# Preface to the Course Primer

I have been studying and teaching mathematics for over two decades and I have realized an important truth. Learning mathematics is the mastery of Object Recognition and Conditional Response (ORCR) that may only be achieved through rigorous practice. Some call this effect *muscle memory*, but that would be incorrect. ORCR is similar to muscle memory, but muscle memory is a physical reflex. Whereas the former is a reflex of the mind. Many know the story of Pavlov's Dog. In the 1890's Russian psychologist Ivan Pavlov showed that every time he entered the room occupied by his dog, the dog would salivate in anticipation of being feed. This became known as the Pavlovian or Conditional Response. This effect is what I believe makes us successful at mathematics. The more we are exposed to certain types of similar problems, the more we recognize these similarities. This is the Object Recognition portion of the process. If every time we are exposed to one of these problems and apply the same solution, we have made a correlation linking the characteristics of the problem to the solution. If we do this enough times, then we may attain an Object Recognition and Conditional Response.

Successful implementation of the ORCR technique is not tricky. It only requires the correct type of practice with the correct type of problems. All math problems can be categorized depending on certain characteristics. Here we want to categorize problems based upon the best common technique for solving the problem. If we chose a problem, then we practice the solution over and over, it should not matter if we change the numbers within that problem provided it does not change the solution's characteristics. Advanced undergraduate and graduate students often approach mathematics in this way, even though they may not be completely conscience of the basic principal. When I was an undergraduate mathematics student at the University of Wisconsin - Madison, I discovered this technique after a friend and study partner shared it with me. He told me to copy the theorem and then copy the proof, over and over until I was able to recreate it on my own with complete understanding. I soon found that this was the secret to learning mathematics. My grades improved dramatically and my understanding of mathematics became very clear.

There is a widely held belief that there exists only two types of people: math people and non-math people. Over the past two decades of practicing mathematics, I have found nothing to support this claim. In fact, it has been my experience that there is no one completely incapable of learning Algebra and Calculus. This is not just a pet theory, I have proven this countless times throughout my career as

a teacher and a student. Learning mathematics takes discipline and direction. Without either, and a considerable amount of patience, there really is no hope for the student. I was never much of a math student in high school, or any other kind of student for that matter. I grew up in a economically depressed Wisconsin town just north of Chicago, where I never once felt academically challenged. Everyday after school I would go to the gym and spar with my teammates, which kept me out of trouble and taught me discipline and the results of hard work. Beloit, Wisconsin could be a rough place and learning self defense was a smart move. I had no plans for college and I figured my chances for survival would be greatly increased if I enlisted as an infantryman in the United States Army.

The Army's motto at the time was "Be All You Can Be." I found much truth in this statement. I accelerated beyond my fellow soldiers and learned that giving up was a choice. Soon after arrival to my permanent duty station I tried out for the Scout Sniper Squad in a forward reconnaissance unit. We trained day and night. It was far from easy, but it was extremely rewarding and exciting as hell. As part of the Battalion Commander's security detail, we fell under the direct command of the Colonial and we received special treatment. One morning shortly after indoctrination to the Scout Sniper Squad, myself and three of my cohorts packed up our gear and we were loaded up on a bus. Eight hours went by and I do not recall any of us inquiring as to where we were headed and why they needed a bus for only four people. Besides, who would we ask? I'm quite certain the driver knew less than we did. Upon reaching our destination, which looked like a large well manicured but completely abandoned Army base, we were greeted by members of the Army's most elite 10th Special Forces Group. It was one of the most exciting experiences of my life. We were going to be trained by the greatest warriors in the world: The Green Berets of 10th Group. The physical and psychological challenges were never too great for me to handle, but there were a plethora of other components to this type of training that took a toll on me. There were academic and intellectual challenges that were always performed under some kind of cruel duress. Half the time you felt mentally paralyzed and quite possibly the world's biggest idiot. Being a Scout Sniper required many formulas that must be committed to memory - the dreaded applications of mathematics - and they were always done in the most unpleasant circumstances. We succeeded where most failed, because we were extremely well prepared. Our unit trained non-stop for hours on end in the harshest environments, as if our survival depended on it, because in fact our survival did depend on it. When we breach that self-inflicted threshold that barricades our true potential, we realize that what bounds us is often

imaginary. Such an epiphany can make one feel invincible.

It was not long after I started teaching calculus that I realized that the approach of copying and re-copying problems was exactly how we approached challenges in the military. One of the most tedious tasks in the Army is performing battle drills. You stage battle scenarios and practice them over, and over, and over again. You read manuals and restated key material which could some day save your life. This was the Army way, and no one was more accustomed to this style of training than the Special Forces Sniper. When the bullets start flying, you don't have time to think. You only have time to react, and it better be the correct decision. We kept log books to record every aspect of every shot we ever took. We noted the temperature, the humidity, the range, wind speed and direction, visibility, the number of rounds put down the barrel, if we were tired, hungry, or cold. We shot many rounds, all day every day. We learned that practice did not make perfect, but it was perfect practice that makes perfect. I put this strategy to the test in the classroom. We recite laws, and we copy problems over and over again until they become second nature. Even in this book many of the words, phrases, and sentences are repeated many times. This is no mistake. A key to effective practice is constant repetition. This method never fails when applied correctly. It is up to the student to practice this way - this highly efficient way - if they want results. It works, and any one of my students that has truly put this method to the test will tell you the same.

This is the Preliminary Edition, and there will be many changes made before the release of the First Edition. This is simply a draft. One might immediately notice that this is not your typical textbook, nor should it be treated as such. I have found that with the implementation of online homework programs, the traditional textbook has lost its niche. Most students only purchase the textbook to have access to assigned problems. This is no longer necessary and very few students now purchase a textbook. However, the student does require direction through examples. Remember that a key to this program's success is to repeat the same and similar problems exactly the same way every time. Hence, examples are more important than ever in the ORCR approach to learning Algebra and Calculus. In fact, another change in the next edition will be more practice problems that correlate to the examples found in Preliminary Edition. There will also be more discussion of the Kinetic Approach to Learning Mathematics (KALM) in the First Edition, as discussed in Chapter 1.1. We are also working with a team of my former Calculus and Computer Science students on a Computer Application that will allow one to practice the KALM method and refine their Algebra skills on a

touch-screen device. Any comments or suggestions of material one may want to see more or less of is always welcome in preparation of the First Edition. Until then, I hope this book serves you well.