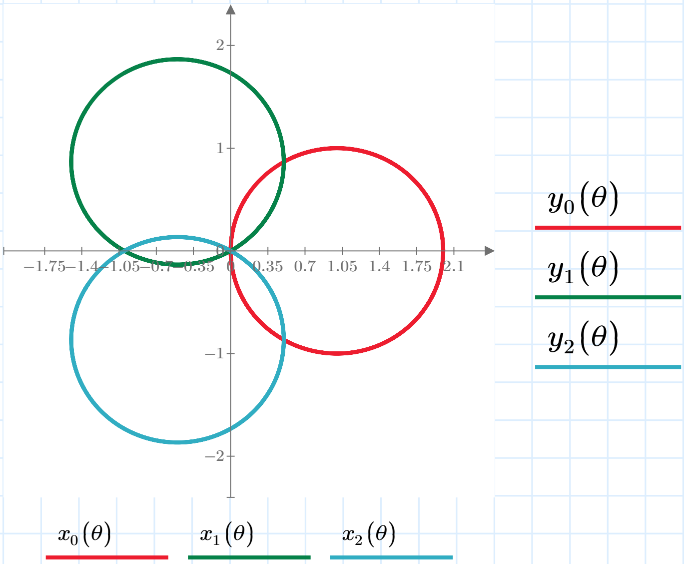
円のグラフを書いてみよう

$a := e^{2j \cdot \frac{\pi}{3}}$ $r_0 := 1$ $r_1 := 1$ $r_2 := 1$ $a = -0.5 + 0.866i$ $a \rightarrow -\frac{1}{2} + \frac{\sqrt{3} \cdot 1i}{2}$

$x_0(\theta) := \mathrm{Re}(a^0) + r_0 \cdot \cos(\theta)$ $x_1(\theta) := Re(a^1) + r_1 \cdot \cos(\theta)$ $x_2(\theta) := Re(a^2) + r_2 \cdot \cos(\theta)$

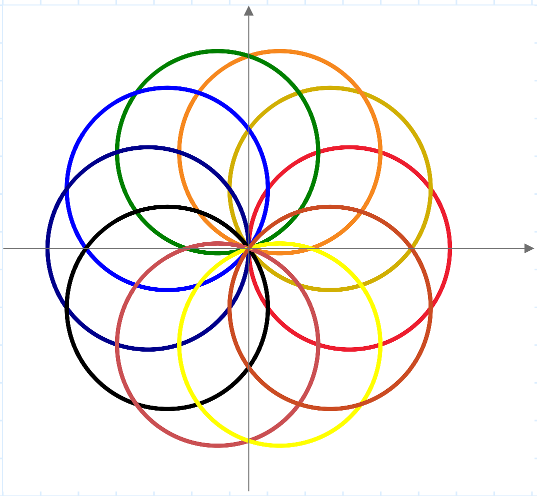
$y_0(\theta) := \mathrm{Im}(a^0) + r_0 \cdot \sin(\theta)$ $y_1(\theta) := Im(a^1) + r_1 \cdot \sin(\theta)$ $y_2(\theta) := Im(a^2) + r_2 \cdot \sin(\theta)$



