Scientific Word/Scientific WorkPlace

A White Paper

MacKichan Software, Inc.

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Abstract

This white paper provides a technical discussion of two innovative software applications. The first, Scientific Word® version 4.0 for Windows, is a software package unique in the way it handles text and mathematics. It is a full document editor, not just an equation editor. Scientific Word understands mathematics and automatically sizes, spaces, and positions symbols for you. The second program, Scientific WorkPlace® 4.0 for Windows, is an enhanced version of Scientific Word. By seamlessly integrating Scientific Word's powerful word processing features with a powerful computer algebra system and a special math interpreter, Scientific WorkPlace defines a completely new software category that will change the way users of technical software work, create, and learn.

Throughout this paper, we refer to the two programs as SW unless we want to make a distinction between them. Also, we use Scientific WorkPlace screens to illustrate various operations—the two programs have identical screens except that Scientific WorkPlace has an extra menu item, Compute.

Tools for Scientific Creativity – the Vision

Before Scientific Word and Scientific WorkPlace, the professional who worked with mathematics had to master a typesetting language like TeX or LaTeX to publish his results, or he had to limit his mathematical vocabulary to the restricted set of symbols and expressions that can be handled by Microsoft Word and other general-purpose word processors. To do computations with a computer algebra program such as Mathematica, MuPAD, or Maple, he needed to master another language. To use a program such as MatLab or SciLab, he needed to master yet another language.

The vision of the creators of Scientific Word and Scientific WorkPlace is that the user can enter mathematics into the computer easily and naturally, using standard mathematical notation. What he has entered is not just an array of symbols, but is real, live, mathematics which can then be:

- displayed on the screen,
- typeset,
- passed to a computer algebra system such as MuPAD ,
- passed to a numerical modeling program such as MatLab or SciLab, or
- can be used as input to a large variety of other programs.

The greatest payoff of this vision comes when it is so easy to enter mathematical expressions that the computer ceases to stand between the professional and his work. He can enter an expression, simplify it, modify it, solve a set of equations, or create a 3-D plot, all as easily as doodling with a pen and paper. It then becomes practical to compose mathematics at the computer, to experiment with it, and to apply the power of symbolic and numerical computations to it. And at the end it can be printed and typeset effortlessly, or posted to the web.

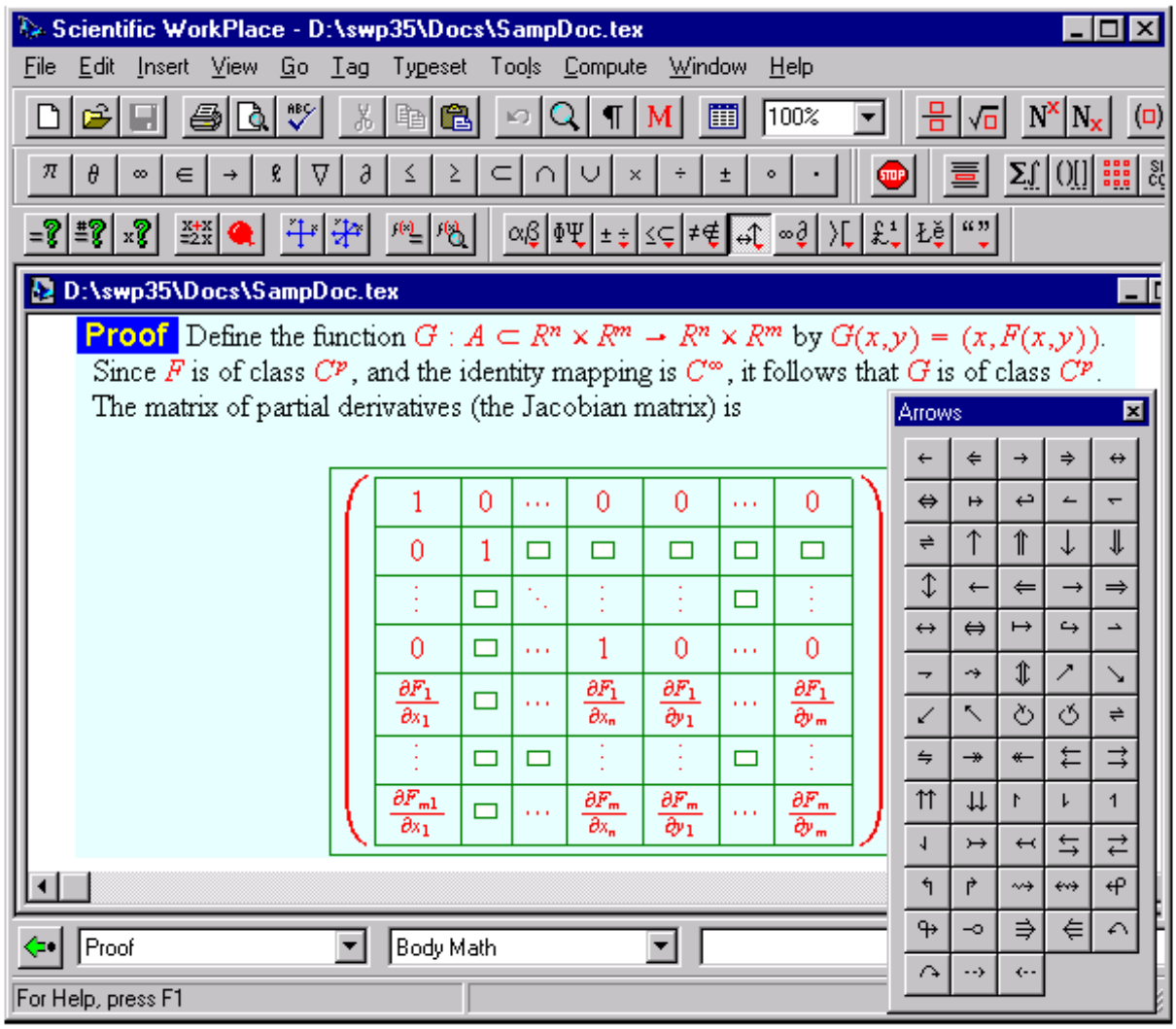
The implementation of the vision of an all-encompassing mathematical (or engineering or scientific) workspace for writing, computing, and analyzing data is still a work in progress, but the Scientific Word and Scientific WorkPlace programs are significant steps in this direction.

Scientific Word and Scientific WorkPlace

Scientific Word and Scientific WorkPlace set the stage for your creativity with their straightforward approach to entering mathematics and text. You use familiar mathematical notation, not special codes, to enter and display mathematics. Since SW completely integrates mathematics and text, you enter mathematics in the same window where you enter text, rather than in a special equation window.

With SW you will be typing mathematics in minutes. You do not have to learn unfamiliar codes to enter mathematical symbols. You can use the mouse to choose symbols from the on-screen panels—just point and click and the symbols appear in your document. If you prefer, you can enter symbols and templates using keyboard shortcuts.

