How to Create Nearly Concentric Rings of Sinewave Spheres

You'll learn how to create nearly concentric rings if sinewave spheres and create images like the one below, plus many more, by following these steps. Become familiar with the basic image to be created: === The Tutorial ===

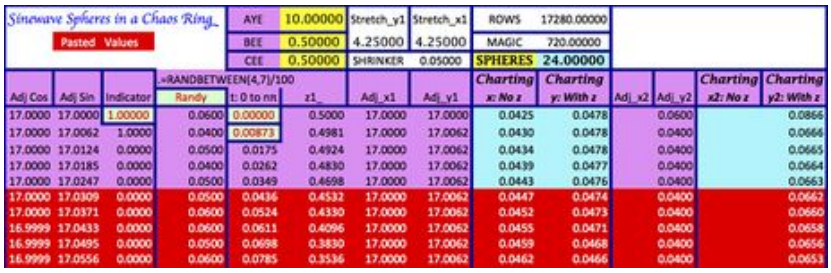
Part 1 of 3:

The Tutorial

1. 

If you have completed the article and workbook, How To Create a Chaos Ring of Sinewave Spheres, you may SAVE AS that workbook under a new appropriate name for this project and look for

NEW or MODIFIED notes in the article text, which follows the previous article prior to deviating from it. Otherwise simple follow the steps as given and open a new workbook and create three worksheets: Data, Chart (unless working with Chart Wizard), and Saves.

2. **Set Your Preferences:** Open Preferences in the Excel menu and follow the directions below for each tab/icon.
    1. In General, set *R1C1* to Off and select *Show the 10 Most Recent Documents* .
    2. In Edit, set all the first options to checked except *Automatically Convert Date System* . Set *Display number of decimal places* to blank (as integers are preferred). Preserve the display of dates and set 30 for 21st century cutoff.
    3. In View, click on show *Formula Bar* and *Status Bar* and hover for *comments of all Objects* . Check *Show gridlines* and set all boxes below that to auto or checked.
    4. In Chart, allow *show chart names* and set *data markers* on hover and leave the rest unchecked for now.
    5. In Calculation, Make sure *Manually* and *calculate before save* are checked. Set max change to .000,000,000,000,01 without commas as goal-seeking is done a lot. Check *save external link values* and *use 1904 system, Command + = performs a calculation session.*
    6. In Error checking, check all the options.
    7. In Save, select *Save preview picture with new files* and *Save Autorecover* after 5 minutes
    8. In Ribbon, keep all of them checked except *Hide group titles* and *Developer* .
3. **Place the cursor at cell A16 and do Freeze Panes.** Edit Go To cell range A1:N17288 and Format Cells Number Number Decimal Places 4, Font Size 9 or 10, Fill (from the color wheel) a nice fuchsia and make the Border Dark Blue bold Outline.
4. 

Enter the upper Defined Name Variables Section (here's a picture):

1. MODIFIEDL: Cell A1: Enter Sinewave Spheres in a Ring to 100
2. B2: Enter Pasted and C2: Enter Values. Format Fill Red and Font White.
3. E1: AYE
4. E2: BEE
5. E3: CEE
6. F1: 10
7. F2: .50
8. F3: .50
9. Select cell range E1:F3 and Insert Name Create Names in Left Column, OK.
10. MODIFIED: G1: Stretch_x1 or cut and paste,
11. MODIFIED: G2: Stretch_y1 or cut and paste
12. MODIFIED: H1: Enter "=(8.5*(SHRINKER*10))" or cut and paste
13. MODIFIED: H2: Enter "=(8.5*(SHRINKER*10))" or cut and paste
14. G3: Shrinker

15. H3: Enter "=0.1*12/SPHERES"
16. MODIFIED: Select cell range G1:H3 and Insert Name Create Names in Left Column, OK.
17. I1: ROWS
18. I2: MAGIC
19. I3: SPHERES
20. J3: 56
21. Select cell range I1:J3 and Insert Name Create Names in Left Column, OK.
22. J1: Enter "=17285-5"
23. NEW: J2: Enter "=ROUND(ROWS/SPHERES,0)"

