

A Guide to

MathWriter™

The Scientific Word Processor for the Macintosh®

$z^3 = -pz + q$ $z^3 = +pz + q$ $z^3 = +pz + q$

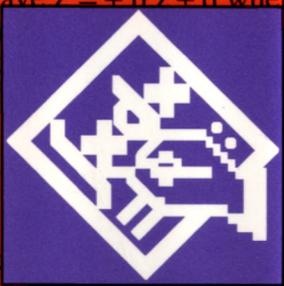
Now, if we have $z^3 = -pz + q$, the rule, attributed by Cardan¹ to Scipio Ferreus, gives us the root

$$\sqrt[3]{\frac{1}{2}q + \sqrt{\frac{1}{4}q^2 + \frac{1}{27}p^3}} - \sqrt[3]{-\frac{1}{2}q + \sqrt{\frac{1}{4}q^2 + \frac{1}{27}p^3}}$$

Similarly, when we have $z^3 = +pz + q$ where the square of half the first term is greater than the cube of the coefficient of the next to the last term, the corresponding root

$$\sqrt[3]{\frac{1}{2}q + \sqrt{\frac{1}{4}q^2 - \frac{1}{27}p^3}}$$

is now clear that all cubic equations can be reduced to one of these two forms without the use of any other than the most elementary of certain known properties, such as the addition of two mean proportionals between such a quantity and unity. Again, if we have $z^3 = +pz + q$ where the square of half the last term is not greater than the cube of the coefficient of the next to the last term, describe the circle with radius NO equal to $\sqrt{\frac{1}{3}p}$, that is to the mean proportional between unity and one-third the known quantity p . Then take $NP = \frac{3q}{p}$, that is such that NP is to q , the other known



J. Robert Cooke
E. Ted Sobel

Educational
Version



A GUIDE TO

MathWriter™



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Version 2.0

Educational Version

J. Robert Cooke
E. Ted Sobel



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The Guide was written and formatted entirely in *MathWriter*[™] and output on a Linotronic[™] 300 Imagesetter.

P R E F A C E

MathWriter[™] was created to make the writing of mathematics-laden scientific and technical manuscripts less daunting. Traditional word processors do not provide tools that are powerful enough to provide a seamless, visual integration of mathematics as text within a manuscript but also intuitive and simple enough not to interfere with the writing process.

MathWriter is an author-centered writing tool. Its creation is a response to the needs exposed by twenty-five years of struggle with composing papers, tedious transcription using inadequate tools, the tracking of inevitable revisions and retyping, and the agony of the equally inevitable task of correcting flaws introduced in galley proofs. *MathWriter* was designed to simplify that process. By composing at the keyboard (and mouse), the author retains greater fluidity in the creative process and avoids the transcription process. By creating camera-ready copy, an additional step can sometimes be saved, as was done with this manual, which we prepared and printed using *MathWriter*.

MathWriter's feature innovations include its "what-you-see-is-what-you-get" handling of mathematics, automatic numbering, revision tracking, interactive library, ease of handling frequent typeface changes, and modularity for customized expansion of functionality.

MathWriter 2.0 evolved from our mathematical expression editor over a three-year period of intense effort. We are grateful for the invaluable assistance we received from our friends—new and old. Leonard Gillman freely shared his insights and professional experience; more important, he provided the encouragement that flows when someone believes in the importance of your task and in your ability to make a meaningful contribution. Morven Gentleman's kind letter first planted the idea for expanding our efforts to create a technical authoring environment, and Richard Palais's wise words on the subject in the Notices of the AMS convinced us to undertake this massive effort. Robert Perl provided competent and dependable support on many tasks.

Some of the features in *MathWriter* followed directly from specific suggestions. For example, Len Gillman suggested auto-italicizing; Jerrold Marsden, the library for typing built-up mathematical expressions; Mike Axelrod, the check for repeated words; Dick Szymanski, the table feature; and Steve Erde, the file name variable.

Some individuals performed specific tasks of particular importance: Nancy Cooke "translated" the manual into English and with Richard Cooke wrote

a primer for students, "Writing a Paper Using MathWriter"; John Cooke programmed the HyperCard demo stack "About MathWriter™ 2.0"; Gary Wernsing wrote the utility for translating files to and from the data interchange format (RTF); Julia Noblitt prepared the math-science-engineering dictionary with the assistance of Sandra Bates, Sam Lenke, Moss Sweedler, and Keith Dennis; Douglas Davenport provided expert PostScript® consultation; Gideon Shaanan provided the earliest and most challenging debugging. Many were involved in testing during an extended period: Loren Argabright, Chris Borkowski, Leonard Gillman, David Gries, James Hurley, Linda Iroff, Steve Lantz, Benton Leong, Jerrold Marsden, Philip McDunnough, Wendy Nelson, Robert Pucel, Larry Riddle, Tom Scavo, James Tasi, Shrinivasa Upadhyaya, and George Wolga. We are grateful for the review comments from Peter J. Bickel, Leo Breiman, Javier Cabrera, David Eisenbud, Peter Eklund, Susan Franklin, Daniel J. Friedman, Edward I. George, Greg Kearney, Benton Leong, Marvin Marcus, Thomas R. Scavo, Raymond F. Smith, Gerald L. Thompson, and Esther L. Zack.

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If *MathWriter* has contributed significantly to your productivity or if you have suggestions for improving the next version or ideas for modules, please write to us in care of Brooks/Cole Publishing Company.

J. Robert Cooke
E. Ted Sobel

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1 Overview

MathWriter[™] is a completely new, full-featured word processor that facilitates the demanding requirements of technical writing. In addition to text and graphics, technical writing often includes mathematical expressions. *MathWriter* allows authors to compose equations and text at the keyboard as easily as prose writers compose with an ordinary word processor.

Virtually every traditional word-processing feature has been made more general in *MathWriter*. The program updates the screen with each keystroke and provides visual clues whenever feasible. It lets you see what you are doing to your manuscript and improves on the description "What you see is what you get." For example, *MathWriter* continually displays the actual page layout, contents, and numbering. For deferred action page and document formatting commands, miniature portraits show the consequences of your choices.

You need not memorize a bewildering collection of keyboard commands to use *MathWriter*. You can combine convenient and visually prompted mouse control with rapid keyboard input to match your preferences and level of experience.

Because each user has different needs, *MathWriter* provides a broad range of settings to accommodate these needs. For example, you may hide the mathematical tools when you are not using them. By using default files you will have quick access to an initial writing environment that includes specific selections of typeface, page layout, text, and graphics you use repeatedly.

With tools designed specifically for technical writing, *MathWriter* helps you produce scientific manuscripts more quickly and easily than with other word processors. An automatic numbering feature is provided for equations, footnotes, and cross-references to them. *MathWriter* automatically updates these numbers when you use Cut and Paste. An additional variable provides numbering for figures or tables. You may type and edit headers, footers, footnotes, and mathematical expressions without moving into separate,

isolated windows. In addition, the Find and Replace facility applies to mathematical expressions, as well as to text.

MathWriter's signature feature is the full integration of mathematical expressions into the text. No longer will you be required to compose mathematical expressions using memorized, embedded commands that are later transformed into conventional mathematical notation. Nor will you need to compose mathematical expressions in a separate environment and paste them into the document as graphics, although you can use *MathWriter* simply as an expression editor.

You create equations as part of the text and in the document window. *MathWriter* automatically handles mathematical typesetting conventions. It reformats expressions with each keystroke or mouse input sequence for maximum visual feedback.

It handles frequent changes in font, font size, font style, and two-dimensional character placements with ease and often automatically. Common mathematical structures such as fractions, brackets, matrices, and tables dynamically resize as you type. Line spacing automatically adjusts to accommodate lines of different heights, common in mathematical expressions. *MathWriter* supports PostScript® output for high-quality printed documents.

Design and Features in Brief

MathWriter includes a number of unique and convenient features including the following.

- Treats mathematical expressions as text, rather than as graphics, providing greater formatting control, Search and Replace for mathematical expressions, and editing of mathematical expressions in context.
- Extends the meaning of "What you see is what you get". *MathWriter's* in-context word processing lets you edit headers, footers, and equations without switching into a separate window; provides automatic pagination; and automatically formats equations with each keystroke.
- Provides visual clues whenever possible.
- Automatically formats tables and mathematical expressions.
- Automatically numbers equations and footnotes, including cross-references within the text, and automatically updates them as you edit. An additional variable can be used to number another category such as figures, paragraphs, or tables.

When used with a screen projector, *MathWriter* doubles as an overhead projector.

We see *MathWriter* as the centerpiece of a new family of elegant writing tools that we hope will allow you to focus your energy on your work, rather than on your word processor!

How to Begin

This User's Guide provides two parallel introductions to *MathWriter*. **Chapter 2** is a self-guided tour of *MathWriter* features to be studied while at the Macintosh keyboard. **Chapters 3 and 4** provide a detailed, step-by-step, task-oriented introduction to nontechnical and technical word processing respectively. **Chapter 5** is a very brief, quick-start alternative for more experienced Macintosh users. **Chapter 6** is a command-oriented description of all features. The **appendix** includes an interface refresher for novice users, a description of *MathWriter* files, a summary of advanced keyboard commands, and other reference materials.

Typographic conventions

- The names of special keys on the keyboard (*return*, *enter*, *delete*, *option*, *⌘*, *shift*, and *tab*) are displayed in lowercase italics.
- Lists of ordered steps are numbered; lists of nonordered items or optional steps are identified by • or ◆.
- The full path for menu commands is indicated by the menu name / menu command / submenu (e.g., Windows/Tools/Math Editor) and this is often followed by a keyboard equivalent (*⌘ shift ;*) where the space separator is not part of the command.

2 Guided Tour

As its name implies, *MathWriter's* signature feature is its ability to write mathematics. We increased the scope of nearly every feature of traditional word processors and, in addition, invented many new tools for this task. In this guided tour, we provide a task-oriented, rather than feature-oriented, introduction to *MathWriter*. This tutorial assumes that you have limited experience using the Macintosh. In the exercises we provide step-by-step instructions for completing a progression of increasingly more sophisticated tasks. Each exercise builds on and assumes a knowledge of the techniques presented in previous exercises.

Because many users may not routinely need to write mathematics, the initial examples demonstrate that *MathWriter's* more technical features can be made completely unobtrusive. Later examples illustrate special mathematical capabilities.

Preliminaries

Software and hardware requirements

The following requirements are recommended.

1. The Educational Version of *MathWriter* can be used with two 800K disk drives as minimal support, but a hard disk is recommended so spell-checking can be used conveniently. *MathWriter* uses overlays, which means that only those portions of *MathWriter* code currently in use are RAM-resident. This leaves more memory for your documents. Because the computer must access the *MathWriter* disk as you use the program, the disk should remain in the drive. With a hard disk you can keep *MathWriter*, the dictionaries, help files, etc., available for immediate use.
2. The most recent operating system compatible with your hardware (e.g. System 4.0 and Finder 6.0 or more recent systems that support hierarchical menus). *MathWriter* is MultiFinder®-compatible. However, if you have only 1 megabyte of RAM, use *MathWriter* with Finder.

To change from MultiFinder to Finder or vice versa, use the Set Startup... selection in the Special menu at the desktop and then select Restart, also in the Special menu.

3. Times and Symbol fonts *must* be available for *MathWriter* to function.

4. A Macintosh SE/30 or a Macintosh II with 2 megabytes of RAM and a hard disk is needed for the Professional Version of *MathWriter*. We do *not* recommend using the Professional Version with less powerful Macintoshes, such as an SE. *MathWriter* is a computation-intensive program so its performance is sluggish on a 68000-based Macintosh. Because documents are RAM-resident, document size must be restricted if you have only 1 megabyte of RAM. Use the reduced-feature Educational Version if you are limited to a Macintosh Plus with 1 megabyte of RAM and two floppy drives.

Make a backup

Before installing *MathWriter*, make a backup of the master disks as described here.

First, write-protect each master disk to guard against accidental erasure: Position the plastic corner tab such that you can see through the square hole on the corner of the disk. Then follow the instructions in your Macintosh *Owner's Manual* to make a working copy of each disk before storing the originals in a safe place. If a working copy becomes unusable, you will be able to make a new one from the originals.

Install *MathWriter*

If you are using a hard disk, create and name a *MathWriter* folder on the hard disk, successively place each working copy in the floppy disk drive, double-click its icon, and then drag the file icons into the new folder on the hard disk. If you are using the educational version with two disk drives, place *MathWriter* and your documents on one disk and the operating system on the other.

Remove unnecessary files, fonts, INITs, and desk accessories to conserve disk space. The Times and Symbol fonts must be available for *MathWriter* to operate. The modified version¹ of the Symbol font distributed with *MathWriter* should be used. Remove the Apple-supplied Symbol screen font and then replace it with the supplied version using the Font/DA Mover received with your current operating system.

When activated by double-clicking its icon, *MathWriter* automatically creates and places a file with configuration information in the system folder.

¹ The extremities of the stretchable brackets and braces of the Apple-supplied version of the Symbol font do not display correctly on the screen and boldface style is not enabled.

About the Exercises

The exercises that follow present step-by-step instructions for completing various common tasks. Some of the steps are numbered and are essential to completing the task. Others are simply suggestions for practice and are indicated with a diamond ♦ at the left text margin.

Again, do not begin until you have made a working copy and have safely stored the master disks. You should have already installed the Symbol font. If you wish to print *MathWriter* files, you must also install the appropriate print driver, select the driver using Chooser, and connect and prepare the printer for printing.

Exercise 1: Reviewing a Short Memo

This first exercise describes the startup process, how to open an existing file, navigating through a document, exploring the interface, printing the document, and quitting.

Starting *MathWriter*

1. Complete the usual Macintosh startup process.
2. Double-click on the *MathWriter* icon. *MathWriter* will automatically open a new document file named *Untitled 1*.

To examine an existing file:

1. Select Open... on the File menu.

The file selection dialog window opens.

2. Select the drive that contains the *MathWriter* file named Exercise 1.
3. Select the folder that contains the desired file. The File Type should read *All known types* or *MathWriter™ 2.0*. If not, drag to select one of these from the pop-up menu list. Only folders and the files that match this file type appear in the window.
4. Select the file Exercise 1 and click on the Open button. Note: As a shortcut, you can double-click on the file name to eliminate use of the Open button.

This exercise asks you to read through and work on the following hypothetical memorandum from the authors to new *MathWriter* users. As you move through the memorandum, which is the same in the manual and on the screen, the text will tell you what to do.

MEMORANDUM

Date: Nov. 15, 1990

To: *MathWriter* New Users

From: The Authors

Subject: *MathWriter* basic features—a first glimpse

We assume that you have a basic familiarity with the Macintosh interface as described in the materials supplied with your computer. Consequently, this first glimpse will describe the basic features you need to perform simple tasks with *MathWriter*—moving around within a document, formatting paragraphs, identifying typefaces, moving text, saving and printing a document, and ending a session.

Basic features

Move around within a document

After reading this paragraph, repeatedly drag and release  the vertical scroll box to examine the entire document and then return here. The number in the scroll box identifies the page that appears in the document window when you release the mouse button. More precisely, it is the page visible at the **top** of the document window. *MathWriter* displays documents as “sheets of paper” and automatically paginates them.

Click *immediately above or below the scroll box* to scroll one complete screen vertically up or down.

Click *in the scroll arrows*  to move a few lines, or press *option* when you click the scroll arrow to scroll a single line.

The boundary lines of the margins, the header, and the footer are visible because Show Layout in the Format menu has been selected (as a result, the menu choice now reads Hide Layout). The cursor changes shape when you move it from one work space where the blinking insertion point is located to another. If you move into the header, click, and then return to the main body, the cursor changes to  and then back to .

Examine the ruler

Observe that the positions of the left margin marker  (together with a left tab it looks like ) and first line indent marker  on the ruler change when you place the cursor first within this paragraph and then within the preceding paragraph (“Examine the ruler”). In this paragraph the first

line "indent" is to the left of the paragraph margin and produces a "hanging indent" to make the paragraph conspicuous.

Notice that the ruler does not scroll from view; it always displays the particular conditions of the paragraph that contains the blinking insertion point. When you press *return*, *MathWriter* creates a new paragraph that inherits the ruler conditions of the previous paragraph. If you change the ruler, a ruler icon  appears in the gray left border unless you select Hide Messages on the Format menu.

← ruler icon in the gray area (in the screen version)

Examine paragraph alignment

Click within this paragraph and then select each of the four paragraph alignment symbols just above the vertical scroll bar. As you click each symbol, the text of this paragraph changes alignment from left , to right , to aligned left and right , and to centered .

To place horizontal tabs on the ruler, drag them from the supply above the paragraph alignment icons. To remove a tab from the ruler, drag it past the *right* margin marker on the ruler. Drag the symbol to reposition a tab. Click on the next blank line (paragraph) to see  on the ruler.

Examine the status bar

Click inside the following words: "Click Here." Notice that the status bar at the foot of the window indicates the typeface, in this case bold. Also, observe that *MathWriter* reports in the status bar the line number (measured from the beginning of the document) and character position (measured from the first character on that line) of the blinking insertion point.

Edit a footer in-context

Scroll if necessary and look at the contents of the footer. In the right corner find the word "(more)" and click between the left parenthesis and the word "more." Then type "Continue for" to see how footers are edited. Backspace to correct any typing errors. If you backspace too far, the word "(more)" may jump to the beginning of the line. With the cursor placed right before the "m" in "more" press *tab* to restore the word to its original position.

Cut, Copy, and Paste

To observe editing with Cut, Copy, and Paste in the Edit menu, follow the instructions to change the sentence below from "Please move this word" to "Move this word, please."

"Please move this word."

Select *Please* using the mouse or using the arrow keys and shift key. With ⌘ X cut it from the text and with ⌘ V paste it after *word* (or use the Cut and Paste selections in the Edit menu). Then complete the editing by changing capitalization and punctuation.

Select Clipboard from the Windows menu to see a copy of the word *Please* placed there by the cut command. Click the Clipboard close-box (top-left corner) to close it.

Save the document

If this file were not locked, you could use Save on the File menu to save your document. However, you can rename the file and save a copy of the entire exercise in *MathWriter* format if you select Save As... from the File menu.

Print a copy of this document

To print the document, click on the Chooser command in the 🍏 (Apple) menu. The name of your printer should appear in the box User Name. If not, select Print from the File menu, make the selections necessary, and click OK in the print dialog box.

Summary

So far you have learned to:

- Scroll within a document and move the insertion point
- Locate headers and footers and edit them
- Create and format paragraphs (first line indent, tabs, leaders, and paragraph alignment)
- Locate the position of the insertion point and identify the typeface of the adjacent character to the left
- Cut, copy, and paste text
- Save and print a document

To continue this guided tour:

1. Select Close on the File menu.

2. Open the "Exercise 2" file to continue the tutorial.

To end this and other *MathWriter* sessions, select Quit from the File menu.

The Exercise 1 file is write-protected, so exit without saving when prompted.

Exercise 2: Reviewing a Manuscript

Word processors contribute a great deal to the task of perfecting a manuscript. In fact, this may be the important contribution a word processor makes to the writing process. In Exercise 1 you learned to make additions and deletions by retyping and by moving text selections from one place to another. In this exercise you learn to check spelling using the *MathWriter* dictionary and to search for a specific word in a document. As was the case in Exercise 1, the text of the exercise file will tell you what to do.

Spell-checker

The spell-checker will, at your request, suggest options for misspelled words, skip words in all capitals, and locate repeated words.

Find/Replace

The Find/Replace feature can locate any string of text whether it is an embedded substring or a whole word. Furthermore, a search can ignore the actual text and search for a particular format such as font, size, or style. *MathWriter* can also locate hidden formatting characters such as the end-of-paragraph symbol or a tab marker. You can even specify a search direction. For example, when composing a document, you often need to search backward from the insertion point.

To search backward from the end of this sentence to find the words “tab marker,” follow these steps:

1. Place the insertion point at the end of this sentence.
2. Select Find/Replace from the Edit menu.
3. Press on the word Direction of the Find/Replace window and drag to Backward.
4. Type the word *tab marker* in the Find box.
5. Click the Find button or type ⌘G to locate each occurrence.

You can replace the located text with the contents of the Replace With box using the Replace (⌘H) command or you can replace and resume searching using the Replace, then Find command. The Replace All command cannot be undone so you should always make a backup of the file before using this command.

Notice that you can search for mathematical expressions, as well as for

typeface characteristics and text sequences.

Summary

MathWriter provides the following document review tools:

- Spell-checker that finds repeated words
- Generalized find and replace capability

This completes Exercise 2. In Exercise 3, you will examine some text entry and formatting tools.

Exercise 3: Input Tools

MathWriter supports both mouse and keyboard input for most commands. By pointing and clicking the mouse, the novice or infrequent user can easily and quickly use *MathWriter* without having to memorize commands. On the other hand, the experienced or power user will appreciate the speed afforded by keyboard commands. Whatever your level of experience, you can mix these approaches as you wish.

Online help

We hope that *MathWriter's* interface is sufficiently intuitive that you can work with minimal prompting. For those times when prompts would be useful, use the Help window as described here.

1. Select Help from the Windows menu (⌘ ?).

The Help window presents a scrollable list of topics, including general information, step-by-step instructions for performing common tasks, and a menu/command summary. Select a topic from the list, scrolling if necessary, and click on the Help button or double-click on the topic. Use the « or » buttons to scroll to adjacent help screens, click Topics to return to the list of topics, click in your document window to return to it while leaving the Help window open, or click in the Help window close-box to put it away.

2. If the Help window is still open, click the close-box in the upper left corner of the window to put it away.

Keyboard commands for type style changes

MathWriter has an extensive set of keyboard commands. Those that control type style changes are listed here.

Font Selection

⌘ *spacebar* Toggles between the current font and the Symbol font (which contains the Greek alphabet and other mathematical symbols)

Font Size Selection

⌘ + Next larger font size on size submenu
 ⌘ *option* + Increase font size by one point
 ⌘ - Next smaller font size on size submenu
 ⌘ *option* - Decrease font size by one point

Font Style

⌘ *P* Plain (and removes all other style attributes)
 ⌘ *B* Bold
 ⌘ *I* Italic
 ⌘ *U* Underline
 ⌘ *Y* Other styles (access to numerous other styles)

Font, Size, Style, Justification, Alignment

⌘ \ Revert to immediately previous style
 ⌘ < Style 1 of user-selected attributes
 ⌘ > Style 2 of user-selected attributes

Use Doc Preferences... in the File menu to assign user-selected attributes.

Transfer of paragraph formatting

Each new paragraph automatically inherits the formatting of the preceding paragraph.

To transfer the Ruler, Format, Ruler & Format, and Style information from one paragraph to another:

1. Click within the originating paragraph
2. Make a copy of the desired information using Edit/Copy Other
3. Click within the destination paragraph
4. Paste the information using Edit/Paste Other

Using default documents

Many documents such as memos contain repeatedly used formats for letterheads, logos, etc. You might have a preferred font for these

documents, depending upon esthetics or printer availability. To speed the creation of such documents, create and use skeletal default files as follows.

1. Use the New command from the File menu (not a New submenu choice even if one is present) to open a blank, generic document.

2. Assign all global properties of this default (template) document. Change the existing defaults as desired. Some options are:

- Use File/Page Layout to set the choice of printer, printer options, space for binding, margin sizes, header and footer sizes, and whether to use facing pages format.
- Use File/Doc Layout to assign the placement of headers, footers, and footnotes within the document.
- Use File/Doc Preferences... to set font, font size, font style, paragraph alignment, and line spacing combinations for styles 1 and 2, and footnotes.
- If relevant, use the Format menu to assign ruler options, line spacing, matrix formats, and formats for the variables such as date, time, etc.
- Use the Style menu to set the font, size, and style for the body of the document.
- Supply any text or graphics that you wish to appear in the default file.

3. Use Save As... on the File menu to turn your document into a default file; select MW Default File from the pop-up menu as the file type. Save the file in the same folder with *MathWriter* or in the system folder so that *MathWriter* can immediately add this name to the New submenu list.²

To use copies of this template in future sessions you need only select it from the New submenu. When you select a default file from New, *MathWriter* automatically uses the defaults contained in that file. Next, we show you how to create this primary startup file.

- ◆ Before going on, for practice, create a default file.

Default settings and the startup file

Another way to reduce the number of commands and the time needed to create a document is to customize the *MathWriter* configuration to match your needs. The startup configuration pertains to *MathWriter*, rather than to a specific document, and is stored in the *MathWriter Prefs* file that *MathWriter* automatically creates in the system folder when you first use *MathWriter*.

² If no default files are present, the New command will not contain a submenu.

The configuration includes your preferred combination of: the four floating windows, Template, Palettes, Tools, Font Table; and the name of the primary startup default file. The frequency with which you type mathematical expressions will probably guide your choices.

◆ To establish your configuration preferences, use the Preferences... command in the File menu to record your choices.

The significance of some of these choices may not be apparent until you have completed Exercise 5, which describes *MathWriter's* mathematical tools. Here is a brief description.

The four floating windows can remain active and on-screen in a convenient location while your document is active. Scrolling will be faster if your screen is large enough to avoid an overlap of the floating windows with the active document window. The Templates window provides mouse access to the auto-formatting mathematical constructs such as fractions, roots, etc. The Palettes window provides mouse access to the Greek alphabet and to your choice of symbols and variables duplicated from the Palettes menu. The Tools window provides mouse access to the three editors (text, math, and character) and to subscript and superscript commands. The Font Table window provides mouse "typing" for every character in every font available to the system, which is especially convenient for entering infrequently used special characters.

You can create a default file here or use the Save As... command discussed in step 3 of the previous section to create one. Then, select one of the default files as the startup file in Preferences... The name of the designated startup file appears at the top of the Preferences dialog box and is the file *MathWriter* automatically opens when you next initiate a *MathWriter* session.

Create and designate a startup file now. If you prefer to revert to the original startup configuration, put the *MathWriter Prefs* file in the trash when you return to the Finder or MultiFinder. This causes *MathWriter* to re-create the original Prefs file the next time the program is launched.

Palettes and Diac menus

The Palettes and Diacriticals menus are always available. Palettes provides mouse access to the characters of the Symbol font (except the Greek alphabet, which is available from the Palettes window), a few special characters, and the Variables. As you drag the cursor over the Palettes menu, the name of your current choice appears on the bottom row.

The Variables include the following: creation date, current date (which you can use in a default file to obtain the current date automatically), creation time, current time, page number and total number of pages (which can appear only in headers and footers), footnotes and cross-references to footnotes, equation numbers, subequation numbers, textual cross-reference to

an equation, one set of user-defined variables analogous to equation numbering, and document file name. You can use these to dynamically number figures, tables, paragraphs, etc. The file name variable allows you to insert the name of the file into the text automatically so you can more easily maintain the correspondence between printed output and the *MathWriter* file used to print it.

MathWriter treats a dynamic variable as a single, uneditable entity whose format and style are set with Variables Format... on the Format menu. (The name of the user-defined variable and its starting number are also set using Variables Format....) *MathWriter* automatically updates existing variables as you insert, delete, cut, and paste them. The print dialog box also provides an option to ensure that the date variables are current.

The Diac menu supplies mouse access to the diacritical marks when the insertion point is immediately to the right of some alphabetic character. The horizontal grouping symbols are available only when you have selected one or more characters. To edit within a horizontal grouping, press the *option* key to obtain the split I-beam cursor.

Floating windows

The properties common to *MathWriter's* floating windows are discussed here; refer to Exercise 5 for more detail.

1. Select each of the four windows (Templates, Palettes, Tools, and Font Table) from the Windows menu.
2. Place the cursor in the gray region adjacent to the close-box of each and move to a convenient location.
3. Explore each menu. Click on the I-beam in the Tools window to be sure that you are in text editing mode when you complete this.
4. Remove the floating windows by reselecting them in the Windows menu or clicking in their close-boxes.

Auto save

We recommend that you set the automatic file saving feature on Doc Preferences... of the File menu as insurance against file loss. The minor delay caused by Auto save can offset the inconvenience of retyping. The Auto backup command, also enabled on Doc Preferences..., preserves the immediate past copy of your document for even better protection.

We **STRONGLY** recommend that you use these protection features when composing original material at the keyboard.

Summary

In this exercise you have learned to use input aids to:

- use online help
- change typeface characteristics
- transfer rulers and other formatting from one paragraph to another
- create reusable default or template files (stationery)
- configure *MathWriter* for your particular needs
- use the floating windows
- create and use user-defined style combinations
- enable the Auto save feature to protect your files.

Exercise 4: Graphics

MathWriter supports the mixing of graphics such as pictures and figures with text. It can also import mathematical expressions as graphics, but a far more powerful approach to writing mathematics is described in Exercise 5. In addition to handling traditional bitmapped and PICT file types such as those created by MacPaint® and MacDraw®, *MathWriter* can also handle encapsulated PostScript files such as those created by Adobe Illustrator® or Mathematica® (Figure 2.1). It reads these graphics files directly as well as by using the usual transfer via the Clipboard.

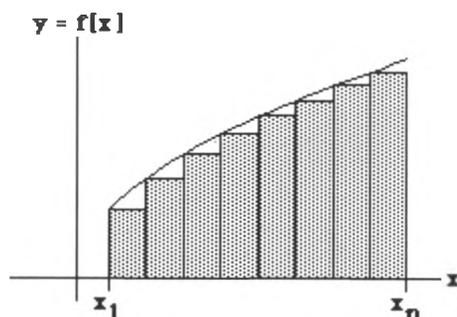


Figure 2.1 A Mathematica-created picture

MathWriter can resize, crop, and position these graphics. It treats a graphic as a tall character within a line of text. You can also apply various border designs and background patterns to sidebars.

Place a graphic  in a line of text

1. To move a copy of the *MathWriter* icon from the above line, select it using the I-beam cursor and copy it to the Clipboard using Copy on the Edit menu or ⌘ C. (You could also use the Scrapbook or another application to place the graphic on the Clipboard.)
2. Place the insertion point at the destination location, somewhere in the document.
3. Use Paste Picture from the Edit menu to transfer the picture into the active *MathWriter* document.
4. Select the Character Editor by either clicking the arrow tool in the Tools window, selecting it from the Tools submenu of the Windows menu, or typing ⌘ shift I. The cursor will change into an arrow.
5. Click on the graphic to select it. A rectangular frame with square "handles" at the corners forms around the graphic.
6. To resize the selected graphic, use Scale Picture... in the Edit menu (now changed because the Character Editor tool was chosen) or drag one of the handles. To preserve the width-to-height ratio, press the *option* key while dragging a handle.
7. To crop the selected graphic, press ⌘ while dragging a handle. To crop all sides proportionally, press both *option* and ⌘ while dragging a handle.
8. To reposition the graphic vertically, select it, release the mouse button, and then drag it.

To adjust the vertical position of *any* text character use the Character Editor as described in step 8.

Summary

In this exercise you mixed graphics and text within a document, and you learned:

- To place graphics within a line of text.
- To resize and crop graphics.

MathWriter allows you to import graphics directly from a file, including high resolution, encapsulated PostScript files.

For a discussion of *MathWriter's* treatment of mathematical expressions, continue on to Exercise 5.

Exercise 5: Mathematics

In this exercise you learn to type two-dimensional mathematical expressions and to number equations automatically.

Part 1: Mathematical expression editor

Preparing to write mathematics

Before we examine math writing features, you need to configure the *MathWriter* environment for these activities. If the Templates, Palettes, and Tools floating windows are not visible, select them from the Windows menu and drag them to a convenient working location.

The Templates window behaves as if it were a vertical menu bar; press on a template category and drag to select a specific template. Alternatively, you may type command (\mathbb{R}) and the row number followed by the column number of a specific template. For example, \mathbb{R} 2 and 1 selects the square root. If you pause before typing the column number, the selection menu pops out to prompt you. Typing other than one of the valid numerals aborts the command.

Exercises

Use the following instructions to explore the auto-formatting templates that were used to create the equation that follows step 3. Use the space that follows the equation as a place to experiment.

1. Select the root template by mouse (from the Templates pop-out menu) or by keyboard (\mathbb{R} 1 and 1) from the Templates window. The insertion point is positioned to receive the argument.
2. Type "(1 + sin x)". The root symbol expands automatically.
3. Press *enter* (not *return*) to exit the root.

Create $\sqrt{(1 + \sin x)}$.

Type here:

If you make a mistake or wish to modify the expression, press *option* to obtain the split I-beam cursor ⌵ to edit within the auto-formatting structure and click within the expression. You could also select the split I-beam from the Tools window or Tools submenu (Windows menu).

Suppose you wanted to square the sine term. Edit the expression below.

Edit this $\sqrt{(1 + \sin x)}$ to obtain this $\sqrt{(1 + \sin^2 x)}$

Edit this expression. $\sqrt{(1 + \sin x)}$

4. *Option click* within the mathematical expression immediately after "sin." This positions the insertion point in the square root structure.
5. Press ⌘] or click on the arrow ⌵ in the Tools window (Windows menu) pointing diagonally upwards (just below the I-beam tool) to create a superscript. This changes the vertical position of the insertion point and decreases the font size.
6. Type the exponent and press *enter* (not *return*).
7. Press *enter* to terminate the superscript entry.

Because this superscript structure is nested within the square root structure, you must press *enter* again to reach the baseline and recover the I-beam cursor of the Text Editor. Alternatively, you could press *return* at any point to reach the baseline immediately. This use of nested operations illustrates the general procedure for constructing a mathematical expression of arbitrary complexity.

Suppose you wish to attach a superscript to a superscript as in the next equation.

$$y = e^{x^2}$$

$y =$

1. Position the insertion point after the equals sign.
2. Type "e".
3. Press ⌘] or click ⌵ and type "x".
4. Press ⌘] again and type "2".

Observe that the leftmost display in the document status bar uses two up arrows ↑↑ to indicate that the insertion point is two levels removed from the baseline.

5. Observe the status bar as you press *enter* twice.

How would you type a subscript to a superscript, as in the next equation?

$$y_1 = e^{x^2}$$

$$y_1 =$$

1. Click to the right of the equals sign and add a space.
2. Type "e".
3. Press \mathbb{E} and type "x".
4. Press \mathbb{E} again and type "2".
5. Press *enter* once to return to the level of the "x".
(Now there is only one up arrow in the status bar.)
6. Press \mathbb{E} *apostrophe* or click on the arrow pointing downward  in the Tools window for a subscript.
7. Type 1 and press *enter* to return to the superscript level.
8. Press *enter* again to return to the baseline.

Math Writer reformats the expression after each keystroke so you need not count spaces before typing even the most complicated expression. Nesting to any depth is supported.

Remember to *option click* to place the insertion point within the expression.

Suppose you wish to type the error function that appears frequently in probability theory and heat conduction problems:

$$\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-\xi^2} d\xi$$

$$\operatorname{erf}(x) =$$

In each example, position the insertion point without reminder.

1. To create a fraction, choose the first fraction template (\mathbb{E} 1 followed by 1 for the first template row and the second template column, or use the mouse). The second fraction template automatically reduces the font size.
2. Type "2" for the numerator and press *enter* to move to the denominator.

Always supply the numerator before the denominator. By using nesting, you can create numerators and denominators of arbitrary complexity.

3. Select the square root symbol (⌘ 2 and 1).
4. Click on π in the Palettes window.

Use the mouse to select " π " from the Palettes window or type ⌘ spacebar to toggle to the Greek alphabet, now noted in the status bar; type p to get pi; and then type ⌘ spacebar to toggle back to the previous font. The Greek alphabet is taken from the Symbol font; the characters have a mnemonic arrangement, "a" for α , "b" for β , etc. But if you cannot locate a character, use the Key Caps desk accessory or the Font Table window.

5. Press *enter* once to leave the root template and a second time to reach the baseline. To avoid your having to scroll, the equation is repeated here.

$$\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-\xi^2} d\xi$$

$$\operatorname{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x$$

1. Select the single integral template with the mouse or type ⌘ 5 and 1.
2. Type "0", the lower limit of integration. (It could be any arbitrary expression.)
3. Press *enter* to move to the upper limit of integration and type " x ".
4. Press *enter* to return to the baseline.

Use *option click* if you need to edit either limit.

5. Complete the integrand as in the previous example.

Close this file and open the file "Exercise 5b" to continue.

Here is another practice example.

$$V = \frac{4V_0}{\pi} \sum_{n=0}^{\infty} \frac{1}{(2n+1)} \exp[-\kappa(2n+1)^2\pi^2t/L^2] \sin \frac{(2n+1)\pi x}{L} \quad [1]$$

As with the previous integral example, use *enter* to move from the lower to the upper limit. The down-scaled infinity symbol is an idiosyncrasy of the Symbol font; use *option click* to select it with the split I-beam and increase its font size with ⌘ + or Text Size on the Style menu.

Try the next example with the special functions that have an argument centered below them. Use ⌘7 or click on f in the Templates floating window to access the limit template. Get the “ \rightarrow ” from the Palettes menu.

$$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2} = \lim_{x \rightarrow 0} \frac{\sin x}{2x} = \lim_{x \rightarrow 0} \frac{\cos x}{2} = \frac{1}{2} \quad [2]$$

The Cut and Paste operations on the Edit menu apply to mathematical expressions, even when you use the Math Editor cursor. In this way you can frequently avoid retyping built-up expressions such as $\lim_{x \rightarrow 0}$.

MathWriter automatically groups rows of expressions with a stretchable symbol as in the following exercise. Use the Palettes menu (or ⌘8 and 1) and the Greek alphabet on the Palettes window (Windows menu) for the special symbols. Use *return* to create a new row.

$$y = |x| \equiv \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases} \quad [3]$$

If you are using the Apple, rather than the Adobe, version of the Symbol screen font, the large brace in the above expression will be truncated, but it will print correctly in LaserWriter output. (Use Calc Prev \int or $|$ Size or ⌘D to size the absolute value symbol from the Palettes menu to fit an expression; use the Character Editor to stretch it to an arbitrary size.)

MathWriter automatically formats matrices and other two-dimensional arrays. In order to create self-sizing parentheses for a tall fraction:

1. Pull down the Style menu to Auto Math Options... and release the mouse. A pop-out menu appears.
2. Click on Auto-bracket sizing if it is not checked and click OK. (This includes the auto-sizing feature in the set to be enabled in step 3.)
3. Now click on Auto Math in the Style menu (or press ⌘E). This activates those items you have checked in the Auto Math Options window.

In general, activate Auto Math only while you are typing an equation and then toggle this feature off with $\text{\textcircled{E}}$ *E* to reduce the computational load.

$$[D] = \left(\frac{E}{1 - \mu^2} \right) \quad [4]$$

Type here $\rightarrow [D] =$

4. To complete equation [4], type an ordinary left parenthesis, select the fraction template ($\text{\textcircled{1}}$ and *1*), supply the numerator, press *enter*, type the denominator, press *enter*, and then type a right parenthesis.
5. Complete the expression below by adding the matrix.

$$[D] = \left(\frac{E}{1 - \mu^2} \right) \begin{bmatrix} 1 & \mu & 0 \\ \mu & 1 & 0 \\ 0 & 0 & \frac{1 - \mu}{2} \end{bmatrix} \quad [5]$$

$$[D] = \left(\frac{E}{1 - \mu^2} \right)$$

6. To construct an array of any number of rows and columns just select the appropriate construct from the Templates window, in this case vectors and matrices (the next to last row on the Templates window), and create the elements. The first element corresponds to row one, column one.
7. Press *tab* to move to the next column (or to create the next column) in the same row.
8. Press *return* to move to the next row (or to create the next row) in the same column.
9. To move into an existing cell, use option click with the mouse or $\text{\textcircled{S}}$ *shift* with the arrow keys.

MathWriter reformats the array as you type. Use Matrix Format... in the Format menu to set placement, line type, justification, and spacing of cells.

Pull down the Format menu to Matrix Format and release the mouse to view the formatting possibilities.

Any changes made in the Matrix Format when a matrix is selected apply to that matrix only; any changes made when no matrix is selected apply to all future matrix input.

As a final exercise, reproduce the following table.

a_{11}	123.456	$\sum_{i=0}^4 (1/i^2)$
$\sqrt{\frac{1+x}{1-x^2}}$	Text	

1. Use $\# 0$ and 2 to activate the table template. Create rows and columns just as in the matrix example. Use "0" to access row "10".

The cells of a table can contain numbers, text, graphics, or mathematical expressions. Use Matrix Format... in the Format menu to change the defaults. When the insertion point is within a cell, you can insert or delete a row or column using Insert and Delete on the Edit menu.

Remember, *option click* to edit within a cell. The status bar indicates the row and column of the insertion point.

Part 2: Technical support

In addition to the need for writing equations, technical writing places other special demands on a word processor. The increased complexity of input due to the enlarged set of fonts and symbols, font sizes, and font styles was discussed in Exercise 3. Now we will explain another feature of special importance.

Automatic numbering

Numbering equations and cross-referencing them in the text is an important feature for writing math. Suppose you decide to assign a number to the first equation shown below. Each equation number would then increase by one. Without *MathWriter's* automatic numbering, you would have to find and increase all succeeding equation numbers and all cross-references to them in the text and elsewhere. *MathWriter* handles this task automatically. Even if you use cut and paste operations to edit your manuscript, *MathWriter* updates the numbering and linkages correctly. This assumes, of course, that you move both an equation and its associated number together.

Warning: If you remove an equation number that is linked to a cross-reference variable, the cross-reference number is no longer meaningful and is changed to a "?".

$$f(z) = \sum_{n=-\infty}^{\infty} \alpha_n (z - z_0)^n, \quad r_1 < |z - z_0| < r_2$$

$$\text{where } \alpha_n = \frac{1}{2\pi i} \oint_C \frac{f(\zeta) d\zeta}{(\zeta - z_0)^{n+1}}, \quad n = 0, \pm 1, \pm 2, \dots, \quad [6]$$

and the integral along C is taken in the positive direction.

Find the Laurent series expansion, in powers of z , for the function

$$f(z) = \frac{1}{(z-1)(z-3)}.$$

Observe that $f(z)$ is analytic for all values of z such that $1 < |z| < 3$. We may find the α_n 's of [6] by using the following device. [Pennisi, et al., *Elements of Complex Variables*]

To add the equation number to the first equation, follow these steps:

1. Drag a right tab  near the right margin.
2. Place the insertion point immediately to the right of the first equation, verify that you placed a tab near the right margin, and inspect the ruler. If necessary, add a right tab.

We centered the equation at the ruler position by a center tab. To avoid a contradiction, NEVER use centered paragraph alignment and a tab to number equations.

3. Press *tab* to position the insertion point at the right margin, and select equation number  from the last row of the Palettes menu. (As you drag the cursor over each icon its name appears on the bottom row of the menu.)

When you release the mouse button, *MathWriter* automatically calculates and assigns the equation number.

The new equation becomes number [6], the original equation [6] becomes equation [7], and *MathWriter* updates the cross-reference to the original equation in the last paragraph of text, too.

The program handles subequation numbering in an analogous manner. It numbers multiple parts of any equation, but you have to identify the linked variable by number, by relative number, or by pointing.

With Variables Format... in the Format menu you can assign such things as the variable style, format, and style of enclosing brackets for equation numbers.

MathWriter automatically updates all variables of this type throughout the document if you change any of the choices in Variables Format... (Format menu). You cannot edit these variables placed within the document as you would other character strings; you can only make changes using Variables Format...

◆ Select Show Invisibles from the Format menu to locate the dynamic variables identified by dotted boxes and Hide Invisibles to conceal them.

Automatic numbering of other entities such as figures, tables, theorems, paragraphs, etc., is also possible. In addition, you can define sets of dynamic variables for other items and *MathWriter* will automatically track them.

To create a "figures" user-defined category, follow these steps:

1. Select Variables Format... in the Format menu, and click Rename.
2. Assign a variable name, e.g., Fig., and select it in the scrolling window.
3. Select a numbering scheme; decide on enclosing brackets, if any; assign a starting number and category label (e.g., "Fig. " including the trailing space). Click OK. *MathWriter* adds this name to the icon.
4. Drag the mouse over the user-defined category on the Palettes menu to verify that the program has assigned the new name.
5. Select and adjust the parameters for the subfigure and figure reference variables.

This completes the guided tour. Close this file and begin experimenting or read Chapters 3 and 4.



3 Nontechnical Writing

Online Help

MathWriter offers more than fifty online Help screens. To use this resource you must have placed the *MathWriter* Help file in the System folder of your Macintosh or in the folder containing *MathWriter* before activating *MathWriter*. If disk space is too limited or if you are an experienced *MathWriter* user, you may forego the convenience of online help. To access *MathWriter's* Help screen, follow these steps:

1. Type $\mathscr{H} ?$ (in other words, while depressing the command key type a question mark)¹ or select Windows/Help² to open the scrolling index (see Figure 3.1). The Help window has a fixed size, but you can reposition it on the screen by dragging its title bar.

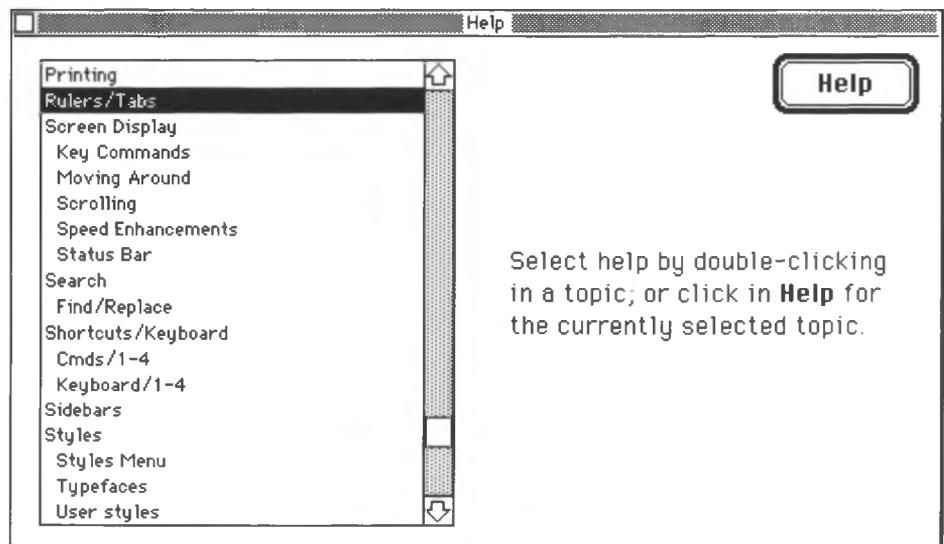


Figure 3.1 Help index

¹ Ignore space separators in commands. See the end of Chapter 1 for a summary of conventions.

² This notation means select the Help command in the Windows menu.

2. Scroll to locate the relevant topic.
3. Double-click on a topic in the list or click on the topic and then click the Help button.

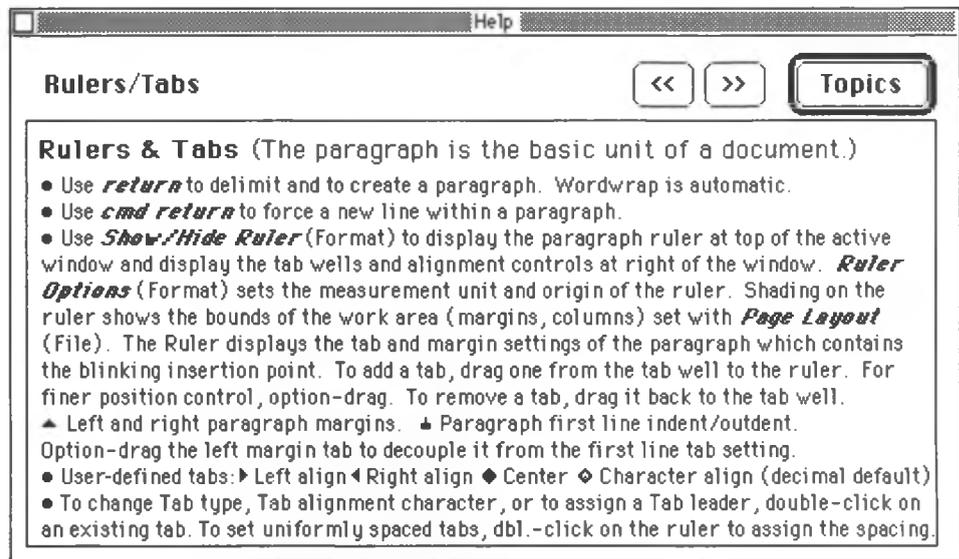


Figure 3.2 Rulers and Tabs help screen

Figure 3.2 displays the relevant Help message (Rulers & Tabs subheading under Paragraph). The Help button becomes the Topics button while messages are displayed and provides a return link to the Help index. Two adjacent buttons « and » appear and provide scrolling forward and backward through the various screens related to this topic. In this case, there is only one relevant screen, so when you click on Topics, you will return immediately to the list of Help topics.

Either select another topic, drag the Help window aside, or click the close-box at the top-left corner of the Help window to remove it.

Producing a Nontechnical Document

MathWriter provides you with more than technical writing capabilities. It is a word processor that enables you to capture your ideas with words or symbols, supplies formatting that enhances the reader's comprehension, allows you to correct errors and rearrange wording to improve precision of expression, preserves a computer-readable copy for use in future sessions, and produces a printed copy of your document. In short, it allows you to produce a printed document efficiently.

Entering text

In the previous chapter you learned to install *MathWriter*. If necessary, repeat that process now and double-click the *MathWriter* icon to activate the application. In this chapter we will discuss the techniques you will need to create a nontechnical document; the more specialized techniques associated with technical writing will be discussed in the following chapter.

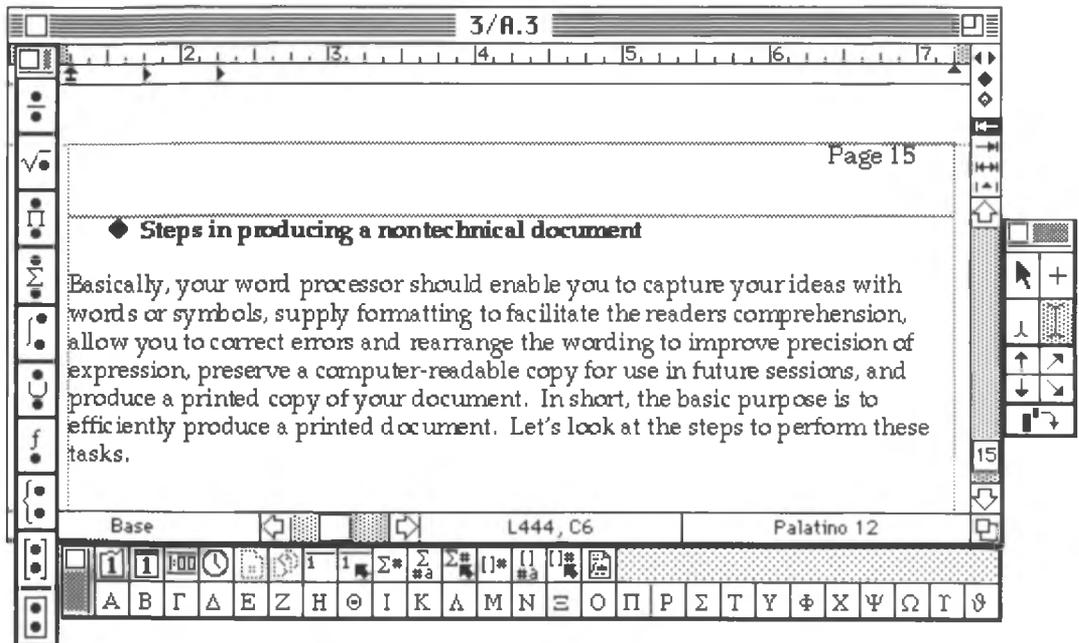


Figure 3.3 Document window with text

Figure 3.3 displays a document window with text. If you are not familiar with the basics of the Macintosh human interfaces, refer to the tutorial materials supplied with your Macintosh. If you only need a simple refresher, refer to appendix 1 of this manual for a quick review.

Opening a document

There are three ways you can open a *MathWriter* document:

- Use the document window and the one-page, blank workspace *MathWriter* presents at startup, unless you have customized it to present a default or template document using Preferences (on the File menu).
- Select a submenu of the New command (on File menu) to obtain a copy of a document template you created previously.

- Open an existing document using File/Open... (⌘ O).

MathWriter's screen display of a document closely resembles the document you eventually print. This important, productivity-enhancing attribute is widely known as "What you see is what you get" or WYSIWYG (pronounced "whizzy-wig"). The closer the correspondence, the easier you can produce the desired printed document. Many of *MathWriter's* features help you visualize the end results as if you were working with a sheet of paper.

Creating text

If you have a Macintosh with a small screen, only a portion of the document page will be visible at one time. The blinking vertical bar (|), known as the insertion point, identifies your position within the document. Characters you type appear at the location of the insertion point, and the insertion point advances as you type.

Unlike a traditional typewriter, a word processor supplies extensive formatting support. For example, when your line of typed text reaches the right margin, any whole word that does not fit on the line moves to the next line. This is called "wordwrap."

Do not press *return* until you reach the end of the paragraph. If you must force a new line within a paragraph, use *shift return*.

When you fill a page, *MathWriter* automatically creates and numbers a second page. The vertical scroll box  always displays the number of the page currently visible at the top of the document window, even if a portion of the next page is also visible on the screen.

MathWriter uses a few normally invisible characters to control screen formatting. Use the command Format/Show Invisibles to display the end-of-paragraph marker ¶; other invisible characters include space (shown by a dot below the line), *tab* ⇨, line break ↵, column break ⌫, and page break ⌮. Page numbering variables in the header or footer are displayed within a dotted box when invisible characters are showing. To make all these characters invisible again, use the same menu command, which now reads Hide Invisibles.

Document organization

The basic elements of a document are paragraphs, sentences, words, characters. We organized *MathWriter* with that in mind. The paragraph is the basic organizing unit of a document. As mentioned above, you use the *return* key to delimit paragraphs. Said differently, a paragraph is the material enclosed by pairs of invisible paragraph markers.

Navigating within a document

Because typed text appears in the document at the insertion point, you must be able to position the insertion point at different places in a document. And because the document is usually larger than *MathWriter* can display on the screen at once, you must be able to select parts for viewing and modification. Mouse and keyboard controls are available for navigating.

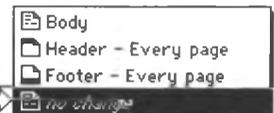
You can position the insertion point anywhere within existing text. In order for *MathWriter* to format a document automatically, text fragments cannot be allowed to dangle arbitrarily within the document, and that would be the case if the insertion point could be positioned without any relation to existing text. Consequently, you can add text within or on the boundaries of existing text. Use Format/Show Invisibles and Show Layout to view these boundaries.

Mouse navigation The gray scroll bars are the primary, mouse-controlled tools for bringing other portions of the document into view. Separate scroll bars control horizontal and vertical motion.

The white scroll boxes indicate the relative location of the current view of the document in its scroll range. The vertical scroll box displays the page number of the page in view at the top of the active document window.

There are a number of ways to scroll using the mouse.

- To scroll in discrete steps of approximately eight lines, click the cursor in one of the arrows at either end of the scroll bar. Because mathematical expressions are frequently taller than ordinary lines of text and because larger screens are more common now, larger movements are made easier by this convention. To scroll a smaller amount (approximately one line), press the *option* key while clicking the scroll arrow.
- To scroll one windowful, click in the scroll bar above or below the scroll box. The actual scroll distance depends upon the current size of the active document window.
- To scroll an arbitrary amount (especially useful for long documents), drag the scroll box with the mouse. You can scroll directly to a specific page in a single try because the scroll box immediately reports the destination page number even before you release the mouse button. The number in the scroll box corresponds to the page that is visible at the *top* of the document window.
- To scroll to a header, footer, footnote, or back to the previous location of the insertion point within the body of the text, use the pop-up menu associated with the insertion point position locator in the status bar. To practice using the insertion point pop-up menu:



1. Select a region, such as the Header, from the pop-up menu. *MathWriter* automatically scrolls that region into view for editing.
2. Select Body from the pop-up menu to scroll to the original location of the insertion point.

The scrolling options listed above provide the control you normally require for editing a document. However, additional choices, described below, make *MathWriter* a convenient substitute for a slide projector for presentations.

- To scroll the page boundary separator of the next or the previous page to the top of the document window, *⌘* click in the scroll bar below or above the scroll box, respectively.
- To scroll the header of the next or previous page to the top of the document window, *option* click in the scroll bar below or above the scroll box, respectively.
- To scroll the text body of the next or previous page to the top of the document window, *⌘ option* click in the scroll bar below or above the scroll box, respectively.

If you group your material into screen segments (for the presentation screen size) each segment can be sequentially positioned at the top of the screen. *MathWriter* allows you to easily and quickly scroll through your presentation. For very rapid scroll speeds, scroll through your document before your presentation to allow *MathWriter* to build lookup tables, or save the file with the "Compact file" option disabled using File/Doc Preferences.

When you scroll, the position of the insertion point relative to the text does not change. To quickly scroll back to the location of the insertion point, either type a character or use the mouse to perform the menu command Edit/Show Selection. To reposition the insertion point, just click the I-beam point at the desired location, possibly after scrolling. As discussed later, when you are selecting text and drag past the top or bottom of the window, the screen scrolls automatically.

If you must work with documents wider than the screen (or window), such as a landscape orientation view (see File/Page Layout/Page Setup), then you can use the horizontal scroll bar to view a hidden portion of the document. *MathWriter* supports automatic left and right scrolling to keep the insertion point in view. *Most operations in MathWriter can be performed using either the mouse or the keyboard.* Consider now the keyboard alternatives for navigating.

Keyboard navigation The arrow keys (\leftarrow , \rightarrow , \uparrow , \downarrow) move the insertion point around within text and mathematical expressions.

- The arrow keys move the insertion point one character to the left or right or one line up or down. As with the other keys, keeping an arrow key depressed causes it to repeat at a rate set in the Apple/Control Panel. If necessary, *MathWriter* automatically scrolls the screen horizontally or vertically to keep the insertion point in view. Because *MathWriter* supports variable character widths, vertical scrolling does not move in a straight line, but along a path that maintains a constant character count (reported in the status bar) from the left margin in the paragraph in which the movement begins. The insertion point then moves to the left margin in succeeding paragraphs. Repeated use of the right arrow moves the insertion point through the text along the path used when reading. The left arrow does the opposite.
- Using the *option* key simultaneously with an arrow key, magnifies the movement of the insertion point. *Option left arrow* or *right arrow* moves the insertion point immediately to the left or the right end of the current line, respectively. *Option up arrow* or *down arrow* initially moves the cursor to the top or bottom of the active window and if pressed again (or if held down) the insertion point scrolls to the top or bottom, respectively, of the document.
- Using \mathcal{K} simultaneously with the up or down arrow scrolls the window a large amount (approx. 8 lines).
- Using \mathcal{K} and *option* simultaneously with the up or down arrow scrolls the window a small amount (approx. 1 line).

To make these key combinations easier to remember, note that in general:

- pressing \mathcal{K} changes the meaning,
 - pressing *option* modifies the scale, and
 - pressing *shift* extends the range.
-

Selecting text

In general, you must explicitly identify the object of a command by selecting it before you give a command. Selected text is displayed with the black and white colors reversed. Rather than black text on a white background, selected text is displayed as white letters on a black background. We also refer to this as “highlighted text.”

Colors can be used for this purpose if you have a color display, but the use of color slows the program considerably. For this reason we recommend using the Apple/Control Panel/Monitor to disable color output.

You can use either the mouse or the keyboard to make selections. Using the mouse, you have the following options:

- To select a **word**, click twice at the same position within the word.

When a word is selected by double-clicking (rather than by dragging, for example), a space character immediately preceding the word is automatically added to the selection if you then use Edit/Cut.

- To select a **line of text**, click three times at the same position within the line.
- To select a **paragraph**, click four times at the same position within the paragraph.
- To select the **entire document**, use Edit/Select All.
- To *undo* a selection, single-click anywhere in the document.

To select an arbitrary contiguous string of characters, drag the cursor over the text.

1. Position the cursor in the text at either the beginning or end of the substring you wish to select.
2. Drag (press and hold the mouse button down while you move the mouse) to the other end of the substring and release the mouse button.

If you drag past the top or bottom of the window, the document automatically scrolls to make the additional selected text visible. Observe that the highlighted text continually changes as you drag the mouse but always includes the text substring between the insertion point and the current cursor position.

For somewhat longer selections you may prefer to use the *shift click* method.

1. Position the insertion point by clicking the cursor in the text at the beginning or end of a substring you wish to select.
2. Scroll to the other end of the text string and press the *shift* key as you click the mouse. (*Shift* serves as an extender.)

To select text using the keyboard, follow these steps:

1. Using the arrow keys, position the insertion point within, not necessarily at one end of, the substring you wish to select. Recall that using the *option* key in combination with the arrow keys produces larger insertion point movements—at the beginning or end of a line, top or bottom of the window, and top or bottom of the document.
2. To complete the selection process, press *shift* and use the arrow keys to “grow” the selection about the insertion point.

Using *option* with *shift arrow* changes the scale. *Option shift* with a left or right arrow selects the current line to the left or to the right of the

insertion point. So if the insertion point is not at the left or right end of the line, use both commands to select the entire line. *Option shift* with up or down arrows selects from the insertion point to the top or bottom of the window, respectively. Use the same *option shift arrow* command twice to select from the insertion point to the top or bottom of the document.

Basic editing

Simple editing techniques for adding, deleting, moving, and copying text are useful when creating a document.

- To add text you simply position the insertion point where you want to add text and type.
- To overwrite text, first select or highlight the text and then type the replacement text.
- To delete a character, position the insertion point to the immediate right of the character and press delete. Repeatedly press delete or hold it down to remove additional characters to the left.
- To delete large selections, select or highlight the text and press delete once. Alternatively, use Edit/Cut (⌘ X) or Edit/Clear to remove the highlighted selection.

The Cut command makes a temporary copy of the selection on the Clipboard for subsequent “pasting” into the document when the insertion point is at another location. The Clear command does not save a copy on the Clipboard, but Edit/Undo restores the removed text if used as your next command. Clear is especially useful when you are deleting a large selection because no Clipboard copy is made.

- To move text from one location in the document to another using the mouse or keyboard:

1. Select the text.
 2. Copy the text to the Clipboard using Edit/Cut or ⌘ X.
 3. Position the insertion point at the intended destination.
 4. Paste the Clipboard contents into the text using Edit/Paste Text or ⌘ V.
- To duplicate, rather than remove, text from one place to use elsewhere, use the procedure described above replacing Edit/Cut (or ⌘ X) with Edit / Copy or ⌘ C.

The command keyboard equivalents appear on the pull-down menus as reminders. By convention and for clarity, uppercase letters are shown; however, you *must* use the lowercase letter to execute the command.

During text entry you may need a few additional, basic editing commands:

- **Undo** The Edit/Undo (or ⌘ Z) command allows you to undo the effects of the immediately preceding command in most cases. A few global commands such as Replace All, of Edit/Find/Replace, cannot be undone with this command. If you must use Replace All, save a protective backup copy of the document just before you use it, perhaps using File/Save A Copy.
- **Invisibles** The Format/Show Invisibles command allows you to display the otherwise invisible formatting characters in the text. Although you need not see a marker to delete a formatting character, seeing them allows you to locate them more easily. To hide these markers, use Format/Hide Invisibles, as this command is now named.
- **Delete** Recall that a new paragraph is created when you press *return*. Therefore, to join two paragraphs, remove the separating paragraph marker. Do this by placing the insertion point at the beginning of the second paragraph, not at the end of the first, and press *delete*.

