Chapter 3
Editing Equations

This chapter describes the mechanics of creating mathematical expressions and making changes in existing mathematical expressions.

The following sections make up this chapter:

Building expressions

How to create mathematical expressions in a straightforward way by just typing a stream of characters. How to create expressions by exploiting their structure.

Editing an existing expression

Inserting and deleting operators, changing the names of variables, using Cut, Delete, Paste, and Copy to streamline your editing. How to add a line break to a lengthy expression.

Rearranging your worksheet

How to move one or more expressions to another part of your worksheet.

Building expressions

You can create many mathematical expressions by simply typing in a stream of characters. Certain characters, like letters and digits, make up parts of names and numbers. Other characters, like ***** and **+**, represent "operators." For example, if you type the characters

3/4+5^2=

you get the result shown below:

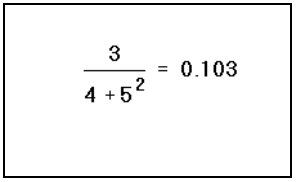


Figure 3-1: An expression and its computed value.

You can type many of these operators by clicking on the appropriate button in the various operator palettes. Each button on the Math Palette, described on page 19, calls up one of these operator palettes. Most of the operators used in this chapter are on the *arithmetic palette* which you can open by clicking on the left-most button (the one with a calculator on it). For example, instead of typing **5^2**, type 5, click on the button labeled x^y on the arithmetic palette, and type 2 in the placeholder.

On the surface, Mathcad's equation editor seems very much like a simple text editor, but there's more to it than this. Mathematical expressions have a well-defined structure and Mathcad's equation editor is designed specifically to work within that structure. In Mathcad, mathematical expressions are not so much typed in as they are built.

Mathcad automatically assembles the various parts that make up an expression using the rules of precedence and some additional rules that simplify entering denominators, exponents, and expressions in radicals. For example, when you type **/** to create a fraction, Mathcad stays in the denominator until you explicitly tell it to leave by clicking on the fraction bar. This means that the characters **3/4+5^2** generate what you see in Figure 3-1 rather than

$$\frac{3}{4} + 5^2$$

Typing in names and numbers

When you type in names or numbers, Mathcad behaves very much like a standard word processor. As you type, you'll see the characters you type appear behind a vertical editing line. The left and right arrow keys move this vertical editing line to the left or to the right a character at a time, just as they would in a word processor. There are, however, two important differences.

- As it moves to the right, the vertical editing line leaves behind a trail. This trail is a "horizontal editing line." Its importance will become apparent in the next section when you begin working with operators.

- Unless the equation you've clicked in already has an operator in it, pressing [**Space**] will turn the math region into a text region. It is not possible to turn a text region back into a math region.

Typing in operators

Operators are symbols like "+" and "–" that link variables and numbers together to form expressions. The variables and numbers linked together by operators are called "operands." For example, in an expression like:

$$a^{x+y}$$

the operands for the "+" are *x* and *y*. The operands for the *exponent* operator are *a* and the expression $x + y$.

The key to working with operators is learning to specify what variable or expression is to become an operand. There are two ways to do this:

- You can type the operator first and fill in the placeholders with operands, or
- You can learn how to use the editing lines to specify what variable or expression you want to turn into an operand.

The first method feels more like you're building a skeleton and filling in the details later. You may find this method easier to use when you're either building very complicated expressions, or when you're working with operators like summation and integration which require many operands and lack a natural typing order.

The second method feels more like straight typing and can be much faster when expressions are simple. In practice, you may find yourself switching back and forth as the need arises.

Here's how to create the expression a^{x+y} using the first method:

- Press **^** to create the exponent operator. You'll see two placeholders.

- Click in the lower placeholder and type **a**.

- Click in the upper placeholder.

- Type **+**.

- Click in the remaining placeholders and type **x** and **y**.

To use the editing lines to create the expression a^{x+y}, proceed as follows:

- Type **a**. The line beneath the *a* indicates that *a* will become the first operand of whatever operator you type next.

- Press **^** to create the exponent operator. As promised, *a* becomes the first operand of the exponent. The editing lines now surround another placeholder.

- Type **x+y** in this placeholder to complete the expression.

