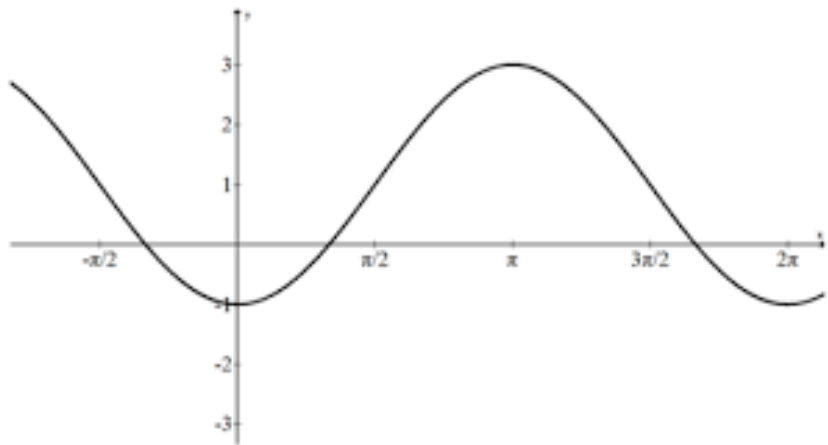
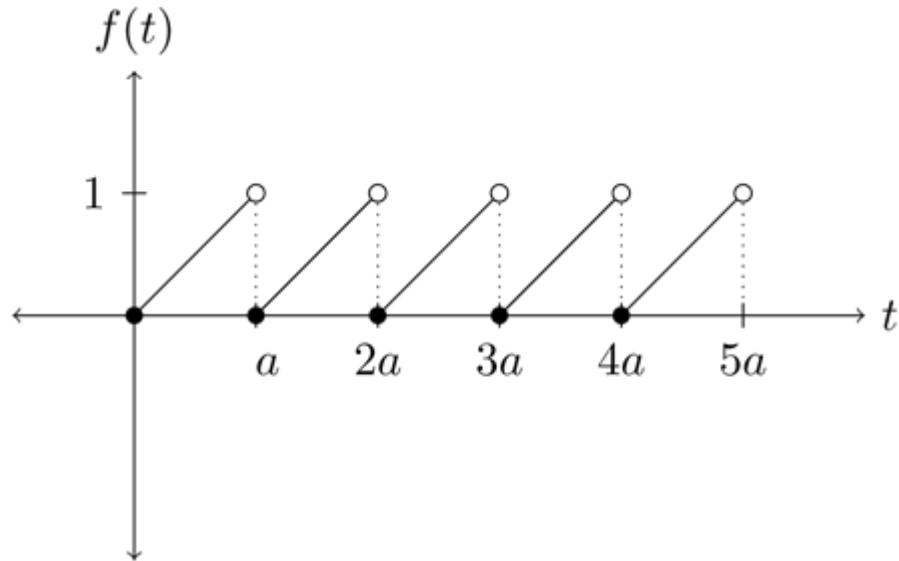