Similarly, if you manually create a new page using Format/Insert Page Break and later wish to remove that marker, place the insertion point at the beginning of the second page (NOT at the end of the first page) and press *delete*. This same pattern applies to column breaks, tabs, etc.

Note that *enter* and *return* have distinct purposes in *MathWriter*. As you will see later, the *enter* key plays a role in creating mathematical expressions analogous to *return* in creating paragraphs in ordinary text.

Space between paragraphs Although you can add space between paragraphs by pressing *return* to create empty paragraphs, we recommend that you use Format/Paragraph Format to assign extra spacing before or after paragraphs. Just as the first line indent of a paragraph eliminates a *tab* key command, this command eliminates one or more *return* keys. In addition, you can quickly change the spacing between paragraphs in pixel increments at any time using Edit/Select All and Format/Paragraph Format. Also, this prevents the paragraph count in File/Doc Info from being inflated.

Numerous input techniques—the Palettes menu, the Windows menu (Palettes Window, the Font Table, and Library)—will be discussed in the next chapter.

Formatting

MathWriter provides users with an especially rich set of formatting capabilities. A rather modest and quickly learned subset of these should be sufficient for nontechnical writing. Depending upon personal preference, you can apply formatting to the text as you enter it or apply the formatting later. If you are a speed typist or are opening an unformatted text file, you

might supply formatting after you finish entering the text. In most cases, however, you should anticipate the general design of your document and make tentative choices before entering the text. Otherwise, changes at the document level, such as margins, affect formatting at the paragraph level, such as line length. The side effects of the changes become more bothersome when advanced structures, such as mathematical expressions and sidebars, are involved.

Document formatting has three levels: **global formatting**, which applies to the entire document (page size, page orientation, margins, columns, headers, footers, footnote placement, etc.), which you set using the File menu; **paragraph specific formatting** (tab settings, alignment, line spacing, borders, etc.), which you set using the Format menu; and **character formatting** (font, size, style, etc.), which you set using the Style menu. The design process normally proceeds from the general to the specific. This is also reflected in the left-to-right ordering of *MathWriter* menus.

Document formatting

To format a simple document you need consider only the choice of printer, which you assign using Apple/Chooser, and two commands on the File menu—Page Layout and Doc Layout.

Chooser Although you can route any existing document to an ImageWriter, to a LaserWriter, or to an even higher resolution device, some differences besides printer resolution do exist. The usually subtle differences between screen display and printer output might affect your choices in order to get optimal output. For example, if you intend to use a LaserWriter, you probably will elect to use LaserWriter fonts throughout your document. In *MathWriter's* Text Font menu the names of built-in laser fonts are underlined. Because font dimensions vary among font families of the same font size, substituting fonts automatically when you print can lead to undesirable spacing.

Page Layout To set up the Page Layout for your documents:

1. Click on File/Page Layout to examine the choices (see Figure 3.4).
2. Click the Page Setup button (Figure 3.4) first because your choice of paper size and orientation will affect your other page layout choices such as margins (see Figures 3.5 and 3.6). Paper size choices are listed in Table 3.1.

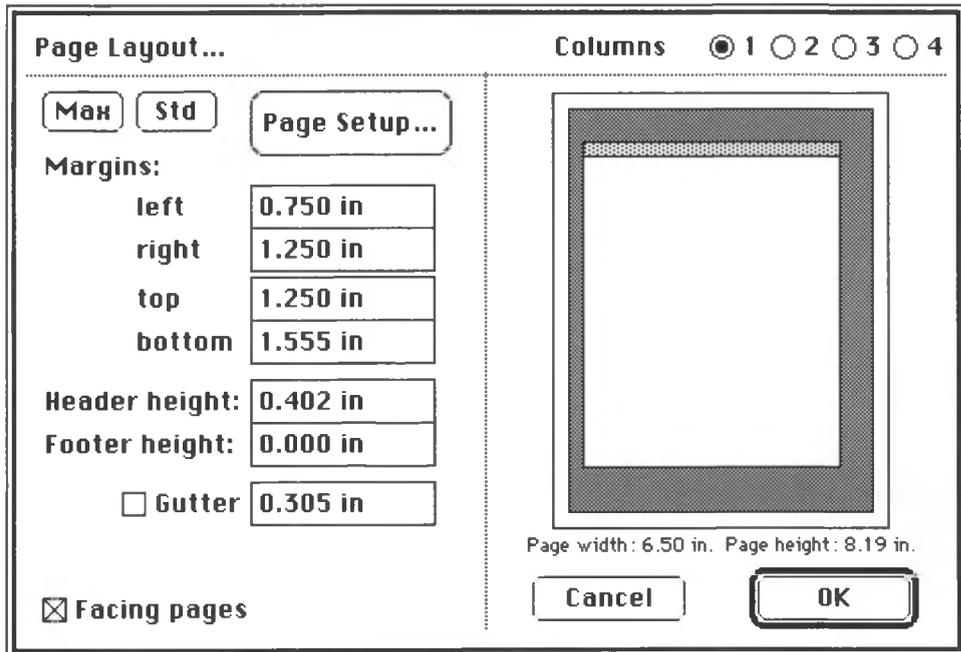


Figure 3.4 Page Layout dialog box

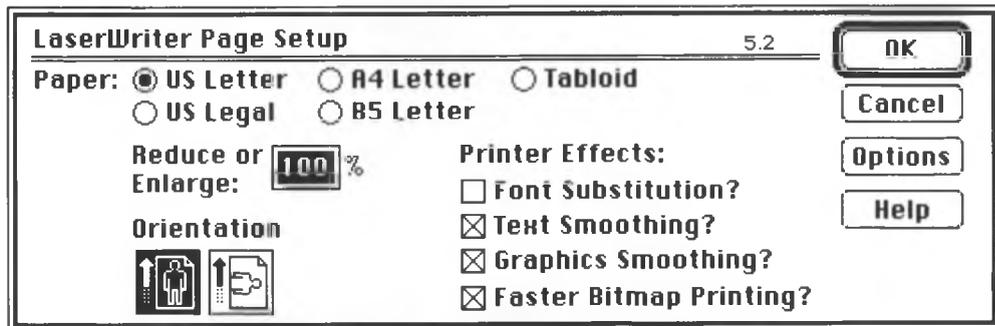


Figure 3.5 Page setup window for LaserWriter

If you must switch printer types to print a document, remember that even if you make no changes, you need to open the Page Setup dialog box and click on OK. This causes *MathWriter* to implement any necessary formatting changes. Proofread your document to verify that no unanticipated changes have been made by *MathWriter*.

Portrait, the default page orientation, is taller than it is wide. The landscape orientation is a portrait-size page rotated 90° producing pages that are wider than they are tall. Size reductions, the various printer effects, and options are examined in detail in the discussion of printing later in this chapter.

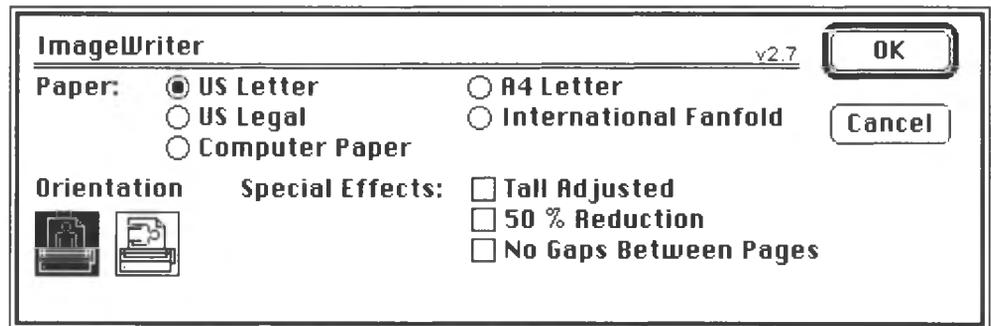


Figure 3.6 ImageWriter page setup window

Table 3.1 Paper sizes

Paper	Width, in.	Height, in.
US Letter	8.5	11.0
US Legal	8.5	14.0
A4 Letter	8.25	11.7
B5 Letter	6.9	10.8
Tabloid	11.0	17.0
Computer Paper	14.0	11.0
International Fanfold	8.25	12.0

3. After making your page layout choices, click OK to return to the Page Layout dialog box.
4. If you require the largest possible print area, click on Max.
5. If you require more standard margins, click on Std and adjust the default margin sizes as necessary. The outer rectangle on the right half of the dialog box represents the physical boundaries of the paper. The enclosed rectangle including shaded portions corresponds to the printable area. The margin sizes are measured from the physical boundaries of the paper, rather than from the print boundaries. This accounts for the existence of a set of minimum acceptable values. Out-of-range values are rejected and a "?" is posted just outside the box. You cannot proceed until you supply an

allowable value. The default units, inches, in, centimeters, cm, and points, pt, match the current ruler units discussed below, but you can use any combination of compatible units and values. The dimensions of the usable print area appear below the miniature portrait of the page.

6. If you wish to reserve any additional space for a binding margin, check the Gutter box and supply a measurement (value and unit). With the Gutter box checked, the distance from the page boundary to the print area is the sum of the values for the gutter and the adjacent margin.

7. If you wish to have the gutter appear on the left of odd-numbered pages and on the right of even-numbered pages, check the Facing pages box.

When you use facing pages, the odd-numbered pages are on the right and the even-numbered are on the left.

The Print dialog box also provides for printing on the front and back of pages.

8. Optionally, adjust the size of the headers and the footers. Headers and footers are the reserved portions of the printable area at the top and bottom of the page, respectively. As discussed below, the contents of these can appear on every page throughout the document, differ from a standard on the first and/or last pages, or differ on left and right pages. If you wish to remove a header or footer, set its size to zero; as you do with margins, specify a value and its units. The header and footer sizes are constant throughout the document. These spaces are frequently used for posting page numbers, creation date, print date, creation time, print time, file name, letterheads, and other identifying notations. After you leave this dialog box and after you make the choices on the distribution of the headers and footers throughout the document, you can place text, graphics, mathematical expressions, or the variables just mentioned in the headers or footers.

9. Click OK to accept any changes you have made. Otherwise, click on Cancel to retain the values that existed when you opened this dialog box.

Doc Layout Consider next the placement of headers, footers, and footnotes among the pages of the document. The document layout dialog box (Figure 3.7) presents the choices visually.

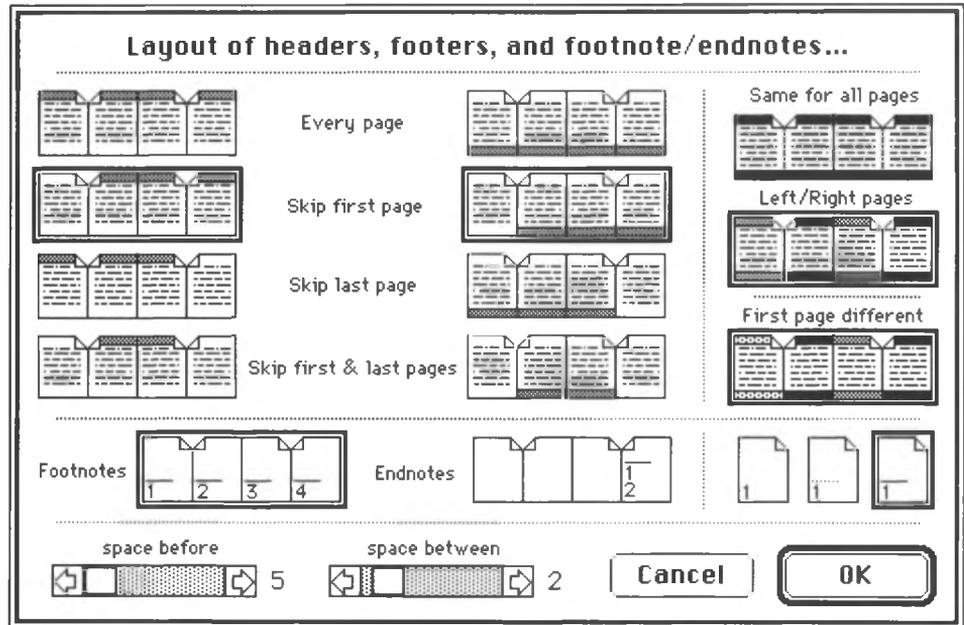


Figure 3.7 Document Layout dialog box

1. In the first column, click on an icon either to place the header on every page, to skip the first page, to skip the last page, or to skip the first and last pages.

2. In the second column, make a similar designation for footers.

3. In the third column, make two choices. Click to select left-right facing pages or same on all pages and then click "First page different" off/on. After you return to the document window, the pop-up window associated with the insertion point locator in the status bar provides rapid scrolling to the headers and footers. You can place parenthetical materials in automatically numbered footnotes located either at the end of the document or at the bottom of the page that contains the reference to the footnote. Space for the footnote is automatically liberated from the space normally allocated to text in the main body of the page. You can make four choices relative to footnotes:

- At the bottom left corner of the dialog box, click to select placement at the bottom of the page or at the end of the document.
- At the right, choose one of the three icons (no line, dotted line, or solid line) for the separation of the footnotes from the body of the text.
- Set the spacing before footnotes (in pixels) using the scroll bar.

- Set the spacing between footnotes using the scroll bar.

4. Click OK to accept any changes you have made. Otherwise, click Cancel to retain the values that existed when you opened this dialog box.

To access the header or footer areas, simply click inside them, without opening a separate window, and begin typing. Throughout *MathWriter*, you can edit within the various structures, such as headers, footers, footnotes, sidebars, mathematical expressions, etc., without opening special windows. The formatting tools available in the body of the text are available for these structures, too. Refer to the section on headers and footers later in this chapter for additional details.

To create a footnote:

1. Position the insertion point in the text where you want the footnote marker.
2. Select the footnote icon from the bottom row of the Palettes menu.
3. Either scroll to the footnote area or select the footnote region from the pop-up menu at the insertion point locator in the document status bar.
4. Type the contents of the footnote.
5. Either scroll back to the body of the text or select Body from the same pop-up menu.

Paragraph formatting

Having established the global environment in which to place your ideas, you can now consider the next most important formatting issues—how to present paragraphs. Since the paragraph is the basic modular unit of composition, *MathWriter* makes it a primary design focus. As you shall see, understanding paragraph formatting is central to using *MathWriter* effectively.

Paragraph formatting commands apply to entire paragraphs. You need only place the insertion point within the paragraph to select it. To select multiple paragraphs you must use the usual selection techniques.

The ruler *MathWriter's* paragraph ruler (see Figure 3.8) serves the dual role of reporting paragraph formatting choices for the paragraph that contains the insertion point and providing a visual dialog box for making new choices of margins, first-line indent tabs for character alignment, and various horizontal alignment options.

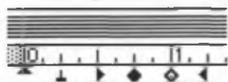


Figure 3.8 The Ruler

The ruler occupies a prime and predictable location across the top of the window with an additional portion in the right border of the window above the vertical scroll bar. You can hide the ruler to obtain a better view:

- ◆ Use Format/Hide Ruler or ⌘-R.

To view the ruler again:

- ◆ Use Format/Show Ruler (or ⌘-R), which toggles with Hide Ruler.

When the ruler is visible, only one copy is on the screen; it does not scroll out of view and it corresponds to the paragraph that currently contains the insertion point. Each paragraph in a document has a ruler that contains its formatting information. Because the vertical dimension of the screen is especially critical when viewing displayed equations, we have designed the portion of the ruler across the top of the window for a minimum depth by placing the tab wells and alignment controls on the right side of the window.

When you press *return* to create a new paragraph, *MathWriter* copies the ruler of the previous paragraph to the new paragraph as the default ruler.

Unique ruler icon If you modify the ruler of any paragraph, *MathWriter* flags the paragraph formatting change by placing a ruler change icon (⌘) in the left margin of the document. Use Format/Hide Message to hide these margin notes and its toggled version, Show Messages, to restore them.

The ruler can be used with three units of measure—inch, centimeter, and point (or pixel), which is 1/72 inch.

Ruler units To select a unit of measure use the Ruler Options submenu of the Format menu to make a selection.

The fourth submenu option, Page Ruler, which toggles as Column Ruler, allows you to have the ruler span all columns of the entire page or begin anew in each column.

Ruler icons The gray shading on each end of the ruler (see Figure 3.8) depicts the boundaries of the working text area you established using the File/Page Layout command. You can work with narrower, but not wider, paragraph margins.

Paragraph margins You may have to scroll horizontally to set the left and right paragraph margins.

The paragraph margin settings allow you to create special effects easily. You can place tightly fitting borders around narrow paragraphs or equations by changing the margins. Quoted material is often single-spaced

with a reduced paragraph width. Using the paragraph margins can allow you to place sidebars, which are discussed in the next chapter, on the page outside the margin.

First line indent To emphasize a paragraph break you might wish to start its first line to the right or left of the rest of the paragraph. Of course this effect could be achieved using *tab* ▶, but using the first line indent marker ▲ is a better way.



For a first line indent drag the first line indent marker to the right of the left margin paragraph marker. *MathWriter* immediately repositions any existing text to conform to the new setting.



For a flush first line drag the first line indent marker to the same position as the left margin paragraph marker. If you move the left margin paragraph marker in either of these cases, the first line indent marker is coupled with it and moves the same distance to preserve the magnitude of the indent.



For a hanging indent (or “outdent”) drag the first line marker to the left of the left margin paragraph marker. If the left margin marker is flush with the left border of the text area, you must first move the left margin paragraph marker to the right before you can make a hanging indent. To decouple the first line indent and the left margin markers to create a hanging indent, press the ⌘ key when you drag the left margin marker.

A hanging indent is especially useful if you wish to have a single line (words or the number of an item in a list) extend to the left of the remainder of the paragraph.

Tab alignment of characters The horizontal alignment of characters within a line of text is facilitated by four types of tabs—left align ▶, right align ◀, center align ◆, and character (decimal) align ◇. Because *MathWriter* supports variable-width characters, accurate horizontal alignment would be difficult, if not impossible, without them. Figure 3.8 provides an example of each type.



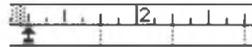
Added text aligned with left-aligned tabs advances to the right, keeping the left end anchored. When right-aligned, added text advances to the left. When center-aligned, added text advances the string to the left and right simultaneously, keeping the center of the string anchored on the tab. Do not use center-aligned tabs with fully justified alignment (due to the implied contradiction discussed next). When decimal-aligned, added text advances the string to the left or right as appropriate, keeping the decimal point in the string anchored on the tab. The decimal tab is most frequently used to align a column of decimal numbers. (See the next section for a discussion of creating tables automatically without tabs.)

To position a tab on the ruler, drag a tab from the tab well (located above the vertical scroll bar at the right of the window) and place it on the ruler just below the horizontal scale and between the left and right paragraph margin markers. To make horizontal alignment with existing characters easier, you can drag a tab down into the text to the horizontal position you want it in the paragraph; when released, it snaps onto the ruler.

To reposition a tab, drag it to its new location (and take text aligned on the tab with it), but beware of the complexity and potential confusion if you drag it past another tab. Use *option*-drag for a smoother drag and finer control of tab spacing.

To remove a tab drag it past the right margin on the ruler. 

To align text on a tab, use the *tab* key either before or after you place text on the line. If you become confused about your results, use Format/Show Invisibles to display identifying markers. To again hide the markers, use Hide Invisibles, which toggles with Show Invisibles.



Fixed tabs: If you require evenly spaced tabs across the ruler, double-click on the ruler anywhere, except on an existing tab, to obtain the Tab Options dialog box (see Figure 3.9). In the Tab Options box you can specify fixed tabs and the interval spacing.

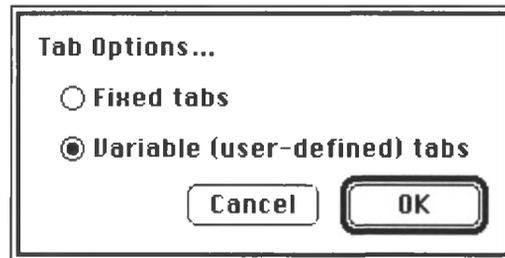


Figure 3.9 Tab options

Paragraph alignment Using automatic wordwrap, *MathWriter* strings the characters you type together into lines of text that form paragraphs. You can influence the placement of line breaks in several ways. Changing the left and right paragraph margins can produce different results with wordwrap. To override the automatic wordwrap algorithm you can press *return* to end a line and the paragraph, or press *shift return* to start a new line without beginning a new paragraph. Adjacent words can be connected by nonbreaking spaces (*option spacebar*) to force them to wrap together as a unit.

Lines of text are frequently aligned flush on the left boundary of the paragraph, allowing lines of text of variable length to form an uneven right end. This is called left-aligned text, corresponding to the first of the alignment icons in the right border of the document window just above the vertical scroll bar. All lines of text within a paragraph share the same alignment. There are four types of alignment:



1. *Left aligned:* ← (Described above.)
2. *Right aligned:* → This is the mirror image of left-aligned with alignment flush along the right end of the paragraph.
3. *Double aligned:* ↔ This is also referred to as full justification. The text is simultaneously aligned on both ends of the paragraph in newspaper style. Warning: (1) Hyphenation (see Edit/Hyphenate) becomes increasingly important with shorter lines. (2) Do not use this alignment and center tabs together.
4. *Center aligned:* ▲ All text on a line is automatically centered. Use this command to center titles on the page. Warning: The first line indent tab (rather than the left margin tab) forms the left boundary of the centering area and can produce an unexpected shift in the first line of the centered paragraph if the first line is set for an indent or outdent.

To change the paragraph alignment of existing text:

1. Select the paragraph by placing the insertion point within it. Use the customary selection techniques for multiple paragraphs.
2. Click on the appropriate alignment icon.

Paragraph attributes for each new paragraph, including alignment, are inherited from the immediately previous paragraph. You can also use the Edit/Copy Other, Style/Style 1, Style/Style 2, and Style/User Styles commands to transfer or to assign paragraph formatting.

Paragraph spacing and placement Paragraph spacing on the page (not to be confused with line spacing) affects visual appeal and readability. *MathWriter* provides a dialog box for paragraph attributes (Figure 3.10), which controls the placement of paragraphs.

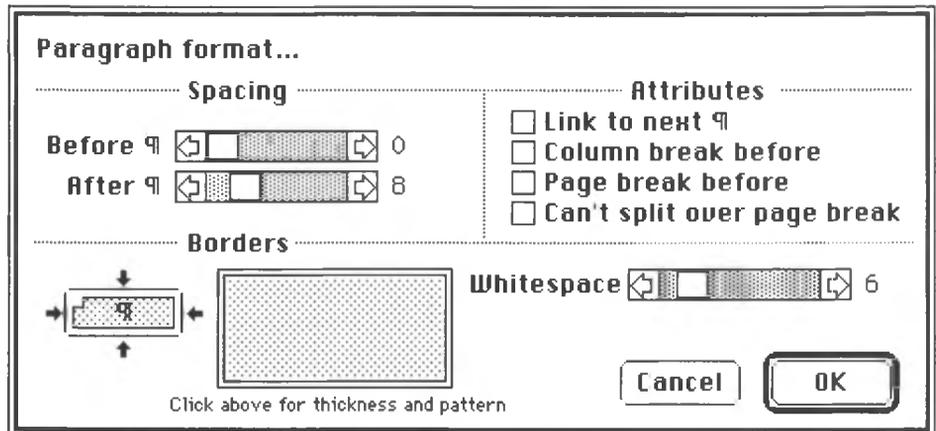


Figure 3.10 Paragraph format dialog box

Spacing between paragraphs: Using Format/Paragraph Format, you can specify the spacing before and after paragraphs in pixel units. Just as the first line indent eliminates extra keystrokes, this command also eliminates the empty paragraphs that you must otherwise place between paragraphs of text to produce whitespace. In addition to keystroke economy, this feature provides an easy way to globally change the spacing between paragraphs.

To adjust the spacing between paragraphs:

1. Select the paragraphs to be affected.
2. Select Format/Paragraph Format (or $\text{⌘} /$).
3. Drag the scroll box in the scroll bars to set the spacing.
4. Click OK.

Spacing paragraphs on the page: The placement of paragraphs with respect to the top and bottom of the page can affect readability. Several controls for this are available in *MathWriter*.

The menu commands that force a paragraph to appear at the top of a page or, in other words, to force a column or page break after the preceding paragraph are Format/Insert Column Break and Format/Insert Page Break. To use these, position the insertion point in the text and select the command from the menu. These commands insert nondisplayed, formatting characters, which you can locate using Format/Show Invisibles. Use Format/Hide Invisibles, which toggles with Show Invisibles, to remove them from the display. These markers remain associated with a particular paragraph even if further editing makes them inappropriate. To remove a paragraph command in such instances, move the insertion point to the

beginning (the top and leftmost position) of the **next** column or page and press *delete*.

Other page break controls: The selection Link to next ¶ causes the current and next paragraph to appear and print on the same page. To link multiple paragraphs, select all paragraphs except the last before using this command. If you want linked paragraphs to appear on the same page, *MathWriter* can move them to one page, provided they actually will fit on a single page. Use this feature to assure that a heading is not separated from the next paragraph by a page break.

The Page break before selection assures that the paragraph will appear at the top of the page. This command serves the same purpose as Insert Page Break on the Format menu, but it remains associated with the paragraph when the paragraph format is transferred using the Copy Other (Edit) command. Use this command when you want a paragraph to begin on the first line of a page. There is no icon that indicates a paragraph carries this attribute. If an unexpected gap appears at the bottom of a page during editing, check for this command by clicking in the paragraph and examining the Paragraph Format dialog box.

The Can't split over page break option assures that the entire paragraph is kept on the same page. If insufficient space remains on the page to display that entire paragraph, as with graphics, *MathWriter* moves the paragraph to the next page.

Paragraph Borders Use borders to highlight or emphasize paragraphs or groups of paragraphs. As you shall see in the next chapter, mathematical expressions are also paragraphs, so you can use borders to emphasize important results.

MathWriter provides many variations on a theme. For example, the box above was formed with a single, one-pixel-wide, solid line on each of the four sides of the paragraph, a two-pixel border, and a 1% gray scale background. In general, you can apply borders to any combination of sides, including a single border on the left or borders above and below a paragraph. To group several contiguous paragraphs with a single border, select them and enable the Treat paragraphs as a group option which then appears (Figure 3.10) below the whitespace scroll bar.

MathWriter places a border at the paragraph's extremities, but you can change the extremities of a paragraph using the left and right paragraph margins to obtain borders that do not extend the full width of the print area. You control the whitespace between the paragraph and the border, and between borders if two border lines are used. Numerous line thickness and line pattern choices are available. You have 38 choices or any gray scale shading (1-100%) for the background pattern.

To assign paragraph borders:

1. Select a paragraph. You need only place the insertion point within a paragraph to identify a paragraph because the command inherently applies to the whole paragraph. Drag the mouse or *shift click* to select multiple paragraphs that share a common ruler. Recall that a unique ruler icon identifies paragraphs that do not share the paragraph formatting of the immediately previous paragraph; you may need to use Format/Show Messages to see them.
2. Select Format/Paragraph Format (or \mathbb{J}) to access the dialog box.
3. Select which sides need borders. To select all sides simply click on the paragraph icon at the bottom-left corner of the dialog box. To select (or deselect) individual sides, click on the relevant icon border or the arrows as shown in Figure 3.10. A miniature portrait adjacent to the icon illustrates your choices.
4. Click in the space identified in Figure 3.10 by "Click above for thickness and pattern" to obtain another dialog box (see Figure 3.11).

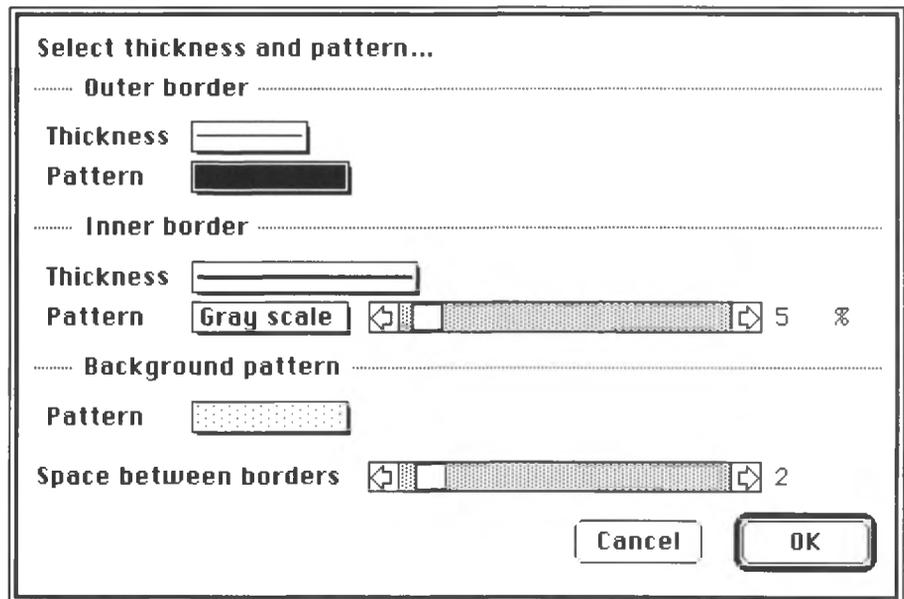


Figure 3.11 Paragraph borders line thickness and pattern dialog box

5. Assign border attributes and a background pattern. To assign these attributes, click in the area identified by "Click above for thickness and pattern," which will display your choices. Use the four pop-up menus to select line thickness and line pattern for the outer border and, if you elect to have one, an inner border. A solid black pattern is the default and a solid

white pattern hides the border. A hairline border can only be printed properly if you have a PostScript printer; it defaults to one pixel width on an ImageWriter. If you select "gray" in the bottom-right corner of the pattern palette, *MathWriter* supplies a scroll bar for you to set a percentage level. You can also assign a background pattern for the paragraph using a similar pop-up menu. If you elect to have two border lines, specify the spacing between the two lines here. For setting the space between the paragraph contents and the borders, see the previous discussion of Figure 3.10.

6. Click OK to accept the choices you just made, or click Cancel to abandon your changes in favor of previous settings. Either choice returns you to the Paragraph format dialog box. Make any final corrections there.

7. Click OK to accept the choices you just made in the two dialog boxes, or click Cancel to abandon your changes in favor of previous settings.

Line spacing Because *MathWriter* must adjust the line spacing when mathematical expressions of variable height are present, the line spacing options are more complicated and, therefore, are accessed from a dialog box (Figure 3.12) using Format/Line Spacing (or ⌘ K), rather than from the ruler.

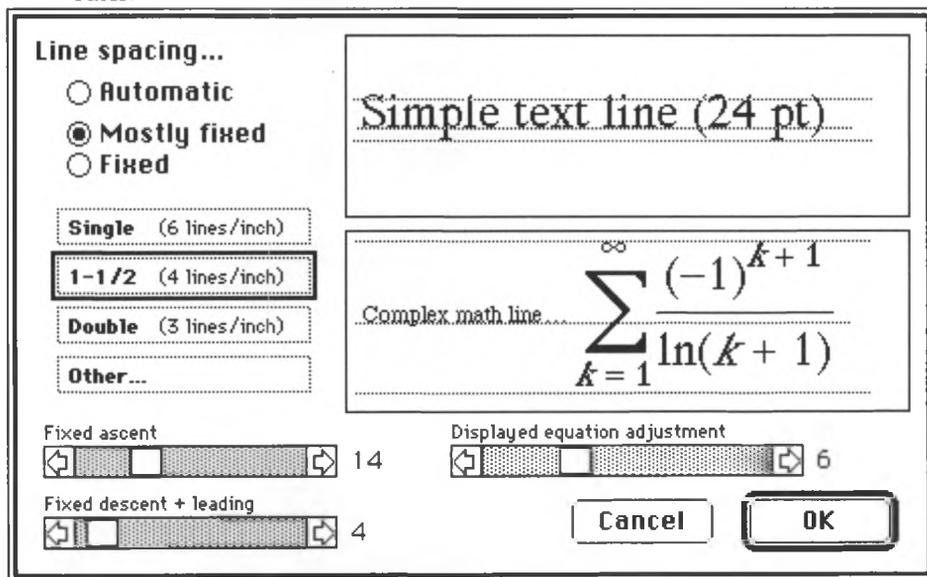


Figure 3.12 Line spacing dialog box

Our discussion of line spacing requires some definitions first (Figure 3.13). The baseline is the line on which the text rests. The ascent and descent are the distances above and below the

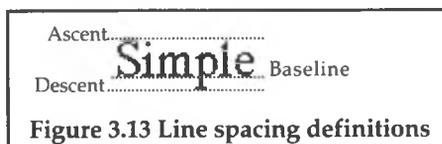


Figure 3.13 Line spacing definitions

baseline, respectively, which together determine the line height. Automatic spacing allows *MathWriter* to adjust line spacing to accommodate height variations in characters, graphics, and mathematical expressions. *MathWriter* uses the maximum of the ascents and descents on a line as the line ascent and descent, respectively. At the other extreme, Fixed spacing ascent and descent are set in the dialog box (Figure 3.12). This assures a constant line spacing even if some characters overlap in the output. Between these extremes is Mostly fixed, a combination of automatic and fixed. The text and mathematical expressions embedded within a line are treated as fixed, but expressions displayed on a separate line perhaps with an equation number are treated as automatic.

Line spacing varies with font size, of course. Furthermore, the line spacing provides space between lines for the ascenders and descenders of the individual characters. In contrast with ordinary word processors, *MathWriter's* Mostly fixed option allows inline expressions (i.e., expressions embedded within a line of text such as subscripts and superscripts) to protrude into the leading (pronounced "ledding") or white space between the lines. This avoids the unsightly fluctuation in line spacing ordinary word processors produce. Mostly fixed also allows you to assign whitespace around equations that occupy a separate display line and which are referred to as displayed equations.

Mostly fixed and Fixed both support the standard line spacings of single, 1-1/2, and double (6, 4, and 3 lines per inch, respectively). The Other spacing option allows you to specify separately the ascent and the descent plus leading.

Ordinarily, you compose your manuscript using automatic line spacing and then, if desired, reassign as either Mostly fixed or Fixed to achieve a uniform spacing throughout the paragraph or document.

To set line spacing:

1. Select the text.
2. Access the line spacing dialog box using Format/Line Spacing (or ⌘K).
3. Select one of the alternatives (Automatic, Mostly fixed, or Fixed) by clicking.
4. If you choose Mostly fixed or Fixed, select a standard spacing or assign a custom spacing (Other).
5. If you choose custom spacing, assign ascent and descent values using the scroll bars.
6. Finally, if you chose Mostly fixed, set the Displayed equation adjustment.

7. Click OK to accept your choices, or click Cancel to abandon your changes in favor of previous settings.

Character formatting

Having discussed document-level and paragraph-level formatting, we can now turn our attention to the third level of formatting—character formatting. Character formatting applies to individual characters and to any combination of characters in the document. Character formatting in *MathWriter* centers largely on the Style menu (Text Fonts, Text Sizes, and Text Styles) and alternative or shortcut ways to execute combinations of those commands.

Typeface: Fonts, Sizes, Styles Character formatting involves three main choices—font, size, and style. The first three menu commands on the Style menu present these options in submenus.

The Style menus for Text Fonts, Text Sizes, and Text Style use a ✓ to indicate that the checked item applies to the entire text selection, while • means that it is used in part of the range.

Fonts: A font is a family of characters having a similarity or family resemblance. You should be aware of three typeface categories. The first category deals with traditional categories typefaces fall into based on design characteristics. Those typefaces such as Times and Courier that contain fancy ends for the main strokes are called serif type and those without, such as Helvetica and Geneva are called sans serif type. A second classification of typeface is according to character spacing—proportional, such as Times and Helvetica, and nonproportional, such as Courier. The characters in a nonproportional font have a uniform width and are said to be monospaced. The third classification is one that arises from technology, and its significance is expected to diminish substantially with the release of the Macintosh System Version 7.0. The bitmapped screen displays in the past have been optimized for 72 dots per inch while the LaserWriter and other printer devices support 300 or more dots per inch. Smoothly scalable screen fonts will significantly improve the screen displays. The names of the built-in LaserWriter fonts are identified with underlines on the Text Fonts menu. If you press and hold *option* before and while you select the Text Fonts submenu, each font name appears in its particular typeface.

If you intend to print a document with a LaserWriter, we strongly recommend that you use laser fonts when writing the document. If you enable font substitution (using Page Setup on the Page Layout command of the File menu), printing may take longer, especially with mathematical expressions, and you may not like the modified spacing. So, although *MathWriter* supports the complete mixing of fonts (and font sizes and font styles) within a document we recommend restraint in the use of this capability.

Sizes: *MathWriter* supports the use of all font sizes, from 4 point through 128 point, with each font. A point corresponds closely with a pixel, which is 1/72 inch on the Macintosh screen. The sizes that appear most clearly on the screen and in ImageWriter output are listed in outline style letters in the menu.

Styles: *MathWriter* provides an extended set of styles to modify all characters from all fonts. Plain, Bold, Italic, Underline, Outline, and Shadow are the most widely used styles. Strikeout, Overbar, Box, Low underline, Underline pattern, Underline weight, and Gray scale are useful in writing technical documents. Certain other style listings, such as not applying the style attributes to space characters, reducing or expanding the space between characters, changing the case of words without retyping them, and providing a background pattern, are available. Background color and character color are supported but impose a substantial computational load on *MathWriter* with only modest benefit.

Assigning character formatting: In most instances you will select favorite font, size, and style before writing a document and will have quick access to them via your custom-made default files. A default file is a file to which the program automatically reverts unless you instruct it otherwise; thus *MathWriter* can automatically call up your favorite selections. When you click the cursor in existing text, *MathWriter* automatically ascertains the typeface of the character immediately preceding the insertion point and applies that combination of font, size, and style to the text you enter. Alternatively, you can assign a font, size, and style to the insertion point and have those attributes apply to text you enter. To change the typeface of existing text, you must first select the portion of text to be affected and then assign font, size, and style.

Specifically, the steps to take to change the format of existing text are:

1. Select the text (refer to text selection techniques above).
2. Select the attributes from the Style menu.

To insert text with the same typeface as surrounding text:

1. Position the insertion point using the mouse or arrow keys.
2. Enter text using the keyboard or using the mouse if text is from the Palettes menu or the Font Table. The font, font size, and font style of the entered text will be taken from context, i.e., will match the attributes of the text immediately to the left of the initial insertion point position.

To insert text with a different format:

1. Position the insertion point using the mouse or arrow keys.

2. Assign the desired font, size, and style to the insertion point.
3. Enter text using the keyboard or using the mouse if text is from the Palettes menu or the Font Table.

Using the Style menu The Style menu has a few unique features that merit a brief discussion. The font, size, and style choices are made with submenus. *MathWriter's* list of fonts must always include those fonts that are required by the operating system and, in addition, the Times and Symbol fonts. There are slight differences between the Symbol font as distributed by Apple and by Adobe that affect the stretchable brackets, parentheses, and braces. *MathWriter* has been tuned for the Adobe fonts, which are supplied on the distribution disk. In addition, the supplied version has been modified to allow boldface Greek letters to retain that attribute when printed with a LaserWriter. Use the Font/DA Mover³ to make these fonts available to *MathWriter*.

MathWriter supports all user-installed fonts⁴ that are compatible with the Macintosh system. In addition to commercial fonts, commercial utilities allow you to create your own specialized laser fonts. You should remove unneeded fonts to increase the RAM available to RAM-resident documents.

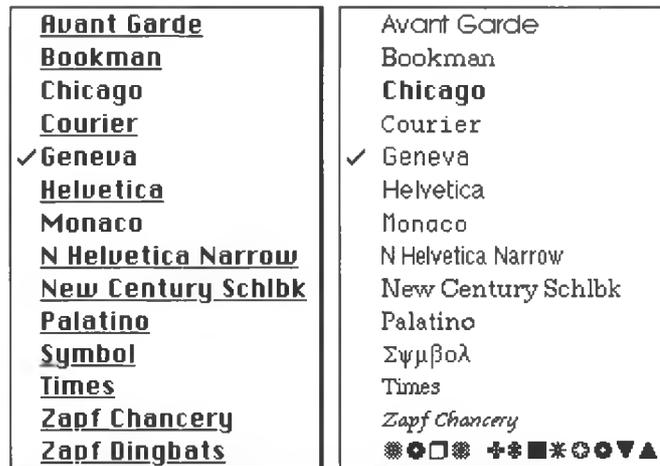


Figure 3.14 Text fonts submenu

The Text Fonts submenu: (Figure 3.14) To see the font names listed in their own fonts, press *option* before you drag the submenu. If only one font is included in a section of text you selected, a check mark appears adjacent to the font's name. If multiple fonts are included in a selection, a bullet appears next to the names of the fonts included in that selection.

³ or a utility such as Suitcase II

⁴ including Adobe Type Manager

If File Warnings on the File/Preferences... dialog box has been enabled, you will be warned if fonts used in the document are not available in your computer. This *MathWriter* feature is especially important for technical documents because the content may change as a result of an unintended, automatic font substitution. While the alphabetical characters have standard locations in a font, regardless of the font, this is not true for other special symbols. Because inadvertent font substitution is not simply a matter of style, *MathWriter* takes special steps to assure that the document has the same appearance and content on any Macintosh.⁵

The Text Sizes submenu: (Figure 3.15) Frequently used font sizes are listed on the Text Sizes submenu. Those sizes that have screen bitmaps available to the system are identified by outline style type. To use any size between 4 and 128 (inclusive) not on the list, click the Other command and supply the desired size. These generated sizes will appear ragged on the screen and on ImageWriter output, but will print smoothly on a PostScript device.

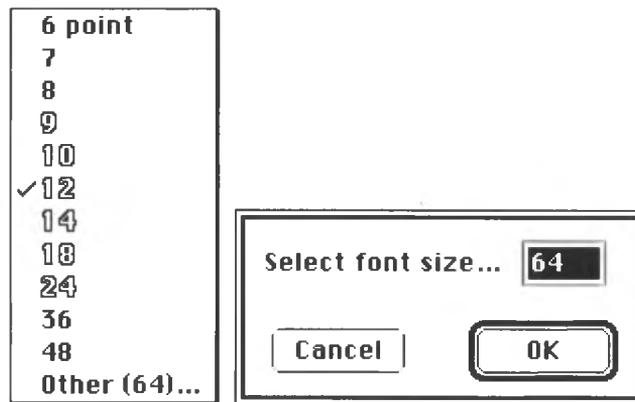


Figure 3.15 Text sizes submenu

The Text Style submenu: (Figure 3.16) Eight character styles are listed on the submenu; four of these can be selected by either mouse or keyboard. The remaining four require use of the mouse.

⁵Technical note: *MathWriter* stores in each document file a table of the local internal font identification numbers and the corresponding font names. When the document is opened with a different Macintosh, *MathWriter* uses the font names to match the fonts with the new local font identification numbers, thereby assuring unchanged content.



Figure 3.16 Text Style submenu

Style/Other Styles... (or ⌘ Y) activates a dialog box with additional choices (Figure 3.17). Except for Plain, any combination of the styles with check boxes beside them can be used simultaneously. Plain has the special characteristic of automatically overriding all other style attributes. If only one style attribute is represented in a selection, a check mark identifies that choice in the dialog box. If two or more attributes are included within the selection, a bullet appears next to the attributes included.

Certain styles are mutually exclusive choices. For example, you can change the displayed case of text to UPPERCASE, lowercase, or Cap. First without retyping the selection, but you can select only one of these alternatives at a time. When you deselect these styles, *MathWriter* restores the original case used when you entered the text. When exporting such text in TEXT format, the displayed, not the original case, is sent to the file.

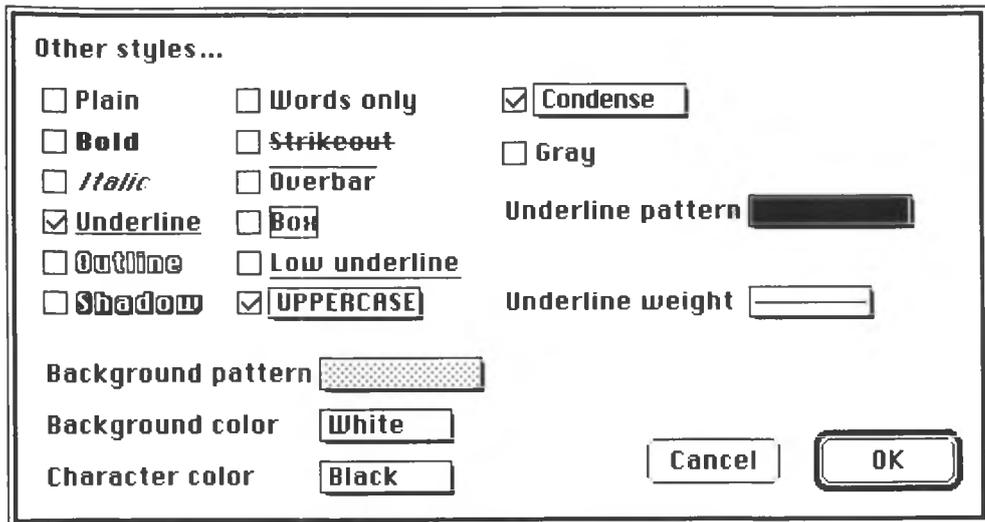


Figure 3.17 Other styles dialog box

Likewise, you may either Condense or Extend text to remove or to add pixels between characters. The mutually exclusive choices for Underline pattern and Underline weight can be applied if and only if at least one of the underline attributes has been chosen also.

The Underline and Low underline attributes can be used concurrently to obtain double underlines. Words only and Underline used together produce underlines for the words, but not the spaces between the words. Box and Strikeout are frequently used for revision tracking. Subscripts and superscripts are handled using the Tools window, and are not included here as a style.

MathWriter will reformat paragraph lines automatically if typeface changes require it. No hidden text style is included because that capability is handled more conveniently using hideable memos (See Format/Insert Memo). As mentioned previously, *MathWriter* supports color attributes for text and text background, but this slows the program considerably.

Using formatting shortcuts: Mathematical manuscripts make extensive use of typeface changes to convey information, especially in mathematical expressions. *MathWriter* supports technical typing by handling many typeface changes automatically and making manual changes more convenient. As discussed in the next chapter, automatic formatting is especially important when entering mathematical expressions. For example, when typing superscripts, the cursor changes position and the font size adjusts automatically. The typeface of the character located to the immediate left of the insertion point is described in the document status bar at the bottom right corner of the document window.

Greek font selection shortcut: Because the Greek alphabet is used frequently, there is a shortcut for toggling between it and your current font.

◆ Press $\text{\textcircled{A}}$ space bar to toggle to and from Greek.

The Greek letter assignments have a mnemonic relationship to the keyboard. Use the first letter of the name of the Greek letter (a for alpha, b for beta, etc.), except in four instances ($h \rightarrow \eta$, $j \rightarrow \varphi$, $y \rightarrow \psi$, and $w \rightarrow \omega$) to avoid ambiguity. To review the keyboard layout, use the Key Caps desk accessory on the Apple menu and select the Symbol font from the Key Caps menu that appears to the right of *MathWriter's* Windows menu. Alternatively, you can "type" the Greek letters from the Palettes Window (Windows menu) or the Font Table (Windows menu) if you have selected the Symbol font from its font pop-up menu.

Symbol font selection shortcuts: You can "type" all other characters in the Symbol font from the pull-down Palettes menu. (The Greek characters are a subset of the Symbol font.) As you drag across a symbol in the Palettes pull-down menu, its name appears on the last line of the menu. In contrast with entries made from the keyboard, the font choice for subsequently entered

text is not affected by this font change. Even more convenient access to repeatedly used characters from the Palettes pull-down menu is possible by assigning a row of the Palettes menu characters to the Palettes Window displayed using the Windows menu.

Assigning characters to the Palettes Window:

1. Select Windows / Palettes Window to display the floating Palettes Window.
2. Drag to select the name of a row of characters in the Palettes pull-down menu. Add other names as desired. Selected rows have a check mark to the left of the row name. Reselect a row to remove it from the Palettes Window.
3. Drag the Palettes window to a convenient location using the gray region below the window's close-box. If you are using two monitors, you can even drag the floating window to the second screen.

You can also enter any of these characters at the insertion point using the Font Table. In fact, the Font Table provides mouse access to every character available to the system.

Using the Font Table:

1. Select Font Table from the Windows menu.
2. If you are using two screens, you can drag the floating window to the second screen using its title bar, or,
3. If screen space is limited, adjust the size of the floating window using the grow box at the bottom-right corner of the window and use the horizontal and vertical scroll bars to bring the characters of interest into view. If you have reduced the font table size, you can use the zoom box at the top-right corner to expand the Font Table quickly to its original full size.
4. If the desired font is not currently displayed, place the cursor on the name of the current font and select the desired font from the pop-up menu.
5. Press on the desired character until it appears at the insertion point.
6. To remove the Font Table, click in its close-box or reselect Font Table Window from the Windows menu.

Changing font size:

1. Select the text.

2. Select Larger Size or Smaller Size from the Style menu or use the keyboard equivalents (⌘ plus or ⌘ minus using *plus* and *minus* on the top row of the keyboard, with or without the *shift* key). This command selects the next larger or smaller size on the Font Size menu. If you press the *option* key when using this command with the keyboard or mouse, the size changes by one point.

Changing font style: Eight popular styles are listed on the Text Style submenu; but numerous additional styles are available from the Other Styles submenu command. For more convenient access, the Other Styles (Figure 3.17) dialog box can be accessed directly using ⌘ Y . The usual list has been expanded to provide revision tracking styles and other special purpose styles.

Changing combinations of attributes: Often you need to change several attributes simultaneously. *MathWriter* provides quick access (using ⌘ < and ⌘ >) to combinations of font, size, style, line justification and line spacing (called Style 1 and Style 2) and another command to restore the Last Style (or ⌘ \). In the next chapter you will be introduced to "User Styles," which perform an analogous role but also remain linked to the text such that a change in the definition at any time changes all the text throughout the document having this user-style.

Using Style 1 and Style 2:

1. Select Doc Preferences... on the File menu. These are document specific definitions. To use the same definitions in other documents you will find it convenient to define template documents using MW Default File Type using Save As... on the File menu.
2. Click either the Style 1 or Style 2 button (see Figure 3.18).

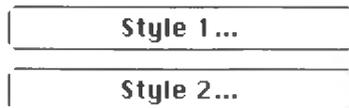


Figure 3.18 Style buttons on Doc Preferences dialog box

3. Assign the attribute combinations (Figure 3.19) that you desire.

Only the categories with check boxes selected will be applied when this style combination is selected. Make font, size, and line justification choices using pop-up menus. The style and line spacing choices lead to other dialog boxes. Your choices are illustrated in the window.

4. To abandon your choices, click Cancel. To accept your choices, click OK.
5. If desired, assign Style 2.
6. Click OK to close the Doc Preferences dialog box.

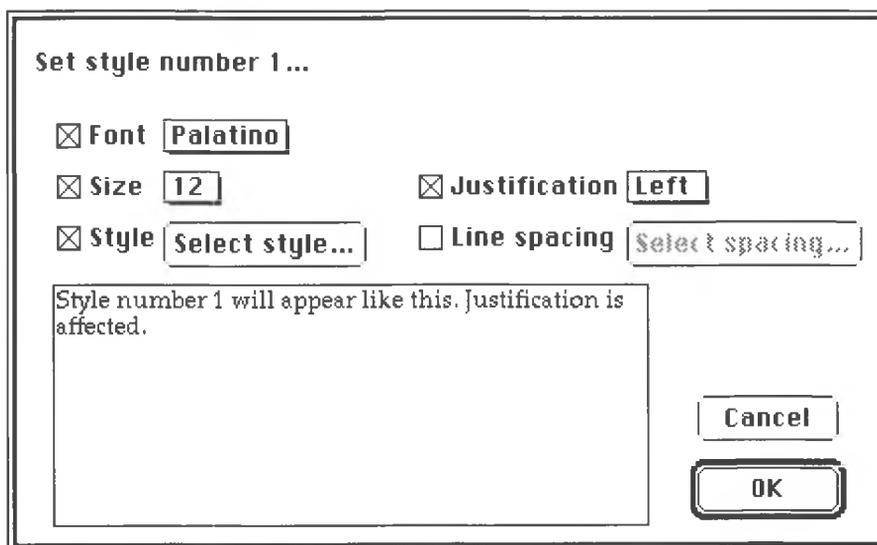


Figure 3.19 Style dialog box

To use *Style 1* or *Style 2* to apply a style combination to existing text:

1. Select the text.
2. Press \mathscr{K} < or \mathscr{K} > for *Style 1* or *Style 2*, respectively

To resume use of the immediately previous style:

Press \mathscr{K} \ or select Last Style.

Editing

We now supplement our earlier discussion of elementary editing techniques to include additional cut and paste operations, find and replace, hyphenation, and spell-checking. A brief discussion of editing automatically formatted tables is included in this chapter, but we defer a discussion of *MathWriter's* extensive, mathematical expression editing features until the next chapter.

Moving text

The ease with which you can rearrange and perfect the contents of a document is probably the most compelling reason for replacing a typewriter with a word processor. *MathWriter* supports the Macintosh metaphor for cutting and copying text onto a Clipboard, a temporary holding area, for subsequent pasting (transfer) to another location within the document, or even into another application. You can, for example, create a picture in one application and paste it into *MathWriter* via the Clipboard. In addition, you can read certain standard file types directly without activating the generating application.

To transfer text and graphics treated as characters:

1. Select the text (and graphics) by mouse or by keyboard. (The Cut, Copy, and Clear commands remain dimmed until you select text.)
2. Use Edit/Copy (or ⌘C) if you want to transfer a duplicate of the selected text onto the Clipboard and *leave* the original intact. Another option is to Edit/Cut (or ⌘X) to transfer the selected text onto the Clipboard and *remove* the original selection.
3. Optional: To examine the contents of the Clipboard, select Windows / Clipboard. Reselect it to hide the Clipboard.
4. Using the mouse or keyboard, position the insertion point where you want the Clipboard material placed.
5. Use Edit/Paste (or ⌘V) to transfer an exact copy of the Clipboard contents into the active document at the insertion point. If you want a copy of the Clipboard contents to assume the typeface (font, size, style) of the character to the immediate left of the insertion point rather than retain its original typeface, use Edit/Paste Other/Paste in Context (or ⌘ shift V).

The Clipboard remains unaltered when you paste, when you switch among applications, or even when you shut down the program. It can be pasted repeatedly. The name of the Paste command changes to reflect the current contents of the Clipboard. If the Clipboard contains text (or mathematics treated as text), it reads Paste Text. If the Clipboard contains a mathematical expression stored in PICT format, which can be transformed back into an editable expression, it reads Paste Math. If the Clipboard contains a picture, the paste command reads Paste Picture.

6. Use Edit/Undo (or ⌘Z) to reverse the immediately preceding operation. Undo applies to most operations, not just to editing procedures.

The Edit/Clear command removes selected text, but does not place a copy on the Clipboard. If you must delete large text selections, use Clear, rather than Cut, to minimize temporary storage demands.

To immediately scroll to the location of the insertion point during an editing operation, use Edit/Show Selection.

The Cut/Copy/Paste operations apply to mathematical expressions if the transfer remains within *MathWriter* documents. Because other word processors do not support the enhanced data structure of *MathWriter* for editable mathematical expressions, you must instruct *MathWriter* to transform such expressions into PICT graphics form when placed on the Clipboard if you intend to subsequently paste the expression into the more limited formats. To do this use Edit/Copy Other/Copy as Picture, not the usual Copy command. See Figure 3.20.

You can replace text (delete old text, insert new) during a paste operation if the text to be replaced is selected before the paste operation is executed. To do this:

1. Place text on the Clipboard as previously described.
2. Select the text to be replaced using the mouse or keyboard.
3. Use Edit/Paste to replace the selection with the Clipboard contents.

In addition to the more advanced techniques for assuring format uniformity such as Styles 1 and 2 on the Style menu, *Math Writer* supports an extended copy feature, Edit/Copy Other, for this purpose (Figure 3.20).

Copy Ruler	⌘⇧R
Copy Format	⌘⇧F
Copy Ruler & Format	⌘⇧A
Copy Style	⌘⇧S
Copy Memo	⌘⇧M
Copy As Picture	⌘⇧C

Figure 3.20 Copy Other menu

Paragraph formatting is stored in two parts—in the ruler and in all the other paragraph attributes—and can be copied separately or together. The ruler stores the paragraph unit of measure, paragraph margins, all tab settings, and paragraph line alignment; in brief, that is the displayed information that is hidden by Format/Hide Ruler (⌘ shift R). Copy Format (⌘ shift F) saves all other paragraph formatting information, such as spacing before and after paragraphs, borders, and such attributes as the ways paragraphs are linked, etc. (See Format/Paragraph Format.) Both types of information can be copied at the same time using Copy Ruler and Format (⌘ shift A). Recall that when you press *return* to create a new paragraph, the new paragraph assumes the format of the preceding paragraph unless you change it. You do not need to use the Copy Other commands as often.

To transfer paragraph formatting, the steps are:

1. Identify the originating paragraph by clicking the cursor anywhere within it; you need not highlight the paragraph.
2. Use the appropriate Edit/Copy Other command (either Copy Ruler, Copy Format, or Copy Ruler and Format) by mouse or keyboard.
3. Click inside the destination paragraph to select it. You can also select several contiguous destination paragraphs.
4. Use the companion Edit/Paste Other command (either Paste Ruler, Paste Format, or Paste Ruler and Format) by mouse or keyboard.

5. Repeat steps 3 and 4 as often as needed.

Ordinary copy and paste commands can be intermixed with paragraph copy and paste commands without disturbing the paragraph formatting information.

You can transfer character formatting (font, size, and style, but without the actual character) from one character to others you have selected. Use of this command is analogous to use of the paragraph command, although you will usually wish to select several contiguous destination characters at once. The steps are:

1. Place the insertion point to the immediate right of a character having the typeface (font, size, style) you wish to transfer.
2. Use Edit/Copy Other/Copy Style (or \mathbb{X} shift S) to make a copy of the character formatting information.
3. Select the text that is to be assigned this typeface.
4. Use Edit/Paste Other/Paste Style (or \mathbb{X} shift D) to transfer the character formatting.

The Copy Other commands use a mnemonic letter for ruler (R), format (F), all (A), and style (S); the Paste Other commands use an adjacent letter on the keyboard that is to the right of the corresponding copy letter, except for A whose neighbor (S) is already used.

The Clipboard is the temporary storage (buffer) for material being copied from your document of another application or file and pasted into your document. During a complicated set of manipulations it may be useful to examine its contents:

- ◆ Select Windows/Clipboard to display the floating Clipboard window.

No editing can be performed directly in this window—it is a display only. It does respond to other window controls. It has a title bar with which you can reposition the window, a zoom box to toggle the size of the window, a grow box to change the width and height of the window, a status display bar just below the title bar that allows you to choose which type of Clipboard contents to display, and a close-box.

- ◆ Click the close-box on the Clipboard window or reselect Clipboard on the Windows menu to hide the Clipboard.

To use the Scrapbook:

Unlike the Clipboard, the Scrapbook is a permanent, online storage location for text, graphics, and mathematical expressions. Individually selected items can be stored here for recovery and use by any standard

Macintosh application. The actual file is stored in the System folder with the name Scrapbook File. Only one Scrapbook file⁶ can be stored there.

To place material in the Scrapbook:

1. Select and copy material to the Clipboard.
2. Select the Scrapbook from the Apple menu.
3. Use the Scrapbook scroll bar to select an entry, which the new entry will precede.
4. Use Edit/Paste to transfer a copy of the Clipboard to the Scrapbook.
5. Optional: Close the Scrapbook or make another window the active window by clicking in it or selecting it from the Windows menu.

The lasso paint tool allows extraneous whitespace to be trimmed from graphics stored in the Scrapbook, thereby avoiding the need for cropping.

To recover material from the Scrapbook:

1. Select the Scrapbook from the Apple menu.
2. Use the Scrapbook scroll bar to select an entry.
3. Use Edit/Copy to transfer an item to the Clipboard. Use Cut or Clear to remove an item from the Scrapbook.
4. Use the customary paste procedure to transfer the item from the Clipboard into the document at the location of the insertion point.

If you wish to create multiple scrapbooks, you can assign a new name to the Scrapbook file in the System folder and the system creates a new file having the name "Scrapbook File". To recover material from the renamed file, you must assign a new name to the current scrapbook file and rename the older file with the reserved name "Scrapbook File". A commercially available utility⁶ provides a more elegant approach to this process.

The Find and Replace commands

MathWriter's find and replace commands allow you to locate and change text and mathematical expressions in a document. For example, you might locate a particular string of characters embedded somewhere in a document that you wish to examine or modify. Optionally, you can use these commands to replace a string with another string or replace all such located

⁶ SmartScrap allows multiple named scrapbooks to be used.

strings automatically. You can qualify a search by looking for only uppercase letters or only whole words rather than embedded strings. Numerous and powerful extensions to these traditional search and replace features are reviewed in the next chapter.

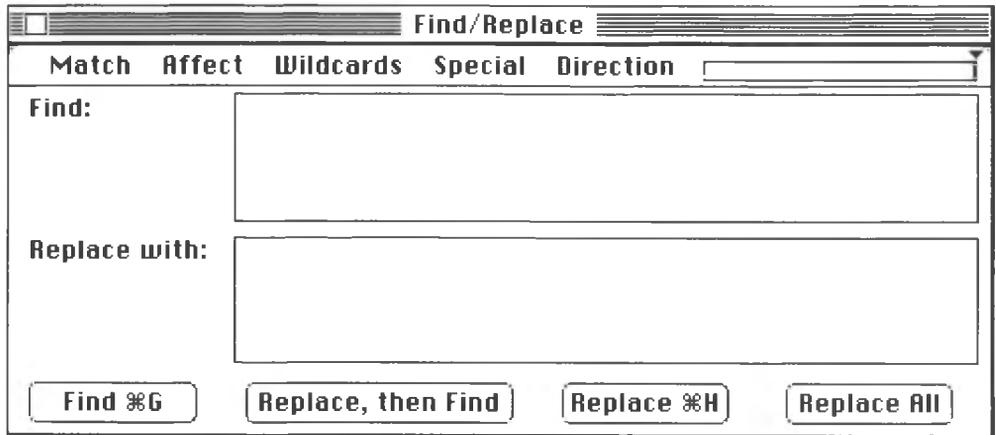


Figure 3.21 Find/Replace dialog box

To find text (and to navigate through a document):

1. Place the insertion point in the document at the starting point of the search.
2. Open the Find/Replace dialog box (Figure 3.21) using Edit/Find/Replace (or ⌘ F).
3. Supply the text to be found in the upper box where the insertion point is flashing. The search will be for the characters you typed in the upper box and will proceed from the insertion point until a match is found or the end of the document is reached, whichever comes first.
4. Use Edit/Find Next, Find in the Find/Replace window, or type ⌘ G or *return* to initiate the search. The search can be directed by mouse from the dialog box or by keyboard if you pressed *return* to remove the dialog box and initiate the search. The latter has the advantage of a larger document word area and not requiring you to switch repeatedly between the dialog box and the document, as the active window, when making changes.
5. *MathWriter* continues to find matches as you use Edit/Find Next or press ⌘ G until the search reaches the end of the document.
6. To modify the document when using a mouse-directed search, you must make the document the active window by clicking in it or by clicking in the close-box of the Find/Replace dialog box.

