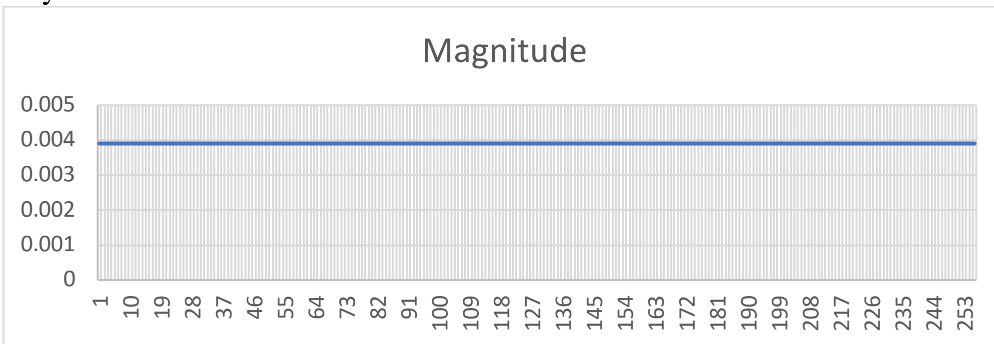
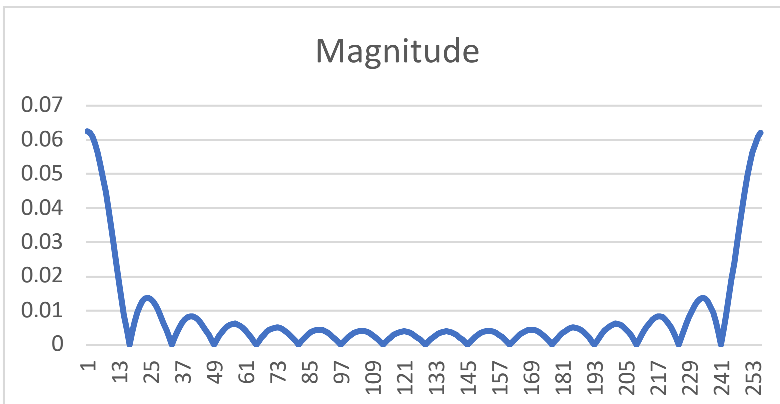
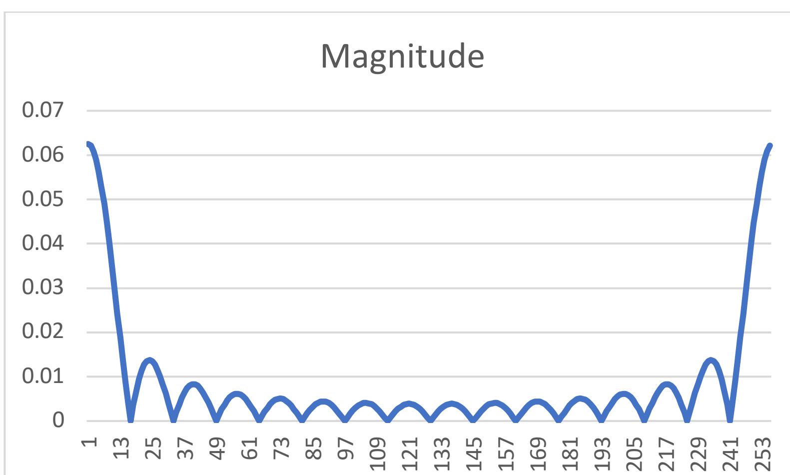
a) The magnitude spectrum is just a constant line because the input was just an impulse. Therefore, the result of the Fourier Transform on an impulse outputs a constant on the frequency domain.