5. **MODIFIED:** Enter the column heading of rows 4 and 5:
    1. A5: Adj Cos (for Adjusted Cosine)
    2. B4: Enter 0 and Insert Name Define Name Adj_Sin to cell $B$4.
    3. B5: Adj Sin
    4. C5: Indicator
    5. NEW: D4: Enter .=RANDBETWEEN(4,7)/100 where if the period is deleted the formula becomes active.
    6. D5: Randy (for RandBetween)
    7. E5: t: 0 to n?
    8. F5: z1_
    9. G5: Adj_x1
    10. H5: Adj_y1
    11. I4 and J4: Charting
    12. I5: x: No z
    13. J5: y: With z
    14. K5: Adj_x2
    15. L5: Adj_y2
    16. M4 and N4: Charting
    17. M5: x2: No Z
    18. N5: y2: With z.
    19. Command+Select cells F1:F3 and I3 and Format Fill yellow.
    20. Select cell J3 and Format Fill light sky blue from the color wheel.
    21. Select cell range I4:J5 and Format Font italic.
    22. Select cell range M4:N5 and Format Font italic.
    23. Command+Select cells A1:D1, A2, A3:D3, D2, G1:N2, G3:H3, M3:N3 and Format Fill White.
6. **NEW:** Insert NEW COLUMNS and move Randy.
    1. Select columns K and Insert Column, Select Columns D;E and Insert Columns.
    2. Cut the Randy column, now column F, and paste it in the new column M.
7. 

Enter the new Defined Variables in M1:L3 and O4; here's a picture:

1. M1: Enter "=AYE" and Format Fill yellow for input.
2. N1: Enter AYE2_

3. M2: Enter "=ROUND(ROWS/SWS2_,0)"
4. N2: Enter Magic2
5. M3: Enter "=SPHERES*SWS_Factor" for now and Format Fill medium sky blue.
6. N3: Enter SWS2_ (for SineWaveSpheres2)
7. Select M1:N3 and Insert Names Create Names in Right Column, OK.
8. O1: Enter "=(-1+SQRT(5))/2" and Insert Name Define Name GMLL for cell $O$1 for Golden Mean Long Leg.
9. O2: Enter SWS Factor
10. O3: Enter 1 for now, Been having problems getting this to work at .5,. 25, etc. The idea is to enter 56 or so Spheres and then .25*56 = 14 for the next inner circle.
11. O4: Enter the formula w/o quotes, "=VLOOKUP(SWS2_*IF(SWS_Factor>0,1/SWS_Factor,1),LOOKSTER2,2)*

IF(SWS_Factor1,-2,1)*0"

1. 1. P1: Stretch_x2
   2. P2: Stretch_y2
   3. P3: Shrinker2
   4. Q1: Enter "=Stretch_y2)"
   5. Q2: Enter "=(8.5*(Shrinker2*10))"
   6. Q3: Enter "=(0.1*12/SWS2_)*VLOOKUP(SWS2_*IF(SWS_Factor>0,

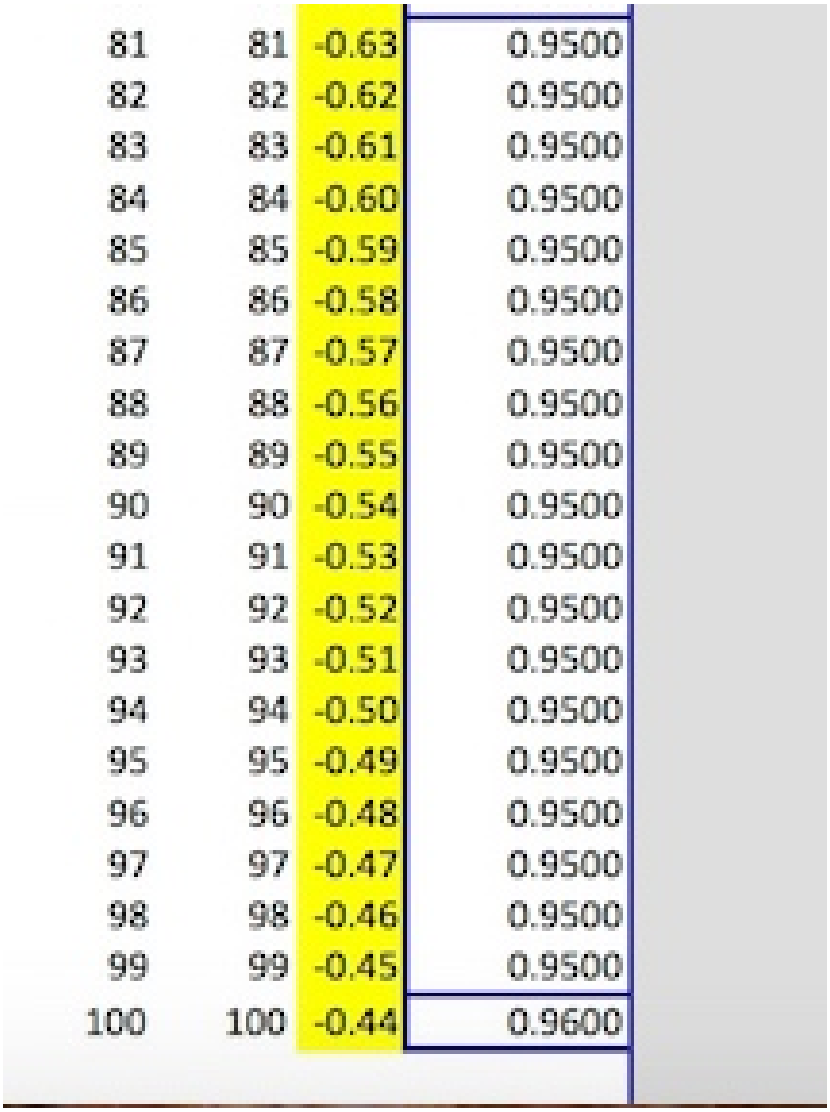
1/SWS_Factor,1),LOOKSTER2,3)*IF(SWS_Factor1,GMLL,1)"