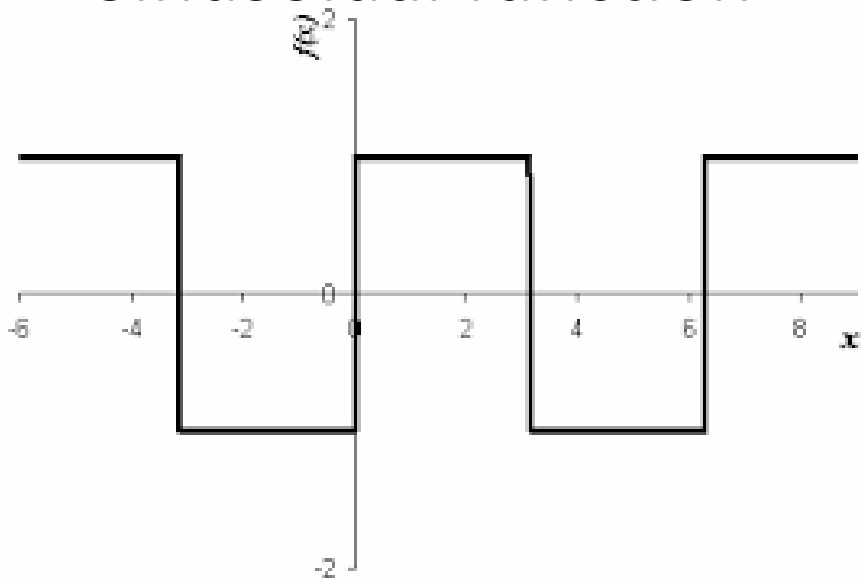
FFT lab notes



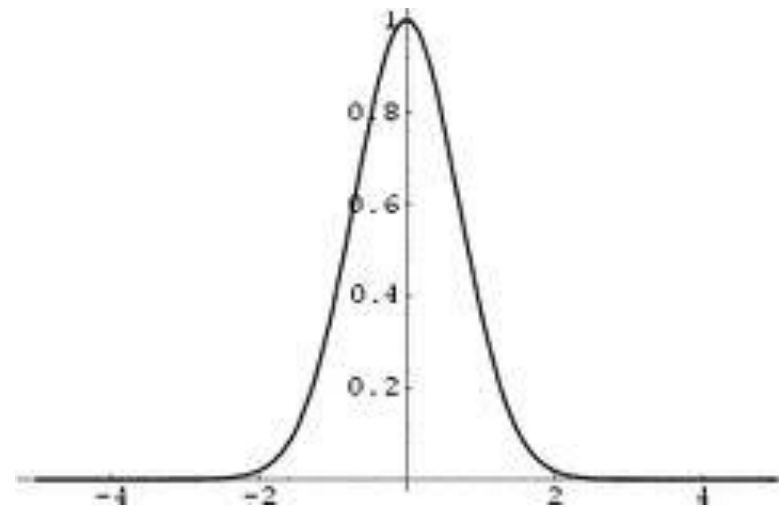
Sinusoidal function



Sawtooth function



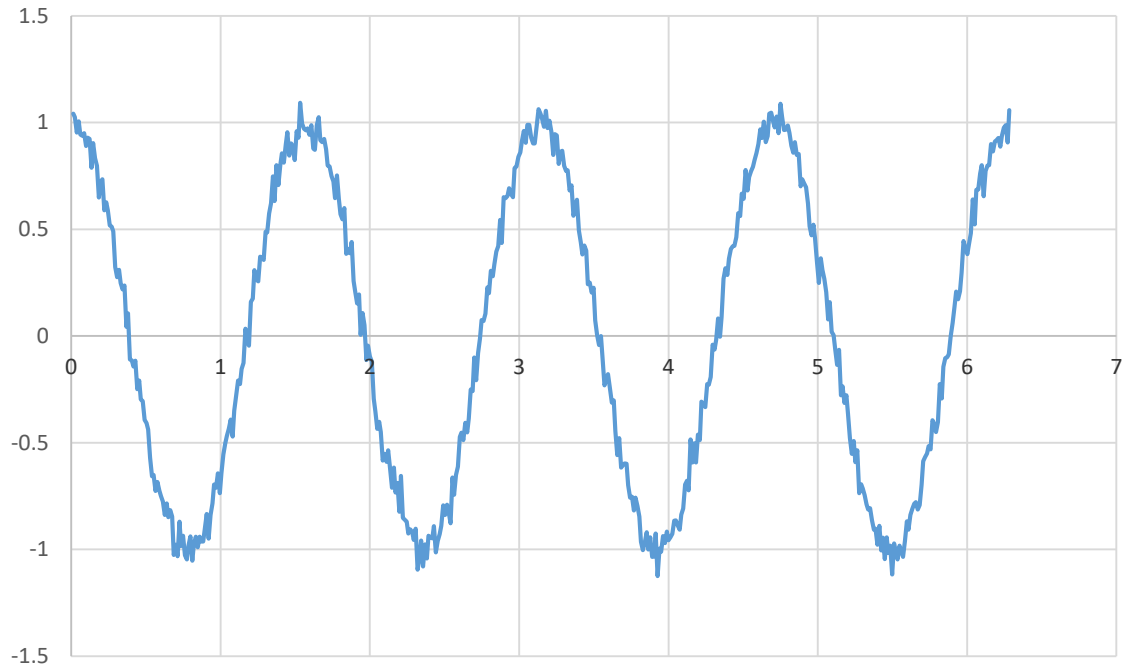
Squarewave function



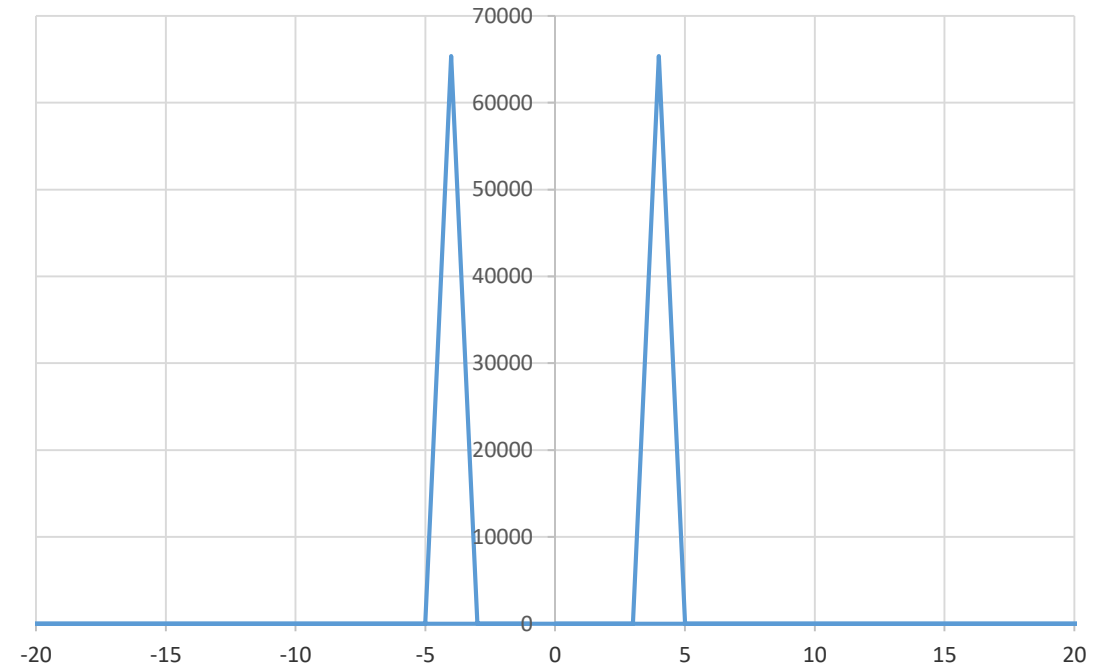
Gaussian function

Power Spectrum of the Fourier Transform of a Cosine Function

Cos(4t)

