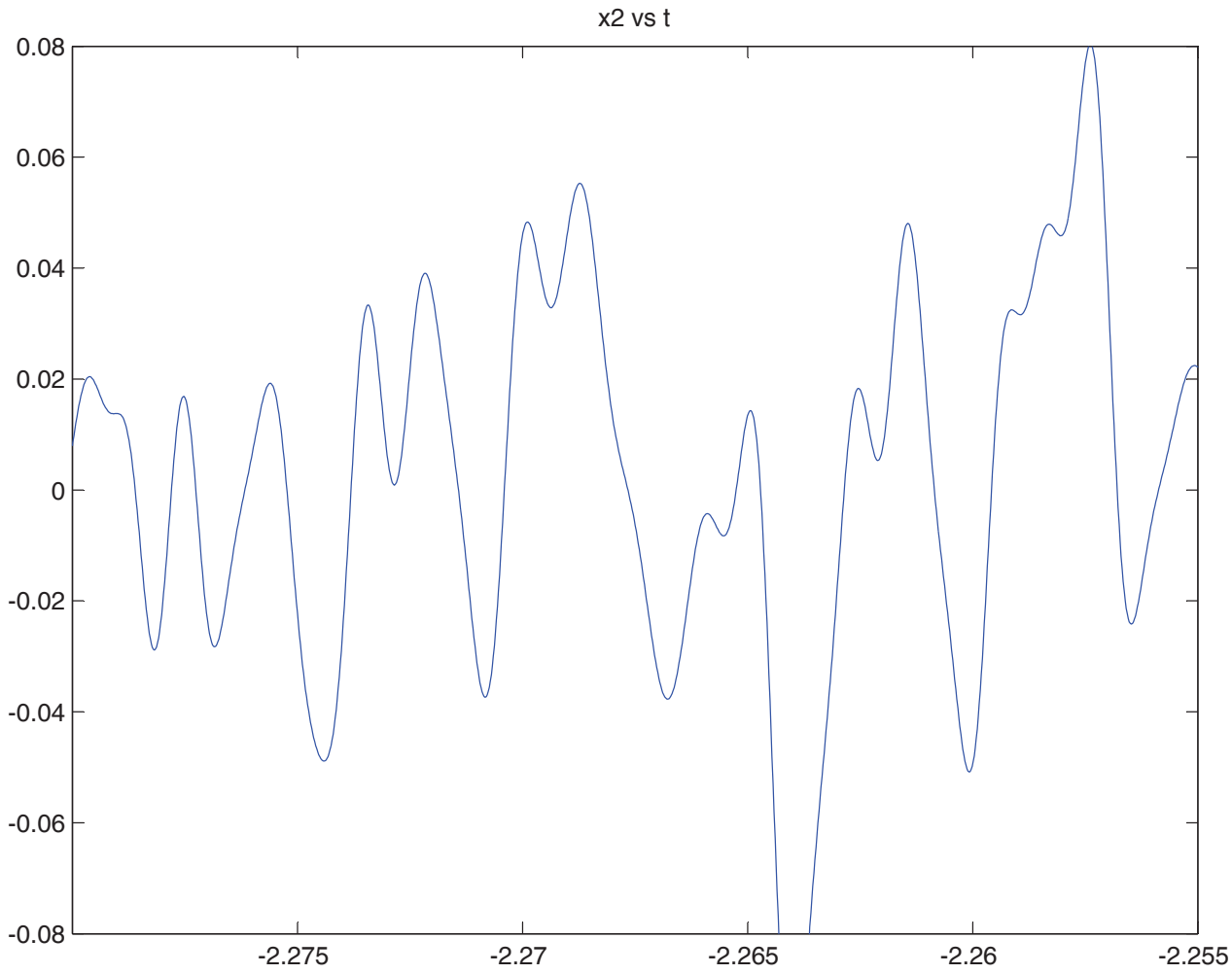
objective 1

- plot of $x_1(t)$

objective 2

- plot of $x_2(t)$

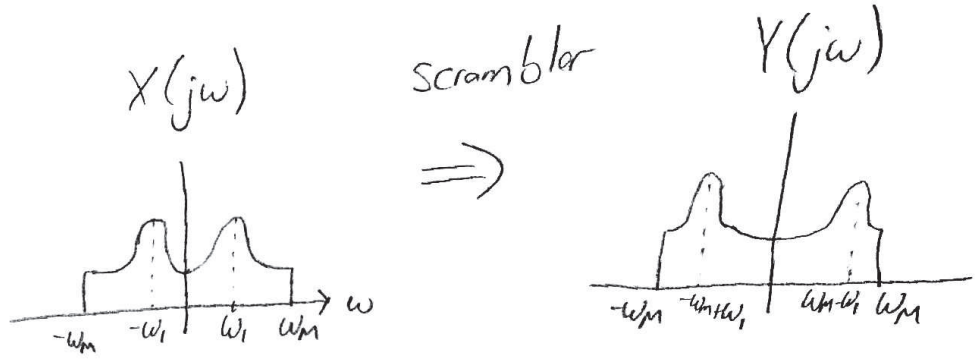

x1 vs t
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-2.275
-2.27