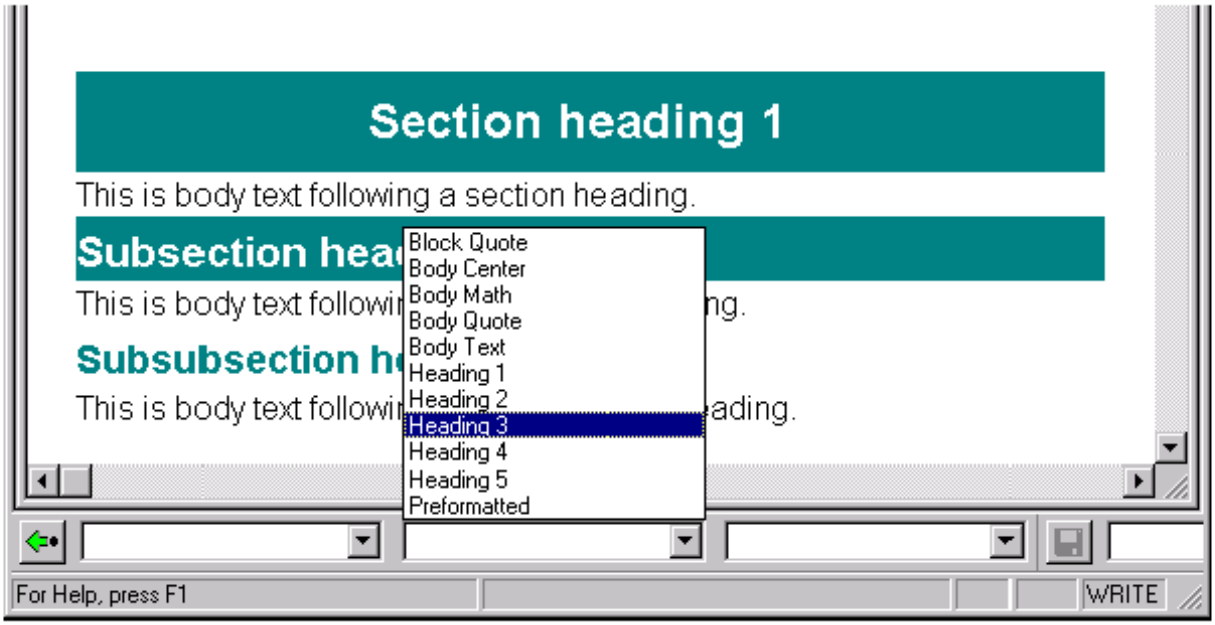
Here is a sample screen showing a matrix with a few "input" boxes remaining in the template. This screen also shows the pull down menu with the full set of AMS (American Mathematics Society) arrow symbols available to you with a click of the mouse:



By “tagging”elements of your document, such as section headings, you create document structure based on content. This content-based approach allows you to determine the overall appearance of your document by choosing a print style instead of entering detailed formatting instructions one by one. When you print with this global print style, the entire document is reformatted automatically to conform to the requirements of that style. SW is unique in that it uses the TeX typesetting software to produce documents with a consistent typeset quality that adheres to internationally accepted mathematical formatting standards. You deal with the content of your work, not the formatting required to print it.

TeX is the mathematical typesetting system created by Donald Knuth and supported by the American Mathematical Society. It is the acknowledged leader in high-quality scientific typesetting. LaTeX, a dialect of TeX created by Leslie Lamport, enhances TeX with document structuring features such as lists, automatic table of contents generation, cross-references, automatic theorem numbering, bibliographies and tables. SW is a Windows-based front-end to LaTeX and saves your documents in LaTeX format.

The following screen shows one of the “tag” pop-up menus.



Scientific WorkPlace incorporates the MuPAD symbolic computation engine. With Scientific WorkPlace you can perform a wide range of mathematical computations directly within your documents. You can easily enter mathematical expressions in natural notation, manipulate the expressions, and **the results are generated in your document so you can use them in subsequent calculations**.

The interface to MuPAD in Scientific WorkPlace is completely different from that found in any other application. By creating a special math interpreter (called EasyMath(TM)), we took a "no compromise" approach that uses SW mathematics "as is" for computations. Just as you do not need to know LaTeX to use SW, you do not have to learn a new way of writing mathematics to compute with MuPAD in Scientific WorkPlace. **Expressions are always in their natural format and there is no distinction between input and results!**

Syntax Versus Natural Notation

Until now, symbolic computation systems forced you to use an array of commands and notations to represent your input. In many of these systems, you are presented with over 2,000 separate operators like int and diff. For example, if you want to integrate the expression

$$\int \frac{x^2}{\sqrt{x^2-9}}dx$$

using a traditional computation system, you must enter it in linear fashion, int(x^2/sqrt(x^2-9),x). Simply by making a typing mistake, you would get an error message. When you get the result of the integration, these systems do not easily allow you to use the result in subsequent work. Scientific WorkPlace eliminates the need to learn complex syntax by using natural notation for input and results.

When you compare the computational features available in Scientific WorkPlace to those found in traditional computation systems, you will identify three major differences:

1. When you enter an expression, Scientific WorkPlace **derives operations** from the natural notation used. For example, if you enter $\int x dx$ or $\frac{dx^3}{dx}$, Scientific WorkPlace understands what you are writing and will evaluate the expressions appropriately. This is not possible in other computation systems because they force you to be exact with your input syntax. To illustrate this, we enter an integral using SW's natural notation input methods (described later) and press CTRL+e to evaluate the integral (or choose Evaluate from the Compute menu).

$$\int \frac{(3x^2+2x+4)}{(x-1)^2(x^2+1)}dx$$

$$= -\frac{9}{2(x-1)} - \frac{1}{2}\ln(x-1) + \frac{1}{4}\ln(x^2+1) - \arctan x$$

Scientific WorkPlace automatically places an equal sign between your original expression and the result of the integration. You can use the result of the integration (or the original expression) in subsequent work by selecting the entire expression or some portion thereof. You can perform standard Windows Copy/Paste operations on the expressions as well. You can save a selected item as a "fragment" (this is the term we use to signify math, text or graphic objects you save for later recall). Fragments are discussed in greater detail in the "Features Overview"

section.

