

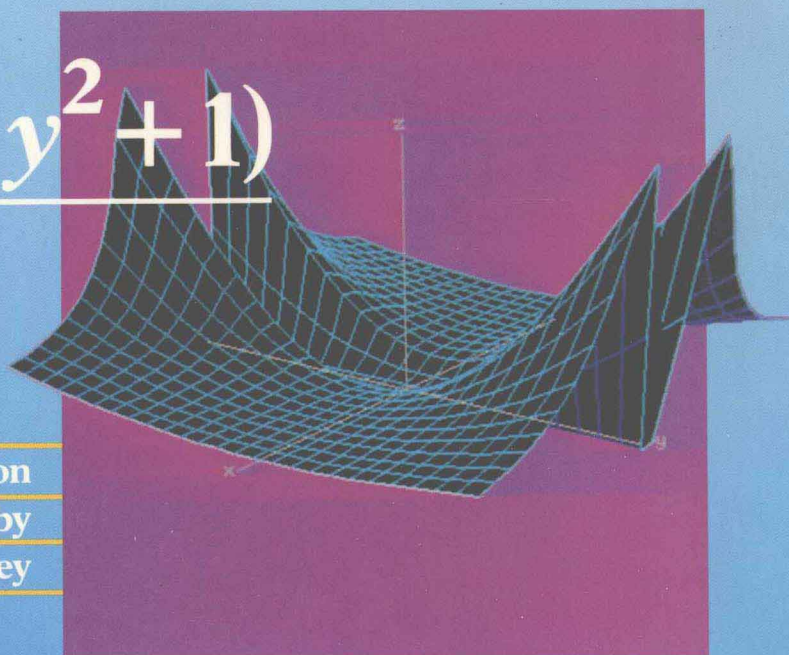


5 1/4" format

The Student Edition of **DERIVE**➔

2000 years of mathematical knowledge on a disk...*adapted for education*

$$\frac{e^{-1/x^2}(x^2 + y^2 + 1)}{2x^2}$$



Student Edition
Manual by
David C. Arney

Addison-Wesley • Benjamin/Cummings

The Student Edition of **DERIVE**

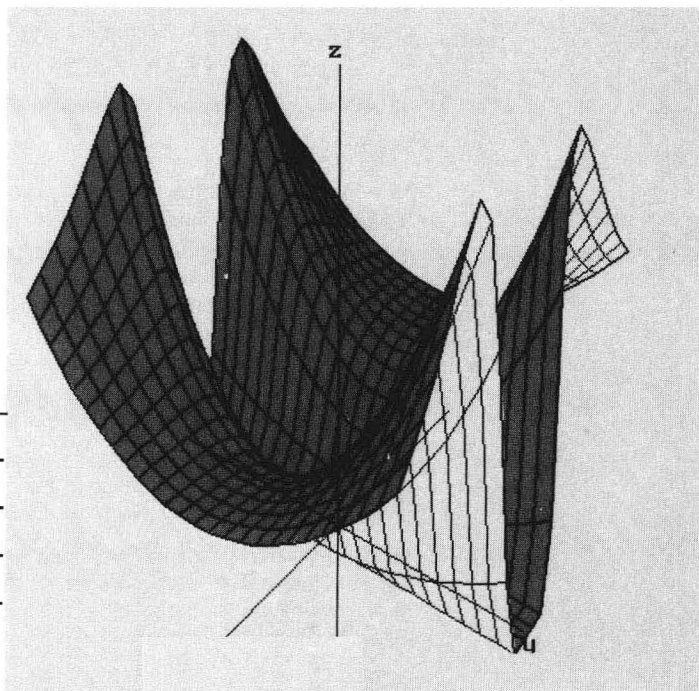


2000 years of mathematical knowledge on a disk . . . *adapted for education*

David C. Arney

United States

Military Academy



This publication was prepared as part of official duties and is not endorsed or approved by the Army or Department of Defense.



