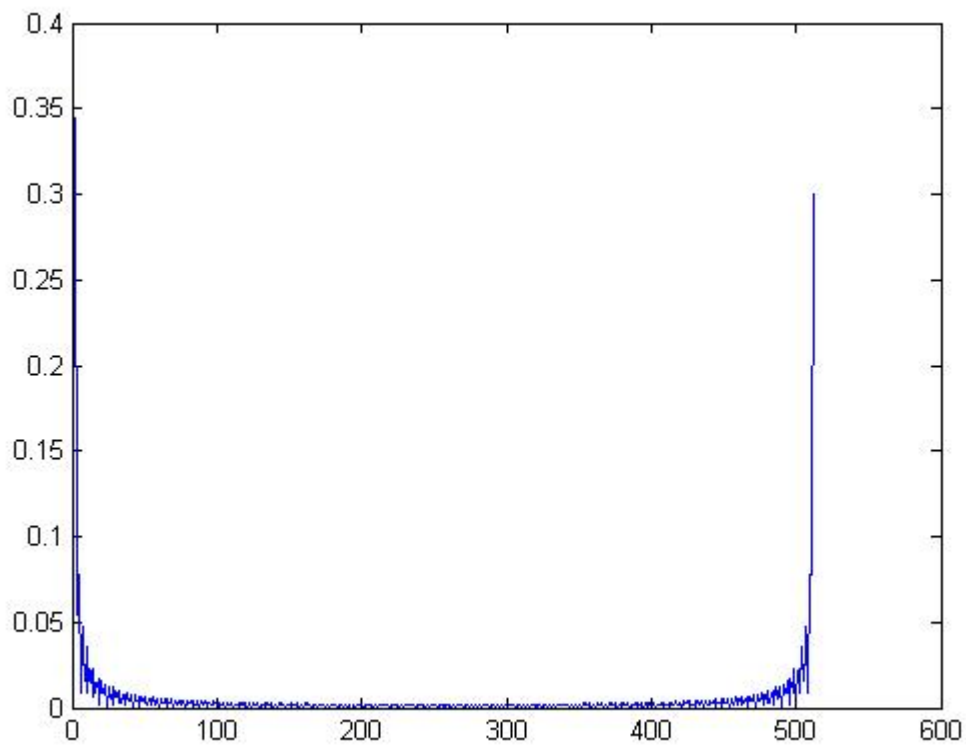


Project 2 : Fourier Series

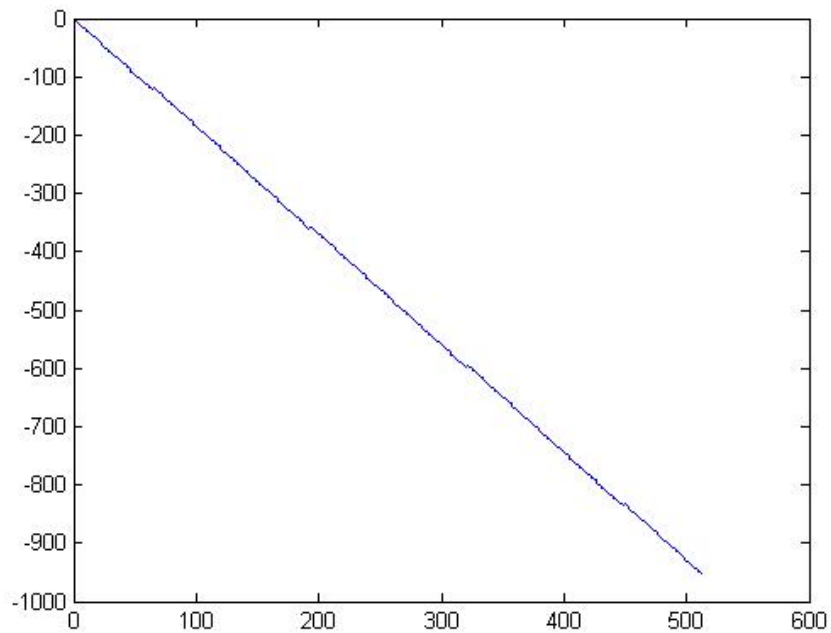
a) $x[n] = u[n + 100] - u[n - 100]$

I used the following MATLAB commands to generate and plot the magnitude and phase of FFT{ $x[n]$ }:

```
n0 = zeros(1, 256)
n1 = ones(1, 200)
n0 = zeros(1, 156)
n = cat(2, n0, cat(2, n1, n0))
x = n
a = (1/512)*fft(x)
amag = sqrt(real(a).*real(a) + imag(a).*imag(a))
plot(amag)
```