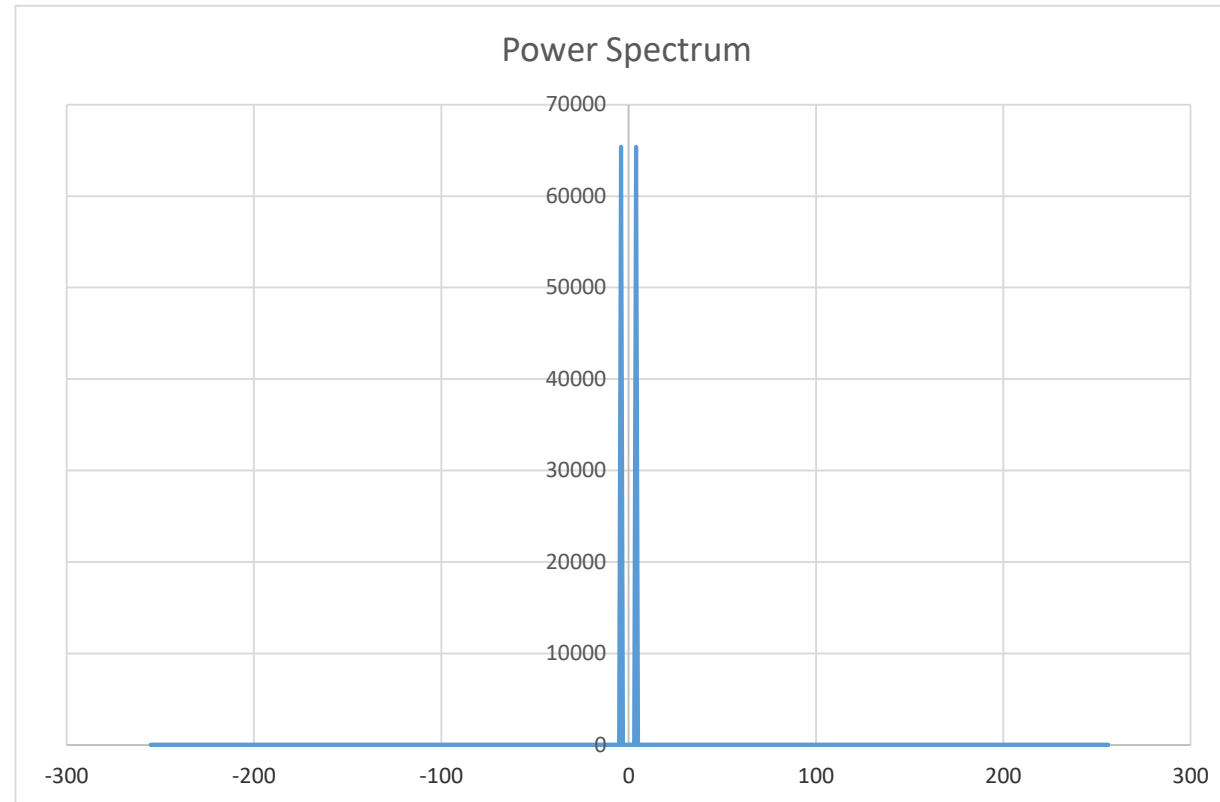


Fourier components of $\cos(4t)$



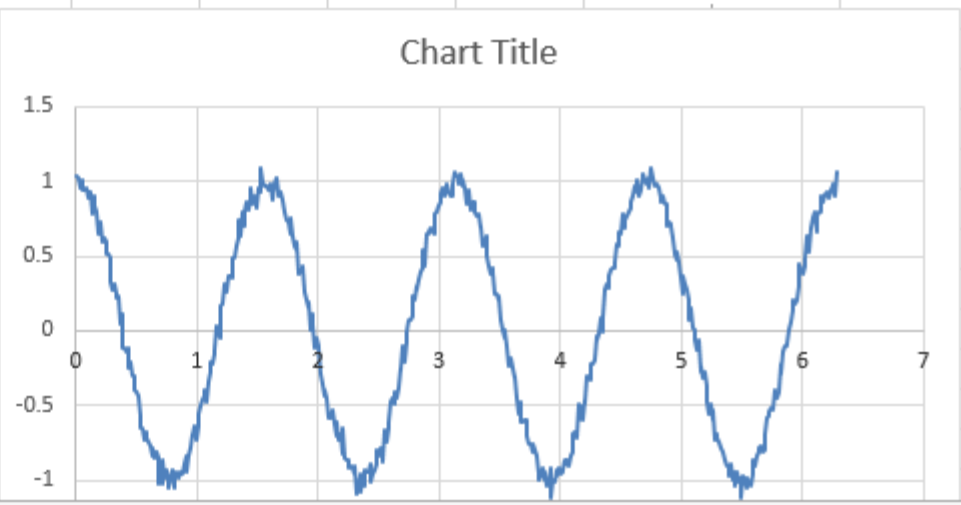
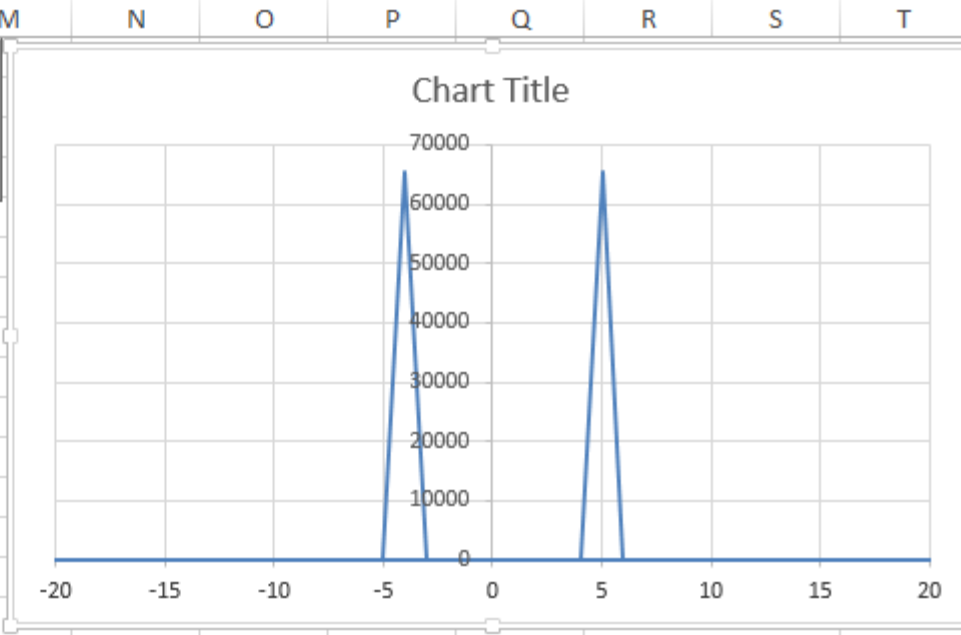
To introduce noise the actual function used was $\cos(4t) + \text{normsinv}(\text{rand}())$
The Fourth Fourier component results from the FFT.

The original power spectrum looked like this.



The following slides show you how to change the plot limits.

Do FFT on C



To change the x-axis
Right click on the chart.
Select:
Format Chart Area

Format Chart Area

CHART OPTIONS | TEXT OPTIONS

- Chart Area
- Chart Title
- Horizontal (Value) Axis
- Horizontal (Value) Axis Major Gridlines
- Plot Area
- Vertical (Value) Axis
- Vertical (Value) Axis Major Gridlines
- Series 1
- Automatic

Color: [dropdown]

Transparency: 0%

Width: 0.75 pt

Compound type: [dropdown]

Dash type: [dropdown]

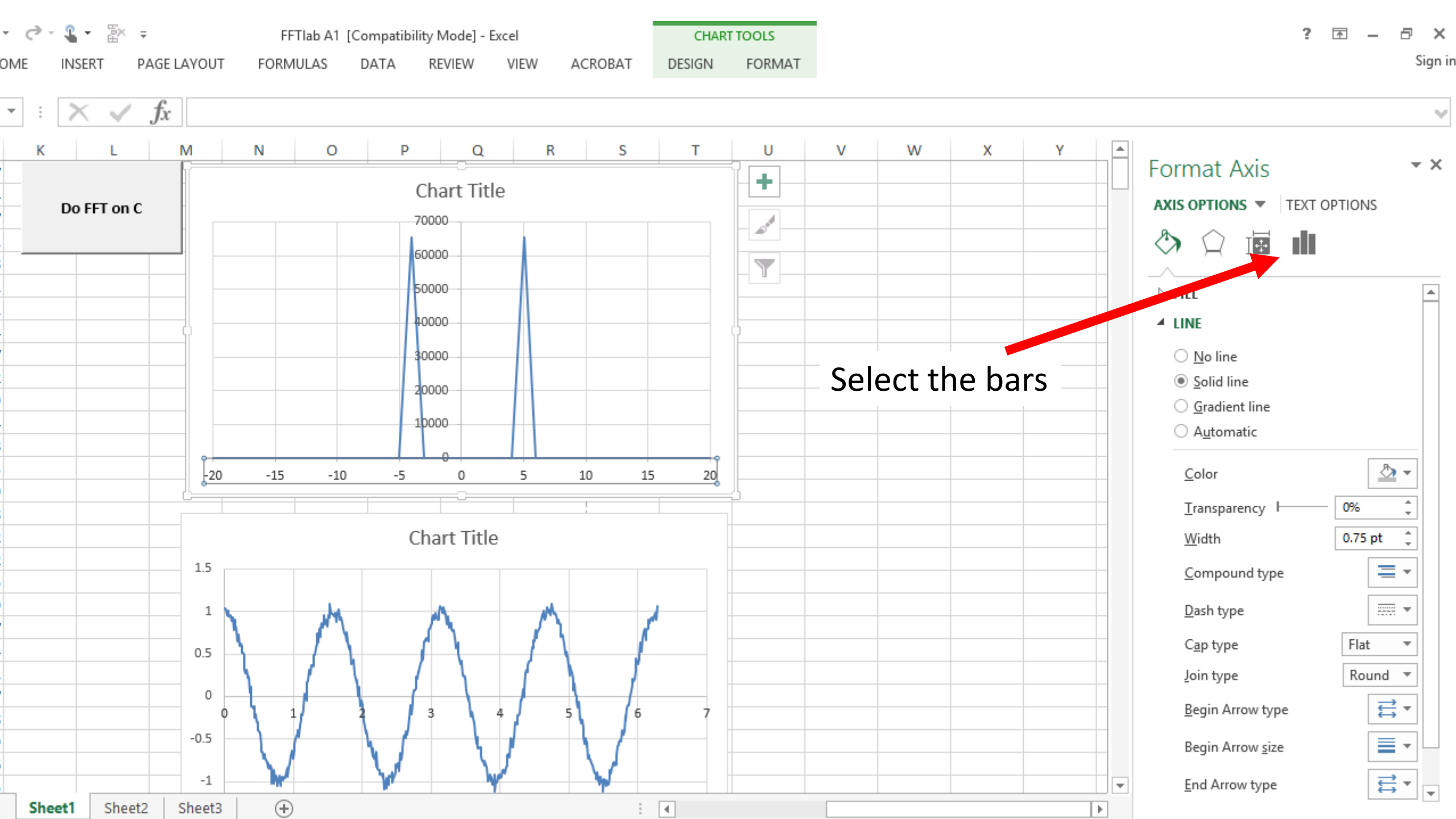
Cap type: Flat

Join type: Round

Begin Arrow type: [dropdown]