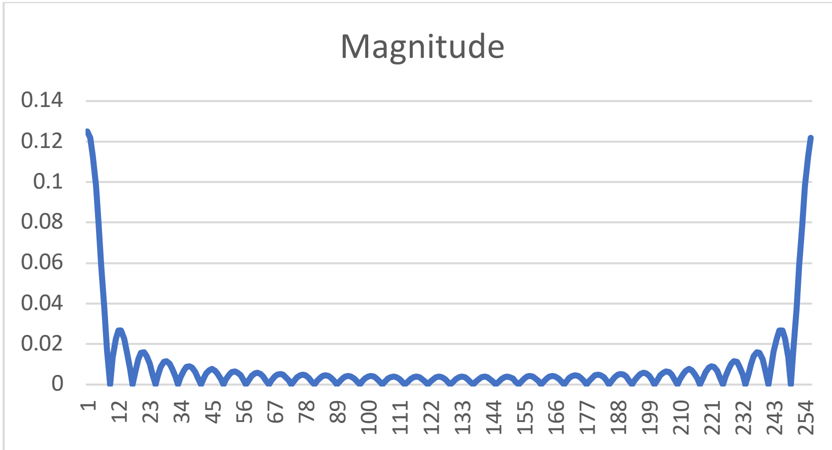


b) The magnitude spectrum is a sinc(x) function starting from 0, but if we include negative values it will be the same.

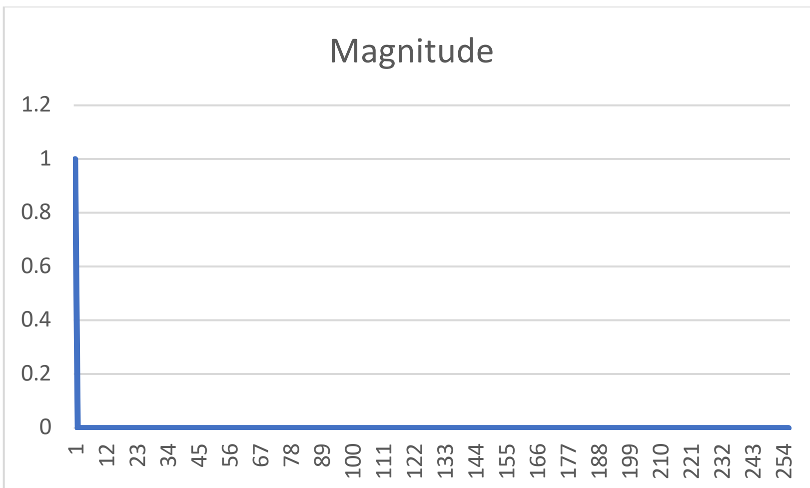


c) Since the spatial domain and frequency domain have an inverse relationship, if the x-axis(box width) increase, then the sinc(x) waves should be narrower in comparison to b(x). This can be seen below: (first picture is b(x), second is c(x))