In addition to locating text, this feature also allows you to replace the located text:

1. Perform steps 1 – 3 above.
2. Supply replacement text in the lower box of the Find/Replace dialog box.
3. Use Edit/Find Next, Find in the Find/Replace window, or type ⌘ G or *return* to initiate the search.
4. Once a match has been found, four options are available:
 - By keyboard: Alternate between ⌘ H (Replace Selection) and ⌘ G (Find Next) to sequentially find and make changes.
 - By mouse: a) Alternate between Replace and Find to sequentially find and make changes; b) Repeatedly use Replace, then Find to reduce the number of keystrokes needed to individually approve each substitution; c) Use Replace All.

Warning Replace All *cannot* be undone so make a precautionary backup before using this command.

You can paste ordinary text into the Find/Replace dialog box, but not mathematical expressions, although they can be typed directly into the oversized boxes.

5. Until the end of the document has been reached, you can repeatedly find matches using Edit/Find Next (or ⌘ G).
6. Click in the close-box to close the dialog box.

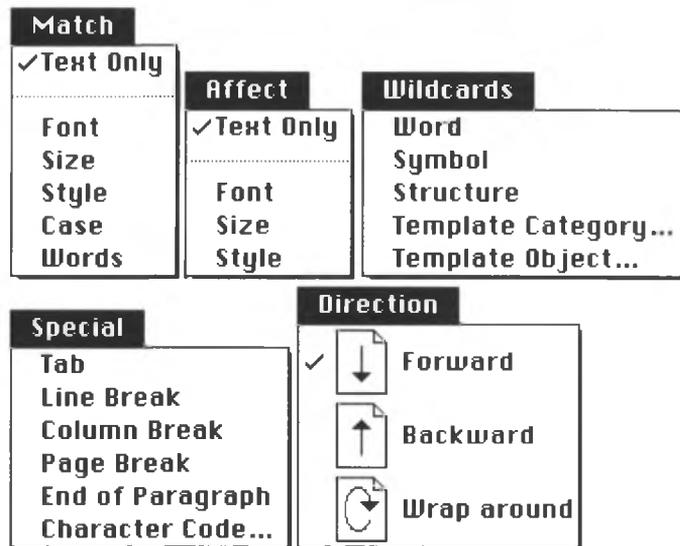


Figure 3.22 Find/Replace pop-up menus

The primary search categories on the Find/Replace dialog box (Figure 3.21) are Match and Affect (Figure 3.22), whose pop-up menus determine whether you are searching and replacing text or style attributes of the text as well.

The five pull-down menus allow you to customize searches (Figure 3.22).

- The Match menu identifies attributes of text in the find box that need to be matched in the search. These attributes, font, size, style, case, or whole words, are in addition to matches with the actual characters typed. A case match requires that each character match the corresponding case (upper or lower) as the text in the find box. A whole word match excludes matches on portions of words.
- The Affect menu identifies attributes of text in the Replace with: box to be applied to the replacement string. These attributes, font, size, and style, are applied to the replaced text, regardless of the attributes of the surrounding text.
- The Word and Symbol selections on the Wildcards menu allow you to find matches on a character string when a leading or trailing string of characters (Word) is immaterial or when an individual character (Symbol) is immaterial. For example, use the Word option “run **word**” to find “run” and “running”, or any word that begins with “run”. Use the Symbol option “ca **?**” to find “cat” and “car”. **?** represents exactly one character. The remaining three options apply to mathematical expressions and are discussed in Chapter 4.

- The Special menu allows you to locate (and replace) the invisible formatting characters—tabs, line breaks, column breaks, page breaks, or any character you identify by its ASCII number. Use the mouse to “type” these characters in the Find/Replace dialog box from the pull-down menu. See the appendix for an ASCII list. The most common use of the Character Code option is to clean up imported files.
- The Direction menu controls the search direction and range. With the arrows you can search forward from the position of the blinking insertion point or backward to the end of the document (only), or search the entire document.

The preceding exercise illustrated a text search, the conventional use of Find/Replace. To change a specified text string *and* typeface combination to another text string *and* typeface combination, follow these steps:

1. Select the match style combination (Figure 3.23) in the Match pull-down menu and supply the search text string in the Find: box (Figure 3.21) and assign the selected style attributes.

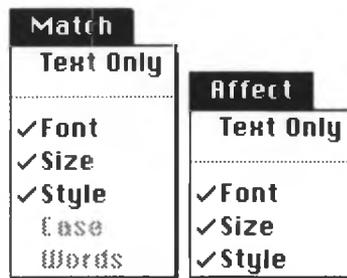


Figure 3.23 Match and Affect attributes

2. Select the replacement string style combination (Figure 3.23) in the Affect pull-down menu and supply the replacement text string in the Replace with: box (Figure 3.21) with the selected style attributes assigned.
3. Perform the search and replace as described above for ordinary text replacement. However, in this search, the selected attributes will not be taken from the context.

Spell-checking

MathWriter can compare each word in your document with a vocabulary list and identify the words that are not found in the vocabulary list. You create a supplementary list of words using the User Dictionary. You can add new words to the supplementary list or remove unwanted words. If you wish, *MathWriter* presents a list of alternative spellings for words not found in the dictionary. Words in uppercase often are acronyms and can be excluded from the suspect list automatically. Repeated words can also be flagged and removed with *MathWriter*.

The word lists Because the system files and *MathWriter* each nearly fill a disk, spell-checking is practical only if you are using a hard disk. The word lists, also called dictionaries, must be accessible to *MathWriter*. If the word lists are placed in the System folder or in the same folder as *MathWriter*, the program automatically locates the main *MathWriter* dictionary and the supplementary dictionary at startup. Otherwise, to locate them and access a dialog box, you must use the two buttons Main Dictionary and User Dictionary on the Check Spelling dialog box. Only one user dictionary can be active, but you can manually switch to other word lists.

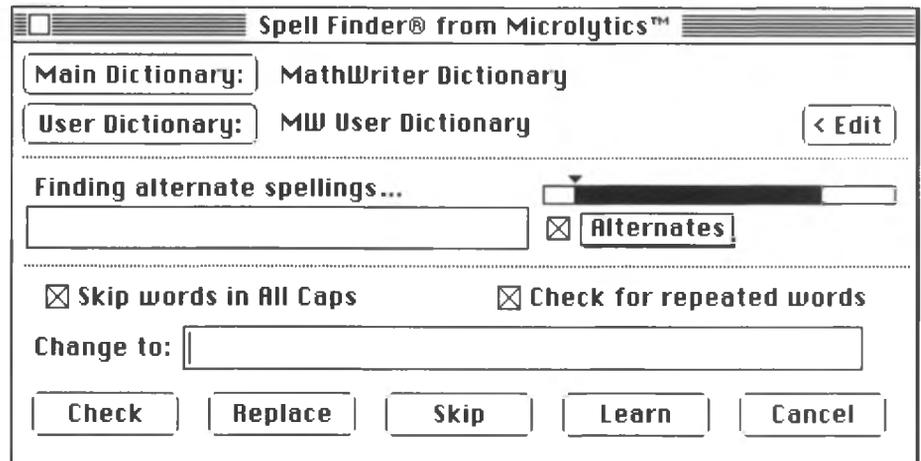


Figure 3.24 Spell-checking dialog box

Spell-checking your documents To find and correct misspelled words, follow these steps:

1. Position the insertion point in the document where checking is to begin.
2. Select Edit/Check Spelling to access the spell-checking dialog box (Figure 3.24).
3. If the names of the main dictionary and the user dictionary do not appear in the dialog box adjacent to the Main Dictionary and User Dictionary buttons, click on those buttons to locate them.

MathWriter locates them automatically at startup if they are in the folder with *MathWriter* or in the system folder. The path to these files is stored in the Prefs file so this process need not be repeated.

4. Click in the check boxes to select which of the following options you prefer:

- Alternatives. If the suspect word shown in the "Status" box is either misspelled or not in the dictionary, *MathWriter* can provide an optional pop-up list of alternatives.

If feasible, *MathWriter* places a “bestguess” alternative in the Change to: box; otherwise, it places the *suspect word* there. If *MathWriter* finds other alternatives, the list appears in the pop-up menu. When you select an entry from the pop-up menu, *MathWriter* transfers the word to the Change to: box.

When you recognize that the suspect word is correct, you can terminate the search for alternatives prematurely by pressing ⌘ *period* or by clicking the mouse. If the desired word is not located, type it in the Change to: box.

- Skip words in All Caps. This option excludes acronyms.
- Click on Check for repeated words to locate contiguous, repeated words. This option locates and removes duplicate words. When contiguous, repeated words such as “very very” are found, the dialog reports “Status: Repeated word.” Click on Replace to remove the word and an adjacent space or on Check to resume checking without making a change.

5. Click on Check to begin checking. The progression of the search  is reported just above the Alternates pop-up menu. The triangle ▼ indicates the relative position of the start of checking.

When a suspect word is found, you have three options:

- Supply the correctly spelled word in the Change to: box if it is not already provided by the Alternatives option and click Replace.
 - Click on Skip to bypass the word, leaving it unchanged.
 - Click on Learn to add the word to the user dictionary, thereby avoiding manual verification of this word in future sessions.
6. Optional: Click on <Edit to review the list of words in the active user dictionary and to remove any that you wish to exclude. (See Figure 3.25 for a view of the Edit User Dictionary dialog box.)
- To remove a word, select it and press Delete Word.

7. When the spell-checker reaches the end of the document, it asks you whether it should continue checking from the beginning of the document. Click on Stop Checking to terminate the search or Continue Checking to resume checking.

8. Click on Cancel to terminate checking.

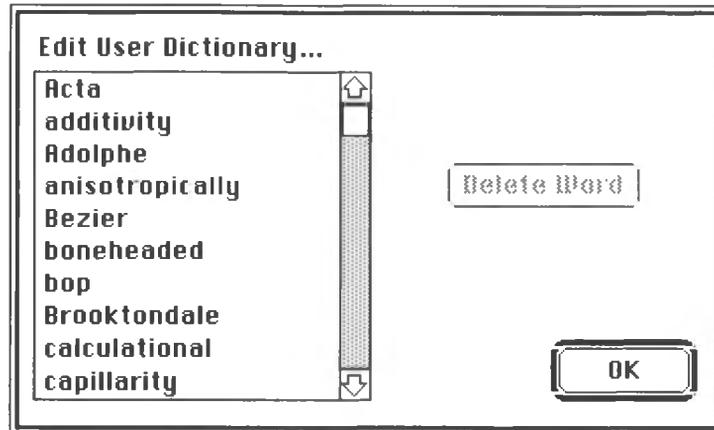


Figure 3.25 Edit User Dictionary

Caution: Always read your document carefully. Spell-checking does not assure that you have used words correctly.

Printing

This section describes the final step in producing a document—printing. *MathWriter* supports output to the ImageWriter and the LaserWriter with the customary options for multiple copies, range of pages, etc. Enhancements allow you to select page ranges based on the page variable numbers; print markers for ruler changes; collate multiple copies; print on both sides of the paper; and print pages in normal or reverse order.

Installing the print driver

Consult your Macintosh user's guide for hardware installation instructions and placement of the appropriate print drivers in the System folder.

Although you can change printers at any time, we recommend selecting the printer type before you create the document because page sizes, margins, and placement of some mathematical expressions are affected by the printer choice.

To route output to a particular printer:

1. Select Chooser from the Apple menu.
2. Click on the icon of the desired printer type (Figure 3.26).
3. Select a specific printer:

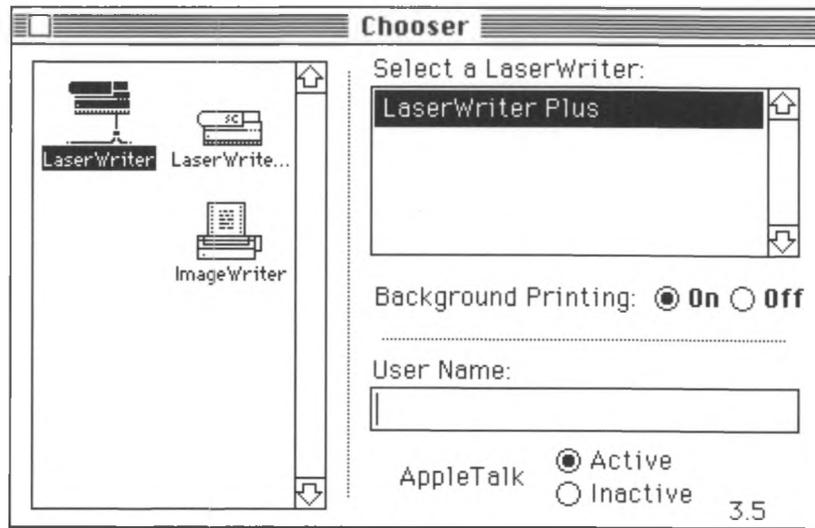


Figure 3.26 Chooser dialog box

ImageWriter To print with an ImageWriter, you must specify a specific printer port by clicking on the icon that corresponds to the printer connection on the back of your Macintosh. Supply your user name if you wish. Click on the close-box.

LaserWriter To print with a LaserWriter you must click on the name of a particular “online” LaserWriter. Only the names of active printers available on your AppleTalk network appear in the list. If the Print Monitor is present in the System folder, you can select background printing, which means that the file will be printed to disk and then sent to the printer, freeing your Macintosh for other tasks.⁷ Supply your user name if you intend to print an identifying cover page. Click on the close-box.

In general, you should have decided the type of printer before creating your document because this decision can affect your choice of fonts, and, therefore, can alter the page layout. If your document layout is critical, explicitly make your own font selections rather than using the “Font Substitution” option under Page Setup on the File/Page Layout menu. Select the “Tall Adjusted” option for proper ImageWriter output of mathematical expressions. Other factors such as paper size are dependent on printer choice, too. (In mathematical expressions the choice of printer affects the horizontal placement of superscripts.)

⁷ The current version of a public domain virus program interferes with background printing.

Selecting a document

The document you want to print must be in the active window.

To select a document, open it, if necessary, using the File/Open command. The document opens at the location of the insertion point when last saved. To have the document open at a specific page, position the insertion point on that page before you save the file.

If the document is open but not in the front window, either click in a portion of the document window or select its name from the Windows menu to bring it to the front.

Using the print dialog boxes

The File/Print command activates a dialog box with the output options, which are different for the ImageWriter and LaserWriter. See Figures 3.27 and 3.28 for a glimpse of these two dialog boxes. Note that you may use the mouse or the *tab* key to move among the input boxes.

ImageWriter v2.7

Quality: Best **Faster** Draft

Page Range: All From: To:

Copies:

Paper Feed: Automatic Hand Feed

Page Range Refers To Page Variable Numbers

Print Markers For:

Memos Ruler Changes Revisions

Print Multiple Copies: Uncollated Collated

Print Both Sides Reverse order

OK Cancel

Figure 3.27 ImageWriter Print dialog box

The ImageWriter-specific options are:

- **Quality:** These options let you balance speed and print quality. “Best” is the slowest option and uses the highest density of dots. “Faster” preserves the font and style information but speeds up delivery. “Draft” is the fastest, but does not preserve the character formatting information.
- **Paper Feed:** Use “Automatic” for fanfold, tractor-fed paper and “Hand Feed” for individual sheets of paper.

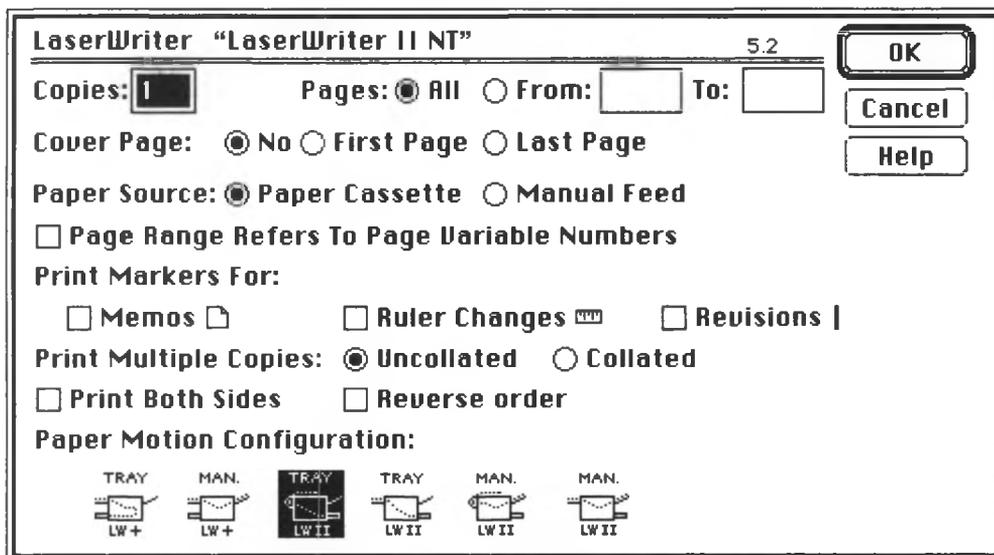


Figure 3.28 LaserWriter controls

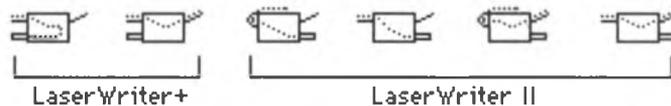
The options common to ImageWriters and LaserWriters are:

- **Page Range:** Use "All," the default, to print the entire document, regardless of the number of pages. Otherwise, supply the beginning and ending page numbers in the "From:" and "To:" boxes; leave the "To:" box blank to print to the end of the document. You can use either the physical page numbers, which correspond to the scroll box in the vertical scroll bar, or page numbers as they appear in the header or footer, in which case you would click on "Page Range Refers To Page Variable Numbers." These numbers will be the same, of course, unless you supply a starting page number (Format/Variables Format) different from "1," which you might do if the current file were a continuation of a previous file. To print a single page, assign the same page number to the "From:" and "To:" boxes.
- **Copies:** Type the number of copies you wish to print here.
- **Page Range Refers To Page Variable Numbers:** See Page Range above.
- **Print Markers For:** This command prints the locating tags for ruler changes. Use Format/Show Messages to display these markers in the left margin on the screen. Paragraph format changes are identified by "unique rulers."
- **Print Multiple Copies:** This command lets you control the order of printing. "Uncollated" is faster and prints all copies of a particular page before moving to the next page. "Collated" prints all pages of a document before beginning another copy of a document.

- **Print Both Sides:** This command prints the odd and even pages separately and provides instructions for changing the paper. For a LaserWriter you must identify the paper motion configuration discussed below.
- **Reverse Order:** This command automatically adjusts the printing order. If Reverse is not checked, the pages print in normal reading order. For a LaserWriter you must identify the paper motion configuration discussed in the next list in order for this feature to work.

The LaserWriter-specific options are:

- **Cover Page:** Use this option to identify your output when you are sharing a LaserWriter with others. This identifying page can precede or follow your document.
- **Paper Source:** The LaserWriter can automatically feed sheets of paper from a paper cassette (tray) or receive hand supplied sheets. If you choose manual feed, you will be prompted by a screen message to insert the pages.
- **Paper Motion Configuration:** The path of the paper through the LaserWriter depends on the model and paper source. Click on one of the icons to select the printer type.



Other printing options

For additional printing options refer to the discussion earlier in this chapter about the Page Setup dialog box available via the File/Page Layout command. (See Figure 3.29 and Figure 3.30) Tall adjusted, 50% reduction, and no gaps between pages are available for ImageWriters. Options for the LaserWriter include reducing and enlarging the page image, font substitution, text and graphics smoothing, faster bitmap printing, fractional widths, flip horizontal, flip vertical, invert image, precision bitmap alignment, larger print area, and unlimited downloadable fonts in a document.

Selecting Tall Adjusted is necessary when using the ImageWriter for the output to look like the screen.

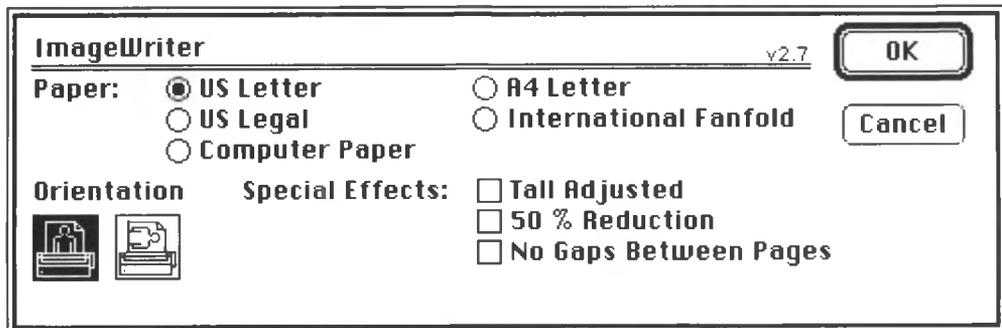


Figure 3.29 ImageWriter Page Setup dialog box

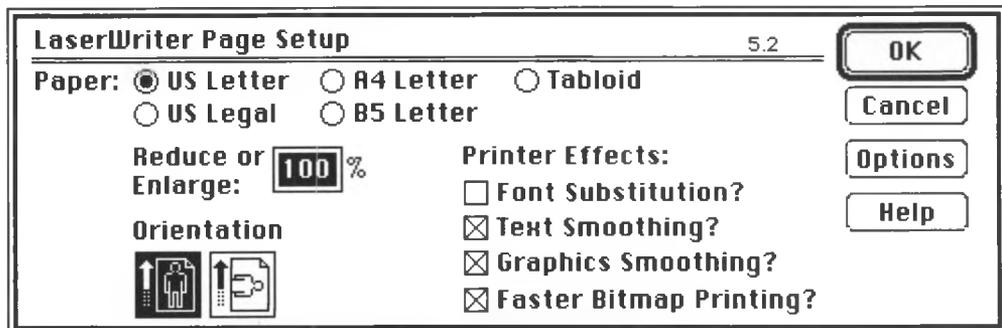


Figure 3.30 LaserWriter Page Setup dialog box

Printing at the Finder level

You can select and print multiple files from the Finder level, as well as with the Print Monitor under MultiFinder as follows:

1. Use the usual selection techniques to select the icons of one or more files from a folder.
2. Choose Print from the File menu to initiate printing.

Summary

In this chapter you have examined the techniques used to create, edit, format, and print a nontechnical document. Most steps can be performed by mouse and by keyboard. *MathWriter* provides immediate visual feedback throughout—from defining the page characteristics and creating fully formatted “sheets of paper” with automatic pagination to typing special characters and designating the type of LaserWriter you’re using.

The next chapter covers the features required for more specialized applications, including *MathWriter’s* unique capability for creating, editing, and numbering mathematical expressions in a document.

4 Technical Writing

The techniques for creating, editing, formatting, and printing general, non-technical documents are described in the previous chapter. In this chapter we extend that discussion to include techniques for enhanced document layout, such as creating headers, footnotes, and advanced typing aids, such as the font table. Our primary focus, however, is the presentation of tools and techniques for composing a mathematics-laden document at the keyboard.

Mathematical expressions contain a larger assortment of fonts, font sizes, font styles, and special characters, as well as more frequent changes in these attributes than is typical of ordinary writing. Furthermore, the special positioning of these characters produces a two-dimensional, rather than a one-dimensional, stream of characters governed by an extensive set of formatting conventions. To the extent feasible, *MathWriter* handles these formatting tasks for you.

The chapter closes with a discussion of customization to reduce repetitive setup tasks, sharing data among applications, and an important modularization technique for extending the scope of tasks handled by *MathWriter*.

Formatting Revisited

A few general formatting techniques not covered in Chapter 3 will be reviewed here.

Document formatting

Ruler options

Because mathematical expressions usually require more vertical space than a line of ordinary text, the vertical dimension of the screen becomes an important issue. Hiding the ruler provides a larger work space.

◆ To hide the ruler, select Format/Hide Ruler to remove the tab setting scale across the top of the document window.

The tab wells and paragraph alignment icons displayed above the vertical scroll bar are also removed at the same time. Hiding the ruler is also useful when you use *MathWriter* for a video presentation of "slides." In the previous chapter we discussed the techniques for rapid, top-of-the-page scrolling.

- ◆ To show the ruler, Select Format/Show Ruler (or \mathfrak{R} `) to display the ruler.
- ◆ To change the unit of measure, drag to select inches, centimeters, or points on the Ruler Options command of the Format menu.

The abbreviations for these units in the File/Page Layout dialog (Figure 4.1) are: in, cm, pt (without a period). Recall that the ruler has an intentional and convenient "coarseness" (for matching tab settings at one-sixteenth inch increments) that you can override by pressing *option* while dragging a tab.

The zero point of the ruler can correspond to either the actual left boundary of the page or to the left edge of the text area.

- ◆ To change the horizontal position of the ruler, drag to select Format/Ruler Options/Page Ruler or Format/Ruler Options/Column Ruler to toggle to the other.

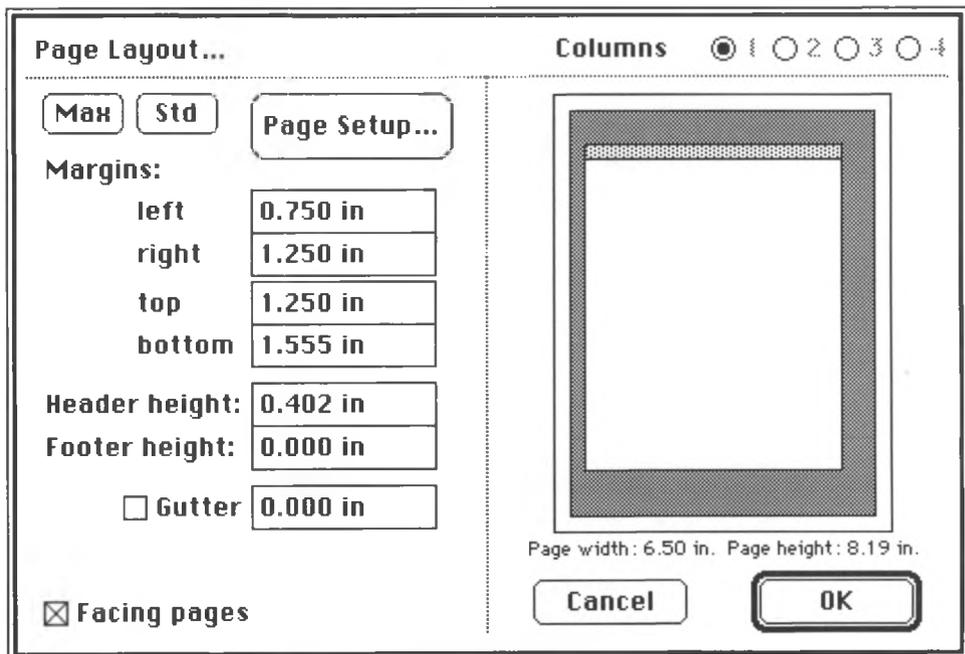


Figure 4.1 Page Layout dialog box

◆ To assign an enlarged margin for binding (Figure 4.1), click on the word "Gutter" or on its check-box and supply a value and unit. The gutter is space in addition to the margin you specified above in the left and right margin dialog box.

If you intend to print your document on the front and back of pages (see File/Print) and have assigned a binding margin or gutter above, you can have *MathWriter* place the binding margin alternately on the left and right borders of the pages.

◆ To create facing pages, click Facing pages to set this option.

Note: If you use the Facing pages option, you will probably also elect to make your headers and footers differ on alternate pages (see File/Doc Layout, "Left/Right Pages").

Paragraph formatting

Line spacing

Appropriate spacing of lines of text in a paragraph makes documents easier to read. Straight prose requires fewer formatting options than technical writing. With the usual word-processor choices of single, 1-1/2, and double spacing, you can double space a printed draft of prose to allow space between the lines for editing and then single space the final document without retyping. However, in the case of simple mathematical expressions, such as exponents, embedded or in-line constructs produce uneven line spacings.

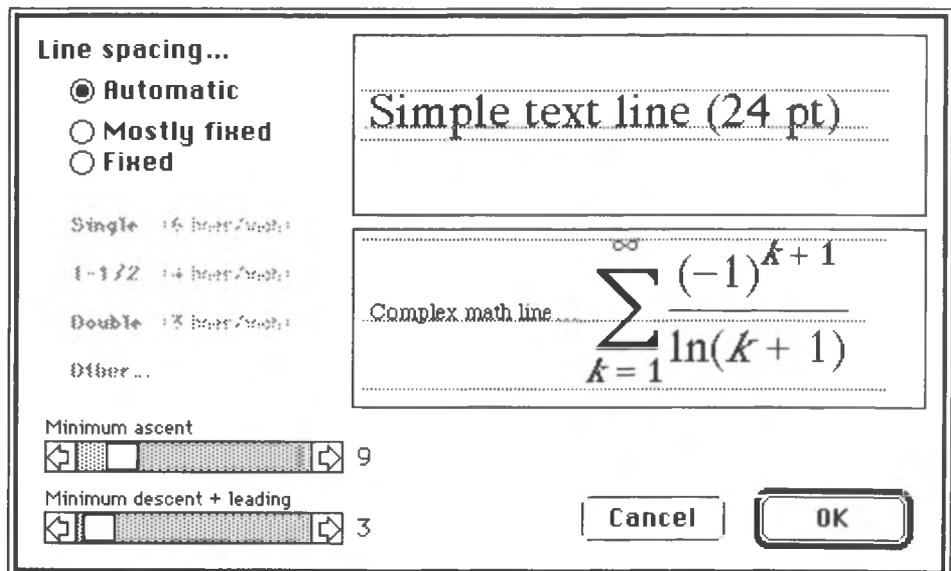


Figure 4.2 Line Spacing dialog box

MathWriter provides additional controls for line spacing (Figure 4.2). The Automatic selection allows you to create mathematical expressions of arbitrary complexity without concern for the required line spacing. If the resulting text has a distracting unevenness, you can select the offending paragraph or paragraphs and assign to it one of the other two spacing options.

Fixed spacing allows you to specify a line spacing that will be maintained, even if portions of the line must be clipped. The ascent and descent settings, not just the leading, can be set separately (Figure 4.3). The Mostly fixed option allows some mathematical structures, such as superscripts and subscripts, to protrude into the whitespace that already exists between the lines of text. Mostly fixed automatically switches to Automatic for mathematical expressions that occupy a separate line (but not for expressions embedded within a line of text).

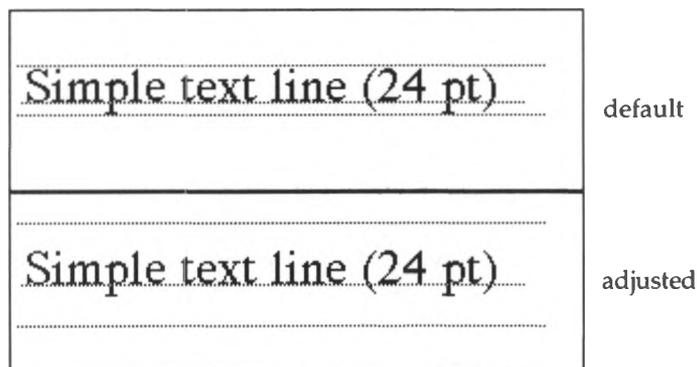


Figure 4.3 Ascent and descent are separately adjustable

The Automatic spacing default settings (Table 4.1) for ascent and descent are 9 and 3 for the minimum ascent and minimum descent plus leading. Figure 4.3 shows a spacing of 30 (top) and 20 (bottom) pixels.

Mostly fixed spacing (Figure 4.4) lets you choose from three standard line spacings and a user-defined fourth. You can add extra whitespace above and below displayed equations (equations on a separate line, not embedded within a line of text).

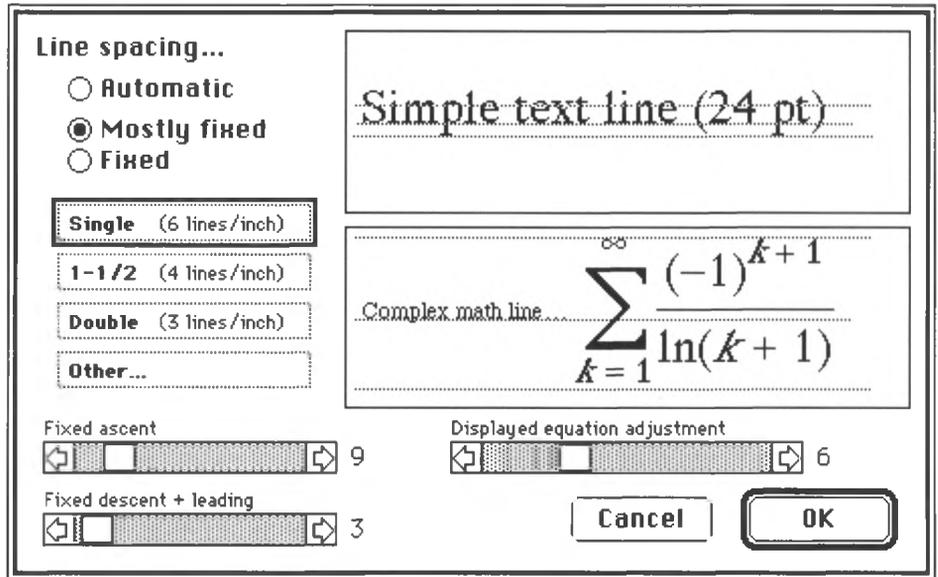


Figure 4.4 Mostly fixed spacing

Table 4.1 Default line settings

Setting:	Single	1-1/2	Double	Other
Lines / inch	6	4	3	na
Min. Ascent	9	14	18	user
Min. Descent + Leading	3	4	6	user

To change the spacing of existing text:

1. Select the text to be affected. Line settings apply to an entire paragraph. Recall that to identify a single paragraph, you need only place the insertion point within the paragraph. You can also select a portion of text within the paragraph to identify it. To select several contiguous paragraphs, place the blinking cursor somewhere in the first paragraph and, with the *shift* key depressed, click somewhere in the last paragraph.
2. Select Format/Line Spacing and assign values for line spacing, displayed equation adjustment, and ascent and descent by clicking or dragging.

When you create a new paragraph by pressing *return*, it inherits the line spacing of the previous paragraph, but not its border information. You can also assign the line spacing for a paragraph any time, including immediately after you create it and before you type any characters.

Paragraph borders

MathWriter applies various borders and background patterns to paragraphs. You can place a border on any combination of sides of an existing paragraph. The border can consist of one or two lines of user-selected thickness, pattern, and spacing (between lines and between the border and the paragraph). The paragraph itself can have a background pattern or a gray-scale on a PostScript printer.

One or more contiguous paragraphs can have borders, but borders must be assigned explicitly to existing paragraphs rather than being passed automatically with the ruler. If you choose borders on all four sides and select two or more paragraphs, the common boundaries will be deleted automatically. Since an equation can also constitute a paragraph, this provides a means for highlighting the important result of a derivation.

To assign paragraph borders:

1. Select the paragraph.
2. Select Format/Paragraph Format. (See Figure 4.5.)

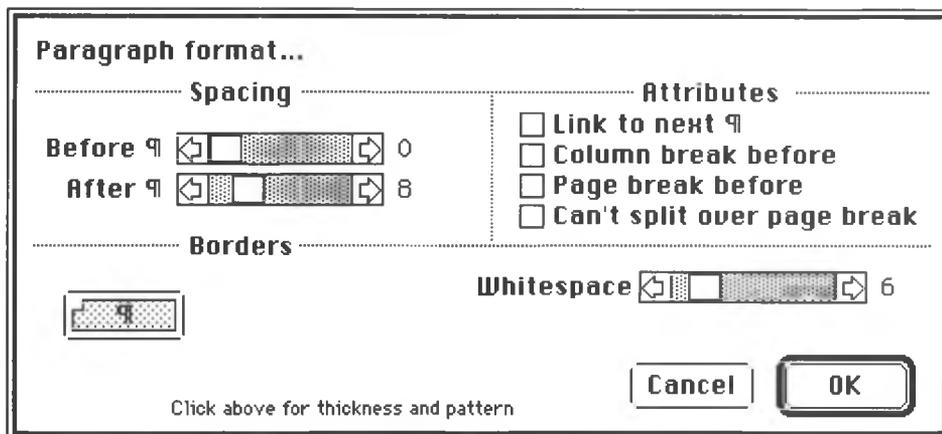


Figure 4.5 Paragraph Format dialog box

3. Click on the sides of the paragraph icon at the left (Figure 4.6) to designate the sides to be assigned a border. Click in the middle of the icon to select four sides at once.
4. To assign the number of lines (1 or 2), line thickness and pattern, or background pattern, click in the space to the right of the paragraph icon.

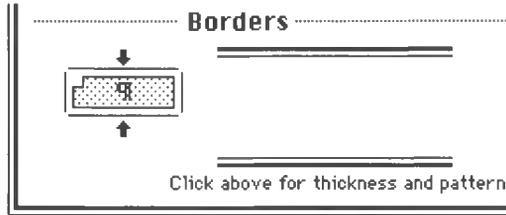


Figure 4.6 Assign sides and line characteristics

5. Make choices regarding number of lines, line thickness and pattern, and background pattern using the pop-up menus (Figure 4.7).
6. Use the scroll bar to assign the whitespace (in pixels or points) between the paragraph and the borders.

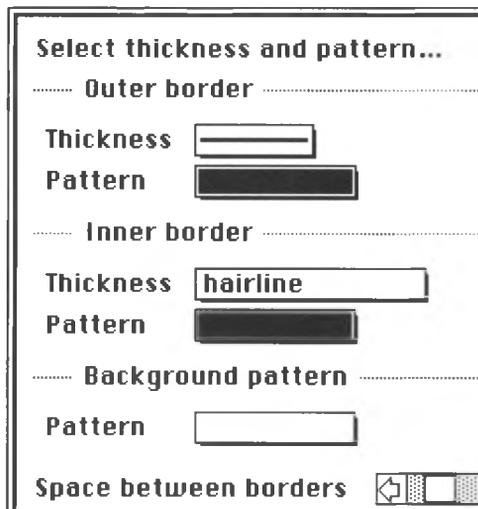


Figure 4.7 Assign border styles

7. Click OK to accept the choices and close the dialog box.

Character formatting

A number of *MathWriter's* numerous techniques for quickly assigning the typeface information to text were discussed in Chapter 3. A few mathematically related techniques are discussed here.

Diacritical marks

Many Macintosh fonts include characters that contain diacritical marks. You can use the Windows/Font Table to type them and the Key Caps desk accessory to locate them on the keyboard. The Diac menu supplements this and also provides various horizontal groupings (over and under bars).

1. Place the insertion point immediately to the right of a character to be assigned a diacritic. Once you have selected a character in this manner, the previously dimmed diacritical marks become available.

2. Select a character using the mouse.

The diacritics in the Diac menu, but not those that are part of the font character sets, are bypassed by the spell-checker.

3. If necessary, adjust the height of the diacritic using the Raise or Lower commands on the Diac menu (or their keyboard equivalents \mathscr{R} and \mathscr{L}).

Multiple levels of characters

To place multiple lines above a character:

1. Place the insertion point to the immediate right of a character, which optionally might already have a diacritic mark.

2. Click  on the Tools menu or press $\mathscr{[}$ and supply one or more characters to be centered above the base character.

3. Optional: Choose the matrix template with no separating lines as the ninth icon (column) on the ninth icon (row) of the Templates window or use $\mathscr{9}$ and 9 (if typed rapidly and the Template is not visible) when you must stack an arbitrary number of rows above a character.

Use the special functions templates on row seven, rather than center below for limits, etc., where irregular spacing around the base character must be avoided.

Horizontal grouping of characters

Twelve, stretchable, grouping symbols become available when you select a string of contiguous characters to represent complex conjugates, vectors, and so on.

Note: Boldface Greek letters (often used to denote vectors) will not print properly on a LaserWriter unless you use the Adobe Symbol font licensed for use with *MathWriter*.

To supply horizontal grouping symbols for multiple characters:

1. Select two or more characters.

2. Select the desired symbol from the Diac menu. After a slight pause, *MathWriter* places the symbol over or under the characters.

3. If necessary, you can use the split I-beam math cursor (obtained by pressing *option* anytime the regular text cursor is present) to edit within the group of characters.

Headers and Footers

Size

To set the size of the header and footer:

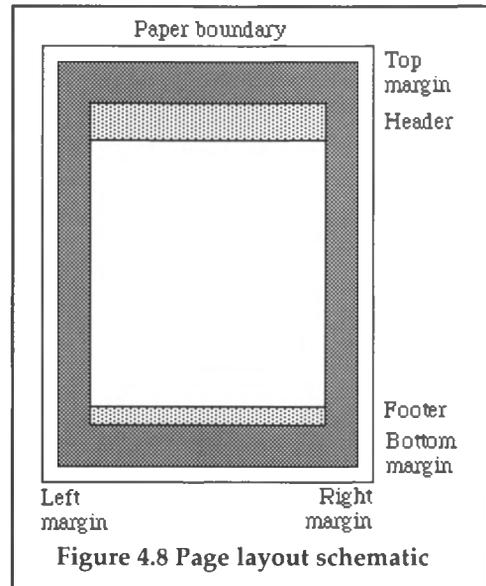
1. Select File/Page Layout. The outer rectangle of the page diagram (Figure 4.8) corresponds to the physical boundary of the paper; the outer rectangle of the area with the darkest shading identifies the maximum LaserWriter print area. The margins (top, bottom, left, and right), measured from the page boundaries, allow you to exclude additional print areas.

2. If necessary, adjust the margins by typing new values. The interior of the remaining rectangular portion of the page contains the body of the document and the headers and footers. The headers and footers extend across the page, even if multiple columns are used.

3. Type the vertical dimension of the header and footer in the dialog box (Figure 4.9). Supply dimensions with units (in, cm, or pt without a period). To eliminate a header or footer, set its dimension to zero. Out-of-range values will not be accepted.

4. Click OK to accept your choices.

Only text that fits in the header will be displayed. You can resize the vertical dimension if necessary.



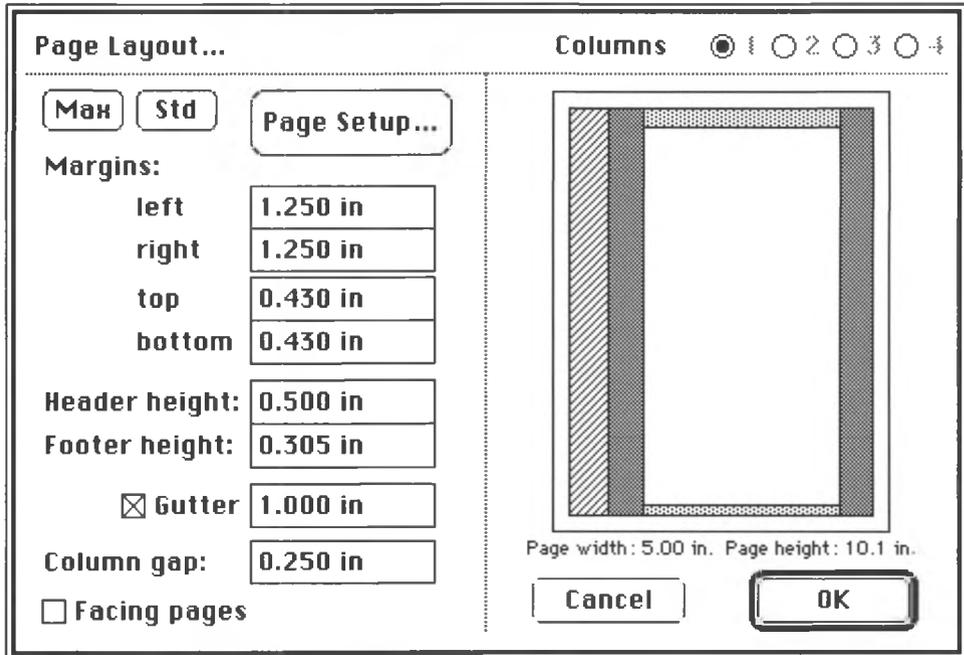


Figure 4.9 Page Layout dialog box

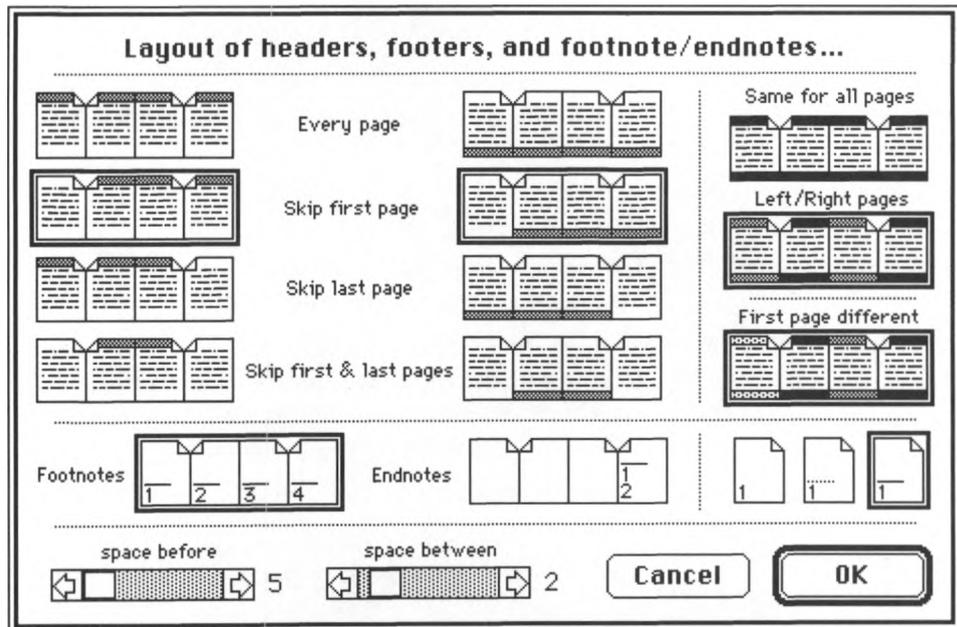


Figure 4.10 Doc Layout dialog box

Placement

To place the headers and footers on pages throughout the document:

1. Select File/Doc Layout (Figure 4.10).
2. Click to make your choices for placement of headers and footers that can appear on every page, skip the first page, skip the last page, or skip the first and last pages. An enclosing border identifies your choices for headers and footers. Additional choices remain. Four sets of alternatives are provided for headers and footers—three sets are comparable, in their actions, to radio buttons and the fourth is comparable to a check-box. (For a complete description of these features, see Chapter 3.)
3. Click to select either “Same for all pages” or “Left/Right pages.” By convention, left pages are even-numbered and right pages are odd-numbered. If you choose “Left/Right pages,” you must specify the placement of the contents of the headers and footers on both odd and even pages. If you have not yet supplied any text, you can use Format/Insert Column Break to make the second page appear. If you selected facing pages using File/Page Layout, then *MathWriter* prints the pages as mirror images with binding margins preserved.
4. Click to toggle “First page different” if you wish the first page headers and footers to differ from the rest. This option is useful, for instance, if you wish to create stationery that has a letterhead only on the first page or if you wish to place page numbers on all pages except the first.
5. Click OK when you are satisfied with your choices.

If you wish to create “stationery” with page numbering that begins on the second page, temporarily add a second page using Format/Insert Page Break, add the page number by clicking  on the Palettes menu, format it with “Page #” on Format/Variables Format, and remove the temporary second page by placing the insertion point at the top left of the text of the temporary page and pressing *delete*.

Editing headers and footers

To edit existing headers and footers:

1. Click within the header or footer to position the insertion point. Your choices in the previous section may have created several different headers or footers so remember to verify that you are editing the correct one.
2. Supply text, graphics, or mathematical expressions as if you were working within the body of the text. Sidebars cannot be placed in the header or footer, but background pictures can.

Select All, Cut, Copy and Paste (all on the Edit menu) apply to headers and footers, as do Format/Paragraph Formatting and Format/Line Spacing.

3. Click within the body of the text to leave the header or footer.

Footnotes and Endnotes

Supplementary or parenthetical information is sometimes placed at the end of the page (as a footnote) or at the end of the document (as an endnote) with a unique symbol assigned to text and to the note to establish a visual linkage. *MathWriter* dynamically numbers footnotes using a user-selected format and reformats the page to make space for them. When you supply footnote text that exceeds the allocated space, *MathWriter* automatically moves body text from that page to the following page to make room for the footnote. If you cut from a document a portion of text that contains a footnote or endnote reference and paste that material elsewhere in the document, *MathWriter* automatically rennumbers the notes, preserving the linkage to the content of the footnote, and displaying the note in its proper location. If you remove a footnote that is cross-referenced by a footnote re-reference variable, that linkage is broken.

Footnote (and endnote) placement

To choose footnotes or endnotes:

1. Select File/Doc Layout. (See Figure 4.10.) Normally, you decide where you want parenthetical material placed (at the foot of the current page or at the end of the document) before you create the document. If you forget, however, *MathWriter* can reformat the document.
2. Click on either the Footnotes or Endnotes icon (Figure 4.10).
3. Select one of the three separation formats (no divider, dotted, or solid).
4. Use the scroll bars to set a) the space before the first footnote and b) the space between footnotes, measured in pixels (or points).
5. Click OK to accept the choices and leave the Doc Layout dialog box, or click Cancel to abandon your choices when you leave the box.

Creating footnotes (and endnotes)

To create a new footnote (or endnote), follow these steps.

1. Place the insertion point in the text where the footnote reference is to be placed.
2. Drag to the footnote icon  on the Variables row of icons of the Palettes menu and release the mouse button. *MathWriter* automatically assigns a footnote number using the default format. The name of the icon appears on the bottom row of the Palettes menu as you drag across the icons in the palette. Alternatively, type ⌘ option F.

If you must select a Variables icon frequently, a speed enhancement is available to you:

- Place the row of variable icons on the floating Palettes window for convenient mouse access without using a pull-down menu. To do this, select Windows/Palettes Window to place the Greek palette on-screen and then select the name "Variables" on the Palettes pull-down menu.

3. Select the footnote number in the pop-up menu of the insertion point locator box in the status bar at the bottom of the page (see Figure 4.11) to scroll to the footnote. You can also use standard scrolling techniques. The window scrolls to the footnote/endnote area with the insertion point positioned for text entry.

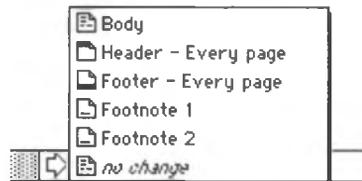


Figure 4.11 Pop-up locator menu

4. Supply the footnote content. The footnote area increases as necessary, displacing lines from the body of the text and automatically moving them to the next page as needed. The technique of setting global formatting attributes for footnotes is described later in this section.

5. Click Body in the pop-up menu (Figure 4.11) in the insertion point locator box of the status bar to scroll back to the location of the insertion point in the body of the text. You can also use the standard mouse and keyboard scroll techniques to return to the text.

Cutting and pasting footnotes (or endnotes)

When you cut and then paste text that includes footnote references, *MathWriter* automatically renumbers and re-positions them. Do not cut and paste the contents of the footnotes separately as that is handled automatically.

To cut and paste a footnote (or endnote):

1. Select the text, which includes the footnote reference. Note that the footnote number is a discrete character that you can cut and paste separately.
2. Cut the text with its footnote reference number. *MathWriter* automatically renumbers the remaining footnotes and updates the linkage to the actual footnote.

The link to a footnote re-reference (i.e., a cross-reference to an existing footnote) is necessarily broken when the footnote is removed, even temporarily, and must be reestablished manually. A question mark replaces the cross-reference number when the link is broken.

3. Indicate the destination of the text and footnote reference by repositioning the insertion point.
4. Paste the text and footnote reference back into the document.

MathWriter automatically renumbers the footnotes; moves the text of the footnote to a new page, if appropriate; and places the footnotes in the proper order.

Formatting footnotes and endnotes

MathWriter supports five standard formats for consecutive numbering of footnotes and a set of six user-selected symbols for non-numeric referencing. To change the default format of footnote *numbers*, follow these steps:

1. Select Format/Variables Format.
2. Scroll to and click on footnote/endnote. (See Figure 4.12.)
3. Click on one of the numerical formats or the “use symbols” category.
4. If you chose to use symbols, you can edit the six characters, which are listed in sequential order.
5. Edit the “starting at” box in the Footnote dialog box to set the lowest footnote number if this is a continuation document.

Complete steps 6 - 8 if you do not want to take the style from context.

6. Optional: To assign a style, click the Variable Style button.
7. Optional: Click the check-boxes or the category names to enable Font, Size, Style, Justification, or Line spacing categories. Font, Size, and Justification lead to pop-up menus and Style and Line spacing lead to dialog boxes for those more complex choices.
8. Optional: Make style selections, verify the output, and click OK.
9. Click OK (Figure 4.12) to accept your choices and leave the Variables Format dialog box, or click Cancel to abandon your choices when you leave the dialog box.

Variables format is a global command so the format of all footnote numbers will assume the format you assign there.

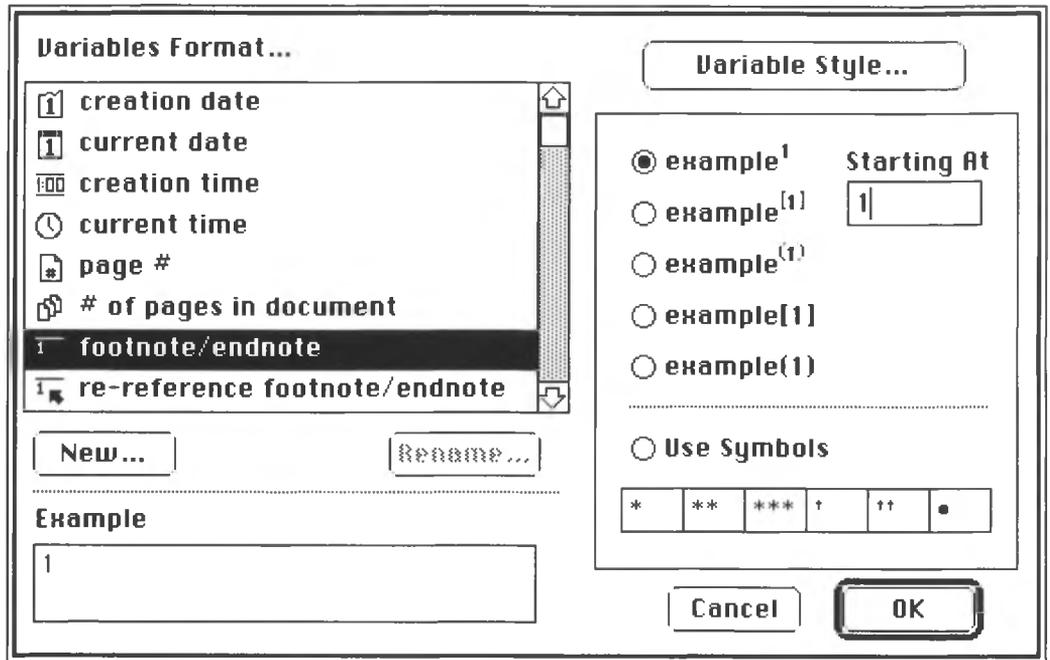


Figure 4.12 Footnote format choices

To change the default style of the *text* of footnotes:

1. Select File/Doc Preferences.
2. Click the Footnote/Endnote style button Footnote/Endnote to access the Footnote/Endnote style dialog box (see Figure 4.13).
3. Click the check-boxes or the category names to enable the Font, Size, Style, Justification, or Line spacing categories. Font, Size, and Justification lead to pop-up menus which list the available choices. Style and Line spacing lead to dialog boxes for those more complex choices.
4. Make selections, verify the output, and either (1) click Apply to implement the changes throughout the document, or (2) click OK to affect the next one.
5. Click OK to accept the choices and leave the Variables Format dialog box, or click Cancel to abandon your choices when you leave the box.

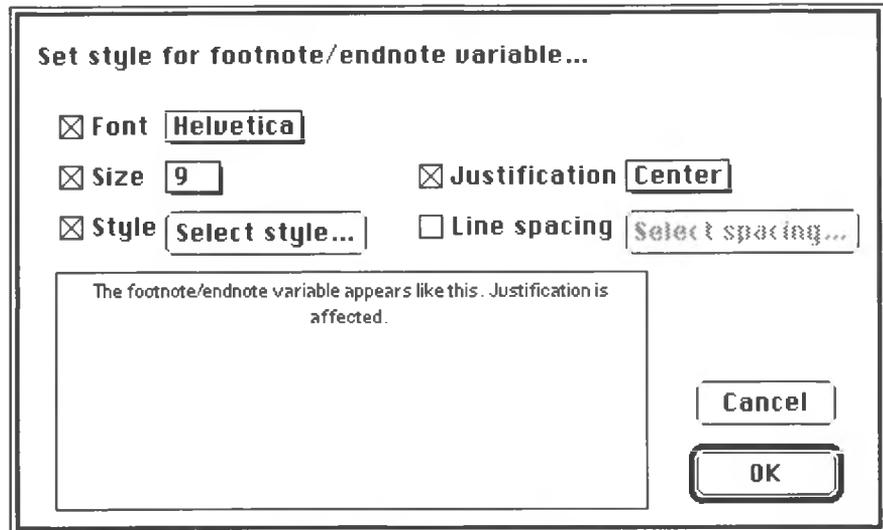


Figure 4.13 Footnote style

Typing Tools (Revisited)

Technical word processing typically uses an enlarged character set. Without special typing aids, learning to type these extra characters would take longer. *MathWriter's* typing tools reduce the learning time and facilitate font changes. Among these tools are the Palettes menu, Diacritics menu, and Font Table, which place visual prompts in front of the typist. Another important typing aid, *Style/Auto Math*, is discussed later in this chapter.

Palettes menu

The Palettes menu contains rows of special symbols taken largely from the Symbol font. To use the Palettes menu:

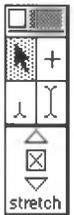
1. Position the insertion point in the text to specify the destination of the character.
2. As you drag the cursor over the symbols in the Palettes menu, the name of each symbol crossed appears in the last row. Release the mouse button when the desired character is located by the cursor to "type" the character.

The | and || symbols have special stretch properties. To modify these characters:

1. Click on Character Editor in the Tools submenu, type $\text{\textcircled{X}} \text{ shift } [$, or click the arrow tool on the Tools floating window.

2. Select a character previously placed in the text. A "character" can also be a built-up mathematical expression that extends to the baseline.
3. Press *option* and, with the cursor, drag either end of the selected character to stretch it. Click at the middle of the symbol to restore its original size.

After step 3, the bottom portion of the Tools window, which formerly contained the subscript and superscript icons, now contains arrows for moving the selected character vertically in one pixel increments. The square in the middle is a reset button; you can click on the middle of the selected character to restore its original size.



The symbols in the last row, called Variables, have special characteristics. These are the numbering and linkage variables that automatically supply values. They include: creation date, current date, creation time, current time, page number, number of pages in a document, footnote/endnote, re-reference footnote/endnote, equation number, subequation number, equation reference number, user-category, user-subcategory, user category reference number, and file name. The typing and formatting of these variables are handled separately. See the section on automatic numbering later in this chapter for details.

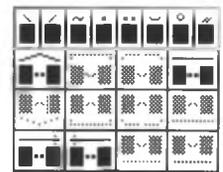
When variables are placed in a document, they behave as an indivisible unit, even when composed of several characters. You can edit the entire unit but not its components. You can change its style and cut, paste, and delete it.

Diac menu

Most Macintosh fonts contain characters with accents and other special markings required for foreign languages. You can identify the key combinations to type them using Apple/Key Caps. The next section describes *MathWriter's* Font Table for mouse access to any character in any font, including the characters that already incorporate a diacritic. The Diac menu provides additional diacritical marks that you can raise and lower as well as symbols for grouping characters together horizontally.

Diacritical marks

The symbols on the first row of the Diac menu, two symbols from the second row, and two from the fourth row are available when the insertion point is placed to the immediate right of an alphabetic character. To type a diacritic:



1. Place the insertion point adjacent to a character, on its right side.
2. Select a symbol from the first row of the Diac menu.

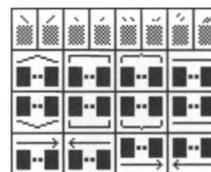
3. If necessary, use Raise, Lower, or Remove from that menu.

If more than one level of symbols is needed, consider using the center above and center below tools on the Tools window in addition to the Diac menu. If more than two levels are required, consider using the two-dimensional array on the Templates window, row 9, column 9. (Access these by mouse or by using \mathscr{R} 9 and then 9).

Horizontal groupings

To type a horizontal grouping symbol:

1. Select two or more adjacent characters of text.
2. Click on one of the symbols from rows two, three, or four of the Diac menu.



If you press the *option* key to obtain the Math Editor, you can edit inside the text string of the group; the grouping symbol length adjusts automatically. Horizontal grouping symbols cannot be raised or lowered.

To remove a horizontal grouping symbol:

1. Select the grouped characters.
2. Select Remove from the Diac menu.

Font Table

Because technical typing uses many special symbols, *MathWriter* provides a Font Table containing every character in every font available to the system.

To “type” a character with the mouse:

1. Position the insertion point within the text.
2. If the floating Font Table window (Figure 4.14) is not visible, select it from the Windows menu.

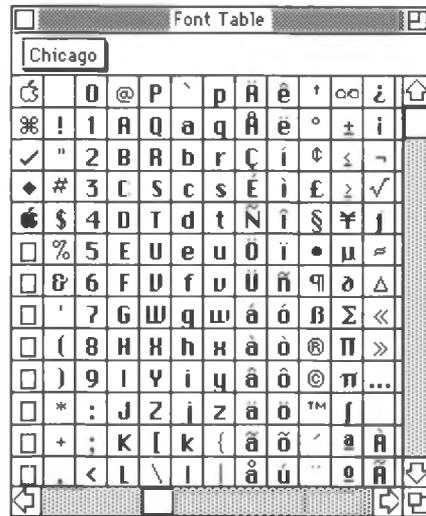


Figure 4.14 Font Table

3. If necessary, click on the font name that appears on the Font Table to select a font from the pop-up menu.
4. Press (don't just click) on a character to select it.

If desired, you can drag the Font Table window by its title bar to position it more conveniently, perhaps even to a second display monitor. If you require access to only a portion of the table, use the grow box in the bottom-right corner of the floating window to shrink it and use the vertical and horizontal scroll bars to adjust the visible portion of the window. The zoom box in the top-right corner of the floating window quickly expands the table to full size. Use the close-box in the top-left corner of the floating window or reselect the Font Table on the Windows menu to hide it.

Automatic Numbering

Technical writers extensively cross-reference pages, footnotes, equations, figures, tables, theorems, and so on. When editing, updating the numbers for these items and the references to them can be daunting.

MathWriter offers a broad automatic numbering capability, one example of which is automatic-numbering of footnotes, discussed earlier in this chapter. This section concentrates on equation numbering, which plays a special role in technical writing because of its importance. An additional user-defined variable in *MathWriter* also provides numbering for other entities and will be covered next.

Numbering equations

Various numbering schemes can be used to identify the equations in a document. In *MathWriter*, equation numbers are user-controlled and appear before or after the equation. Proximity is the only link between the equation and the equation number. Thus you have to cut and paste both the equation and its number together. You number the starting equation and *MathWriter* automatically numbers subsequent ones.

