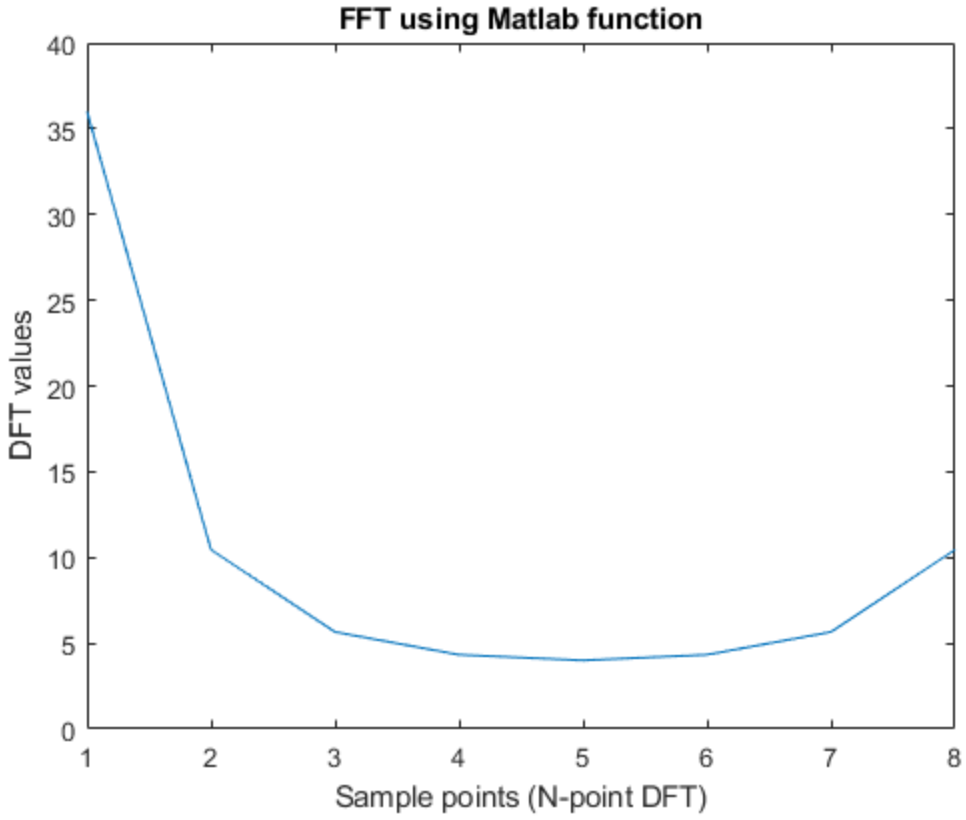
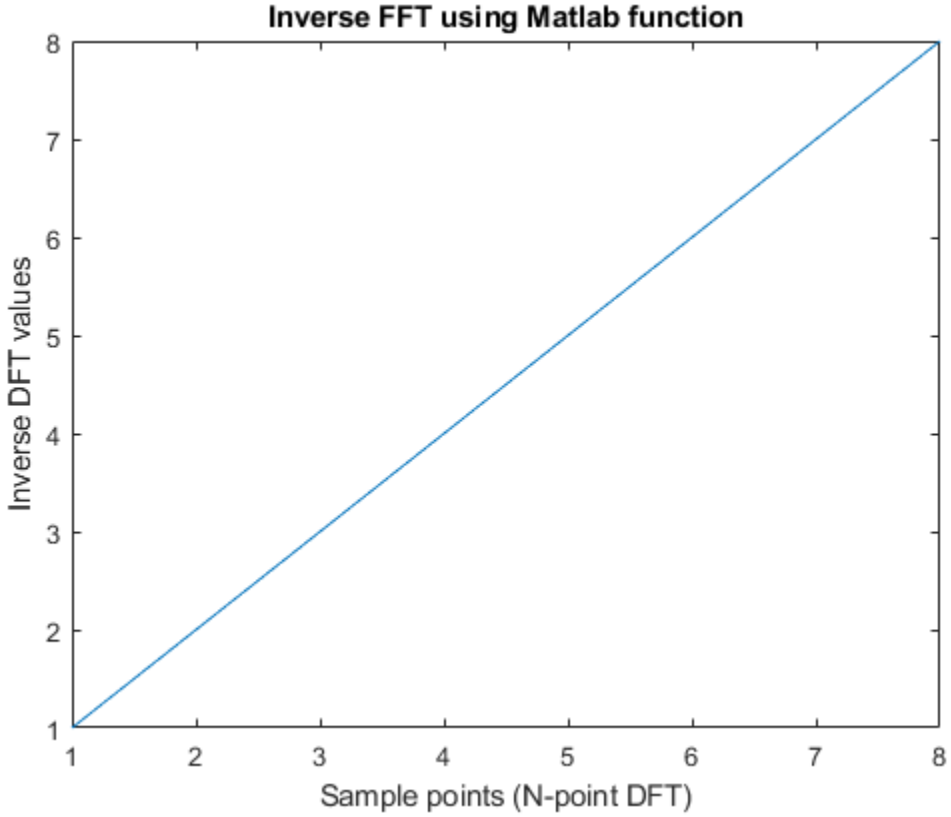