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**The Student Edition
of *Derive***

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Preface

WELCOME to the Student Edition of Derive.

Derive is a powerful and exceptionally easy-to-use computer algebra system with numerical, symbolic, and graphical capabilities, published by Soft Warehouse, Inc., in Honolulu, Hawaii. The Student Edition of *Derive* is a streamlined version of this program, designed to provide students with tools to solve complex real-world problems. Its menu driven interface and on-line help make the software user-friendly and easy to learn. The accompanying manual is pedagogically oriented and takes students through the key features of the program step by step.

The Student Edition of *Derive* can do the following:

- manipulate formulas in algebraic form, performing such operations as equation solving, integration, differentiation, and power series expansion
- exact arithmetic to thousands of digits and approximate arithmetic to 6 digits with real and complex numbers
- perform matrix manipulation
- plot 2-D and 3-D functions or data lists in black and white or in color, then allow the user to change the appearance of the graph by varying the graph range and domain, moving the center of the plot, zooming in and out, or in a 3D graph, by changing the point of view
- display formulas with sophisticated mathematical symbols attractively on screen, and print them out
- allow programming to perform iteration and conditional branching
- solve differential equations
- find areas and volumes

The Student Edition of *Derive's* powerful capabilities can free students from the drudgery of performing long and tedious mathematical calculations by hand. It can enhance their learning experience by

allowing students to spend more time in mathematical exploration, or in solving sophisticated problems.

The Student Edition of *Derive* can be used on most IBM/PCs or IBM-compatibles because it requires only 262K bytes of disk space; 512K bytes of RAM; and a Hercules, CGA, EGA, VGA, or MDA graphics card. With low hardware requirements and versatility, the program can be easily used in demonstrations or on a student's own personal computer.

Audience and Scope The Student Edition of *Derive* is designed to introduce students to the powerful capabilities of a sophisticated computer algebra system. The manual that accompanies the Student Edition of *Derive* allows students from a variety of disciplines to learn to use this package on their own. The Student Edition of *Derive* is not tied to a specific course. Addison-Wesley texts that tie *Derive* to specific courses are listed on page xii.

Tutorials 1 through 6 cover *Derive* basics through a variety of applications. These are accessible to students with a college algebra background in functions and graphing. Tutorials 7 through 12 are more specialized, and require varying levels of mathematical background. The mathematics assumed for each tutorial is as follows:

Tutorial 1	Quadratic Equations, Factoring
Tutorial 2	Systems of Equations, Functions
Tutorial 3	Exponential Functions
Tutorial 4	Cartesian Coordinate System, Graphing, Trigonometric Functions
Tutorial 5	Polar Coordinate System, Piecewise Functions
Tutorial 6	Difference Equations, Iteration
Tutorial 7	Differential Calculus
Tutorial 8	Integral Calculus
Tutorial 9	First-Order Differential Equations
Tutorial 10	Second-Order Differential Equations
Tutorial 11	Matrix Algebra
Tutorial 12	Programming, Logical Operators

The primary objectives of the package are:

- To provide a powerful and versatile tool for students that will enhance their learning experience in mathematics
- To provide students with a tool for solving the real-world problems that arise in engineering, physics, life sciences, and business
- To provide a format for students to learn *Derive* on their own
- To provide teachers with a flexible means of integrating technology into their classroom

- Features** The Student Edition of *Derive* features much of the full mathematical power of *Derive* Version 2, including:
- Powerful, easy-to-use *Derive* software
 - Carefully developed Student Edition manual, by Professor David C. Arney, United States Military Academy
 - Instructor's manual that includes a discussion of the use of the student edition software with the professional Version 2.0, additional applications for enhanced learning, solutions to in-text exercises that can be made available to students, and transparency masters for use with an overhead projector
 - Lab resource manuals for calculus and physics that contain essays by *Derive* users on how to integrate technology into the classroom

Organization The Student Edition manual is organized into three sections. Section One, "Getting Started," begins by detailing the contents of the Student Edition package. It follows with a concise explanation of the conventions used throughout the manual, information regarding technical support, backing up *Derive*; copying *Derive* to a hard disk; and installing, starting, and quitting *Derive*. "Getting Started" concludes with a comprehensive sample session, designed to give students an overview of the program and interest them in its capabilities.

