**Mathematics 25 Review for Final**
**December, 2009**

**Definitions you should be able to state.** *You should learn the definition verbatim from the text or from class notes. If instead you try to express the idea in your own words, it is extremely likely that you will get it wrong, either because you don't understand the idea well enough yet, or because you are unable to precisely express the idea.*

1. The *domain, codomain, and range* of a function. (See note on webpage entitled "Note on notation and terminology for functions.")
2. A *one–to–one* function (definition 1, page 60). The inverse of a one–to–one function (definition 2, page 61).
3. The *limit* $\lim_{x\to a} f(x) = L$. (page 88 of text)
4. A function $f(x)$ is *continuous* at $x = a$. (page 119 of text)
5. The definition of the derivative of a function $f(x)$ at a point $x = a$. (page 146 of text, or formula (5) on page 147)
6. A function $f(x)$ is strictly increasing on an interval $J$. (definition given in class)
7. *Global max or min, local max or min, neighborhood.* See note on webpage entitiled "Note on max-min".
8. *Critical number*, see definition 6, page 274.

**Theorems you should be able to state.** *Same warning applies as for definitions.* Remember that a theorem has hypotheses and conclusions; both need to be clearly stated.

1. The intermediate value theorem, page 126.
2. Extreme value theorem, page 272.
3. Fermat's theorem in the formulation at the bottom of page 274.
4. Rolle's theorem, page 280.
5. Mean value theorem, page 282.
6. The fundamental theorem of calculus, parts I and II, pages 381 and 384.

The remaining items mentioned here are *in addition* to the things appearing on the first and second midterms, and on the review sheets for those exams.

We have the following important applications of differentiation from chapter 4: Max-min theory; graphing a function using first and second derivative information, as well as information about asymptotes and symmetry; applied max-min problems (section 4.7); Newton's method for equation solving.

Every differentiation rule is also an anti-differentiation rule; therefore, you have to learn these rules both forwards (as differentiation rules) and backwards (as anti-differentiation rules). See the table page 392. *If needed, I will provide that part of the table below the entries for anti-derivatives of* sin *and* cos.

Aside from the basic anti-differentiation formulas, we have (so far) one important technique for finding anti-derivatives (and definite integrals), namely, the technique of substitution.

We have the following important applications of definite integrals: calculations of areas below a curve or between two curves, calculations of areas by slicing, especially the washer method for volumes of rotation, calculation of volumes of rotation by cylindrical shells, and work integrals.