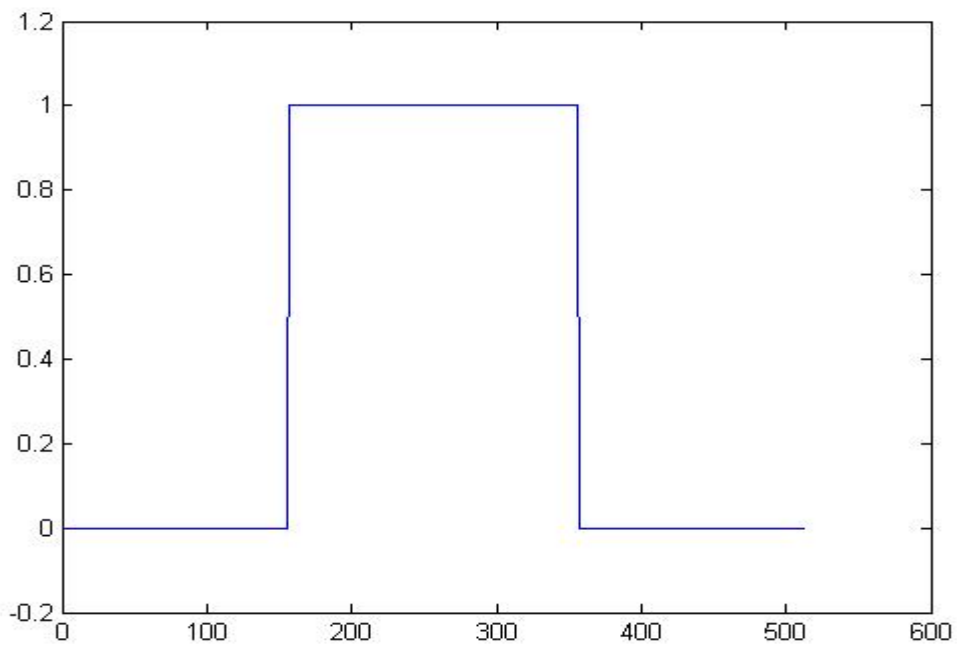


```
aphs = atan2(i mag(a), real (a))
plot(aphs)
aphs1 = angle(a)
diff = aphas - aphas1
aphs2 = unwrap(aphs)
plot(aphs2)
```



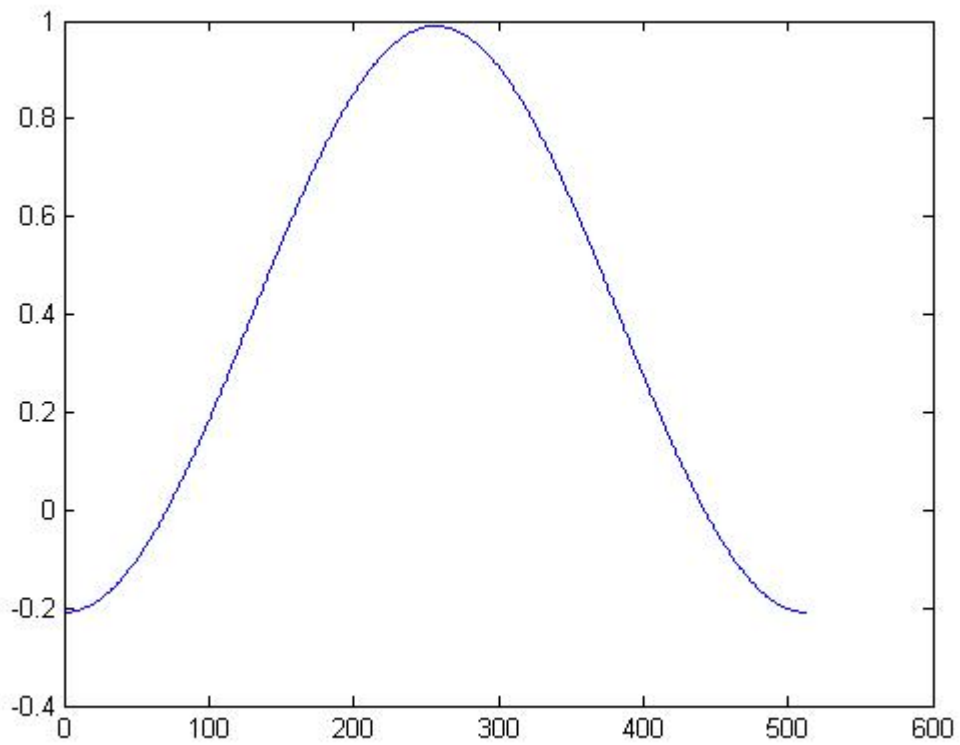
b) Reconstruct and plot $x[n] = \text{IFFT}\{\text{FFT}\{x[n]\}\}$

```
x1 = 512 * i fft(a)
plot(x1)
```



