

Animating Parametric Equations in 3 Space

Before we describe animating in 3-d let's first consider generating 3d parametric curves

Define $S := 0..200$ this determines the number of points to be graphed here obviously we're using 200 points

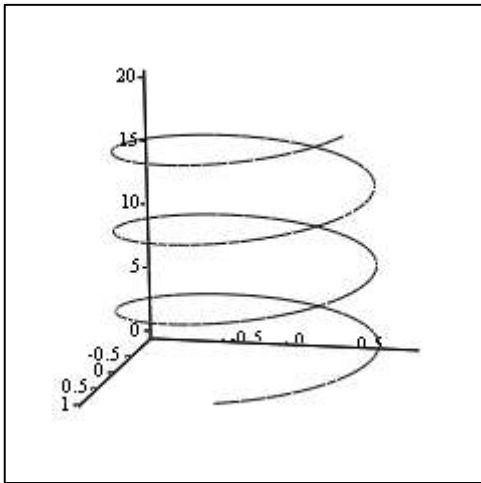
$t(S) := S \cdot .1$ This determines the increment .Here we are using an increment of .1. If we want integer increments we could simply use s but generally this would not yield a very smooth curve.

$i := 0..1$ Defines a "dummy variable " to give the computer a multi-dimensional array to graph.

Now we define the parametric equations to be graphed in terms of t(s). For an example we'll define a helix

$$X_{i,S} := \cos(t(S)) \quad Y_{i,S} := \sin(t(S)) \quad Z_{i,S} := t(S)$$

In the graphing window choose surface plot and put (x,y,z) in the place holder. Note the parentheses must be used.



(X, Y, Z)

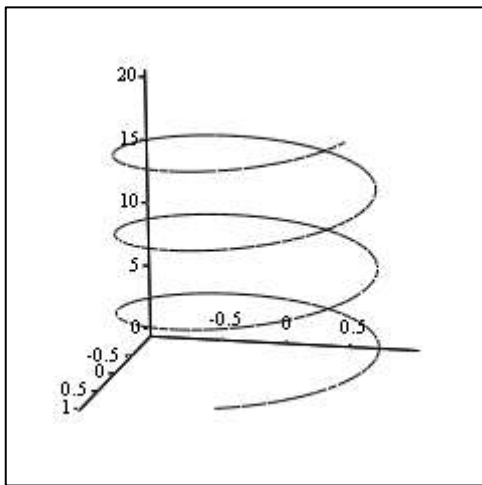
The Formatting would be:

$S := 0..200$

$t(S) := S \cdot 1$

$i := 0..1$

$X_{i,S} := \cos(t(S))$ $Y_{i,S} := \sin(t(S))$ $Z_{i,S} := t(S)$



(X, Y, Z)

Now we are ready to animate.

1. Fix the axes Note on the graph x and y go from -1 to 1 and z goes from 0 to 20.

Double click on the graph and click on the Axes tab

Click on x-axis and turn Auto Scale off and put in -1 for the minimum value and 1 for the maximum value. Do the same for the y axis and z axis

The reason we do this is as we animate if the axes aren't fixed the graph will readjust each frame and you'll have a bad animation.

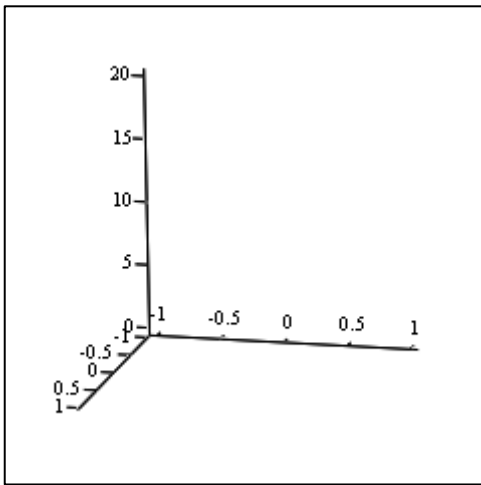
[See Good Animation Axes fixed](#)

[See Bad Animation Axes not fixed](#)

In general you'll want to graph the curve first

2. Now to animate all you have to do is change $S := 0..200$ to $s := 0..FRAME$ and animate

```
s := 0..FRAME
t(s) := s*.1
i := 0..1
xi,s := cos(t(s))    yi,s := sin(t(s))    zi,s := t(s)
```

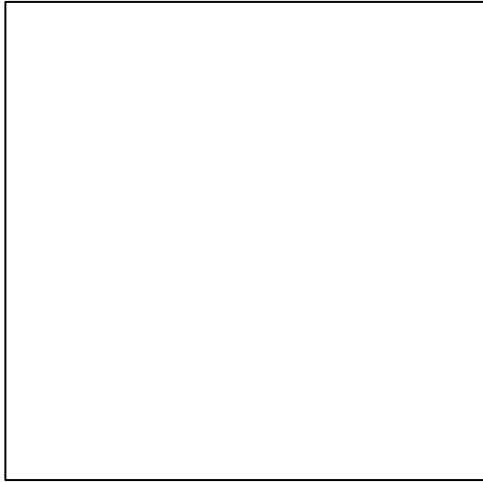


(x,y,z)

Of course you can change the Appearance to a colormap and make any other cosmetic changes you want.

Graphing 2 sets of parametric equations. Suppose we also want to generate a second helix. we simply define a second set of parametric equations and name them say x1,y1, and z1

```
s := 0..FRAME
t(s) := s*.1
i := 0..1
xi,s := cos(t(s))    yi,s := sin(t(s))    zi,s := t(s)
x1i,s := cos(t(s))    y1i,s := -sin(t(s))    z1i,s := t(s)
```



$(x, y, z), (x_1, y_1, z_1)$