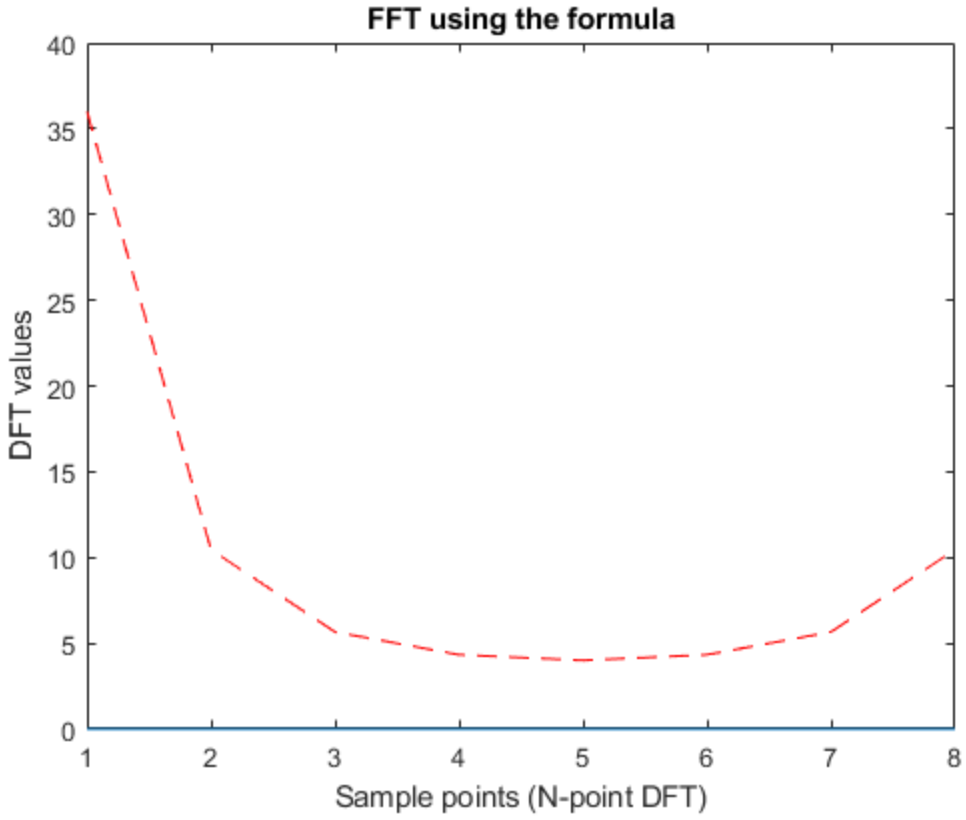
Problem 1