Section Two, "Tutorials," is the heart of the manual. It contains twelve interactive tutorials that teach students how to use *Derive* by solving real-world applications from engineering, physics, life sciences, and business.

Each tutorial begins with a list of objectives, followed by a description of the application, which will be revisited later in the tutorial. Then the tutorial walks students through the solution of the application step by step, introducing the appropriate *Derive* commands.

As the student performs each step in the tutorial, a screen print is presented in the manual to keep the student on track and to reinforce key concepts.

Each lab requires approximately 1 hour to complete (not including practice problems). The actual time to complete any one tutorial will vary somewhat from tutorial to tutorial, student to student, and instructor to instructor.

The individual tutorials end with a summary, a review section that includes a list of key commands and functions that the students have learned, and a set of practice problems. An additional list of commands is presented along with applications related to those covered earlier in the tutorial, giving students a sense of *Derive*'s tremendous potential. The tutorials are structured in a modular fashion, to allow

instructors the greatest flexibility in course development. After students have mastered the basic commands in Tutorials 1, 2, and 3, and graphing in Tutorial 4 and 5, they can proceed with any other tutorial that interests them.

Section Three, “Reference,” contains comprehensive descriptions of the *Derive* commands, menus, and functions. This section is extensively cross-referenced to the Tutorials in Section Two.

Comparing the Student Edition and the Professional Version

The Student Edition of *Derive* is streamlined for ease of use by both students and teachers. Several features in the professional version of *Derive* not essential for educational use have been simplified or limited in the Student Edition as follows:

- Only one algebra window can be open and it is limited to a maximum of 64 expressions
- Approximate arithmetic is limited to 6-digit accuracy
- Vectors and matrices are limited to a maximum of 64 elements
- Simultaneous linear equation solving is limited to a maximum of 6 equations
- A single 2-D or 3-D plot window can be open at one time
- 3-D plots are limited to a maximum of 25 by 25 grids
- User-defined functions are limited to a maximum of 64 levels of iteration or recursion
- Taylor series polynomial approximations are limited to eighth order
- The cubic quartic formulas are not used for factoring or equation solving
- The following higher-level utility files are omitted: Bessel, hypergeometric and zeta functions; classic orthogonal, polynomials; elliptic Fresnel and exponential integrals; Pade approximations; and recurrence equations
- Variable names can only be single letters unless a multi-letter name is specifically declared by the user
- Variable names can consist of lower case letters only
- There is no command for entering and simplifying an expression in a single step
- Only a single expression can be moved at a time
- Separate commands for displaying DOS file directories and deleting files replace a command for executing any DOS commands from within *Derive*
- Mathematical expressions can be saved for reloading into *Derive* but not into FORTRAN, Pascal, or BASIC programming formats
- Radix bases are limited to binary, decimal, or hexadecimal rather than any radix from 2 through 36
- Variables can be declared Complex, Real, Positive, and Negative, but cannot be restricted over an arbitrary user-specified interval