You also have a number of options for styling and formatting equation numbers in *MathWriter*. In the following example, the equations have been created in a paragraph with automatic line spacing, Format/Line Spacing, the paragraph is left aligned \blacktriangleleft , the equation is centered using a center tab \blacklozenge , and the equation number is aligned at the right margin \blacktriangleleft .

$$ax^2 + bx + c = 0 \quad [1]$$

has two roots

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad [2]$$

References in the text to equations [1] and [2] are linked to the actual equation numbers such that the references are automatically updated when the equation numbers are changed. In this example the equation numbers are bracketed, but many other possibilities exist.

1. To format equation numbering, using Format/Variables Format, scroll to equation number Σ^* , select it, and define the format options. There are seven numbering schemes (1, 5.1, 5-1, A, a,I, and i), four bracketing options (none, (1), [1], and user-selected characters), a starting number (an Arabic number), and text label (such as chapter and section number). The font, size, and style of the variable is the same as the text surrounding the equation unless you assign different ones using the Variable Style button.

Subequation numbers are handled the same way but you select among six numbering styles (a, A, 1, I, i) and three separators (no space, dash, and period); for equation reference, the same options as equation numbering are available. Note that the format of the equation reference variable need not be the same as the equation variable.

The variable format choices you make for your first equation numbers apply throughout the document and remain linked such that a redefinition is immediately and automatically applied throughout the document.

\blacklozenge Establish the paragraph ruler tabs for displayed equations (i.e., equations that occupy a separate line). If the ruler for a displayed equation is to be different from the text ruler, you can copy the ruler by clicking Edit/Copy Other/Copy Ruler. Then, if you want all displayed equations to

have the same paragraph ruler, click Edit/Paste Other/Paste Ruler to place that ruler in your document. If you wish to establish the paragraph alignment, etc., you can copy and paste both the Ruler and Format at the same time.

To create a displayed equation and equation number:

1. Establish the paragraph formatting, perhaps using Edit/Paste Other/Paste Ruler & Format (or ⌘ shift Z), as just discussed, tab to the center tab, and enter the equation.

2. Tab to the position for the equation number and select $\Sigma\#$, the equation number variable, from the Variables row of the Palettes menu to insert the equation number. You can identify the icon easily because as you drag across a variable icon its name appears on the last row of the menu. You can also use the Palettes floating window or type ⌘ option E.

Apply subequation numbers $\Sigma\#_a$ using the same technique to show a grouping relationship such as 5.a, 5.b, 5.c.

Cross-references

To create a cross-reference to an equation:

Using the *MathWriter* cross-references command $\Sigma\#$, text references to equations can be dynamically linked to the automatically numbered equation variables such that if the number of the equation cited updates automatically, so does the reference to it. There are three ways to provide this linkage after you insert the variable.

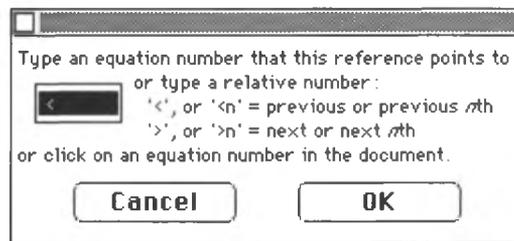


Figure 4.15 Equation reference dialog box

- Supply the current value of the equation number being cited by typing it in the dialog box (see Figure 4.15).
- Supply the equation number being cited by typing in the dialog box the relative equation number (< means the immediately previous equation, <2 means the second previous equation, >2 means the second higher equation).
- Scroll to and click on the equation number being cited and *MathWriter* will calculate the linkage.

If you must move a numbered equation, cut and paste *both* the equation and its number. This maintains the proper linkage and automatically renumbers all equation variables affected by the move *except* when a cross-reference variable is linked to it. The linkage of a cross-reference variable is maintained if only a cross-reference variable is moved.

However, if you cut or delete, even temporarily, an equation numbering variable that has a linked cross-reference variable, the linkage becomes meaningless and a question mark replaces the cross-reference equation number to identify the broken link. You must remove the cross-reference or manually reestablish the linkage.

MathWriter was created as an authoring tool, not just a transcription or desktop publishing tool for completed technical manuscripts. The equation numbering variable epitomizes the difference between these two tasks. Without *MathWriter*, an author can incur a heavy penalty for adding or deleting numbered equations or figures. Design choices for this version emphasize operational simplicity for the author, rather than transcription typing speed or the handling of large documents.

User-Defined Variable

In addition to footnotes and equations, various other entities are frequently referenced by number in technical manuscripts—figures, tables, paragraphs, theorems, corollaries, etc. *MathWriter/Educational Version* provides one user-defined variable.

Defining a variable

To define a user-variable:

1. Select Format/Variables Format. The user-defined variable is obtained by renaming the triplet of variables (User category #, sub-User category #, User category reference) found at the end of the scrolling window in the Variables Format dialog box (Figure 4.16).
2. Scroll to and click on User category #.
3. Click on Rename.
4. Supply a name, e.g., "Figure," in the Rename dialog box (Figure 4.17) and click Rename. This renames the collection of three user-defined variables and supplies the name to the Palettes menu icons.
5. Assign the formatting attributes for this family of variables by responding to the same dialog box used for the equation number variables shown in Figure 4.16.

Your formatting choices in Figure 4.16 (variable style button, brackets, numbering scheme, starting number, and label) apply throughout the document; all subsequent changes in this dialog box will be applied immediately to the entire document.

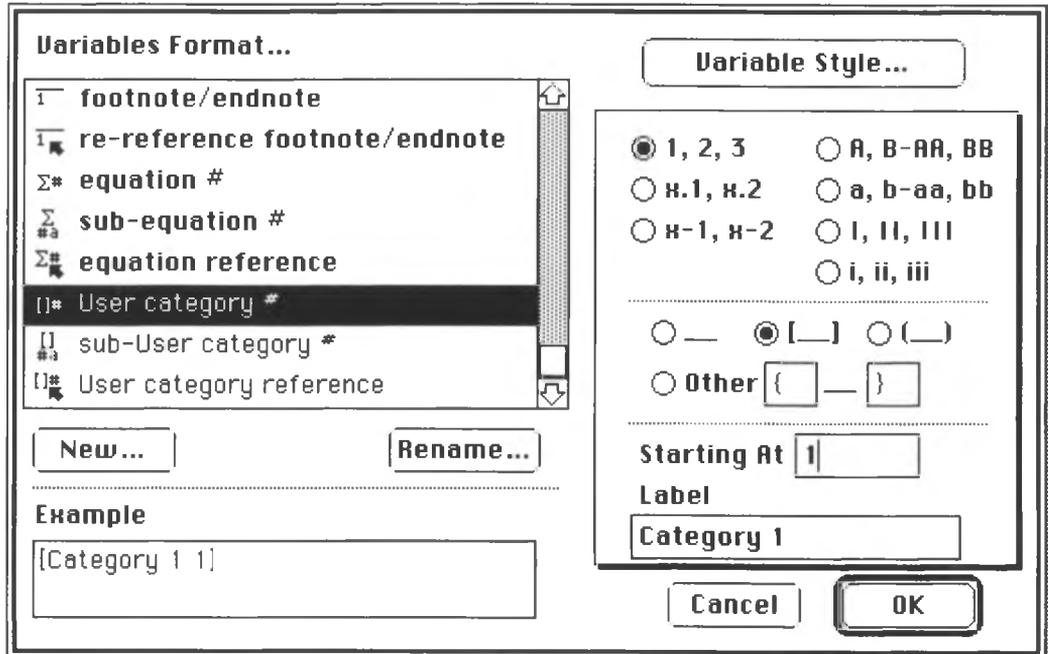


Figure 4.16 Select the User category



Figure 4.17 Rename the User category

To identify variables in your document, use Format/Show Invisibles. Variables (but not portions of variables) can be moved using the usual cut and paste techniques.

6. Click OK to accept your choices.

Applying the variable

If you have defined the triplet of variables, you place this variable in the document in exactly the same way equation numbers are placed, but using the adjacent triplet of icons from the Palettes menu.

For access from the Palettes Window:

1. Select Windows/Palettes Window if it is not already in view.
2. Place the Variables row of icons on the Palettes window by dragging to the name "Variables" on the Palettes pull-down menu and selecting it.
3. Press on the desired user-defined variable icon type on the Palettes window and drag to select the variable from the pop-up menu (Figure 4.18) on this floating window.

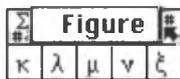


Figure 4.18 Palettes user-category pop-up menu

If the starting number for the variable is different from the default, such as occurs when a document extends beyond a single file, follow these steps to reset the starting variable number:

1. Select Format/Variables Format.
2. Scroll to and select the name of the variable.
3. Assign a new value in the Starting At box.
4. Click OK.

Collaborative Writing

Scientific manuscripts usually involve multiple revisions and collaboration, among authors and between authors and editors. This communication is an important part of the writing process. *MathWriter* provides a document history that characterizes the evolution, size, and complexity of the file.

Document history

To track the history of a *MathWriter* file:

1. Select File/Doc Info. This dialog box (Figure 4.19) provides nonprinting space for a history of the document and keywords. *MathWriter* automatically reports various characteristics of the file—number of sessions, creation date and time, date and time last modified, size on disk—and various characterizations of the document such as pages, paragraphs, lines, words, memos, etc.
2. Click OK to close the window.

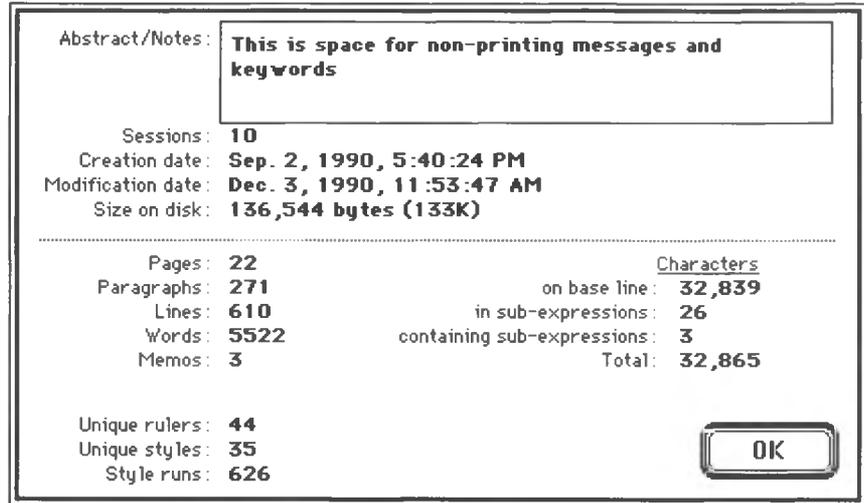


Figure 4.19 Document info dialog box

Revisions

With *MathWriter/Professional Version* the actual additions and deletions you make when revising a manuscript are marked automatically using distinctive, user-selected styles to identify the changes. That version also provides tools for locating and implementing the changes conveniently. In this Educational Version you can use the enlarged set of text styles to identify proposed changes also, but you must mark the additions and deletions manually. Define Styles 1 and 2 using the File/Doc Preferences dialog box and apply them using the Style menu or the keyboard equivalents as discussed in Chapter 3.

Tables

Because simple tables are often required in technical writing, *MathWriter* treats them as a variation on a matrix and provides automatic formatting. *MathWriter* adjusts the spacing of the cells and the borders with every keystroke so the layout is always visible. New rows and columns can be added or deleted quite easily.

You prescribe the alignment of text in a table cell (left, right, center, or decimal), the typeface of the text, the attributes of the bounding lines and background, and the minimum amount of space between the contents of cells and the borders. Tables (Table 4.2) can contain text, mathematics, and graphics.

Table 4.2 Table with graphics

Ruler Icons	Usage
	paragraph indent
	paragraph margins
	right align
	left align
	center align
	character align

Tables are fully editable using the Math Editor. The self-formatting templates provide tables that have no boundaries, a single boundary enclosing the table, or boundaries for each cell. Individual cells can even contain a table. Tables, and sidebars discussed below, provide a side-by-side paragraph option. The word-wrap algorithm treats a table as a tall character and, therefore, does not split it across page boundaries. In addition *MathWriter* can transform a table into PICT format for pasting into other applications.

Create a table

Although you can use tabs to create tables, *MathWriter* provides a self-formatting template for this purpose. Simply select the template and, while you supply the contents of the cells, *MathWriter* handles the formatting. You may use the mouse or the keyboard to create a self-formatting table.

To create the table using the mouse, follow these steps:

1. Select a table template by, first, opening the Windows/Templates Window if it is not already accessible.

2. In the Templates Window, drag to the next-to-last template, the matrix  , or to the last, the table  , and release the mouse button.

The last entry on the matrix category  is an array without visible borders. The table category includes a table with an overall bounding border  and one with borders for each cell .

3. Optional: Supply the contents of the first cell (row 1, column 1).

4. Press *tab* to create a new column and press *return* to create a new row. Repeat these steps to create a rectangular table of the desired number of rows and columns. When columns and rows exist to the right or below the current cell respectively, the *tab* and *return* keys simply advance the insertion point. A 3 x 3 table is shown in Table 4.3.

Table 4.3 A 3 × 3 table

(1,1)	(1,2)	(1,3)
(2,1)	(2,2)	(2,3)
(3,1)	(3,2)	(3,3)

5. Supply the contents of the cells in any order. To reposition the insertion point with the mouse, press *option* to switch from the Text Editor (I-beam cursor) to the Math Editor (split I-beam), and click. Click outside the table or click on the I-beam tool to resume text editing.

To create the table using the keyboard:

1. With the Template window visible, press \mathscr{R} and a template row number followed by the column number of the individual template that you want on that row. For example, typing $\mathscr{R}9$ followed by 9 selects the template for an array without bounding lines (Figure 4.20). If you pause after typing $\mathscr{R}9$, the matrix menu pops out with prompting numbers on each choice. Typing $\mathscr{R}0$ (for the last row) followed by 2 selects the template for a table with bounding lines for each cell.

If the Template window is not visible, you must type the commands quickly and the prompting column numbers do not appear.

2. Optionally, supply the contents of the first cell (row 1, column 1).
3. Press *tab* to create a new column, and press *return* to create a new row. Repeat these steps to create the rectangular table of the desired number of rows and columns. The *tab* and *return* keys simply advance the insertion point to the next column and row, respectively.
4. Supply the cell contents in any order to the cell that currently contains the insertion point. Place the insertion point within a cell and press the *option* key to switch from the Text Editor (I-beam cursor) to the Math Editor (split I-beam), and click. Click outside the table or click on the I-beam tool to resume text editing. Use \mathscr{R} *shift cursor* keys to move the insertion point (left, right, up, down) among the cells.

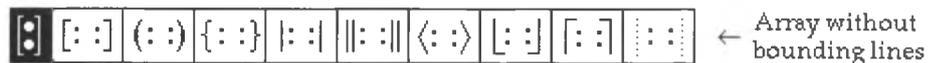


Figure 4.20 Matrix templates

You can edit the text and mathematics of a table by working directly with the cells of the table. To select and edit the contents of a cell:

1. To place the insertion point I within a cell, press the *option* key to get L and click the split I-beam within the cell. Use \mathscr{R} *shift cursor* keys to navigate among the cells.

2. To edit mathematical expressions, *option click* the insertion point within the structure. Use the mouse or *shift cursor* to make a selection. Cut and paste is supported.

To add rows and columns:

1. *Option click* to place the insertion point in a cell adjacent to the position of the new row or column, e.g., row 2, column 2.
2. Select Insert and a submenu from the Edit menu or use a keyboard equivalent (Figure 4.21) to add a row or column (Figure 4.22).

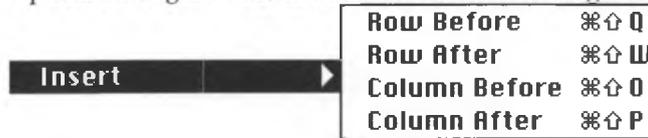


Figure 4.21 Insert (Edit) submenu

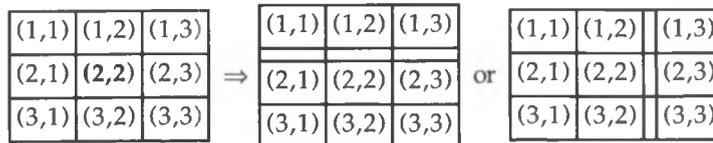


Figure 4.22 Row before and column after, respectively

3. Supply the contents for the new cells.

To delete rows and columns:

1. *Option click* to place the insertion point in a cell of the row or column to be deleted, e.g., row 2, column 2.
2. Select Delete and a submenu for a row or column (Figure 4.23) from the Edit menu or use a keyboard equivalent to obtain Figure 4.24.



Figure 4.23 Delete (Edit) submenu

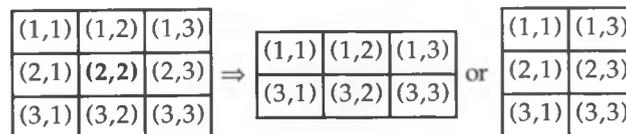


Figure 4.24 Row and column deleted

The table template supports a single row of text in a cell, but multiple rows can be added if you place a table within a cell. To place multiple rows of text in a cell:

1. Create a table.
2. *Option click* to place the insertion point in a cell.
3. Optional: Select Format/Matrix Format and adjust the row spacing of the table within the table by dragging the icon, as discussed below. Note that negative values produce an overlap.
4. Select the template for a table without boundary lines  (⌘ 9 and 9).
5. Supply the text. Press *return* for each new row; wordwrap is not supported.

Table format

Cell alignment The alignment (left, right, center, and decimal alignment) of the entries within each cell can be set before or after you create the table. To set cell alignment:

1. If the table has already been created, drag to select it; otherwise, skip to step 2.
2. Select Format/Matrix Format and click on an alignment icon (Figure 4.25 and Figure 4.26).

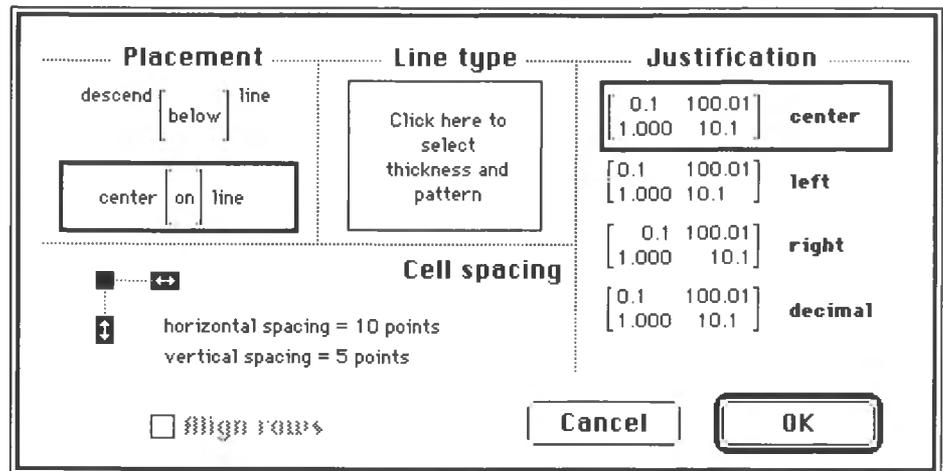


Figure 4.25 Table (and matrix) format dialog box

Justification	
$\begin{bmatrix} 0.1 & 100.01 \\ 1.000 & 10.1 \end{bmatrix}$	center
$\begin{bmatrix} 0.1 & 100.01 \\ 1.000 & 10.1 \end{bmatrix}$	left
$\begin{bmatrix} 0.1 & 100.01 \\ 1.000 & 10.1 \end{bmatrix}$	right
$\begin{bmatrix} 0.1 & 100.01 \\ 1.000 & 10.1 \end{bmatrix}$	decimal

Figure 4.26 Cell alignment

Cell size Cell height automatically adjusts to the size of the largest element in that row and the cell width adjusts to the size of the largest element in that column. If you change font size or style, the table adjusts automatically. To change the relative size of cells you can pad elements with space characters.

Cell spacing The minimum number of pixels of whitespace between rows and columns is specified by the user. To adjust cell spacing:

1. If the table has already been created, drag to select it; otherwise, skip to step 2.
2. Select Format/Matrix Format (Figure 4.25).
3. Drag the icons to set the minimum number of pixels between any element and its borders (Figure 4.27).
4. Click OK to leave the dialog box.



Figure 4.27 Cell spacing icons

Borders and Background You can select the line thickness and pattern for the borders and specify a background pattern or gray scale for the entire table. Background patterns and gray scale can be set for individual elements using Text Style.

To adjust borders and background:

1. If the table has already been created, drag to select it; otherwise skip to step 2.
2. Select Format/Matrix Format dialog box (Figure 4.25).
3. Click in the Line type box (Figure 4.28) to select line attributes (Figure 4.29).

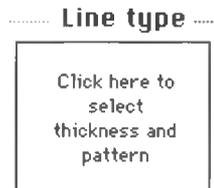


Figure 4.28 Line type button

4. Use the pop-up menus to select among the 9 line thicknesses, the 39 line patterns, and the 39 background patterns. If you select gray scale, a scroll box appears so that you can establish the density of dots.
5. Click OK to leave the dialog box.

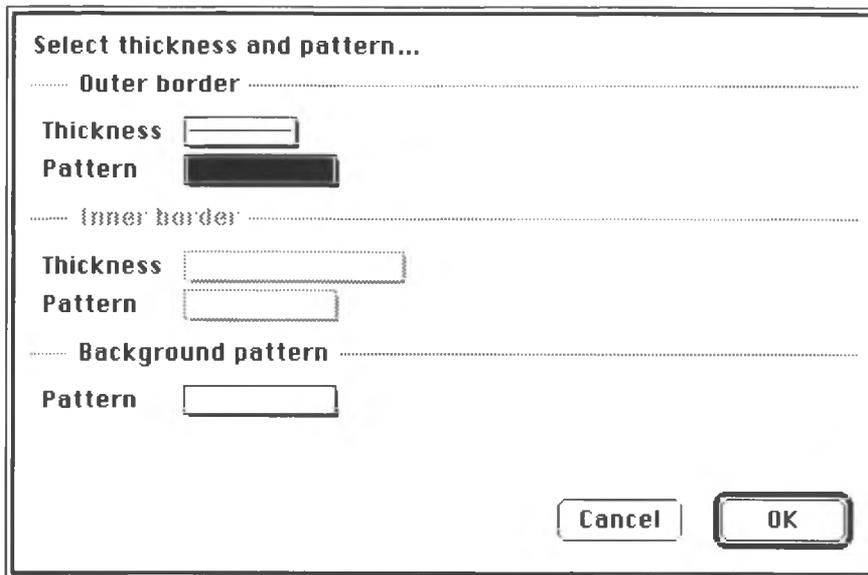


Figure 4.29 Line type dialog box

Positioning a table

The wordwrap feature treats a table as a single entity and, therefore, does not split it across page boundaries. Note that you must *not* create a table that is wider than the column or page! A table is treated as a single character in a line. You control its vertical alignment relative to the rest of the line and its horizontal alignment. To align a table vertically:

1. If the table has already been created, drag to select it; otherwise skip this step.
2. Select Format/Matrix Format.
3. Click on one of the placement icons (Figure 4.30).

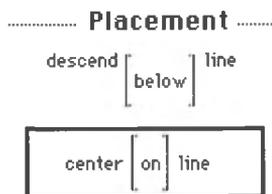
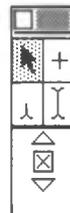


Figure 4.30 Automatic placement in a line.

4. Click OK to leave the dialog box.

You can manually adjust the vertical position of any character using the Character Editor.

1. Enable the Character Editor by doing one of the following:
 - Click on the upward-left-pointing arrow in the Tools window.
 - Select Character Editor from the Windows/Tools menu.
 - Type $\text{\textcircled{C}} \text{ shift } [$.
2. Click on the table or any character in the table.
3. Now you have two options:
 - Drag the table (treated as a single character) up or down with the mouse.
 - Click on the upward or downward pointing triangles in the lower portion of the Tools window. Continued pressing repeats the command; the square with an "x" restores the character to its baseline position.
4. Select the Text Editor by clicking on the I-beam in the Tools window, using the Tools submenu in the Windows menu, or by typing $\text{\textcircled{C}} \text{ shift } \text{apostrophe}$.



Because *MathWriter* treats a table as a tall, editable character, you can use tabs and paragraph alignment with tables. To position a displayed table horizontally:

1. Place the insertion point adjacent to the table on the left or right.
2. Click on a paragraph alignment icon.

Tabs are especially useful when you must align a table that is part of a line of text. To use tabs with a table:

1. Place the insertion point immediately to the left of the table.
2. Click on the left-align icon for the paragraph.

3. Drag a tab (left, center, or right) into the document area and release the mouse button when the tab reaches the desired horizontal position. This allows you to establish vertical alignment with other objects. When released, the tab automatically snaps vertically to the ruler.
4. Press *tab* to align the table with the tab.
5. If necessary, drag the tab to the left or right on the ruler to adjust the position of the table; the table automatically follows the tab.

MathWriter does not protect against an excessively wide table.

Converting a table to PICT format

A table is an editable, self-formatting structure while within *MathWriter*. Other word processors and page layout programs do not support this data structure; so if you must export a table, transform it into a format that is supported, namely PICT.

1. Select a table by dragging the mouse over it.
2. Copy it with Edit/Copy Other/Copy As Picture or \mathbb{X} *shift* C. This command transforms whatever is selected, including mathematical expressions, text, and graphics, into the PICT format and places the transformed copy on the Clipboard.
3. Optional: Select Windows/Clipboard to view the contents of the Clipboard. The status bar reports the PICT format.
4. Paste the contents of the Clipboard into the Scrapbook or into another application.

MathWriter provides a more powerful approach that you will find convenient if you need to transfer many mathematical structures or graphics into a Scrapbook. (See "Data Sharing" later in this chapter.) Refer to the discussion of Edit/Save As for the details of automatically transferring these into a named scrapbook when saving a file as a TEXT-only file in Chapter 6. In fact, this feature is intended to let you retire our expression editor, *MathWriter*TM 1.4; use *MathWriter* 2.0 to create and format mathematical expressions for transfer to other page layout programs.

Deleting a table

To delete a table:

1. Select the table by dragging the mouse over it or moving the insertion point to the left or right of the table with the cursor keys and pressing the *shift* key and the *right* or *left cursor* key, respectively.
2. Press *delete*.

Graphics

MathWriter allows you to import, display, and position graphics. This section describes how to treat a graphic as a “tall” character within a line of text.

Three types of graphics files are supported by this version of *MathWriter*—bit-mapped images created by a paint program, object-oriented graphics created by a drawing program, and Encapsulated PostScript, created by such programs as Mathematica™ and Adobe Illustrator™, which combines a screen display and separate PostScript commands and provides high quality printed output. This feature previously has been available only in page layout applications. This line of text contains several embedded graphics  illustrating the simplest case. Very early word processors had to isolate a graphic on a separate line.

Placement of a graphic

- Use spaces, tabs, or paragraph alignment to adjust the horizontal position of the graphic.
- If necessary, adjust the vertical position of the graphic with the Character Editor.

To place a graphic in a line of text, *MathWriter* offers two techniques—transfer via the Clipboard and direct import from a file. To transfer a graphic into a line of text via the Clipboard:

1. Place the graphic on the Clipboard by using the application in which the graphic originated or by removing it from the universal storage structure, the Scrapbook, which is accessible from the Apple menu.
2. Position the insertion point in your active document to identify the intended destination of the graphic.
3. Select Edit/Paste Picture, the current name of that command because the Clipboard contains a graphic. The customary  V provides the same result.

MathWriter can read three file types (MacPaint, PICT, and EPSF) without using the application that generated them. This has several benefits. You need not switch applications to transfer the files into the Scrapbook or have enough RAM to have both applications simultaneously in memory operating under MultiFinder. To transfer a graphic into a line of text directly:

1. Position the insertion point within your active document to identify the intended destination of the graphic.

2. Select Edit/Import Graphics File.
3. Optional: Drag the pop-up menu of file types (Figure 4.31) to a specific type to limit the dialog box list to that type (and folders).

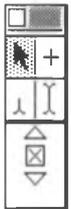


Figure 4.31 Graphics file types

4. Select a file, changing drives and folders and scrolling as necessary.
5. Click Open or *double-click* the file name.

Whichever method you use, *MathWriter* places the file at the insertion point. Additional adjustments may be necessary.

When you place a graphic in a line of text, a default baseline position is used for vertical positioning. However, with *MathWriter* you can drag a graphic (and any text character or built-up mathematical expression) an arbitrary distance up or down. To vertically position a graphic:



1. After the graphic has been placed, select the Character Editor (Figure 4.32).

Figure 4.32 Character Editor

2. Select one of the following options and vertical positioning icons will replace the superscript/subscript icons.

- Click on the Character Editor icon (the arrow that points up and left) in the Tools window.
- Select Windows/Tools/Character Editor.
- Type ⌘ shift [.

3. Select the graphic. A bounding frame with small squares at the corners appears.



4. To move the graphic vertically use these methods:

- Place the arrow cursor within the bounding frame and drag the graphic up or down. The typeface box in the document status bar reports the vertical displacement in pixels.
- Click on the up or down arrow in the modified Tools window for pixel movements. Continue pressing for repeated motion, or click on the square between the arrows to restore the original placement.

Modifying a graphic

Suppose you wish to mask a portion of a graphic. Clearly you could return to the originating application to remove a portion of the picture, but there is

an easier way. *MathWriter* allows you to crop a graphic after it is imported:

1. Activate the Character Editor. There are three ways you can do this:

- Select the Character Editor arrow tool in the Tools window.
- Select Character Editor from the Windows/Tools submenu.
- Type ⌘ shift l .

Selection of the Character Editor replaces the subscript/superscript tools on the Tools window with vertical positioning tools, described next.

2. Click to select the graphic. Small square handles appear at the corners of the bounding frame. If you press ⌘ while the graphic is selected, the typeface box in the document status bar displays "Crop" (Figure 4.33). Pressing ⌘ and *option* reports "Crop, Proportional".

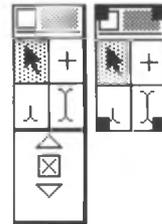


Figure 4.33 Cropping

3. Press ⌘ and drag a handle to mask (crop) the lower portion of the graphic.

4. To select the Text Editor again, do one of the following:

- Click the I-beam icon on the Tools window.
- Select Windows/Tools/Text Editor.
- Type $\text{⌘ shift apostrophe}$.

MathWriter can scale a graphic using fixed or variable proportionality for the width and height.

To resize a graphic:

1. To activate the Character Editor, do one of the following:

- Select the Character Editor arrow tool in the Tools window.
- Select Character Editor from the Windows/Tools submenu.
- Type ⌘ shift l .

Selection of the Character Editor replaces the subscript/superscript tools on the Tools window with vertical positioning tools, described above.

2. Click to select the graphic. Small square handles (Figure 4.34) appear at the corners of the bounding frame. The typeface box in the document status bar displays "Scale." Pressing *option* changes this to "Scale, Proportional."

3. Scale the graphic either by mouse or keyboard:

- By mouse: Drag a handle to scale the width and height of the graphic using separate proportionality constants. Press *option* while you drag if you want to assure that the width to height ratio is preserved.

- By keyboard: When the Character Editor is active and a graphic is selected, the Edit menu has a new command—Scale Picture.

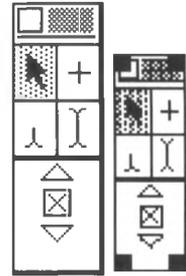


Figure 4.34 Scaling

- Select proportional or nonproportional and supply the scaling percentage(s).

4. Click OK to leave the dialog box.

5. To select the Text Editor again, do one of the following:

- Select the I-beam icon in the Tools window.
- Select Windows/Tools/Text Editor.
- Type ⌘ *shift* *apostrophe*.

To hide graphics for faster scrolling:

You can increase the scrolling speed somewhat for a graphics-laden document by suppressing the redrawing of the pictures.

- ◆ To suppress repeated drawing of the graphics, select Format/Hide Pictures.
- ◆ To restore graphics display, select Format/Show Pictures.

This menu command toggles between Show Pictures and Hide Pictures.

Character Manipulation

MathWriter provides you with tools to vertically position text characters, as well as graphics and portions of mathematical expressions treated as text characters, by mouse and by keyboard. In addition, it allows you to stretch certain characters.

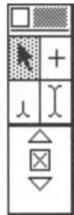
Moving characters

In contrast with the subscript and superscript templates, which automatically change a character's vertical position and font size, you can manually move any character an arbitrary distance above or below the baseline.

To move a character up or down:

1. To enable the Character Editor, do one of the following:

- Click on the Character Editor icon (an arrow pointing up and to the left) on the Tools window.
- Select Character Editor from the Tools submenu on the Windows menu.
- Type \mathscr{K} shift [.



2. Click on a character to select it.

Remember to release the mouse button before the next step.

3. Move the character by mouse or keyboard.

- By mouse: Drag the character vertically to its destination. The number of pixels moved is reported in the typeface box of the document status bar.
- By keyboard: Click on the up or down triangles in the Tools window to move in pixel increments. Press them continuously to move rapidly.

4. To reset the character to its initial position, click the square between the triangles.

Stretching characters

MathWriter provides numerous templates that automatically self-adjust in size. Some manual adjustments are possible too.

Vertical bars | and || in the Operators row of the Palettes menu can be stretched.

1. Use the mouse to place these symbols in your document.

2. To enable the Character Editor, do one of the following:

- Click on the Character Editor icon (an arrow pointing up and to the left) on the Tools window.
- Select Character Editor from the Tools submenu on the Windows menu.
- Type \mathscr{K} shift [.

3. Click on either the | or || character to select it.
4. Press *option* and the bottom portion of the Tools window reads "Stretch." Drag either end of the symbol to change its vertical dimension.

If you do not press *option*, the character is simply moved without a size change.

5. Optional: *Option click* in the middle of the character to restore its original length.

Rather than always requiring a keystroke to signal the completion of the integrand, *MathWriter* requires a keystroke only when you want to stretch the default symbol size.

Suppose you type: $\int_{x=0}^{\pi} \left[\frac{x^2}{1+\sin^3 x} \right] dx$, but prefer this: $\int_{x=0}^{\pi} \left[\frac{x^2}{1+\sin^3 x} \right] dx$.

To stretch the integral:

- ◆ Select Format/Calc Prev] or | Size, or press ⌘ D, when the insertion point follows the integrand to adjust the size of the integral to match the tall integrand.

MathWriter automatically sizes the brackets enclosing the fraction if you have selected Auto-bracket sizing in Style/Auto Math Options and enabled Style/Auto Math by menu or by using ⌘ E.

Mathematical Expressions

With *MathWriter* you can create and edit mathematical expressions easily. The Greek alphabet, used prominently in technical writing, receives special treatment.

Mathematical expressions are frequently taller than the text, so line spacing receives special attention. Built-up expressions are self-formatting and can be created by keyboard or by mouse. Various support tasks such as automatic sizing of brackets are optional. The find/replace feature is general enough to support search and replace on mathematical expressions.

MathWriter can be used solely as an expression editor if you must use a page layout program that does not have this capability. Simply create the equations one per line, save the *MathWriter* file, and save them in a Scrapbook by selecting *MathWriter's* File/Save As and choosing TEXT file type on the subsequent window. Alternatively, using *MathWriter's*

File/Copy As Picture you can transform individual expressions into the standard PICT format before placing them on the Clipboard for transfer into another application.

Greek letters

Since Greek characters are widely used in mathematical expressions, quick and convenient access to them is important. *MathWriter* offers several alternatives for accessing them: via keyboard, mouse, or the Library.

Keyboard access

To type Greek characters on the keyboard, press \mathscr{L} *spacebar* to toggle from the current font to Greek and press \mathscr{L} *spacebar* again to toggle back to the original font. By mouse, select Style/Greek to toggle between the fonts.

The Greek letters are taken from the Symbol font and generally have a mnemonic correspondence with the keyboard characters, such as "a" for alpha, "b" for beta, etc. Use the Apple/Key Caps desk accessory to review the keyboard assignments. The name of the current font appears in the typeface box of the document status bar; when Greek is active, *MathWriter* places a check beside Greek on the Style menu.

Mouse access

To select Greek characters using the mouse:

1. Select Windows/Palettes Window.

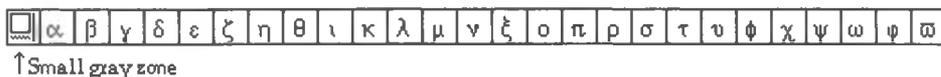


Figure 4.35 Greek alphabet

2. Drag the Palettes window, if you want to reposition it, by the tiny gray bar immediately beneath it (see Figure 4.35).
3. Click on Greek letters in the Palettes window to type them at the insertion point. As expected, pressing the *shift* key changes the Palette to uppercase letters (see Figure 4.36).



Figure 4.36 Uppercase Greek (and Variables) from Palettes menu

Any combination of rows from the Palettes menu can be placed on the Palettes floating window for more convenient access.

Quick typeface changes

MathWriter provides three keyboard controls (⌘ <, ⌘ >, and ⌘ \) for rapid typeface changes. Alternatively, the same options can be exercised using Style 1, Style 2, and Last Style on the Style menu. Refer to the discussion in the first section of this chapter for more details.

Quick type size changes

MathWriter provides four keyboard controls for rapid font size changes: *command plus*, *command minus*, *command option plus* (⌘ ⌥ +), and *command option minus* (⌘ ⌥ -). These commands increase (⌘ +), or decrease (⌘ -), the font size to the next size on the Text Sizes menu or by *one point* if you simultaneously press the *option key* (⌥). By mouse, you can exercise the same options by clicking Larger Size, Smaller Size, *option* Larger Size, and *option* Smaller Size on the Style menu. *Command backslash* (⌘ \) and *Style/Last Style* revert to the immediately previous typeface. Refer to the discussion in the first section of this chapter for more details.

The *plus* and *minus* can be typed from the top row of the keyboard, or from the numeric keypad.

Auto Math Options

Mathematical typesetting is governed by numerous conventions. Parentheses, brackets, and braces should match the size of the enclosed expression. The arithmetic operators in the Symbol font are considered by many to be more pleasing than their equivalents in other fonts. *MathWriter* can handle these operations automatically.

◆ To enable the Auto Math Options, set the Style/Auto Math Options (Figure 4.37) using one of the following methods.

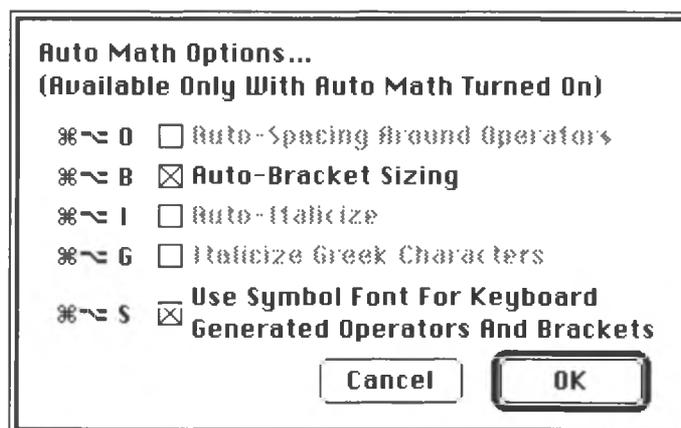


Figure 4.37 Auto Math Options dialog box

- Select Style/Auto Math Options to choose a combination of these options and click OK.
- Use the keyboard commands to toggle options on or off at any time.

These commands define the set of options that are enabled/disabled by $\mathcal{A}E$ or Style/Auto Math. Because using Auto Math slows *MathWriter*, you usually enable the Auto Math command only while forming mathematical expressions.

Auto Math Options merely defines the combination features you desire. You **MUST** use the Edit/Auto Math (or $\mathcal{A}E$) to *actually enable the options!!*

When Auto Math is enabled, the typeface box on the status bar of the document appears in inverse, white on black (Figure 4.38).

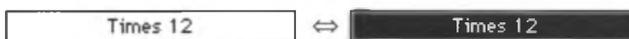


Figure 4.38 Auto Math enable-indicator

Mathematical structures

First, let's look at a few general principles. The Templates and Tools Windows provide self-formatting templates for key mathematical constructs. For convenience, these templates can be selected by mouse and by keyboard. *MathWriter* automatically handles the changes in font size and vertical placement.

The templates provide the structure and special symbols needed to create them. The template positions the insertion point for entry of the first expression, which can be arbitrarily complex. After you enter an expression, which can include several templates, press *enter* to position the cursor for the next expression. In matrices and tables, press *return* to advance the cursor to the next row and *tab* to advance to the next column.

Enter and *return* serve different purposes.

To edit in mathematical expressions you need a split I-beam cursor. When you click outside the structure, the traditional I-beam Text Editor is restored; to resume editing in a built-up expression, press *option* (⌘) and click to position the split I-beam cursor anywhere within the expression.

Because mathematical expressions reformat continually as you type them, remember to use Format/Line Spacing to assign automatic spacing during document creation.

Here are a few more tips. The same four keys used with \mathscr{K} \uparrow to obtain the four editors are used with \mathscr{K} to obtain the center above, superscript, center below, and subscript commands. *MathWriter* automatically adjusts the position and font size for superscript. The \uparrow in the status bar indicates that the cursor is one level above the baseline. Pressing enter removes one level of nesting, in this case moving the insertion point from the superscript position back to the baseline. The status bar box again reports "Base." Two up arrows would indicate that the insertion point is in a superscript to a superscript. One up arrow followed by a down arrow would indicate that the insertion point is in a subscript to a superscript.

The keys for sub and superscripts, (obtained with \mathscr{K} and [] ; ') correspond in position to the icons  in the Tools.

Edit an equation

Let's change $y = ax^2 + bx + c$ [2]

into $y = ax^4 + bx + c$ [3]

First, remember that editing in a built-up mathematical structure is a generalization of editing in ordinary text. The I-beam, text editing cursor must be replaced by the split I-beam, math editing cursor to edit characters that do not directly touch the normal text baseline.

1. Therefore, select the Math Editor by doing one of the following:

- Press *option* if the cursor is an I-beam.
- Click on the split I-beam  in the Tools window.
- Select Math Editor from the Tools submenu of the Windows menu.
- Type \mathscr{K} *shift semicolon*.

The arrangement of the keyboard equivalents for the four editors (Character, Sidebar, Math, and Text) corresponds to their arrangement on the Tools window. The Sidebar Editor is unavailable in this version.

2. Click at the bottom-right corner of the superscript to position the insertion point after "2".

3. Press *delete* to remove "2", leaving the insertion point in the superscript position.

4. Type "4".

5. Click outside the expression to restore the Text Editor.

Mathematical expressions are fully editable in the context of a document! Simply position the split I-beam cursor to add and delete. Drag to select expressions within “bounding rectangles,” etc. Editing is not limited to simple replacements as in this example; you can make arbitrarily complex changes. The expression is automatically reformatted with each keystroke. If you select and change the font size of an expression containing superscripts, for example, *MathWriter* will scale all font sizes to preserve the size relationships established in Style/Metrics.

The insertion point movement handled by mouse in the previous exercise can be controlled by keyboard too.

1. Use the four cursor arrow keys to move the I-beam to the immediate right of the character with the exponent.
2. Type the superscript command, $\text{⌘} 1$, to place the insertion point to the right of the superscript.
3. You could complete the exercise as in the previous example. A different method is to type *shift left arrow* to select the “2” and then type “4”.

To save your work, use one of these options:

- File/Save ($\text{⌘} S$) to use the existing file name, file type, and destination. You will be prompted if these have not been previously specified.
- File/Save As... to change the existing file name, file type, or destination. These changes apply to the active document and the previously active file is closed and left unchanged.
- File/Save A Copy to save a copy with a possibly different name, file type, or destination WITHOUT making this new file the active document.

MathWriter keeps the entire active document completely within RAM for greater speed; this makes frequent saving to a file a prudent action. Unless you change the default, files will be saved every fifteen minutes.

MathWriter automatically saves a file if you click AutoSave in File/Doc Preferences. You can even indicate how often you want the program to save your file. The type-ahead buffer saves the keystrokes you type during the file saving activity, letting you continue typing. When you are composing an original manuscript, we recommend an additional step—keeping a copy of the immediately previous file version too—using the automatic backup feature, also enabled with File/Doc Preferences. Click the “Warn me before saving” option on Doc Preferences to avoid accidentally replacing a good file copy with one that might be in the midst of a major revision.

MathWriter supports several file types. The comprehensive *MathWriter*[™] 2.0 format preserves the document and all the information required to re-establish the complete editing environment as you left it when the file was saved. Use Save As with the TEXT file type to save the text as an ASCII file without character formatting. This command also permits you to automatically extract the graphics and mathematical expressions and place them in a named scrapbook for transfer to another application. TEXT files can be read by many different applications.

When other translators become available, simply place them in the system folder or in the folder with *MathWriter* before startup and they will be added to the File Type pop-up menu automatically. A standard file interchange format filter (Microsoft's RTF standard) has been written for *MathWriter*. This filter allows *MathWriter* to read files from all major Macintosh word processors and to preserve character formatting, headers, footers, page numbering, graphics, graphics placement and even translate the embedded, nongraphic mathematical expressions of Word 4 documents into "WYSIWIG" editable mathematics. Mathematical expressions created by traditional mathematical expression editors, including *MathWriter 1.4*, are received as uneditable PICTs.

Fractions

We will show you how to create the fraction in equation [4] (from linear feedback control theory):

$$G(s) = \frac{K_2}{s^2(1 + T_f s)(1 + T_m s)} \quad [4]$$

$$G(s) = \frac{K_2}{s^2 (1 + T_f s)(1 + T_m s)} \quad \text{(not italicized)} \quad [4a]$$

First, here are some general comments. The Templates window provides three constructs for fractions on the pop-out menu (see Figure 4.39). All three are self-formatting, including adjustment of the length of the fraction bar and centering of the numerator and denominator. The first uses the current font size as the base, while the second immediately decreases the base font size to the next smaller menu size to reduce the display height. The third provides a slanted fraction bar.



Figure 4.39 Fractions templates

To use a self-formatting template, such as the fraction:

- Press on the category icon , and the menu pops out.

- Drag to the first icon  and release the mouse button.

The keyboard equivalents for steps 1 and 2 are: Press \mathscr{K} 1 and then 1.

The general numbering scheme is \mathscr{K} row number and then the column number. If you pause after typing \mathscr{K} row number, the menu of icons pops out with tiny column numbers to identify them. Type the keyboard equivalents quickly if you do not want this prompting menu to appear. Furthermore, if the Templates window is NOT displayed, type quickly or the command will be aborted.

Enter the numerator and the denominator, in that order. Press *enter* to advance from the numerator to the denominator or to exit the template. Both the numerator and denominator can be built-up expressions of arbitrary complexity.

To exit a built-up expression and return immediately to the baseline, press *return*, instead of *enter*.

To create the numerator "K₂", use the instructions box that follows:

action	K		2	
keybd		<i>cmd-apostrophe</i>		<i>enter</i>
baseline	↑	↑↓		↑

1. The subscript icon  is located on the Tools window. The keyboard command for a subscript is \mathscr{K} *apostrophe*. The adjustments of font size and vertical placement of the subscript are handled automatically.

2. Move the insertion point to the denominator. A down arrow indicates that the denominator has been entered.

action	
keybd	<i>enter</i>
baseline	↓

The placement of keys [] ; ' for sub and superscripts (pressed with \mathscr{K}) correspond to the positions of  
  on the Tools window.

3. Complete the denominator.

action	s		2		sp (...)	
keybd		\mathscr{K}]		<i>enter</i>	etc.	<i>enter</i>
baseline	↓	↓↑		↓		↓ Base

Parentheses, brackets, and braces

Automatic-sizing of parentheses, brackets, and braces is handled by the Auto Math feature, which you normally enable only while you are creating an equation. First, you select the options in Style/Auto Math Options (Figure 4.40). Then you enable them by selecting Style/Auto Math.

To create the parentheses in [5]:

$$C_P - C_V = -T \left(\frac{\partial V}{\partial T} \right)_P^2 \left(\frac{\partial P}{\partial V} \right)_T \quad [5]$$

1. With the mouse, select Style/Auto Math Options and check all options in the set to be enabled together. From the keyboard you can also use *command option letter* to add/remove each option, even when the dialog box (Figure 4.40) is not visible.

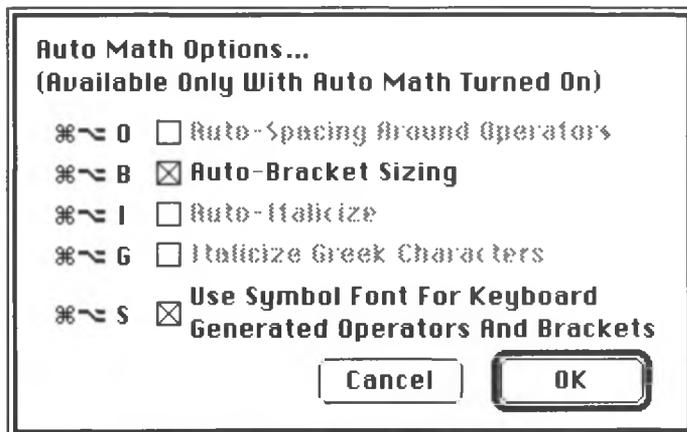


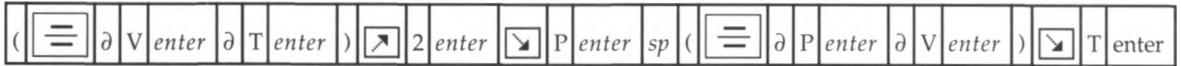
Figure 4.40 Auto Math Options

2. Enable Auto Math by clicking Style/Auto Math with the mouse or typing ⌘E from the keyboard. In general, toggle this feature on when creating each displayed equation and toggle it off when you finish. The typeface indicator in the document status bar at the bottom of the document window uses white letters on a black background while this option is activated.

3. Click Windows/Palettes Window to place the floating Palettes Window on the screen. Then click the Math/Calculus row in the Palettes menu to place it in the Palettes window.

A portion of this equation, $C_P - C_V = -T$, is created using the techniques of the previous example so only the extensions are discussed here. Follow the directions shown in the box below.

$$\left(\frac{\partial V}{\partial T}\right)_P^2 \left(\frac{\partial P}{\partial V}\right)_T \quad [6]$$



MathWriter automatically stretches the standard parenthesis, brace, or bracket to match the size of the expression. Enter the numerator and then the denominator. Obtain the partial derivative symbol from the Math/Calculus row of the Palettes menu. Frequently used palette symbols can be copied to the floating Palettes Window for rapid access.

Practice

Test your skills with the following practice problems. We assume you will go through these sequentially, so we will not repeatedly instruct you on techniques already discussed. First, practice with subscripts in an expression that relates stomatal pore width to the pressure in the guard and surrounding cells.¹

$$W = b_o + b_g P_g + b_s P_s \quad \text{when } W \geq 0 \quad [7]$$

We used a center tab to position the equation, a left tab for the condition, and a right tab to align the equation number. We supplied the equation number by pressing *command option E* (⌘ E).

The following example,² illustrates that superscripts can be built-up expressions. If you create a more complex superscript, pressing *enter* eventually brings the insertion point back to the base level. With the mouse, select rho from the Greek alphabet on the floating Palettes window; or type ⌘ spacebar to toggle to the Symbol font, which includes the Greek alphabet as indicated in the typeface box in the status bar. Type "r" for rho, and type ⌘ spacebar to return to the previous font.

This example also illustrates that a variable can have both a superscript and a subscript; they can be entered in either order.

$$G_2 = f^2 m^{2/3} \rho_2^{1/3} CR \quad [8]$$

In the next example,³ Auto Math substitutes the keyboard version of the operators with the Symbol font equivalents.

¹ Cooke, J. R. et al. 1976. A finite element analysis of guard cell deformations. *ASAE Transactions* 19(6): 1107-1121.

² Cooke, J. R. 1972. An interpretation of the resonant behavior of intact fruits and vegetables. *ASAE Transactions* 15(6): 1075-1080.

³ Cooke, J. R. and R. H. Rand. 1980. Diffusion resistance models. Ch 5 in *Predicting Photosynthesis for Ecosystem Models*. J. D. Hesketh and J. W. Jones (ed). CRC Press 1:93-121.

$$R = R_b + R_s = (a/D) \{ T + [\beta^2 \ln (4 / \alpha) + L_p \beta^2 / \alpha - \beta] \} \quad [9]$$

The next example⁴ illustrates the use of subequation numbers and special alignment. You establish the style of subequation numbers by selecting Format/Variables Format, clicking subequation # in the subsequent window, and clicking the buttons beside the style you want.

- To create equation numbers [10a] through [10f], click on the subequation number icon  on the Variables row of the Palettes menu to insert a subequation number in your text at the blinking insertion point. The variables row can also be placed on the Palettes floating window version of the Palettes menu for convenient access.

$$(a_1 + a_2 \omega^2)^2 - (a_3 \omega^2 - a_4) (a_5 \omega^2 - a_6) = 0 \quad [10]$$

where $a_1 = K$ [10a]

$$a_2 = M R L \quad [10b]$$

$$a_3 = [(\mu / 3) + M] L^2 \quad [10c]$$

$$a_4 = S + K[(\mu / 2 + M) g L] \quad [10d]$$

$$a_5 = (7 / 5) M R^2 \quad [10e]$$

$$a_6 = M g R + K \quad [10f]$$

The volume of an apple [11] can be modeled over the entire growing season using bispherical coordinates.⁵ Geometrically, this means rotating a sphere about a chord.

Astonishingly, the width to height ratio changes such that both surface area and volume increase linearly with time.⁶

$$V = [2 \pi / 3] [a / \sin \theta]^3 [3 \sin \theta + 3 (\pi - \theta) \cos \theta - \sin^3 \theta] \quad [11]$$

where θ is found from [11a].

⁴ Cooke, J. R. and R. H. Rand. 1969. Vibratory fruit harvesting: A linear theory of fruit-stem dynamics. *Journal of Agric. Engineering Research* 143:195-209.

⁵ Cooke, J. R. and R. H. Rand. 1969. Vibratory fruit harvesting: A linear theory of fruit-stem dynamics. *Journal of Agric. Engineering Research* 143:195-209.

⁶ Cooke, J. R. 1970. Mathematical determination of surface area and volume for developing apple, lemon, and peach fruits. ASAE Paper No. 70-388. 36 pages.

$$W/H = \begin{cases} (1 + \cos \theta), & 1 < W/H \leq 2 \\ (1 + \cos \theta) / \sin \theta, & 0 < W/H \leq 1 \end{cases} \quad [11a]$$

Equation [11a] illustrates the use of a vertical grouping bracket to distinguish between the conditions for a dimpled apple shape and a spindle-like lemon shape, including a sphere. This self-formatting structure is a matrix without the enclosing bracket on the right. Notice the cross-reference to the equation in this paragraph; if *MathWriter* rennumbers equation [11] as a result of the addition or deletion of equations during the writing process, it also automatically updates this cross-reference.

To create equation [11a]:

1. Select the template from the Templates window by dragging to row 8 and then to icon 1 or by pressing $\mathbb{8}$ and 1 in quick succession.
2. Create row 1, column 1.
3. Press *tab* to create a new column and *return* to create a new row.
4. Supply each cell as required. The enclosing bracket expands as necessary.
5. Optional: Use Format/Matrix Format to adjust the cell spacing, alignment within cells, line characteristics, and background characteristics.

The next example⁷ illustrates a parametric representation of a doubly elliptical toroidal shell used to perform a stress analysis of a stomate, which is the valve that regulates gas exchange in plants. You can type the Greek letters using $\mathbb{spacebar}$ to toggle between the Symbol and the current font.

$$x = \cos \theta \{B + A \cdot B [1 + \sin \phi] [(A \cos \theta)^2 + (B \sin \theta)^2]^{-(1/2)}\} \quad [12]$$

$$y = \sin \theta \{A + B \cdot C [1 + \sin \phi] [(A \cos \theta)^2 + (B \sin \theta)^2]^{-(1/2)}\} \quad [13]$$

$$z = \cos \phi \quad [14]$$

$$\text{where } 0 \leq \theta \leq \pi/2, \quad -\pi/2 \leq \phi \leq \pi/2 \quad [15]$$

The equations of motion⁸ for the free vibration behavior of a three-degree-of-freedom double pendulum model for the detachment of fruits make use of diacritical marks.

⁷ Cooke, J. R. et al. 1976. A finite element analysis of guard cell deformations. *ASAE Transactions* 19(6): 1107-1121.

⁸ Cooke, J. R. and R. H. Rand. 1969. Vibratory fruit harvesting: A linear theory of fruit-stem dynamics. *Journal of Agric. Engineering Research* 143: 195-209.

$$[(\mu/3) + M] L^2 \ddot{\theta} + M L R \ddot{\phi} + S \theta + K(\theta - \phi) + [(\mu/2) + M] g L \theta = 0 \quad [16]$$

$$(7/5) M R^2 \ddot{\phi} + M L R \ddot{\theta} + K(\phi - \theta) + M g R \phi = 0 \quad [17]$$

$$(2/5) M R^2 \ddot{\psi} + C \psi = 0 \quad [18]$$

◆ To use the diacritical marks:

1. With the insertion point to the immediate right of a character, select the double dot symbol for time derivative on the Diac menu.
2. Adjust the vertical position of the diacritical mark with the Raise (⌘ R) or Lower (⌘ L) command.

The second derivative in Matheiu's equation [19] uses the fraction and superscript templates.

$$\frac{d^2 y}{d t^2} + [D_0 - D_1 a \Omega^2 \cos \Omega t] y = 0 \quad [19]$$

Equation [20] gives the radial component of velocity of a spherical seed⁹ rolling along the nonradial vane of a rotating disk.

$$\dot{r} = \left\{ \left[\frac{2H_r}{m} + r^2 \omega^2 \right] \left[\frac{5}{7} \left(1 - \frac{p^2}{r^2} \right) \right] \right\}^{1/2} \quad [20]$$

This example uses a diacritic, as discussed above, the fraction template for reduced font size, self-formatting stretch brackets and braces, and an exponent for a stretched brace, as discussed next. Remember that you choose the combination of formatting features using Style/Auto Math Options and then enable/disable all in the selected set using Style/Auto Math (or ⌘ E).

◆ To enable self-sizing brackets and braces:

1. Select Auto-bracket sizing in Style/Auto Math Options.
2. Click Style/Auto Math or type ⌘ E to enable Auto Math.
3. Toggle this feature off (⌘ E) when the equation has been entered.

◆ To use the reduced font size fraction template:

⁹ Cooke, J. R and J. W. Dickens. 1971. A centrifugal gun for impactation testing of seeds. ASAE Transactions 14(1): 147-155.

1. Click the second fraction template or type $\frac{\text{num}}{\text{den}}$ 1 and 2.
2. Supply the numerator.
3. Press *enter* to move to the denominator.
4. Supply the denominator.
5. Press *enter* to leave the denominator.

To achieve the effect of a magnifying glass, select text and choose a larger font size; the font size relationships are preserved. Edit the expression, select the same text again, and restore the original font size.

- To use a superscript with a stretched brace, the normal superscript procedures apply.

The following equation¹⁰ using Hankel wave functions illustrates most of the features used in the previous examples—alignment of multiple equations, self-formatting brackets and braces, subscripts and superscripts on the same variable, Greek letters, equation numbering, etc.

$$u(z,t) = T_{av} + B \exp[i(\omega t - \zeta z)] \quad [21]$$

$$v(r,z,t) = T_{av} + A H_0^{(1)}(r) \exp[i(\omega t - \zeta z)] \quad [22]$$

$$\text{where } \beta = \alpha \sqrt{(\phi/\alpha_s)} \quad [23]$$

$$\lambda = V_a/\omega \quad [24]$$

$$\gamma = (m'_a c'_a \omega_h) / k_s \quad [25]$$

$$N_{Bi} = (h a / k_s) \quad [26]$$

$$B = A [H_0^{(1)}(\beta) - \frac{\beta i^{3/2}}{N_{Bi}} H_1^{(1)}(\beta)] \quad [27]$$

$$\zeta = \frac{1}{\lambda} + \sqrt{i} \left[\frac{\lambda \gamma}{\beta} \left(\frac{H_0^{(1)}(\beta)}{H_1^{(1)}(\beta)} + \frac{\beta i^{3/2}}{N_{Bi}} \right) \right]^{-1} \quad [28]$$

The next example is taken from a paper¹¹ that demonstrates the conditions that allow stomatal pore width (which regulates gas exchange between a plant and its environment) to undergo rhythmic opening and closing when a plant is subjected to a completely nonvarying environment.

¹⁰ Scott, N. R. et al. 1982. Analysis of earth-air heat exchange. Lawrence Berkeley Laboratory Report. 72 pages.

¹¹ Rand, R. H. et al. 1981. Hopf bifurcation in a stomatal oscillator. *Journal of Mathematical Biology* 12: 1-11.

$$S = \omega(G_{\xi\xi\eta} + G_{\eta\eta\eta}) + G_{\xi\eta}(G_{\xi\xi} + G_{\eta\eta}) \quad [29]$$

$$= \frac{k_2(k_1^2 + k_2^2)c_1^2}{(1+k_3)^6} \left\{ \frac{6(1+k_3)^2}{c_1} + \frac{4k_1}{\omega^2} \right\} \quad [30]$$

The pressure in stomatal guard cells and the surrounding cells can be described by a system of second order, nonlinear ordinary differential equations.¹²

$$\xi_1 \begin{Bmatrix} \dot{P}_g \\ \dot{P}_s \end{Bmatrix} = \begin{bmatrix} b_1 & b_2 \\ b_5 & b_6 \end{bmatrix} \begin{Bmatrix} P_g \\ P_s \end{Bmatrix} + \begin{Bmatrix} b_3(t) \\ b_8(t) \end{Bmatrix} + \begin{Bmatrix} b_4 \\ b_9 \end{Bmatrix} + \begin{Bmatrix} 0 \\ g_1 \end{Bmatrix} \quad [31]$$

$$\text{where } \xi_1 = \frac{2V_g^0}{L\varepsilon_g A_2} \quad [31a]$$

$$b_1 = -[1 + (\pi_g^0/\varepsilon_g)] \quad [31b]$$

$$b_2 = [1 + (\pi_g^0/\varepsilon_s)] \quad [31c]$$

$$b_3(t) = \tilde{\pi}_g \quad [31d]$$

$$b_4 = (\pi_g^0 - \pi_s^0) \quad [31e]$$

$$b_5 = \varepsilon V [1 + (\pi_g^0/\varepsilon_g)] \quad [31f]$$

$$b_6 = -(\varepsilon V + 2\varepsilon AV) [1 + (\pi_s^0/\varepsilon_s)] \quad [31g]$$

$$b_8(t) = -\varepsilon V \tilde{\pi}_g \quad [31h]$$

$$b_9 = \varepsilon V (\pi_s^0 - \pi_g^0) + 2\varepsilon AV (\psi_r + \pi_s^0) \quad [31i]$$

$$g_1 = \frac{-2\varepsilon AV R_p}{R_t} (c_m - c_a) \quad [31j]$$

MathWriter easily handles the matrix form of this system of equations. Use the matrix templates (§ 9 and 1; § 9 and 3) to form the vectors and matrices. Use Format/Matrix Format to adjust the placement, line type, justification within element cells, cell spacing, and row alignment within matrix equations. *Tab* creates new columns and *return* creates new rows. To

¹² Delwiche, M. J. and J. R. Cooke. 1977. An analytical model of the hydraulic aspects of stomatal dynamics. *Journal of theoretical biology* 69: 113-141.

edit within a matrix, use the Math Editor (Tools submenu of Windows) to position the insertion point. The cursor keys used with ⌘ ⇧ moves the cursor among the elements of a matrix. Use the Diac menu to apply and adjust the diacritical marks.

