



# Chapter 6

## Equation and Result Formatting

You can specify how Mathcad displays answers, including specifying the number of decimal places, the base in which answers are displayed, and the use of scientific notation. And although Mathcad shows equations in standard math notation, you can apply math styles to control the font, font size, and font styles and effects used for names and numbers in equations.

The following sections make up this chapter:

### **Formatting results**

Changing the display of computed values in equations.

### **Math styles**

Changing the font, font size, and font styles and effects used in equations and plots.

### **Highlighting equations**

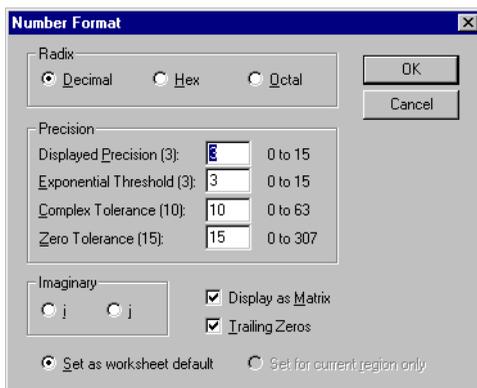
Making a particular equation stand out from all the other equations and regions in your worksheet.

## Formatting results

The way that Mathcad displays numbers (the number of decimal places, whether to use  $i$  or  $j$  for imaginary numbers, and so on) is called the *result format*. You can set the result format for a whole worksheet or for a single calculated result.

### Setting worksheet default format

To change the default display of numerical results, click on an empty space and choose **Number** from the **Format** menu. You will see the dialog box shown below. Default values for the four precision settings are shown in parentheses. The range of values allowed for each setting is shown to the right of the corresponding text box.



Change the desired settings and click “OK.” Mathcad changes the display of all results whose formats have not been explicitly specified. You can control the display of a single result without affecting any others by setting the *local result format*. The section “Setting the format of a single result” on page 128 discusses how to do this.

This is the meaning of each of the settings in the dialog box:

#### Radix

This allows you to set the radix (base) in which results are displayed. The default is decimal. If you select “Octal” or “Hex,” Mathcad truncates the number to an integer and displays it as octal or hexadecimal. Hexadecimal results are indicated by the letter “h” after the number, octal results by the letter “o.” (Mathcad does not reliably show hexadecimal or octal numbers of magnitude greater than  $2^{31}$ , or about  $2 \cdot 10^9$ ).

#### Imaginary

Click on the  $i$  or  $j$  button. Mathcad uses the selected letter to indicate an imaginary result. The default is  $i$ . You can use either  $i$  or  $j$  in equations—Mathcad always understands both. The selection you make here tells Mathcad which one to use when it gives you a complex answer. See the section “Complex numbers” in Chapter 8 for more information on how to type complex numbers.

## Display as Matrix

Check this box to suppress the use of scrolling output tables. Vectors and matrices having more than nine rows or columns are displayed as scrolling output tables unless this box is checked. See the section “Displaying vectors and matrices” in Chapter 10 for more information on scrolling output tables.

## Trailing Zeros

Check this box to make all displayed results have as many digits to the right of the decimal point as required by the current choice of Displayed Precision. For example, with Displayed Precision set to 3, Mathcad displays 5 as 5.000.

## Displayed Precision

Enter an integer between 0 and 15. This indicates how many decimal places to show in computed results. The default is 3. Numbers are rounded for display only. Mathcad maintains 15 digits of precision internally.

## Exponential Threshold

Enter an integer  $n$  between 0 and 15. Mathcad shows computed results of magnitude greater than  $10^n$  or smaller than  $10^{-n}$  in exponential notation. When the threshold is 3, numbers like 30,000 are displayed as  $3 \cdot 10^4$  instead of 30,000. The default is 3.

## Complex Tolerance

Enter an integer  $n$  between 0 and 63. If the ratio between the real and imaginary part of a complex number is less than  $10^n$  or greater than  $10^{-n}$ , then the smaller part is not shown. The default setting is 10. This means that numbers like  $1 + 10^{-12}i$  will appear simply as 1. Mathcad rounds only the displayed values. No change is made in the internally stored values.

## Zero Tolerance

Enter an integer  $n$  between 0 and 307. Numbers less than  $10^n$  are shown as zero. The default setting is 15. This means numbers of magnitude less than  $10^{-15}$  appear as zero. Mathcad changes the displayed values only. No change is made in the internally stored values.