2. Scientific WorkPlace **deduces choices** based on familiar notation. In typical symbolic systems, you must use a different function for the same operation. For example, to factor an integer using one of these computation systems, you would need to use the operator "ifactor" but to factor a polynomial, you must use the operator "factor". In contrast, Scientific WorkPlace examines what you are applying a particular operation to and responds appropriately. Here is an illustration. In Scientific WorkPlace you can factor the integer 12345 and the polynomial $5x^5 + 5x^4 - 10x^3 - 10x^2 + 5x + 5$ using the same Compute menu option, Factor.

$$12345 = 3 \times 5 \times 823$$

$$5x^5 + 5x^4 - 10x^3 - 10x^2 + 5x + 5 = 5(x-1)^2(x+1)^3$$

3. By using a **natural interface** for both input and output, Scientific WorkPlace provides you with the ability to select portions of an expression to which you can apply subsequent operations. In contrast, typical computation systems force you to extract and manipulate portions of an expression using special commands. We illustrate this by selecting a portion of an expression for evaluation and having the results replace the selection. This feature is called "computing in place" and is very useful. If you select the rational expression inside the integral

$$\int \frac{(3x^2 + 2x + 4)}{(x-1)^2(x^2+1)} dx$$

and while pressing the CTRL key, choose Partial Fractions from the Compute/Calculus submenu, this expression becomes

$$\int \frac{9}{2(x-1)^2} - \frac{1}{2(x-1)} + \frac{1}{2}\frac{-2+x}{x^2+1} dx$$

If you click the parentheses icon while the expression is still selected, the expression then becomes

$$\int\left(\frac{9}{2(x-1)^2} - \frac{1}{2(x-1)} + \frac{1}{2}\frac{-2+x}{x^2+1}\right) dx.$$

In the next section we show the exact steps you would take to enter two expressions.

Entering Mathematics

In this first example, we use the mouse wherever possible (you can use keyboard shortcuts once you become familiar with them). Here is how you would enter $\int \frac{x^2}{\sqrt{x^2-9}} dx$ using the mouse.

	Entering an integral using the mouse	
Step #	**Action**	**Result**
1	Click	$\int$
2	Click	$\int \frac{\square}{\square}$
3	Type *x*, click , type 2	$\int \frac{x^2}{\square}$
4	Click in the denominator box, click	$\int \frac{x^2}{\sqrt{\square}}$
5	Repeat step #3, click to the right	$\int \frac{x^2}{\sqrt{x^2}}$
6	Type –9, click to the far right	$\int \frac{x^2}{\sqrt{x^2-9}}$
7	Type *dx*	$\int \frac{x^2}{\sqrt{x^2-9}} dx$

The fraction bar and radical sign expand automatically. You can add limits to an operator like $\int$ by applying a subscript and a superscript. Other systems provide a special icon with the limits already present, but this leads to a bewildering array of icons on the screen. SW uses a much smaller set of icons. Another large reduction in the

number of icons comes from SW's unique ability to size and position limits on operators like $\sum$ automatically (or at your discretion) from their in-line form $\sum_{n=1}^{\infty}$ to their display form

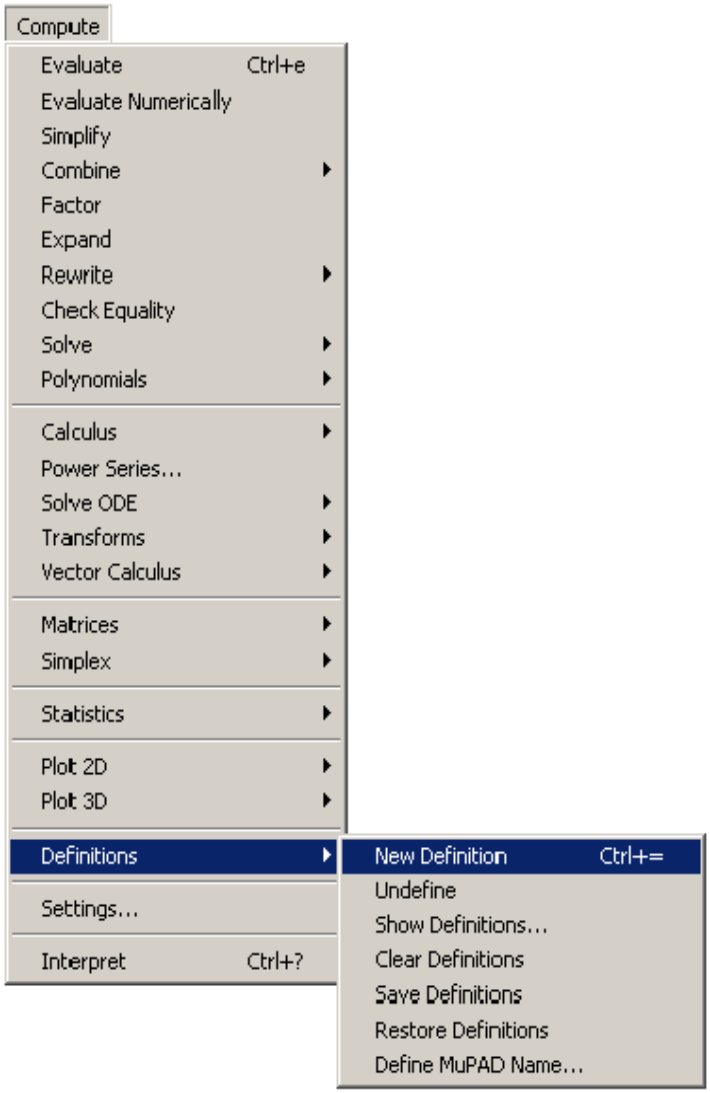
$$\sum_{n=1}^{\infty}$$

In our second example, we construct a mathematical expression, take advantage of Scientific WorkPlace's ability to perform calculations on the expression, and then plot the result.

1. Enter the expression, $x^4 - 7x^3 + 14x^2 - 8x$.
2. Choose Factor from the Compute menu:
$x^4 - 7x^3 + 14x^2 - 8x = x(x-1)(-2+x)(x-4)$
3. Copy the factored expression to a new line. We will use this new expression to define a function and plot the function.
4. Working on the line to which you just copied the factored expression, insert "$f(x) =$" at the beginning of the expression. It will look like this:

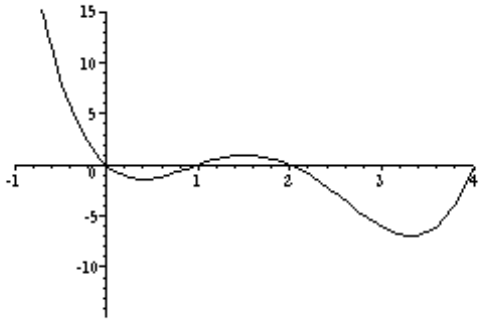
$$f(x) = x(x-1)(-2+x)(x-4)$$

5. Define f by the equation $f(x) = x(x-1)(-2+x)(x-4)$ by placing the insertion point (cursor) anywhere within the expression and using the Compute/Define/New Definition menu option.