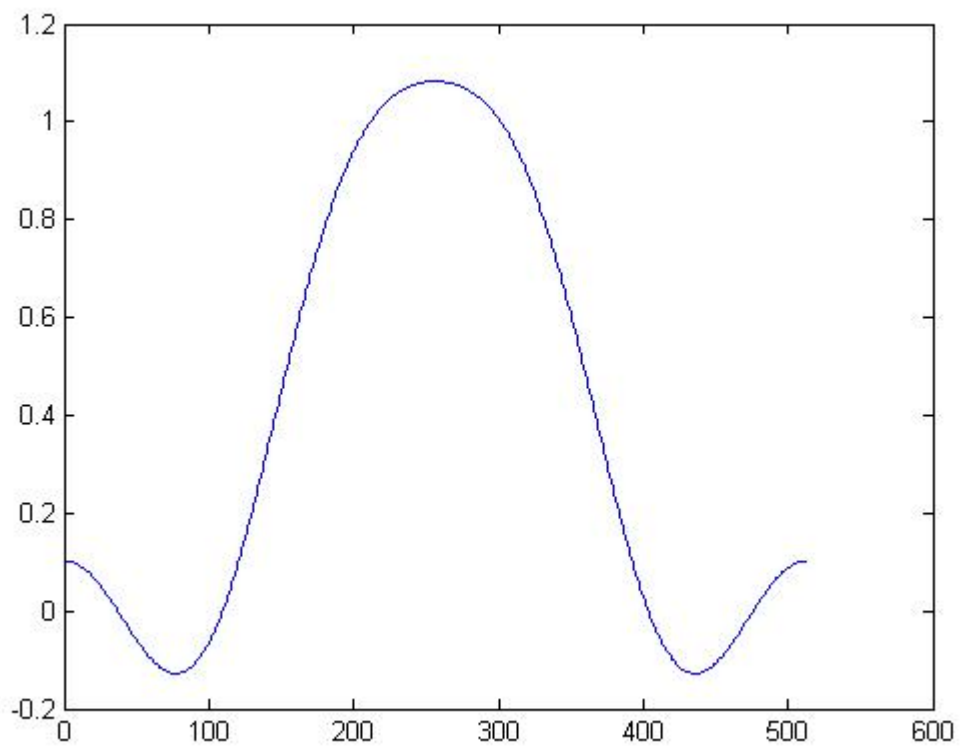
c) Reconstruct and plot $x[n]$ using only $-1 \leq k \leq 1$:

```
a1 = [a(1) a(2) zeros(1, 509) a(512)]  
x1 = real(512 * ifft(a1))  
plot(x1)
```



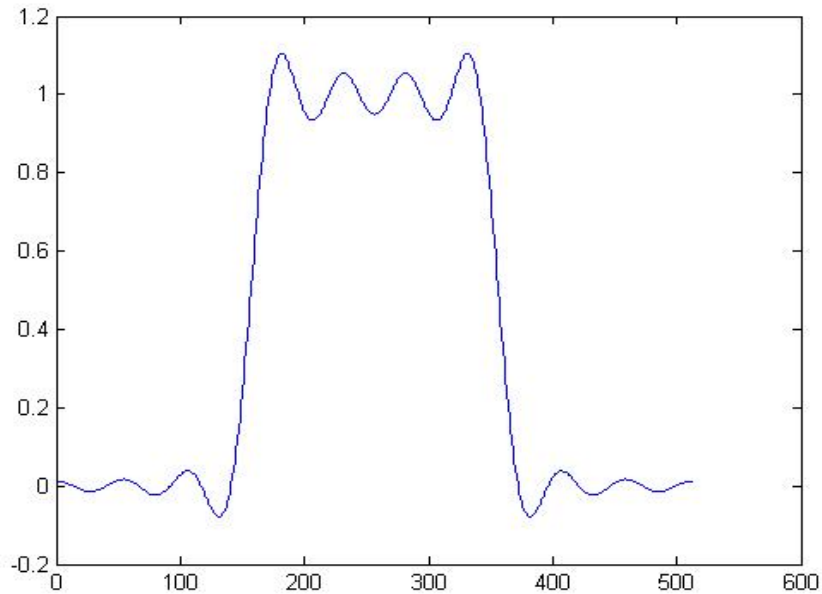
d) Reconstruct and plot $x[n]$ using only $-3 \leq k \leq 3$:

```
for k = 1:3
    a3(k) = a(k)
end
a3 = cat(2, a3, zeros(1, 505))
for k = 1:4
    a3(k) = a(k)
end
a3(509) = 0
for k = 510:512
    a3(k) = a(k)
end
x3 = real(512 * ifft(a3))
plot(x3)
```



e) Reconstruct and plot $x[n]$ using only $-10 \leq k \leq 10$:

```
a10 = a
for k = 12:502
a10(k) = 0
end
x10 = real (512 * i fft(a10))
pl ot(x10)
```



e) Reconstruct and plot $x[n]$ using only $-100 \leq k \leq 100$:

```
a100 = a
for k = 102:412
a100(k) = 0
end
x100 = real (512 * i fft(a100))
pl ot(x100)
```