Changing the worksheet default result format affects only the worksheet you were in when you made the change. Any other worksheets that may have been open at the time retain their own default result formats.

If you want to re-use your default result formats in other Mathcad worksheets, save your worksheet as a template as described in Chapter 4, “Worksheet Management.”

All of these formatting options affect only the display of a number. Mathcad continues to carry out all calculations in full precision regardless of formatting options. If you copy a result by choosing **Copy** from the **Edit** menu, Mathcad copies the answer to the precision displayed.

To see the number as it is stored internally:

- Click anywhere on the result.
- Press **[Ctrl][Shift]N**.

- Mathcad displays the number in full precision on the message line at the bottom of the application window, as shown in Figure 6-1.

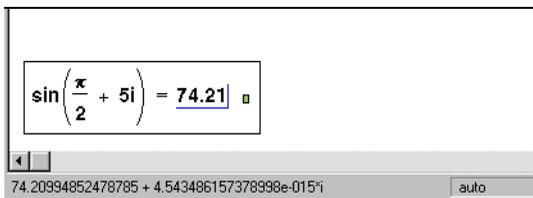
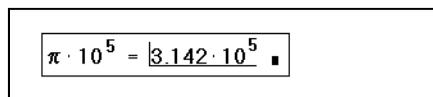


Figure 6-1: Full precision is maintained internally.

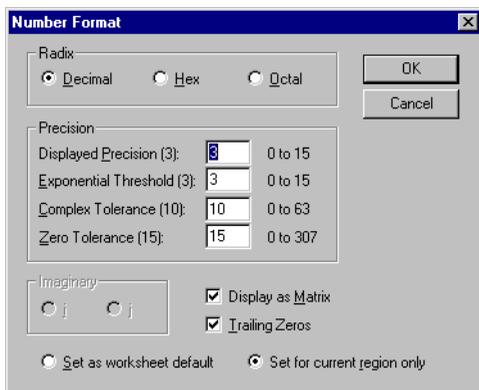
## Setting the format of a single result

You can set the format for a single result—a number, table, vector, or matrix—independently of the worksheet default result format. To change the format with which a particular result is displayed, do the following:

- Click anywhere in the equation whose result you want to format.

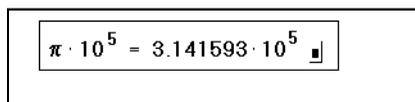


- Choose **Number** from the **Format** menu. Alternatively, double-click on the equation itself. The dialog box shown below appears. Note that the option button “Set for current region only” is already selected.



- Change the desired settings. See the section “Setting worksheet default format” on page 126 to learn what the various settings do and what their allowed values are. To display the six decimal places shown below, you would change “Displayed Precision” from 3 to 6.

- Click “OK.” Mathcad redisplay the result using the new format.



You can also apply local formats to all tables, vectors, or matrices. Just click on the table, vector, or matrix and choose **Number** from the **Format** menu. When you click on “OK,” Mathcad applies the selected format to all the numbers in the table, vector, or matrix. It is not possible to format these numbers individually.

When you click the button labeled “Set for current region only,” Mathcad disables the Imaginary Unit and Zero Tolerance settings. These settings can only be defined for the entire worksheet, not for individual regions.

To redisplay a result using the worksheet default result format settings:

- Click on the result to enclose the result between the editing lines.
- Delete the equal sign.
- Press = to replace the equal sign. The result format has now been restored to the worksheet default settings.

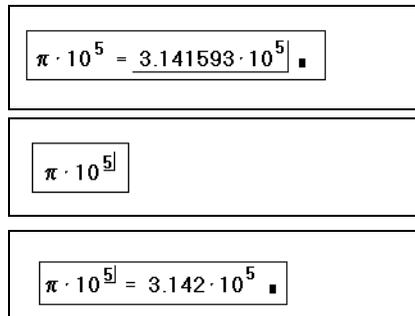


Figure 6-2 shows the same number formatted several different ways.