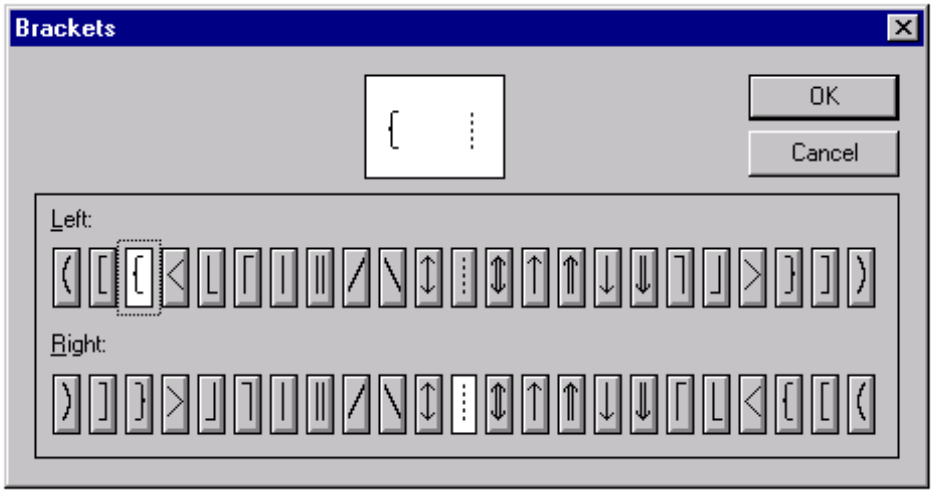
6. Enter $f(x), f'(x), f''(x)$ on a new line by itself.
7. With the insertion point located anywhere within this list, choose the Compute/Plot2D/Rectangular menu option. Scientific WorkPlace creates a graph of the three functions using a default range.
8. To change the x and y ranges (say, $-1 \le x \le 4$ and $-15 \le y \le 15$) for the plot, revise it by clicking "Edit/ Properties"

Scientific WorkPlace generates this revised plot:



Writing Mathematics

Complex expressions are easy to create. The process is made even easier by the ability to apply radicals, brackets, fractions and displays to selections. As demonstrated above, if you have already typed a large expression and you want to apply brackets to all or part of it, you select that part, then click on the brackets icon or choose a set of brackets that uniquely fit your needs. Here is the brackets dialog box:



In the brackets dialog box, you select a hidden bracket by choosing the icon .
The following expressions were created with little effort and were formatted automatically.

$$\vec{\vec{H}} = \begin{bmatrix} \frac{\partial^2 \Omega}{\partial^2 x} & 0 \\ 0 & \frac{\partial^2 \Omega}{\partial^2 y} \end{bmatrix}$$

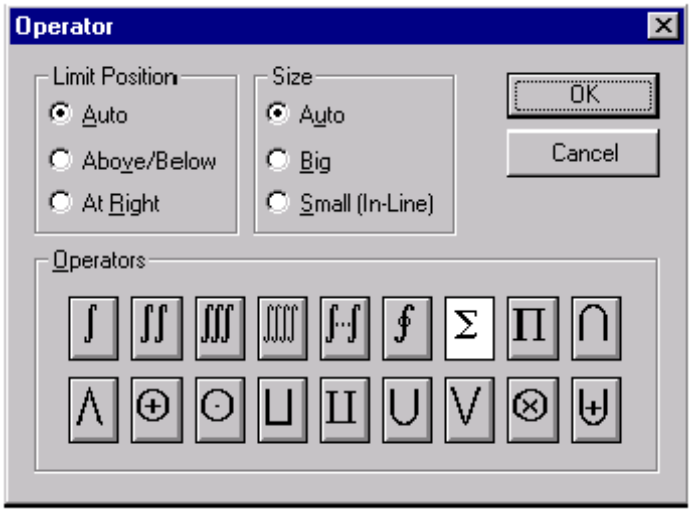
$$\left\{ \int_a^b \left(\sum_{i=1}^{m} \lambda_i(x) \right)^p dx \right\}^{\frac{1}{p}} \leq \sum_{i=1}^{m} \left\{ \int_a^b (\lambda_i(x)^p) dx \right\}^{\frac{1}{p}}$$

$$\int_a^b f(x)dx \triangleq \lim_{n \to \infty} \frac{b-a}{n} \sum_{r=1}^{n} f\left(a + \frac{r}{n}(b-a)\right)$$

$$\cos 2A = \begin{cases} \cos^2 A - \sin^2 A \\ 1 - 2\sin^2 A \\ 2\cos^2 A - 1 \end{cases}$$

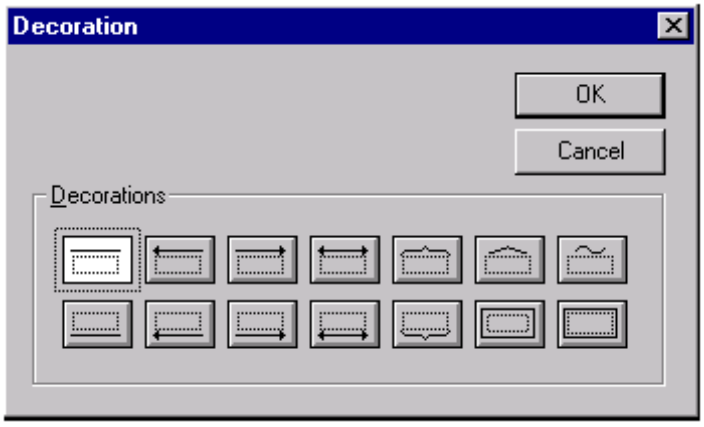
$$\hat{\beta} = \frac{\sum_{i=1}^{m} x_i y_i - n\bar{x}\bar{y}}{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2} = \frac{\sum_{i=1}^{m} x_i y_i - \frac{1}{n}\left(\sum_{i=1}^{m} x_i\right)\left(\sum_{i=1}^{m} y_i\right)}{\sum_{i=1}^{m} x_i^2 - \frac{1}{n}\left(\sum_{i=1}^{m} x_i\right)}$$

Mathematical objects in SW are designed to provide the simplest and most natural editing possible. Furthermore, SW is an intelligent interpreter of what you type. If you are in mathematics and type“cos”, the software recognizes it as a function and stores and displays it accordingly. SW selects the correct typeface, spacing, and placement of limits required by functions as you type. The same holds true for any operator. Here is the operator dialog box used to select from the full set of AMS operators:

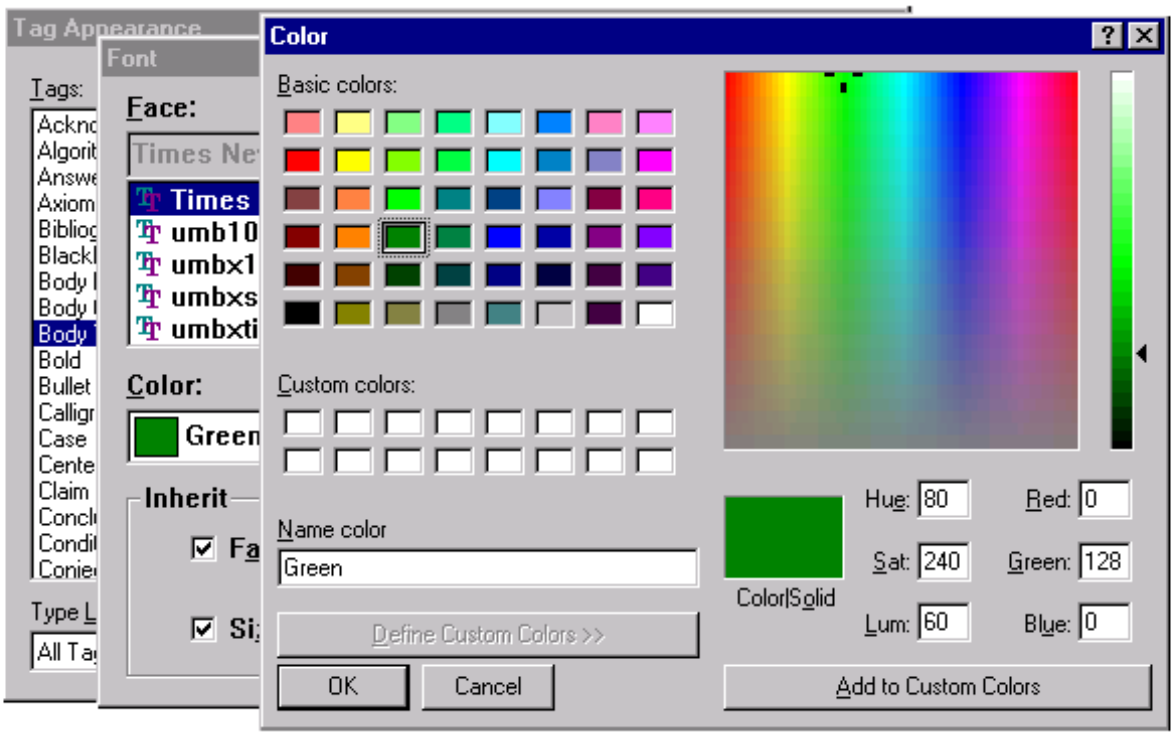


SW treats plain text in much the same way as any other word processor, following the standard Windows conventions for inserting, deleting, selecting, cutting, copying, pasting, and drag/drop. Text and math flow freely on screen—there is no separate equation editor. As a result, **you can search and replace within text and mathematics**.

You can apply a variety of “decorations” to your text and math, including those found in the decorations dialog box:

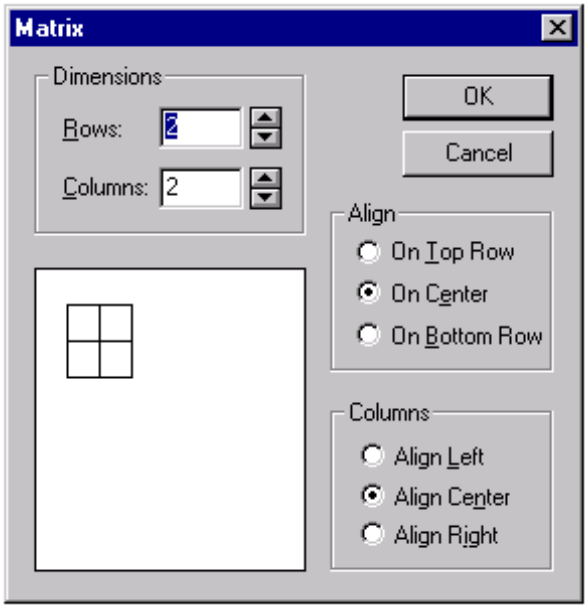


By default, mathematics is shown in red on the screen. This feature makes it easy to discern and read the mathematics and also makes clear whether punctuation is or is not part of the mathematics. You can change the various screen colors to match your taste. Here is the dialog box used to modify the on-screen colors.



Consider a Matrix

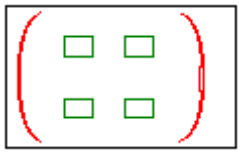
You can create highly complex matrices very quickly by clicking on the matrix icon, , and by specifying the number of rows and columns. In the following example, we create a simple 2 by 2 matrix, using the matrix dialog box:



Typing entries into the matrix is the same as entering any other mathematics in SW. You move the insertion point to the position or input box desired and enter the symbol you need by clicking on the symbol's icon or via keyboard shortcut.

After you click OK from the matrix dialog, SW creates the appropriate matrix template. You can apply brackets

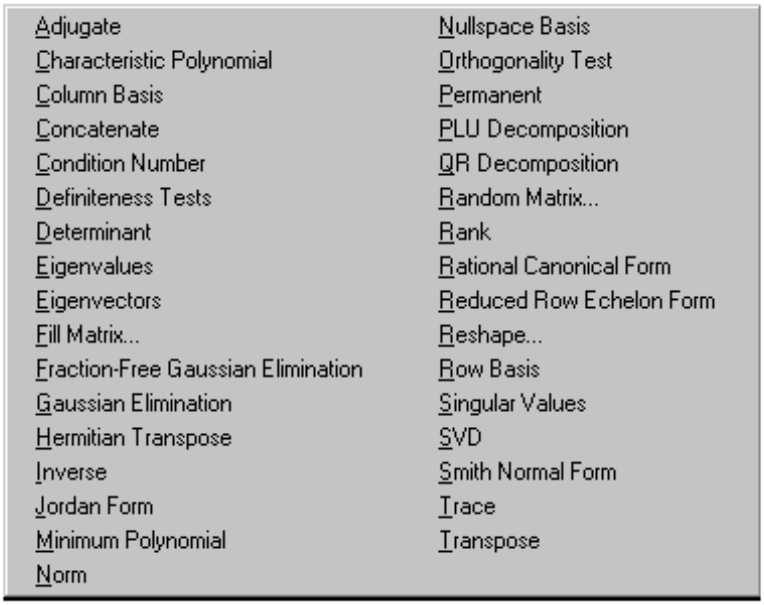
as shown and begin constructing the matrix:



We let Scientific WorkPlace calculate the eigenvalues of the matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ by choosing the Eigenvalues option from the Compute/Matrices menu.

$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$, eigenvalues: $\frac{5}{2} + \frac{1}{2}\sqrt{33}, \frac{5}{2} - \frac{1}{2}\sqrt{33}$

Modifying a matrix is as easy as creating one. You can select rows or columns and delete them. It is a simple matter to insert additional rows or columns in an existing matrix. And as demonstrated above, if you have Scientific WorkPlace you can perform a variety of operations on your matrix and use the results of those operations in subsequent computations. Here are the operations available from the Matrices submenu:



A Content-Based Approach

The heart of the SW approach is the separation between content and appearance. The purpose of writing is to convey ideas, so the creative process of forming ideas and putting them into words should be the writer's primary concern. The mechanical process of displaying the document on the printed page in the most readable and organized format is the function of typesetting, not writing, and should not be the writer's primary concern.

This separation of the creative process of writing from the mechanical process of layout is known as **logical design**. Logical design results in greatly increased productivity because the writer is freed from formatting concerns and can focus on creating content. Logical design also leads to better, more consistent typeset results because choices of fonts, spacing, emphasis, and countless other aspects of the document's appearance are made automatically. Before SW, this approach was only available in batch systems like TeX, LaTeX, and other production typesetting systems which use markup languages.

By using TeX for printing, SW takes advantage of the many automatic typesetting features available within TeX, such as kerning, hyphenation, and automatic sizing, placement, and positioning of mathematics. In SW you interact directly with mathematics in familiar form, not with TeX codes.