円のグラフを書いてみよう（１０個に拡張）

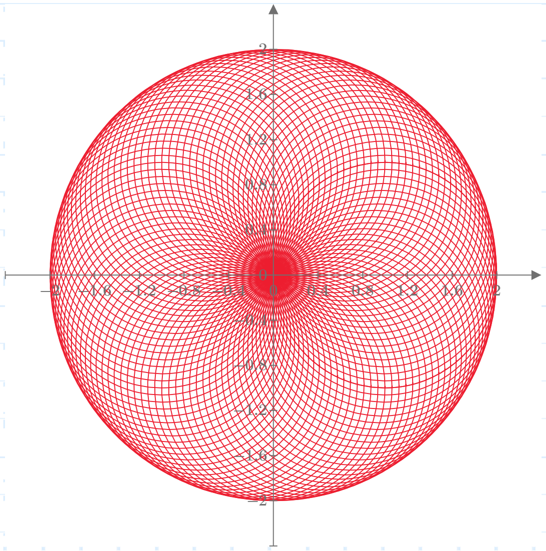
$n := 10$

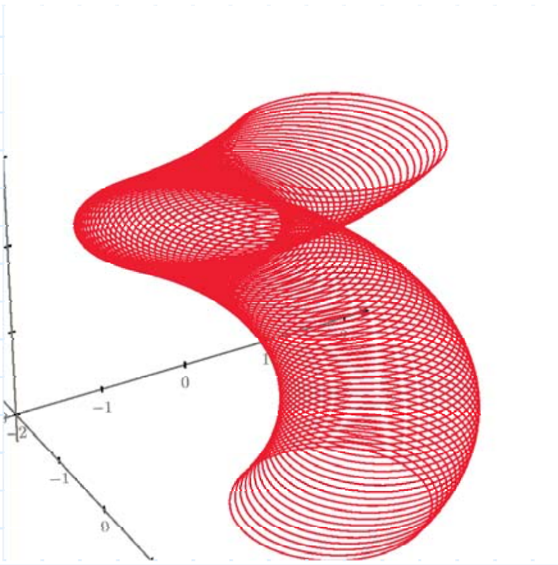
$i := 0..n$ $a_i := e^{2j \cdot \frac{\pi}{n} \cdot i}$ $x(\theta, i) := \mathrm{Re}(a_i) + r_0 \cdot \cos(\theta)$ $y(\theta, i) := \mathrm{Im}(a_i) + r_0 \cdot \sin(\theta)$



$n := 100$

円のグラフを書いてみよう（１００個にプログラミングで拡張）





Parametric Curves in 3 Dimensions (1 Parameter)

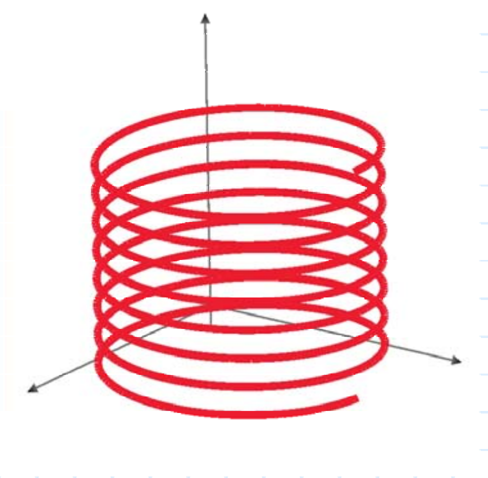
Use the **CreateSpace** function to generate a nested matrix for use with 3D plots, the elements of which are the x-, y-, and z-coordinates of a space curve based on a parametrically-defined function or functions.
Input function:

$$curve(a) := \begin{bmatrix} \sin(a) \\ \cos(a) \\ a \end{bmatrix}$$

Input lower limit on a: $a0 := 0$

Input upper limit on a: $a1 := 16 \cdot \pi$

$$S := \text{CreateSpace}(curve, a0, a1, 1000)$$



CreateSpace allows you to specify the bounds on the parameter, and, if desired, the spacing of points, external to the plot. You could also use the function as the argument to the 3D Plot operator.

You can also use three separate functions to define the three coordinates. In this case, the input functions define radius, horizontal angle and vertical angle in spherical coordinates.

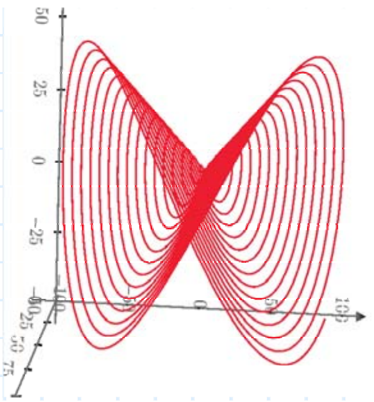
$Q(a) := a$ $R(a) := a$ $S(a) := a$ $R2(a) := 2 \cdot a$ $S3(a) := 3 \cdot a$

