Homework 6 - Math 142, Frank Thorne (thornef@mailbox.sc.edu)

Due Friday, October 3.

(a) Read Chapter 10 of Thompson. Explain how he describes the geometrical interpretation of differentiation, and compare it to Stewart’s treatment.

(b) What is a parametric curve? Draw a picture and give an example.

(c) Given a curve defined by parametric equations $x = f(t), y = g(t)$, which variables are functions of the other variables?

(d) Give (and draw) examples of parametric curves that illustrate the following possibilities. Explain thoroughly.

- $y$ can be described as a function of $x$.
- $x$ can be described as a function of $y$.
- Both of the above are true.
- Neither of the above are true.

(e) Suppose you have a function $y = f(x)$ that you want to define by parametric equations. How would you do it? Could you do it a different way? Is there any limit to the number of ways you could do it?

(f) Give parametric equations for a line, a circle, an ellipse (other than a circle), and a parabola. Graph all of your curves.

(g) A bug sits on the edge of a bicycle tire while you ride the bicycle, and does not move (relative to its position on the tire). Assume that the bicycle moves forward at a constant speed and that the bug starts at the bottom of the wheel.

Give parametric equations describing the bug’s motion, and draw a graph which describes it.

(h) Same as above, but now assume that the bug sits on a bicycle spoke, initially pointing downwards, halfway between the center and the edge of the wheel.

(i) Same as above, but now assume that the bug sits at the center of the wheel.

(j) If you are given a parametric curve $y = f(t), g = f(t)$, how do you find $\frac{dy}{dx}$? Give the formula, explain why it is true, draw a picture, and give an example.

(k) 10.1, 1-10, 24-28.

(l) Find $\frac{dy}{dx}$ for each of the “bug” problems described above. Draw sample tangent lines on your graph, and explain how your answers differ from each other.

(m) 10.2, 1-10.
Additional problems:

(a) 10.1, 11-14.

(b) 10.2: Graph all of the curves sketched in 1-8 along with their tangent lines.

Bonus (2 points): 10.2, 73.