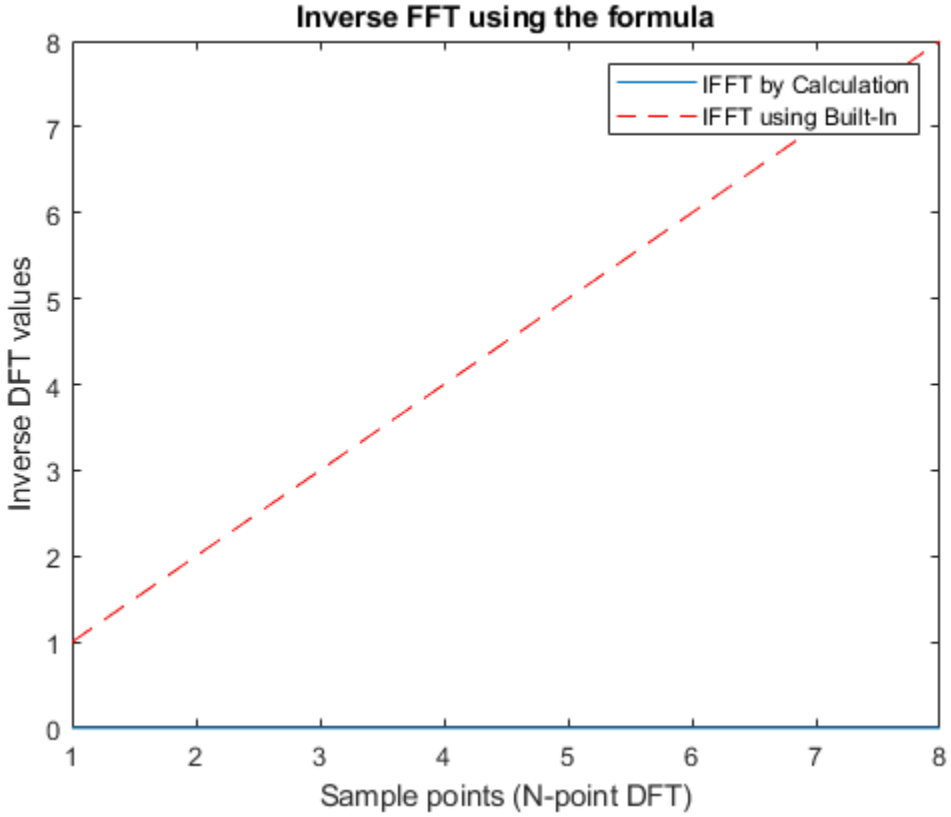
```
x = [1, 2, 3, 4, 5, 6, 7, 8];
%part a
a = fft(x);
figure(1)
plot(abs(a)), xlabel('Sample points (N-point DFT)'), ylabel('DFT values')
title("FFT using Matlab function")
%part b
b = ifft(a);
figure(2)
plot(abs(b)), xlabel('Sample points (N-point DFT)'), ylabel('Inverse DFT values')
title("Inverse FFT using Matlab function")

%part c
figure(3)
X = myDFT(x)
plot(abs(X)), hold on, plot(abs(a), 'r--')
title('FFT using the formula');
xlabel('Sample points (N-point DFT)');
ylabel('DFT values')

%inverse
figure(4)
Y = myInvDFT(X);
plot(abs(Y)), hold on, plot(abs(b), 'r--')
title('Inverse FFT using the formula');
xlabel('Sample points (N-point DFT)');
ylabel('Inverse DFT values');
legend('IFFT by Calculation', 'IFFT using Built-In')
```

```
X =

     0     0     0     0     0     0     0     0
```