Note that in this example, you could type the expression the same way you'd say it out loud. However, even this simple example already contains an ambiguity. When you say "*a* to the *x* plus *y*" there's no way to tell if you mean a^{x+y} or $a^{x}+y$. For more complicated expressions, the number of ambiguities increases dramatically.

Although you could resolve any of these ambiguities by using parentheses, doing so can quickly become cumbersome. A better way is to use the editing lines to specify the operands of whatever operator you type. The following example illustrates this by describing how to create the expression $a^{x}+y$ instead of a^{x+y}.

- Type **a^x** as you did in the previous example. Note how the editing lines hold the *x* between them. If you were to type **+** at this point, the *x* would become the first operand of the plus.

- Press [**Space**]. The editing lines now hold the entire expression a^{x}.

- Now type **+**. Whatever was held between the editing lines now becomes the first operand of the plus.

- In the remaining placeholder, type **y**.

Multiplication

A common way to show multiplication between two variables on a piece of paper is to place them next to each other. For example, expressions like ax or $a(x + y)$ are easily understood to mean "a times x" and "a times the quantity x plus y," respectively.

This cannot be done with Mathcad variables for the simple reason that when you type **ax**, Mathcad has no way of knowing whether you mean "a times x" or "the variable named ax." Similarly, when you type **a(x+y)**, Mathcad cannot tell if you mean "a times the quantity x plus y" or whether you mean "the function a applied to the argument $x + y$."

In the special case when you type a numerical constant followed immediately by a variable name, such as **4x**, Mathcad interprets the expression to mean the constant multiplied by the variable: $4 \cdot x$. Mathcad displays a space between the constant and the variable to indicate that the multiplication is implied. You can produce math notation in this way that closely approximates the notation you see in textbooks and reference books. Note that Mathcad reserves certain letters, such as "i" for the imaginary unit and "o" for octal, as suffixes for numbers, and in these cases will not attempt to multiply the number by a variable name but rather will treat the expression as a single number with a suffix.

To avoid ambiguity, we recommend that you press ***** explicitly to indicate multiplication, as shown in the following example:

- Type **a** followed by *****. Mathcad inserts a small dot after the "a" to indicate multiplication.

- In the placeholder, type the second factor, **x**.

An annotated example

When it comes to editing equations, knowing how to use the editing lines assumes an importance similar to knowing where to put the flashing vertical bar you see in most word processors. A word processor can get away with a vertical bar because text is inherently one-dimensional, like a line. New letters go either to the left or to the right of old ones. Equations, on the other hand, are really *two-dimensional*. Their structure is more like a trees with branches than like a line of text. As a result, Mathcad has to use a *two-dimensional* version of that same vertical bar. That's why there are two editing lines: a vertical line and a horizontal line.

Suppose, for example, that you want to type the slightly more complicated expression

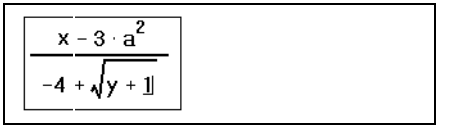
$$\frac{x - 3 \cdot a^2}{-4 + \sqrt{y + 1}}$$

Watch what happens to the editing lines in the following steps:

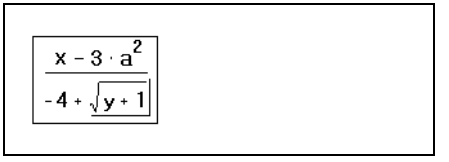
- Type **x-3*a^2**. Since the editing lines contain just the "2," only the "2" becomes the numerator when you press the **/**. Since we want the whole expression, $x - 3 \cdot a^2$, to be the numerator, we must make the editing lines hold that entire expression.

- To do so, press the [**Space**]. Each time you press the [**Space**], the editing lines hold more of the expression. You'll need to press [**Space**] three times to enclose the entire expression.

- Now press **/** to create a division bar. Note that the numerator is whatever was enclosed between the editing lines when you pressed **/**.

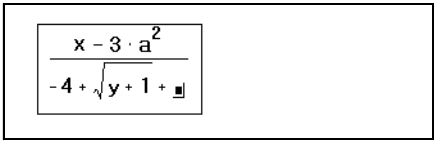


- Now type **-4+** and click on the button labeled "$\sqrt{\ }$" on the arithmetic palette. Then type **y+1** under the radical to complete the denominator.