Input mesh size for z:

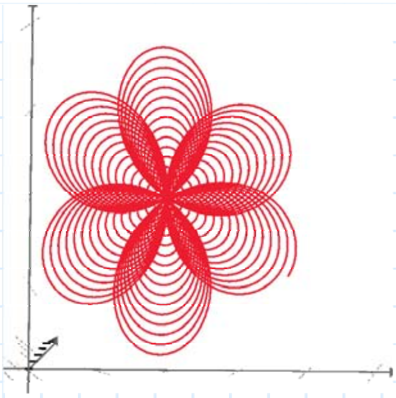
$$amesh := 4000$$

Define the mesh with a built-in mapping function from spherical to XYZ coordinates as the optional last argument:

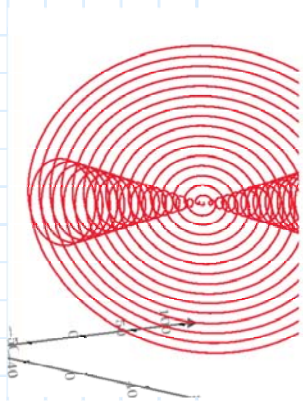
$$L := \text{CreateSpace}(Q, R, S, 0, 100, amesh, \text{sph2xyz})$$
$$L2 := \text{CreateSpace}(Q, R2, S3, 0, 100, amesh, \text{sph2xyz})$$
$$L3 := \text{CreateSpace}(Q, R2, S, 0, 100, amesh, \text{sph2xyz})$$



L



$L2$



$L3$

Parametric Surfaces in 3 Dimensions (2 Parameters)

To parameterize a surface, use **CreateMesh** instead of a space curve.
Enter three functions to plot, representing the three coordinates:

$$X(u,v) := (2+\cos(u)) \cdot \cos(v)$$

$$Y(u,v) := (2+\cos(u)) \cdot \sin(v)$$

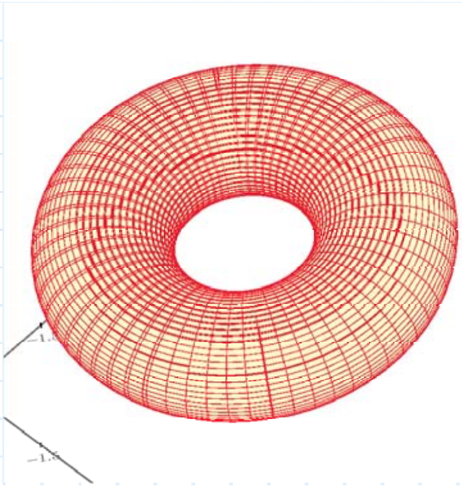
$$Z(u,v) := 1 \cdot \sin(u)$$

$$Z_1(u,v) := 2 \cdot \sin(u)^2$$

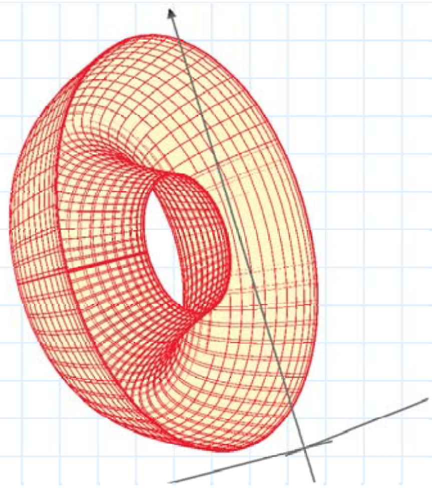
Input mesh size for u: Input mesh size for v:

$$xmesh := 100 \qquad ymesh := 100$$

$$N := \text{CreateMesh}(X, Y, Z, xmesh, ymesh) \qquad N1 := \text{CreateMesh}(X, Y, Z_1, xmesh, ymesh)$$