An alternative approach to word processing, called **visual design**, focuses on making the screen look as much like the printed page as possible. This approach has also been called WYSIWYG, for What You See Is What You Get. Visual design is an inefficient and short-sighted use of modern windowing systems. More often than not, visual design systems entice highly paid professionals to waste many hours "fiddling" with the appearance of a document, only to produce an inconsistent and unprofessional result. One recent study found that the loss of productivity resulting from this so-called "futz factor" reduces our gross domestic product by 2% annually!

This concept of “logical design” vs. “visual design” is used by Leslie Lamport in his book, the *LaTeX User’s Guide and Reference Manual*.

The PC “Futz Factor”: User Time Studies, conducted by SBT Market Research, from Survey III Summary Sheet, August 1992.}

We feel it’s important for you to understand the difference between the two approaches because a logical system requires a very different interface from a visual system. If you are familiar with a WYSIWYG system, you may at first be surprised by some of the differences:

- When you use a WYSIWYG system, you constantly give commands that affect the appearance of the content—you select text and then choose a font, a point size or a typeface. You apply alignment commands such as center, left justify and right justify. To center an equation, you select it and choose the center alignment.
- In a logical system, all of these commands are replaced by commands that define the **logical structure of the content** instead of its appearance. Instead of centering text, you create a title, create a section head or create a displayed equation. The format of the title, the alignment of section heads and the alignment of equations are all determined separately by the print style. Print styles are predefined for a variety of document types or you can create your own styles with the style editor.
- WYSIWYG systems divide documents into pages according to their anticipated typeset appearance. To see an entire line, you often have to scroll horizontally because the screen dimensions and page dimensions do not match.
- In a logical system, working with pages is unnecessary, since the division of a document into pages has no connection to the document’s logical structure. Thus, on the screen SW breaks lines to fit the window. In print, the lines break according to the format defined by the print style.
- In systems that focus on appearance instead of content, pressing the spacebar inserts a space that shows on the screen and is duplicated in print. Pressing the spacebar a second time inserts a second space.
- In a logical system, a space represents a logical division between words. Pressing the spacebar a second time has no meaning, so it has no effect in the printed output.

SW’s emphasis on logical structure does not ignore the fact that documents must still be printed in a readable, organized and visually pleasing format. Any of the many predefined print styles gives your document a high-quality, typeset appearance in print.

Separating the processes of creating and formatting a document combines the best of the on-line and print worlds. You do the work of creating a good document; SW does the work of creating a beautiful one.

Features Overview

Windows conventions. SW uses Windows conventions and runs as a Windows application. You can apply what you already know about using Windows applications directly to the SW environment. First, you’ll find the available commands in menus, bars, icons and popups on the screen. Second, you can enter commands with the mouse or from the keyboard using standard mouse and keyboard techniques. And third, you’ll recognize many standard Windows keyboard conventions, such as using CTRL+x to cut a selection. Pressing the right mouse button will bring up a context-sensitive menu.

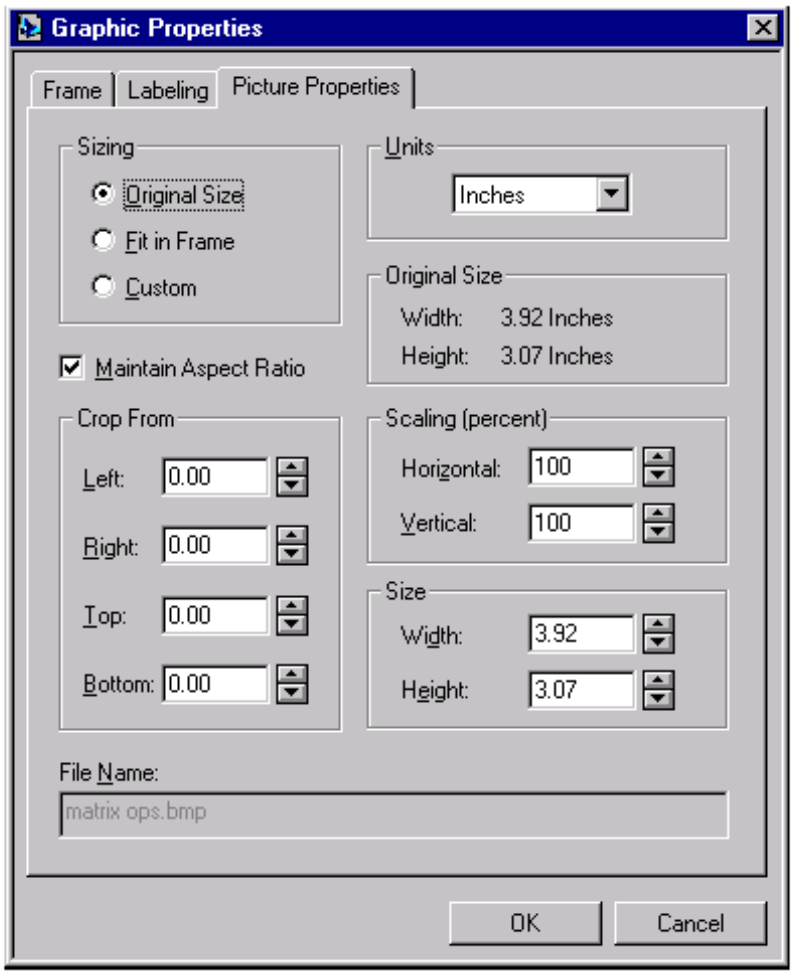
Foreign languages. SW supports any left-to-right language supported by Windows. In particular, in Japanese and Chinese Windows, or in Windows 2000, it is possible to write documents in Japanese and Chinese.

Keyboard shortcuts and special keyboards. In addition to the Windows keyboard conventions, you can use a rich set of keyboard shortcuts, special key combinations for performing basic operations or entering symbols, characters and the most common mathematical objects. The shortcuts are often faster to use than the mouse.

Paragraphs contain both text and mathematics. Your paragraphs can contain both text and mathematics. The screen default is to show text in black and mathematics in red so that you can easily distinguish them. The Math/Text icon on the main window indicates whether the insertion point is in text or in mathematics. You can search or replace within text and mathematics.