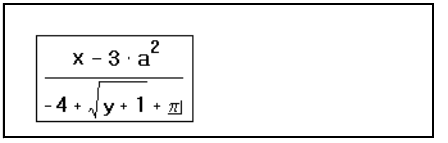


- To add something *outside* the radical sign, press [**Space**] twice make the editing lines hold the radical. For example, to add the number π to the denominator, press [**Space**] twice.

- Press **+**. Since the editing lines were holding the entire radical, it is the entire radical that becomes the first operand when you press **+**.



- Click on the button labeled "π" on the arithmetic palette. This is one of Mathcad's built-in variables.



Editing an existing expression

This section describes how to make changes to an existing expression.

The simplest changes you can make are discussed in "Changing a name or number" on page 61. Here, the underlying tree structure of a math expression doesn't matter. As a result, the equation editor behaves very much like a text editor.

Most difficulties in editing equations arise from working with operators. That's because it's only when you start working with operators that the underlying tree structure of a math expression shows up.

The next few sections describe the three things you can do with an operator: inserting an operator, deleting an operator, or replacing one operator with another.

The equation editor normally works from left to right. If you want to insert an operator *before* an existing expression, or if you want to apply a function to an existing expression, see "Inserting an operator" on page 62 and "Applying a function to an expression" on page 66.

Although Mathcad inserts parentheses wherever required to prevent ambiguity, you may at times want to add parentheses to clarify an expression or delete extraneous parentheses. To do so, use the techniques described in the sections "Inserting parentheses" on page 67 and "Deleting parentheses" on page 68.

When working with a complicated expression, it is often easier to work with more manageable subexpressions within it. The sections "Moving parts of an expression" on page 68 and "Deleting parts of an expression" on page 69 describe how to use **Cut**, **Copy**, and **Paste** to do so.

Changing a name or number

To edit a name or number:

- Click on it with the mouse. This places the editing lines wherever you clicked the mouse.
- Move the editing lines if necessary by pressing the [→] and [←] keys. Alternatively, place the mouse pointer wherever you want the editing lines to go, and click the mouse.
- If you type a character, it will appear just to the left of the editing lines. Pressing [**Bksp**] removes the character to the left of the editing lines. Pressing [**Delete**] removes the character to the right of the editing lines.

If you need to change several occurrences of the same name or number, you may find it useful to choose **Replace** from the **Edit** menu. To search for a sequence of characters, choose **Find** from the **Edit** menu. These commands are discussed further in Chapter 5, "Text."

Inserting an operator

The easiest place to insert an operator is between two characters in a name or two numbers in a constant. For example, here is how to insert a plus sign between two characters:

- Place the editing lines where you want the plus sign to be.

- Press the **+** key.

Note that Mathcad automatically inserts a space on either side of the plus sign. You should never need to insert a space when typing an equation. Mathcad inserts spaces automatically wherever doing so is appropriate. In fact, if you do try to insert a space, Mathcad assumes you meant to type text rather than math and converts your math region into a text region accordingly.

Operators such as division and exponentiation result in more dramatic formatting changes. For example, when you insert a divide sign, Mathcad moves everything that comes after the divide sign into the denominator. Here's how you insert a divide sign.

- Place the editing lines where you want the divide sign to be.

- Press the **/** key. Mathcad reformats the expression to accommodate the division.

Some operators require only one operand. Examples are the square root, absolute value, and complex conjugate operators. To insert one of these, place the editing lines on either side of the operand and press the appropriate keystroke. Many of these operators are available on the arithmetic palette as well. For example, to turn *x* into $\sqrt{x}$ do the following:

- Place the editing lines around the "*x*," either preceding or following the character.

- Press **** to insert the square root operator.

Applying an operator to an expression

The methods described in the previous section work most predictably when you want to apply an operator to a variable or a number. If, however, you want to apply an operator to an *entire expression* there are two ways to proceed:

- You can surround that expression in parentheses and proceed as described in the previous section, or
- You can use the editing lines to specify the expression you want to apply the operator to.

Although the first method may be more intuitive, it is definitely slower since you will need to type pairs of parentheses. The more efficient second method is the subject of this section. The sections “Inserting parentheses” on page 67 and “Deleting parentheses” on page 68 describe ways to work with parentheses more efficiently.