N



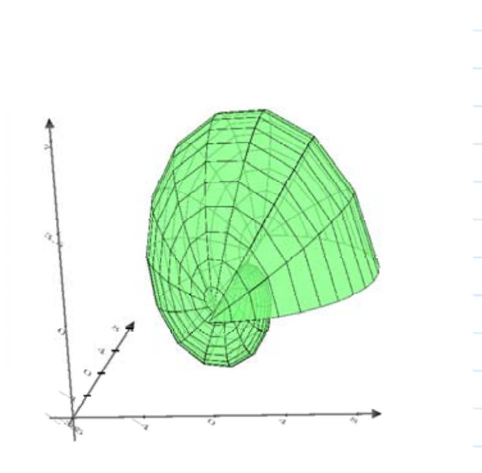
Or, a single vector function giving three coordinates:

$$S1(u,v) := \begin{bmatrix} u \\ u \\ v \end{bmatrix}$$

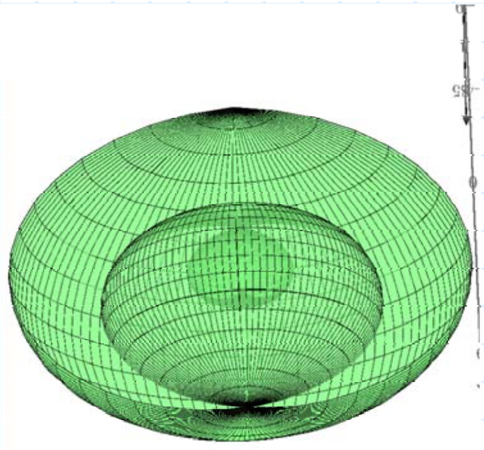
$$S20 := \mathrm{CreateMesh}\left(S1, 0, \frac{5}{2} \cdot \pi, 0, \pi, 20, \mathrm{sph2xyz}\right)$$

$$S10(u,v) := \begin{bmatrix} u \\ v \\ u \end{bmatrix}$$

$$S21 := \mathrm{CreateMesh}\left(S10, 0, 3 \cdot \pi, 0, \pi, 60, \mathrm{sph2xyz}\right)$$



$S20$



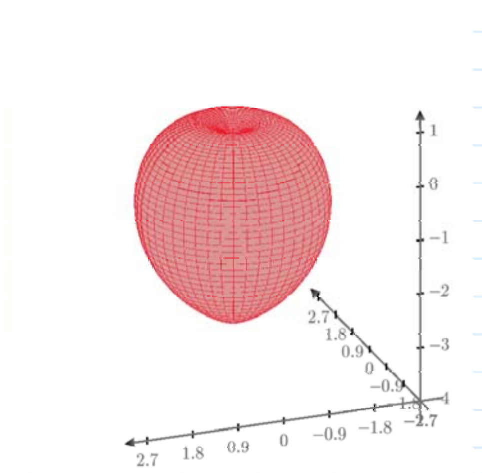
$S21$

$$S11(u,v) := \begin{bmatrix} v \\ u \\ v \end{bmatrix}$$

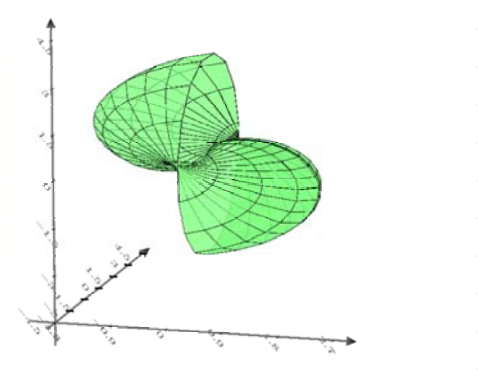
$$S22 := \mathrm{CreateMesh}\left(S11, 0, \frac{5}{2} \cdot \pi, 0, \pi, 60, \mathrm{sph2xyz}\right)$$

$$S12(u,v) := \begin{bmatrix} v \\ v \\ u \end{bmatrix}$$

$$S23 := \mathrm{CreateMesh}\left(S12, 0, \frac{5}{2} \cdot \pi, 0, \pi, 20, \mathrm{sph2xyz}\right)$$



$S22$



$S23$