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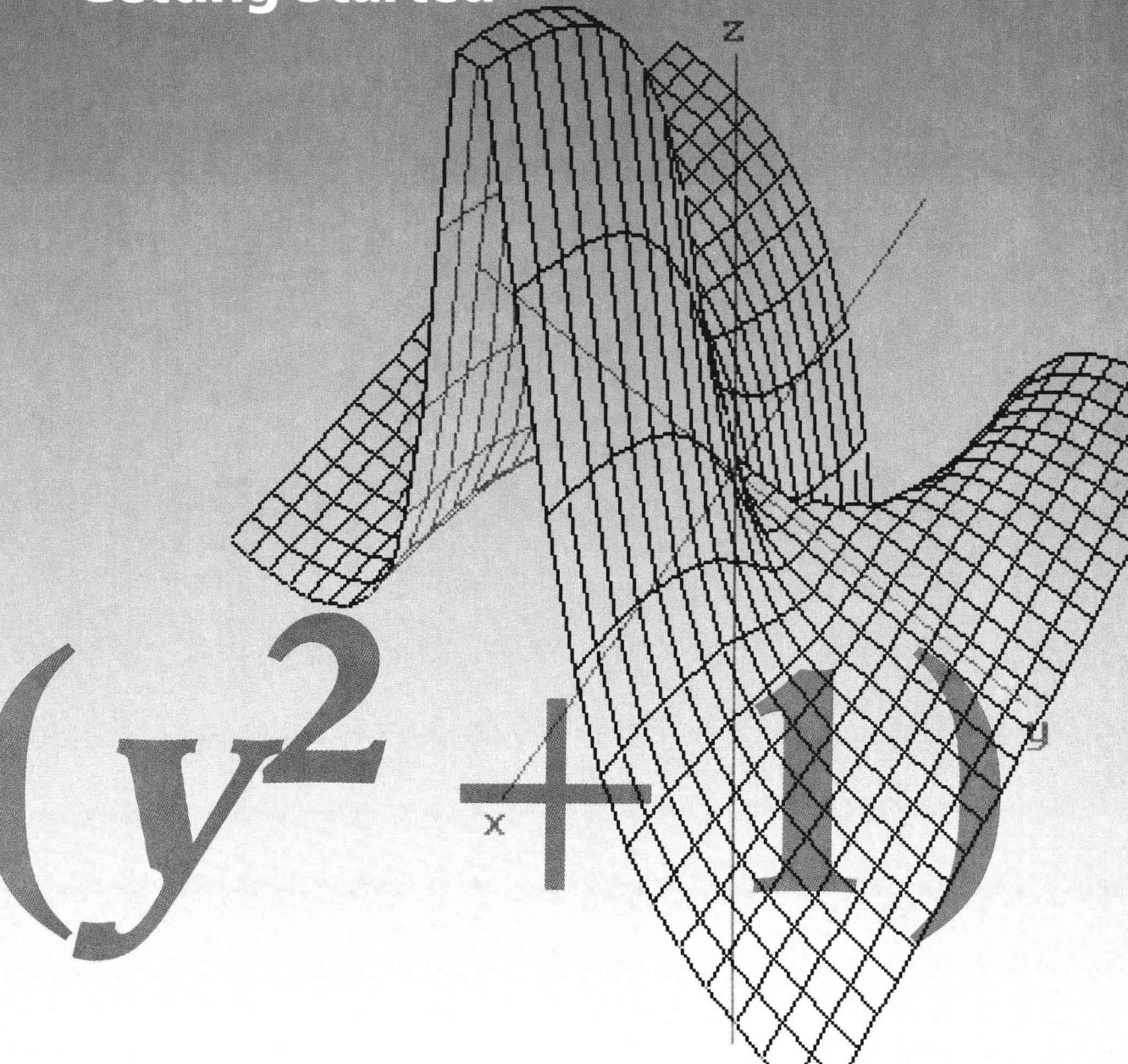
Derive Texts Available from Addison-Wesley

Exploring Calculus with *Derive*
by David C. Arney
ISBN # 0-201-52839-8

Derive Laboratory Manual for Differential Equations
by David C. Arney
ISBN # 0-201-57268-0

Section One

Getting Started



Chapter 1

Before You Begin

Welcome to the Student Edition of *Derive*. This chapter helps you make sure you have everything you need to run the software. It also explains the typographical conventions used throughout the manual. Please read this chapter before you install or use *Derive*.

