PREFACE

This manual, which accompanies the Second Edition of *Calculus* by Robert Smith and Roland Minton (McGraw-Hill, 2002), is designed to help the student achieve two goals:

- Through the use of the computer algebra system *Derive*®, the student will gain valuable insights into the text material that would be difficult to obtain without the computer.

- The student will learn how to use *Derive* to carry out many of the symbolic and graphical operations of calculus; since *Derive* is used throughout the world in academic and scientific settings, this knowledge will be of great value in the student's future studies and technical work.

"A violin played well," the old adage goes, "can bring tears to your eyes -- and so can one played badly." Most instructors who have tried to use computers to enhance mathematics instruction will (ruefully) understand this allusion. Computer algebra systems, with their spectacular computational and graphic abilities, can illustrate and animate calculus in ways never before possible -- provided that the instructor's goals for using the computer are not completely overshadowed by the student's frustration with error messages, command-line syntax, and a host of other technical problems. Too often what should have been an educational and enriching session at the computer becomes a series of unproductive trips to and from the instructor's office because "we can't get *Derive* to work." Meanwhile, precious teaching time, both in and out of class, is wasted, while the instructor's original purposes for using *Derive* remain unachieved.

To try to alleviate these problems, when each new command is introduced, this manual will specify the exact characters that the student will type in the particular application at hand. The students' first experience with each command is therefore almost always a success, which builds confidence not frustration, and sets the stage for more general use of that command in the future. There are several other distinctive features of this manual as well:

- The material is divided into assignments corresponding to stated sections of the Second Edition of *Calculus*. Each assignment either introduces *Derive* commands pertinent to these sections, or applies the computer to illustrate the material therein, or both. (We write "3.1-4" to indicate Sections 1 through 4 of Chapter 3 of *Calculus*.)

- In the early going the emphasis is on accomplishing the basic tasks of calculus using *Derive*; to this we later add the actual investigation of mathematical ideas. Our experience has been that students must become somewhat comfortable with the "look and feel" of *Derive* before any serious exploratory work can be done.

- The introduction of computer work into a syllabus often puts an unwelcome strain on class time, which is already at a premium in the typical calculus sequence. These assignments are designed to require a minimum of explanation from the instructor, so that the computer work will truly augment, and not compete with, the goals of the course.

- At Wabash Valley College, students are asked to complete and hand in the assignment pages only, rather than computer output. Even graphics are to be sketched by hand. We feel that there is little value in asking the student to simply execute a *Derive* command, so we ask the student to recopy, study, and interpret the computer's output.

- These assignments can be carried out on any computer platform running *Derive*. The only prerequisite is that the student must be able to open a fresh window in *Derive*, type in a command, and make *Derive* execute it.

- Only standard *Derive* 5.02 commands and packages are used in this manual. Programming to create more sophisticated functions, modules, etc. can be very useful in the hands of an experienced *Derive* user, but at this level we wish to avoid distracting the student from the primary goal of learning standard *Derive* in the service of learning calculus. *Derive* 5.0 can be upgraded for FREE to the latest version by visiting the *Derive* website at www.derive.com. The commands for Assignment 20 require version 5.02 or higher.

- Instructors using the Second Edition of *Calculus* may download solutions to the assignments in the form of *Derive* MTH files. This material is housed at

  `http://www.mhhe.com/smithminton/` .

  Contact your local McGraw-Hill representative for more details.

I would like to thank the people who have influenced and helped me throughout my studies in mathematics: Kerry Austin at Atkins High School, Dr. John Watson and Dr. Don Carnahan at Arkansas Tech University and Dr. Jagdish Patel at the University of Missouri at Rolla. I would like to thank Allyndreth Cassidy and Michelle Munn of McGraw-Hill for their help and encouragement as well as David Calvis for all his work using *Mathematica*® in laying the foundation for this manual using *Derive*. Most of all, I would like to thank my mom, dad, Carrie and my wife, Elaine, for their continued love and support during my countless hours at the computer.

C. ALLEN BROWN
MOUNT CARMEL, ILLINOIS

TO THE STUDENT:

I hope this manual leads you to a good working knowledge of *Derive* and, more importantly, a deeper and richer understanding of calculus. Remember, however, that this manual is only capable of *helping* you discover this new world. As the accomplished author Louis L'Amour once wrote:

> I know that no university exists that can provide an education; what a university can provide is an outline, to give the learner a direction and guidance. The rest one has to do for oneself.
>
> No one can "get" an education, for of necessity education is a continuing process. If it does nothing else, it should provide students with the tools for learning, acquaint them with methods of study and research, methods of pursuing an idea. We can only hope they come upon an idea they wish to pursue.

And so it is with this manual. The "education" I hope to help you obtain involves learning the tools needed to help you discover calculus in a new and, it is hoped, better manner using *Derive*. As you work your way through the manual, continually ask yourself "What other ways can I do this?" and "What can I apply this to?" By answering these questions yourself, you are learning far more than can be taught from any book; you are learning to learn on your own. Never underestimate the importance of this. With this capability, you will be able to explore new concepts and ideas, perhaps some never before thought about.

When following the steps in this manual, you must follow each step very carefully. Experiences at Wabash Valley College have shown that student errors in typing and skipping steps are the most common problems students have when following a lab manual such as this. Often when an instructor hears, "I did exactly what the book said and it didn't work," the only problem is that a critical step was skipped or a parenthesis was left out! Check your work carefully and don't give up after one attempt!

Strive to turn in work that is not only correct — both in its mathematics and in its use of English — but neat and professional in appearance. Since you will be turning in the actual sheets in this manual, work out your answers on other paper first, and then fill out the final version on the sheets provided here. Always start with a fresh session of *Derive* to erase any functions and/or utility files left over from a previous user.

In the end, it is hoped that this manual will encourage you to work and explore complex questions using *Derive*. *Derive* is user-friendly and easy to use; this ease of use, however, comes only with practice. Also, remember that *Derive* is simply a tool; one that is very useful in the hands of a skilled thinker and one that can greatly simplify some of the drudgery involved in certain procedures. *Derive*, however, like every other computer algebra system, will never be able to solve all mathematical questions simply by "plugging them in." You must tell *Derive* what to do; you must supply all the thinking. No software package will ever replace this aspect of mathematics!

C. ALLEN BROWN
MOUNT CARMEL, ILLINOIS