Lab 5: Parametric Curves

This lab studies properties of curves that are defined parametrically. Refer to Sections 9.3-9.5 in Stein.

Step 1

Copy the **Lab5.ma** notebook file into your own **notebooks** subdirectory If you don't remember how to do this, review Step 3 of Lab 2.[1] After opening the main cell, it should look like this:

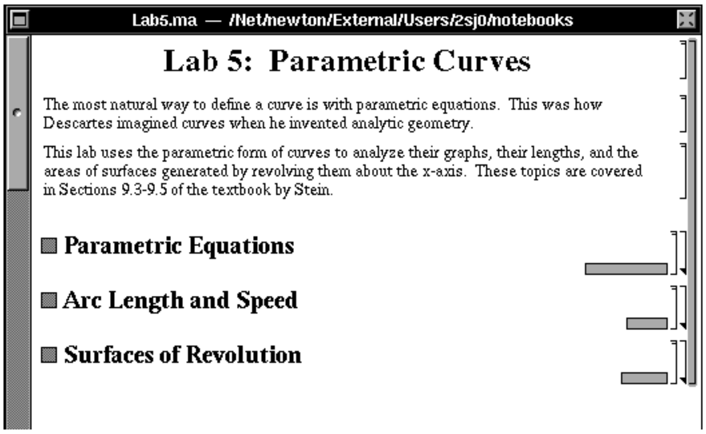

Figure 1 The main sections of **Lab5**

Work through this lab. Be sure to ***open all subcells*** and ***execute all Mathematica commands*** in the order in which they appear.

In the second section you will need to teach *Mathematica* how to simplify the square root of a square. Do this by defining the same rule you used in Lab 4.

In the exercises in the second section, you will have to use the `NIntegrate` command instead of the `Integrate` command to obtain values of the distance function along the Trefoil Knot curve. The `NIntegrate` command produces numeric values instead of a closed form expression for the definite integral.

The third section uses a specially-defined `Surface` command to plot surfaces of revolution about the x-axis. It is analogous to the `Surface` command that we used in Lab 4. The only difference is that it takes a pair of parametric functions `{x[t],y[t]}` instead of a single function `f[x]` to define the curve. You may use the `ViewPoint` option here just as you did in Lab 4 to view the surface from different angles.

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[1] Or ask someone.

Step 2

After you and your lab partner have finished working through the notebook, prepare to write your own lab reports describing what you have learned.[2] Use the *WriteNow* word processor to do this. Refer to Step 5 of Lab2. Be sure to illustrate your work with examples.[3]

Don't forget to save your work regularly.[4]

Step 3

Here are some ideas to consider when writing your report:

Parametric Equations

1. What interesting results did you find from the exercises?
2. Do any of these curves have asymptotic points?

Arc Length and Speed

1. Why did you use a definite integral to obtain the antiderivative?
2. What did you learn from the output of the `Table` command?

Surfaces of Revolution

1. How did you react to the Astroid of revolution?
2. When would the `NIntegrate` command be necessary?

Step 4

After you finish writing your lab report, mail it to **math212**. Be sure that the *WriteNow* icon for your report is in the Send window before you click on the Deliver button.

Appendix: *Mathematica* Commands

Here are some of the *Mathematica* commands that are used in this lab:

`Table[{x[t],y[t]},{t,0,b,c}]`	Produces the list of pairs: { (**`x[0],y[0]`**), (**`x[c],y[c]`**), ..., (**`x[b],y[b]`**) }.
`// TableForm`	Presents the output of the current **`Table`** command in tabular form.
`ParametricPlot[ {x[t],y[t]}, {t,a,b} ]`	Draws the curve given parametrically by **`x=x[x]`**, **`y=y[t]`** for **a** ≤ **t** ≤ **b**.
`Surface[ {x[t],y[t], {t,a,b}]`	Draws the surface obtained by revolving about the x-axis the graph of **`x=x[x]`**, **`y=y[t]`** for **a** ≤ **t** ≤ **b**.
`ViewPoint -> {8,7,1}`	An option used within the **`Show`** command to change the point of view.

[2] You should study the "sample" lab reports for Lab3 and Lab4 in the **math212/reports** directory.
[3] Note that the examples used in the "sample" lab reports are all taken from the notebook exercises.
[4] Use Command-s.