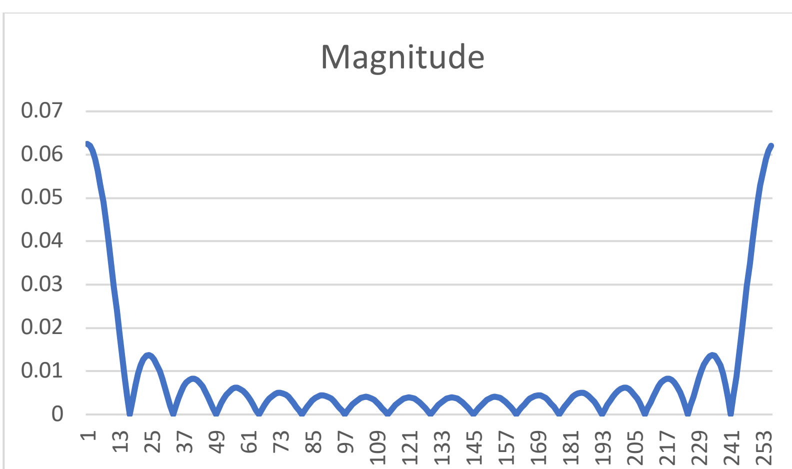


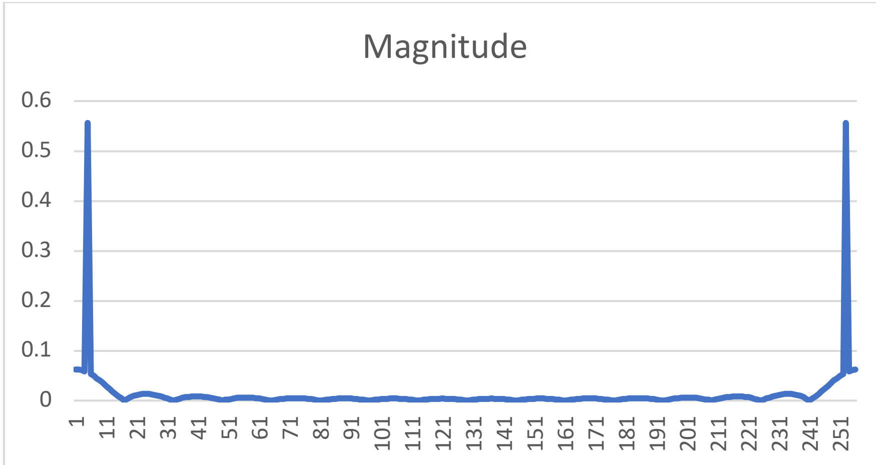


d) The Fourier transform on a constant signal produce a single signal.

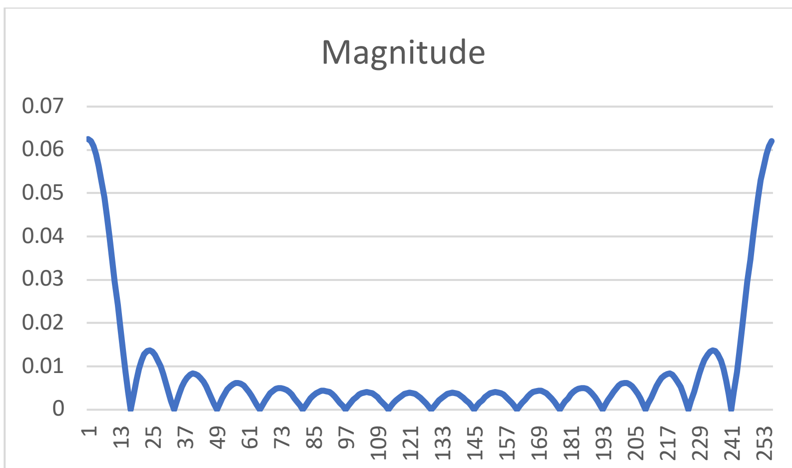


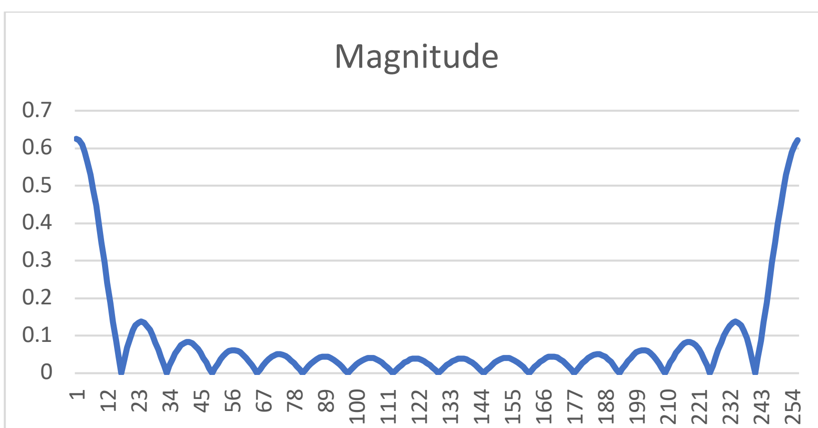
e) We can see that the second graph(F(x)) have two spikes produce by the Fourier Transformation of cos(x). This is the additive property that sum up a sinc(x) and the Fourier transform of a cosine (2 spikes). (first graph is b(x), second is e(x))