A study¹³ of parametric excitation of nonlinear normal mode behavior of a fruit-stem model for vibratory fruit harvesting reveals a strong dependence of resonance upon amplitude of oscillation when you want to harvest cherries without stems attached. Equation [32] is a matrix equation where v is the horizontal component of the forcing function and $\ddot{\eta}$ is the vertical component of acceleration of the stem.

$$\mathbf{A} \ddot{\mathbf{x}} + \mathbf{B} \mathbf{x} = \mathbf{v} \tag{32}$$

where

$$\mathbf{x} = \begin{bmatrix} \theta \\ \phi \end{bmatrix} \tag{32a}$$

$$\mathbf{A} = \begin{bmatrix} (\mu/3 + M) L^2 & MLR \\ MLR & 7/5 MR^2 \end{bmatrix} \tag{32b}$$

$$\mathbf{B} = \begin{bmatrix} S + K + (\mu L/2 + ML)(g + \ddot{\eta}) & -K \\ -K & K + MR(g + \ddot{\eta}) \end{bmatrix} \tag{32c}$$

$$\mathbf{v} = \begin{bmatrix} -(\mu L/2 + ML) \ddot{\xi} \\ -MR \ddot{\xi} \end{bmatrix} \tag{32d}$$

Bold Greek letters, such as v , display correctly on the screen and on ImageWriter output, but unless you use the Symbol font supplied with *MathWriter* the boldface style will not print in boldface on a LaserWriter.

The water status in plants is often studied using a pressure chamber¹⁴ to force sap from the stem of an excised leaf. The results can be expressed in series form as in equations [38]–[40]. Two summation templates in *MathWriter* provide for displayed (⌘ 4 and 1) and inline (⌘ 4 and 2) series. These can also be selected from the pop-out Templates window. The insertion point moves immediately, when the symbol is placed, to the lower limit; when you finish, press *enter* to move to the upper limit. *MathWriter* automatically positions both limits horizontally and reduces

¹³ Rand, R. H. and J. R. Cooke. 1970. Vibratory fruit harvesting: A non-linear theory of fruit-stem dynamics. *Journal of Agric. Engineering Research*. 15(4): 347-363.

¹⁴ Stroshine, R. L. et al. 1985. Analysis of resistance to water flow through wheat and tall fescue leaves during pressure chamber efflux experiments. *Plant, Cell and Environment* 8: 7-18.

the font size. Use the split I-beam Math Editor to edit within these limits.

$$\phi(r,t) = T_w + \frac{2(T_w - T)}{r} (r_0) \sum_{n=1}^{\infty} \frac{(-1)^n}{n} e^{-\lambda_n t} \sin[(n\pi/r_0)r] \quad [33]$$

$$V_r(x,t) = -\frac{k_4}{k_3} + \sum_{m=1,3,5,\dots}^{\infty} \frac{4a_1}{m\pi} \exp(\mu_m t) \sin(\lambda_m x) \quad [34]$$

$$P(x,t) = \frac{-16a_1 k_1^2}{\pi^3} \sum_{m=1,3,5,\dots}^{\infty} \mu_m \frac{\exp(\mu_m t)}{m^3} \sin(\lambda_m x) \quad [35]$$

The electrostatic charge on an elliptical disk conductor is analogous to the diffusion from an isolated elliptical surface.¹⁵ The result [36] is expressed using the integral and square root templates in the elliptic integral [37].

$$Q = \frac{2\pi D C_0 a}{K(\epsilon)} \quad [36]$$

where
$$K(\epsilon) = \int_{\phi=0}^{\pi/2} \frac{d\phi}{\sqrt{(1 - \epsilon^2 \sin^2 \phi)}} \quad [37]$$

and
$$\epsilon^2 = \frac{a^2 - b^2}{a^2} \quad [38]$$

◆ To create the integral symbol with automatic spacing around the operators perform the steps in the table (which are summarized in the numbered steps 1–4):

$$\int_{\phi=0}^{\pi/2}$$

⌘ 5		∫	=	0	enter	π	sp	/	sp	2	enter
-----	--	---	---	---	-------	---	----	---	----	---	-------

1. Type ⌘ 5 and | to select the integral that has the insertion point in the lower limit of integration. The limits can be built-up expressions of arbitrary complexity.

2. Supply the lower limit and press *enter*.

3. Supply the upper limit of integration and press *enter*.

4. If necessary, *option click* in either limit to edit.

¹⁵ Cooke, J. R. 1966. Some theoretical considerations in stomatal diffusion: A field theory approach. *Acta Biotheoretica* 173: 95-124.

5. Create the integrand using the keystrokes in the following table.

$$\frac{d\phi}{\sqrt{(1-\epsilon^2) \sin^2 \phi}}$$

⌘	I	I	d	ϕ	enter	⌘	2		(-	ε	⌘		2	enter)	sp	s	i	n	⌘		2	enter	ϕ	enter	enter
---	---	---	---	---	-------	---	---	--	---	--	---	---	---	--	---	-------	---	----	---	---	---	---	--	---	-------	---	-------	-------

6. After completing the integrand, press ⌘ D to resize the integral sign. Only if the integrand is tall must you adjust the integral size. If you prefer, you can manually stretch the integral symbol (Figure 4.41).

◆ To manually stretch an integral:

1. Enable the Character Editor.
2. Click on the vertical shaft of the integral symbol *above* the midpoint.
3. Press *option* to enable the stretching capability (see Tools window).
4. Drag upward to stretch the rectangular frame around the integral and its limits to obtain the desired height.

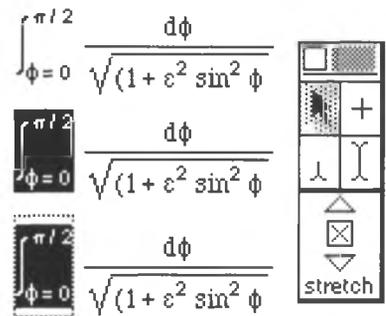


Figure 4.41 Integral stretching

5. Optional: To restore the default height of the symbol, *option* click on the vertical shaft of the integral symbol *at* the midpoint.

6. Enable the Text Editor again.

The above procedure also applies to the stretching of | and || characters obtained from the Palettes menu.

This component of the classical Navier-Stokes equation [39] includes most of the structures of the previous examples. Notice that Times and Symbol fonts are the workhorses for these equations.

$$\rho \left(\frac{\partial v_r}{\partial t} + v_r \frac{\partial v_r}{\partial r} + \frac{v_\theta}{r} \frac{\partial v_r}{\partial \theta} - \frac{v_\theta^2}{r} + v_z \frac{\partial v_r}{\partial z} \right) = - \frac{\partial p}{\partial r} + \left[\frac{\partial}{\partial r} \left(\frac{1}{r} \frac{\partial}{\partial r} (r v_r) \right) + \frac{1}{r^2} \frac{\partial^2 v_r}{\partial \theta^2} - \frac{2}{r^2} \frac{\partial v_\theta}{\partial \theta} + \frac{\partial^2 v_r}{\partial z^2} \right] + \rho g_r \quad [39]$$

In order to analyze the transmission of energy through a tree subject to a sinusoidal oscillation, a finite element model of an assemblage of branched

tapered columns was studied.¹⁶ To adjust the integral in [40] we used Auto Math Options and the Calc Prev \int or \int Size (Format) or \mathscr{D} with the insertion point immediately following the integrand.

Before we adjusted the integral size and matrix row alignment:

$$\mu_c = \frac{1}{2} \int_{y=0}^{L_i} \left([f_i \quad m_i] \begin{bmatrix} \frac{y^2}{EI} + \frac{1}{K_s GA} & \frac{y}{EI} \\ \frac{y}{EI} & \frac{1}{EI} \end{bmatrix} \begin{Bmatrix} f_i \\ m_i \end{Bmatrix} \right) dy \quad [40]$$

After adjustments:

$$\mu_c = \frac{1}{2} \int_{y=0}^{L_i} \left([f_i \quad m_i] \begin{bmatrix} \frac{y^2}{EI} + \frac{1}{K_s GA} & \frac{y}{EI} \\ \frac{y}{EI} & \frac{1}{EI} \end{bmatrix} \begin{Bmatrix} f_i \\ m_i \end{Bmatrix} \right) dy \quad [41]$$

◆ To calculate and adjust the size of the integral symbol automatically:

1. Place the insertion point after the integrand.
2. Press \mathscr{D} (or use the Edit menu), and *MathWriter* sizes the integral sign.

◆ To align the rows of the matrices in an equation:

1. Select the matrices.
2. Select Format/Matrix Format.
3. Check the Align rows box.
4. Click OK.

The remaining examples illustrate some typical calculus problems.

$$V^{\text{out}} = V_{\text{in}} \quad [42]$$

$$y = \frac{1+x}{1-x} \quad [43]$$

$$\frac{d}{dx}(u/v) = \frac{v \, du/dx - u \, dv/dx}{v^2} \quad [44]$$

¹⁶ Upadhyaya, S. K. et al. Limb impact harvesting, Part I: Finite element analysis. Transactions ASAE 24(4): 856–863.

$$\frac{d}{dx} (u/v) = \frac{v \, du/dx - u \, dv/dx}{v^2} \quad [45]$$

$$\sqrt{\sqrt{\sqrt{256}}} = 2 \quad [46]$$

$$\frac{1}{\Gamma(z)} z e^{\gamma z} \prod_{n=1}^{\infty} \left[\left(1 + \frac{z}{n}\right) e^{-z/n} \right], \quad |z| < \infty \quad [47]$$

$$\frac{1}{\Gamma(z)} z \exp(\gamma z) \sum_{n=1}^{\infty} [(1 + z/n) \exp(-z/n)], \quad |z| < \infty \quad [48]$$

$$\sum_{n=1}^3 (1/n^2) = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} \quad [49]$$

$$J_{\nu}(z) = \left(\frac{z}{2}\right)^{\nu} \sum_{\kappa=0}^{\infty} \frac{(-z^2/4)^{\kappa}}{\kappa! \Gamma(\nu + \kappa + 1)} \quad [50]$$

$$\int_{x=0}^2 x \, dx = \frac{x^2}{2} \Big|_0^2 = \frac{2^2}{2} - \frac{0^2}{2} = 2 \quad [51]$$

$$\int u \, dv = u v - \int v \, du \quad [52]$$

$$\int (ax + b)^n \, dx = \frac{(ax + b)^{n+1}}{a(n+1)}, \quad n \neq -1 \quad [53]$$

$$\frac{d}{dc} \int_{a(c)}^{b(c)} f(x, c) \, dx = \int_{a(c)}^{b(c)} \frac{\partial}{\partial c} f(x, c) \, dx + f(b, c) \frac{db}{dc} - f(a, c) \quad [54]$$

$$\gamma = \lim_{m \rightarrow \infty} \left[1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots - \ln m \right] \quad [55]$$

Use \otimes 7 and 1 to create the limit (not \square).

$$\int \frac{dx}{[(a+bx)(c+dx)]^{1/2}} = \begin{cases} \frac{2}{(-bd)^{1/2}} \arctan \left[\frac{-d(a+bx)}{b(c+dx)} \right]^{1/2}, & bd < 0 \\ \frac{-1}{(-bd)^{1/2}} \arcsin \left(\frac{2bdx + ad + bc}{bc - ad} \right), & b > 0, d < 0 \\ \frac{2}{(bd)^{1/2}} \ln | [bd(a+bx)]^{1/2} + b(c+dx)^{1/2} |, & bd > 0 \end{cases} \quad [56]$$

The self-sizing bracket (\mathscr{B} 8 and 1) is a matrix with 3 rows and 1 column without a closing brace.

Find/Replace for mathematical expressions

In the previous chapter we discussed the find and replace capabilities for locating and replacing text and text styles. Having discussed the creation of mathematical expressions in this chapter, we can now extend that discussion.

MathWriter can find and replace built-up mathematical expressions and portions of an expression that extend to the baseline, i.e., expressions that can be selected using the I-beam Text Editor. However, the built-up expression must be created within the Find/Replace (Edit) (or \mathscr{B} F) dialog box; only text can be pasted into the Find/Replace window.

Suppose you wish to search for α^2 and replace it with β^3 .

1. Position the insertion point in your document where the search is to begin.
2. Select Edit/Find/Replace (\mathscr{B} F) to access the dialog box (Figure 4.42).
3. Create the expression you want to locate in the upper box opposite Find:.
4. Create the expression to replace the located expression in the lower box opposite Replace with:.
5. If necessary, set the search conditions:

Restrict the two general categories using the two corresponding subcategories.

- Set the "Match" pull-down menu to "Text".
 - Set the "Affect" pull-down menu to "Text".
6. Optional: Select a search direction in the pop-down Direction menu. The search begins where the insertion point is currently located.
 7. Direct the search by mouse from the dialog window (Figure 4.42) or by keyboard.
 8. Click the Find button or type \mathscr{B} G to initiate the search with the dialog box visible or press *return* to hide the dialog box and initiate the search.
 9. When a match is found, click Replace, then Find (or to separate the steps click Replace and then click Find), or type \mathscr{B} H to make the substitution and then \mathscr{B} G to resume the search.

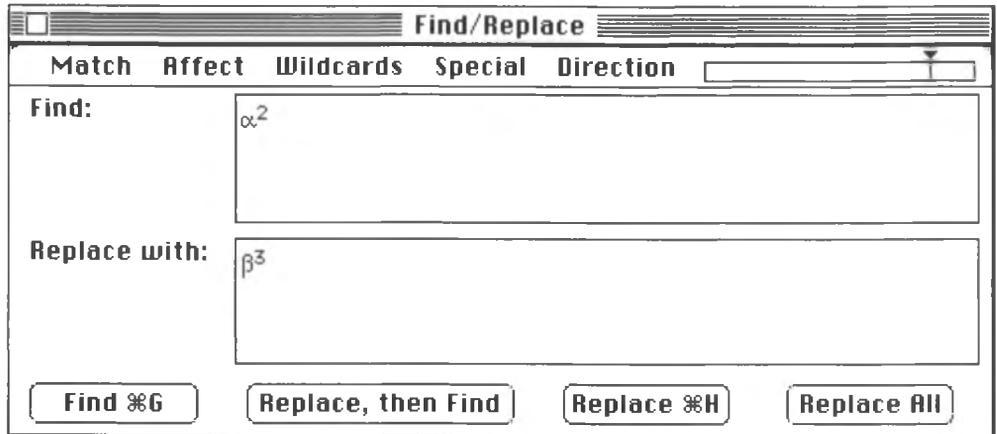


Figure 4.42 Find/Replace dialog box

10. To continue the search, repeat step 8.

When using the mouse, the Find, then Replace button combines the Find and Replace buttons.

If desired, use $\% F$ to retrieve the dialog box when using a keyboard directed search.

When the dialog box is visible, the “thermometer” scale to the right of the Direction menu indicates the starting position of the insertion point and the progression of the search through the document. When the dialog box is hidden, a larger screen area is available for viewing the document.

Wildcard searches on mathematical expressions

In the previous chapter we discussed text wildcard characters that you can substitute for a single character ? or any leading or trailing string of characters word in a match. For example *than* and *then* can both be found using th?n , with the single character wildcard. On the other hand, the word wildcard word would allow the search “ J?word ” to find both *Jones* and *Johns*, and “ word?arch ” would find both *search* and *research*, although the number of characters differs.

The analogous wildcards for mathematical expressions are



The first matches any built-up mathematical expression that extends from the baseline, the second illustrates a category (or row) from the Template windows, and the third illustrates a match for any specific template selected from the Templates window.

The first wildcard would match all three of the following, the second would match the second and third, and the third would match only the second.

$$\alpha^2, \sqrt{(x^2)}, \sqrt[2]{4}$$

To search with a mathematical wildcard:

1. Position the insertion point in your document where the search is to begin.
2. Select Edit/Find/Search (or ⌘ F).
3. Place the insertion point in the large Find: box.
4. Select one of the three wild cards from the Wildcards menu Structure (⌘ ?), or click on one of the ten template categories from Template Category, or on one of the 51 templates from Template Object and click OK.
5. Click on Find or type ⌘ G to initiate the search.
6. Click on the close-box to terminate the search.

Mathematics and the Clipboard

The usual cut, copy, and paste techniques apply to mathematical expressions alone and those intermixed with text. However, the format used to represent editable mathematics is unique to *MathWriter*, so the usual techniques only allow you to cut and paste within and among *MathWriter* documents. Therefore, to transfer mathematics to the Clipboard in a standard (PICT) format:

1. Select the mathematical expression.
2. Use Copy Other/Copy As Picture from the Edit menu to convert the selected material into the PICT format before placing the selection on the Clipboard.

This works for mathematics, text, and graphics. The mathematical expressions that originated in *MathWriter* can be pasted back into *MathWriter* from the Scrapbook for further modification, if necessary.

However, if the PICTs are modified in a drawing program and transferred back into *MathWriter* or into another application such as a page layout program, such expressions will be treated as pictures, rather than as editable text.

Customization

Even though *MathWriter* provides tools not included in a conventional word processor, we tried to configure the program for those who do not want

to write mathematics as well as those who do. For example, if you do not ordinarily encounter mathematics, you should not be burdened by the tools used only for that purpose.

MathWriter helps you avoid repetitive startup tasks by providing two levels of customization—one that applies to *MathWriter*, regardless of the document, and one that is document specific. Since most of these techniques have been considered throughout this and the previous chapter, we give only a general summary here.

Global preferences



Certain configuration choices remain relatively constant from one document to the next and from one working session to the next. To avoid repetitively setting these conditions, *MathWriter* stores them in the *MathWriter Prefs* file placed in your system folder during your initial session and whenever you choose any of the defaults. You set many of these global conditions using Preferences on the File menu.

To return to the original defaults, simply place the current Prefs file in the trash, and *MathWriter* will create a replacement. Note: Document-specific defaults are stored in each document or in MW Default file templates accessible from the New (File) submenu.

The *MathWriter Prefs* file contains the following categories.

- **File/Preferences dialog box**

Default file name and volume reference of the file opened at startup

Floating window selection and position at startup (Font Table, Tools, Templates, and Palettes).

Combination of symbols in Palettes window at startup

File warnings at startup

Enable Screen auto-refresh

- **Windows/Font Table**

Name of last selected font

- **Format/Matrix (table) format**

Placement, Line type, Justification within cells, Cell spacing, Alignment within rows

- **Style/Text sizes**

Last used Other Font Size

- **Edit/Check Spelling**

Name and volume reference for main and user dictionaries

State of check boxes in spell-checker (Alternates, All caps, Repeated words)

- **File/Print**

Most recent choice of LaserWriter Paper motion configuration

Local preferences

The typeface and even some of the contents of various document types remain constant. *MathWriter's* primary customization technique is the creation of template documents as MW Default Files using the Save As (File) command. *MathWriter* files store not only the contents of a document but the complete specifications of the editing environment that existed when the file was saved. Therefore, when you open an existing file, you can resume work at once. MW Default Files have one additional important attribute—they serve as a template that you can copy to form the basis for a new working environment. Therefore, each combination of features and the initial contents of the document preserved in this form becomes a type of stationery. You can create such a file for each of your major tasks. The names of the default files appear on the Newsubmenu for convenient selection if you store the master copy in the system folder or in the same directory as *MathWriter*.

If you select New, but *not* one of its submenu entries, you open a blank generic file.

Producing a list of all the features you can preset with this technique would be exhaustive. Instead, a few of the more important and some of the less important but obscure possibilities follow.

- Page Layout (margins, headers, footers, gutter, facing pages); Printer Setup (Printer type, paper size, paper orientation, enlargement percentage, printer special effects)
- Document Layout (styles 1 & 2, footnote & endnote typeface, auto-save, auto-backup, file compaction, smart quotes, fractional character widths)
- Printer options, print sides, type of LaserWriter
- Format (ruler and units, spacing before and after paragraphs, line spacing)

- Matrix format (row and column spacing, line type and pattern, justification within cells)
- Variables format (dates, time, page footnote, page, equation, figure, tables, etc.)
- Layout display (hidden boundaries, messages, invisible characters, pictures)
- Typeface (font, font size, font style in body, headers, and footers)

Default files can also store frequently used text and pictures such as logos. For example, a memo might contain a logo, the "To, From, Subject" headings, and automatic date and time stamping. The footer might contain variables to identify the source file, the date and time of printing, and the current and total number of pages in the file. Such a memo template is included on the distribution disks.

Data sharing

The Macintosh user interface gives special attention to the transfer of text and graphics among Macintosh applications. Applications such as *MathWriter* that adhere to the published interface standards can be assured of a communications channel through the Clipboard. MultiFinder makes switching applications quick and easy if there is sufficient RAM. Data can be stored in the Scrapbook for delayed transfer into other applications. System 7.0 will expand the pathways.

Delayed transfer by direct reading of files from other applications is another, somewhat more complex, pathway for information transfer. Each application must use a file structure that is suited for storing of information peculiar to its purposes. Often the translation process does not transfer all of the information in a manner that can be fully recovered, so save the original *MathWriter* file before you begin a translation.

Text files



Text File



Scrapbook File

Word-processor files, known as ASCII files, that save only the character keystrokes and some minimal paragraphing information are the common denominator. While this is universally supported, transferring the contents of a file from one word processor to another loses such information as character formatting and graphics. *MathWriter* does provide an additional enhancement—the graphics and mathematical symbols are automatically extracted and stored in a named scrapbook for subsequent transfer into another application. *MathWriter* can also place a marker in the text file to assist in the merging of the information from the other application.

To save a text (ASCII) file:

1. Select File/Save As.
2. Select TEXT from the File Type pop-up menu (Figure 4.43).
3. Select a destination drive and folder.
4. Supply a file name. **Never** use the name of the parent file. Appending ".txt" is a convenient way to show its relationship to the original file.
5. Click Save.
6. Specify that a line break (Figure 4.44) not be added to preserve the structure of the lines. Ordinarily the line structure is preserved only if the receiving application cannot handle paragraphs as a continuous stream of arbitrary length.

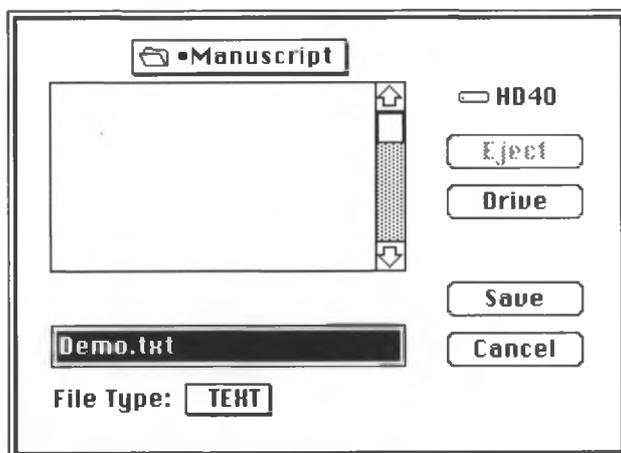


Figure 4.43 Save As dialog box

7. Check to indicate whether *MathWriter* should save the graphics and equations in a named scrapbook.
8. If yes, indicate a marker, if any, to locate the point of extraction for later reassembly in another format. The default encloses a counter enclosed between parentheses and asterisks (*0*).
9. Select a grouping criterion. The middle option is the default. If you have created a file of only displayed equations, choose the last option.
10. Click OK.

Unless you have a desk accessory such as SmartScrap™ to open the scrapbook file you must place the scrapbook in the system folder, rename any existing scrapbook file, and temporarily rename the scrapbook just created "Scrapbook File."

TEXT options:

Text only

Text with line breaks

Save equations in scrapbook

Mark location in text with:

Name of Scrapbook file:

Equation parser will convert...

each symbol into a separate PICT

groups of symbols into separate PICTs

entire line containing symbols into a PICT

Figure 4.44 Scrapbook file

Microsoft interchange format (RTF)



The so-called Rich Text Format (RTF) provides a standard for file transfer that preserves the character formatting and graphics intact. Depending upon the other features supported by each word processor, some information is passed as comments and not immediately restored to its original appearance. *MathWriter's* RTF filter must be placed in the folder with *MathWriter* or in the System folder in order to have its name appear in the File Type menu for Open¹⁷ on the File menu. Most word processors support this file format. *MathWriter* also imports Mathematica Notebooks that have been translated into RTF.

To read an RTF file (if the RTF filter is in the folder with *MathWriter* or in the system folder):

1. Select File/Open.
2. Select RTF from the File Type pop-up menu. Otherwise, the untranslated RTF code will be read as a TEXT file.
3. Click OK. The translation process is lengthy because of *MathWriter's* rich data structure. The translation consists of two parts—translation of the RTF code and the formatting of the document within *MathWriter*. Allow time for the completion of both parts and then save the file.

¹⁷ Initially the RTF filter provides import only (i.e., RTF to *MathWriter*).

The RTF filter does not check the code for *MathWriter* compatibility. Furthermore, this code bypasses the usual syntax checking provided by *MathWriter* during mouse and keyboard input.

4. Supply additional formatting in *MathWriter* as necessary, especially for features not supported by both word processors.

To save an RTF file (if the RTF filter is in the folder with *MathWriter* or in the System folder):



File/RTF

1. Select File/Save As.
2. Select RTF in the File Type pop-up menu.
3. Supply a file name different from the parent *MathWriter* file, perhaps by appending "/RTF" to the file name.
4. Select a folder and drive and click OK.

Other translators

Commercial translators (filters) provide a channel among various formats read by both the Macintosh and IBM-PCs. The creation of a T_EX translator for entire, "WYSIWYG"-created *MathWriter* documents is being considered.

Importing from graphics files

MathWriter can read paint, draw, and Encapsulated PostScript files directly without the originating application. Refer to the previous chapter for details.

Modular extensions



Since *MathWriter* is a modular¹⁸ word processor, you can extend its **function** with modules that can access and process *MathWriter*'s data structure using calls to *MathWriter*. These modules literally extend functionality. When modules are placed in the folder with *MathWriter* or in the System folder before startup, *MathWriter* locates and integrates them as a part of *MathWriter*. No more than one modular extension at a time may be used in *MathWriter*/Educational Version.



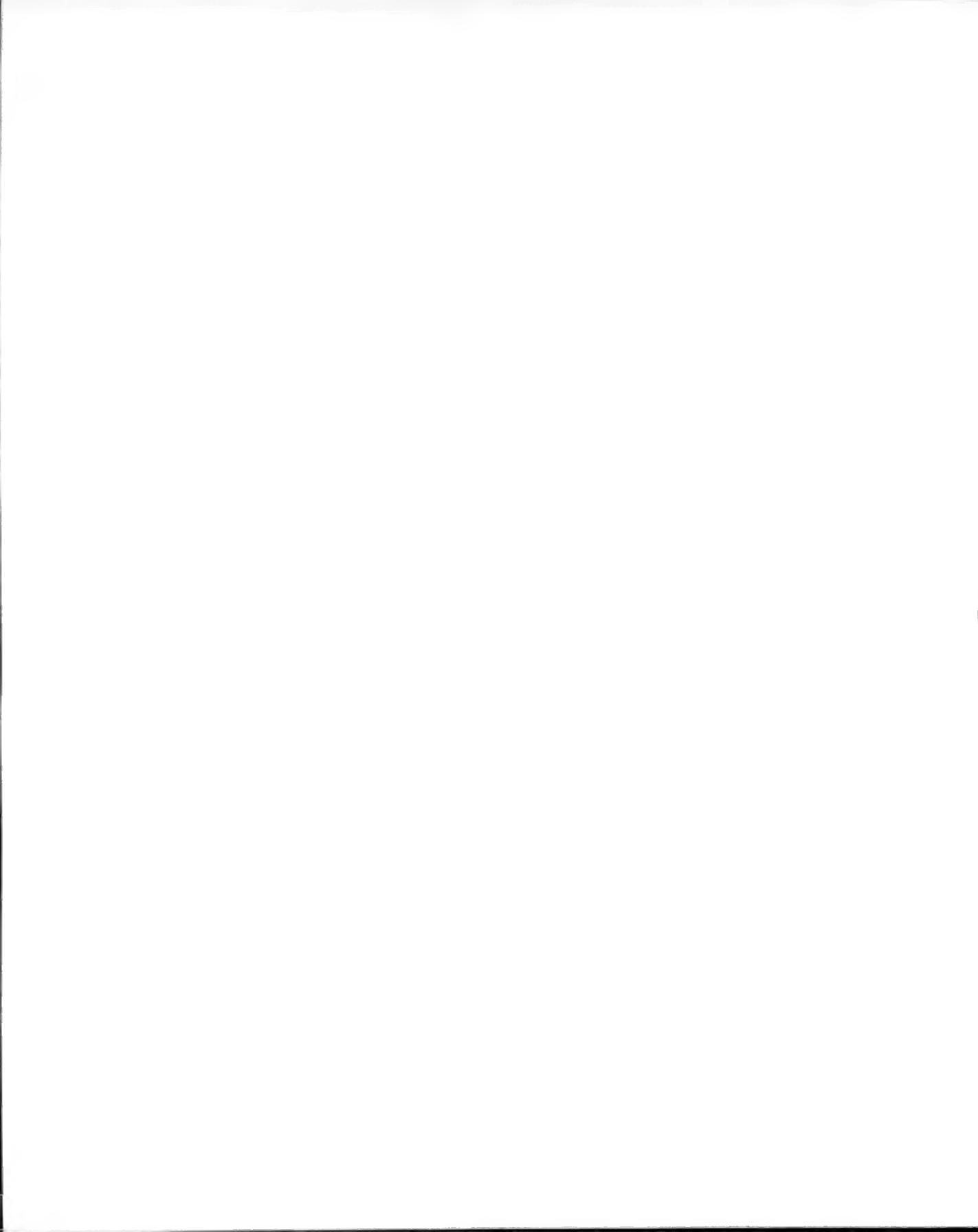
This allows you to customize *MathWriter* in a fundamental manner. You work only with the modules relevant to your needs. This limits the complexity and size of *MathWriter*, decreasing disk space used and increasing the speed. Use the Windows/Modules submenu (or ⌘ option number) to access the modules.

¹⁸ *MathWriter* is believed to be the first truly extensible word processor.

ExamBuilder™ **Figure 4.45 Sample module submenu**

ExamBuilder™ is the first such module to extend the function of *MathWriter* by adding a special purpose, disk-based database for test items. ExamBuilder, accessed from Windows/Modules (Figure 4.45) or by keyboard, provides a tool for the rapid generation of alternative forms of examinations from a collection of test items that can include text, graphics, and mathematics. Questions can be true/false, multiple choice, matching, essay, or a scenario that is sequence-dependent. The ordering of questions can be random and the multiple-choice options can be shuffled. Answer sheets and a log of items used is provided. The full formatting power of *MathWriter* is available for output.

The handling of long documents, outlining, indexing, and integrating the retrieval of bibliographic citations are likely candidates for modular extensions. The *MathWriter* interface already exists.



5 Summary for Experts

This chapter outlines, for the experienced Macintosh user, how to start up *MathWriter* and how to handle some common tasks. For a detailed, step-by-step description of technical word-processing tasks, read the chapters on nontechnical (Chapter 3) and technical writing (Chapter 4). The Command Reference chapter (Chapter 6) provides a comprehensive description of operational commands, and the tutorial summary (Chapter 2) is provided as a set of hands-on *MathWriter* files. The Quick Reference Card and the online help provide terse summaries. All keyboard commands are listed in the appendix as well as in the online help.

Getting Started and Handling Text

Installing *MathWriter*

This summary for expert Macintosh users assumes that you have a 68020- or 68030-based Macintosh, at least 2 megabytes of RAM, a hard disk, and can benefit from all the technical word processing features provided by the *MathWriter* professional version.

To install *MathWriter*:

- Create a folder named *MathWriterf* anywhere on your hard disk, lock and copy the contents of all distribution disks into the folder. The support files must either be in the same folder as *MathWriter* or in the system folder so *MathWriter* can automatically locate them. Refer to the appendix for a discussion of the various files.

MathWriter disables a feature when its support file is not accessible.

- *MathWriter* requires the Times and Symbol fonts. Automatic formatting and mathematical templates require these fonts. Install the supplied versions using the Font/DA Mover. We recommend that you switch from the MultiFinder to the Finder and restart to use the Font/DA Mover; you should remove the Apple version of the Symbol font before installing the modified

version supplied with *MathWriter*. (The ends of a few stretchable brackets are clipped in the screen display, but are still printed properly in the LaserWriter output. The supplied version also enables the printing of the boldface Greek characters.)

- If you are using MultiFinder, open the *MathWriter* folder and click (not double-click) on the *MathWriter* icon. Unlock the file, allocate the maximum available RAM for *MathWriter* and its open documents, relock the file, and close the Info window. Although *MathWriter* can be used with small documents with only 800K, we recommend 2,000K or more.
- Double-click the *MathWriter* icon to start the program.

MathWriter must perform various initialization tasks at startup. Since this is probably your first use of *MathWriter* on your computer, the program creates a *MathWriter Prefs* file in the System folder that contains a set of global defaults. Later, you can modify these defaults to customize the startup environment to your specific needs. *MathWriter* also automatically locates and links with any support files such as help, dictionaries, file translation filters, modules, stationery defaults, etc., that you have placed in the folder with *MathWriter* or in the System folder.

Getting help

For online information use the Help window on the Windows menu or ⌘? to access the Help file and select a specific topic. The topics are listed alphabetically and within several subgroups.

The online help provides an overview and probably enough detail for you to handle most tasks. In order to support the “What you see is what you get” nature of *MathWriter*, the program keeps open files in memory.

Therefore, when you are composing original material at the keyboard, we recommend that you enable the automatic save and automatic backup features using the File/Doc Preferences dialog box.

- If a *MathWriter Update* file is present on the distribution disk, review it before you begin serious use of *MathWriter*. Don't skip this step!
- Select About *MathWriter* on the Apple menu for technical support information and our copyright notice.

MathWriter reports the approximate amount of RAM available by the thin lines in the bottom-left corner of the status bar of the active document. The solid line reports the fraction of RAM being essential for *MathWriter* and the open documents. The dotted line reports the actual RAM in use, including memory that *MathWriter* can release when necessary.

Standard documents

MathWriter handles many ordinary business word-processing tasks in addition to the more complicated processes associated with technical word processing. Advanced features need not be visible or otherwise require your attention. For example, the tools used to create mathematical expressions are hidden unless deliberately called up.

MathWriter provides convenient access to your personal collection of standard document types (sometimes called stationery) with standard page layout, typeface, and boilerplate contents already prepared.

To create a custom default file for memos:

1. Open the Memo default file (Figure 5.1) using the New submenu on the File menu.

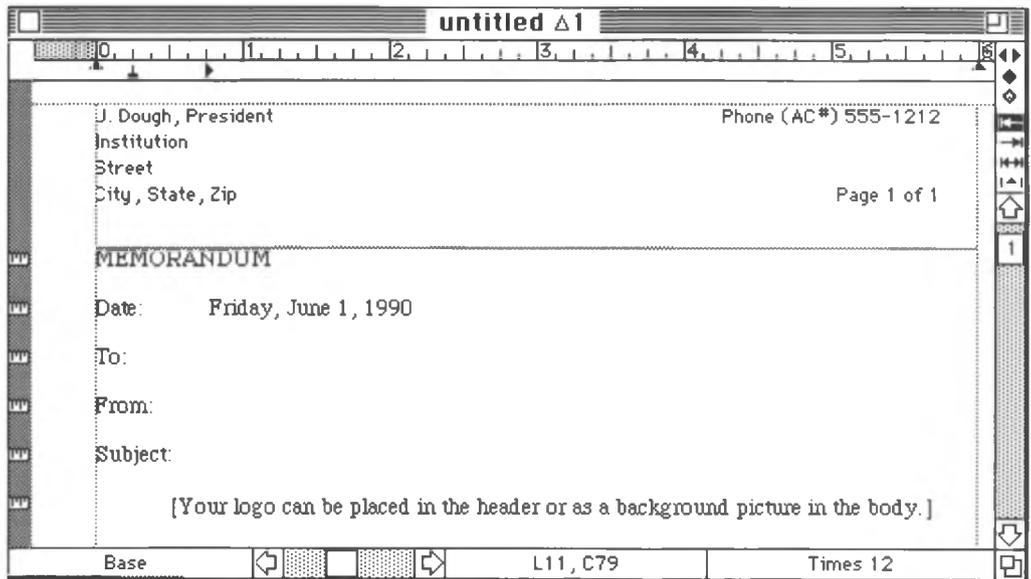


Figure 5.1 An example of stationery: Memo.def

The new file "Untitled Δ1" is a copy of the file Memo selected from the New submenu list. Selecting New, but not a submenu, produces a generic blank file.

Stationery or default files located in the folder containing *MathWriter* or in the System folder appear in this list. If none are present, only a traditional New command without a submenu appears.

2. Use the Save As command with File type: MW Default File selected from the pop-up menu to create stationery for future sessions.

Figure 5.1 shows the document window too. The name of this open document appears on the Windows menu along with any others that might be open. When you select a document name from the Windows menu, that document window becomes the active window (i.e., it comes to the front for editing).

The document window

MathWriter uses a “sheet-of-paper display” with automatic pagination. The Memo stationery file, for example, contains a header at the top of the page that displays the current page number and the current total number of pages; *MathWriter* automatically updates both variables as you add pages. The header can also contain text or graphics, such as a logo. You could also use a bitmapped, a PICT, or an Encapsulated PostScript graphic as a background picture, creating a “watermark.” The body of the document, below the nonprinting horizontal line, contains the standard memo entries. *MathWriter* automatically supplies the current date. You might elect to use the filename variable on the last row of the Palettes menu to visually associate your printed memo with its originating data file.

MathWriter provides a full “What you see is what you get” visual display. All editing is done in context. For example, you can edit the headers, footers, footnotes, and mathematical expressions without moving into separate windows. Just select the appropriate editing tools using Tools on the Windows menu. Even if you suppress the page layout lines with Hide Layout on the Format menu, the cursor continues to change depending upon its location in your document. In order to achieve maximal visual feedback, *MathWriter* refreshes the screen often; you can initiate a screen refresh with ⌘ option Z.

MathWriter supports the usual window controls such as the close-box, zoom box, grow box, horizontal and vertical scroll bars, and ruler lines that identify this as the active window. See the Help window (Windows menu) for a summary of mouse and keyboard commands used to move around within a document. Because displayed mathematical expressions frequently span several lines, a click on a scroll arrow moves the document multiple lines. Option click on the arrow to scroll only one line.

The ruler does not scroll from the top of the document window but remains visible, displaying the tab settings for the selected paragraph, the paragraph that contains the blinking insertion point. Each time you press return, you create a new paragraph that inherits the ruler settings of the previous paragraph. When you change the ruler of the new paragraph, *MathWriter* adds an identifying icon in the left margin. *MathWriter* places various markers at the left border, but you can hide them by selecting Hide Markers from the Format menu.

The tab supply and paragraph justification controls appear just above the vertical scroll bar, rather than on the horizontal portion of the ruler, to leave you as much vertical space as possible. This is especially valuable when you are writing two dimensional, mathematical expressions and screen size becomes critical. Drag the tabs onto the ruler or into the text. A rubber-band feature lets you drag a tab into the text to determine its exact alignment. When you release the tab, it snaps onto the ruler. To remove a tab, drag it off the right end of the ruler past the right margin marker.



The tab icons are left-aligned , right-aligned , center-aligned , or decimal-aligned . The paragraph alignment relative to margins includes left align , right align , both margins aligned , and centered .

The two-dimensional nature of mathematical expressions requires more extensive line spacing control than traditional single and double spacing; therefore, we expanded this control and moved it to the Format menu. The line spacing options include automatic, mostly fixed, and fixed spacing with separate leading adjustments for space above and below the baseline. The mostly fixed option, a combination of fixed and automatic, permits subscripts and superscripts to protrude into the space between the lines, but allows displayed equations to increase line spacing automatically. Never use fixed line spacing *while* composing mathematical expressions.

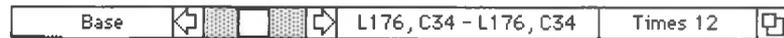


Figure 5.2 The status bar

The status bar (Figure 5.2) at the bottom of the document window provides advisory information. The font, font size, and font style of the character adjacent to the blinking insertion point appear on the right. When you open a file, a progress indicator appears here. Indicators identifying the options you have, such as *Auto Math* also appear here. The panel to the left reports the line and character position of the cursor or the range of selected text. *MathWriter* supports type-ahead and mouse-ahead features and handles numerous off-screen formatting operations in the background while the keyboard is idle; a progress indicator also appears here. This panel, in addition, provides a pop-up menu to control the movement of the insertion point among the various regions of the document and to scroll the window if necessary. For example, if you place a footnote or an endnote, you can scroll directly between the note itself and back to the reference point in the text using the insertion point menu. The "Base" panel reports the progress of various background tasks, RAM usage, and the position of the insertion point within a built-up mathematical expression or within a table. For example, if the insertion point is positioned for a superscript to a superscript, two upward arrows appear here.

Note: Use $\mathring{\text{R}}$ *right bracket* and $\mathring{\text{A}}$ *apostrophe* to create superscripts and subscripts, respectively. The font size reduction and vertical positioning are automatic. Press *enter* to cancel each subscript or superscript command.

See the online Help in the Windows menu for a discussion of the Math Editor. The Character Editor provides arbitrary vertical positioning for any character.

Menu commands

Before creating a document, structure its global properties. Use Page Layout on the File menu for printer and paper choices, margins, header and footer size, etc., and use Doc Layout for placement of headers, footers, and footnotes within the document.

The Edit menu provides the usual undo, cut, copy, and paste commands as expected. In addition, *MathWriter* supports copying and pasting of paragraph formatting information. A Paste In Context command allows added text to assume the style of the text adjacent to its destination, rather than retaining its original style. Note: To transform mathematical expressions into PICTs for pasting into traditional applications, use the Copy Other submenu command Copy As Picture. Find/Replace supports search and replace for mathematical expressions, typeface changes, wildcards, hidden formatting commands, such as return markers at the end of paragraphs, and reverse direction searches, which are especially useful when you are composing as opposed to simply typing an existing mathematical manuscript.

Use the Format menu to format paragraphs (borders, shading, splits at page breaks, etc.), set line spacing, and choose the dynamic variables for page numbering, paragraph numbering, footnote numbering, equation numbering, etc. Set starting numbers for these variables here, too. Use the Palettes menu to "type" these dynamic variables at the insertion point. (The sequence $\mathring{\text{O}}$ *option E* types the automatic equation numbering variable.)

Use the Diac menu to type and to adjust diacritical and horizontal grouping markers.

The Style menu supplies typeface choices for font, font size, and font style. Both mouse and keyboard control are provided for typeface changes because of the frequency of this process in mathematical manuscripts. Use Doc Preferences in the File menu to assign typeface combinations for Style 1 and Style 2 on the Style menu.

All *MathWriter* versions use a common menu organization; the menu commands not available in this version are dimmed on the screen, as are other commands not currently available.

Handling Graphics

Using graphics

MathWriter allows you to import graphics (bitmapped, PICT, and Encapsulated PostScript) directly from files, as well as through the Clipboard. You can treat a graphic as a large text character within a line of text.

To import a graphic as a character:

With a document open and the destination identified by the position of the blinking insertion point, use Import Graphics File on the File menu to insert the graphic. Unless you select a specific file type with the pop-up menu, the names of all folders and all allowable file types appear in the file selection window. The usual cut-copy-edit commands apply to the graphic; therefore, you can paste into a *MathWriter* document a graphic placed on the Clipboard by another application.

To resize and crop a graphic



1. Activate the Character Editor using the arrow icon  on the Tools Window of the Windows menu, the Tools submenu, or type ⌘ shift [.
2. Click on the graphic to display the bounding rectangle with "handles" on the corners.



3. To resize the selected graphic with the width-to-height ratio preserved, either drag a handle while you press the *option* key or select the graphic and, with the Character Editor active, use the Scale command that appears on the Edit menu. If width and height are to have different scales, just drag a handle or set the actual percentages for each dimension using the Scale command on the Edit menu; you can also restore the original size here.
4. To crop (or mask) a portion of the graphic or undesired bounding white-space, drag a handle on the bounding rectangle while pressing the ⌘ key or use ⌘ option to crop proportionally. When you press the key, *MathWriter* posts the permitted operation in the typeface box of the status bar.
5. To leave the Character Editor, select the normal Text (I-beam) Editor.

Using the Math Editor

The handling of mathematical expressions is *MathWriter's* most distinctive and powerful feature. By reducing typesetting tedium and providing you with technical writing tools, we hope you can compose mathematical manuscripts at the keyboard, rather than transcribe hand-written drafts into print. We believe these tools empower authors of scientific and mathematical papers just as traditional word processors facilitate the process of writing prose.

MathWriter treats mathematical expressions as ordinary text, rather than graphics; this allows you to compose and edit built-up expressions of arbitrary complexity in context. You can generate nearly all input and commands by mouse or keyboard. "Smart" templates provide automatic formatting of the two-dimensional displays of mathematical expressions. Line spacing adjusts automatically. Various input aids expedite changing typefaces, and entering special symbols in mathematical expressions. During editing, *MathWriter* automatically numbers equations and updates the text references linked to them. Footnotes are numbered automatically too. The Find/Replace command applies to both text and mathematical expressions. Revision aids for authors include dynamic line numbering and in-context marking of version additions and deletions using automatic style changes.

Configure the floating windows

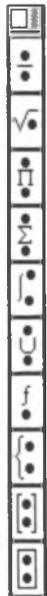
- To begin using the Math Editor, select the appropriate combination of the floating windows from the Windows menu. Your document window remains active even when floating windows are present and active.

All of the commands on the following floating windows, which are displayed using the Windows menu, can be typed (for a list of keyboard commands, see appendix 3), but mouse access is always an option.

- ◆ The Tools window provides access to the auto-formatting subscript  and superscript  commands ($\%'$ and $\%|$ are the keyboard equivalents) in addition to the various editors, including Math λ .

Use the *enter* key to complete a mathematical subexpression or template and move the cursor to its previous state. Use the *return* key to return immediately to the baseline for text.

- ◆ The Templates window has ten horizontal pop-out menus of common mathematical expressions. Drag to select or type $\%$ and a numeral simultaneously to select a category (numbered from the top) followed by a numeral for the specific template (numbered from the left). For



example, if you type $\frac{\text{⌘}1}{1}$ and 1 , the first fraction template appears at the insertion point in your document.

Note to *MathWriter 1.4* users: The Templates window behaves as a floating, vertical menu bar. You must drag, not just click, to select a command.

Use the *enter* key to advance the cursor from one placeholder to the next. For matrices and tables use the *tab* key to create new columns and the *return* key to create new rows. Most formatting is automatic.

These template structures, including subscripts and superscripts, can be nested to any level; for example, a superscript can have a superscript. Within a template, pressing *enter* returns the insertion point to the previously used template. For example, when within the superscript of a superscript, pressing *enter* once moves the insertion point back to the first level superscript.

- ◆ The Palettes window always contains the Greek alphabet and as many additional rows of symbols as you want; select a row by clicking on its name from the Palettes menu. *MathWriter* places symbols selected from this window in the document at the blinking insertion point. The sequence $\frac{\text{⌘}}{\text{spacebar}}$ toggles between the current and the Symbol font, which contains the Greek alphabet. A Style menu command serves the same purpose.

- ◆ The Font Table is a generalized typing aid that provides access to all characters of all active fonts. Use the pop-up menu to select the font. You can reduce the portion of the table that is visible in order to preserve screen space.

Two additional floating windows, Clipboard and Help, provide information, but they cannot be edited directly.

Additional keyboard commands

In addition to more than 100 keyboard commands listed in the appendix and those provided by the floating windows, *MathWriter* supports various other user-defined commands, or macros, to control typeface changes. You can increase or decrease the font size or revert to the immediately previous typeface on the Style menu. Additionally, using Doc Preferences on the File menu, you can assign two typeface combinations, from among user-selected categories of font, font size, font style, justification, and line spacing, to the style menu with $\frac{\text{⌘}}{>}$ or $\frac{\text{⌘}}{<}$.

Additional typeface and formatting controls

The Auto Math feature provides various tools peculiar to mathematical expressions. You select the combination of features in Auto Math options and enable/disable the set using Auto Math (with $\frac{\text{⌘}}{E}$). This feature is normally disabled unless needed. When enabled, the typeface indicator on the status bar appears in inverse (white on black). *MathWriter* resizes

parentheses, brackets, and braces as the enclosed expression changes in height.

When the insertion point is adjacent to an alphabetic character, you can use the Diac menu to supply diacritical marks. When a group of characters is selected, you can apply a special grouping symbol, such as a horizontal brace, from the Diac menu.

To adjust the height of integral and absolute value symbols to match the expression size when the insertion point immediately follows the integrand or argument, use \int or the Calc Prev command on the Format menu. Use the Character Editor to make arbitrary adjustments to vertical position and size.

Other Format menu commands provide borders for emphasizing paragraphs and equations and control for line spacing (automatic is the default) and matrices. Changes in these settings apply to subsequent input and to text you designate by selecting before you change the defaults. Use the Insert and Delete submenus of the Edit menu to add or delete rows or columns of matrices when you place the insertion point within a cell using the Math Editor \int .

Find/Replace of the Edit menu allows you to include mathematical template constructs as well as specific built-up expressions within a search. Searches can be typeface-sensitive and direction-specific.

Other important commands

MathWriter's automatic scrapbook feature, invoked using the TEXT file type with Save As on the File menu, automatically extracts graphics and mathematical expressions, converts them into PICT form, and places them in a scrapbook file for use with other applications. Traditional word processors simply discard these graphics when making a text file and require that you individually transfer graphics. With *MathWriter* you also can transfer a mathematical expression into another application via the Clipboard by selecting the expression and using Copy As Picture from the Copy Other submenu on the Edit menu. This converts the editable expression into a PICT format recognizable by many other applications.

The Preferences command of the File menu allows you to establish a *startup configuration* suitable for mathematical work.

MathWriter's powerful automatic numbering feature in Variables Format on the Format menu dynamically numbers footnotes, equations, subequations, and cross-references to them in the text. In addition, the user-defined category with cross-references can simultaneously link a user-defined variable such as table, figure, theorem, lemma, etc. If you add equations during the editing process, *MathWriter* automatically updates all subsequent equation numbers and references to them.

To *number equations*, assign a format, position the insertion point with a tab, and then use the mouse to type the dynamic variable Σ^* from the Palettes menu. *MathWriter* automatically numbers the current variable higher than the immediately preceding variable and updates all remaining occurrences in the document. Subequations $\Sigma_{\#3}$ are handled similarly. When you assign a cross-reference $\Sigma_{\#}$, you must establish the linkage; but *MathWriter* dynamically updates the link after subsequent editing. Use the Variables Format command to set the attributes of this triplet of variables. You also use Variables Format to establish an arbitrary number of triplets for numbering figures, tables, paragraphs, theorems, etc.



6 Command Reference

This chapter is a detailed reference guide to *MathWriter* commands and is organized by commands, rather than by tasks.

Hardware and System Requirements

The Professional Version of *MathWriter 2.0* requires a 68020- or 68030-based Macintosh with at least 2 megabytes of RAM and a hard disk. The reduced feature Educational Version can be used with 1 megabyte of RAM using the Finder, rather than MultiFinder. The reduced version is smaller and leaves disk space for files. The other drive would contain your system file, the print driver, and limited space for file storage. A hard disk is preferred for serious work, especially if you use the spell-checker.

Use the most recent operating system consistent with your hardware, although any system that supports submenus will work (i.e., System 4.0 and Finder 6.0, or later). *MathWriter* works comfortably with MultiFinder, provided you have enough memory. *MathWriter's* mathematical capabilities utilize the Times and Symbol fonts; therefore, the screen font for at least one font size of Times and Symbol must be available to the system during writing and printing. *MathWriter* includes a self-check of the system version and the availability of the Symbol and Times fonts.

MathWriter's Main Screen

Figure 6.1 shows *MathWriter* with a single open file displaying three of the floating windows (Templates, Palettes, and Tools), and the ruler, tabs, and scroll bar. You can remove the floating windows by clicking in their close-boxes or by selecting their names in the Windows menu. You can also drag them to more convenient locations on the main screen or to an attached secondary screen. This is especially useful if you have a larger monitor. If possible, avoid having them mask a portion of the document by resizing the

document window. An overlap placement slows scrolling due to the extra screen refreshing.

With the Templates, Palettes, and Tools windows removed, the screen is remarkably simple (Figure 6.2). The ruler is thin and is always at the top of the screen, never usurping window space in the body of the text nor scrolling out of view. You can even remove the ruler with the Format menu if desired. At the bottom of Figure 6.2 is the status bar. You can resize, drag, close, or scroll the document window in the customary Macintosh fashion.

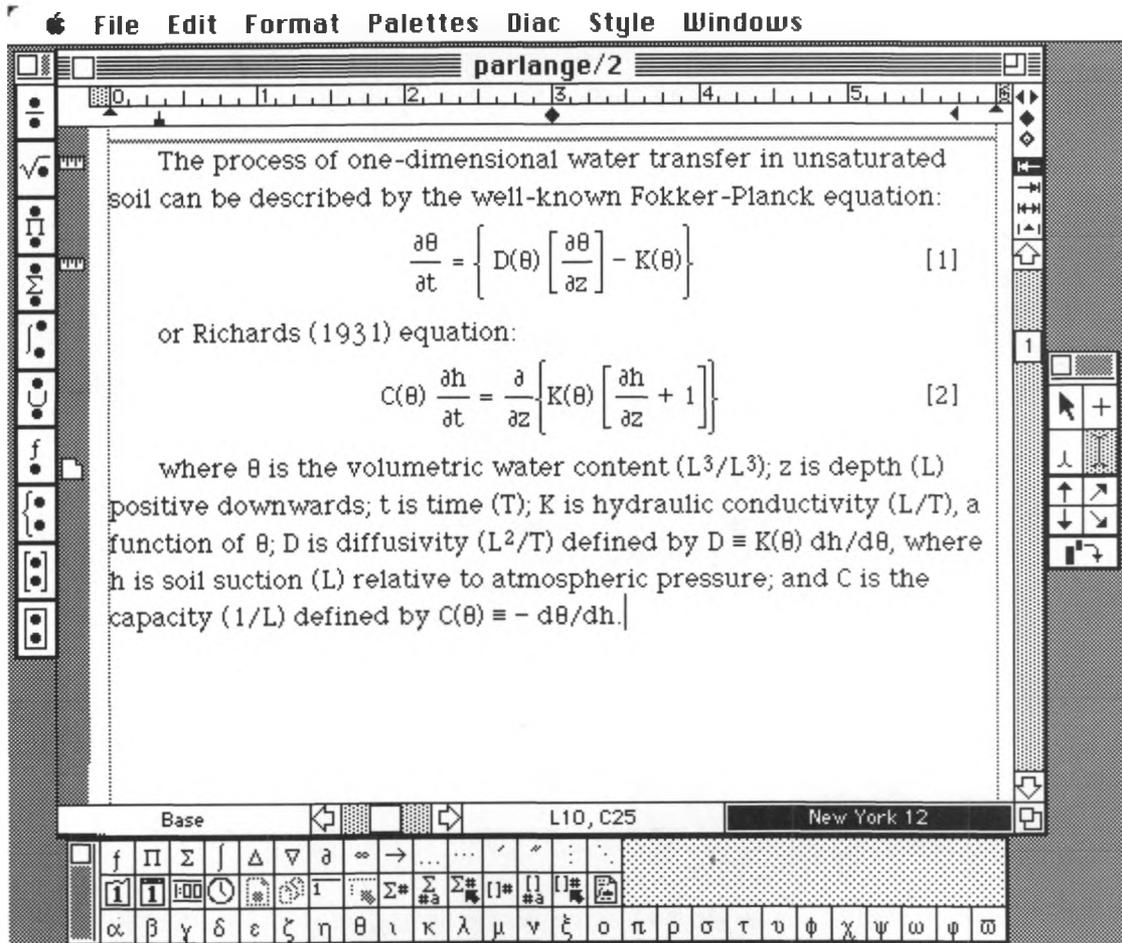


Figure 6.1 MathWriter main screen configured for mathematical work

Up to four documents can be open at once. This is not an inherent limitation, but a reasonable limit since active files are RAM-resident for increased editing speed.

Use Finder rather than MultiFinder if you have only 1 megabyte of memory. We strongly recommend that you use more than 1 megabyte of memory and use *MathWriter* with MultiFinder; remember to increase the Application Memory Size to make this additional memory available for larger documents. While at the MultiFinder level before activating *MathWriter*, use the Get Info command on the File menu to set this before activating *MathWriter*.

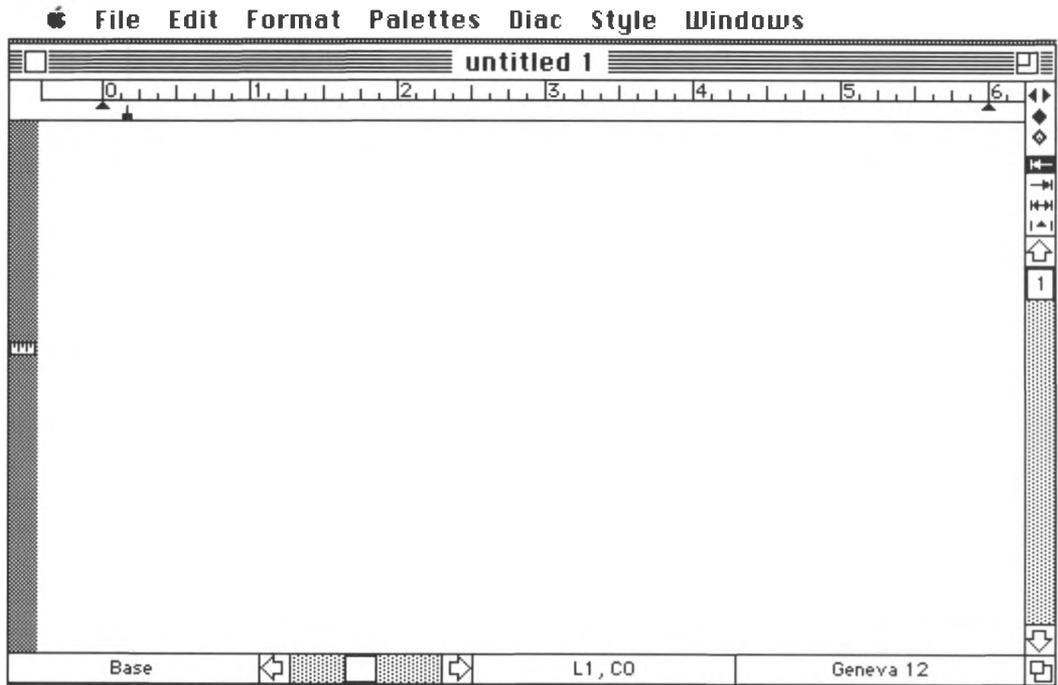


Figure 6.2 *MathWriter* main screen configured without mathematical tools

The Apple operating system 7.0 will let you increase the size of documents arbitrarily by supporting memory management for virtual memory. *MathWriter* retains only the necessary parts of itself in memory, obtains additional segments from the disk as needed, and automatically purges unused parts. That leaves unused RAM for your current document, which is memory resident. The thin lines in the "Base" panel of the status bar (Figure 6.1) indicate the relative utilization of RAM, as discussed later in this section.

Ruler and tabs

MathWriter is paragraph-based and the ruler refers to the paragraph that contains the blinking insertion point. Note that you end a paragraph by pressing the *return* key. The ruler displays the tab settings for the current paragraph, the paragraph with the flashing insertion point. The tab wells at the right of the document window, just above the vertical scroll bar, contain left, right, center, and user-defined character alignment tabs; this placement avoids a reduction in the critical vertical dimension of the screen, necessary for displayed equations. Double-click in the ruler to select ruler options for uniformly spaced tabs.



To place a tab, drag one from the well and pull it into the text area to decide its exact placement (or place it directly on the ruler). When released, the tab icon snaps to the ruler as if attached to a rubber band. To remove a tab, drag it off the *right* end of the ruler past the print boundary indicated by shading  on the ruler. Double-click on a tab in the ruler to open a window for additional control or to choose a tab leader and alignment symbol. You can assign an arbitrary alignment character, such as an equals sign used in mathematical writing, rather than the traditional decimal-aligned tab.

To obtain left, right, full, and center line justification for paragraphs, locate the icons just below the tab supply and click on the one you want. Justification applies to the paragraph that contains the blinking insertion point or to multiple paragraphs of selected text. The usual text selection techniques such as dragging, *shift clicking*, etc., apply; however, to identify a paragraph for justification or tab placement, you only need to place the insertion point within that paragraph.



MathWriter automatically passes the ruler settings from one paragraph to the next when you press the *return* key. If you change the ruler settings, a small ruler icon on the left border of the window identifies ruler changes unless you use Hide Messages on the Format menu to hide this and other message icons.

The status bar



Figure 6.3 *MathWriter* status bar

The status bar at the bottom of the document window (Figure 6.1 and Figure 6.3) contains information about the position of the insertion point within a mathematical expression ("Base" in this figure) and the adjacent text. Figure 6.4 shows examples of the insertion point in mathematical expressions and in a table. With the insertion point adjacent to the "1", the first up arrow indicates an exponent placement and the down arrow

indicates that the exponent has a subscript. In the second example the cursor is adjacent to the subscript and the down arrow indicates this.

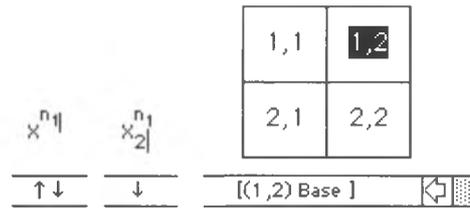


Figure 6.4 Insertion point position within a mathematical expression

When the insertion point is in a table or matrix, the status bar gives the row and column number of the element you are editing (Figure 6.4). A thin horizontal line in the “Base” panel (Figure 6.3) shows the fraction of RAM in use. The solid line represents actual usage and the dotted line represents the additional usage that can be purged by *MathWriter* if necessary. As mentioned above, *MathWriter* documents are memory resident so you should allocate as much memory as possible to *MathWriter*.

Also on the status bar in Figure 6.3 are the horizontal scroll bar; the position of the insertion point within the document, line 1 and character 0; and the current font, font style, and font size, which are plain, Geneva, 12 point. During computation-intensive operations like reformatting or loading a file, a progress indicator appears in the typeface indicator box also. *MathWriter* reformats off-screen text in the background when it is processing no new commands; you can follow its progress in the insertion point locator panel. The font typeface panel appears in inverse type (white letters on black background) when the automatic math options on the Style menu are in use. Brackets enclose this typeface indicator when you enable automatic revision tracking.

The cursor

The *MathWriter* cursor changes to convey information about operations that are possible or in progress. The first row of Figure 6.5 contains the arrow, the I-beam, and the split I-beam cursors of the Character, Text, and Math Editors, respectively. The cursors of the second row indicate when the text cursor has moved into: the main body of the manuscript, the header, the footer, or the footnote, respectively. Because *MathWriter* allows you to edit these different sections of text without opening separate windows, you need to know into which portion of the document you have moved the cursor. The third row shows the search icons. The fourth row icons indicate that disk activity is in progress.