FFT using Matlab function
DFT values
Sample points (N-point DFT)
0
5
10
15
20
25
30
35
40
1
2
3
4
5
6
7
8

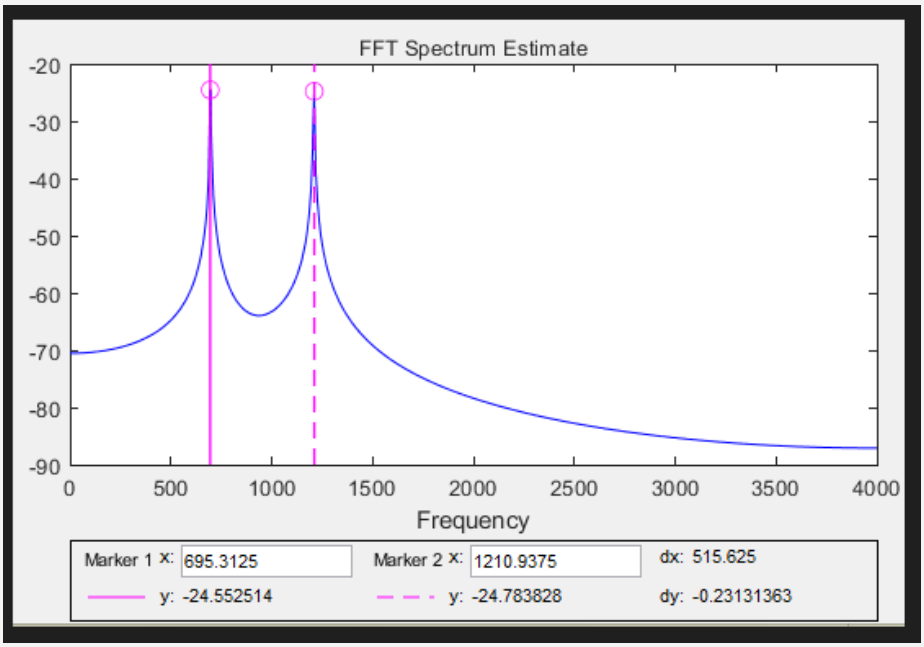

Inverse FFT using Matlab function
Inverse DFT values
Sample points (N-point DFT)
1
2
3
4
5
6
7
8


FFT using the formula
DFT values
Sample points (N-point DFT)
0
5
10
15
20
25
30
35
40
1
2
3
4
5
6
7
8


Inverse FFT using the formula
IFFT by Calculation
IFFT using Built-In
Inverse DFT values
Sample points (N-point DFT)
0
1
2
3
4
5
6
7
8

