Space Curve Mathematica Assignment

This assignment is due on Wed, Feb. 10. It will count as one quiz. You must create this assignment as a Mathematica notebook that you send to me as an email attachment. If you are *getting more serious about the heart in #3, take a picture of your creation and attach that in addition to the Mathematica notebook. Note that this is optional, using Mathematica only would be sufficient (but might not win the bonus points, however :)*

Recall that we defined a vector valued function (or space curve) as

$$\vec{r}(t) =< x(t), y(t), z(t) >$$

For our purposes they come in a 3D or 2D variety. They are somewhat difficult to graph but can result in interesting shapes and figures, so we want to use Mathematica to help us graph them.

Mathematica offers two commands: **ParametricPlot** (for 2D functions) and **ParametricPlot3D** (for 3D functions). For example, to plot $\vec{r}(t) =< cos(t), sin(2t) >$ in 2D, we would use

```
ParametricPlot[{Cos[t],Sin[2t]},{t,0,2 Pi}]
```

This command shows a "figure 8" in 2D. To plot the 3D curve $\vec{r}(t) =< cos(t), sin(t), t/5 >$ we would use:

```
ParametricPlot3D[{Cos[t],Sin[t],t/5},{t,0,4 Pi}]
```

which shows a portion of a 3D Slinky along the z-axis.

Optional: Especially 3D curves can look rather thin and can be pretty hard to see, so you can replace the curve by a thick tube of radius 0.1 (or whatever you like) using the Mathematica *replace* command **/.**

```
ParametricPlot3D[{Cos[t],Sin[t],t/5},{t,0,4 Pi}] /. Line -> (Tube[#, 0.1] &)
```

Your assignment:

1. Pick two integers n and m and draw the 2D vector-valued function $\vec{r}(t) =< cos(nt), sin(mt) >$. Use whichever combination of n and m you like best.
2. Draw a 3D slinky around the y-axis. You could use the simple ParametricPlot3D command or optionally replace the curve by a thicker tube if you prefer
3. Use Mathematica to draw a 2D heart as best as you can. You might want use the Internet to find appropriate parametric equations for hearts. Note that since **Valentine's Day** is coming up, you might find other uses for this curve … In fact, the *prettiest heart submitted will get some bonus points*! You are welcome to use your artistic abilities any way you like (crayons, water color, oil on canvas, etc), but your picture must be based on the graph of a vector valued function drawn in Mathematica.
4. Note that a "circle with variable radius" is $r(t) =< t\cos(t), t\sin(t) >$. How does the graph of this curve look like (use t from 0 to 6 Pi). Next, draw a 3D spiral that spirals up the z-axis. Your picture should resemble a tornado, as least somewhat.
5. Finally, create your own 3D vector-valued function and use Mathematica to plot it. You are welcome to search for some "fun" functions or to create your own entirely. Anything is fine, the only restriction is to draw a curve *different* from simple slinkys and 3D spirals. Again, *the "prettiest" 3D graph will get bonus points.*