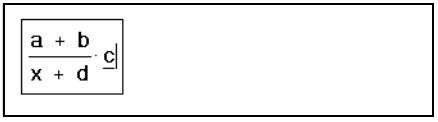
The editing lines consist of a horizontal line and a vertical line that moves left to right along the horizontal line. To make an operator apply to an expression, select the expression by placing it between the two editing lines. The following examples show how typing ***c** results in completely different expressions depending on what was selected.

- Here, the two editing lines hold only the numerator. This means any operator you type will apply only to the numerator.

- Typing ***c** results in this expression. Note how the expression held between the editing lines became the first operand of the multiplication.

- Here, the editing lines hold the entire fraction. This means any operator you type will apply to the entire fraction.

- Typing ***c** results in this expression. Note how the everything between the editing lines became the first operand of the multiplication.



- Here, the editing lines hold the entire fraction as they did in the previous example. However, this time the vertical editing line is on the *left* side instead of on the right side.

- Typing ***c** results in this expression. Note how the expression enclosed by the editing lines became the *second* rather than the first operand of the multiplication. This happened because the vertical editing line was on the *left* side rather than the right side.

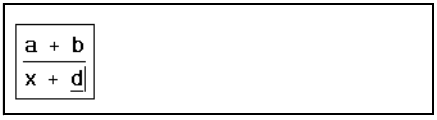
Now that you know the significance of what's held between these two editing lines, the pertinent question becomes “How do I control what's held between the two editing lines?”

One way to control the length of the editing lines is to click on an operator. When you click on an operator, you make the pair of editing lines hold that operator together with everything that operator applies to. Depending on exactly where on the operator you click, you'll find the vertical editing line either on the left or on the right. Use the [**Insert**] key to move it from one side completely to the other, or use the left and right arrow keys to move a character at a time.

A second way to control the length of the two editing lines is to press [**Space**] to cycle through all possible positions of the editing lines. Each time you press [**Space**] the editing lines grow progressively longer. As they do so, they enclose more and more of the expression, until eventually, they enclose the entire expression. Pressing [**Space**] one more time brings the editing lines back to where they were when you started.

The following example walks you through a short cycle:

- This is the starting position. The two editing lines hold just the single variable “*d*.”



- Pressing [**Space**] makes the editing lines grow so that they now hold the entire denominator.

- Pressing [**Space**] once makes the editing lines grow again so that they now hold the entire expression.

- At this point, the editing lines can't become any longer. Pressing [**Space**] brings the editing lines back to the starting point of the cycle.

You'll notice that in stepping through the previous cycle there was never an intermediate step in which the editing lines held just the numerator. Nor was there ever a step in which the editing lines held just the *a* or just the *b* in the numerator. That's because the sequence of steps the editing lines go through as you press [**Space**] depends on the starting point of the cycle.

To set the starting point of the cycle, you can either click on the appropriate part of the expression as described earlier, or you can use the arrow keys to move around the

expression. The arrow keys walk the editing lines through the expression in the indicated direction. Keep in mind however that the idea of “up” and “down” or “left” and “right” may not always be clear, particularly when the expression becomes very complicated or when the expression involves summations, integrals and other advanced operators.

Deleting an operator

To delete an operator connecting two variable names or constants:

- Place the editing lines after the operator.

- Press the [**BkSp**] key.

Now you can easily insert a new operator to replace the one you deleted just by typing it in.

You can also delete an operator by placing the editing lines before it and pressing the [**Delete**] key instead. For example:

- Place the editing lines before the operator.

- Press the [**Delete**] key.

In the above examples, it is easy to see what “before” and “after” mean because the expressions involved naturally flow from left to right, the same way we read. Fractions behave the same way. Since we would naturally say “*a* over *b*,” putting the editing lines “after” the division bar means putting them just before the *b*. Similarly, putting the editing lines “before” the division bar means putting them immediately after the *a*. The following example illustrates this:

- Place the editing lines *after* the division bar.

- Press the [**BkSp**] key.

To delete an operator having only one operand (for example, $\sqrt{x}$, $|x|$ or $x!$):

- Position the editing lines just after the operator.

- Press the [**BkSp**] key.

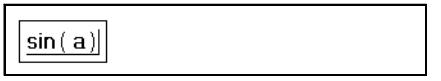
For certain operators, it may not be clear where to put the editing lines. For example, it is not clear when looking at $|x|$ or $\bar{x}$ what "before" and "after" mean. When this happens, Mathcad resolves the ambiguity by referring to the spoken form of the expression. For example, since you would read $\bar{x}$ as "*x* conjugate," the bar is treated as being *after* the *x*.