AMS symbols. Incorporate in your documents all the symbols in the American Mathematical Society fonts, including Blackboard Bold (e.g. $\mathbb{D}$, $\mathbb{N}$, $\mathbb{R}$, $\mathbb{P}$ and Fraktur $\mathfrak{A}, \mathfrak{B}, \mathfrak{C}$. SW now supports the full set of AMS fonts on the screen and in print. Here is the complete set of available symbols from 9 drop-down menus:

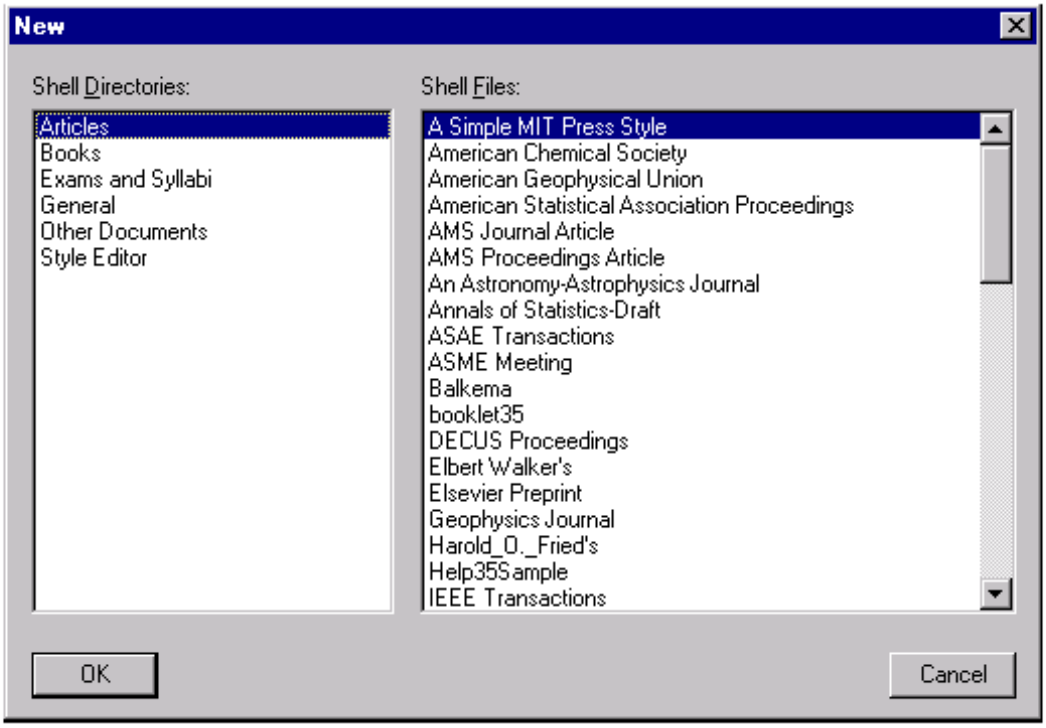
Lowercase Greek	$\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi\pi\varpi\rho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\varkappa\varrho$
Uppercase Greek	$\Gamma\Delta\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega\digamma$
Binary Operations	$\pm\ \mp\ \setminus\ \cdot\ \times\ *\ \star\ \diamond\ \circ\ \bullet\ \div\ \triangleleft\ \vee\ \wedge\ \oplus\ \ominus\ \otimes\ \oslash\ \cap\ \cup\ \uplus\ \sqcap\ \sqcup\ \triangleleft\ \triangleright\ \wr\ \bigcirc\ \bigtriangleup$ $\triangleright\ \odot\ \dagger\ \ddagger\ \amalg\ \trianglelefteq\ \trianglerighteq\ \boxdot\ \boxplus\ \boxtimes\ \boxminus\ \barwedge\ \veebar\ \Cup\ \Cap\ \curlywedge\ \curlyvee\ \intercal\ \intercal\ \circledcirc\ \circledast\ \circleddash\ \divideontimes$
Binary Relations	$\leq\ \prec\ \preceq\ \ll\ \subset\ \subseteq\ \sqsubset\ \sqsubseteq\ \in\ \vdash\ \smile\ \frown\ \equiv\ \sim\ \simeq\ \asymp\ \approx\ \geq\ \succ\ \succeq\ \gg\ \supset\ \supseteq\ \sqsupset\ \sqsupseteq\ \ni\ \dashv\ \mid\ \parallel\ \perp\ \cong\ \bowtie\ \propto\ \models\ \doteq$ $\bowtie\ \Vdash\ \Vdash\ \models\ \eqslantless\ \eqslantgtr\ \thickapprox\ \because\ \because\ \doteqdot\ \risingdotseq\ \fallingdotseq\ \backsim\ \backsimeq\ \subseteqq\ \supseteqq\ \lessapprox\ \gtrapprox\ \lessdot\ \gtrdot\ \lessgtr\ \gtrless\ \lesseqgtr\ \gtreqless\ \lesseqgtr\ \gtreqless\ \eqcirc\ \circeq\ \triangleq\ \triangleq\ \gtrless\ \gtrless$ $\lozenge\ \blacktriangledown\ \blacktriangleright\ \blacktriangleleft\ \vartriangle\ \varpropto\ \between\ \between\ \pitchfork\ \backepsilon\ \blacktriangleleft\ \blacktriangleright\ \shortmid\ \shortmid\ \vartriangleleft\ \vartriangleright\ \trianglelefteq\ \trianglerighteq\ \bumpeq\ \Bumpeq\ \doteqdot\ \risingdotseq\ \fallingdotseq\ \eqcirc\ \circeq\ \triangleq\ \triangleq\ \gtrless\ \gtrless\ \lessapprox\ \gtrapprox\ \lessdot\ \gtrdot\ \lessgtr\ \gtrless\ \lesseqgtr\ \gtreqless\ \lesseqgtr\ \gtreqless\ \eqcirc\ \circeq\ \triangleq\ \triangleq\ \gtrless\ \gtrless$
Negated Relations	$\neq\ \not\in\ \not\ni\ \not\parallel\ \not\mid\ \not\cong\ \not\asymp\ \not\doteq\ \not\bowtie\ \not\sim\ \not\simeq\ \not\approx\ \not\cong\ \not\approx\ \not\cong\ \not\sim\ \not\simeq\ \not\approx\ \not\cong\ \not\sim\ \not\simeq\ \not\approx\ \not\cong\ \not\sim\ \not\simeq



Templates for entering mathematical objects. You enter mathematical objects such as fractions, radicals, enclosures and matrices by inserting and then filling the template for the object you want. You do not need templates to enter individual mathematical symbols and characters. You enter them directly into your expression using the icons on the screen, the special keyboards or the keyboard shortcuts.

Tags add structure. You use tags to add structural elements such as lists, sections or theorems to your document and to emphasize words or phrases in the text.

Styles define document appearance. You can use a wide range of predefined print styles and shell documents for producing books, articles, reports and other types of documents. Because the styles contain complete document formatting instructions, you can concentrate on writing your document instead of on formatting its appearance. Here are some of the available predefined article shells:



Use direct printing to bypass LaTeX. When you want a quick printout, or when you don't need the power of LaTeX, you can print directly, without invoking LaTeX. SW then prints your document in the same way it displays it on the screen.

Post your documents on the web, and read documents from the Web. You can open files from any web server as easily as you can read a local file. Use hyperlinking to create an entire web of SW documents. MacKichan Software, Inc. provides a free browser (Scientific Viewer) for SW documents on the web. The free browser is also on the SW disks. The combination of SW and the free Scientific Viewer is currently the best solution for displaying mathematics on the web. Or, you can convert your documents to HTML, with the mathematics rendered as graphics or as MathML.

