

**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  $y = f(t)$ ,  $x = g(t)$ , 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.