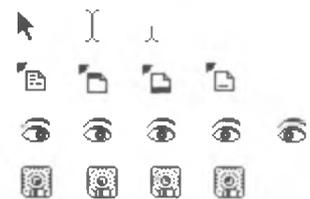


Figure 6.5
MathWriter icons

If you have trouble identifying the region in which the insertion point is located, select Show Layout on the Format menu. That displays the dotted lines that separate the different regions of the document. In addition, a pop-up window on the status bar at the bottom of the screen tells you whether you are in the "Body," "Header," or "Footer" (Figure 6.6).

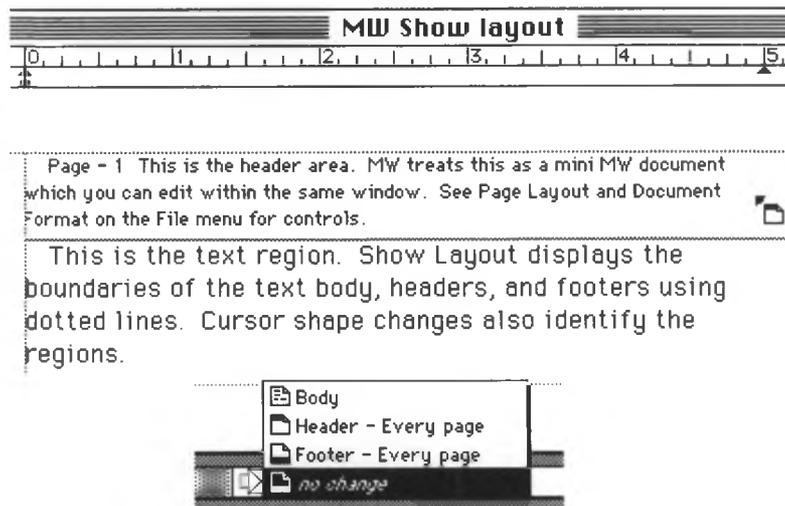


Figure 6.6 Show layout and pop-up region locator

Floating windows

Palettes window

The floating "Palettes" window contains the Greek alphabet and any rows of symbols from the "Palettes" pull-down menu that you choose. You can modify, move, or remove the floating Palettes window (Figure 6.7). It responds to the *shift* key for uppercase Greek letters. To place the floating Palettes window on the screen, select it from the Windows menu. Then click on the name of a row in the Palettes menu, rather than on the specific symbols, to copy a row of symbols to the floating window. You can remove a row by clicking on it again in the Palettes menu. You can reposition the floating Palettes window by placing the cursor just below its close-box and dragging it (more easily seen in Figure 6.1).



Figure 6.7 Greek alphabet in the Palette window

Templates window

Smart templates in the Templates window allow you to create fractions, radicals, products, summations, integrals, set operators, special structures such as limits, grouping brackets, vectors and matrices, and tables. Each of the ten icons in the Templates window (Figure 6.8) contains two to ten options in pop-out menu format.

2. Three choices of radicals (§ 2) are available.

The first is the usual square root, the second allows you to supply a root, and the third is for long division. Press *enter* to move from within the radical to the second entry, the root. Press *enter* to leave the structure.



3. The product symbol template (§ 3) allows you to place limits above and below the product symbol or to the right of the product symbol to conserve vertical space

for in-line expressions. *MathWriter* automatically positions the cursor in the lower portion and reduces the font size. Supply the lower limit, and press the *enter* key to move to the upper limit. Supply the upper limit and press *enter* to return to the baseline to enter the function. The limits can be of arbitrary complexity. Use the split I-beam to edit within the limits. Press *enter* to move the insertion point to the base level.



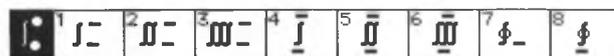
4. Like the product symbol template, the summation template (§ 4) allows you to place the limits above and below the symbol or to the right to conserve vertical

space for in-line expressions. *MathWriter* automatically positions the cursor in the lower index and reduces the font size. Supply the lower limit and press *enter* to move from the lower limit to the upper limit. Supply the upper limit and press *enter* to move to the baseline to supply the function. The limits of integration can be of arbitrary complexity. Use the split I-beam to edit within the limits. Press *enter* to move the insertion point to the base level.



5. The integral (§ 5) can be single, double, or triple,

and you can place the limits either adjacent to or above the integral sign. Supply the lower limit and press *enter* to move to the upper limit. Supply the upper limit and press *enter* to move to the baseline, and then supply the integrand. The limits can be of arbitrary complexity. A contour integral is available. Press *return* to move the insertion point to the base level; if desired, use the split I-beam tool to edit within the limits again. To resize the integral for larger integrands, use Calc Prev on the Format menu or § D with the insertion point positioned to the immediate right of the integrand. Make arbitrary size adjustments and vertical positioning adjustments using the Character Editor.



6. The union and intersection operators (§ 6) also accept limits. Press *enter* to move from the lower to the upper limit and again to move back to the baseline. Use the split I-beam to edit the limits.



7. The special



function menu (§ 7) contains constructs that include expressions centered below the operator name. Press *enter* to return to the baseline. Use the split I-beam to edit the limits. In contrast to use of  on the Tools menu, the name remains a unit.

8. Grouping brackets (§ 8) include multiple rows grouped on the left or right with braces, brackets, parentheses, and angle symbols. Use the split I-beam to edit within the structure. Press *return* to change rows and *tab* to change columns.

9. Vectors, matrices, and determinants

(§ 9) can have an arbitrary number of rows and columns. *MathWriter* provides various enclosing symbols. Use the *tab* key to change or create columns. Press *return* to change or create rows. *MathWriter* automatically formats the matrix as you type each keystroke. Use the split I-beam from the Tools window to edit inside a cell or within an expression inside the cell. Click inside a cell to outline it with a box (Figure 6.9). Click outside the structure or select the I-beam tool to return to normal typing. Click on the appropriate box in Matrix Format on the Format menu to specify the placement, line thickness and pattern, justification within cells or elements, and row and column spacing of cells.

To modify the format of previously typed expressions, simply select the expression before using the Matrix Format command. To add or delete a row or column, select a cell within that row or column and then use Insert or Delete from the Edit menu.

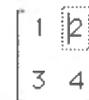


Figure 6.9
Edit inside structures

10. The last menu produces tables (§ 0). You can box the entire table or each cell individually. *MathWriter* treats tables as matrices with additional horizontal and vertical rules. Click on the appropriate box in Matrix Format on the Format menu to specify the placement, line thickness and pattern, justification within cells or elements, and row and column spacing of cells. To modify the format of previously typed expressions, simply select the expression before using the Matrix Format command. Use the split I-beam from the Tools window to edit a cell (outlined with a dotted box when you click within a cell) or an expression within the cell. Click outside the structure to return to normal typing. Press *option* to temporarily change from an I-beam to a split I-beam cursor.

Also, with the Templates window you can select any mathematical structure using the Character Editor and replace it with any other structure from the same row in the Templates window without retyping it. For example, you can convert a matrix into a determinant this way.

Tools window

The floating Tools window (Figure 6.10) serves multiple purposes. Use the split I-beam cursor to place the insertion point inside an existing mathematical structure. The full I-beam allows you to place the insertion point in ordinary text. The small, vertical, up and down arrows move the insertion point above or below a symbol, reduce the font size, and center the subsequent input. The slanted up and down arrows position superscripts and subscripts. Clicking the bottom icon is *equivalent* to pressing the *enter* key and will move you out of superscript or subscript mode and back to the baseline or to the level on which the insertion point was located before you clicked on the slanted up or down arrow. See appendix 3 for a table of keyboard equivalents.



Figure 6.10
Tools window

The Main Menu Commands

🍏 File Edit Format Palettes Diac Style Windows

The dimmed menu commands are unavailable in this version.

The Apple 🍏 Menu

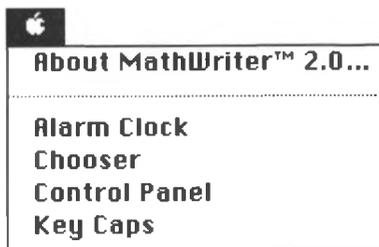


Figure 6.11 The 🍏 menu

The Apple menu contains information about the application and provides access to the desk accessories (Figure 6.11). Use the Font/DA Mover to modify the list.

About MathWriter™ 2.0

This window displays credits, copyright, and trademark notices (Figure 6.12). The copyright notice is a reminder that illegal copying of this intellectual property constitutes theft, and that end-user technical support is provided by the publisher, Brooks/Cole Publishing Company, rather than Cooke Publications, Ltd. Click to close the window.

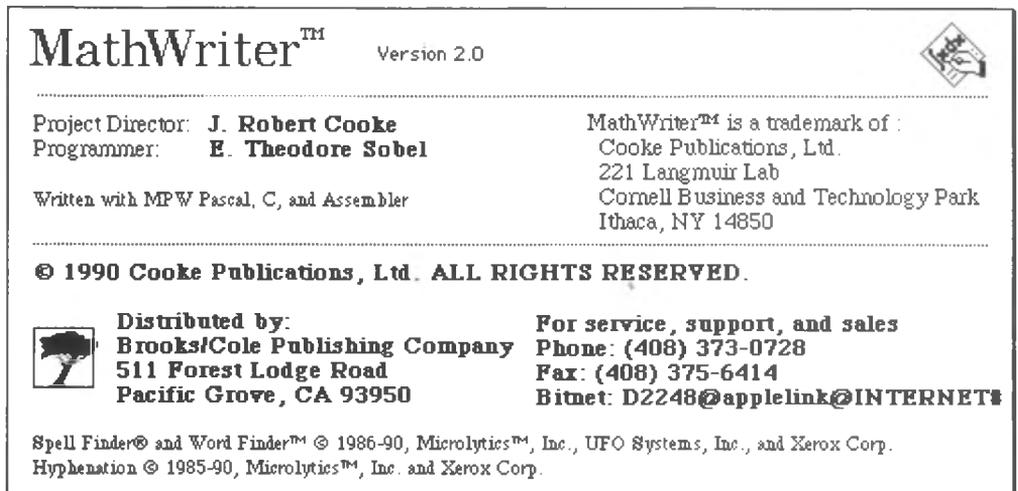


Figure 6.12 The About *MathWriter 2.0* window

Desk accessories

The names of desk accessories currently available to the system also appear on the Apple menu (Figure 6.11). Use the Font/DA Mover¹ to modify this list. See the Macintosh Utilities manual for a discussion of desk accessories. The Font/DA Mover should be used under Finder, rather than MultiFinder. *MathWriter's* Font Table in the Windows menu is a generalization of the Key Caps desk accessory; it allows you to “type” characters directly using the mouse.

The File Menu

The File menu (Figure 6.13) contains the customary Macintosh file management commands. A file named “Untitled 1” (or one of your choice in File/Preferences) opens automatically on start-up or when you use New (but not a submenu) in the File menu. In addition, New opens a submenu (Figure 6.14) that displays a list of your default files.

New

The New command together with Preferences on this menu allows you to set ALL of the default settings and create custom configurations of *MathWriter*; the default fonts, font sizes, and font styles within the headers, footers, and main body of a document; the palette choices; and the page layout and initial file contents including current date markers. Such startup files are called stationery or MW Default files.

¹Or SuitCase™ II, for example.



Figure 6.13 File menu

You can create a stationery file for each distinctive type of document you use and designate one of the stationery files as the default, using Preferences on the File menu. When you choose from the submenu *MathWriter* copies that particular stationery. For example, you can create a standard memo form that includes your letterhead, footers, common text, and the current date. *MathWriter* automatically keeps the date current. If you place several stationery files in the system folder, their names appear on the submenu of the New command for convenient selection. An unused stationery file automatically closes if you open an existing file without making any change to the stationery file.

Open... (⌘O)

Use Open... to open an existing file. Note: The three dots following the word "Open" indicate that you have to supply additional information to complete the command. When you click Open..., a dialog box appears (Figure 6.15). The name of the current drive appears at the top right. If you press Eject, the computer ejects the disk. Pressing Drive moves you from one drive to another. The pull-down menu, here labeled MW 2.0f lists folders on the current disk and lets you choose one. Use Open to open the file you selected from the window or use Cancel to abandon it.

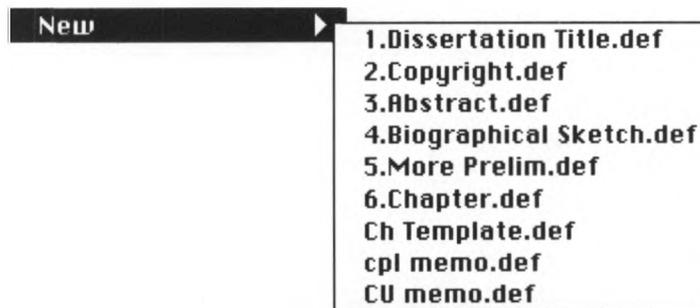


Figure 6.14 Example of a New submenu showing default templates

Press All known types on the pop-up menu shown in Figure 6.15, and *MathWriter* presents a list of allowable file types. The names of files already opened are excluded from the list. Drag to select the file type you wish to have appear in the list, and the scrollable window displays only files of that selected type. All known types are the file types that *MathWriter* can read with its present configuration. Initially, the file type, pop-up list includes *MathWriter 2.0* files and text files. Text files are those that have been saved in a default font and have very limited formatting information.

MathWriter also saves the graphics and mathematical expressions in a named scrapbook file when you create a TEXT file.

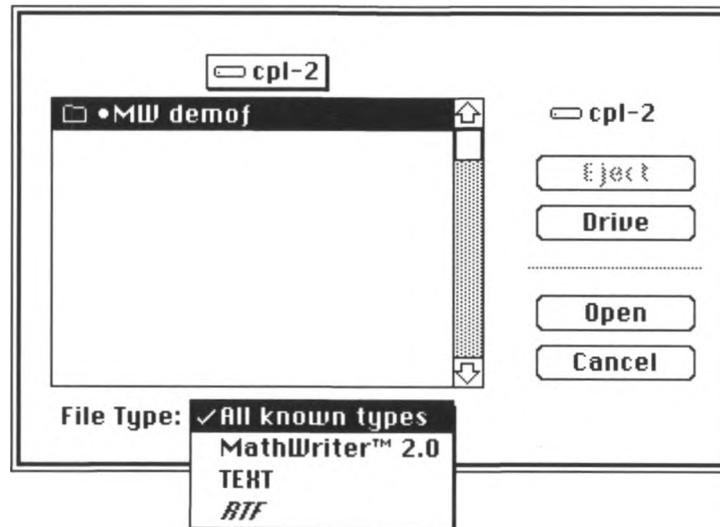


Figure 6.15 Open dialog box

A translator for Microsoft's Rich Text Format (*RTF*) for file interchange among various word processors appears (in italics) in the File Type list too, when placed in the folder with *MathWriter* or in the System folder.² The *RTF* files **do** preserve character formatting and graphics within the file during import. Non-WYSIWYG, embedded text commands for generating mathematical expressions imported from Word® 4 *RTF* files are translated into fully editable, WYSIWYG expressions in *MathWriter*!

Use *MathWriter 2.0* file type, *MathWriter's* own format, to keep the formatting and configuration information you chose when you created your document for subsequent printing and editing sessions with *MathWriter*. *MathWriter* automatically restores this environment when you open the file later.

The preservation of font choices when a file is opened on a different computer is crucially, not just cosmetically, important. Unlike alphabetical characters, the special symbols used in technical writing do not have standard keyboard assignments so an unintended font change will probably change the content of your document. *MathWriter* uses font names, rather than computer-specific font identification numbers, to prevent unintended substitutions. *MathWriter* uses this checking process for both native *MathWriter* files and *RTF* files when opened. If you use the File Warnings option in the File/Preferences dialog box (Figure 6.19), *MathWriter* issues a warning message if a font used in the file you open is not available to your

² The *RTF* filter may be shipped separately, and will initially open, but not save files.

system. If a PICT displays correctly in the originating *MathWriter* file, it will display correctly when opened on another computer having the required fonts installed. In contrast with conventional Macintosh word processors, *MathWriter* preserves file integrity, even when transmitted by network to a different computer, provided identical font files are used.

Close (⌘W)

To close the active file, click in the close-box at the top-left corner of the active window or choose the Close option from the File menu. If you have made changes since the last save, *MathWriter* gives you an opportunity to save a permanent copy of the document in a file. *Remember the RAM-resident copy will be lost unless you save it as a file!*

Save (⌘S)

Save makes a disk copy of the active window document using the previously assigned file name and path. If you have not assigned a name, the Save As... dialog box appears so that you can assign one. If you have a power failure, the computer will lose the memory resident copy. Save your document frequently. We recommend that you click Auto save and Auto backup/Doc Preferences in the File menu to enable Auto save and Auto backup for additional protection. During a file save operation the Auto backup command retains the previous version of the file by appending ".backup" to its name before making a new copy. If a ".backup" file already exists, *MathWriter* replaces it with the new ".backup" file. This approach assures that the two, and only two, most recent copies are preserved.

MathWriter does not compute the size of a file before executing the save command. Therefore, if insufficient disk space is available to save a complete copy, the partial file (and the older copy) will be deleted and you will be prompted to insert a disk with sufficient space. Save a copy IMMEDIATELY.

Save As...

The Save As... command is similar in function to Save except that a window appears on the screen in which you can type a name for the file (Figure 6.16). This window also offers a pop-up list of allowable file types. If you have already saved the active file with a different name, *MathWriter* closes it with the contents unchanged and applies the new name to the current file, which remains open, and creates a copy with this new name. Again, we recommend that you use the Auto save and Auto backup commands in Doc Preferences of the File menu for added safety and convenience, especially when you are composing original material at the keyboard.

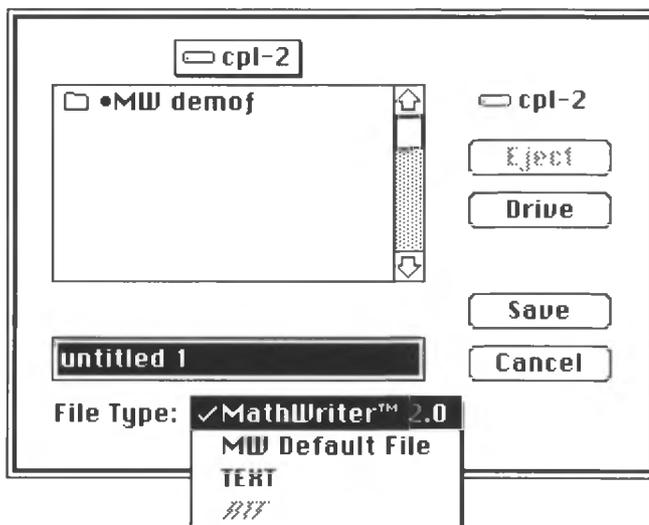


Figure 6.16 Save As dialog box

MathWriter™ 2.0 format

This format preserves your complete document and all document-specific configuration information. Always save a copy in this format; other formats may not preserve all the information needed to resume editing.

MathWriter Default File

The *MathWriter* Default File selection saves your *MathWriter* document configuration, placing it in the New submenu (on the File Menu), and for potential use as a startup file. Pull down the File menu to New to reach the submenu and drag to the file name you want to copy. The original is not affected.

TEXT file

Virtually every word processor can read or translate the TEXT file type. When *MathWriter* or any other word processor reads such a file, the file may not look on screen as it looked originally because TEXT preserves only limited formatting information. In particular, the character formatting (font, size, and style) and graphics are not preserved.

You can save text files in two formats. Text only is the more common format and retains the markers for paragraphing. Text with line breaks places a paragraph symbol and creates a new paragraph at the end of each line.

“Save equations in scrapbook” is *MathWriter’s* automatic scrap feature. It automatically extracts graphics and mathematical expressions, converts them into PICT form, and places them in a Scrapbook file for use with other applications (Figure 6.17). This lets you use them in a page layout

program or other application without having to collect them manually. If you desire, you can add a numbered marker to the text file to facilitate the reconstruction of the document. You can edit the symbols surrounding the “#” symbol in the box following “mark location in text with:.”

To use a named Scrapbook file with the standard Scrapbook desk accessory, you must temporarily rename the existing “Scrapbook File,” rename the created file as “Scrapbook File” and place it in the System folder.³ *MathWriter* stores the equations as PICTs (the object form used by applications such as MacDraw™) and provides three grouping levels. The lowest level enables you to edit each character with draw programs. The middle level is satisfactory for most purposes. The last level preserves entire lines of text that contain mathematical expressions or graphics; use this option to transform a file of displayed equations into a scrapbook. To transfer individual mathematical expressions to other applications, use the Copy As Picture command on the Edit menu.

TEXT options:

Text only

Text with line breaks

Save equations in scrapbook

Mark location in text with: (* # *)

Name of Scrapbook file:

Demo.text.PICT

Equation parser will convert...

each symbol into a separate PICT

groups of symbols into separate PICTs

entire line containing symbols into a PICT

Cancel Save

Figure 6.17 Automatic scrap saves graphics and equations to a scrapbook

RTF and other filters

The list of file types that *MathWriter* can read and write will change as other translators (or filters, as they are also called) become available. As indicated above, place a translator, i.e., filter file, in the same folder with *MathWriter* or in the System folder, and *MathWriter* automatically

³SmartScrap™ can read scrapbooks located anywhere on the disk with any name.

updates the File Type list you see here to include the new filter file. You must save a document in the standard *MathWriter* format to retain all the information required for further editing within *MathWriter*. Filters can support one- or two-way translations⁴ between *MathWriter* and other applications. Some translators may preserve only a subset of formatting information used by *MathWriter*—the minimal information required by the receiving application. Other file types may save all the information required to restore the original *MathWriter* file.

Save a Copy...

Save a Copy... allows you to save a snapshot of the current file, including the changes since the last save, under a different name, different file type, and different disk. The dialog box is the same as with the Save As... command. In contrast with Save As..., however, neither the name, the file type, nor the status of the active file is affected. The pop-up list of file types includes *MathWriter 2.0*, MW Default File, TEXT, and the names of optional translators. To use the optional types, simply place the *MathWriter* filters or translators in the folder with *MathWriter* or in the System folder, and *MathWriter* adds them to this list at startup. Although *MathWriter* reads text and RTF files (and eventually other formats, too), use the *MathWriter* format for documents that you intend to edit or print later using *MathWriter*.

Import Graphics File...

Import Graphics File... allows *MathWriter* to read graphics directly from a file, without the need for the application in which you created the graphic (Figure 6.18). Therefore, you can directly transfer MacPaint, PICT, and Encapsulated PostScript files into a *MathWriter* file even on a 1 megabyte Macintosh. You do not have to pass the graphics through the Scrapbook or switch between applications, but some cropping within *MathWriter* may be necessary with directly read graphics.

MathWriter displays in the scrolling window folders and the files that are the file type(s) designated in the pop-up menu: All Graphics Types, MacPaint, PICT, and EPSF. You have the usual commands for moving among disks or within folders on a disk, as described above for Open....

⁴ The *MathWriter* RTF filter reads files from all word processors which export in this format.

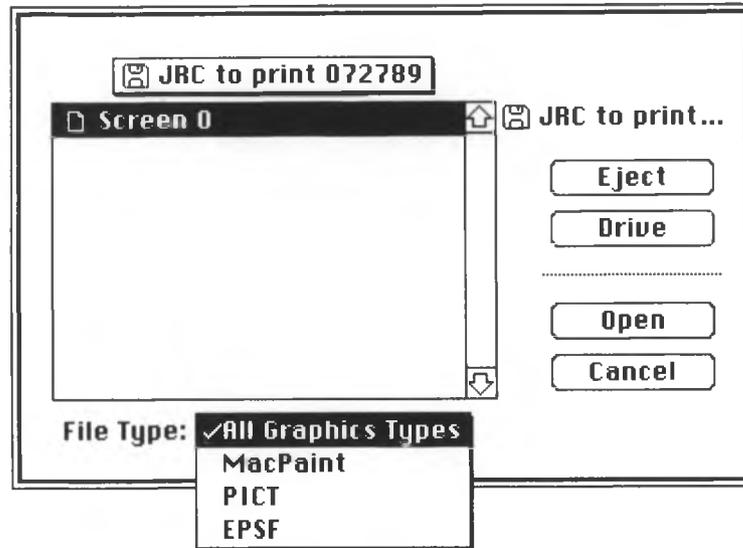


Figure 6.18 Insert Graphics dialog window

Preferences...

Preferences... on the File menu (Figure 6.19) allows you to set global defaults to configure *MathWriter* for your needs. In contrast with document-specific conditions set in Doc Preferences, Preferences... lets you establish a default configuration for the primary startup file and for the New command on the File menu. These startup files are called "stationery." You can create stationery for each distinctive type of document you use and designate one as the default.

First, choose any combination of the floating windows (Templates, Palettes, Tools, and Font Table) for *MathWriter* to place on the screen when you start up.

After you select the combination of floating windows (Tools, Templates, Palettes, or Font Table) appropriate to your routine needs and position them on the screen according to your personal preferences and your hardware configuration, store these choices in the *MathWriter Prefs* file with a single click. Then use the Use current window setup button to store these choices in the "*MathWriter Prefs*" file.

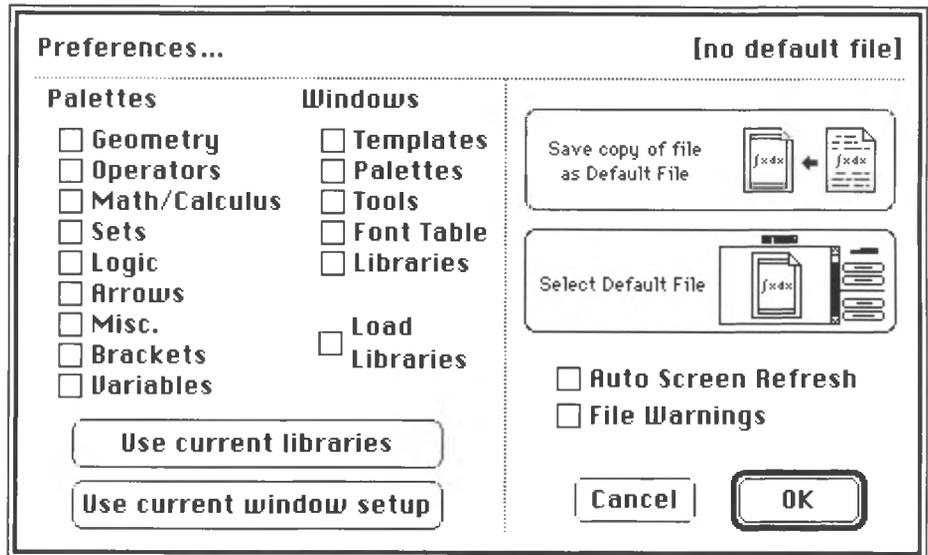


Figure 6.19 Preferences window

In addition, *MathWriter* stores document-specific preferences in stationery or default files. These files contain all other configuration choices such as default font, font size, and font style in the body, headers, footers, and footnotes, as well as text and graphics common to a specific type of document, such as an automatically dated memo with a logo. In the Style menu select which font, font size, and font style you want.

Click Save copy of file as Default File (Figure 6.20). The ensuing dialog box gives you a chance to name the default or stationery file and save it. The Select Default File (Figure 6.21) button opens a box that lets you select a previously created stationery file.

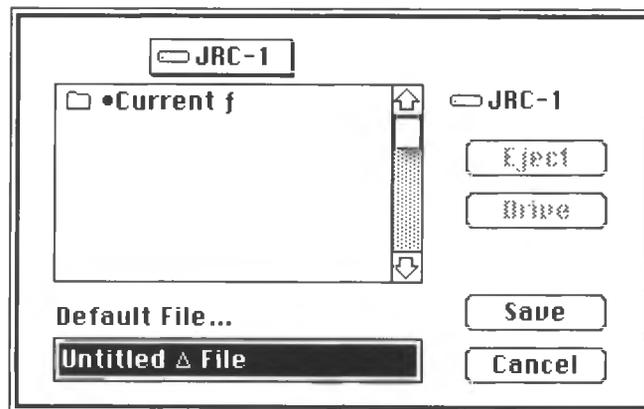


Figure 6.20 "Save copy of file as Default File" dialog box

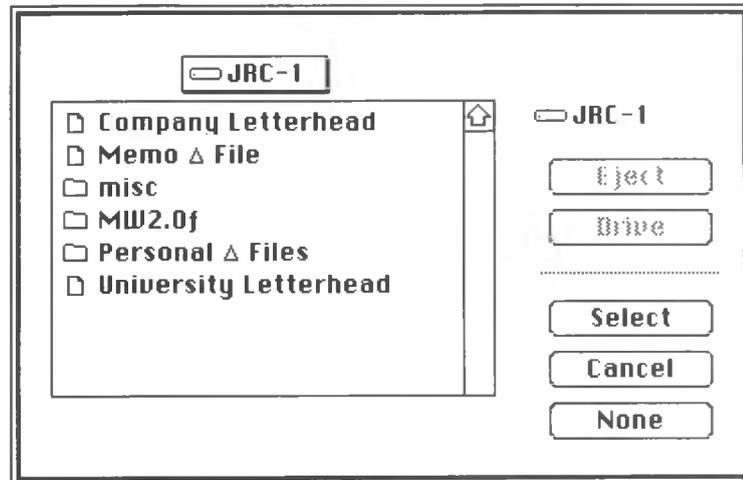


Figure 6.21 "Select Default File" dialog box

The name of this default appears in the top-right corner of the Preferences dialog box. On startup, *MathWriter* retrieves a copy of the selected default file if one exists. To override this default, change the choice of the stationery file using the Select Default File button. You can manually open these default files, too. Click OK to accept changes made or use Cancel to abandon your choices.

The Auto Screen Refresh option (Figure 6.19) provides supplemental, timed screen refreshing. Ordinarily *MathWriter* redraws the screen locally and only as needed to minimize computational overhead. Use this option for additional automatic refreshing and ⌘ option Z for supplemental manual redrawing of the entire screen.

The file warning option enables advisory messages when you open a file. A warning of missing fonts, discussed in connection with the Open command, is often crucial to assure file content integrity. The names of missing fonts are listed. The enable/disable status of automatic file saving is noted when files are being opened.

The conditions established or reported by File/Preferences apply to all documents. Use File/Doc Preferences to establish document-specific conditions.

Doc Info...

In the Doc Info... window you see that *MathWriter* automatically tracks the number of sessions, the creation date, the date last modified, and the size of your document file (Figure 6.22). The Abstract/Notes box lets you jot down notes about the file.

Abstract/Notes:	Space for keywords, abstract, and notes	
Sessions:	8	
Creation date:	Sep. 4, 1990, 11:34:10 PM	
Modification date:	Nov. 27, 1990, 9:23:32 AM	
Size on disk:	171,069 bytes (167K)	

Pages:	16	<u>Characters</u>
Paragraphs:	106	on base line: 20,806
Lines:	348	in sub-expressions: 155
Words:	3503	containing sub-expressions: 1
Memos:	0	Total: 20,961
Unique rulers:	16	
Unique styles:	14	
Style runs:	104	
		OK

Figure 6.22 Doc Info window

When you open the Doc Info... window, *MathWriter* counts the number of pages, paragraphs, lines, words, equations, memos, characters on the base-line, characters in subexpressions, and characters containing subexpressions of your file.

Page Layout...

The Page Layout... command on the File menu controls the page layout specifications for the document (Figure 6.23). The portrait at the right illustrates a sheet of paper. The outer rectangle is the size of the paper; the inner is the print area. The portrait changes to illustrate your choices of columns, margins, etc.

You can increase or decrease the size of the margins by clicking in each respective box and changing the values. Supply units abbreviation (without punctuation) of in, cm, or pt according to the units set in Format/Ruler Options. Out-of-range values will be indicated by a "?"; invalid answers will not be accepted. ? Clicking in the Max box gives a print area of 7.66 inches by 10.1 inches for an 8-1/2 by 11 inch sheet of paper. "Std" restores the previous values.

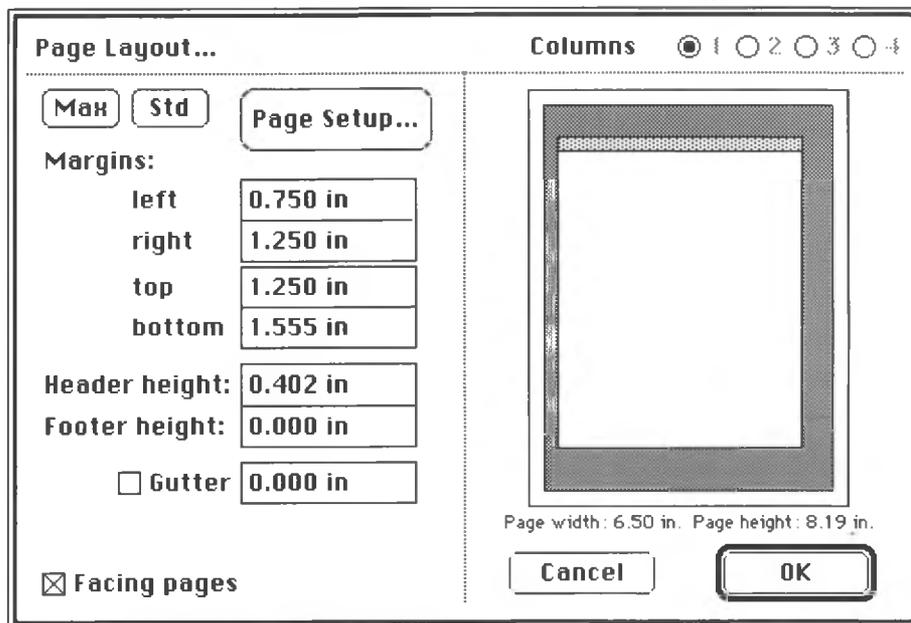


Figure 6.23 Page Layout window

MathWriter measures the margins from the physical edges of the paper, not the edge of the print area. The actual print area is smaller than the paper. For convenience, *MathWriter* adds the width of the white border and any additional margin length excluded from the print area to get the margin measurements. The dimensions of the print area, including the headers and footers, appear just beneath the miniature portrait. You can add an additional binding margin (gutter) to the margin.

The gutter is the extra space in the margin needed for binding. If you choose "Facing pages," *MathWriter* reserves this binding margin on the left side of odd-numbered pages and on the right side of even-numbered pages.

The area with the lighter shading at the top is the header and is within the print area. Headers and footers are always present, so set the header and footer heights to zero to assign this space to the main body of text, as done in Figure 6.23. The contents of the headers and footers appear automatically throughout the entire document as specified in Doc Layout of the File menu.

Page Setup (Figure 6.23) lets you set paper size, reduction percentage, orientation, font substitution, text smoothing, graphics smoothing, and faster bitmap printing. Click the Page Setup button. Page Setup has ImageWriter options and LaserWriter options. Depending upon the printer you chose in the Apple menu, your screen shows ImageWriter (Figure 6.24) or LaserWriter (Figure 6.25) options.

The LaserWriter offers more controls than the ImageWriter. Click Options (Figure 6.25). LaserWriter Options (Figure 6.26) lets you flip the image horizontally or vertically, invert the image, use precision bitmaps, use a larger print area, or use unlimited downloadable fonts. The Larger Print Area option increases the print area to 8 inches by 10.7 inches (see Table 6.1). Click Help (LaserWriter Page Setup, Figure 6.25) for an explanation of these terms (Figure 6.27).

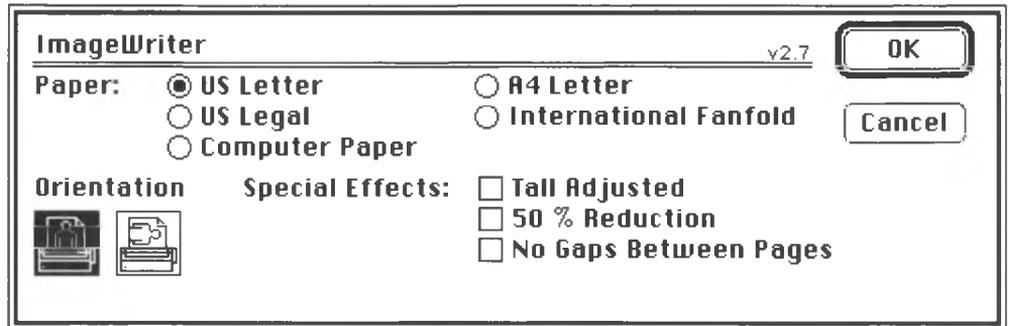


Figure 6.24 ImageWriter options

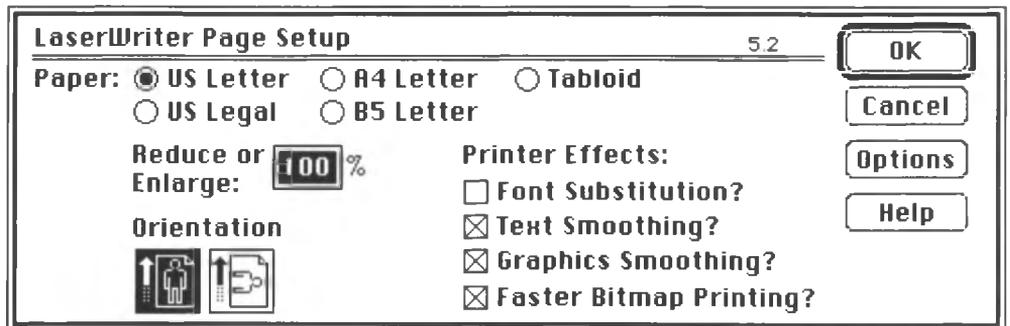


Figure 6.25 LaserWriter options

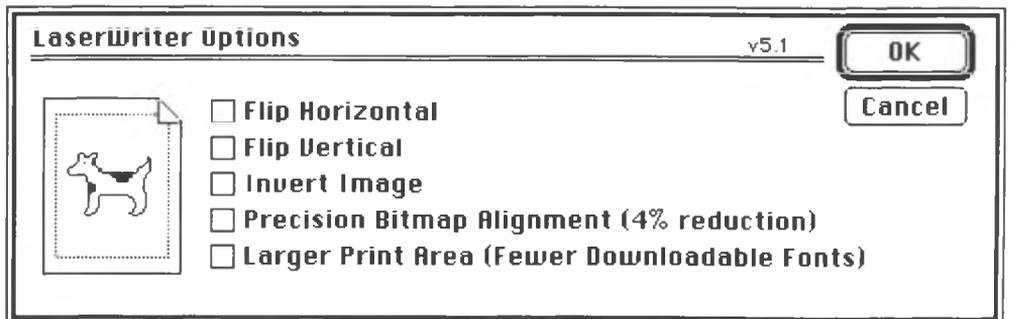


Figure 6.26 LaserWriter options dialog box

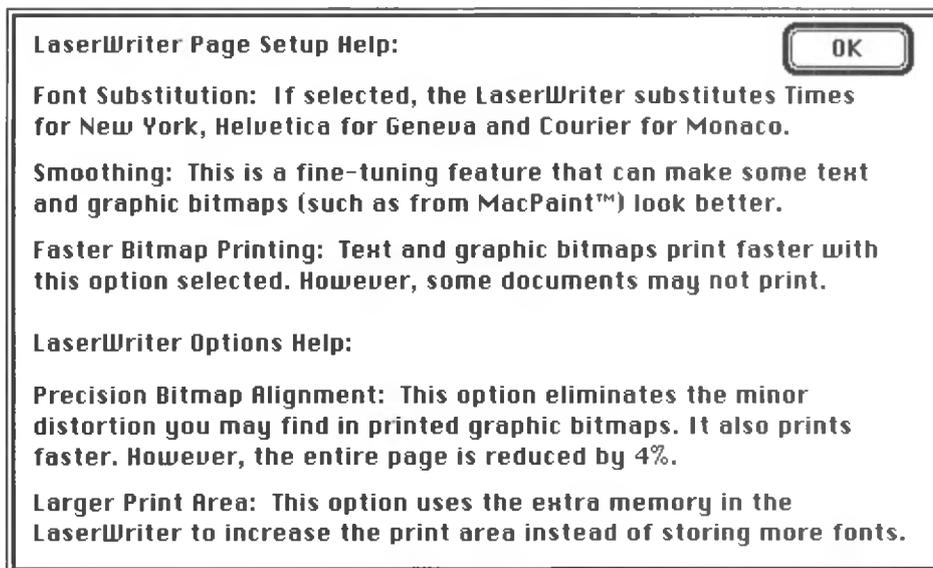


Figure 6.27 LaserWriter page setup help

If you make layout changes to an existing document, a “thermometer” type indicator appears in the typeface area of the status bar at the bottom of the screen while *MathWriter* is implementing the changes. Under normal circumstances you should set the page layout before creating your document. If you change the layout after you create the document, the page width could shrink too small for certain equations or graphics. Additional options are available from the Print dialog box (Figure 6.28).

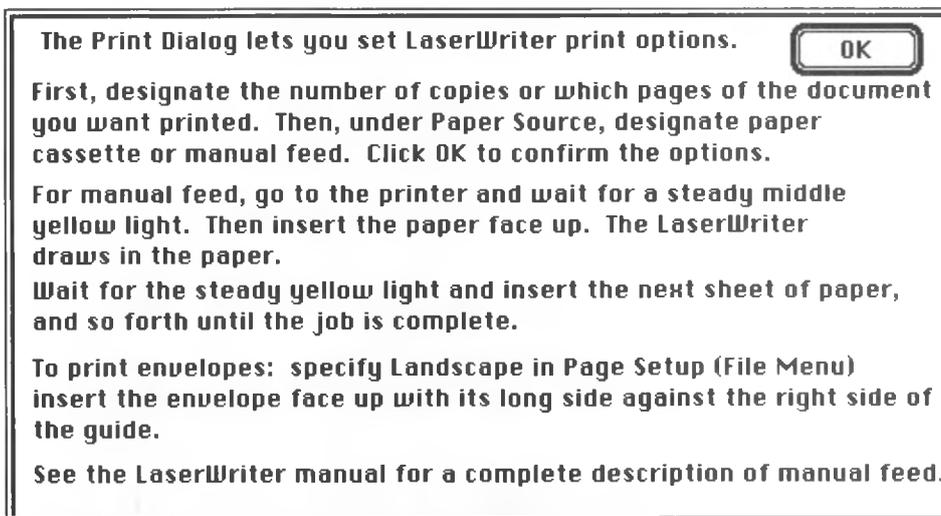


Figure 6.28 LaserWriter help from the Print dialog box

Table 6.1 Minimum margins and maximum print areas for the LaserWriter

8.5 × 11.0 inch paper	Normal Max	Larger Print Area
w × h print area	7.66 × 10.1	8.00 × 10.7
Min left & right margins	0.416	0.430
Min top & bottom margins	0.250	0.111

Doc Layout...

Doc Layout... of the File menu allows you to specify the placement of headers, footers, footnotes, and endnotes throughout the document by clicking on icons (Figure 6.29). For example, if you click the icon in the top-left corner of Figure 6.29, headers will appear on every page. Headers and footers can appear on every page, or you can skip the first page, skip the last page, or skip the first and last pages. You can specify that common headers and footers appear on all pages, that they be common except for the first or the last page, or that the left and right page headers and footers differ. Note that left pages are even-numbered pages and right pages are odd-numbered pages.

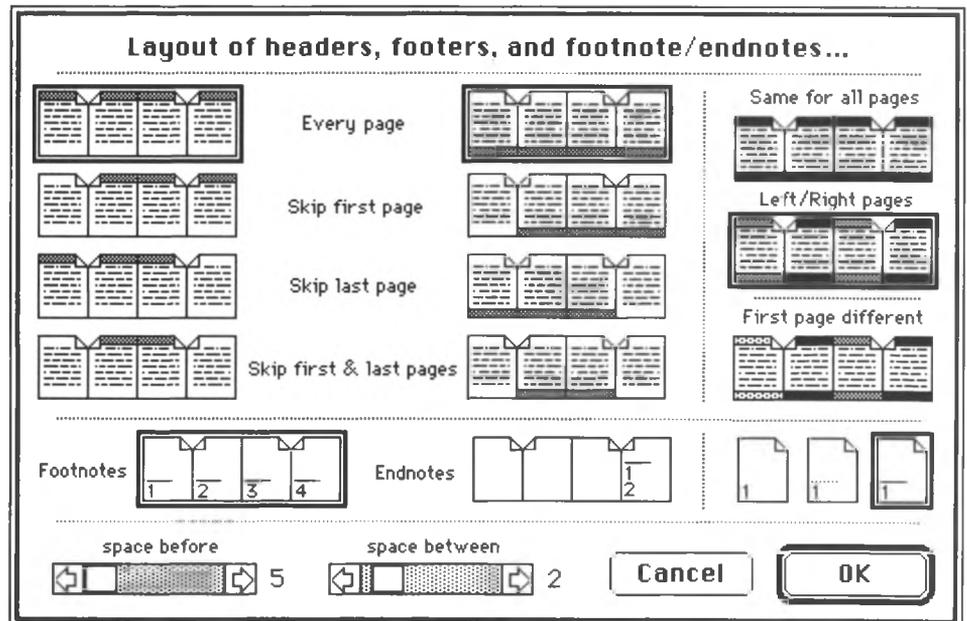


Figure 6.29 Document Layout window

Annotations can appear on the page where cited, or be collected at the end of the document. If you click the icon beside Footnotes, footnotes can appear

on every page. If you click Endnotes, annotations will appear at the end of the document, as endnotes. The last three icons illustrated in the line with the footnote and endnote icons offer three styles for separating the footnotes from text. Click one to choose it. By dragging the scroll bar shown at the bottom of Figure 6.29, you can set the spacing between the text and footnotes (5–30 pixels) and between footnotes (0–20 pixels).

MathWriter automatically numbers footnotes and endnotes and automatically rennumbers them if you add or remove a footnote or endnote. Even cross-references within the text are updated automatically.

To insert a footnote (or endnote), position the insertion point in the text and then select the footnote icon on the Palettes menu (or type ⌘ option F). To type a footnote's contents, move the cursor into the footer (not a separate window) and type. When you move the cursor into the footnote/endnote region, the cursor changes shape. The space for footnotes grows automatically upward as needed. *MathWriter* adjusts the lower boundary of the main text to avoid a collision with the footnote. To avoid manual scrolling to insert the content and to scroll back to the insertion point in the body of the document, use the pop-up selector in the insertion point/selection indicator in the status bar (see Figure 6.6).

Doc Preferences...

Doc Preferences... offers a variety of options (Figure 6.30) for your document. On the left side of the Document Preferences window are several styles: Style 1, Style 2, and Footnote/Endnote. Each of these styles has a specific function.

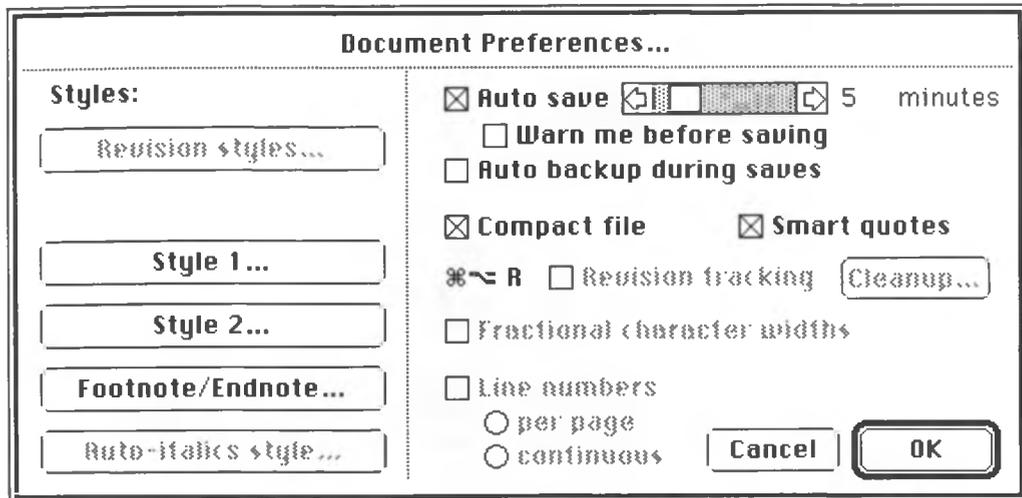


Figure 6.30 Document Preferences menu

Styles 1 and 2 enable you to create and assign style combinations with a keystroke. Footnote/Endnote lets you set the footnotes or endnotes default style. Since the instructions for Style 1, Style 2, and Footnote/Endnote are similar, let's look at only one set of instructions. You will be able to apply what you learn to the others.

Click on Footnote/Endnote. The Set footnote/endnote style... window appears (Figure 6.31). To select the font in which you want footnotes or endnotes to appear, choose Font by clicking the box to the left of Font. Then click the box to the right of Font to get a list of font choices. Select one. Note that the rectangular portrait box beneath Font, Size, and Style illustrates your choice. In a similar manner you can select the size of the font and whether you want footnotes right-justified, left-justified, centered, or aligned (i.e., simultaneously left and right justified).

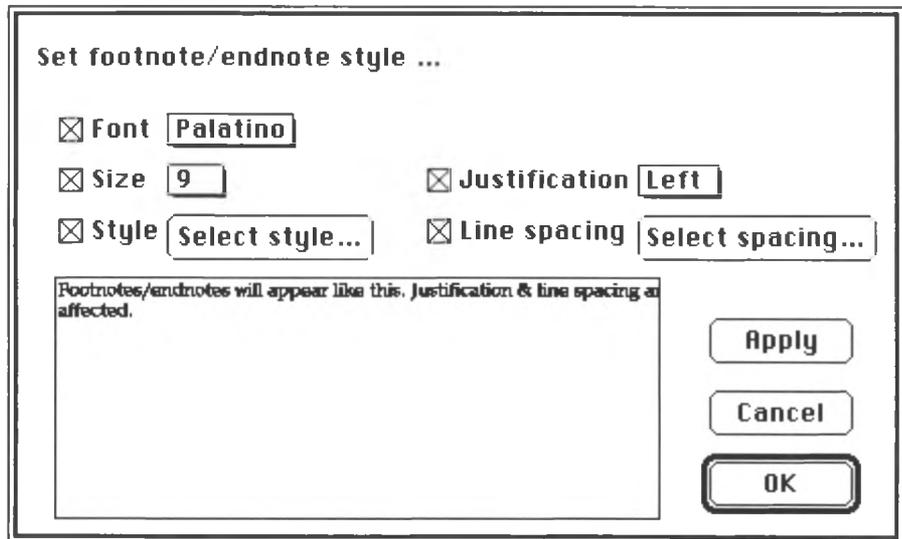


Figure 6.31 Footnote/Endnote dialog box

Now click the Line spacing... box. Then click Select spacing. The Line spacing... window appears (Figure 6.32). Here you can choose Automatic, Mostly fixed, and Fixed spacing. Automatic spacing automatically spaces lines according to the maximum size of an expression such as a mathematical equation. Mostly fixed allows simple subscripts and superscripts to protrude into the leading between the lines. Mostly fixed is a combination of automatic (or flexible) spacing and fixed spacing. When typing tall displayed expressions, Mostly fixed reverts temporarily to automatic. Fixed lets you set spacing with the four buttons: Single, 1-1/2, Double, and Other. The ascent and descent for the three fixed spacings are: (9,3) for Single, (14,4) for 1-1/2, and (18,6) for Double. The Other category lets you set the ascent and descent separately. This is the control that allows you to squeeze an extra line onto a page.

To accommodate personal preferences and a variety of fonts, you can set the vertical position in the number of pixels above or below the ascent, descent, or baseline. The baseline is the imaginary line on which a line of text rests. The descent is the imaginary line to which characters, such as g, j, p, q, y, and z, extend below the baseline. The ascent is the imaginary line to which stems of characters, such as b, d, f, h, k, l, t, extend above the baseline. (Refer to paragraph formatting in Chapter 4.) The displayed equation adjustment allows you to set space above and below equations displayed on a separate line.

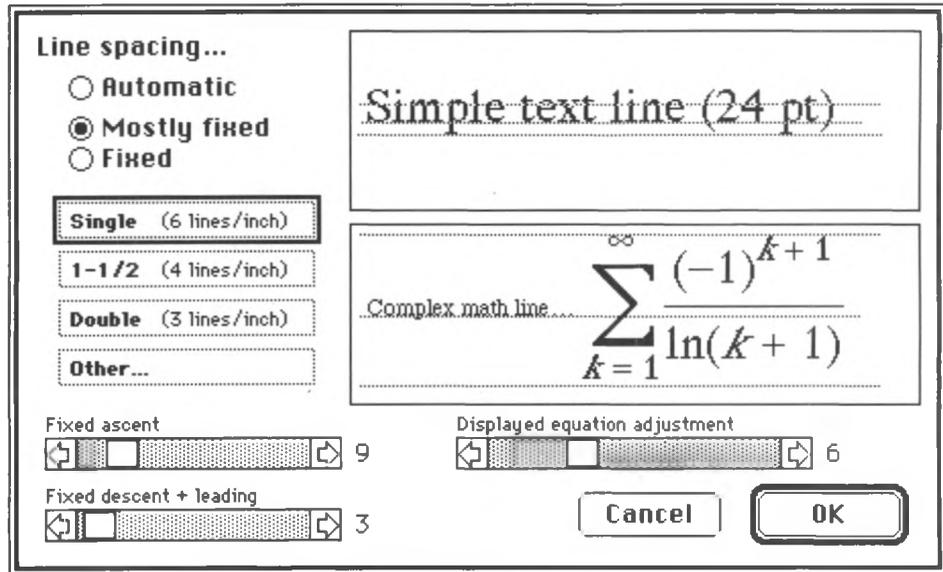


Figure 6.32 Line spacing dialog box

Click OK to accept your line spacing choices.

You can use automatic line spacing while composing a manuscript when you do not want to be concerned with making a line spacing choice. If your writing includes in-line expressions, you can modify the line spacing by selecting or highlighting the relevant text with the mouse or keyboard and applying the desired line spacing. NEVER compose built-up mathematical expressions using fixed line spacing because a portion of the text is likely to be clipped and the screen refresh for the line will not erase characters that extend outside the specified height. There may be instances when you will assign fixed spacing to previously created paragraphs that contain mathematics, however.

Next, let's look at styles. Click the Style box in the Set footnote/endnote ... window. Then click Select Style. This opens the Other styles window. Here you have an array of choices (Figure 6.33). Most of the boxes in the left quadrant of the window let you choose a particular style of font. Underline

and Low underline offer additional options. Click in the box beside Underline. On the right side of the window, Underline pattern and Underline weight are now available. Click in the box beside Underline Pattern. *MathWriter* offers numerous underlining patterns. Click in the box beside Underline weight. This lets you choose the width of the underline.

Sometimes combining two choices can be desirable. For example, selecting both Underline and Words only means that *MathWriter* underlines the words but not the spaces in your document. Underline and Low underline together produce double underlines.

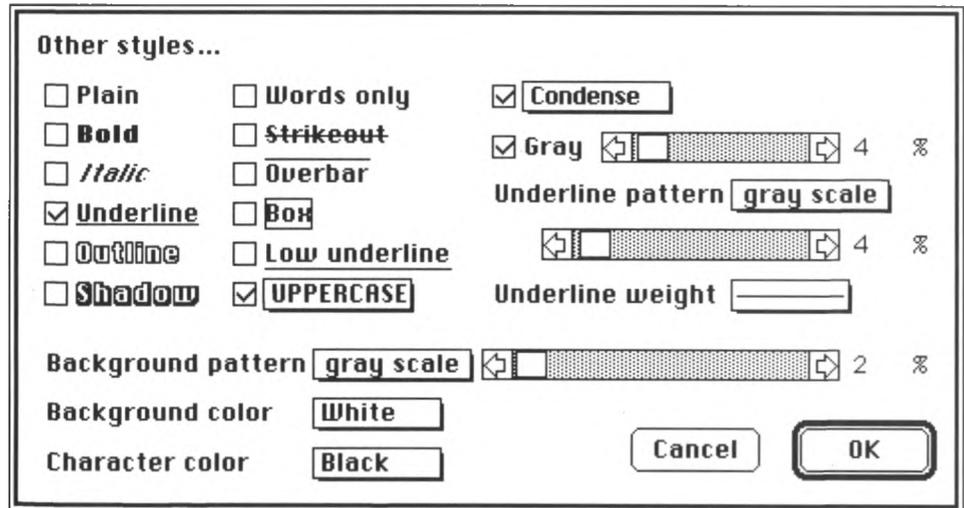


Figure 6.33 Other styles

The last box in the group of font choices offers UPPERCASE, lowercase, and Cap. First as mutually exclusive choices. That lets you choose whether you want text in all capitals, all lowercase, or the first letter of each word capitalized, regardless of the shift key. Case changes can be applied to existing text without retyping.

The Condense/Extend box removes or adds one pixel, respectively, after each character. The Gray box opens a scroll bar for setting the percentage of gray. Background pattern gives you a collection of possible patterns for backgrounds. Usually a low (1-5 percent) range is appropriate. Finally, if you have a color monitor, Background color and Character color let you choose a color for the background of your text and one for text characters.

The extra computational burden associated with a color display can be a heavy penalty. To avoid this penalty, use the Control Panel on the Apple menu to set the Monitors to Black & White.

Click OK to accept your style choices.

To set text styles for Style 1 and Style 2, follow the same procedures that you used for Footnote/Endnote.

Several other options remain in Doc Preferences. Look at the right portion of the window. If you click Auto save, *MathWriter* saves your document at intervals, the length of which you determine with the horizontal scroll bar to the right. Click Warn me before saving if you want *MathWriter* to tell you it is about to save your document and give you a chance to decline the save. If you click Auto backup during saves, *MathWriter* automatically makes a backup of the previous version of your file in addition to saving the current file. Auto backup causes the previous copy to be retained. Compact file reduces the file size by eliminating data added for faster scrolling, which can be regenerated when needed.

Click on Smart quotes to replace the typewriter style "quote" and 'apostrophe' with the curved style "quote" and 'apostrophe' some prefer. Fractional character widths let you control the character spacing more finely than the 1/72 inch resolution of the screen pixels. This option might be used when fine control is important, such as when using fully justified (left and right) text. Because this option sometimes makes the screen display less readable, enable this option immediately prior to a final review of the manuscript before printing.

NEVER use fractional widths with documents that contain mathematical expressions. When using this system call, verify that the printed results are satisfactory.

When you have completed your preferences for the document, click OK to accept changes or click Cancel if you do not want to make any changes in this window.

Overview...

The Overview command is not available in this version.

Print...(**⌘T**)⁵

Depending upon the choice of printer you made in the Chooser of the Apple menu, when you click Print on the File menu, an ImageWriter (Figure 6.24) or LaserWriter (Figure 6.25) panel appears. *If your file has previously been set up for one printer and you choose the other, click Page Layout (File menu) and then click in the Page Setup box before printing.* This sets up your document for the correct printer. Because the printers' requirements are slightly different, we recommend scrolling through the document to verify page layout before printing it.

⁵ The Macintosh user interface standard specifies this command key. If you are accustomed to Command-P for print rather than plain, refer to appendix 5 for reassignment instructions using *Cmd Key Switcher*.

In general, you should choose a printer type before composing your document because your choice of fonts and sizing of graphics and equations may be affected.

ImageWriter: (Figure 6.34) With the dot matrix printer, you can choose the print quality (Best, Faster, Draft) appropriate for your purposes. Click the circle beside one of these to make a choice. For the Best quality, your system file should contain the bitmaps for the specified font sizes and the fonts of twice the size requested. If a particular font size is available to the system, that font size appears outlined on the Font size menu. The remaining options apply to both the ImageWriter and the LaserWriter (Figure 6.35).

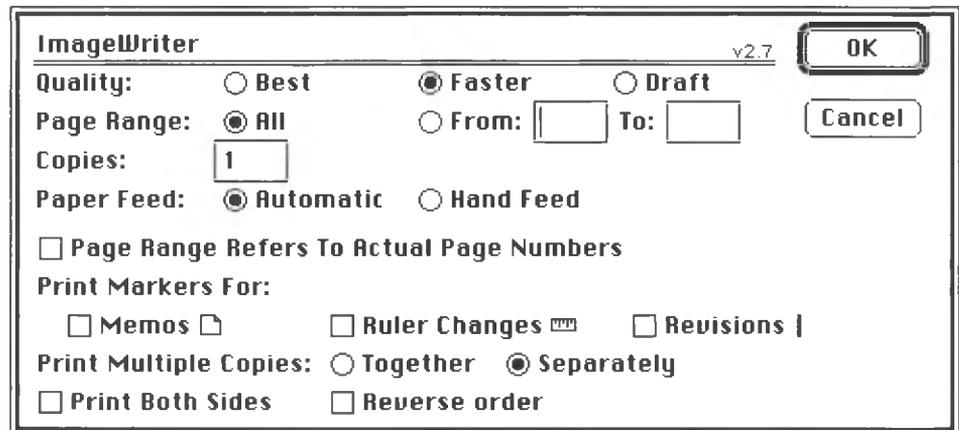


Figure 6.34 ImageWriter controls

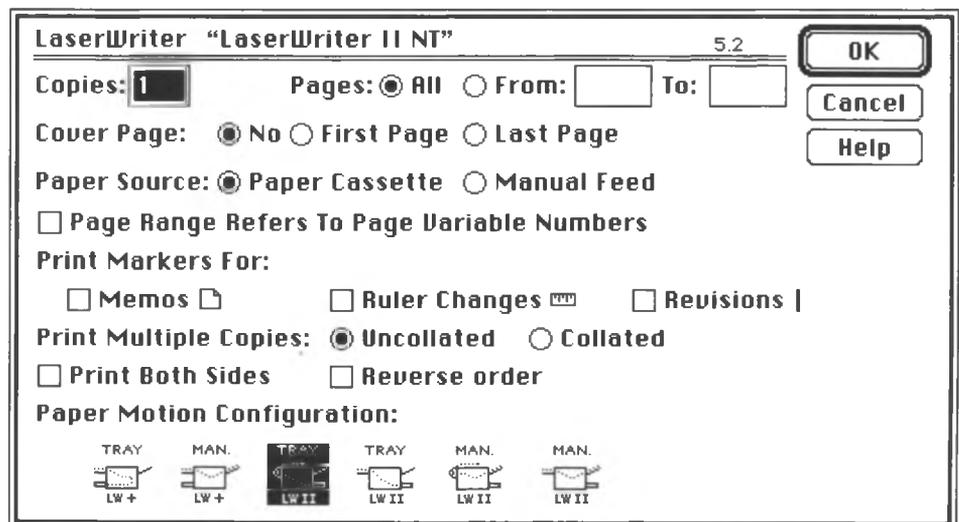


Figure 6.35 LaserWriter controls

Copies: In the box beside *Copies*, type the number of copies you want. This is the default location of the insertion point and the default number of copies is one.

Pages: The default is Print All. To print only a portion of the active document, specify the beginning and ending pages in the boxes beside *From:* and *To:*. To print a single page, type the same number in each box. If you supply no value for *To:*, the end of the document is assumed.

If your file is part of a larger document, the page numbers in the headers may differ from the physical page numbers. Check *Page Range Refers to Actual Page Numbers* on the dialog box just below the paper feed option if you prefer using the page numbers from the document header or footer. [The header page numbers are set using *Starting at* in the *Variables Format...* (Format menu).] Alternatively, *MathWriter* will calculate and display the translated values for you. The number in the vertical scroll bar is the physical page number that always ranges from 1 to the maximum number of pages in the document. When you press on the scroll box the page variable page number for that page is displayed in the status bar.