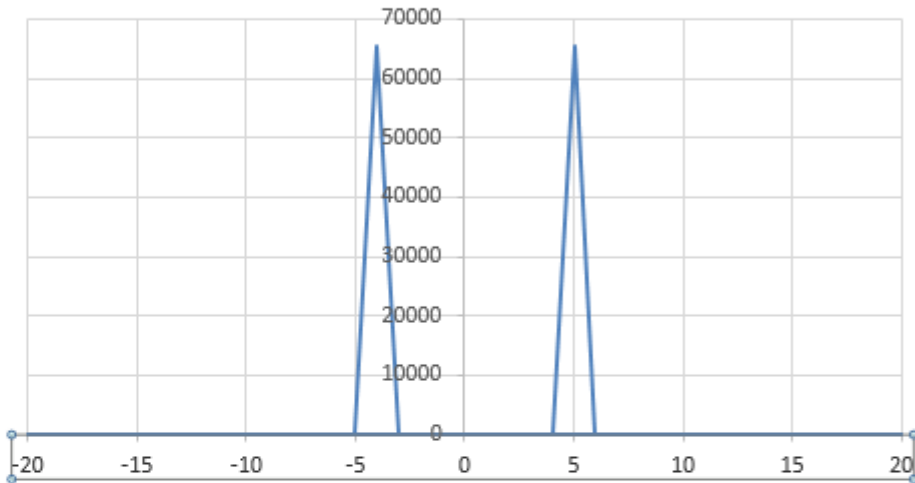
Begin Arrow size: [dropdown]

End Arrow type: [dropdown]