1.

LOOKSTER, LOOKSTER2

Spheres	SWS2_	Aj	Shrinker2PC
1	1	-2.00	0.9000
1	1	4.00	0.1000
2	2	-4.00	0.2500
3	3	-4.00	0.3333
4	4	-4.00	0.3333
5	5	-4.00	0.4000
6	6	-4.00	0.5000
7	7	-4.00	0.5750
8	8	-4.00	0.6500
9	9	-4.00	0.6500
10	10	-3.00	0.7000
11	11	-3.00	0.7250
12	12	-3.00	0.7500
13	13	-3.00	0.7667
14	14	-3.00	0.7833
15	15	-3.00	0.8000
16	16	-3.00	0.8167
17	17	-2.00	0.8333
18	18	-2.00	0.8500
19	19	-2.00	0.8500
20	20	-2.00	0.8500
21	21	-2.00	0.8500
22	22	-2.00	0.8500
23	23	-2.00	0.8500
24	24	-2.00	0.8500
25	25	-1.50	0.8771
26	26	-1.50	0.8792
27	27	-1.50	0.8813
28	28	-1.50	0.8833
29	29	-1.50	0.8854
30	30	-1.50	0.8875
31	31	-1.50	0.8896
32	32	-1.50	0.8917
33	33	-1.50	0.8938
34	34	-1.50	0.8958
35	35	-1.50	0.8979

35	35	-1.50	0.8979
36	36	-1.50	0.9000
37	37	-1.45	0.9025
38	38	-1.45	0.9050
39	39	-1.45	0.9075
40	40	-1.45	0.9100
41	41	-1.41	0.9120
42	42	-1.36	0.9140
43	43	-1.32	0.9160
44	44	-1.27	0.9180
45	45	-1.23	0.9200
46	46	-1.18	0.9220
47	47	-1.14	0.9240
48	48	-1.09	0.9260
49	49	-1.05	0.9280
50	50	-1.00	0.9300
51	51	-1.00	0.9307
52	52	-1.00	0.9314
53	53	-1.00	0.9321
54	54	-1.00	0.9329
55	55	-1.00	0.9336
56	56	-1.00	0.9343
57	57	-1.00	0.9350
58	58	-1.00	0.9357
59	59	-1.00	0.9364
60	60	-1.00	0.9371
61	61	-1.00	0.9379
62	62	-1.00	0.9386
63	63	-1.00	0.9393
64	64	-0.80	0.9400
65	65	-0.79	0.9400
66	66	-0.78	0.9400
67	67	-0.77	0.9400
68	68	-0.76	0.9400
69	69	-0.75	0.9400
70	70	-0.74	0.9400
71	71	-0.73	0.9400
72	72	-0.72	0.9400
73	73	-0.71	0.9400
74	74	-0.70	0.9400
75	75	-0.69	0.9400
76	76	-0.68	0.9400



