Overview of Lessons Involving "A Car Scenario"

Calculus allows us to study rectilinear motion (motion along a line), a common application of calculus to physics. Each of the five lessons listed below incorporate a specific example of rectilinear motion called "the car scenario" to introduce major concepts in calculus as indicated in the lesson titles.

     Average and Instantaneous Speeds (Introducing Limits)
     Introducing Continuity
     Introducing Differentiability
     Introducing Antidifferentiation
     Motivating the Fundamental Theorem of Calculus

While not all these lessons have been previously put on paper, the ideas in them for the most part have been used many times by the writer of these lessons. These lessons are compiled as OER Resources with the instructor in mind, illustrating how the instructor can use "the car scenario" to introduce major concepts in calculus and serve as a springboard for further investigation and more formal study. Teaching notes are provided which include information about prior experiences students need to have had for these lessons to have their intended effect, as well as point out desired points of emphasis and common points of student confusion. While compiled with the instructor in mind, these lessons can also be completed by students independently; solutions are provided after each lesson.

Understanding a problem is key to solving the problem. So there is power in using one example throughout the first semester of calculus to launch major concepts. However, completion of a particular lesson is not a prerequisite for subsequent lessons, as long as the prerequisite material mentioned in the lesson has been covered. For example, a teacher can use the lesson "Motivating the Fundamental Theorem of Calculus" to introduce the Fundamental Theorem of Calculus without having used the lesson "Introducing Antidifferentiation" to introduce antidifferentiation, although students must have been introduced to antidifferentiation to be able to complete the lesson "Motivating the Fundamental Theorem of Calculus" as indicated in the teaching notes. Obviously, these lessons are intended to be spaced throughout the semester as new topics are introduced. Again, they are intended to be used as introductions to the major concepts with subsequent work needed on each of the topics.

Part 1, Average and Instantaneous Speeds, is typically the second lesson the writer of these lessons teaches during calculus 1. To familiarize students with what is meant by a position function for motion along a line, the first lesson in the semester typically involves a whole group class activity involving students walking along a number line in front of a motion detector (Texas Instruments (TI) Calculator Based Ranger (CBR)) to produce the position function for their walk and then analyzing how the walk was related to the graph of the position function.

 Finally, the car scenario utilized in each lesson is the following: Suppose you are in a car travelling on a straight flat road. The car accelerates from 0 to 55 miles per hour in 10 seconds, with a constant rate of acceleration. Then after 10 seconds, the car travels at a constant speed of 55 miles per hour.