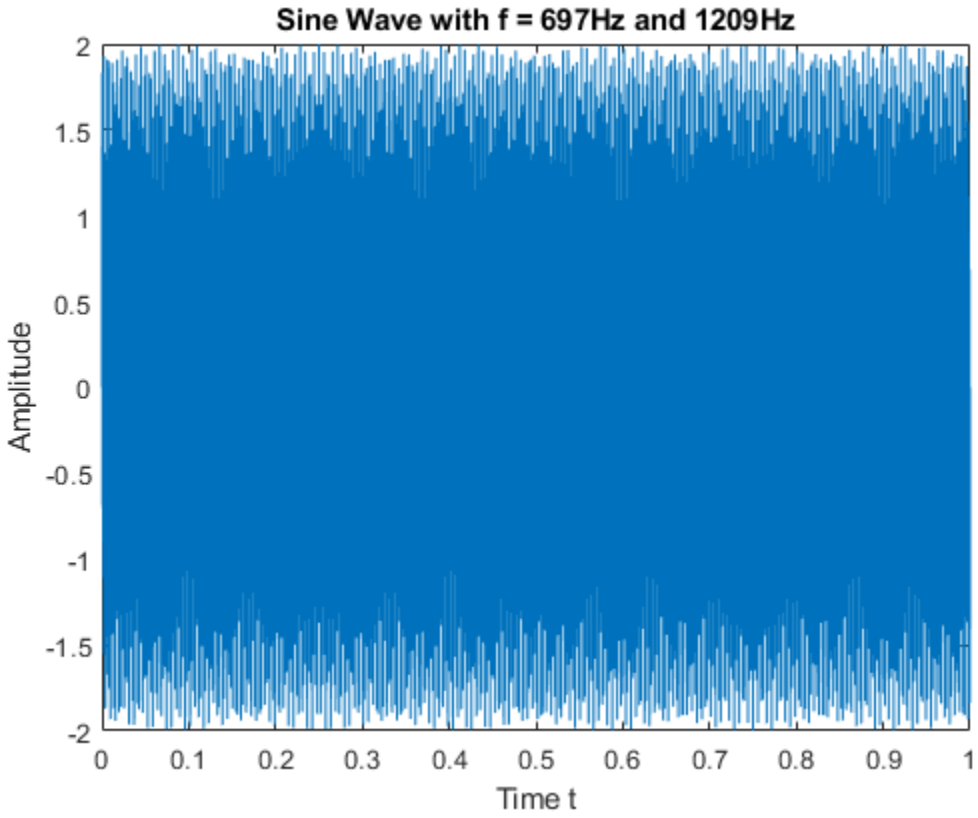
Problem 2

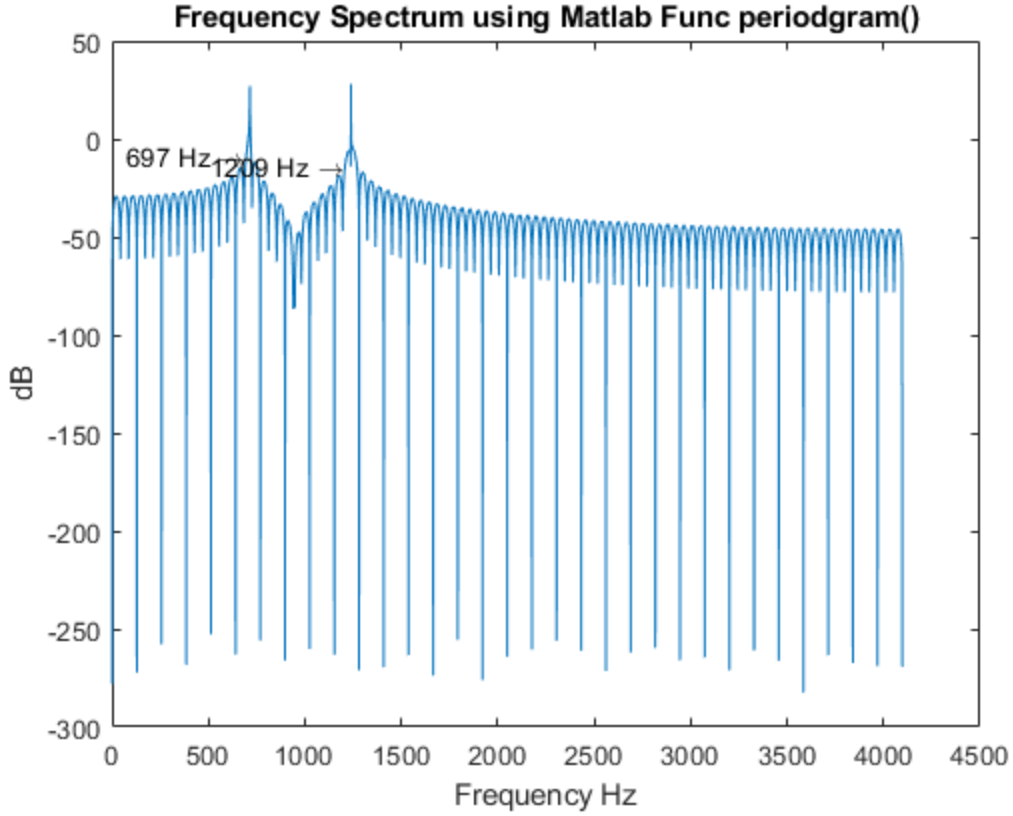
```
Fs = 8000;  % 8kHz
Ts = 1/Fs;
t = 0:Ts:1;
f1 = 697;   % 697 Hz
f2 = 1209;  % 1209 Hz
y = sin(2*pi*f1*t) + sin(2*pi*f2*t);
figure(5)
plot(t,y), xlabel('Time t'), ylabel('Amplitude');
title(['Sine Wave with f = ', num2str(f1), 'Hz and ', num2str(f2), 'Hz'])

% part B) Freq Spectrum
y_psd = periodogram(y);
figure(6)
plot(10*log10(y_psd));
title('Frequency Spectrum using Matlab Func periodgram()')
xlabel('Frequency Hz'), ylabel('dB')
text(697, 10*log10(y_psd(697)), '697 Hz \rightarrow', 'HorizontalAlignment','right');
text(1209, 10*log10(y_psd(1209)), '1209 Hz \rightarrow', 'HorizontalAlignment','right');

%part c) sptool
% file import (input signal (y) and sampling freq (Fs) -> update, apply,
% take screen shot of peak values
```