Check Your Package

Your package for the Student Edition of *Derive* should contain:

- The User's Manual (this book)
- A warranty registration card
- A 5¼" or 3½" program disk

Product Support

Neither Addison-Wesley nor Soft Warehouse, Inc. provides telephone assistance to students for the Student Edition of *Derive*. Addison-Wesley provides phone assistance to *registered* instructors who have adopted the Student Edition.

If you have difficulty using the Student Edition software:

- Refer to the Help screen
- Consult the sections of this manual that describe the commands or procedures you are trying to perform

If you have to ask your instructor for assistance, describe your question or problem in detail, noting the steps or procedures you

followed when the problem occurred. When an error message appears, write down its exact wording and the steps that led to it. If you are connected to a printer, try pressing **Shift-PrtSc** simultaneously to get a screen print.

How to Use this Book

This User's Manual contains four sections:

- Getting Started
- Tutorials
- Reference
- Appendixes

Getting Started

This section provides the information you need to get acquainted with *Derive*. When you finish the current chapter, proceed to Chapter 2: Installing, Starting, and Quitting. As you read Chapter 2, refer only to the sections that apply to your own computer (for example, a single-drive system).

Note: If this is your first experience with an IBM-PC compatible computer, you may find it useful to read Appendix C, DOS Basics, before you begin Chapter 2 of Getting Started.

Chapter 2 also describes the basic parts of the *Derive* screen and tells how to issue commands. Take a moment to practice a few of the keystrokes it mentions, and familiarize yourself with the basic procedures.

Chapter 3: Sample Session gives you an opportunity to practice using *Derive* in a simple, introductory exercise. As you follow this "hands-on" session, you will begin to appreciate the ease and power of the *Derive* software.

Tutorials

The tutorials in this manual are designed to teach you how to use each of the features of the *Derive* program by applying the program to realistic situations. As you work through a series of problems typical of those you might encounter in your course work, you will learn the most common *Derive* commands and procedures.

Note: This manual is not a mathematics textbook! If some of the mathematical concepts or methods are not yet familiar to you, you can still learn the relevant *Derive* procedure by following the step-by-step directions in the tutorials.

Tutorials 1 through 6 cover most of the commands you need to know for equation solving and plotting in pre-calculus contexts. Tutorials 7 and 8 demonstrate the use of *Derive*'s calculus capabilities.

Note: Even if you are not yet a calculus-level math student, you can follow the directions and complete these tutorials to gain a sense of how *Derive* handles calculus.

Tutorials 9 and 10 cover differential calculus; you can work through these tutorials to see how to use *Derive*'s utility files to solve differential equations. Tutorials 11 and 12 demonstrate, respectively, the use of *Derive*'s matrix algebra and programming functions.

Reference

The Reference section covers keyboard notation, all of the commands, built-in functions, and utilities of the Student Edition of *Derive*.

Appendix

The appendixes consist of the following:

- Program Disk File Listing
- Display Mode Table
- DOS Basics
- Screen Capture Programs

Typographical Conventions

This manual uses a number of typographical conventions that make it easy for you to follow along.

Step-by-Step Directions



If you are to perform a series of steps, the instructions appear in a bulleted list with the action you are to take on the left and the explanation of that action on the right:

- Press **A** to select the **Author** command
- Type **This is a test**

Keystrokes

If you are to enter certain information, the words (or keystrokes) to be typed are printed in special type, as shown in the second bullet of the preceding example.

The Enter Key

The symbol for the Enter key is . When you see this symbol, press the key marked **Enter**, **Return**, or .

Derive Prompts and Status Indicators

Certain *Derive* prompts and status indicators appear at the bottom of the *Derive* screen; they are represented in the text as follows:

AUTHOR expression:

New Terms and Concepts

New terms and concepts appear in italics. There is also a list of newly introduced *Derive* features at the end of each tutorial.

Notes and Reminders

Occasionally, a brief note will appear in the margin to remind you of something you learned in an earlier tutorial.