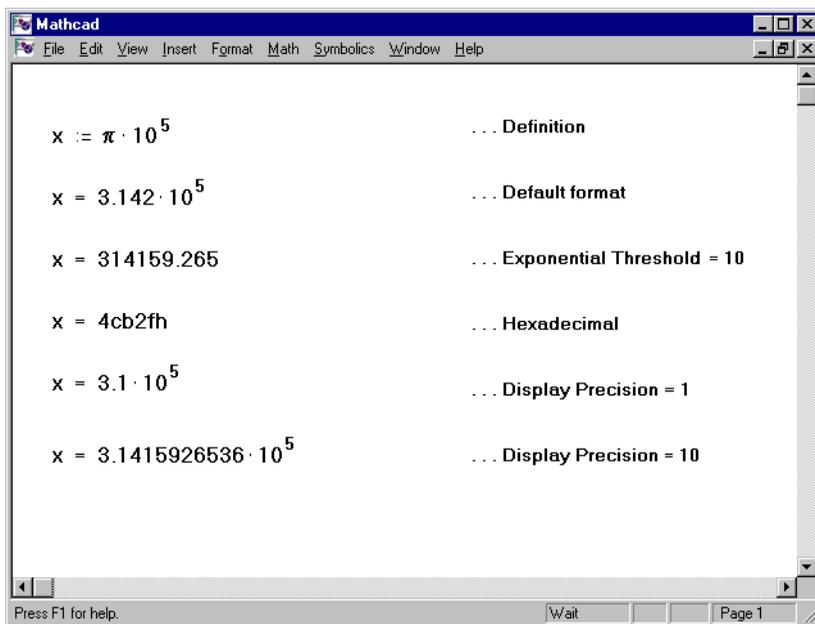


Figure 6-2: Several ways to format the same number.

## Math styles

Just as you apply predefined styles and styles you create to modify the appearance of text regions in your worksheet, as described in Chapter 5, “Text,” you apply math styles to assign particular fonts, font sizes, font styles and effects, and colors to the elements of your math regions. Mathcad has two predefined math styles that govern the default appearance of all the math in your worksheet, but you can define and apply additional styles to enhance the appearance of your equations.

Mathcad’s predefined math styles are:

- **Variables**, which governs the default appearance of all variables and plots.
- **Constants**, which governs the default appearance of all numbers you type in math regions as well as all numbers that appear in results.

Whenever you type a variable name, Mathcad:

- Assigns to it a math style named “Variables.”
- Looks up the font, font size, and font style and effects associated with that particular math style.
- Displays the variable name using the characteristics associated with the style named “Variables.”

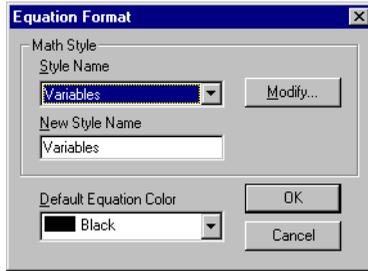
Similarly, when you type a number or when a result is calculated, Mathcad:

- Assigns to it a math style named “Constants.”
- Looks up the font, font size, and font style and effects associated with that particular math style.
- Displays the number using the characteristics associated with the style named “Constants.”

### Editing math styles

To change Mathcad’s default style for all variables and plots:

- Click on a variable name in your worksheet.
- Choose **Equation** from the **Format** menu to see the dialog box shown below. The style name “Variables” is selected.



- To change the font associated with that variable's math style, click on “Modify.” You'll see a dialog box for changing fonts.
- Click the “OK” button. Mathcad changes the font of all variables in the worksheet.

If you change the Variables style, you may also want to change the style used for numbers so that the two look good together. To do so:

- Click on a number.
- Choose **Equation** from the **Format** menu to see the Equation Format dialog box. The style name “Constants” is now selected.
- Follow the procedure given above for modifying the Variables style.

You can also use the Format Bar to change the font, font size, or font style associated with a math style. To use the Font Bar to modify some of the settings for the Variables math style, for example, click on a variable, then click on the appropriate Format Bar button to make variables bold, italic, or underlined or to specify the font or point size in the drop-down lists.



The font, font size, and font style you choose for the Variables and Constants styles (as well as any math styles you define) affect not only the appearance of equations, but the appearance of the entire worksheet. Mathcad's line-and-character grid does not respond to changes in the font sizes used in text and math. Therefore, changing font characteristics, particularly font sizes, may cause regions to overlap. You can separate these regions by choosing **Separate Regions** from the **Format** menu.