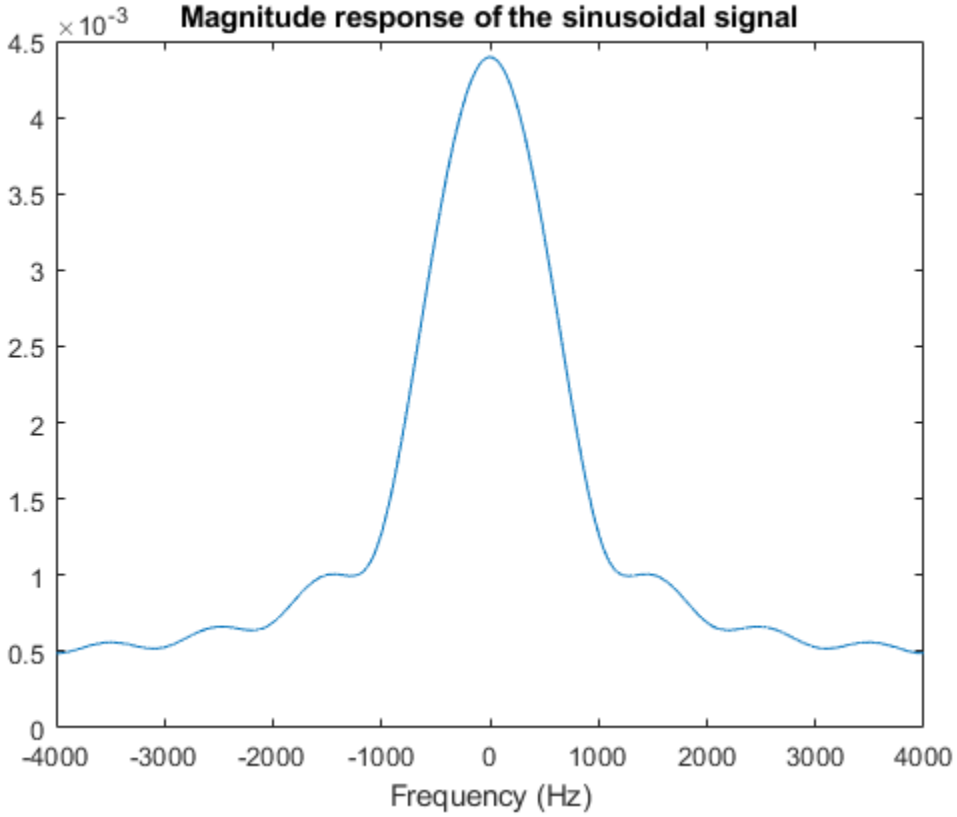



```
%part d) FFT
L = length(y);              % Window
n = pow2(nextpow2(L));      % next power of 2 from length of y
y_dft = fft(x,n);           % DFT
y_s = fftshift(y_dft);      % Rearrange y values
f = (-n/2:n/2-1)*(Fs/n);    % 0 centered frequency range
```

```
figure(7)
plot(f,abs(y_s)/n), xlabel('Frequency (Hz)'), title('Magnitude response of the sinusoidal
signal')
```




Frequency Spectrum using Matlab Func periodgram()
697 Hz
1209 Hz
dB
Frequency Hz
50
0
-50
-100
-150
-200
-250
-300
0
500
1000
1500
2000
2500
3000
3500
4000
4500


Magnitude response of the sinusoidal signal
×10^-3
Frequency (Hz)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-4000
-3000
-2000
-1000
0
1000
2000
3000
4000

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