Do FFT on C

Chart Title



Select the bars

Format Axis

AXIS OPTIONS | TEXT OPTIONS



LINE

- No line
- Solid line
- Gradient line
- Automatic

Color

Transparency 0%

Width 0.75 pt

Compound type

Dash type

Cap type Flat

Join type Round

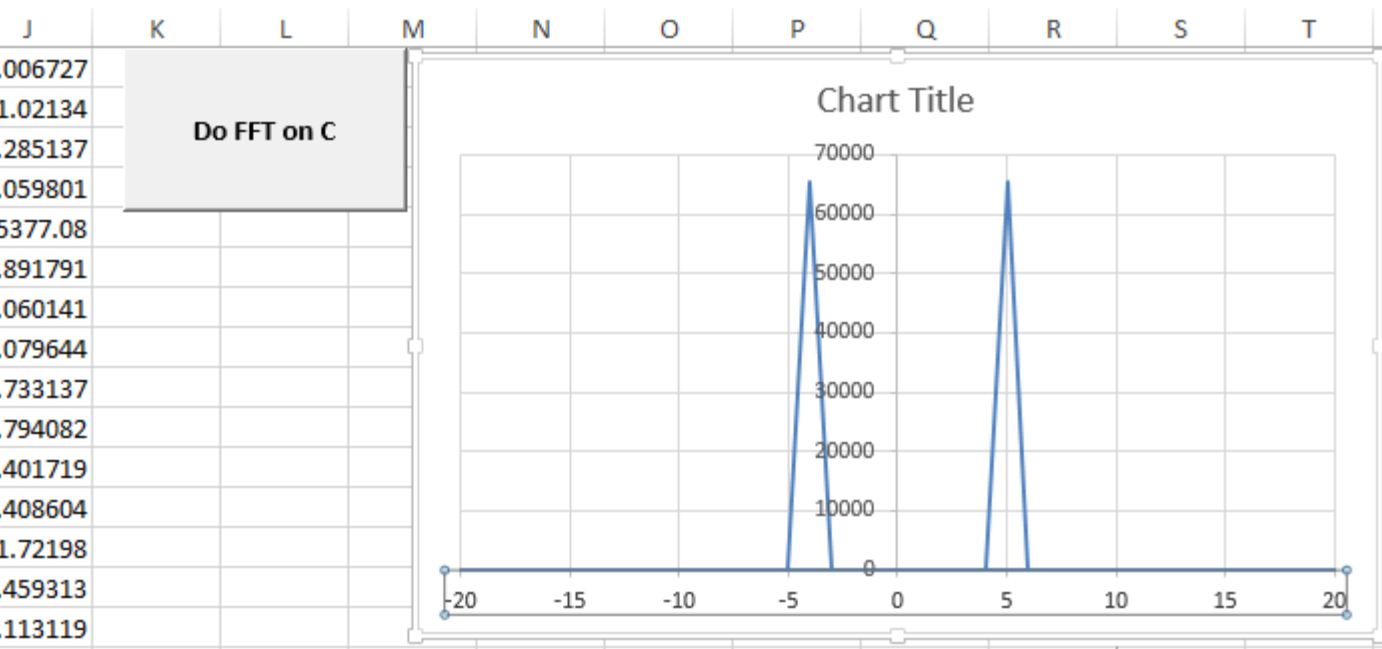
Begin Arrow type

Begin Arrow size

End Arrow type

4

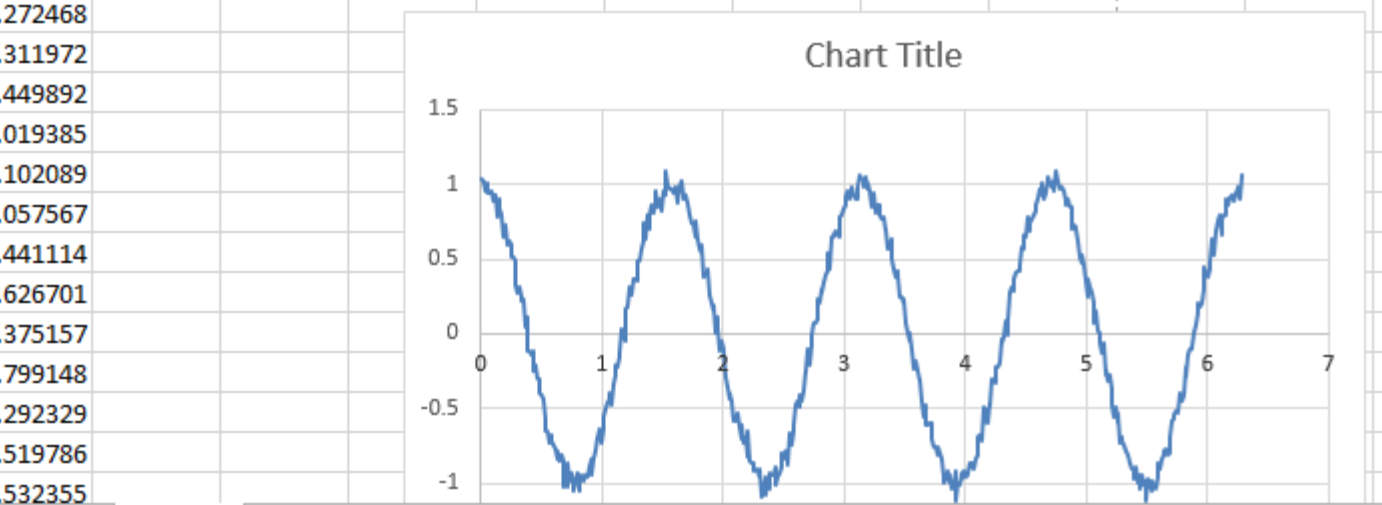
X ✓ fx



Do FFT on C



Under Axis Options Change the Bounds



Format Axis

AXIS OPTIONS TEXT OPTIONS



AXIS OPTIONS

Bounds

Minimum -20.0 Reset

Maximum 20.0 Reset

Units

Major 5.0 Auto

Minor 1.0 Auto

Vertical axis crosses

- Automatic
- Axis value 0.0
- Maximum axis value

Display units None

Show display units label on chart

Logarithmic scale Base 10

Values in reverse order

TICK MARKS

LABELS

Sheet1

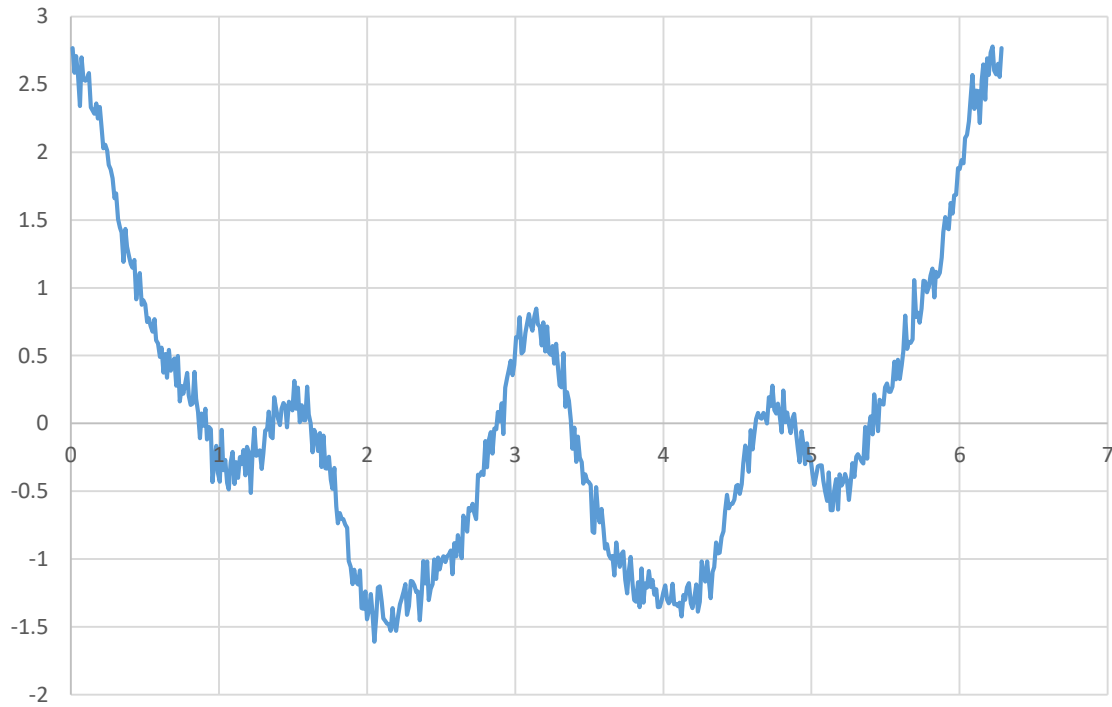
Sheet2

Sheet3

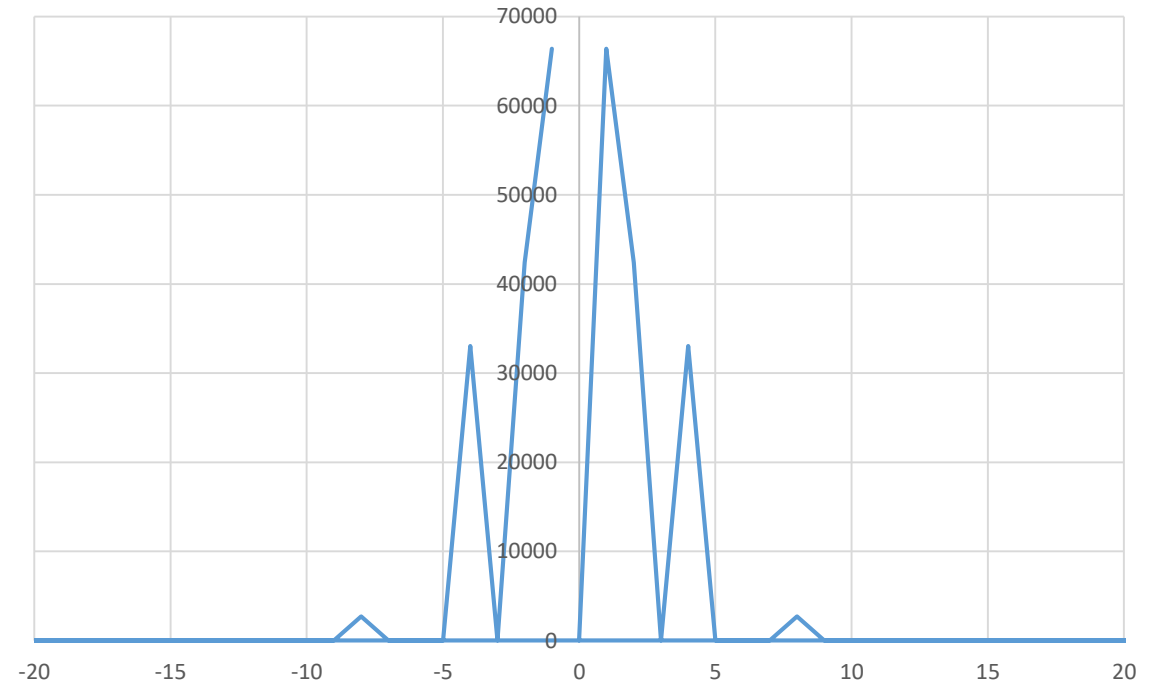


The function used is $\cos(B1) + 0.8*\cos(2*B1) + 0.4*\cos(2*B1+0.1)+0.2*\cos(8*B1)$