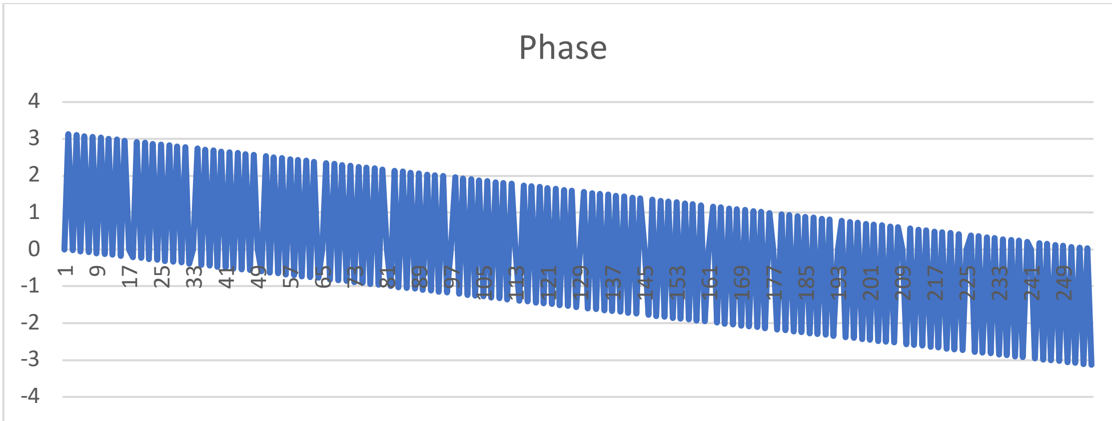


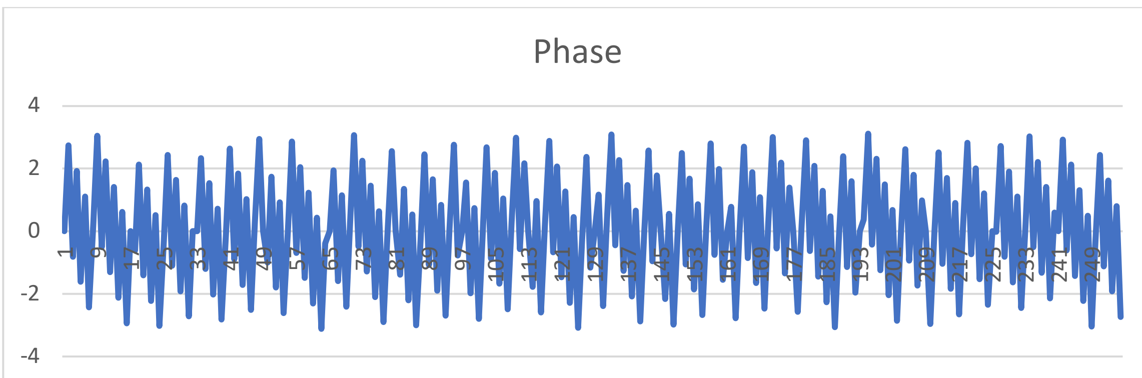
f) Notice that f(x) is b(x) but scaled up and because it's just a scaled-up version of b it's still boxy. When a Fourier Transform is performed on f(x) we will get 10 times higher sinc(x) function on the frequency domain. (first picture is b(x), second is f(x))





