

MATH 104/184: Week 8 Learning Goals

October 21, 2013

Learning Goals

This week we cover the first and second derivative tests and curve sketching. This is material in sections 4.2 and 4.3 in Briggs Cochran, with some additional material from 2.5 focused on asymptotes.

Suggested problems that help build these skills are given as [section: question #s].

The specific learning goals for this week are that by the end of the week and review homework, you should be able to:

1. explain how the first derivative of a function determines where the function is increasing and decreasing and apply this to specific functions to determine their intervals of increase and decrease; [4.2: 1, 3, 12, 16, 22, 30,63]
2. use the first derivative test to identify local maxima and minima; [4.2: 2, 32, 36, 37, 40]
3. explain how the second derivative of a function determines concavity and apply this to specific functions to determine where they are concave up and concave down, and to identify inflection points; [4.2: 48, 50,54, 56,80,63]
4. use the second derivative test to classify local maxima and minima; [4.2: 60,62, 77,78]
5. identify any asymptotic behaviours a function may have: vertical asymptotes, horizontal asymptotes, and oblique or slant asymptotes; [2.5: 22,24,38,39, 43,54]
6. use calculus to sketch a graph of a given function. [4.3: 2,3, 8, 14, 19, 22, 26, 31, 32, 42, 43, 64]

Potential Learning Approaches and Issues

1. The material in 4.2 is presented using the viewpoint “what derivatives tell us.” It is crucial to spend time this week making links between the calculations you do and the intuitive aspects of drawing sketches of functions to help you interpret your results. I do recommend that you use a graphing tool (e.g. www.wolframalpha.com) so that you can check your answers by viewing the final graphs. The examples in this section are very good, and I suggest that you work through them carefully by covering up the book’s solutions and trying them on your own, and then comparing your solutions to the examples. There are some interesting features in some of the examples: e.g. in Example 4 on p. 237, you explore a function with a cusp that is a local minimum. Can you find another function with this property?
2. It is useful to master “good bookkeeping” techniques for the first derivative test. The kinds of figures that encode the first derivative test (e.g. see Figure 4.21 or 4.23) are very useful to you to track your results. They are also a good way to present the information clearly and precisely. There are other forms of such tables, but the result is the same. Students who do not track their thinking and express it through these sorts of tables or diagrams tend to get lost and lose many marks on exams.
3. FOR THOSE LOOKING FOR MASTERY OF DEEPER CONCEPTS: Inflection points are worth thinking about carefully. Briggs and Cochran’s definition of an inflection point is not consistent with the actual geometric definition of such points. However, please follow the definition

of *inflection point* in the text. If any of you were to go on to study classical differential geometry, you would learn that geometer's would insist on a tangent line at a point of inflection, but it is a rare calculus text that does (most are not written by geometers!). None of the examples Briggs and Cochran give violate this, but by their definition a "kink" with the curve concave up on one side and concave down on the other would be an inflection point. (It is not necessary to have $f''(c)$ exist at an inflection point, as in Figure 4.28(c) on p. 239.)

4. Our coverage of the material in section 2.5 on limits at infinity and infinite limits is solely to serve curve sketching at this point. You should be able to find vertical, horizontal, and oblique asymptotes. In section 2.5, examples 3 and 4 are key.
5. The curve sketching material in section 4.3 is nicely presented. I encourage you to practice sketching many curves!

Suggested Problems and Assignments

Suggested Problems: This week, all suggested problems from the text are:

Chapter 4.2: 1, 2, 3, 12, 16, 22, 30, 32, 36, 37, 40, 48, 50, 54, 56, 60, 62, 77, 78, 80.

Chapter 4.3: 2, 3, 8, 14, 19, 22, 26, 31, 32, 42, 43, 64.

Chapter 2.5: 22, 24, 38, 39, 43, 54.

Webwork Homework: Students will be asked to do WebWork Assignment 8 based on this material. It will be due on the Wednesday of the following week.