

THE
MAPLE
BOOK

Frank Garvan

To my parents,
Kevin and Clare.

PREFACE

MAPLE[®] is a very powerful interactive computer algebra system. It is used by students, educators, mathematicians, statisticians, scientists, and engineers for doing numerical and symbolic computation. MAPLE has many strengths: (1) it can do exact integer computation, (2) it can do numerical computation to any (well almost) number of specified digits, (3) it can do symbolic computation, (4) it comes with many built-in functions and packages for doing a wide variety of mathematical tasks, (5) it has facilities for doing 2- and 3-dimensional plotting and animation, (6) it has a worksheet-based interface, (7) it has facilities for making technical documents, and (8) MAPLE is a simple programming language which means the user can easily write his/her own functions and packages.

The present book is a greatly expanded version of an earlier book, *The MAPLE v Primer*, by the author. A lot has happened to MAPLE since. This book covers MAPLE 7, the latest version of MAPLE. The book is quite comprehensive. It should serve both as an introduction to MAPLE and as a reference. If you are learning MAPLE for the first time, it is advised that you work slowly through the book up until at least Chapter 7. Keep the book open with you at the computer as you try the commands. All the MAPLE commands used in this book are available on the web at

<http://www.math.ufl.edu/~frank/maple-book/mbook.html>

as MAPLE text files. See Section 12.3. Also on this page there are links to various other files referred to in the book.

MAPLE is both an interactive computer algebra system and a programming language. An important goal of this book is to show you how to write simple MAPLE programs (or procedures). Chapter 7 is a tutorial for learning the MAPLE programming language. There are programming exercises for the reader to tackle. Their solution is given at the end of the chapter. Once the reader has learned how to program, he/she will appreciate the real power of MAPLE. Hopefully the reader will learn to write their own programs and packages to suit their needs.

As you progress further into the book you will learn how to use MAPLE for more advanced mathematics: differential equations, linear algebra, vector cal-

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culus, complex analysis, special functions, statistics, finite fields, group theory, combinatorics and number theory. MAPLE has many packages that are not automatically loaded when a MAPLE session is begun. To load a *package* one needs to use the `with(package)` function. One of the big changes to MAPLE 6 was the new *LinearAlgebra* package. All of MAPLE's packages are covered in the book to some degree. Some are covered in great depth like the *LinearAlgebra* package in Chapter 9 and the *stats* package in Chapter 16.

Additional MAPLE packages and worksheets are available *free* at *The Maple Application Center* page on the web at <http://www.mapleapps.com>. See Section 18.1 for more information.

MAPLE has fabulous built-in help facilities. Help can be found either through the interactive Help menu or by using the `?` command. For instance, a very short introduction to MAPLE can be found by typing `?intro`. You don't really need an additional MAPLE reference book since the help pages are so exhaustive.

MAPLE is available on Windows, MacIntosh, UNIX and Linux systems. The author would like to thank Waterloo Maple Inc. for permission to include pictures of the MAPLE icons and buttons, and some portions of the text from the on-line help system. Special thanks go to Cynthia Wilson Garvan and Weir Hou, who helped a lot with Chapter 16, the chapter on statistics. The author thanks Bob Stern at CRC Press, for his encouragement and patience.

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