Cover Page: (LaserWriter only) If you share a LaserWriter with someone else and want to identify your document after it prints, click *First Page* or *Last Page*. Then the LaserWriter prints a first or last page with your name, the name of your document, the date, the time, and the printer name.

Paper Feed/Paper Source: The ImageWriter options are Automatic and Hand Feed; the LaserWriter options are Paper Cassette and Manual Feed. With the manual options, *MathWriter* prompts you for single sheet paper feed. If you select *Print Both Sides* or *Reverse Order*, you will be given instructions. For these two options to work properly with a LaserWriter, you must specify the paper-feed configuration for your particular printer. The icons depict the path from tray or manual feed to output. To avoid making this choice repeatedly, create stationery (MW Default file) with this choice preserved for you.

Page Range Refers To Actual Page (Page Variable) Numbers: Click this option to use the page numbers from the document header or footer, rather than the number displayed in the scroll bar. To set the starting header page numbers click *Variables Format...* on the Format menu. That opens the *Variables Format* window. Move down to "page #" and click. That opens another window on the right under *Variable Style*. Find the box beside "starting at" and type the page number at which you want to start printing.

Print Markers for Ruler Changes: Select this option to print markers in the left margin of the document to help you locate these changes.

Print Multiple Copies: When printing multiple copies you can either print all copies of each page before advancing to the next page (Uncollated) or print all pages of the file before beginning another set (Collated).

Uncollated is faster, especially if the file is graphics-laden, because the printer has to compose each page only once.

Print Both Sides: This option causes the printer to print the odd- and even-numbered pages separately. You must identify the specific Paper Motion Configuration of your LaserWriter for this to work properly and reposition the paper as instructed (after all pages from one side have been printed). The first and second icons correspond to the older LaserWriter Plus.

Reverse Order: Check this option to print the pages in reverse order, i.e., reverse order in the output tray. When this option is not checked, the LaserWriter uses your Paper Motion Configuration so that the pages will appear in the output tray in the normal reading order. The actual printing sequence depends upon the hardware.

Quit (⌘Q)

This is the standard last menu item on the Macintosh File menu. Use this command or its command key equivalent ⌘Q to terminate the application. *MathWriter* reminds you to save modified files of any type before terminating the program.

The Edit Menu

The Edit menu (Figure 6.36) transfers formatted text and graphics, rulers, paragraph formats, styles, and text converted to PICTs from one location to another. Edit also provides a generalized find and replace facility that searches both mathematical expressions and text. Spell-checking appears on this menu.⁶ To access the entire Edit menu on a small screen, move the mouse to the small, triangular arrow at the bottom of the first portion of the menu and drag.

Undo (⌘Z)

The Undo command restores the document to its status prior to the most recently executed command. Undo lets you explore alternatives as well as correct mistakes. Undo is not available for a few situations (such as global replace and within mathematical expressions).

⁶ *MathWriter* uses spell-checker code from Microlytics.

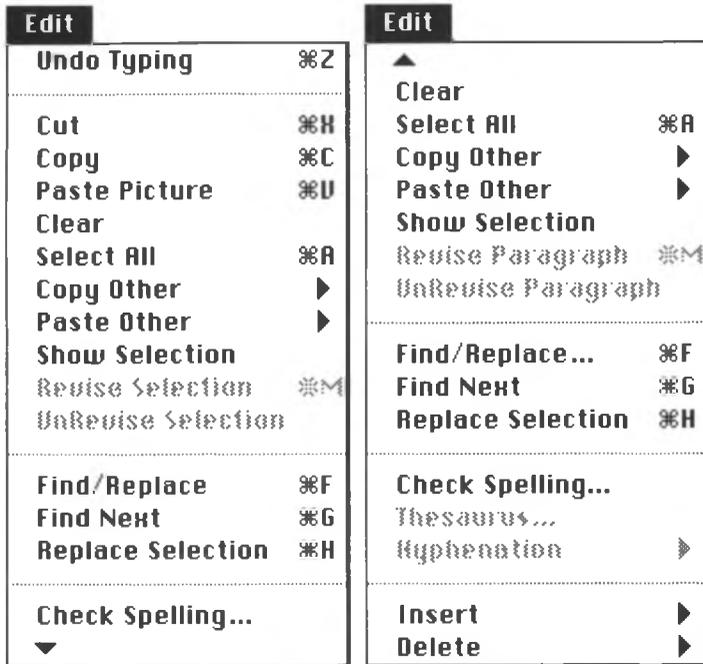


Figure 6.36 Edit menu (scrolling with arrows)

Cut (⌘X), Copy (⌘C)

The Cut and Copy commands are dimmed and disabled until you select the portion of text you want to act upon. This is consistent with the Macintosh convention that an object must be selected before a command is issued. The Cut command removes the selected material from the document and places it on the Clipboard for subsequent transfer to another location, while the Copy command simply copies the selected material to the Clipboard without disturbing the original. To view the contents of the Clipboard, pull down the Windows menu at the top of the screen until you reach Clipboard and then release the mouse. The Clipboard stores material from only one Cut or Copy operation at a time. Clear removes a selection, but does not affect the Clipboard. The Clipboard remains intact even after you

exit *MathWriter*, allowing you to transfer material to another application.

Paste (⌘V)

Paste inserts into the document material previously cut or copied to the Clipboard. Click the I-beam at the place in the document where you want to paste material. Then pull down the Edit menu to Paste and release the mouse. The pasted material appears in the document. If you select or highlight a portion of text and then use the Paste command, *MathWriter* replaces the highlighted portion with the contents of the Clipboard. Unlike Cut or Copy, Paste does not remove material from the Clipboard; instead, you can paste Clipboard material into another document or even into a document of another application. (See Table 6.2 for a summary of these commands.)

Clear

Clear removes a selection of a document without placing a copy of that selection on the Clipboard. It is equivalent to pressing the *delete* key. Use this command to remove large blocks of text when memory is limited.

Table 6.2 Editing summary

Action	Affects document	Affects Clipboard
Cut	yes	yes
Copy	no	yes
Paste	yes	no
Clear	yes	no
Delete	yes	no

Select All (⌘A)

Select All selects all of the material in the portion of your document (body, header, etc., identified in the pop-up menu at the insertion point locator in the status bar) that contains the insertion point. From the keyboard you can also select everything by clicking just before the first item and then *shift clicking* at the end. Various cursor key combinations also provide selection capabilities (see appendix 3).

Copy Other

Cut, Copy, and Paste apply to the combination of types of textual and graphic material within a selection. However, you can choose various types of formatting information such as Ruler, Format, Ruler and Format, Style, and Picture and copy them using Copy Other (see Figure 6.37). Copy Ruler, Copy Format, and Copy Ruler and Format relate to the paragraph containing the blinking insertion point.

Copy Ruler (⌘ shift R) copies only the ruler and associated tab settings. Copy Format (⌘ shift F) copies only the values you set using Paragraph Format... and Line spacing... of the Format menu. Copy Ruler & Format (⌘ shift A) combines these two commands. Copy Style (⌘ shift S) relates to text you select or highlight and copies all the information prescribed in the Style menu. Copy As Picture (⌘ shift I) turns the selected material into a PICT format graphic element and places it on the clipboard. Use this command if you wish to transfer an equation to another application.



Figure 6.37 Copy Other from the Edit menu

Paste Other

Paste Other (Figure 6.38), which complements Copy Other, pastes the information you retrieved with Copy Other into the document at the location of the insertion point. Paste Other includes: Paste Ruler (\mathbb{C} shift T), Paste Format (\mathbb{C} shift G), Paste Ruler and Format (\mathbb{C} shift Z), Paste Style (\mathbb{C} shift D), and Paste In Context (\mathbb{C} shift V). When you use the additional command, Paste In Context, pasted text assumes the type characteristics of its new context, rather than preserving its original.



Figure 6.38 Paste Other from the Edit menu

Show Selection

Show Selection scrolls to the paragraph containing the blinking insertion point of the active window.

Revise Selection (\mathbb{C} M) and UnRevise Selection

Revision tracking is not available in this version.

Find/Replace... (\mathbb{C} F)

Find/Replace... is a generalized, substantially enhanced search utility (Figure 6.39). One of the consequences of *MathWriter's* total integration of mathematical expressions into text is its ability to search for such expressions. You can replace portions of mathematical expressions provided you can select the unit with the I-beam cursor. In other words, *MathWriter* only locates portions of expressions that extend to the baseline.

The Find: and Replace with: categories are completed by the more specific choices in the Match and Affect pull-down menus. The match can be on text, and additionally on any combination of font, size, style, case, or word. The Affect list includes text only, or text in combination with font, size, and style.

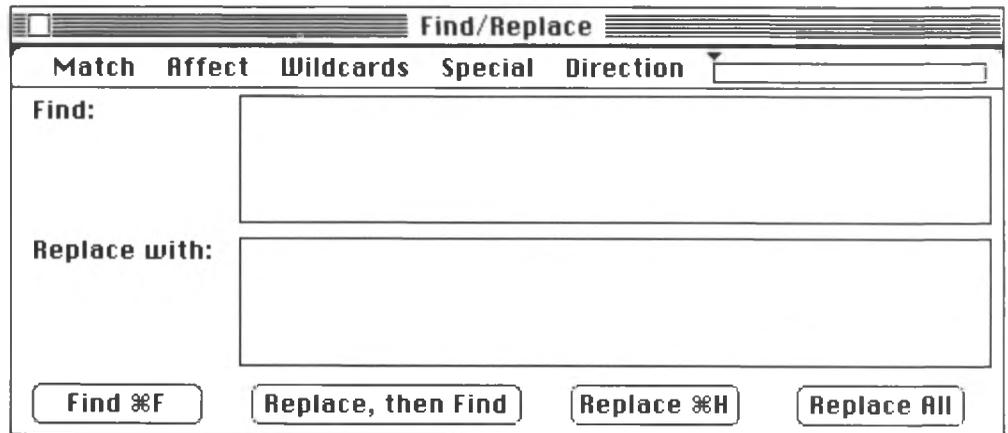


Figure 6.39 Find/Replace window

Find Next (⌘G)

The Find Next menu command (or the Find dialog button) searches for the next match.

Replace Selection (⌘H)

Replace Selection replaces the selected text with the previously specified contents of the Replace window.

After specifying the search and replace contents and search filter, you have the option of controlling the search from the keyboard. Press *return* to remove the Find/Replace window and initiate the search from the insertion point. Use Find Next (⌘G) and Replace Selection (⌘H) to control the substitutions from the keyboard. If you leave the Find/Replace window in view, you can use the mouse to activate Find; Replace, then Find; Replace; and Replace All buttons.

The Find/Replace feature illustrates one of the primary design goals of *MathWriter*; to extend the scope and power of virtually every feature of traditional word processors without making tasks more difficult to perform. For example, using the defaults that exist when you activate *MathWriter* (find text, match text only, replace with text, affect text only), the commands Find; Replace, then Find; Replace; and Replace All perform in the customary manner. In particular, suppose you type a text string in the large Find: text box and another text string in the large Replace with: text box. When you click the Find button, the search starts from the location of the blinking insertion point and advances through the file until it finds a substring match or reaches the end of the file. If it finds a match, you can abandon the search; click the Replace button to make the substitution; click the Replace, then Find button to make the substitution and search for

another match; or click Replace All to automatically replace all other matches without your intervention.

Warning: Use Replace All with caution because Undo does not apply to this command. Unless you have made a backup before using this command, you may be unable to easily restore your document if unanticipated changes result.

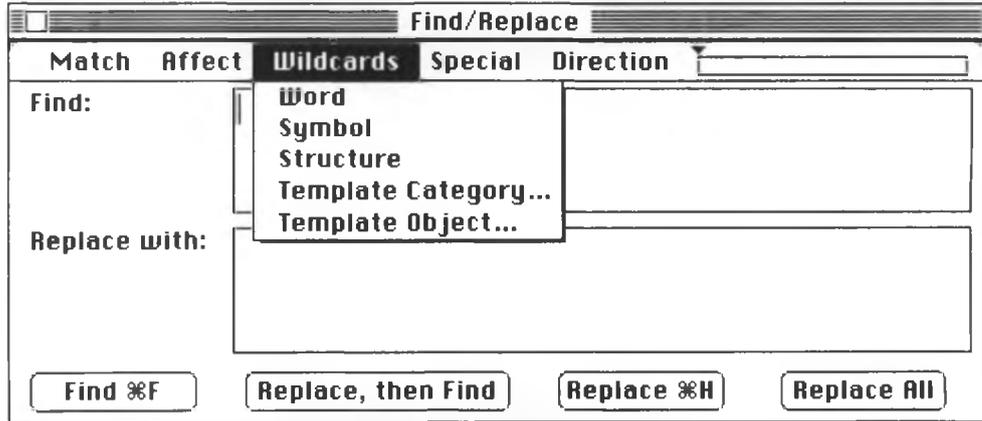


Figure 6.40 Find/Replace window has seven menus

MathWriter provides five pull-down menus as part of its very powerful search capability. Using these menus (Figure 6.40 and Figure 6.42) it is possible to define very complex search and replace strategies quite easily.

You can search on text strings, typeface, or any combination of these using combinations from the Match menu. For example, to search for a text string, regardless of the combination of font, size, or style, the combination of upper and lowercase, or whether it is a whole word or embedded string, you set Match to Text only. Any combination of the Match menu items can replace Text only to allow you to locate text having those qualifying attributes, too.

MathWriter supports five types of wildcards (Figure 6.41 and Figure 6.42):

- *word* represents any leading or trailing string of zero or more characters, comparable to the "*" in MS-DOS.
- ? matches any single character in a string, comparable to the "?" in MS-DOS.
- ?^ represents a mathematical structure.



Figure 6.41 Wildcards for searching

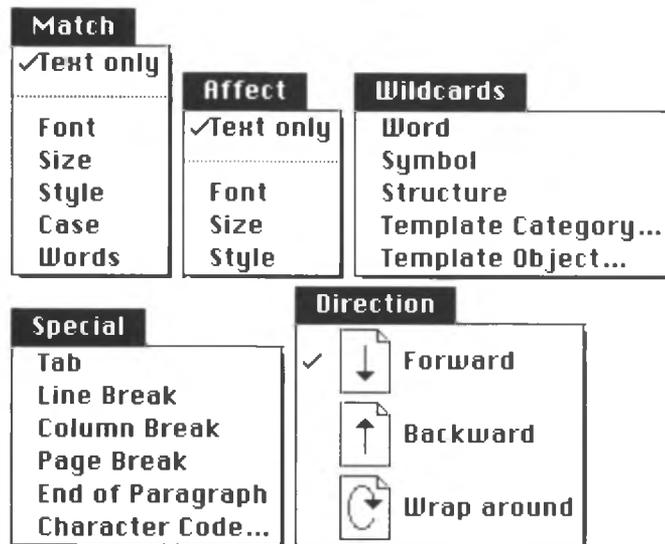


Figure 6.42 Find/Replace menus

- You can use any of the ten classes or rows of mathematical structures on the floating Templates window in a search. Any template icon at the beginning of a row in the Template window is the Template Category (Figure 6.43) of that row and is used to match any template within that row.
- You can locate specific templates (Figure 6.44) using the Template Objects list.

You can also search for invisible formatting characters (Tab, Line Break, Column Break, Page Break, and End of Paragraph) by name (Figure 6.45) or ASCII number (Figure 6.46).

A search begins wherever you place the blinking insertion point whose relative position within the file is indicated in the box to the right of the direction menu (Figure 6.42). You may direct the search to the end or beginning of the file or wrap from the end to the beginning for a complete search of the document.

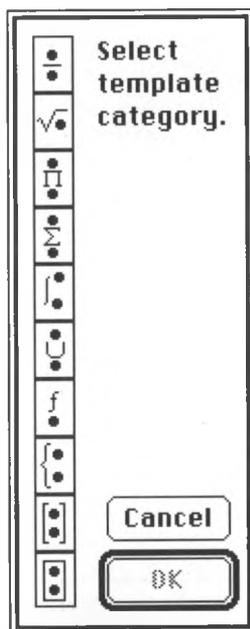


Figure 6.43 Template categories

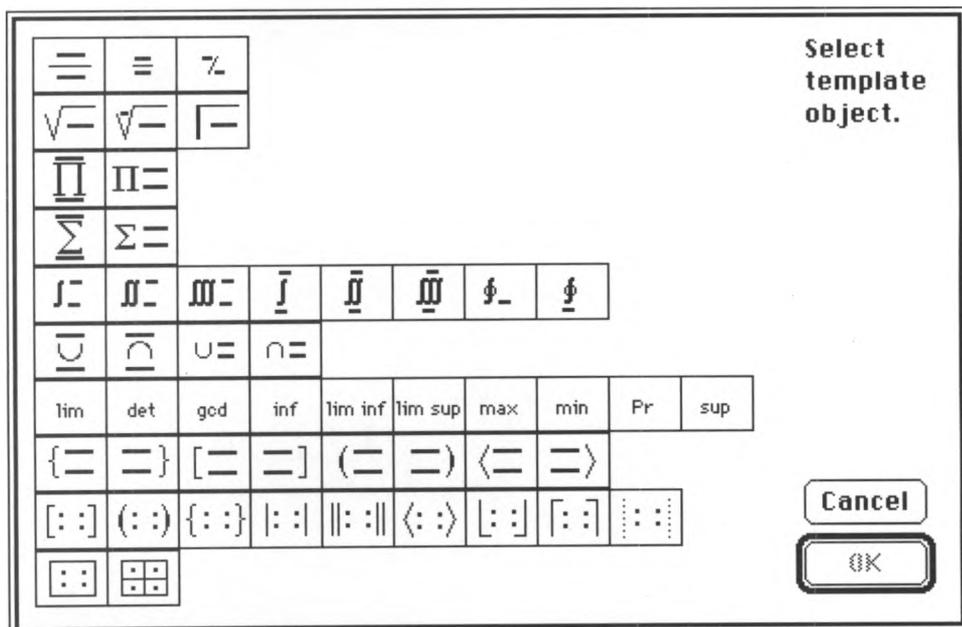


Figure 6.44 Template objects

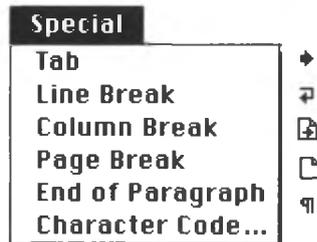


Figure 6.45 Invisible formatting commands and display characters

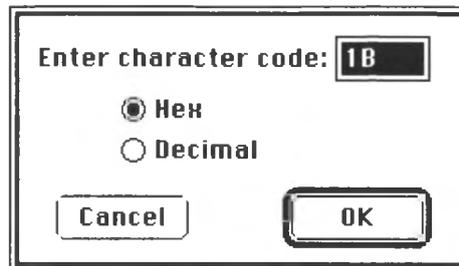


Figure 6.46 Search for individual characters by ASCII code

Check Spelling...

When you began *MathWriter*, you should have placed the main and user dictionary files in the same folder with *MathWriter* or in the System folder. Otherwise, you must locate those files by clicking Check Spelling in the Edit menu and then the corresponding buttons Main Dictionary and User Dictionary in the Spell Finder window (Figure 6.47). Only one User dictionary can be open at any time.

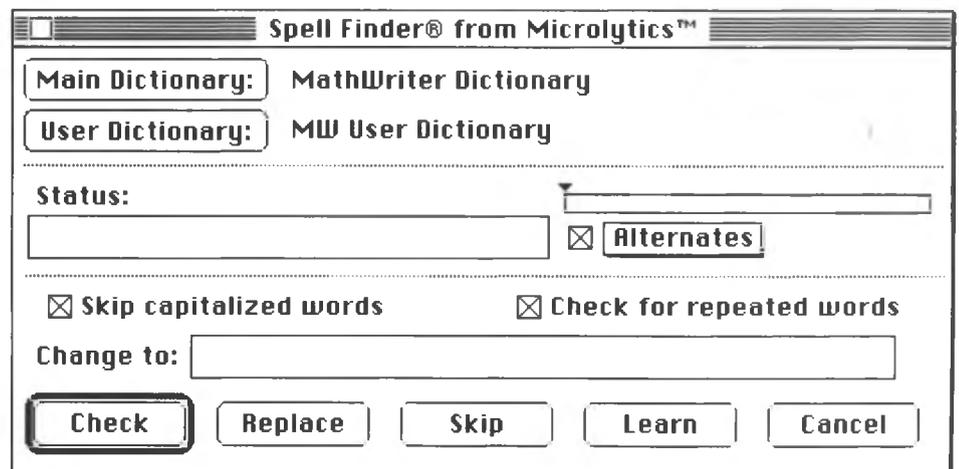


Figure 6.47 Check Spelling options

If you want *MathWriter* to offer possible spelling alternatives, before you begin checking spelling, check the Alternates box. Check Skip capitalized words if you do not want to check them, and click on Check for repeated words if you want the program to look for words that have accidentally been typed twice. Click Check to start the spell-checking *at the insertion point*. Misspelled words appear in the rectangular box under Status. A bar chart to the right indicates where in the document spell-checking began and how far the search has gone. A dialog box appears to let you choose Continue Checking or Stop Checking.

If the spell-checker finds a misspelled word and the Alternatives box is checked, *MathWriter* pauses to generate a list of suggested spellings. If you recognize the word being examined as correct, clicking the mouse aborts the alternatives-search process. If the alternatives listed in the pop-up menu include the correctly spelled word, click on the word to transfer it into the Change to field. Otherwise, you must type the correct word in the Change to box. Click Replace to replace the misspelled word in your document with the correctly spelled one.

Warning: The presence of a word in the dialog box does not necessarily imply a suggested spelling. Check the status line and the alternatives list.

The Skip choice tells *MathWriter* to ignore a possible misspelling. Click on Learn to add the word to your user dictionary. You can also return to the document window, edit the text, open the Check Spelling window once more, and click Check to resume checking. Anytime after you return control to the spell-checker, you can terminate checking by clicking Cancel.

When two identical, consecutive words are found, a message is placed after the inconspicuous word *Status:* and you either click Replace to delete it (and a space character) or click Check to retain the repeated words and resume checking.

When the checker encounters an unknown, but correctly spelled word that you are likely to encounter in the future, click Learn to add it to the User Dictionary. To remove a word from the User Dictionary, click Edit in the dialog box; *MathWriter* opens a window that lets you edit the User Dictionary. Select a word in the scrollable list. If you want to delete that word, click Delete Word.

Thesaurus...

The Thesaurus command is not available in this version.

Hyphenation...

The Hyphenation command is not available in this version.

Insert, Delete

Insert and Delete (Edit) extend the cut and paste commands to apply to rows and columns of matrices or tables. To enable these commands, first create a matrix or table and then select a cell using the split I-beam (Figure 6.48).

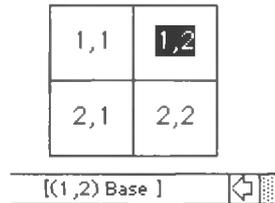


Figure 6.48 Select a cell of an array

With the Insert command (Figure 6.49) you can create a new row before or after the row of the selected cell or create a new column before or after the selected cell (Figure 6.48). Use the split I-beam to edit within the newly created cells.



Figure 6.49 Insert row or column in an array or table

When you click Delete (Figure 6.50), *MathWriter* deletes the row or column passing through the selected cell.



Figure 6.50 Delete row or column of an array or table

The Format Menu

The Format menu (Figure 6.51) contains such selections as paragraph formatting, matrix formatting, and footnotes. The basic unit of organization in *MathWriter* is the paragraph—created when you press the *return* key. The ruler always remains at the top of the window and never scrolls out of view. If desired, you can hide the ruler. The ruler units can be inches, centimeters, or picas and can begin at the left of each column or at the left boundary of the window.



Figure 6.51 Format menu

Hide Ruler/Show Ruler (⌘ `)

The first command, Hide Ruler, toggles with Show Ruler. When you select the Hide Ruler command, the tab and justification controls from the vertical scroll bar (Figure 6.52) disappear too. The ruler displays the formatting information for the paragraph that contains the blinking insertion point.

Ruler Options

Ruler Options lets you choose from a pop-up menu (Figure 6.53), a ruler measured in Inches, Centimeters, and Points (Figure 6.54) that correspond to the 1/72 inch pixels on the Macintosh screen. Page Ruler on that menu toggles with Column Ruler; they measure from the left border of the page or from the text boundary, respectively.

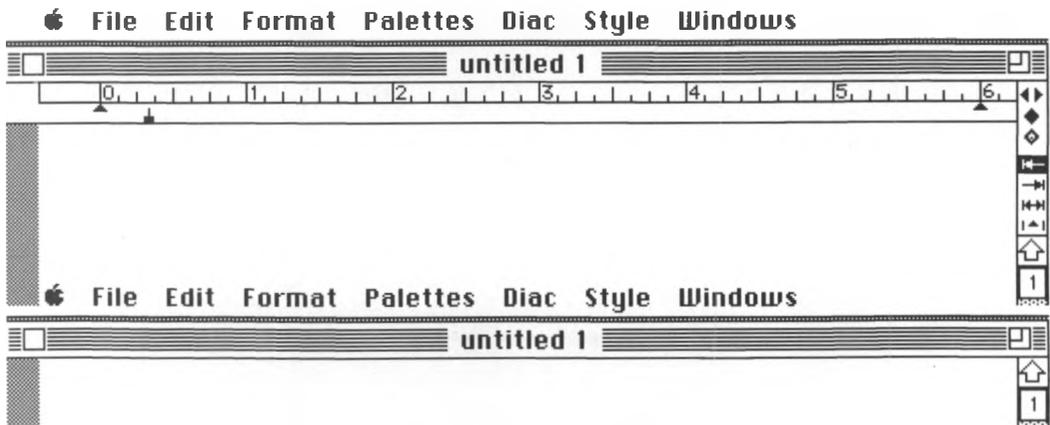


Figure 6.52 Show/Hide Ruler command



Figure 6.53 Ruler Options

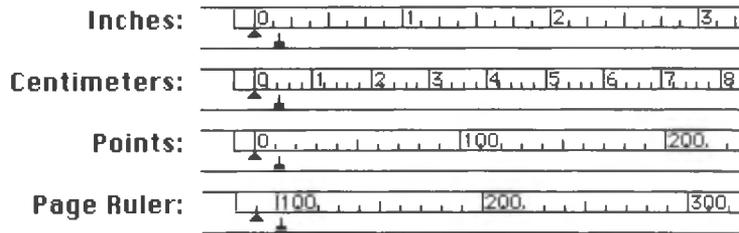


Figure 6.54 Ruler units

Paragraph Format... (⌘ J)

To change the format of a paragraph, place the cursor within that paragraph to select it. Now, click on Paragraph Format.... Within the Paragraph Format... window, you can set the vertical spacing before and after paragraphs from 0 to 40 pixels by scrolling within the arrows under "Spacing". This eliminates the need to type more than one *return* at the end of a paragraph, regardless of the spacing you desire. In this window you can also tell *MathWriter* to link paragraphs, begin a new page with a particular paragraph, or not split a paragraph over a page break. Use the Page break before option to force the text that immediately follows the insertion point to appear on the first line of the following page.

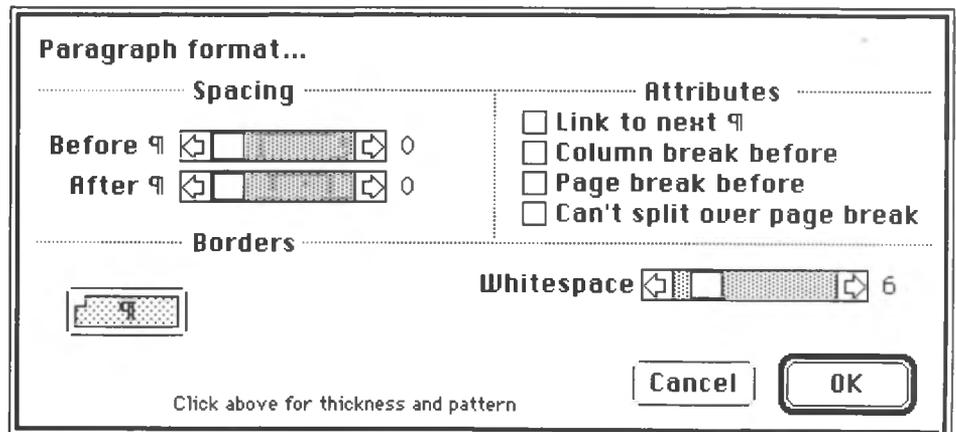


Figure 6.55 Paragraph format window

No icon is associated with Page break before. Use this dialog box (Figure 6.55) to verify its existence or to remove it.

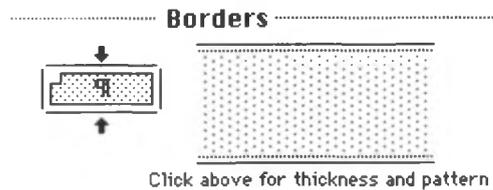


Figure 6.56 Paragraph borders

Click at the center of the shaded paragraph icon at the bottom-left corner of the window to place borders on all four sides of the paragraph (Figure 6.55 and Figure 6.56). Click on or near individual sides to select or "deselect" each of the four borders separately. A paragraph portrait just to the right displays the borders selected. Borders consist of one or two lines; you can assign the line thicknesses and patterns as well as the background pattern for the entire paragraph. Whitespace (Figure 6.55) refers to the space between the paragraph and the inner border measured in pixels. Click in the paragraph portrait to open a window that assigns Outer borders, Inner borders, Background pattern, and Space between borders (Figure 6.57).

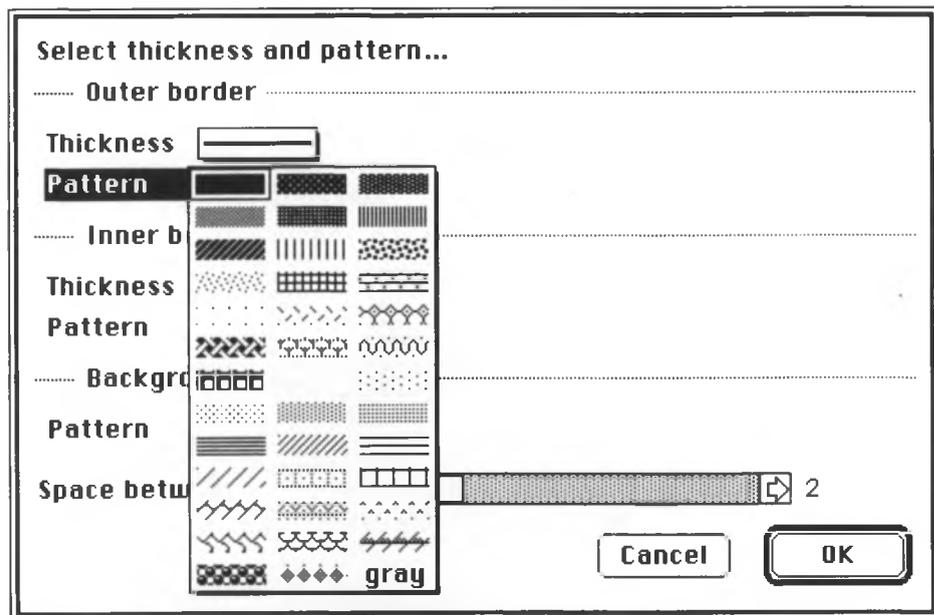


Figure 6.57 Pop-up menus for border lines and patterns

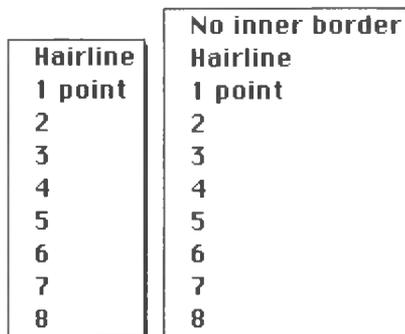


Figure 6.58 Border line thicknesses

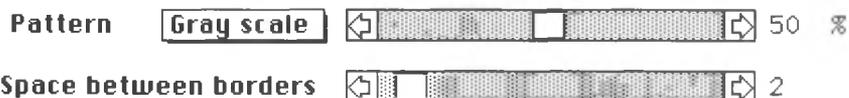
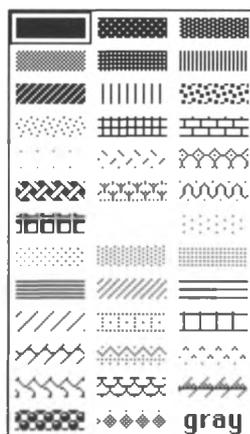


Figure 6.59 Pattern palette

Use the pop-up menus available when you click the rectangles beside Thickness and Pattern to set line thickness, line pattern, and background pattern for each (Figure 6.55 and Figure 6.56). Drag to select from among the choices. The line thickness choices range from hairline to 8 point in one point increments (Figure 6.58). *Math Writer* has a No inner border option for the inner border. When you choose "gray" from the bottom-right corner of the pattern pop-up menu shown in Figure 6.59, a scroll bar for setting the percentage appears on the right. "Space between borders" has a scroll bar that lets you set the space between inner and outer borders of a paragraph box.

Line Spacing... (⌘K)

With Automatic line spacing enabled, *MathWriter* automatically spaces lines to include the maximum size of such expressions as mathematical equations (Figure 6.60). Mostly fixed means that *MathWriter* allows simple subscripts and superscripts to protrude into the “leading” between the lines. Fixed lets you set the spacing using four buttons: Single, 1-1/2, Double, and Other. Samples appear at the right, as in Figure 6.60. The default ascent-and-descent-plus-leading values for the three fixed spacings are: (9,3) for Single, (14,4) for 1-1/2, and (18,6) for Double. The Other category lets you set the ascent and descent separately. Ascent is the height provided for the characters above the baseline on which the letters rest. Descent plus leading is the space allowed for the character below the baseline.

You can use automatic line spacing while composing a manuscript when you do not want to be concerned with making a choice. If your writing includes in-line expressions, you may wish to modify the line spacing subsequently to achieve greater uniformity. To modify the spacing, select the relevant text using the mouse or keyboard and apply the desired line spacing. Never compose variable-height mathematical expressions with fixed line spacing because portions of the line may be displayed improperly and inadequately refreshed.

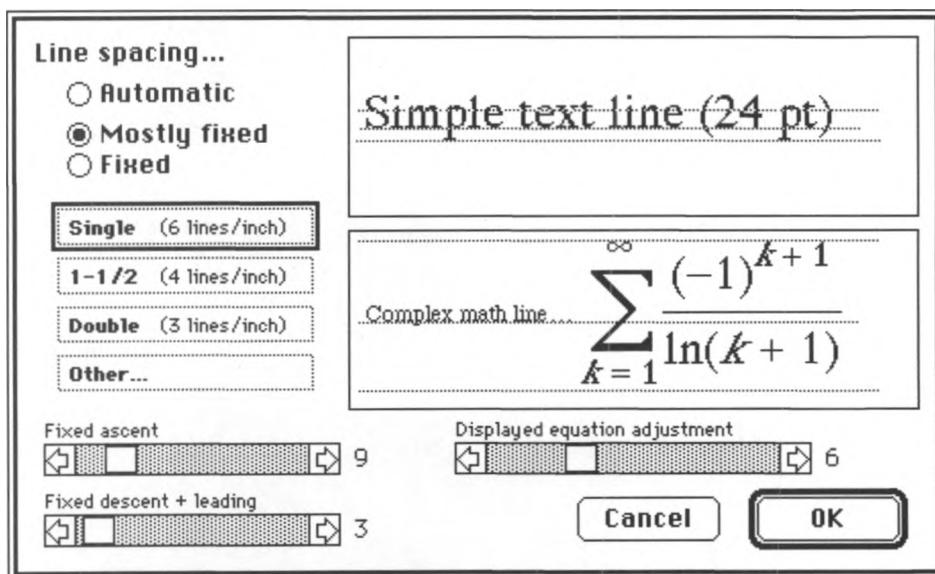


Figure 6.60 Line spacing dialog box

Matrix Format...

This window (Figure 6.61) controls matrix and table formatting. Under Placement, click on "descend below line" to place a matrix below a line of type. "Center on line" centers it within a line of text.

Click in the box below Line type. This opens a window that lets you choose the thickness and pattern of the outer border of a matrix (Figure 6.62). Select an outer border pattern by clicking in the box beside Pattern. Since matrices use single line borders, the inner border is not enabled. Select a background pattern by clicking the box beside Pattern. Click OK to accept changes or Cancel to reject them.

The alignment of elements within the matrix can be centered (most often used for symbolic expressions), positioned to the left or right, or decimal justified. Under Justification, click on center, left, right, or decimal to align elements within the matrix. *MathWriter* automatically handles the spacing of rows and columns. It reformats a matrix with each input keystroke. Changes made while a matrix is selected apply only to that matrix; changes made with none selected apply to all subsequent matrices.

Cell spacing affects the size of the cells of a matrix. Drag the vertical and horizontal arrow icons to change the size of the cells vertically or horizontally (Figure 6.61).

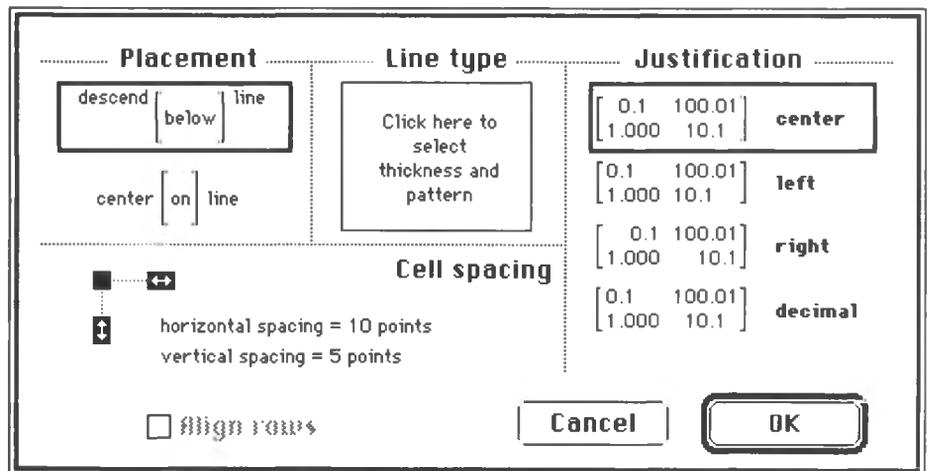


Figure 6.61 Matrix format window

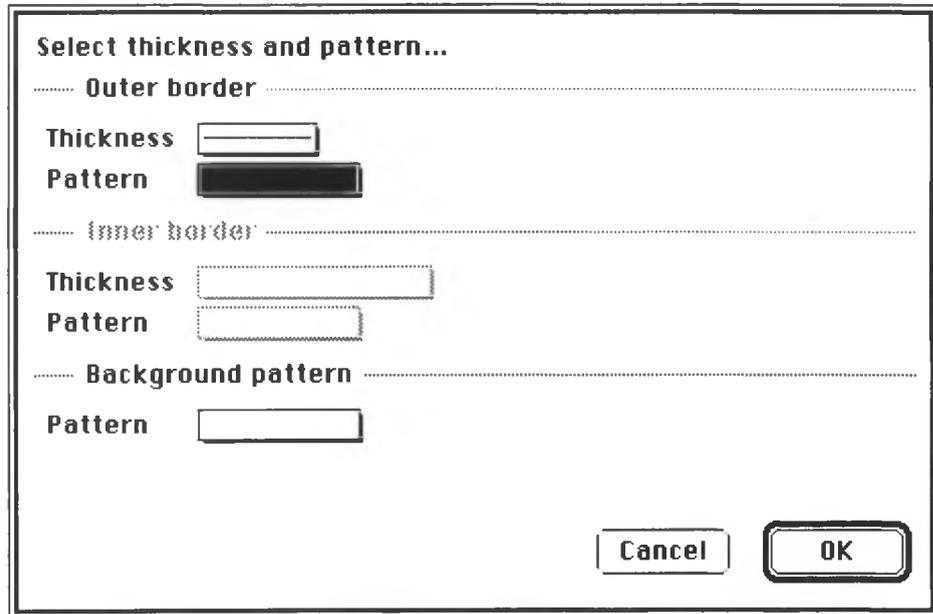


Figure 6.62 Line type window

Variables Format...

Variables Format... on the Format menu (Figure 6.51) lets you select formatting options for such variables as the date, time, page number, and footnote marker. These variables automatically appear in the text in the form that you choose here. Show Invisibles (Format menu) displays a dotted box around these dynamic variables.

Click on Variables Format.... Then click in the box Variable Style:. To the left of this window is a Variable Style box. Click in that box. A window opens that lets you choose Font, Size, Style, Justification, and Line spacing for each of the variables in the Variables Format window (see Figure 6.64). (For a discussion of these, go to Doc Preferences...(File menu).) Click Cancel. You are back in the Variables Format... window. If you do not select Variable Style, the typeface matches the adjacent text. Alternatively, whatever style type you assign here overrides the style of the surrounding text as far as the variable is concerned.

Creation date  and *current date*  : Select "creation date" from the group of variables at the left (see Figure 6.63). In the rectangular box to the right of the Variables Format window are various choices such as month/date/year (m/d/y) and date/month/year (d/m/y). Click in the button beside m/d/y. An illustration of your choice appears in the box labeled "example" in the lower-left corner of the window. Click "leading zeros," and a zero appears before single-digit numbers. Click "short year,"

and the year appears in two digits rather than four. Click "month, date, year," and the month appears as a word rather than a number. Click "day, month, date, year," and the day and month appear as words rather than numbers. Click "abbrev. month" and "abbrev. day," and the month and day are abbreviated. Click OK to accept your choices or click Cancel to reject them.

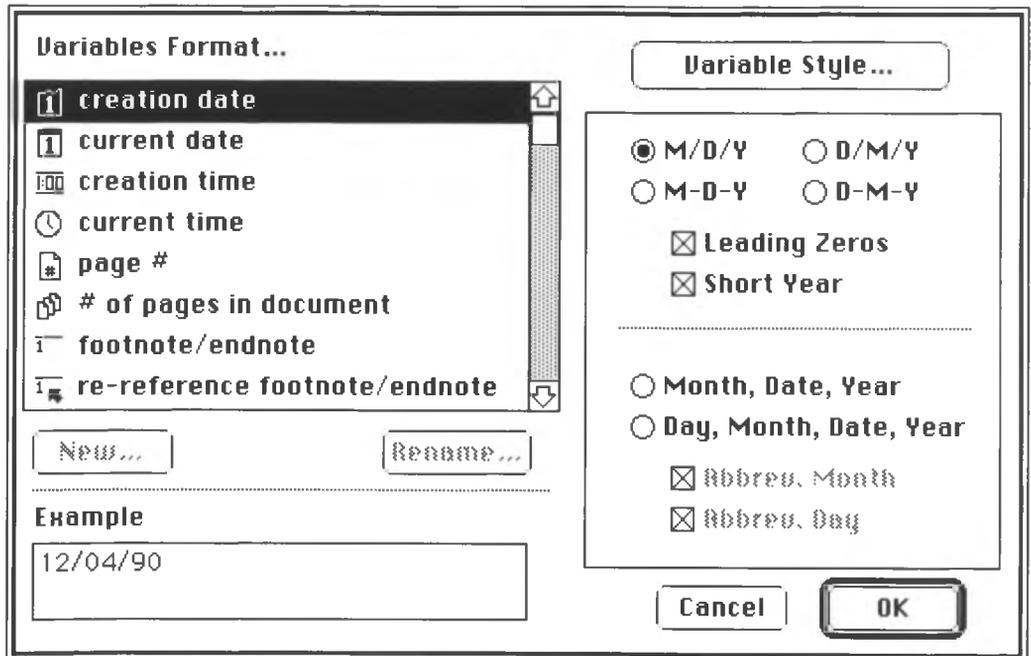


Figure 6.63 Creation date format

Click "current date." Note that the choices here are the same as those for "creation date."

Creation time  and *current time*  : Click "creation time." (See Figure 6.65.) To the right of the Variables Format window are various choices such as hr:min:sec and hr:min. Click hr:min:sec. An illustration of your choice appears in the box labeled "example" in the lower-left corner of the window. Click hr:min, and only the hours and minutes appear. Click 12 hr., and AM and PM appear beside the time. Click 24 hr, and hours are numbered from 1 to 24.

Click "current time." Note that the choices here are the same as those for "creation time."

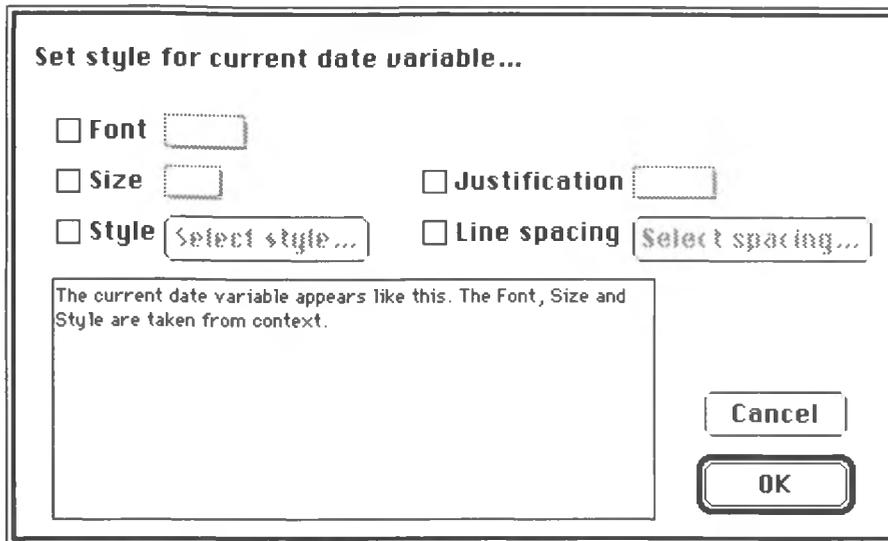


Figure 6.64 Style assignment for variables

Page number  and **number of pages** : Click “page #.” (See Figure 6.66.) Depending on which type of numbering you want, choose Roman numerals (i,ii,iii,...), uppercase Roman numerals (I,II,III,...), or traditional Arabic numerals (1,2,3,...) from the left side of the window. In the box labeled “leading text” you can type “Page” and in the box “trailing text,” you can type “of ” and produce an entry such as “Page 3 of 25” if you also use the number of pages variable. If this file is a continuation of a previous file and you want the page numbers of this file to pick up where the other left off, type the correct beginning page number for this file in the “starting at” box, but omit the total pages variable.

Footnote/endnote  and **re-reference footnote/endnote** : *MathWriter* formats footnotes and endnotes alike. It offers five automatic numbering styles: example¹, example^[2], example⁽³⁾, example[4], and example(5), as well as a collection of symbols (see Figure 6.67). Click in the buttons at the right to choose which type you prefer. If you need at most six footnotes, you can define and use symbols of up to three characters. If this file is a continuation of a previous file, you can assign a starting footnote number where the numbering for the previous file ended.

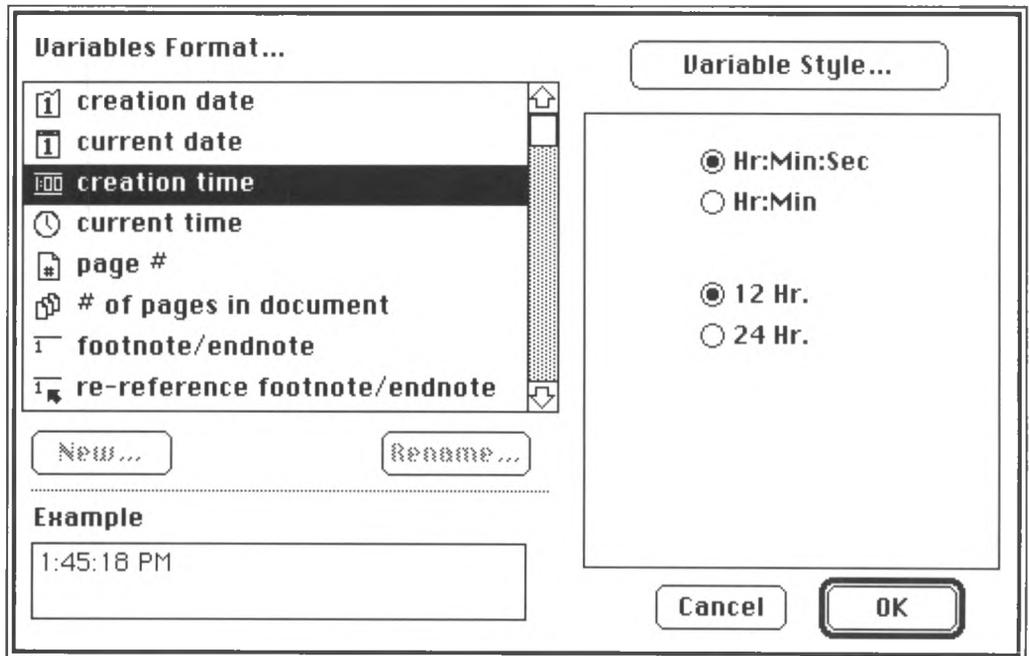


Figure 6.65 Creation time format

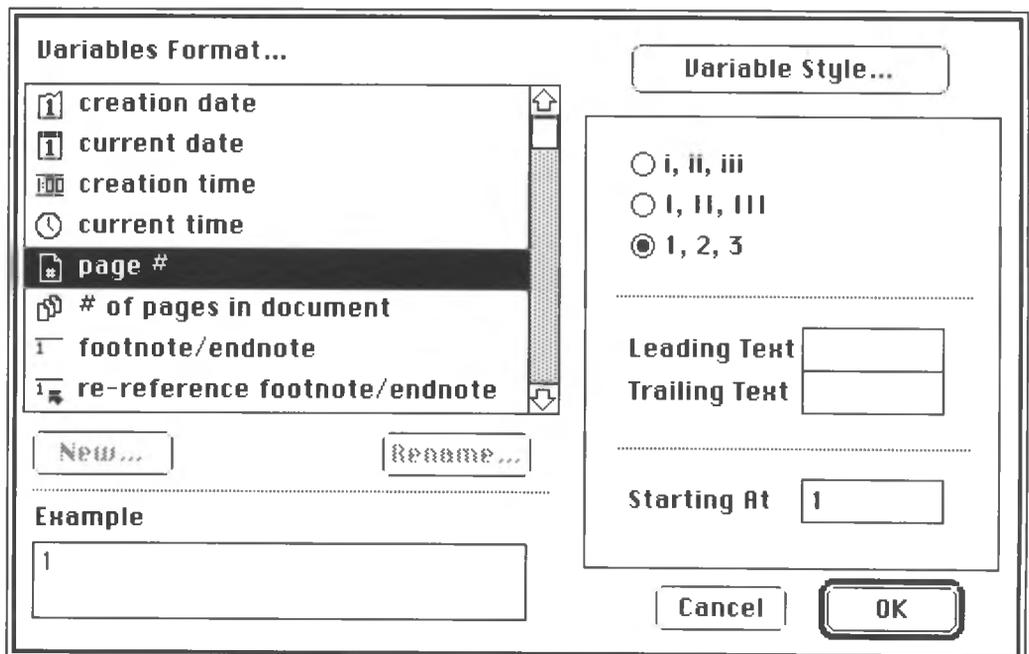


Figure 6.66 Page number format

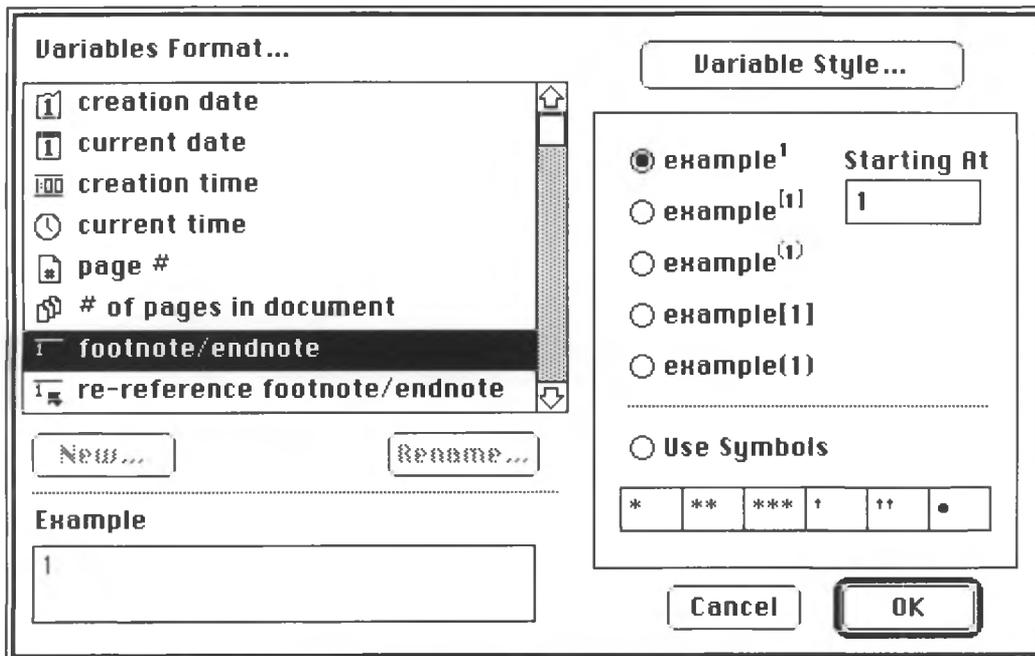


Figure 6.67 Footnote format

Equation number Σ^* and *equation reference* Σ^* : You can format equation numbers and references to equations within the text (Figure 6.68) in several standard styles: with or without a descriptive text label; with Arabic or Roman numerals; with parentheses, brackets, braces; or with a user-defined symbol. You can, of course, assign the starting number. Here are some illustrative examples: 10, 5.10, 5-10, J, j, X, x, [eq. 10], {5.10}. Click in the buttons at the right to choose which type you prefer. The example box illustrates your choices.

Subequation # Σ^* : A subequation variable automatically numbers groups of equations that are subsidiary to other equations. *MathWriter* offers five numbering styles (Figure 6.69): lowercase and uppercase Roman alphabet, Arabic numerals, and lower and uppercase Roman numerals. You can separate these from the equation number by a dash, period, or no space. Here are some illustrative examples: [1a], 1b, 1c, [1A], 1.1, 1.2, 1.3, 1-I, 1-i, 5.10.1, and 5.10.2. Subequations inherit the label and enclosing symbols assigned to the equation numbers. Click in the buttons at the right to choose which type you prefer.

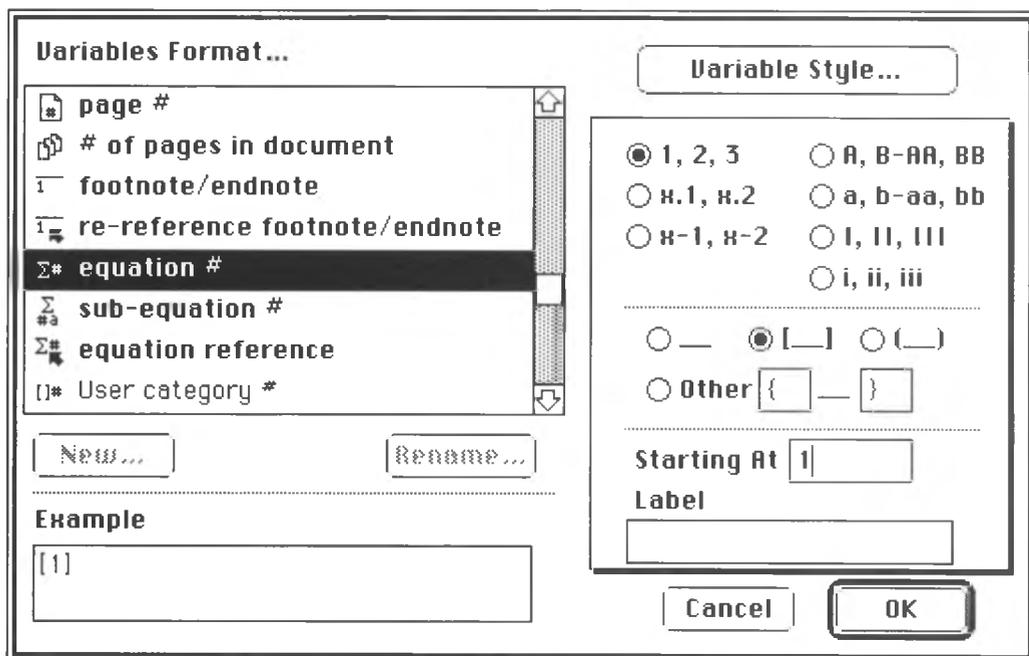


Figure 6.68 Equation number format

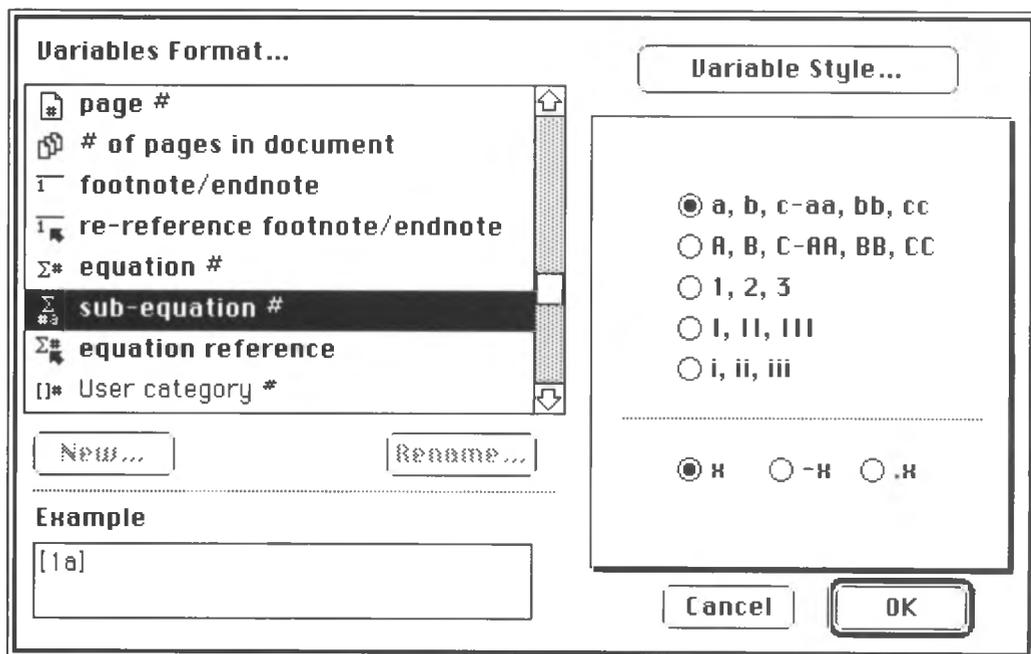


Figure 6.69 Subequation number format

User category $[]\#$, sub-User category $[]\#a$, User category reference $[]\#\#$: User-defined variables (Figure 6.70 and Figure 6.71) are a generalization of the equation numbering variable described above. The formatting options are the same. However, you can create a user-defined variable as needed for paragraphs, figures, tables, theorems, lemmas, etc.

In the dialog box shown in Figure 6.70, scroll to User category #, click Rename, and *MathWriter* asks you to rename the category (Figure 6.72). *MathWriter* renames three new entries analogous to equation numbering. Supply formatting information. You can edit the default label Category 1, which initially is the same as the category name you assigned.

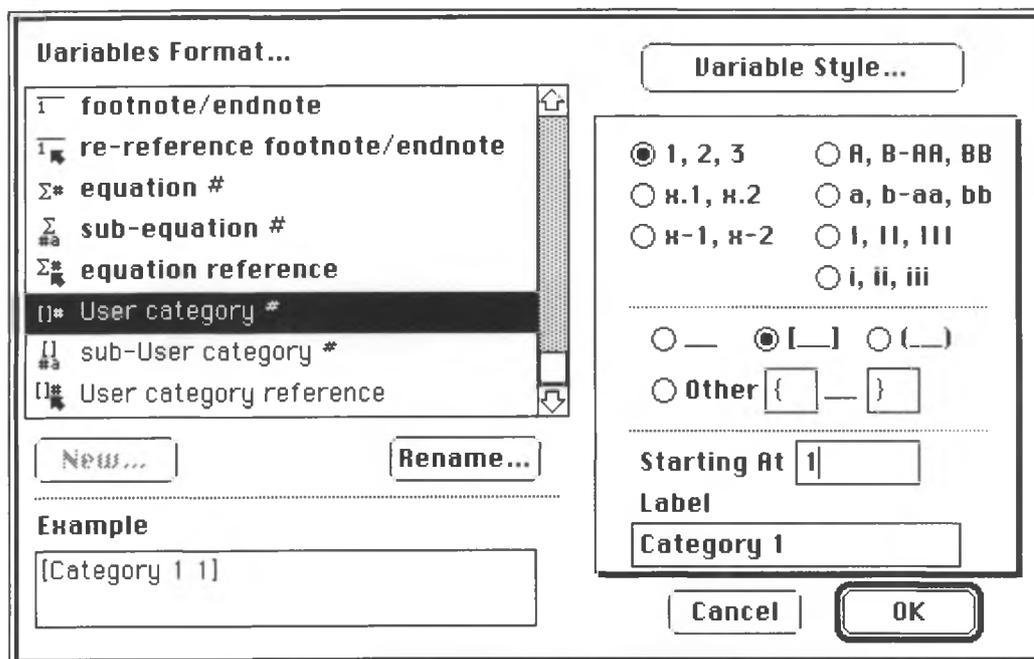


Figure 6.70 User-defined category format

MathWriter numbers the entries consecutively when you select the variable. Even if you intersperse additional entries among existing variables, *MathWriter* automatically updates the higher numbered variables. If you insert a reference to one of these variables into the text using the re-reference command from Palettes, *MathWriter* automatically updates those textual references also.

Computer-supplied variables in the document remain linked to the definition and conditions established in Variables Format. If you make changes in the Variables Format dialog box, the implementation throughout the document is immediate. Similarly, format changes must be made here, rather than in the document.

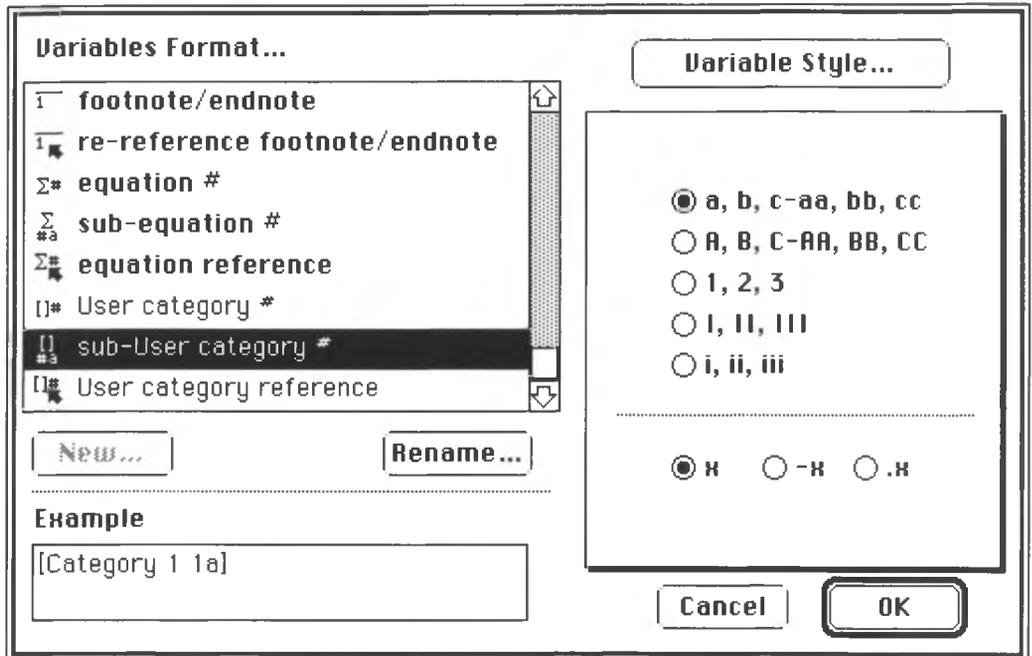


Figure 6.71 User-defined sub-category format



Figure 6.72 Name user-defined variable

Insert Memo

The Insert Memo command is not available in this version.

