# MAT 136 Final Examination Comments

A C or better in MAT 136 signals that you are ready to take MAT 127 (Calculus II). To reach this threshold, you need to be able to:

- Have an intuitive understanding of limits (mt1review problem 5)
- Be able to compute some simple limits, including at infinity (leading term method).
- Know the limit definition of continuity: $f$ is continuous at $a$ if $\lim_{x\to a} f(x) = f(a)$.
- Be able to use the definition of derivative to find the derivative of a function.
- Understand that $f'(a)$ is the slope of the tangent line to the curve $y = f(x)$ at the point $(a, f(a))$.
- Understand the geometric meaning of $f''(x)$ as giving the concavity of the graph.
- Be able to use the basic rules of differentiation to compute derivatives (power rule, product rule, chain rule). This is a BIG one! Do lots of problems so that you know this stuff cold.
- Know the derivatives of important functions like $\sin(x), \cos(x), e^x, \ln(x)$.
- Be able to find the critical points of a function, and use the first derivative test to characterize them as local max, local min, or neither.
- Use L'Hospital's rule to compute limits of the type $\frac{0}{0}$ or $\pm\frac{\infty}{\infty}$.
- Understand that the notation $\int f(x)dx = F(x) + C$ means that $F'(x) = f(x)$, and any other antiderivative of $f(x)$ has the form $F(x) + C$ for a constant $C$.
- Know antiderivatives of basic functions: Polynomials, sine, cosine, $e^x$, $1/x$, etc.
- Be able to compute a given Riemann sum (estimating area by adding up rectangle areas).
- Understand that the definite integral $\int_a^b f(t)dt$ of a continuous function is defined as a limit of Riemann sums where the widths of the rectangles are going to 0.
- Evaluate definite integrals using the Fundamental Theorem of Calculus:

$$\int_a^b f(x)dx = F(b) - F(a),$$

  where $F$ is any antiderivative of $f$.

There is a lot of MAT 126 material beyond the list above, including max/min word problems, implicit differentiation, related rates, L'Hospital's rule applied to other indeterminate forms, the Mean Value Theorem, the Intermediate Value Theorem, etc.

There is also the theoretical stuff we have done. To get an A in the class, you should demonstrate facility with most of the above concepts, as well as some of the theoretical stuff. In particular, an A student in Honors-level Calculus must be able to compute a basic limit (say, of a quadratic polynomial) using the $\epsilon$-$\delta$ definition of limit. Of course, participation and homework will play a role as well, as outlined on the course syllabus.

To study, do lots of problems, including the midterms and midterm review problems. I especially recommend doing the MAT 126 old-exams (link).