Sum of four cosine functions



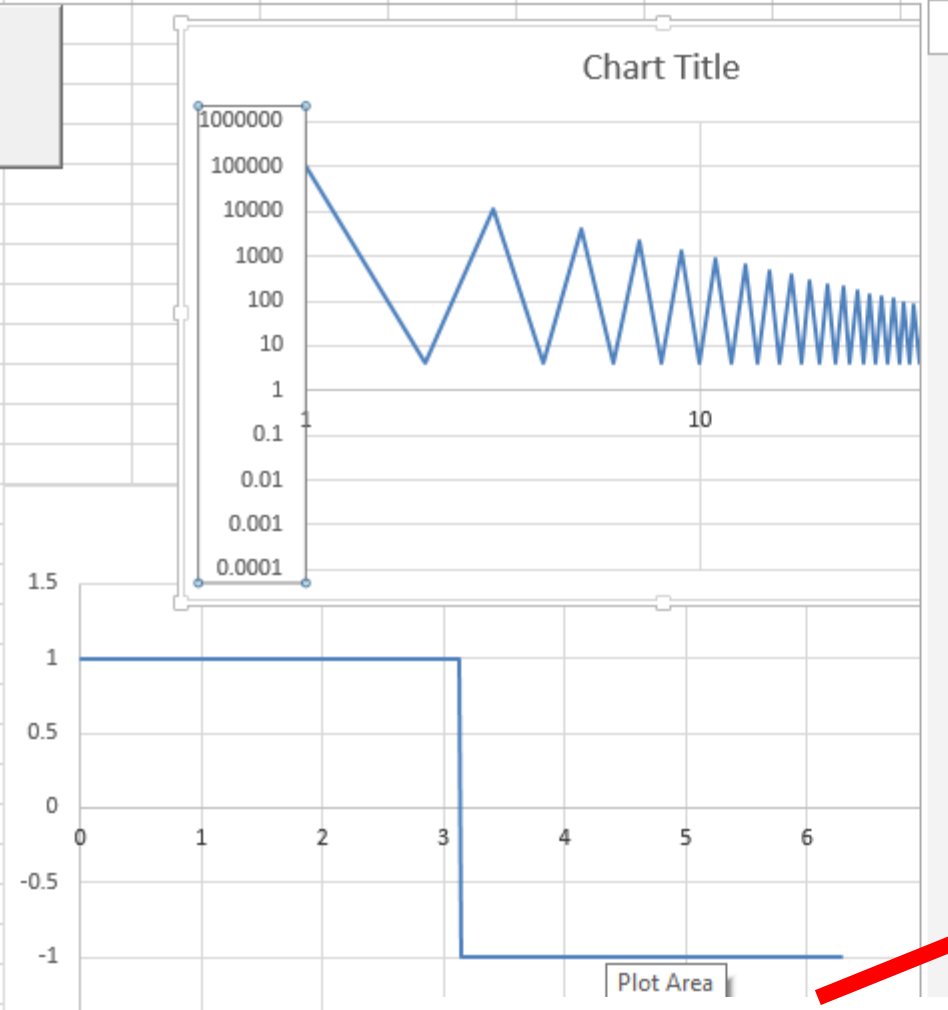
Power spectrum



fx

| | | | | | | | | | | | | | | | |
|---|------------|----------|---|----------|----|----------|---|---|---|---|---|---|---|---|---|
| D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
| | -2 | -2 | | 3.141593 | 0 | 4 | | | | | | | | | |
| | 3.9998494 | 3.999849 | | -1.55852 | 1 | 106240.3 | | | | | | | | | |
| | -1.9993976 | -1.9994 | | -3.11705 | 2 | 4 | | | | | | | | | |
| | 3.9986447 | 3.998645 | | -1.53398 | 3 | 11802.11 | | | | | | | | | |
| | -1.9975909 | -1.99759 | | -3.09251 | 4 | 4 | | | | | | | | | |
| | 3.9962362 | 3.996236 | | -1.50944 | 5 | 4247.052 | | | | | | | | | |
| | -1.9945809 | -1.99458 | | -3.06796 | 6 | 4 | | | | | | | | | |
| | 3.9926252 | 3.992625 | | -1.48489 | 7 | 2165.558 | | | | | | | | | |
| | -1.9903694 | -1.99037 | | -3.04342 | 8 | 4 | | | | | | | | | |
| | 3.9878139 | 3.987814 | | -1.46035 | 9 | 1308.976 | | | | | | | | | |
| | -1.9849590 | -1.98496 | | -3.01887 | 10 | 4 | | | | | | | | | |
| | 3.9818052 | 3.981805 | | -1.43581 | 11 | 875.3756 | | | | | | | | | |
| | -1.9783530 | -1.97835 | | -2.99433 | 12 | 4 | | | | | | | | | |
| | 3.9746028 | 3.974603 | | -1.41126 | 13 | 625.9916 | | | | | | | | | |
| | -1.9705552 | -1.97056 | | -2.96979 | 14 | 4 | | | | | | | | | |
| | 3.9662109 | 3.966211 | | -1.38672 | 15 | 469.5265 | | | | | | | | | |
| | -1.9615709 | -1.96157 | | -2.94524 | 16 | 4 | | | | | | | | | |
| | 3.9566347 | 3.956635 | | -1.36217 | 17 | 364.9589 | | | | | | | | | |
| | -1.9514042 | -1.9514 | | -2.9207 | 18 | 4 | | | | | | | | | |
| | 3.9458799 | 3.94588 | | -1.33763 | 19 | 291.6388 | | | | | | | | | |
| | -1.9400629 | -1.94006 | | -2.89616 | 20 | 4 | | | | | | | | | |
| | 3.9339529 | 3.933953 | | -1.31309 | 21 | 238.2515 | | | | | | | | | |
| | -1.9275522 | -1.92755 | | -2.87161 | 22 | 4 | | | | | | | | | |
| | 3.9208610 | 3.920861 | | -1.28854 | 23 | 198.176 | | | | | | | | | |
| | -1.9138806 | -1.91388 | | -2.84707 | 24 | 4 | | | | | | | | | |
| | 3.9066120 | 3.906612 | | -1.264 | 25 | 167.3284 | | | | | | | | | |
| | -1.8990563 | -1.89906 | | -2.82252 | 26 | 4 | | | | | | | | | |
| | 3.8912146 | 3.891215 | | -1.23946 | 27 | 143.0786 | | | | | | | | | |

Do FFT on C



Format Axis

AXIS OPTIONS | TEXT OPTIONS

AXIS OPTIONS

Bounds

Minimum: 0.0001 (Auto)

Maximum: 1.0E6 (Auto)

Units

Major: 10.0 (Auto)

Minor: 10.0 (Auto)