81	81	-0.63	0.9500
82	82	-0.62	0.9500
83	83	-0.61	0.9500
84	84	-0.60	0.9500
85	85	-0.59	0.9500
86	86	-0.58	0.9500
87	87	-0.57	0.9500
88	88	-0.56	0.9500
89	89	-0.55	0.9500
90	90	-0.54	0.9500
91	91	-0.53	0.9500
92	92	-0.52	0.9500
93	93	-0.51	0.9500
94	94	-0.50	0.9500
95	95	-0.49	0.9500
96	96	-0.48	0.9500
97	97	-0.47	0.9500
98	98	-0.46	0.9500
99	99	-0.45	0.9500
100	100	-0.44	0.9600

Enter the new Lookup Table. Here's a picture (outlined areas are copied, yellow filled areas are series, open-ended outlined areas may be from series -- I forget. Not all have been tried, so if you find a discrepancy, please report back to us all-- thanks. They should be close though.) I suggest the table be entered in cell range T1:W103. Define Name LOOKSTER as the range T3:W103 and LOOKSTER2 as the range U3:W103 in that case.

2. **NEW OR MODIFIED:** Enter the column formulas - BE VERY CAREFUL TO COPY AND PASTE VALUES as specified please.
    1. Adj Cos: Edit Go To cell range A6:A17285 and enter into A6 w/o quotes the following formula, "=17*COS((ROW()-6)*0.25/12*PI()/180)" and Edit Fill Down.
    2. NEW: Adj Sin: Edit Go To cell range B6:B17285 and enter into B6 w/o quotes the following formula,"=17*SIN((ROW()-6)*0.25/12*PI()/180)+Adj_Sin"and Edit Fill Down.
    3. Indicator: Select cell C6 and enter 1. Edit Go To cell range C7:C17286 and enter w/o quotes the formula, "=IF((ROW()-7)/MAGIC=INT((ROW()-7)/MAGIC),1,IF((ROW()-7)=0,1,0))" and Edit Fill Down.
    4. Indicator2: Select cell D6 and enter 1. Edit Go To cell range D7:D17286 and enter w/o quotes the formula, "=IF((ROW()-7)/Magic2=INT((ROW()-7)/Magic2),1,IF((ROW()-7)=0,1,0))" and Edit Fill

Down.