-2.265
-2.26
-2.255


x2 vs t
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-2.275
-2.27
-2.265
-2.26
-2.255

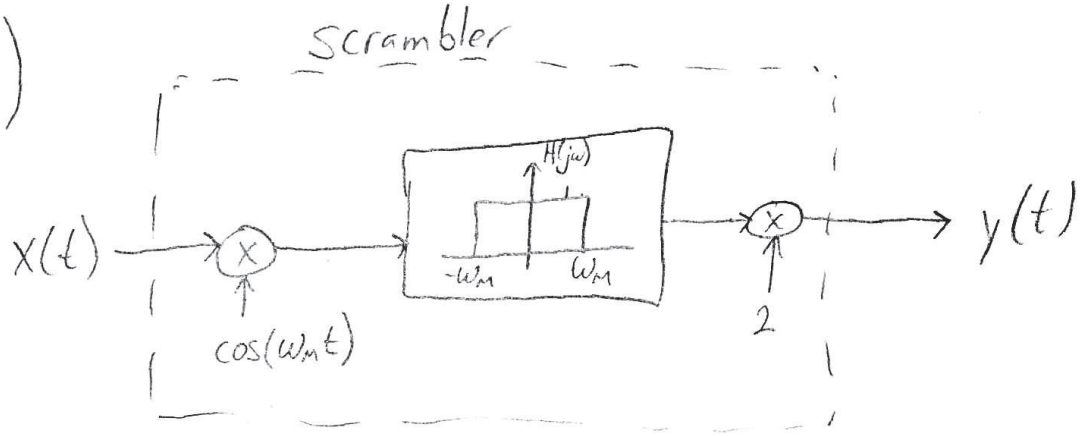
Question 95 4

8.25)

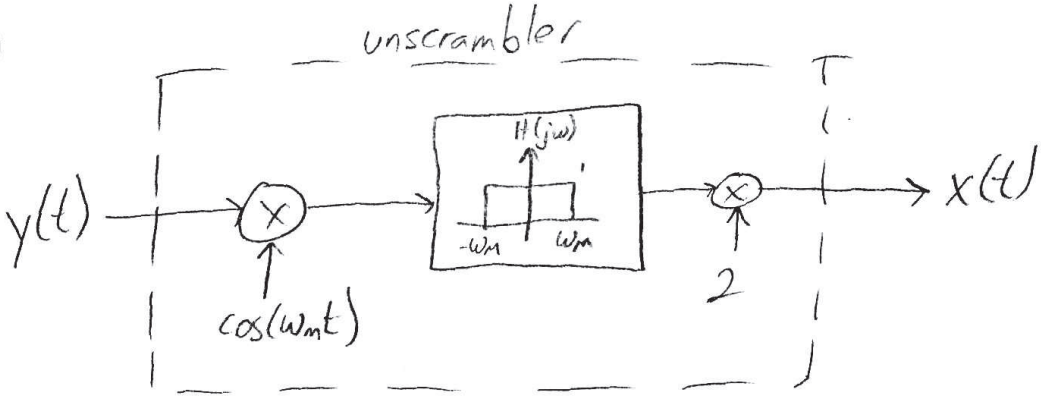
a.)



