For my final project I decided to focus on Limits. I remember taking my first calculus class here at USU and hating limits. Other students told me that once I got past limits in Calc 1, I would never need to deal with them again. It was my impression that limits were a part of explaining the basics of Calculus, but not an important part of solving actual Calculus problems.

It took me a long time to figure out what was going on conceptually. I knew all sorts of fancy tricks and could recognize what technique I would need to use to find limits fairly quickly, but I never really understood what I was doing. After Calc 1 I forget all those magic techniques and let limits slip away into a dark spot of my mind that I never planned on revisiting. The idea came up occasionally in other classes, but it was always only mentioned and then forgotten. Tragically, I stopped caring about limits.

Then, to my surprise and distaste, limits were reintroduced into my course load. (Interestingly enough by the same professor I had for Calc 1.) By the time I was in Foundations of Analysis I thought I was pretty cool. I thought I knew what was going on with Calculus until I learned that I didn’t know what the definition of a limit was. Limits are the first thing you learn in calculus, and I didn’t even know the definition. I checked my calculus book, I checked my calculus for dummies book, and neither of them gave an actual definition. As a matter of fact, I don’t think I had even heard the definition before, if a professor had mentioned it to me, I can guarantee I logged it away as useless.

Delta-epsilon proofs seemed like nonsense to me. It was like we were making up our own rules just to say something about nothing (Which is pretty much all of mathematics anyways.) So I memorized the definition and spit it back out on the test and forgot about it again.

I once had a professor tell me that knowing the definition of a term or concept was the first step to understating what it was all about. I disagree; and it’s not because I hated his class (or him), it’s because no matter how much I thought about that definition of a limit that I had memorized, I wasn’t getting anywhere. I couldn’t visualize it, I couldn’t conceptualize it, and it was just a string of words to me. So I never learned it. After a while I just stopped trying and stopped caring.

I chose to focus my project on limits so that I could try, one more time, to learn what they really are all about.

I would like users of my page to understand what a limit is. Whether it’s the ‘definition free’ version, or the scary, “I hate you”, “grrrrrr”, delta-epsilon proof version of a limit. Although it’s not a ‘sit on the edge of your seat lesson’, ‘my favorite day of class’, or ‘coolest part of Calculus’ topic, it is actually pretty important. After all, Calculus can be defined as the part of mathematics that deals with limits.2

Spelled out, the objectives of this page are to:

* Help users understand the concept of a limit
* Help users become familiar with, or comprehend, the proper definition of a limit
* Help users see that there one sided limits, and limits that do not exist.
* Help users identify the major methods for algebraically evaluating a limit
* Help users recognize that limits were used before Calculus was invented.

Included on my final project page are several links: The definition of a limit, Basic limit ideas, the existence of a limit, methods of evaluating limits, delta epsilon proofs, and a resources page.

The first link will help users with the definition of a limit. The second link will help users who are new to limits conceptualize the idea of a limit. The second and third links are for users unfamiliar with calculating limits, (either because they are new to them or they have forgotten), they cover topics such as one-sided limits. The fourth link is one that users can jump directly to if they want to learn how the delta-epsilon proof works, and the resources page lists several books that I referenced or quoted.

My two applets are both in the basic limit ideas section. One focuses on seeing the limit of a basic function. This will help students to learn what a limit represents. The second applet focuses on how Archimedes used the idea of a limit to calculate the area of a circle. This applet will help users see the usefulness of applets, how they can be applied to problems, and how calculus is built upon limits.

In the delta epsilon section I provide a link to another applet that helps demonstrate the proper definition of a limit. I find this applet to be the most beneficial as it helps demonstrate the trickiest thing about limits. This applet will hopefully aid my peers in also understanding the proper definition of a limit and where it comes from.

I didn’t expect to learn as much as I did about limits, but it turns out I had forgotten a lot. As I was reading up about limits, I came across many good examples of how limits are used in everyday life, and how they were used to solve problems before Calculus. Although I didn’t focus on the application side of limits, it was a good opportunity for me to see why we use them and why I needed to learn about them way back in Calc 1.

I also finally comprehended the definition of a limit. The base of all calculus and I learned it last. Delta epsilon proofs are an important part of Calculus, though we may not be teaching them to all of our students in secondary education, we are teaching them the ideas that were built off of them.

I expect my peers to lean how important limits are, especially when viewed with the proper definition. I also expect them to be able to comprehend the proof of a limit well enough to explain it to their future students.