Insert Column Break, Insert Page Break

The Insert Column Break is not available in this version. Click on Insert Page Break to move the text that is beyond the blinking insertion point to the top of the next page. When you use Show Invisibles (Format menu), this commands appears as . These markers do not terminate the paragraph; *return* provides that control so press *return* if the alignment, line spacing, tabs, etc., are to be different for the two parts.

Calc Prev \int or $|$ Size (\mathscr{D})

Use this command to automatically size the \int or $|$ symbols. For example, after you enter the integrand, press \mathscr{D} to resize the integral sign. To manually adjust the size, use the Character Editor.

Show Layout/Hide Layout

Show Layout toggles with Hide Layout to reveal the boundaries of the headers, footers, margins, etc. Without these boundaries you obtain an uncluttered view, but with them you can tell where various regions are on the page (Figure 6.73 and Figure 6.74).

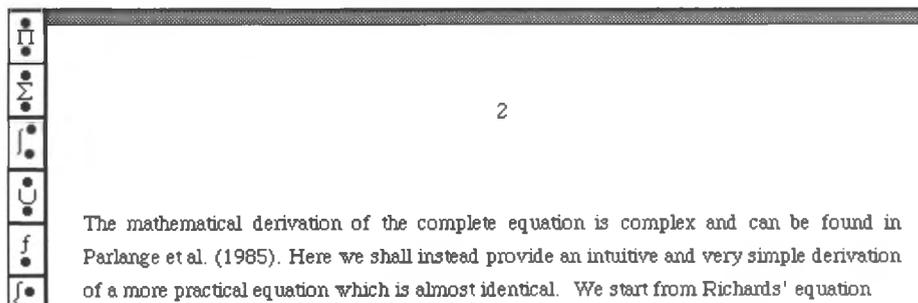


Figure 6.73 Page without margin indicators

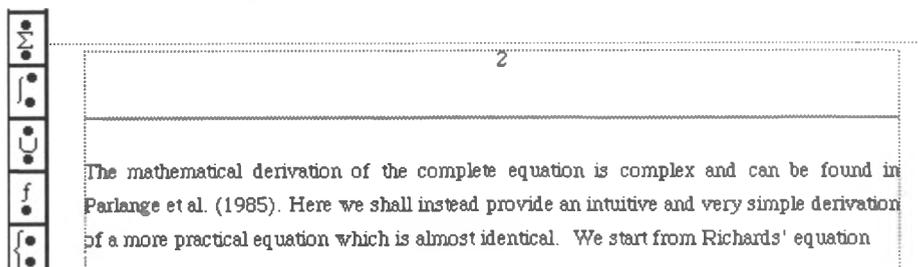


Figure 6.74 Page with margin indicators

Hide Messages/Show Messages

Hide Messages toggles with Show Messages, and they display the markers for paragraph rulers. Use Print on the File menu to print these markers.

Show Invisibles/Hide Invisibles

Show Invisibles toggles with Hide Invisibles and provides visual access to the hidden formatting characters (Figure 6.75), such as tabs, line breaks, page breaks, end of paragraphs, and spaces. To remove these markers, click just before the *next* character (NOT just after the marker) and press *delete*.



Figure 6.75 Hidden character symbols

Hide Pictures/Show Pictures

Hide Pictures toggles with Show Pictures and suppresses the display of pasted graphics in order to produce faster scrolling. A rectangular placeholder preserves the page layout (Figure 6.76).

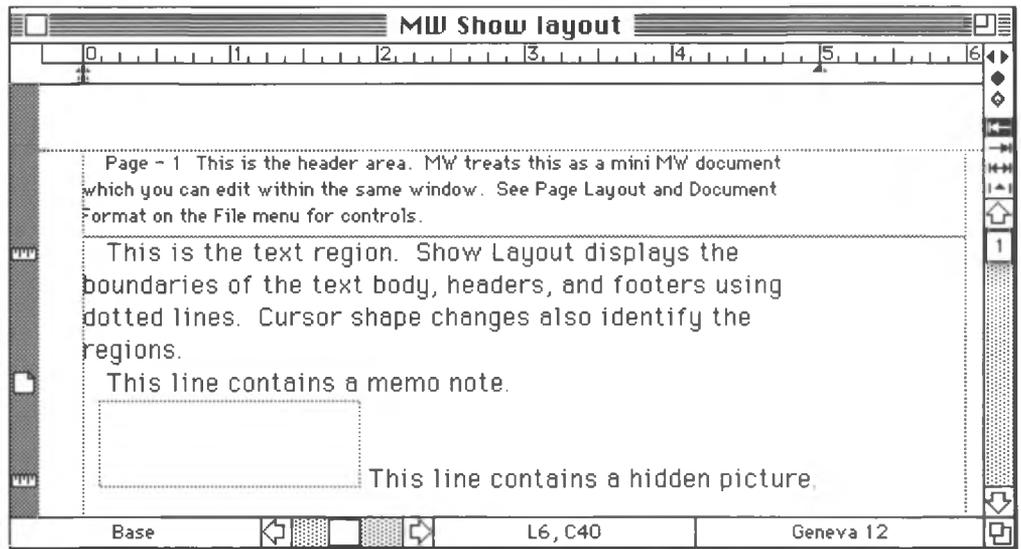


Figure 6.76 Hide pictures for faster scrolling

The Palettes Menu

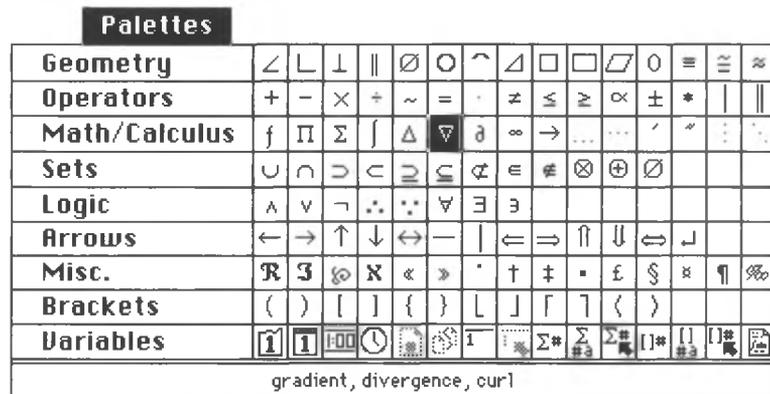


Figure 6.77 Palettes menu

The Palettes menu (Figure 6.77) displays all of the symbols from the Symbol font except the Greek alphabet, which is available when you click

on the Palettes window (Windows menu). In addition, the Greek alphabet is immediately accessible from the keyboard. Press \% *spacebar* to toggle between the current font and the Greek alphabet. Pull down the Palettes menu and move the cursor among the items in the window. Note that the name of the character on which you place the cursor appears in the row at the bottom of the window. Click on a character to insert it into your document.

You can copy each row of this Palettes menu to the Palettes window. First select the Palettes window (Windows menu). This places the Greek alphabet at the bottom of the screen. Then pull down the Palettes menu and select Geometry. The Geometry row of characters appears at the bottom of the screen with the Greek alphabet. To remove Geometry from the screen, select it again from the Palettes menu. *MathWriter* marks each row that you copy to the Palettes window with a check.

The Diac Menu

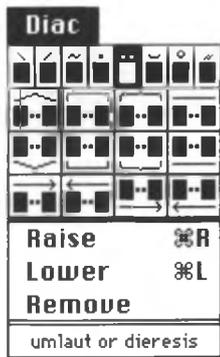


Figure 6.78
Diacritics menu

When you place the cursor immediately to the right of an alphabetical character, the diacritics on the top row of the Diac menu (Figure 6.78) become available. Note that the name of the diacritic on which you place the cursor appears in the row at the bottom of the window. Click to associate a diacritical mark with a character. Use the Raise and Lower commands to adjust the height of these diacritical marks. Use Remove to remove a diacritic. If you repeatedly require a spacing different from the default, use the Library macro capability (Windows menu) to save and type the adjusted combination quickly.

When you highlight a group of characters, the remaining commands on rows two, three, and four become available. *MathWriter* automatically stretches these overbars, underbars, grouping brackets, etc., as needed. Use the split I-beam to edit within the structure. The Raise, Lower, and Remove commands apply to the structures while selected.

The Style Menu

The Style menu contains menus for assigning fonts (typefaces), sizes, and styles.

Text Fonts

Pull down the Style menu (Figure 6.79) until you reach Text Fonts. A menu pops out containing a list of fonts (Figure 6.80). The list depends upon those fonts currently available to the system. (Use the Font/DA Mover to change

the list. Refer to the Macintosh User's Manual for a discussion.) The laser fonts available to the LaserWriter Plus are underlined. If you press the *option* key while selecting text fonts, each font name appears in its respective style (Figure 6.81).



Figure 6.79 Style menu

Because mathematical writing necessarily involves many nonalphabetic, special characters, making global font changes could significantly change the document content because special symbols are not assigned to the same ASCII code throughout all fonts. To guard against this pitfall, *MathWriter* identifies the fonts by name, not just ID numbers. When you open a file, *MathWriter* warns you if the entire set of fonts used in the document is unavailable to the operating system. *MathWriter* extends this machine independence to include the PICT pasted into a *MathWriter* document. Because the font identification number is not a unique identifier, conventional word processors allow the font name to be lost and hence a loss of assurance that the document is unchanged. Because mathematical symbols have no universal ASCII position, a font change can have serious, not just cosmetic, consequences. If a *MathWriter* document has the correct appearance, including imported PICTs on your computer, it will have the same appearance on any other Macintosh that has the correct set of fonts installed—even if they have different font identification numbers. Use the File Warnings option on the Preferences command of the File menu to warn you if the document being loaded requires additional fonts to match those of the originating computer.

MathWriter's font identification procedures allow you to share a document by electronic mail, provided the recipient is using the identical set of fonts.



Figure 6.80 Font submenu Figure 6.81 Fonts listed using own font

Text Sizes

When you drag to Text Sizes (Figure 6.79), a menu (Figure 6.82) pops out that contains various standard font sizes. The outlined sizes identify the

fonts with actual bitmaps available to the system. The system must create the other sizes, which will appear ragged on the screen and on Image-Writer output, but not on LaserWriter output. System 7.0 addresses this problem.

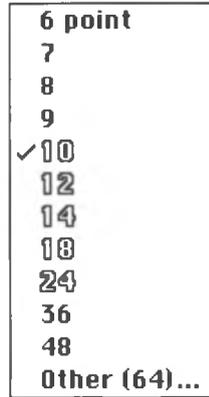


Figure 6.82 Text sizes submenu

With the Other (64)... command (Figure 6.83) you can select sizes not included in the submenu list. Enter the desired integer font size and click OK. This new size is displayed in the Other () command.

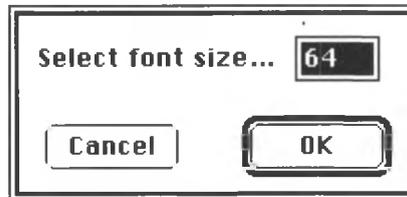


Figure 6.83 Select other font sizes

Text Style

The standard Text Styles (Plain, Bold, Italic, Underline, Outline, Shadow, Condense, and Extend) are available from the submenu (Figure 6.84). When you select Plain, all other styles are overridden. Uppercase and Condense appear dimmed until you check them. Then each has a pull-down menu. The pull-down menu for Uppercase provides all uppercase letters, all lowercase, or Cap. First, which capitalizes the first letter of each word. Condense and Extend alter the spacing of any group of selected characters by removing or adding a pixel between characters. You can apply a limited form of kerning to letter combinations throughout the document using the style-sensitive feature of Find/Replace (Edit menu). See Chapter 3 for instructions on how to do this.



Figure 6.84 Text Style menu

Click Other Styles... (Figure 6.84). This opens an Other styles window (Figure 6.85) that supplements the standard choices. The first column repeats the standard styles of Plain, Bold, Italic, etc. If you select Underline or Low underline, Underline pattern and Underline weight options become available. Click in the rectangular box beside Underline pattern (or on the name) for a choice of patterns and Underline weight for a choice of weights. When you check Gray, a scroll bar for setting the gray scale appears. Seven of the options (UPPERCASE, Condense, Underline pattern, Underline weight, Background pattern, Background color, and Character color) provide alternative choices using pop-up menus. To use the pop-up menus, press on a choice and drag to make a new selection. See Figure 6.86 for examples.

Use Words only to make other choices apply to the words, but not the spaces between the words. Use Strikeout to indicate deleted text. Use Overbar for vectors and complex conjugates in mathematical manuscripts. Use Box to denote added text, and use Underline and Low underline, individually or together, to identify new text or to place special emphasis on certain sections.

Without retyping, you can change text to lowercase, uppercase, or make the first letter of a word uppercase. First highlight the text you want to change. Then open the Other Styles window of Text Style (Style menu) and click on the style change you want. *MathWriter* preserves the original style information and allows you to restore it without retyping.

Background pattern, Background color, and Character color provide pop-up menus that offer a variety of choices. You need a color monitor to benefit from the Background color and Character color choices.

The shading styles may also be useful to mark added text or make blocks of text more prominent. If you have a color monitor, you can enable color from the Control Panel (Apple menu) and assign a background and character color for display on a color monitor.

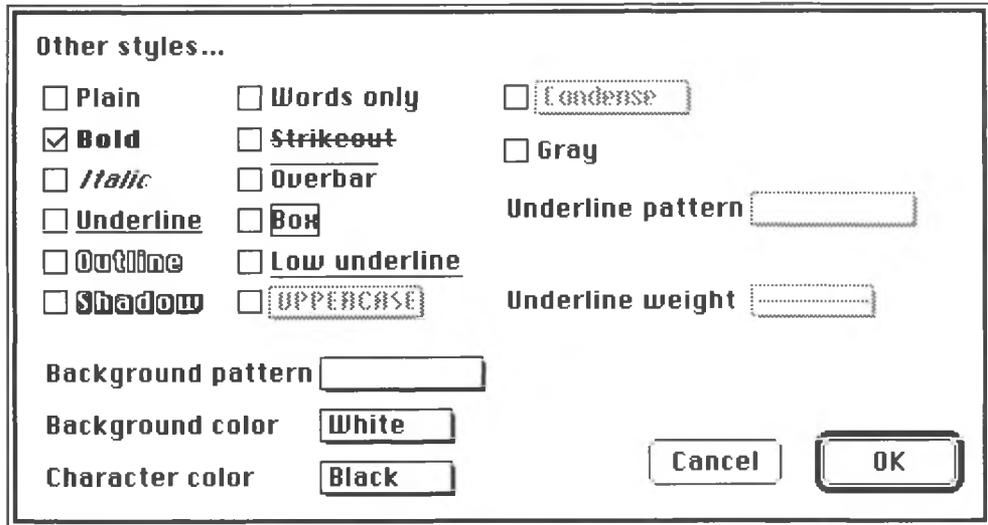


Figure 6.85 Other styles

When processing the additional information needed for a color monitor, *MathWriter* will perform more slowly. For additional details refer to the discussion of the Other styles in connection with Doc Preferences (File menu). When you finish changing styles in the Other styles window, click OK to accept your choices, or click Cancel to reject them.

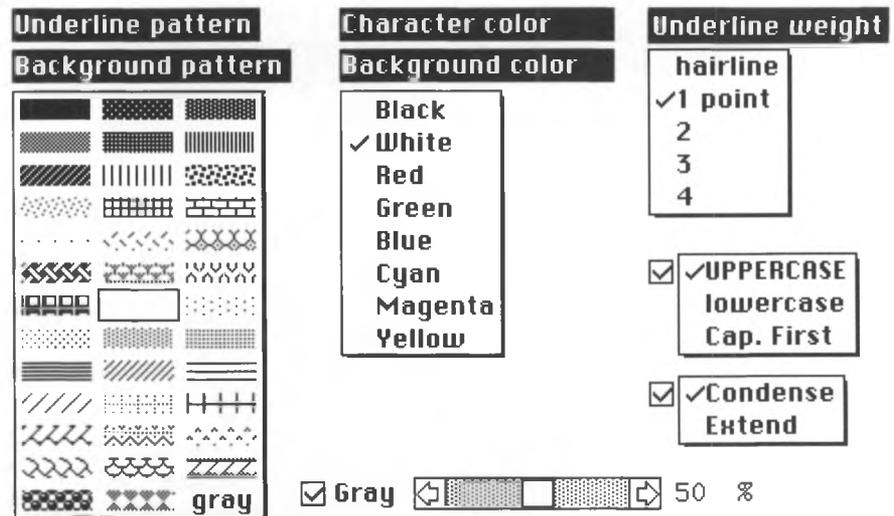


Figure 6.86 Other styles pop-up choices

Greek (\mathbb{S} spacebar)

Because the Greek alphabet is so widely used in mathematics, science, and engineering, a dedicated menu command and key command for rapid access are provided. The Greek command is disabled by a selection from the text font submenu. For rapid changes, both the mouse and keyboard commands toggle between Greek (on the Symbol font) and the last font in use. The Last Style command on this menu plays the same role for all other fonts.

Larger Size (\mathbb{S} +), Smaller Size (\mathbb{S} -)

Because you change font size so frequently when typing mathematics, *MathWriter* supplies special menu and keyboard commands for changing font size. You can easily step through the font sizes on the font size menu using these keyboard commands. When used with the *option* key (\mathbb{S} *option* + and \mathbb{S} *option* -), these commands make smaller changes—one point steps, rather than going through the sizes on the menu.

Style 1 (\mathbb{S} <), Style 2 (\mathbb{S} >)

Style 1 and Style 2 let you compose two of your own style combinations. First, open Doc Preferences... (File menu). Click on Style 1. This opens the Set style number 1... window where you can choose the styles you want to use. Click OK to accept the styles and close the window. Click OK to close the Doc Preferences... window. Now select or highlight a portion of text. Pull down the Style menu to Style 1 and release the mouse. The selected text should appear in the style you chose for Style 1. These style combinations are merely a typing aid. *MathWriter* does not preserve any linkage with the text you type using these styles. However, you can use Find/Replace (Edit menu) to make local or global style substitutions without altering the text.

Last Style (\mathbb{S} \)

The Last Style command provides a quick return to the immediate past style. This feature is especially useful when you must toggle between two styles, such as the frequent use of boldface notation for vectors and scalars.

Auto Math (\mathbb{S} E), Auto Math Options...

The next group of commands provides for automatic handling of two routine tasks associated with typing mathematics. Click Auto Math Options... and select the options you want from the open window. Then, clicking Auto Math (not just their selection in the options box) enables those choices. While composing a manuscript, use \mathbb{S} E to toggle on and off the combination of features selected using Auto Math Options (Figure 6.87).

Auto Math options include: auto-bracket sizing, and automatic replacement of arithmetic operators with the corresponding, better-formed characters

from the Symbol font. For example, the plus sign in the Times font is larger than the Symbol plus sign.

When Auto Math is enabled, *MathWriter* automatically sizes brackets as you form an expression (Figure 6.88). If Auto Math is inactive while you create an expression, you can select an existing expression and then choose Auto Math, ⌘ E, to size the expression automatically.

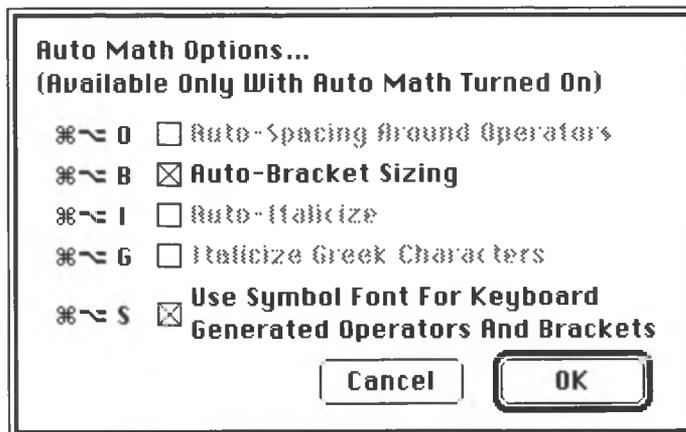


Figure 6.87 Auto Math options

$$\left(\frac{1+x}{1-x^2}\right)\left(\frac{1+x}{1-x^2}\right)$$

Figure 6.88 Parentheses typed without and with Auto-sizing

If you click Use Symbol Font for keyboard-generated operators and brackets, *MathWriter* substitutes the Symbol font for other, less attractive font characters. You can select these options using the mouse or type the appropriate ⌘ option letter (⌘ option with the first letters B, S), but they are not enabled until you use Auto Math (⌘ E).

The typeface indicator in the status bar at the bottom-right corner of the document window appears in inverse when Auto Math is active. If you turn this feature off, *MathWriter* runs faster.

Italics Exception List...

The Italics Exception List command is not available in this version.

Metrics...

The Metrics command is not available in this version.

User Styles...

The User Styles command is not available in this version.

The Windows Menu

The Windows menu (Figure 6.89) provides access to various windows—Tools, Templates, Palettes, Font Table, Modules, Clipboard, Help, and any open document window. You can arrange the windows of the open documents for convenient access. The use of the Tools, Templates, and Palettes windows is discussed in detail at the beginning of this chapter. The Font Table provides increased typing speed for infrequently used characters in all fonts.



Figure 6.89 Windows menu

Clean Up Windows

Clean Up Windows “stacks” the document windows with a slight offset that makes the multiple file names partially visible and allows you to make any file active by clicking within its window. *MathWriter* brings the active file to the front. Up to four files can be open at once.

MathWriter provides four floating windows: Templates, Palettes, Tools, and Font Table. You can place these on the screen by selecting them in the “Windows” menu. If you do not like their position on the screen, place the mouse in the gray area of a window and drag the window where you want it. *MathWriter* remembers the locations of the floating windows when you retrieve the file later. To completely remove these windows, either click their close-boxes or reselect the window from the Windows menu. Scrolling will be faster if the floating windows do not obscure the document window, which would require the screen to be redrawn more often.

Tools Window

The Tools Window selection (⌘ Δ, i.e., *command tab*) displays or hides the floating Tools window (Figure 6.90). If you reposition the Tools window, *MathWriter* retains the new location of the window even if you temporarily remove the window.

Type ⌘ *tab* (⌘ Δ) to bring the Tools window (Figure 6.90) to the foreground. We use Δ to denote the *tab* key.



Figure 6.90 Tools Window

Tools

The Tools submenu (Figure 6.91) provides menu access to the four editors:

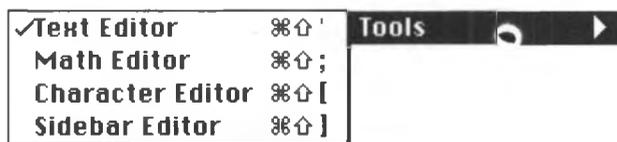


Figure 6.91 Editor selection menu

- Text Editor, identified by the traditional I-beam cursor
- Math Editor, identified by a split I-beam cursor and used for editing within mathematical expressions
- Character Editor, identified by an arrow cursor and used for moving characters
- Sidebar Editor, identified by the “+” cursor, is not available in this version.

You can reach these tools from the Tools window or from the keyboard using the commands shown in Figure 6.91.

Templates Window

Click the Templates window selection on the Windows menu. A column of mathematical templates appears on the left of the screen (Figure 6.92). These include fractions, radicals, products, summations, integrals, set operators, special structures such as limits, grouping brackets, vectors and matrices, and tables. Click on the first template, the fraction template. A pop-out menu provides three types of fraction templates. Move the arrow cursor to the one you want and release the mouse. This places that choice in your document at the location of the blinking cursor. To type a fraction, type the numerator, press *enter*, type the denominator, and press *return*. The other templates operate in a similar fashion. (For a more detailed discussion, see Chapter 4.)



Figure 6.92 Templates Window

Palettes Window

Click the Palettes Window on the Windows menu. A row containing the Greek alphabet appears (Figure 6.93) at the bottom of the screen. Click one of the letters of the alphabet. The letter appears in your text at the location of the blinking insertion point. You can add palettes from the Palettes menu at the top of the screen. Pull down the

Palettes menu to Geometry and release. This places the row of Geometry symbols at the bottom of the screen for easier access. To remove Geometry, pull down the Palettes menu and click on Geometry again.

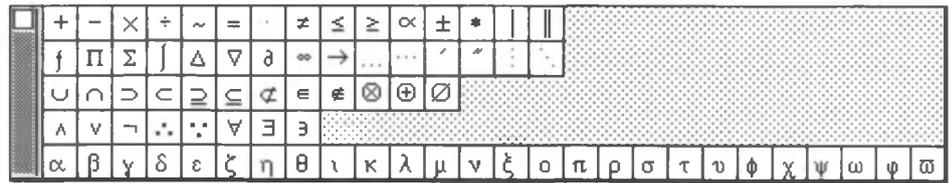


Figure 6.93 Palettes window

Font Table Window

The Font Table (Figure 6.94) is an especially useful window to have open if you must type rarely used symbols or symbols that do not correspond to easily remembered keys. You can type characters directly from the Font Table, unlike the Key Caps desk accessory. This is especially useful for symbols that may have little mnemonic correspondence with the keyboard. Special mathematical symbol fonts such as Machais are prime candidates for use here. To gain access to other fonts, click on the name of the font in the window. A pop-up menu gives you a list of possible fonts. Select a different font by dragging to the name of the font you want and releasing the mouse. Resize the font window, if screen space is at a premium, by clicking in the boxes at the lower-left corner and dragging.

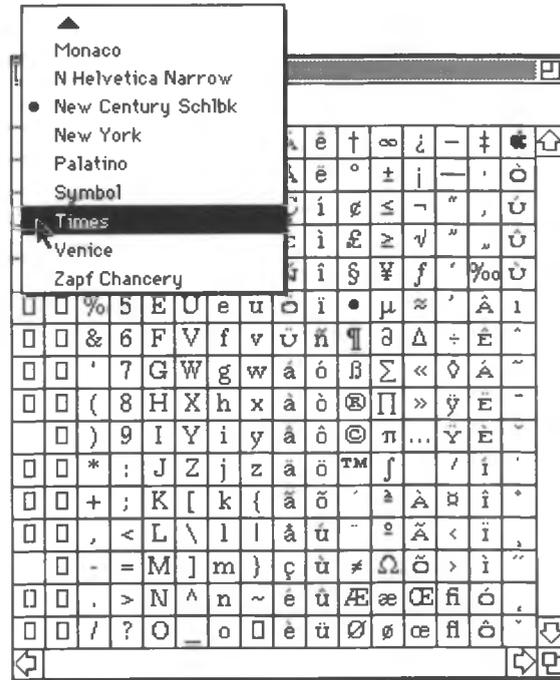


Figure 6.94 Font Table

Library Window/Library

The Library and Library Window commands are not available in this version.

Modules

The Modules submenu provides access to the modular extensions to *MathWriter*. You can extend the scope of *MathWriter* by adding modules, or you can remove unneeded features for disk space. The first module is a disk-based database that can interact with the data structure of *MathWriter* and use *MathWriter* for formatting and output.

To add a module, simply place it in the system folder or in the same folder with *MathWriter*. *MathWriter* locates and incorporates such modules when you next open the application. To remove a module, exit from *MathWriter* and remove the module from its folder.

The Modules feature allows you to customize *MathWriter* with ease. Read the "Read Me" file on the distribution disk and the section on modules at the end of Chapter 4 for additional information.

Clipboard

The Clipboard command on the Windows menu provides diagnostic access to the contents of the Clipboard, which is used to transfer text and graphics between applications or from one location to another within a document. The mathematical expression in Figure 6.95 is shown as a PICT file because it was placed there using Copy As Picture (Copy Other submenu) on the Edit menu. To copy text to the Clipboard, select or highlight the text and then select Copy (Edit menu). To copy a picture, select Copy as Picture (Copy Other, Edit menu).

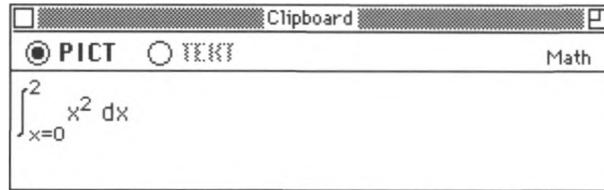


Figure 6.95 Clipboard window

Help (⌘ ?)

The Help window supplies online hints on the use of *MathWriter* features. Scroll through the list or select a topic to go directly to a specific topic.

Document names

The final entries on the Windows menu are the names of open documents. Either click on an exposed portion of a document window or select it here by name to make it the front window on the screen.



1 Interface Fundamentals

The Macintosh interface embodies three qualities—responsiveness, permissiveness, and consistency. Responsiveness means that commands are intuitive and results are direct. Permissiveness means that you can perform reasonable tasks at any time. Consistency means that all applications have similar interface standards. This shared interface makes your transition to *MathWriter* much easier. In fact, experienced word processor users probably can use many of the *MathWriter* enhancements without reading the manual. Although we have extended the scope of *MathWriter* well beyond traditional word processors, we believe *MathWriter's* interface makes the use of this greatly expanded functionality intuitive.

MathWriter's hallmark is its visual orientation. Whenever possible, *MathWriter* provides a visual means for selecting commands such as scrolling lists and palettes. Generally, when you make a choice by clicking, your choice is highlighted by a reversal of its black and white pixels. Because the primary purpose of a word processor is the preparation of printed output, an immediate and faithful visual representation of the document on the screen expedites the process. This characteristic is called "What you see is what you get," or WYSIWYG (pronounced "wizy-wig"). *MathWriter* updates its screen display after each keystroke. Even the editing of the various components on the displayed page (header, footer, footnotes, and equations) is handled in context.

Keyboard and Mouse

The standard keyboards contain two types of keys—character and modifier keys. The character keys produce letters, numbers, symbols, and spaces. Other character keys (*enter*, *tab*, *return*, *delete*, and *clear*) provide formatting and other control and may be context-dependent.

MathWriter uses the *return* and *enter* keys for different tasks when you edit mathematical expressions. The *enter* key moves the cursor to the next lower hierarchical level in an expression, but the *return* key immediately moves the cursor to the baseline of ordinary text. For example, if you position the insertion point at a superscript to a superscript, pressing *enter* moves the insertion point down to the first superscript, but pressing *return* immediate-

ly moves it to the baseline. In this example, pressing *enter* twice is equivalent to pressing *return* once.

Tab advances the insertion point to the next field or tab marker. *Enter* signals that text or data in an input field is complete. *Return* signals movement to the leftmost field one step down; during text entry it signals a new paragraph. Both *return* and *enter* close dialog boxes. When creating a table in *MathWriter*, use *tab* to create a new column and *return* to create a new row.

Pressed modifier keys [*shift*, *caps lock*, *option*, *control*, and *command* (⌘)] change the interpretation of keystrokes and mouse actions. *Shift* and *option* change the character set associated with the character keys. Press the *shift* key to select the upper character on keys with two symbols. *Caps lock* latches the *shift* key only for alphabetic keys. You can use *caps lock* and *option* in combination on alphabetic keys. Use *shift return* to force a new line while still in the current paragraph, such as for a mathematical expression that needs to be continued on another line. Use *option spacebar* to toggle between the current and Greek alphabets. Character keys that you select while you press the *command* key usually produce commands. You can execute many menu commands using combinations of *command*, *option*, and *shift* keys. See appendix 3 for a list of these combinations and scrolling commands.

If the Macintosh is busy executing previous commands, *MathWriter* saves the keyboard and mouse commands in a queue for subsequent processing. If you hold a character key down longer than the time you specified in the Control Panel, the computer types the key repeatedly. The arrow keys control the movement of the cursor.

There are both mouse and keyboard controls for the blinking insertion point. Most mouse actions involve positioning of the cursor "hot spot", e.g., the tip of the arrow, over an object and pressing the mouse button. The cursor shape changes to indicate the nature of its current use. With an I-beam you edit within the body of the text, the header, or the footer. Use the arrow for selecting. Use the split I-beam to position the insertion point in mathematical structures.

Mouse actions include clicking, pressing, and dragging. To click, position the pointer with the mouse and then press and release the mouse button. To press, position the pointer with the mouse, then hold the mouse button down without moving the mouse. To drag, position the pointer with the mouse, hold the mouse button down while you reposition the pointer, and then release the mouse button. To accommodate even the fastest typist, mouse actions ("mouse-ahead") and keyboard commands ("type-ahead") made during the normal execution of other commands are saved in a buffer for subsequent execution.

MathWriter provides several composite operations. Click to position the insertion point where you want to add new text in a *MathWriter* document. Double-click to select a whole word and triple-click to select an entire line of text. Use the Control Panel to adjust the double-click speed and the sensitivity of the cursor to mouse movement. To make an extended, contiguous selection of text, click at one end of the selection and either drag to the other end or *shift click* to establish the other end. The status bar reports the line and character of the beginning and ending of the selection.

To scroll the active document window in *MathWriter* by mouse: (1) click in the scroll arrows to scroll a few lines, (2) *option click* in the scroll arrows to scroll a single line, (3) press in the scroll arrows to repeatedly scroll in multiple line increments, (4) *option press* to repeatedly scroll in single line increments, (5) drag the scroll box to move larger distances (the position of the scroll box indicates the relative position of the current screen within the entire document, and the page number¹ is displayed here), and (6) click in the scroll bar above or below the scroll box to scroll the height of the current window. See appendix 3 for a table of commands.

To use *MathWriter* for screen presentations, *option click* in the scroll bar to advance to the top of the header of the next or previous page or *command option click* to advance to the top of the text body of the next or previous page. With a screen image projector, *MathWriter* doubles as an overhead projector.

MathWriter lets you open multiple windows at the same time. Up to ten documents can be open, but only one can be active at any time. *MathWriter* identifies the active document with lines in the title bar and a scroll box in the vertical scroll bar, and it is the front-most document window. Click anywhere within an uncovered portion of a window or select it from the Windows menu to make it the active window.

MathWriter also provides floating windows, selectable from the Windows menu that can be active while a document window is active. These windows contain tools and information you use to modify the document in the active window. You control the placement of all windows by dragging the title bar. You cannot drag it completely off the screen. Click in the close-box at the top-left corner to close or remove a window. You can enlarge or reduce the size of a window by dragging its size box at the bottom-right corner of the window. The zoom box at the top-right corner toggles the window between its current size and placement to full-screen utilization. The horizontal scroll bar allows you to select the horizontal portion of the document you want to see if the document is wider than the window.

¹ The page number of the page number variable in the header or footer is displayed in the status bar when you press on the vertical scroll box.

MathWriter handles some scrolling automatically. If you drag the cursor above or below the active window when selecting text, the document window scrolls. If a selection is not currently showing in the window when you perform an operation, the window scrolls automatically. Some operations, such as Find/Replace or Check Spelling, automatically scroll the selection into view. Show Selection on the Edit menu scrolls the document such that the insertion point becomes visible.

Menus and Commands

Commands either perform operations on the entire document or the current selection or specify the attributes of an object. Attributes apply to the current selection and to subsequent input until you change the attributes. When you place the insertion point adjacent to existing text, the typeface of the new text will match the typeface of the character immediately before the insertion point. Many commands apply only to the current selection; such commands remain unavailable and, therefore, dimmed unless you make a selection. You must identify the object first and then give the command. Menu commands not available in this version remain dimmed at all times. Gray lines group related commands on a menu.

The *MathWriter* menu bar lists commands grouped by function. Drag to select an item from a pull-down menu list, which remains hidden until needed. Menu items marked with the three dot ellipsis (...) produce a dialog box in which you make choices or type information. Some menu items provide additional alternatives in submenus. Drag to select the menu item; when the submenu appears, continue dragging to select the command. *MathWriter's* extended command set benefits from this organizational hierarchy. Check marks indicate the current choice among mutually exclusive choices such as the active document window and the current font name. In a selected portion of text *MathWriter* identifies a common font with a check mark; but if you include multiple fonts within a selection, *MathWriter* identifies the fonts in the selection with a bullet adjacent to each font included. If multiple attributes such as bold, italic, etc., are in effect at one time, a bullet identifies the selected attributes. In all cases, Plain cancels all other style attributes.

Some menu lists change to reflect the current status. For example, some commands toggle between two choices such as Show Layout and Hide Layout. *MathWriter* dims currently unavailable menu commands. It displays the names of open document files on the Windows menu.

Finally, those menu commands that you can execute from the keyboard use the key combinations of *command*, *shift*, and *option* shown on the menu. See appendix 3 for a list of these commands. The command to abort the current operation, *command period*, has no menu equivalent.

MathWriter has eight menus. The Apple menu provides information about *MathWriter* and access to the desk accessories. The File menu provides access to the file handling capabilities, various global defaults, printing, and session termination. The Edit menu provides tools for modifying the text. The Edit menu adapts according to the current choice of editor—character, text, and math. The Format menu handles the various formatting functions. Palettes and Diac provide rapid access to special symbols. Style provides controls for typeface changes. Windows provides control of the document and floating window choices.

Dialog and Alert Boxes

When a command is incomplete or ambiguous you must supply additional information before *MathWriter* can complete the command. You can make multiple choices within a single dialog box and even revise your choices before you accept the entire combination. This approach is easier for the user than responding to a series of prompts presented individually. Click on the Cancel button or the close-box to abandon a dialog box without making any changes. Click on the OK button when you are ready to implement the choices you have made. The default or preferred choice is boldly outlined. Pressing *return* is equivalent to clicking on the default button.

MathWriter uses more than two dozen dialog boxes that include scroll windows, circular radio buttons for mutually exclusive choices, square check boxes for nonexclusive choices, text boxes for text input, buttons to issue commands and select alternatives, pop-up menus for mutually exclusive choices, and scroll bars. Alerts warn you when unusual situations occur. For example, if you attempt to close a file that you have modified since you last saved it, *MathWriter* alerts you to the potential loss of information and allows you to take corrective action.

APPENDIX

2 MathWriter Files

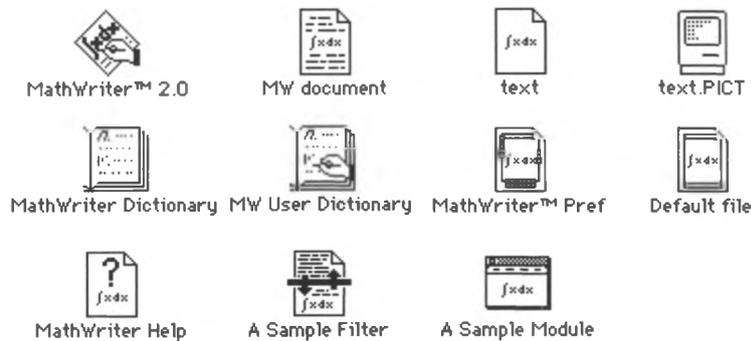


Fig A.1 MathWriter file icons



The *MathWriter 2.0* file icon is a variation of the older *MathWriter 1.4* icon. Some lines of text have been added to illustrate that you can combine mathematical expressions with text.

A *MathWriter* document is a file created using Save on the File menu. Save your manuscript in this format if you expect to edit or print it with *MathWriter* later. In addition to text, graphics, mathematics, and formatting information, *MathWriter* saves all the configuration information; when you subsequently open the document, the previously defined writing environment is restored.

MathWriter can also create standard ASCII text files for export to other applications. A text file preserves the text characters. *MathWriter* optionally creates consecutively numbered place holders to identify the placement of mathematical expressions and graphics stripped from the file and automatically stores them in a user-named scrapbook file. Unless you use a utility such as SmartScrap, you must place the Scrapbook in the System folder and rename it "Scrapbook File" to access its contents.



text.PICT



MathWriter Dictionary



MathWriter™ Pref



Default File



MathWriter Help



A Sample Filter

When you create a text file, *MathWriter's* AutoScrap feature optionally stores the mathematical expressions and graphics in a scrapbook file for subsequent transfer into other applications. *MathWriter* optionally adds placeholders to the text file.

High-end word processors provide various editing aids, e.g., a spell-checker. The spell-checker also identifies repeated words, a frequent typing error.

A United Kingdom version of the dictionary is available. To use it, replace the United States version in the System folder with the UK version, and rename it to match the US versions, i.e., remove the three characters "UK " from their names. Alternatively, use the button on the Spell-check dialog box to select this file.

MathWriter automatically saves the default configuration applicable to all documents in a preferences file (*MathWriter Prefs*) in the System folder. The *MathWriter* application should remain locked to reduce the risk of a computer virus infection. The defaults retrieved when you open a document supersede these global preferences.

Stationery files or default files are templates for frequently used document types that you create using Preferences on the File menu. A list of user-created default files is available (when you subsequently restart *MathWriter*) as a submenu of the New command on the File menu. When you select New, a copy of a stationery file, including the *MathWriter* configuration, layout, typeface, content, etc., becomes the basis for a new document. The stationery file remains unchanged. *MathWriter* automatically loads a user-designated default file on startup; use Preferences on the File menu to designate the startup file.

Online help is retrieved from this file using the Windows menu. Help provides general information, a summary of keyboard commands, descriptions of menu commands, and steps to complete common tasks.

An anticipated family of file filters or translators allows you interchange files with other applications. To the extent feasible, *MathWriter* saves the formatting as well as text with these filters. Simply place these filters in the same folder with *MathWriter* or in the System folder, and *MathWriter* automatically recognizes them during startup, adding them to the pop-up list of file types in the file dialog boxes. This modular design allows you to customize *MathWriter* easily. A *MathWriter* filter for Microsoft's Rich Text Format (RTF) for file transfer is supplied with *MathWriter*. Most word processors can create RTF files.



A Sample Module

MathWriter modules extend the functionality of *MathWriter*, the first word processor to provide modular extensions. Simply place a *MathWriter* module in the folder with *MathWriter* or in the System folder, and *MathWriter* will automatically link it to the main program and provide access to the enhanced features via the Modules submenu of the Windows menu. This feature lets you customize *MathWriter* to your specific needs and make enhancements without awaiting a new release of *MathWriter*.

APPENDIX

3

Keyboard Commands

Arrow Key Usage

(←, →, ↑, or ↓ with key combination)

Command	Option	Shift	Result
			Moves insertion point a line or a character*
Cmd			Scrolls window large amount
	Option		Begin/end line; top/bottom page, then doc.
		Shift	Extends Selection small amount
Cmd	Option		Scrolls window small amount**
Cmd		Shift	Move between cells in a matrix/table
	Option	Shift	Extends Selection large amount
Cmd	Option	Shift	<NotUsed>

*Arrow keys (← → ↑ ↓) alone.

** *Cmd Option* ↓ scrolls document window down approximately 1 line

Vertical Scroll Bar Usage

Key	Mouse	Result
	Drag Scroll Box	Scroll arbitrary amounts
	Click Arrow	Scroll large amount (approx 8 lines)
Option	Click Arrow	Scroll small amount (approx 1 line)
	Click Scroll Bar	Scroll 1 screen
Cmd	Click Scroll Bar	Top of Next/Prev Page*
Option	Click Scroll Bar	Top Next/Prev Header*
Cmd Option	Click Scroll Bar	Advance to top of Next/Prev Page Body*

*To scroll through lecture note screens

Keyboard Commands

Key	Command (⌘)	Command Shift	Command Option
A	Select All	Copy Ruler & Format	
B	Bold		Auto Bracket
C	Copy	Copy As Picture	
D	Calc Prev or Size	Paste Style	
E	Auto Math		Number equation
F	Find/Replace	Copy Format	Insert footnote
G	Find Next	Paste Format	Italicize Greek
H	Replace Selection		
I	Italic		
J	Paragraph Format	Delete Row	
K	Line Spacing	Delete Column	
L	Lower Diacritical		
M	Revise	Copy Memo	
N	New Entry From Selection	Paste Memo	
O	Open	Column Before	Auto Operator Spacing
P	Plain	Column After	
Q	Quit	Row Before	
R	Raise Diacritical	Copy Ruler	Revision Tracking
S	Save	Copy Style	Auto Use Symbol Font
T	Print	Paste Ruler	
U	Underline		
V	Paste	Paste In Context	
W	Close	Row After	
X	Cut		
Y	Other Styles		
Z	Undo	Paste Ruler & Format	
1-9,0	•Template Categories		
` (~)	Hide/Show Ruler		
= (+)	Larger Size (on menu)		1 Pt. Larger Size
- ()	Smaller Size (on menu)		1 Pt. Smaller Size
, (<)	Style 1		
. (>)	Style 2		
/ (?)	Help		
\ ()	Last Style		
; (:)	•Center Subscript	Math Editor	
' (")	•Right Subscript	Normal Editor	
[()	•Center Superscript	Character Editor	
] ()	•Right Superscript	Sidebar Editor	
Tab	Tools Window		
Return	•Same as Enter key		
Spacebar	•Toggle Greek		

Special Key Combinations:²

<i>Command</i> +  or  Can't select sublines.
<i>Option</i> +  + stretchable char ³ Enables stretching (noted by the word stretch in the bottom of the Tools window). Clicking and dragging in bottom or top of symbol stretches symbol. Clicking in center of symbol causes a reset to standard size.
<i>Option</i> + scroll up/down 10 pixel scroll, as opposed to 80 pixel scroll.
<i>Command</i> + [] ; '	Corresponds to superscripting/subscripting tools as follows:
	⌘ [=  ⌘] = 
	⌘ ; =  ⌘ ' = 
<i>Option</i>	Toggles between  and  .
<i>Option</i> + drag tab Smooth drag.
<i>Command</i> + drag left margin Doesn't move indent marker.
<i>Option</i> + symbol in Palettes Vertical bar; always extends to the limits of the line.
<i>Command</i> K or <i>Command</i> F Immediately after clicking OK in Print dialog box press and hold down until a banner appears to produce and save PostScript file for the active document.

² Command ≡ ⌘

³ Stretchable characters include any of the brackets and the integral symbol.

A P P E N D I X

4 Speed Enhancement

Graphical Representation

MathWriter is remarkably easy to learn and use because it is very visual. Within the limits of the technology, the screen image is a faithful representation of the document to be printed. *MathWriter* uses all of the currently available information to format the screen, even when you are creating complicated mathematical expressions. To the maximum extent possible *MathWriter* assumes responsibility for the complex formatting details, freeing you to concentrate on the substance of your document. With this approach *MathWriter* caters to the needs of the scientist-authors, while also making the task of the technical typists and desktop publishing professionals easier.

This high level of interactive visual support requires considerable computational power—even more than most explicitly numerical Macintosh programs such as our MacPoisson™ and MacElastic™ for solving partial differential equations using the finite element method. We recommend using *MathWriter* with the more powerful Macintosh models that utilize the 68020 and 68030 CPU.

Because of the computational requirements, we also designed *MathWriter* to retain the open documents in RAM for quicker access. However, portions of *MathWriter* itself are RAM-resident as needed. When your document approaches the RAM limitations, the additional disk activity required to retrieve code will slow *MathWriter*.

MathWriter's data structure is necessarily more complex than those for conventional word processors. In particular, the editable mathematical expressions, which inherently contain multiple fonts, font sizes, and font styles as well as characters displaced from the baseline, require a richer data structure.

Approximately one third of *MathWriter's* 100,000 lines of code were written in the C language for increased performance.

Speed Improvement

Here are some possibilities.

Hardware

- Use the most powerful Macintosh available to you
- Install more RAM

Operation

- Use existing RAM effectively.
 - a) Set Application Memory Size to utilize the available memory using Get Info on the File menu at the MultiFinder level. The memory allocated is used by *MathWriter* and your open documents. Allocate at least 2 megabytes, although minimal configuration is 800 kilobytes. This setting is irrelevant if you are using the Finder, rather than MultiFinder.
 - b) With severe RAM limitations, operate under Finder, rather than using MultiFinder.
- Disable features not currently needed.

Many of *MathWriter's* features can be individually enabled and disabled.

 - a) Use the Black & White setting for the Monitor using the Control Panel. Color is marginally useful and significantly impacts speed.
 - b) Toggle the Auto Math features off (⌘E) when not entering a mathematical expression.
 - c) Reduce screen refreshing by hiding the graphics, hiding the layout lines, hiding invisible formatting characters, and hiding the message icons in the left margin using the Format menu.
- Use multiple, smaller documents, especially if the memory utilization indicator on the status bar exceeds 90%. Also have only necessary documents open simultaneously when RAM is limited.
- Configure the document window and floating windows to minimize overlap, thereby reducing complicated screen refreshing.
- Use the typing aids (Style 1, Style 2, Font Table, Auto Math, keyboard command equivalents for mouse actions, etc.) effectively.
- Use configuration and stationery files to reduce startup time.
- When possible, enter text at the end of paragraphs to reduce screen refreshing time.
- Because Encapsulated PostScript files contain dual representations and therefore are larger, import them as late as possible.

APPENDIX

5

Command Key Switcher

Swap Command Keys

MathWriter uses ⌘P to select plain text and ⌘T to print (type) output as specified in the Macintosh interface standards. Many have become accustomed to swapped roles for these commands so we have included a simple utility that will make this change.

A special-purpose utility

1. Verify that *MathWriter* is available and that neither the disk on which it resides nor *MathWriter* is locked.
2. Double click the Command key switcher icon.
3. Click a radio button to select the preferred assign option (Figure A.2).



Cmd Key Switcher

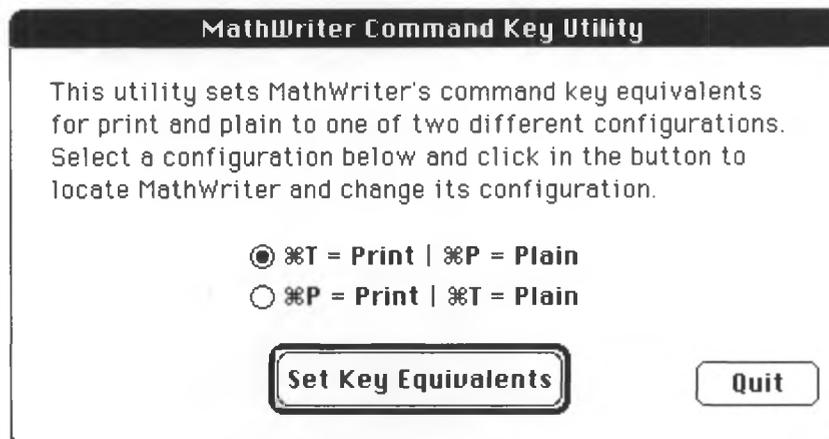


Fig A.2 Command key utility dialog box

4. Click the Set Key Equivalents button, locate the *MathWriter* application using the usual file opening dialog box, and click to save the change.

APPENDIX

6

MathWriter Versions⁴

Educational Version

MathWriter/Educational Version is a subset of the Professional Version of *MathWriter* and is intended for use by authors who do not require the advanced features and who do not have access to the more powerful Macintoshes.

You should use the Professional Version if you have a Mac II or an SE/30 with 2 megabytes or more of RAM and a hard disk. If you have a Macintosh Plus, SE, Portable, or Classic (68000-based CPUs) with only 1 megabyte of memory and two disk drives, use the Educational Version.

Both versions fully support the creation and editing of mathematical expressions within the document, as well as traditional word-processing functions. *MathWriter* is a completely new and powerful technical word processor designed specifically to address the demanding requirements of creating scientific manuscripts. The Educational Version retains the core features of the Professional Version, including its mathematical expression editor, and maintains file compatibility with the larger version.

Features removed

Color, Thesaurus, Hyphenation, Math-Science-Engineering dictionary, Revision tracking, Library, Memo notes, Sidebars, Background pictures, User styles, Adjustment for some defaults, Overview, Multiple columns, Auto-italics in mathematical expressions, Tab on user-selected character, Tab leaders, and Line numbering.

Features restricted

Character Editor retains cropping and sizing of graphics, up to one user-defined variable allowed, Find/Replace limited to traditional character searches, no more than one modular extension can be used at a time, and no more than four documents can be open at one time.

⁴ The specifications for the various versions are subject to change without notice.

Features retained

Retained are within-the-same-document window editing of mathematical expressions, headers, footers, footnotes, etc.; dynamic variables for automatic numbering of pages and equations and their cross-references in the text; one user-defined variable set; Font Table for mouse access to all characters in all fonts; direct importation of graphics (bitmapped, object, encapsulated Postscript); resizing and cropping of graphics; easy typeface changing; automatic transfer of mathematical expressions and graphics to a scrapbook file; automatic numbering of footnotes; automatic pagination; automatic line spacing; easy access to multiple stationery files; and easy customization.

Demo Version

The *MathWriter*/Demo Version is a virtually complete working version, but code has been removed to make it unusable for productive purposes, except to permit evaluation. *All productive uses, except evaluation to make a licensing decision, are legally prohibited by the license agreement governing the use of this version.*

- Document saving capabilities have been removed.

MathWriter can open files created by a working version. All the document-creating tools are enabled in the Demo, so documents can be created, but cannot be saved for later use.

- All cut and paste features have been removed.

Output cannot be transferred into other applications via the Clipboard.

- The Spell-checker, Thesaurus, and Hyphenation code segments have been removed.
- Printed output is limited.

Randomly selected lines are truncated on each page.

Module Version

This minimal version provides formatting and printing for *MathWriter* modules. This version is available only as a host for a module. Modules, however, are compatible with the larger versions of *MathWriter*.

Professional	Education	Module Ver
Math	✓	✓
User category numbering	limit (1)	x
Revision tracking	x	x
Library	x	x
Auto Math	limit (2)	limit (2)
Font Table	✓	x
Tables	✓	✓
Char editor	limit (3)	x (#0)
Color	x	x
Auto Scrap	✓	x
Math-Sci-Engr Dict	x	x
Spell-Checking	✓	x
Thesaurus	x	x
Hyphenation	x	x
Sidebars	x (#1)	x (#1)
Headers/Footers	✓	✓
Footnotes	✓	x
Auto-pagination	✓	✓
Find/Replace	limit (4)	x
Line spacing	✓	✓
Import Graphics	✓	✓
Stationery	✓	✓
Ruler	✓	✓
User-selected Tab	x	x
Para borders	✓	x
Metrics cmd	x	x
Typeface changes	✓	Limit (5)
Modules	Limit (6)	limit (7)
Customization	✓	✓
User Styles	x	x
Line numbering	x	x
Memos	x	x
Multiple columns	x	x
Overview	x	x
Fract. Char Width	x	x
Doc. Open at once	4	2
RTF	✓	x
Online help	✓	✓
Documentation	limit (8)	limit (9)
RAM	1Meg	1Meg
Storage	2 Floppies	2 Floppies

a) Maintain core mathematics features. b) Maintain [upward] file compatibility.

Limit (1) Disable New Variable, i.e., allow only one variable in addition to equation numbers.

Limit (2) Keep only auto bracket sizing.

Limit (3) Retain sizing and cropping of graphics.

Limit (4) Retain only traditional text search and replace (remove style only and revision style searches).

Limit (5) Remove Other Styles dialog.

Limit (6) Allow one Module at a time.

Limit (7) Restrict to a specific Module.

Limit (8) Delete material pertaining to deleted features; include Quick Summary.

Limit (9) Module manual will contain a terse summary; include Quick Summary.

(#0) Will retain sizing and cropping info assigned by larger versions; otherwise will require exact size from paint/draw program.

(#1) Discards contents of sidebars if included from full version doc.

These specifications are subject to change without notice.

A P P E N D I X

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Other Software by the Authors

The authors collaborated with others in the creation of the following:

Macintosh Software

- **MathWriter™ 1.4** The mathematical expression editor predecessor of MathWriter™ 2.0—The Scientific Word Processor for the Macintosh.
- **MW2TeX™ 1.0** A translator of MathWriter 1.2-1.4 files into TeX.
- **MacPoisson™ 1.0** and **MacElastic™ 1.0** Instructional finite element analysis programs for two-dimensional and axisymmetric problems in steady heat conduction, electrostatics, ideal fluid flow, seepage, etc., and classical elasticity, respectively. Both are available in student and professional versions. MacPoisson was selected for "The Best Engineering Software" in Higher Education in 1989 by EDUCOM.
- **MacRegistrar™ 1.03** A specialized database for managing class records.
- **StomateTutor™ 2.0** A HyperCard presentation of original research on gas exchange in higher plants (includes two Pascal computational/graphics modules).
- **ExamBuilder™ 1.0** A MathWriter™2.0 database module for exam items.

IBM-PC Software

PC-Poisson and **PC-Elastic** Instructional finite element analysis programs for two-dimensional and axisymmetric problems in steady heat conduction, electrostatics, ideal fluid flow, seepage, etc., and classical elasticity, respectively. Both are available in student and professional versions.

DiskManagerPC™ 1.12 Hard disk security and disk management program.

PC-Registrar™ 2.0 A specialized database for managing class records.

QuikBase™ 1.0 A pull-down menu, flat file database program with template editing and report generating support.

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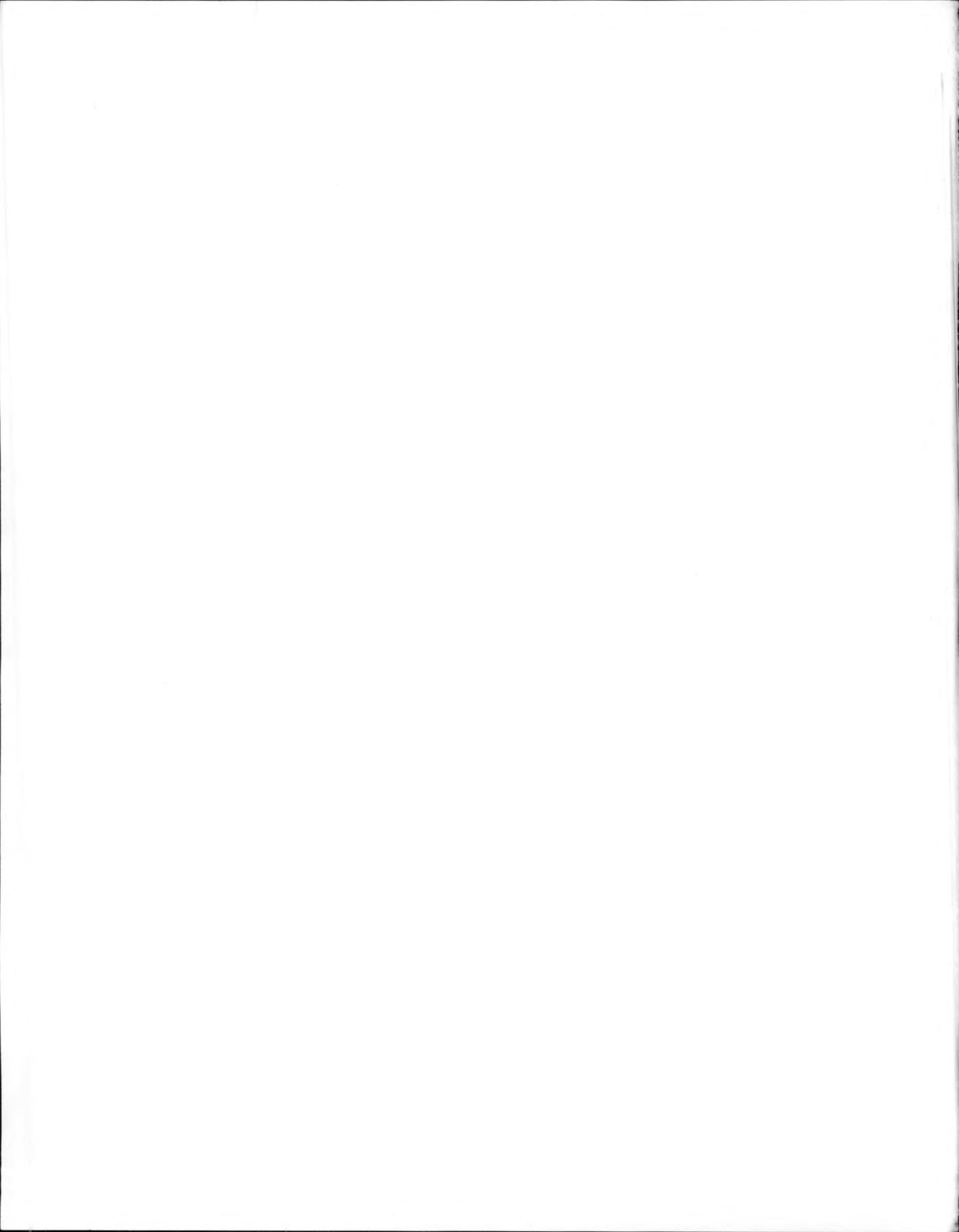
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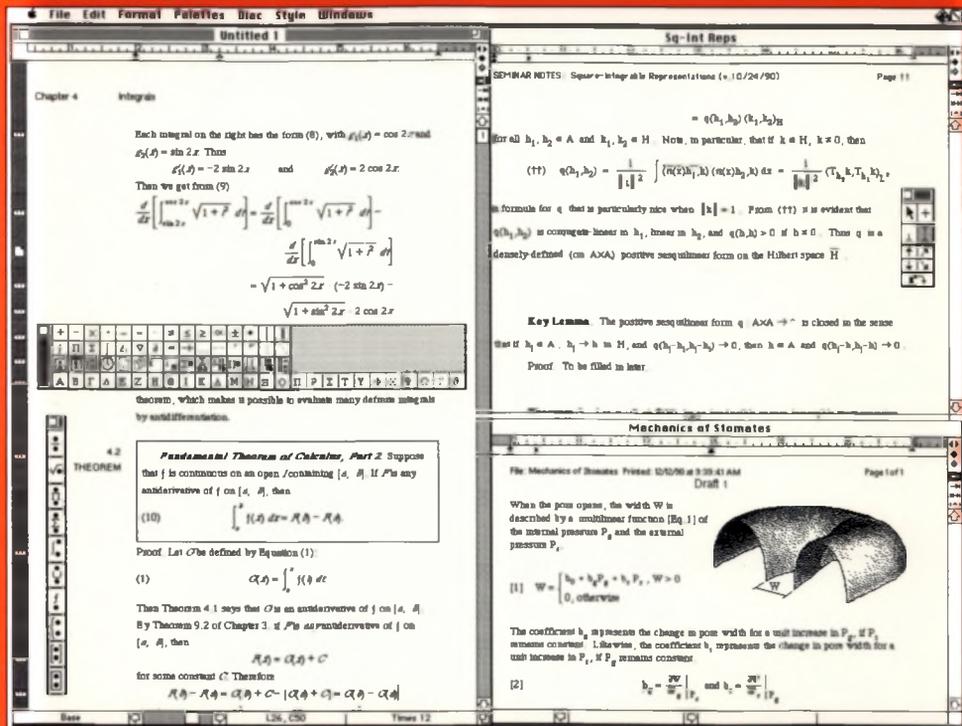
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