Hyperlink your documents. You can easily create hyperlinks to other parts of your document, to other SW documents, or to any document on the World Wide Web. If you create a link to an HTML document, SW will launch your browser to read it.

Style editor. Use the style editor to create special print styles that match your needs, then save those styles for future use . You don't have to know LaTeX to create print styles with the style editor.

TeX produces typeset-quality documents. Your documents are typeset using TeX and LaTeX. The Windows implementation of TeX and LaTeX that is supplied with SW is TrueTeX®, a product of Kinch Computer Company. Because typesetting is automatic, you do not have to know TeX or LaTeX to use SW effectively. However, if you are familiar with TeX, you can enter TeX commands directly into your document. Files are stored in ASCII LaTeX format.

TrueType fonts. Outline fonts provide pleasing on-screen mathematics and italics. SW uses Windows 95 (or higher) TrueType fonts.

Spell checker. Allow SW to check your spelling using one of 19 dictionaries, including several European languages. American English will be the default dictionary shipped with your package and you can order other dictionaries as needed.

Computer algebra kernel embedded (Scientific WorkPlace only). Perform a wide range of mathematical computations directly from Scientific WorkPlace using the MuPAD computer algebra system.

Multi-line displays. Multi-line displays and equation arrays are very easy to create. You can add numbers selectively to each line of the display for easy cross-referencing throughout your document, and you can override the automatically generated numbers with your own labels.

Automatic cross-referencing. You reference an equation or a bibliographic entry in your document by inserting a cross-reference to the "key" given to the equation or bibliographic entry.

Drag and drop. Speed copy and move operations with the mouse. Save steps by using the "drag and drop" mouse techniques to drag or copy selected portions of your document from one place in the document to another.

Copy mathematics as a picture. You can copy any part of an SW document as a Windows metafile. This allows you to import mathematical expressions into other programs and to use mathematical labels in graphics

program. You can export the picture in any of seven popular formats (EMF, BMP, DIB, GIF, JPG, PCT, or PNG).

Import contents. Bring other LaTeX files directly into your active document. Use the Import Contents feature to speed document creation by copying the contents of other files into your active document.

Master documents/Subdocuments. Break your large documents into smaller, more manageable pieces by creating a master document that incorporates several subdocuments. When you print the master document, SW creates all surrounding front and back matter specified by the print style and resolves all cross references internal to all subdocuments.

Bibliographic libraries. Generate a bibliography with BibTeX, a public domain program by Oren Patashnik. BibTeX creates a bibliography by extracting references from a database you create. Once created, the database can be used as often as you like with other LaTeX documents.

Create AMS-LaTeX documents. SW includes the ability to create documents in AMS-LaTeX format. These documents are created automatically when you choose one of the AMS-LaTeX print styles.

Latest in TeXnology. Use the latest versions of TeX and LaTeX to create documents with a much wider variety of scalable fonts. SW includes support for the New Font Selection Scheme, LaTeX2e and a higher capacity TeX that processes your documents faster.

Insert accented characters. Choose character accents from the Accent dialog box. SW displays all available accents at the same time to make the selection easier.

Table editor. Enhance your documents with tables. With the easy-to-use table editor, you can present both text and mathematics in a tabular format.

Convert RTF files. The RTF (Rich Text Format) import feature recognizes and converts mathematics created in Microsoft Word.

REVTeX support. REVTeX is a package of LaTeX macros designed for preparing physics manuscripts. SW can save your document in REVTeX format.

Printer support. All Windows-compatible printer devices supported, including fax boards.

Windows previewer. With the previewer, you can examine the typeset appearance of the document without actually printing it. Get a close look at your document via magnification.

Fragments. Fragments are a macro-like feature for saving often-used math and text expressions. You can select a portion of a document and save it for later use within the same document or within other documents. You can use fragments to create a library of frequently used formulas, phrases, and plots. These fragments are actually TeX codes, which take up significantly less disk space than if you were to save, for example, a plot in bitmap format. To recall a fragment, you place the insertion point where you want to insert the fragment, then click on the fragment icon at the bottom of the screen. This displays a list of previously saved fragments from which to choose. You can also hold down the CTRL key while typing in the fragment's name.

Help. Extensive on-line help, concise but extensive user manuals— Getting Started, Creating Documents with Scientific Word and Scientific WorkPlace, and Doing Mathematics with Scientific WorkPlace (with Scientific WorkPlace only)—and a technical reference supplement will assist you in learning quickly. If you need personal assistance, our responsive customer support staff is always happy to assist Please contact us by phone between 8am and 5pm Pacific time at the following numbers or by fax or E-mail.

- fax: (360) 394-6039
- phone: U.S. & Canada
  1-360-394-6033
  1-877-SCI-WORD
  1-877-SCI-NOTE
- E-mail: support@mackichan.com
- Web: www.mackichan.com
- MacKichan Software, Inc.
  19307 8th Avenue, Suite C
  Poulsbo, WA 98370-7370
  USA

System Requirements

- Operating Systems
  Windows® 95, 98, 2000, XP, Windows NT 4.0 or later
- Minimum of 16 Mbytes of RAM
- Disk Space
  55-180 Mbytes of hard disk space, depending on the type of hard drive you have
  Note: Scientific Word and Scientific WorkPlace can be installed in a minimal (slowest) form requiring the least hard disk space; a medium form; or a complete form (fastest) requiring as much as 180 MB of hard disk space, depending on your file system. (Much of the disk space required for a complete installation is needed for help or reference files.) Hard disk requirements are smallest when you use the new Windows 95 32-bit FAT or Windows NT's NTFS.
- Other

CD-ROM drive

MacKichan Software, Inc.

MacKichan Software, Inc. was founded in 1998 to acquire the assets of TCI Software Research. The principals of MacKichan Software are cofounders of Triad Computing, Inc., which later became TCI Software Research.

In 1976, mathematicians from New Mexico State University developed a technical editing system using a mainframe. Their vision of an easy-to-use and inexpensive word processing system for math-based disciplines was realized in the early 1980's as personal computers became more widely available. In 1981, they formed Triad Computing, Inc.

MacKichan Software, Inc. and its predecessor companies have served the world-wide scientific and engineering communities with quality software products, beginning with the award-winning T^3 Scientific Word Processing System and continuing with Scientific Word, Scientific WorkPlace, and Scientific Notebook. The development efforts of the current products were supported in part by grants from the National Science Foundation (Small Business Innovation Research, Phases 1 through 3). You can be sure that your needs will continue to receive the highest priority for years to come through the development of innovative software products.

In 1993, TCI Software Research was acquired by Brooks/Cole Publishing, a publisher of textbooks and software, and a division of International Thomson Publishing Inc. Because of the differences between publishing textbooks and developing software, it was decided to spin off TCI Software Research to some of its original owners. Because of name conflicts with the large cable company, the name was changed at the same time.

MacKichan Software distributes its products directly from its office and works with a number of U.S. and overseas resellers who are authorized by MacKichan Software to sell and support its products. Here is a link to our overseas distributors and their phone numbers: http://www.mackichan.com/products/distributors.html.

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