b.)



c.)



optional - see next page

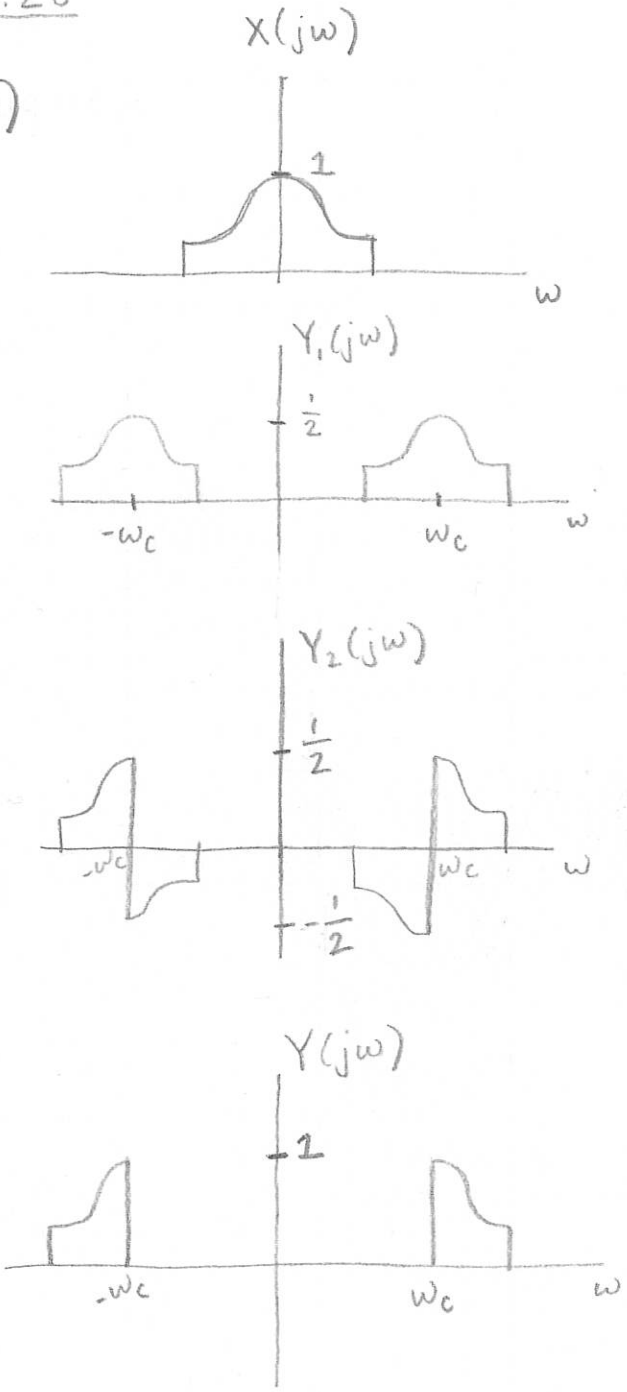
```
% Question 2 [Optional]

duration=8;
f_sample=44100;
t=(((0-4)*f_sample+0.5):((duration-4)*f_sample-0.5))/f_sample;

%let x = original signal
%let Wm = the maximum frequency of x

%ideal scrambler

h = sin(Wm*t)./(Wm*t);
y = 2*ece301conv(x .* cos(Wm*t),h);

%ideal unscrambler

x = 2*ece301conv(y .* cos(Wm*t),h);
```

Question 5

Question 96

8.28

a)



*only the upper sidebands are retained

b)