Horizontal axis crosses

Automatic

Axis value: 1.0

Maximum axis value

Display units: None

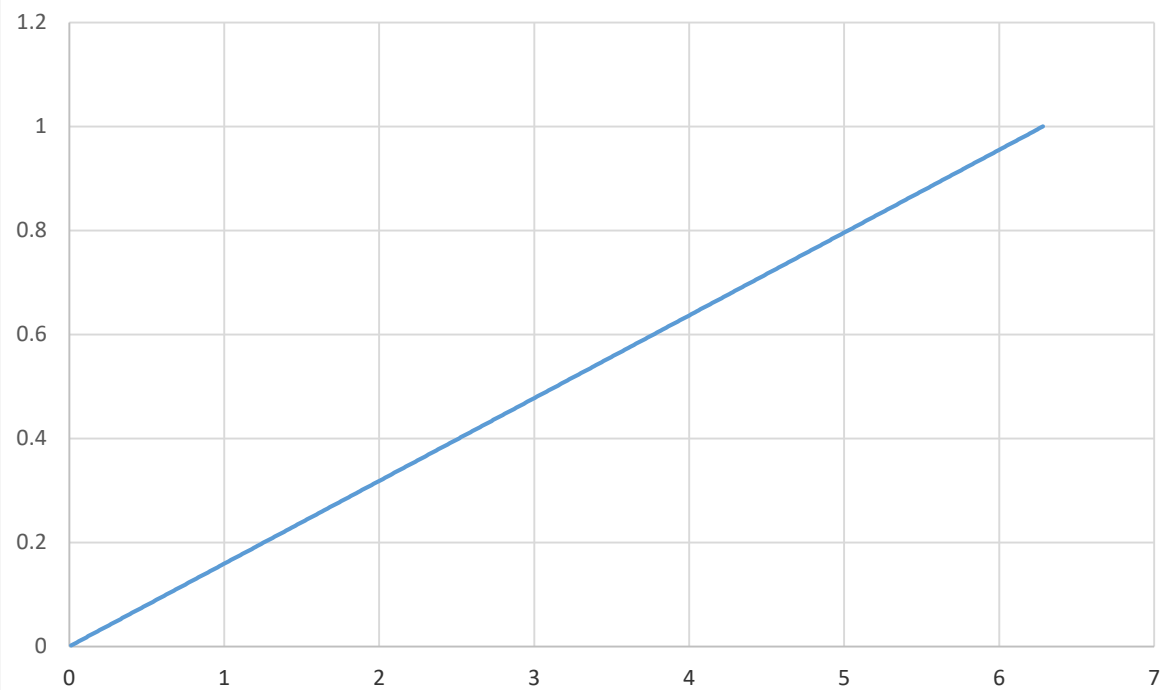
Show display units label on chart

Logarithmic scale Base: 10

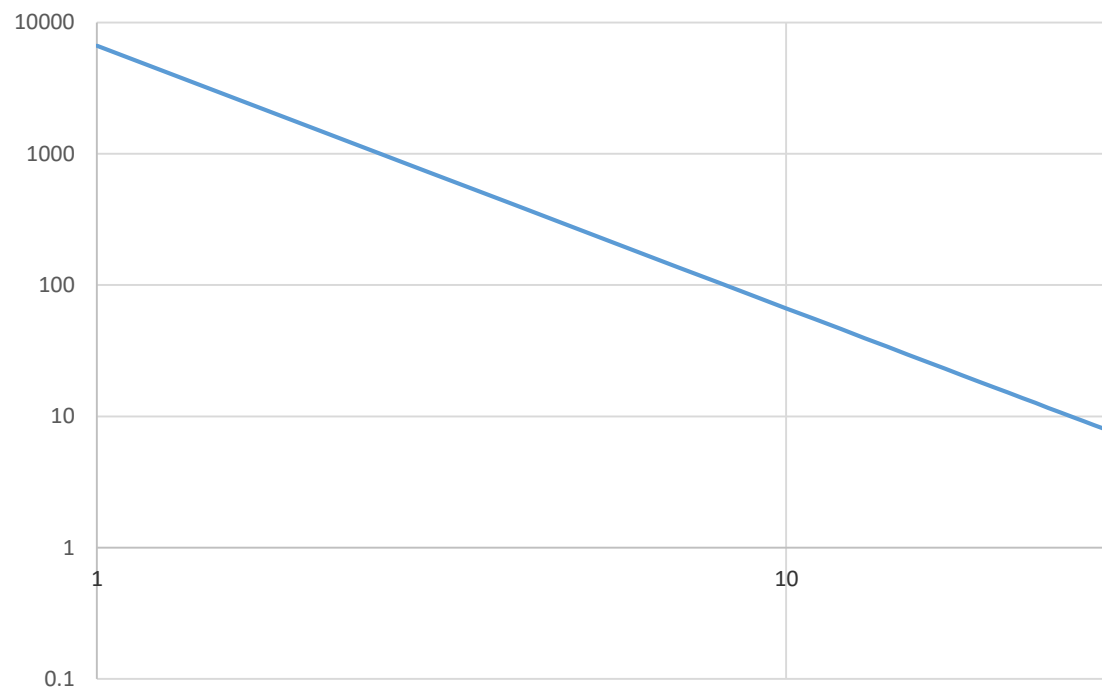
Values in reverse order

To change to a logarithmic scale
Check the box

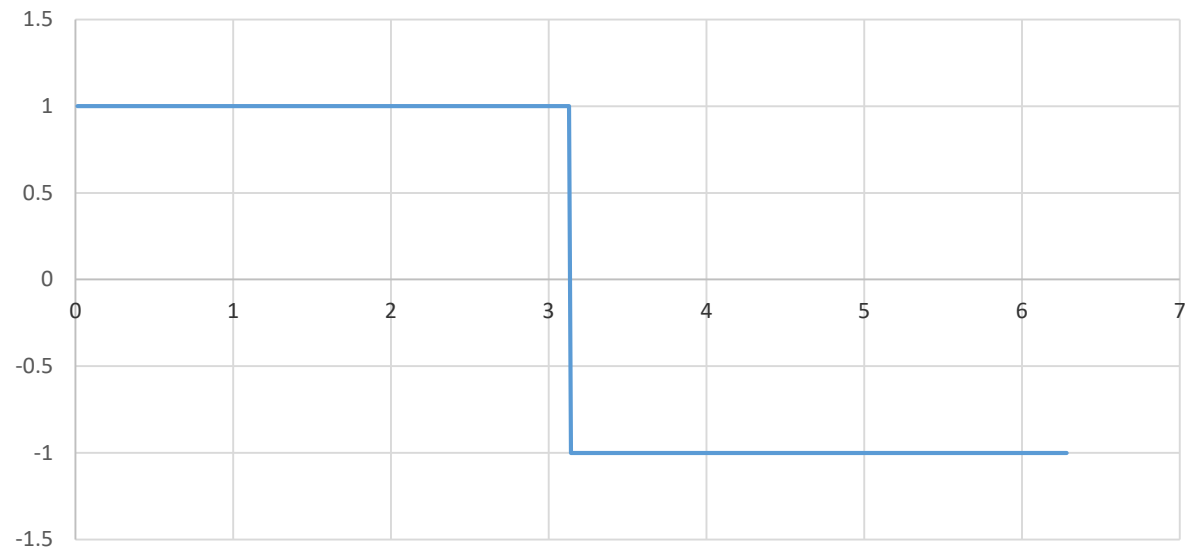
Sawtooth Function



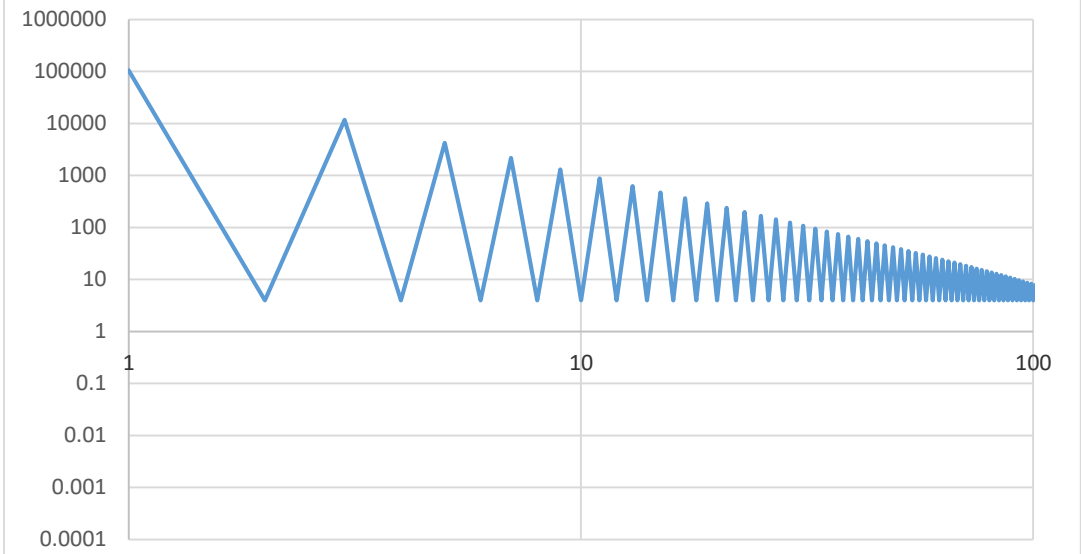
Frequency domain (log-log plot)