You may wish to have your equations display in a different color than your default text regions to avoid mixing the two up. To change the default color of all equations in your worksheet,

- Choose **Equation** from the **Format** menu.
- Select a color in the “Default Equation Color” drop-down list.
- Click “OK.”

## Applying math styles

As described in the previous section, variables in your Mathcad worksheet by default are assigned the “Variables” style, and numbers are assigned the “Constants” style. Answers displayed on the right of an equal sign are always assigned the “Constants” style. These two style names cannot be changed. You may, however, create and apply additional math styles, named as you choose, in your worksheets and templates.

To see what math style is currently assigned to a name or number, double-click on the name or number to select it, or simply click in the name or number, and look at the style window on the Format Bar.

Alternatively, you can double-click on the name or number and choose **Equation** from the **Format** menu. You'll see the dialog box shown in the previous section. The math style associated with whatever you clicked on will appear in the drop-down list as shown in Figure 6-3.

If you click on the button to the right of “Variables” in either the Format Bar or the Equation Format dialog box, you'll see a drop-down list of available math styles. If you now choose “User 1” and click “OK,” a new math style is applied to the variable selected in Figure 6-3 and its appearance changes accordingly. Figure 6-4 shows the result.

In this way you can apply any of a variety of math styles to:

- individual variable names in an expression, or
- individual numbers in a math expression (but not in computed results, which always display in the “Constants” style).

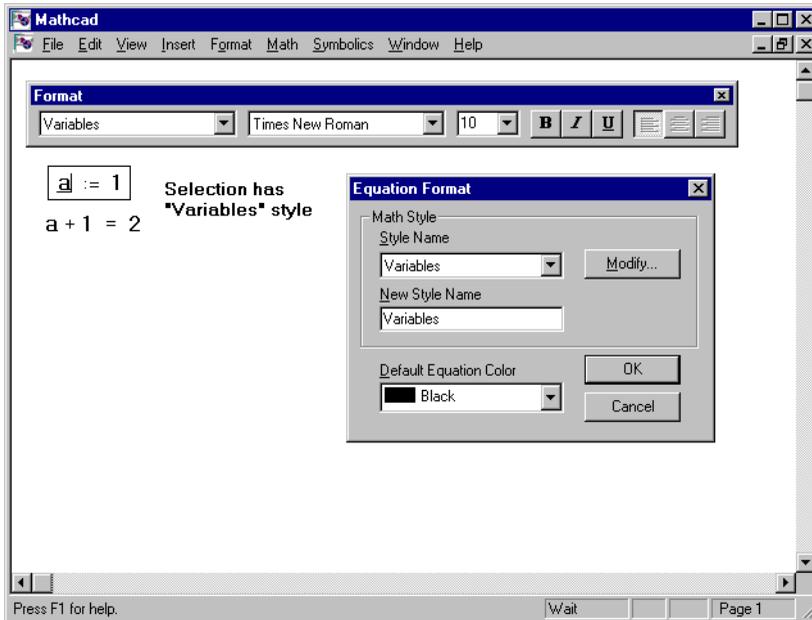


Figure 6-3: Scrolling list shows math style of selected math element.

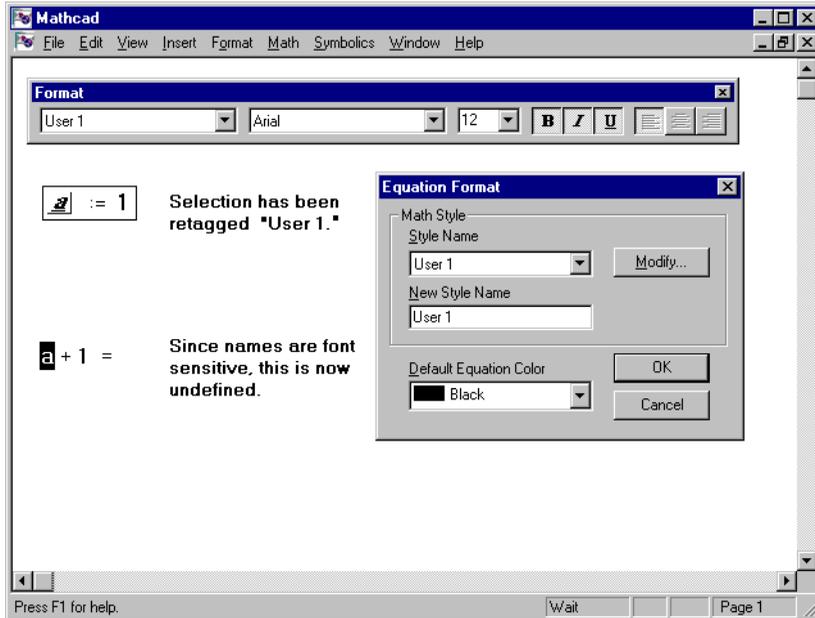


Figure 6-4: A different math style has been applied to the first variable name in Figure 6-3. Note change in font.