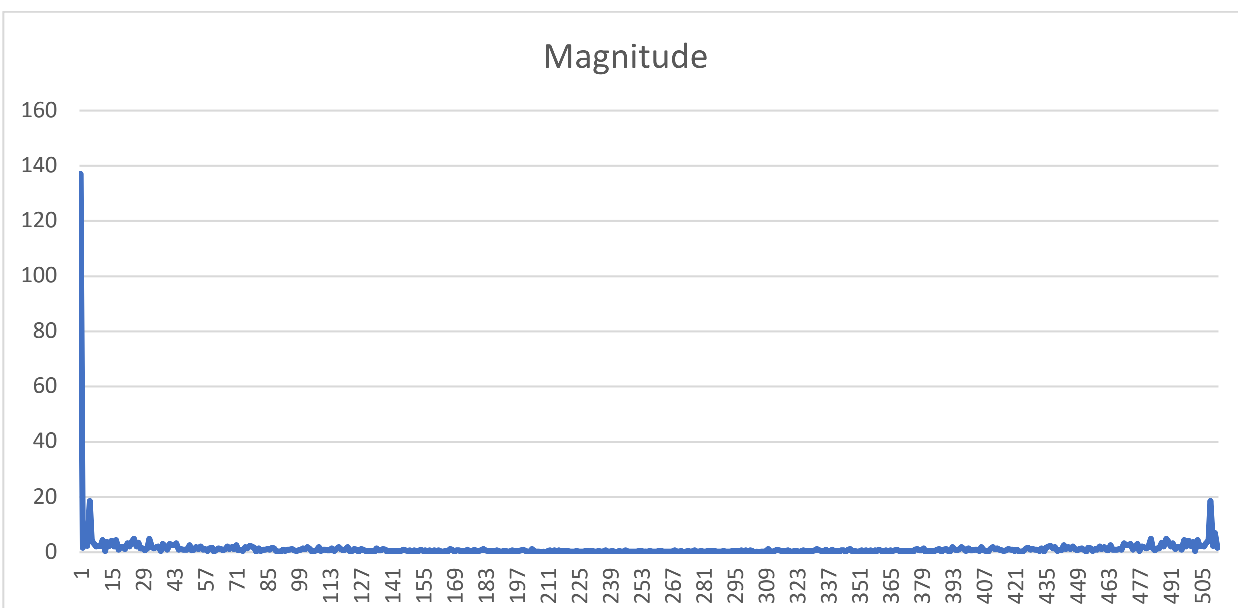
g) Shifting b(x) does not change the magnitude spectrum however the phase spectrum was changed and shifted.





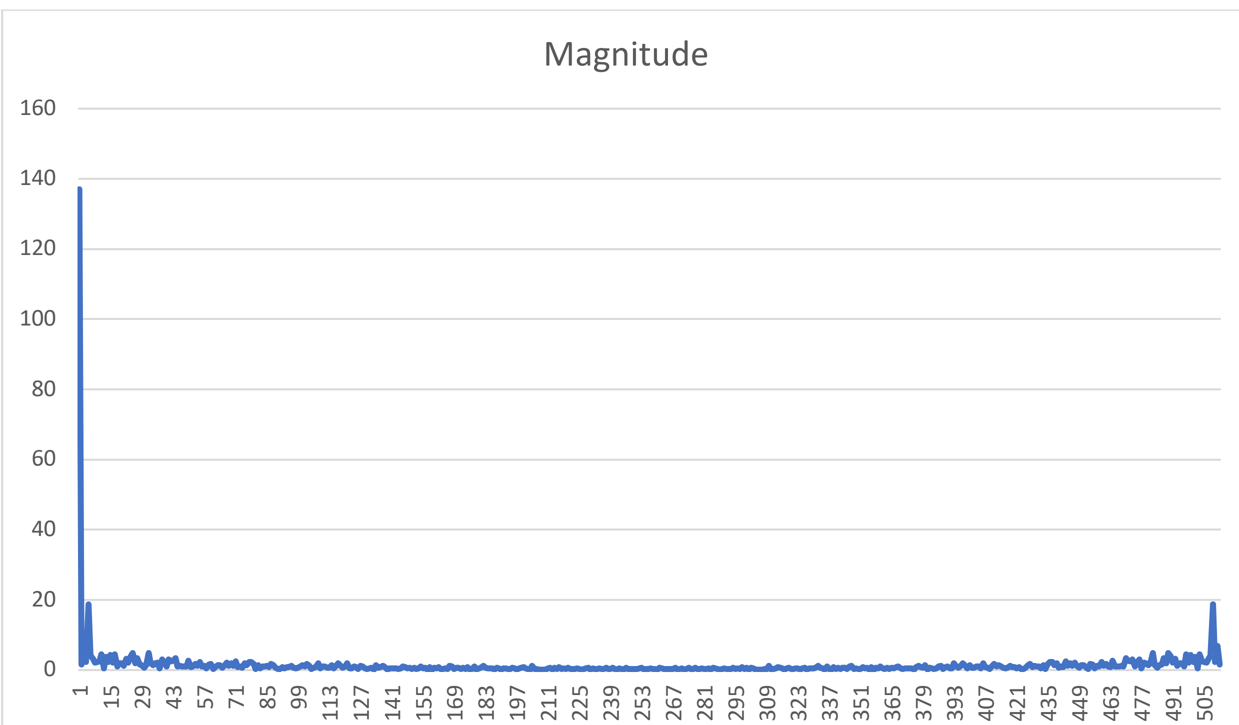
h) The magnitude spectrum stays the same for both since the input was only shifted and from the same input on where we are doing the Fourier Transform. However, the phase spectrum has shifted since there was a circular shift of 32 units to the right.