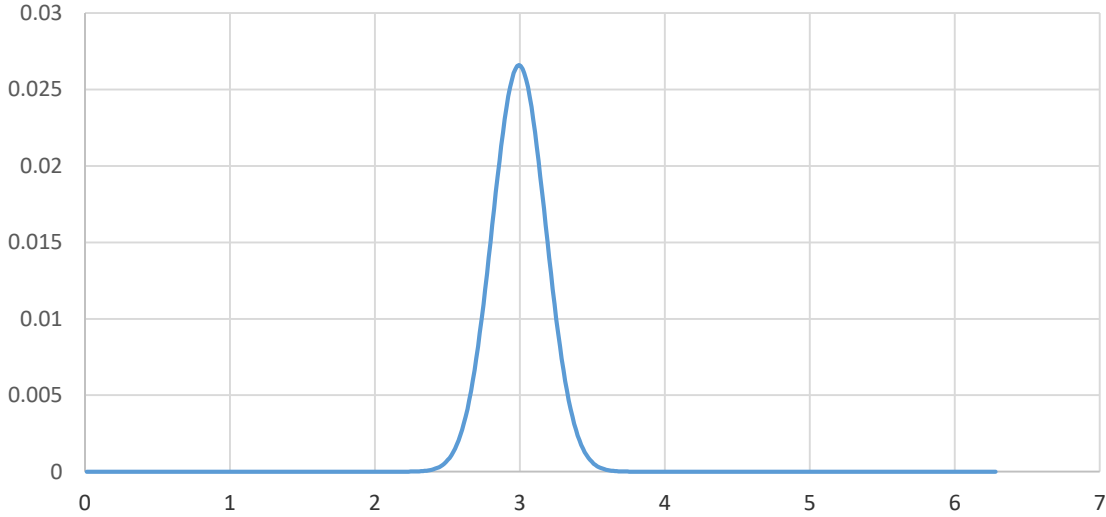
Square Wave



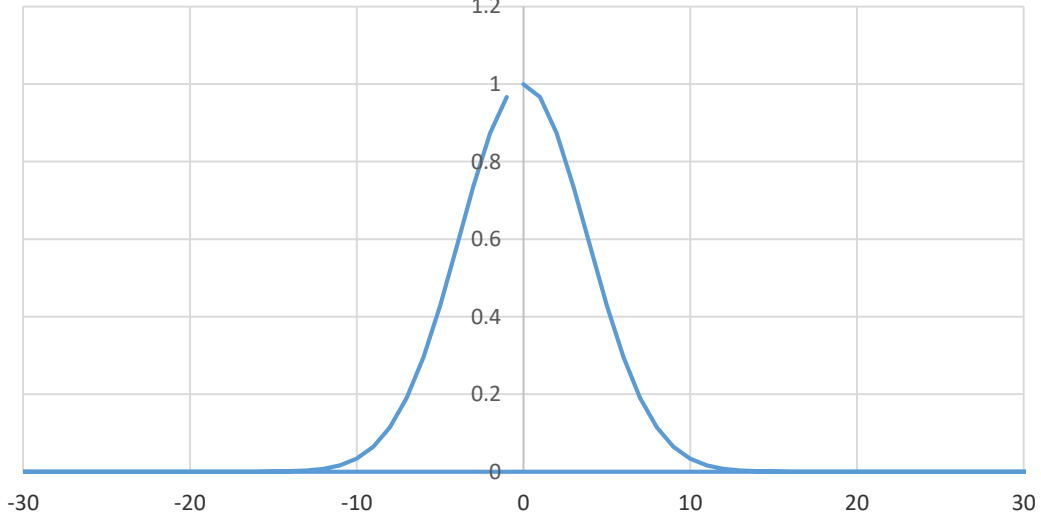
Log-log Plot



Gaussian in time domain

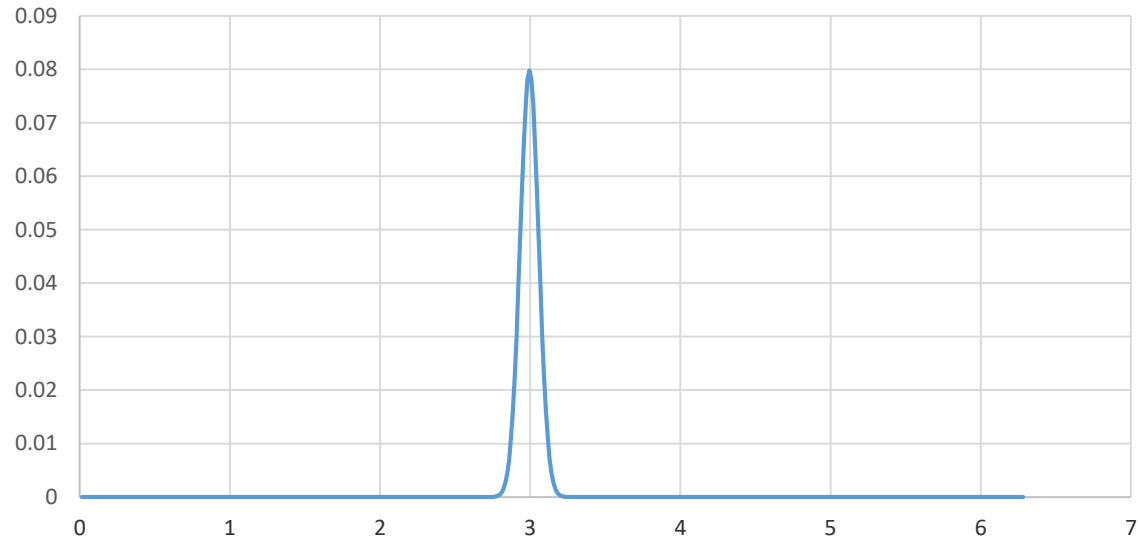


Gaussian in frequency domain

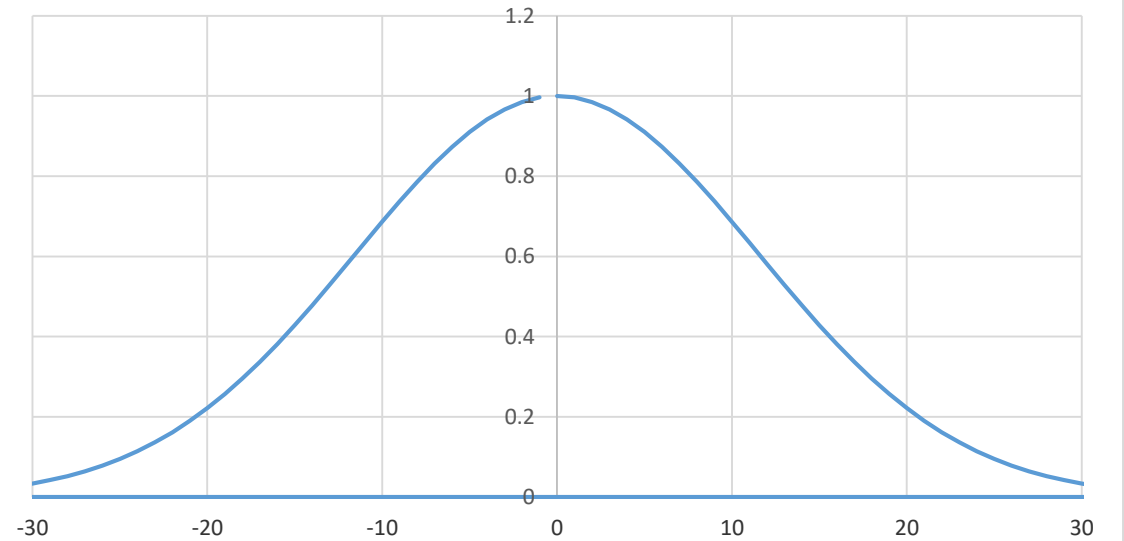


C1: =NORMDIST (A1,244,15,0)

Narrower Gaussian in time domain



Broader Gaussian in frequency domain



C1: =NORMDIST (A1,244,5,0)