5. t2: 0 to n?: Select cell E6 and enter 0. Select cell E7 and enter the formula "=(2*PI()/Magic2)". Edit Go To cell range E8:E17285 and enter w/o quotes into E8 the formula "=IF(D8=1,2*PI(),2*PI()/Magic2+E7)" and Edit Fill Down.
6. z2_: Edit Go To cell range H6:H17285 and copy it and paste it to F6. Enter w/o quotes into F6 the formula "=CEE*COS(AYE2_*E6)" and Edit Fill Down. Edit Go To cell range F6:F17285 and Insert Name Define Name z2_ to cell range $F$6:$F$17285.
7. t: 0 to n?: Select cell G6 and enter 0. Select cell G7 and enter the formula "=(2*PI()/MAGIC)". Edit Go To cell range G8:G17285 and enter w/o quotes into E8 the formula "=IF(C8=1,2*PI(),2*PI()/MAGIC+G7)" and Edit Fill Down.
8. z1_: Edit Go To cell range H6:H17285 and enter w/o quotes into H6 the formula "=CEE*COS(AYE*G6)" and Edit Fill Down. Edit Go To cell range H6:H17285 and Insert Name Define Name z1_ to cell range $H$6:$H$17285.
9. Adj_x1: Edit Go To cell range I6:J17285 and enter w/o quotes into I6 the formula "=IF(C6=1,A6,I5)" and Edit Fill Down. Edit Go To cell range I6:I17285 and Insert Name Define Name Adj_x1 to cell range $I$6:$I$17285.
10. Adj_y1: Edit Go To cell range J6:H17285 and enter w/o quotes into J6 the formula "=IF(C6=1,B6,J5)" and Edit Fill Down. Edit Go To cell range J6:J17285 and Insert Name Define Name Adj_y1 to cell range $J$6:$J$17285.
11. x: No z: Edit Go To cell range K6:K17285 and enter w/o quotes into K6 the formula "=SHRINKER^2*(Stretch_x1*(((BEE^2-CEE^2*COS(AYE*G6)*COS(AYE*G6))^0.5* COS(G6)))+Adj_x1" and Edit Fill Down.
12. y: With z: Edit Go To cell range L6:L17285 and enter w/o quotes into L6 the formula "=SHRINKER^2*(Stretch_y1*(((BEE^2-CEE^2*COS(AYE*G6)*COS(AYE*G6))^0.5* SIN(G6))+z1_)+Adj_y1)" and Edit Fill Down.
13. MODIFIED: Randy: Edit Go To cell range M6:M6918 and enter into M6 3 and into M6918 .5999 and do Edit Fill Series Column Linear Trend, OK. Edit Go To cell range M6918:M17285 and enter 4.5 into cell M17285 and Edit Fill Series Column Linear Trend OK. This is left over from the last image of the previous article but it occurred that you might like to have it.
14. Adj_x2: Edit Go To cell range N6:N17285 and enter w/o quotes into N6 the formula "=IF(D6=1,A6,N5)" and Edit Fill Down.
15. Adj_y2: Edit Go To cell range O6:O17285 and enter w/o quotes into O6 the formula "=IF(D6=1,B6+Aj,O5)" and Edit Fill Down.
16. x2: No z: Edit Go To cell range P6:P17285 and enter w/o quotes into P6 the formula "=Shrinker2^2*(Stretch_x2*(((BEE^2-CEE^2*COS(AYE2_*E6)*COS(AYE2_*E6))^0.5* COS(E6)))+Adj_x2)" and Edit Fill Down.
17. y2: with z: Edit Go To cell range Q6:Q17285 and enter w/o quotes into Q6 the formula "=Shrinker2^2*(Stretch_y2*(((BEE^2-CEE^2*COS(AYE2_*E6)*COS(AYE2_*E6))^0.5* SIN(E6))+z2_)+Adj_y2)" and Edit Fill Down.
18. Select cell K17286 and enter the formula w/o quotes "=K6" and select cell L17286 and enter the formula w/o quotes "=L6". This makes the top connecting line from the last sphere to the first. Copy cell range K17286:L17286 and paste it to P17286.
19. Edit Go To cell range K6:L17288 and do Format Fill sky blue. Edit Go To cell range P6:Q17288 and Format Fill sky blue.
20. Select cell M5 and Format Fill light sea green, font red, Border navy blue outline bold. Copy this cell to J17287. Then do Edit Paste Special Format of this cell to cell C6, D6, E6, E7, G6, G7, K17286, L17286, P17286 and Q17286 to make distinct the format of those cell's formulas/values.

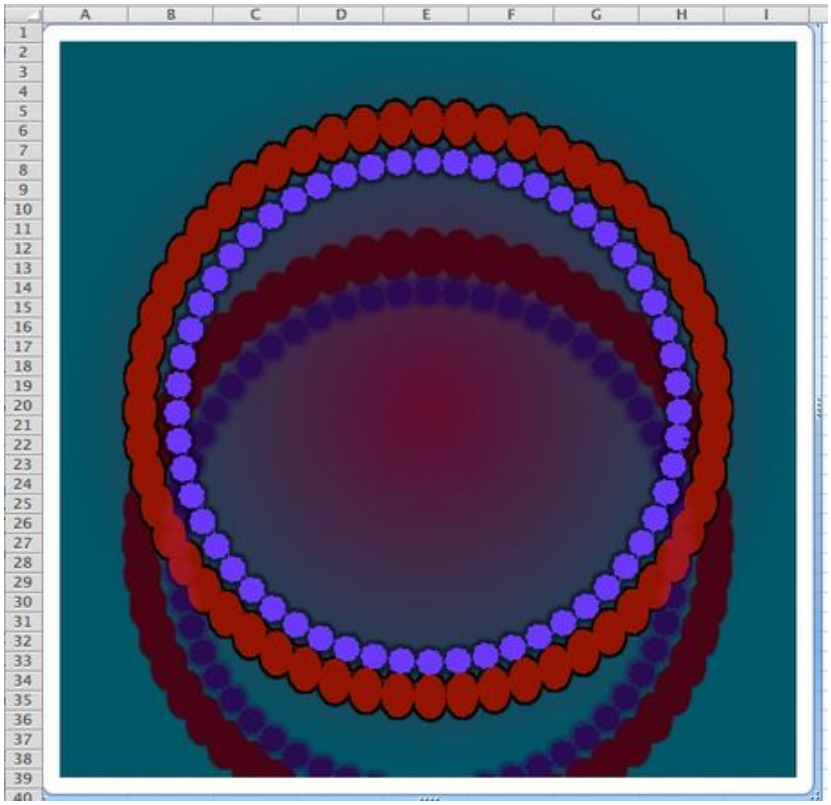
21. Copy cell range A11:J17285 and then PASTE SPECIAL VALUES right back atop the same cell range. Format Fill Red and Font White. This means that the top Variables section is no longer operative in any useful way until you Edit Fill Down the formulas from row 10, which may mean having o wait a considerable length of time, as in 25 - 40 minutes. It can also take that long to save the workbook, so ...
22. Save the workbook. Suggested filename is Sinewave Spheres in Rings.