## Applications of math styles

You may already have encountered the styles used for determining the appearance of Mathcad text regions, as described in Chapter 5, “Text.” By making changes to text styles rather than to individual text regions, you can make sweeping and strikingly uniform changes in the way a worksheet looks. You can get this same kind of leverage in the display of equations by math styles.

For example, many math books show vectors in a bold, underlined font and matrices in a bold font. If you want to use this convention, do the following:

- Choose **Equation** from the **Format** menu.
- Click the down arrow beside the name of the current math styles to see a drop-down list of available math styles.
- Click on an unused math style name like “User 1” to select it.
- The name “User 1” should now appear in the “New Style Name” text box. Click in this text box and change the name to something like “Vectors.”
- Click on “Modify” to change this style to a bold, underlined font.

This creates a math style called “Vectors” with the desired appearance. Proceed in a similar way to create a math style named “Matrices” having a bold font. When you're done defining both styles, click “OK.”

Now rather than individually changing the font, font size, and font style for names of

vectors and matrices, you can simply change their math styles. To do so, do the following:

- Click on the name of the vector or matrix. The style assigned to that name appears on the Format Bar. By default, this is “Variables.”
- Click on the arrow beside the Format Bar window and scroll down to the math style “Vectors”. The style changes to “Vectors” and the appearance of the name changes to a bold, underlined font because that's the font assigned to the Vectors style.

Repeat the previous two steps for all vectors in the worksheet. For matrices, choose the newly created style “Matrices” instead. Note that you can apply a style to only one name at a time.

If after having done this you decide to remove all the underlines from the vectors, you can simply:

- Choose **Equation** from the **Format** menu.
- Choose “Vectors” from the drop-down list of styles at the top of the dialog box.
- Click “Modify.”
- Click on the Underline check box.

Once you click on the “OK” button, the underlines will be removed from every vector in the worksheet.

Note that this procedure changes the appearance of the *names* of vectors and matrices, not the individual vector or matrix elements themselves. The individual elements continue to have the “Variables” or “Constants” math style by default.

## Saving math styles

Once you've completed a set of math styles that you like, you need not repeat the process for other worksheets. You can save math style information by saving a worksheet as a template.

To apply math style information to another worksheet, open your template from the **File** menu and copy the contents of the worksheet to the template. For more information about worksheet templates, see Chapter 4, “Worksheet Management.”

## Font sensitivity

All names, whether function names or variable names, are font sensitive. This means that  $x$  and  $x$  refer to different variables, and  $\mathbf{f}(x)$  and  $f(x)$  refer to different functions.

In deciding whether two variable names are the same, Mathcad actually checks *math styles* rather than fonts. To avoid having distinct variables that look identical, don't create a math style with exactly the same font, size and style as another math style.

## Highlighting equations

Mathcad allows you to highlight equations so that they stand out from the rest of the equations and text in your worksheet:

To apply a background highlight color to an equation:

- Click in the equation you want to highlight.
- Choose **Properties** from the **Format** menu.
- Click on the Display tab.
- Click in the box next to “Highlight Region.” Click “Choose Color” to choose a highlight color other than the default choice.
- Click “OK.”

Mathcad fills a box around the equation with either the default background highlight color or the color you chose. This is a purely cosmetic change with no effect on the equation other than rendering it more conspicuous.

The appearance of a highlighted equation on printing will depend very much on the capabilities of your printer and the choice of highlight color. Some printers will render a color as black, obscuring the equation in the process. Others will render the exact same color as just the right gray to highlight the equation without obscuring it.

To change the default background color of a highlighted equation, do the following:

- Choose **Color** from the **Format** menu.
- Pull right and choose **Highlight** to bring up a dialog box containing a palette of colors.
- Click on the appropriate color.