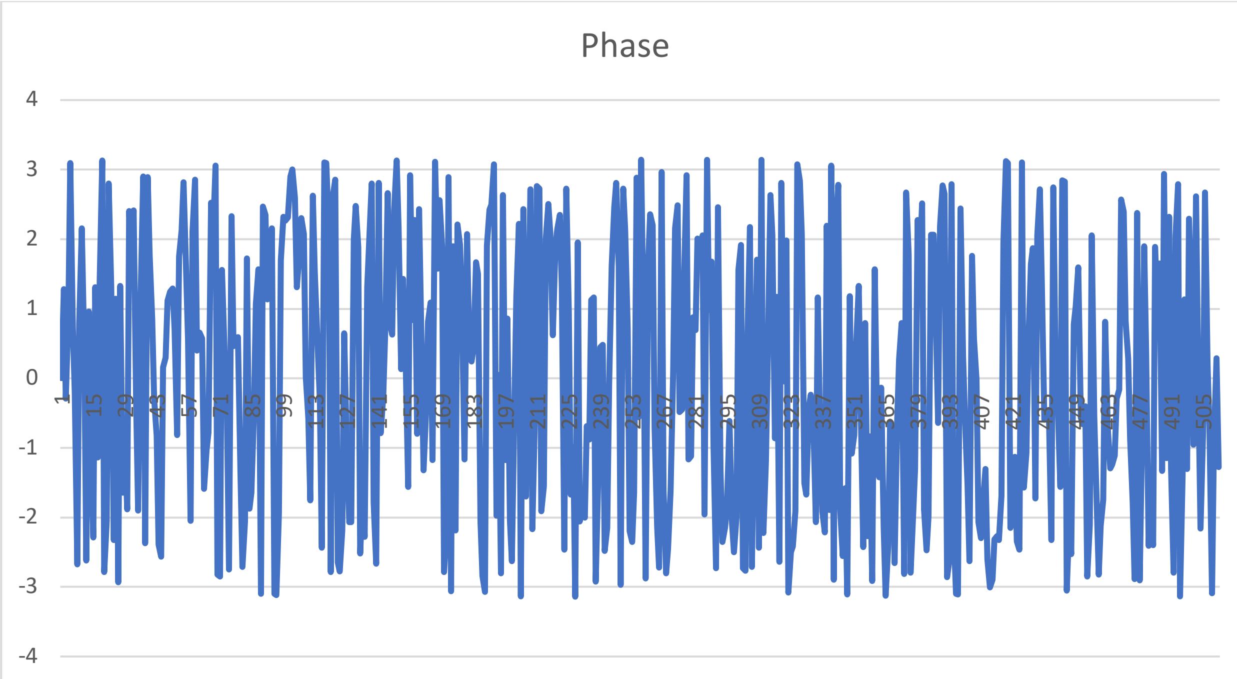
32 shift:




Phase
4
3
2
1
0
-1
-2
-3
-4
1
15
29
43
57
71
85
99
113
127
141
155
169
183
197
211
225
239
253
267
281
295
309
323
337
351
365
379
393
407
421
435
449
463
477
491
505

Row 128:


Magnitude
160
140
120
100
80
60
40
20
0
1
15
29
43
57
71
85
99
113
127
141
155
169
183
197
211
225
239
253
267
281
295
309
323
337
351
365
379
393
407
421
435
449
463
477
491
505



Phase
4
3
2
1
0
-1
-2
-3
-4
1
15
29
43
57
71
85
99
113
127
141
155
169
183
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