Review for Third Exam

The third exam will cover Sections 4.1, 4.2, 5.1, 5.2, 5.3, 6.1, and 6.2 of the text. The problems should be similar to those on homework assignments 20 through 27. I might also ask you for one or more of the following:

- definition of a continuous function (**5.1.1**)
- sequential criterion for continuity (**5.1.3**)
- the proof of the theorem that the composition of continuous functions is continuous (**5.2.6**). You can give either the proof I gave in class, or the proof in the text; they are really the same proof, just expressed in different ways.
- statement (not proof) of the following theorems: extreme value theorem (**5.3.4**), location of roots theorem (**5.3.5**), and mean value theorem (**6.2.4**)
- definition of derivative (**6.1.1**)

Here is a guide to which parts of the text were covered in class and are relevant to the exam.

4.1. Limits of functions. On the second exam, we only covered the first part of this section, but for the third exam you should be familiar with the whole section, including the examples in 4.1.10.

4.2. Limit theorems. We covered all of this section except the examples in 4.2.8, which you can skip. We put Theorem 4.2.9 off until the last week of class, when we used it to prove the theorem that the derivative of a function at an interior relative extremum is zero (6.2.1).

5.1. Continuous functions. We covered this entire section except for Example 5.1.6(h), which you can skip, although it is quite interesting.

5.2. Combinations of continuous functions. You should review the entire section, except that you don't need to read the proofs that the trigonometric functions are continuous (Examples 5.2.3(c,d,e)). In this class, whenever a trigonometric, logarithmic, or exponential function comes up in the examples or exercises, we just assume that it is continuous without proof. We also assume when necessary that these functions are differentiable, and that their derivatives are given by the formulas you learned in elementary calculus.

5.3. Continuous functions on intervals. We covered the material in this section from the beginning through Theorem 5.3.5 and its proof. You can skip Theorems 5.3.7, 5.3.8, and 5.3.9.

6.1. The derivative. You should read from the beginning of the section through Theorem 6.1.3 and Corollary 6.1.4. We did not prove the chain rule in class, but you should know its statement (Theorem 6.1.6) and understand how it is used in the examples in 6.1.7. In particular, it follows from the Chain Rule that the function $f(x)$ defined in Example 6.1.7(e) is differentiable for all $x \neq 0$. Notice, however, that the Chain Rule can not be used to show that the function defined in Example 6.1.7(e) is differentiable at $x = 0$; to do that we showed that the limit in the definition of derivative does not exist.

You can skip the part of this section concerning inverse functions (from the bottom of page 168 to the end).

6.2. The mean value theorem. In this section we covered (or will cover, if we haven't already) the material from the beginning of the section through Theorem 6.2.7. You should also look at the examples in 6.2.10 on page 177. You can skip the remainder of the section.