Part 2 of 3:

Explanatory Charts, Diagrams, Photos

1. (dependent upon the tutorial data above)

1. **Create the Chart.**
    1. Enter to cell L3 60 if not already done.
    2. Select cell range K6:L17285, and either Insert Chart or select Charts from the Ribbon,
    3. Select chart type Scatter, Smooth Line Scatter, and a chart will appear atop your worksheet.
    4. Select cell range P6:Q17285 and do command and c, Copy.
    5. Click on the existing circle of spheres in the existing chart you just made and do command and v, paste. A second ring of spheres and a line will appear. Click on the line and then the delete key.
    6. Click on the new colored ring of sphere, Series 2, and its Series Formula will appear in the Formula Bar above.
    7. Edit the formula to read, w/o external semi-quotes, '=SERIES("Inner Ring",'DATA 01'!$P$6:$P$17285,'DATA 01'!$Q$6:$Q$17285,2)' exactly.
    8. Click on the outer ring of circles and edit its Series Formula up in the Formula Bar to: '=SERIES("Oputer Ring",'DATA 01'!$K$6:$K$17285,'DATA 01'!$L$6:$L$17285,1)' w/o semi-quotes externally, exactly.
    9. Tap the + Tab at the bottom right of the worksheet(s) to create a new worksheet and name it Saves.
    10. Click back on the tab of the first Data worksheet and do Command and x, Cut, the new Chart after making sure it's the object currently selected.
    11. Tap on the Saves worksheet Tab and select a cell towards the mid upper left and do Command and v, Paste. Then hover the mouse over the lower right corner of the chart until it turns into a Two-Headed Arrow, and grab the Chart corner with the mouse and pull the chart down and to the right diagonally until it measures about 3.5" tall by 4" wide.
    12. Double click on the Outer Ring and a window to Format Data Series will pop up. Set Line Color bar to Bright Red. Set Shadow to color black, 270 degrees, Outer, Size 100%, Blur 4%, Distance 70 pt, Transparency 25%,
    13. Double click on the Inner Ring and a window to Format Data Series will pop up. Set Line Color bar to Bright Purple. Set Shadow to color black, 270 degrees, Outer, Size 100%, Blur 4%, Distance 70 pt, Transparency 25%,
    14. Click in the chart area but not on a series or object. Double-click. A Format Plot Area box appears -- enter Fill Gradient Style Radial Centered, Left Pointer=White, Right Pointer=Blue-Green, Add Color Pointer in Middle-Red or Burnt Orange from color wheel.
    15. In the Ribbon's Chart Layout or Format, set Gridlines Horizontal to None -- same for any vertical.
    16. Double click on the Vertical Axis.Select Fill Solid White. Select Number, Uncheck Linked to source, set Number Format to Custom, ;; which will cause no numbers to appear bu leave the white axis line. Do likewise for the Horizontal Axis.
2. **Done!**

3. 

Part 3 of 3:

Helpful Guidance

1. **Make use of helper articles when proceeding through this tutorial:**
    1. See the article How to Create a Spirallic Spin Particle Path or Necklace Form or Spherical Border for a list of articles related to Excel, Geometric and/or Trigonometric Art, Charting/Diagramming and Algebraic Formulation.
    2. For more art charts and graphs, you might also want to click on Category:Microsoft Excel Imagery, Category:Mathematics, Category:Spreadsheets or Category:Graphics to view many Excel worksheets and charts where Trigonometry, Geometry and Calculus have been turned into Art, or simply click on the category as appears in the upper right white portion of this page, or at the bottom left of the page.