Inserting a minus sign

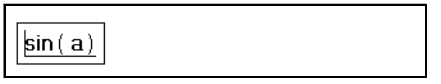
The minus sign that means "opposite of" uses the same keystroke as the one that means "subtract." To determine which one to insert, Mathcad looks at where the vertical editing line is. If it's on the left, Mathcad inserts the "opposite of" minus sign. If it's on the right, Mathcad inserts the "subtract" minus sign. To move the vertical editing line from one side to the other, use the [**Insert**] key.

The following example shows how to insert a minus sign in front of the expression "sin(*a*)."

- Click on the sin(*a*).



- If necessary, press [**Insert**] to move the vertical editing line all the way to the left.



- Type **-** to insert a minus sign.

If what you really want to do is turn $\sin(a)$ into $1 - \sin(a)$, insert another operator (say, "+") as described in the section "Inserting an operator" on page 62. Then replace the operator with a minus sign as described in the section "Deleting an operator" on page 65. Notice that in Mathcad the unary minus sign in the expression $-\sin(a)$ appears smaller than the minus sign in expressions such as $1 - \sin(a)$.

Applying a function to an expression

To turn an expression into the argument of a function, follow these steps:

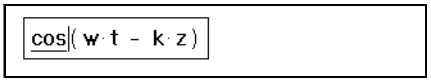
- Click in the expression and press [**Space**] until the entire expression, $w \cdot t - (k \cdot z)$, is held between the editing lines.

- Type the single-quote key (the same as the double-quote key, but unshifted). The selected expression is enclosed by parentheses.

- Press [**Space**]. The editing lines now hold the parentheses as well.

- If necessary, press the [**Insert**] key. The vertical editing line switches to the left side. If the vertical editing line is already on the left side, skip this step.

- Now type the name of the function. If the function you wish to use is a built-in function, you can choose **Function** from the **Insert** menu and double-click on the name of the function.



Inserting parentheses

Mathcad places parentheses automatically as needed to maintain the precedence of operations. There may be instances however, when you want to place parentheses to clarify an expression or to change the overall structure of the expression. You can either insert a matched pair of parentheses all at once or you can insert the parentheses one at a time. We recommend you insert a matched pair since this avoids the possibility of unmatched parentheses.

To enclose an expression with a matched pair of parentheses:

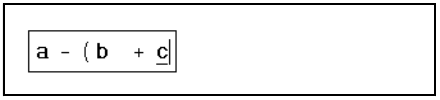
- Select the expression by placing it between the editing lines. You can do this by clicking on the expression and pressing [**Space**] one or more times.

- Type the single-quote key. The selected expression is now enclosed by parentheses.

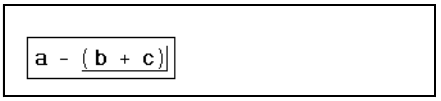
It is sometimes necessary to insert parentheses one at a time using the **(** and **)** keys. For example, to change $a - b + c$ to $a - (b + c)$ do the following:

- Move the editing lines just to the left of the *b*. Make sure the vertical editing line is on the left as shown. Press [**Insert**] if necessary to move it over.

- Type **(**. Now click to the right of the *c*. Make sure the vertical editing line is to the right as shown. Press [**Insert**] if necessary to move it over.



- Type **)**.

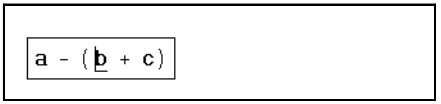


Deleting parentheses

You cannot delete one parenthesis at a time. Whenever you delete one parenthesis, Mathcad deletes the matched parenthesis as well. This prevents you from inadvertently creating an expression having unmatched parentheses.

To delete a matched pair of parentheses:

- Move the editing lines to the right of the "(".



- Press the [**BkSp**] key. Note that you could also begin with the editing lines to the left of the ")"and pressing the [**Delete**] key instead.

Moving parts of an expression

The menu commands **Cut**, **Copy**, and **Paste** from the **Edit** menu are useful for editing complicated expressions. They function as follows:

- **Cut** deletes whatever is between the editing lines and copies it to the clipboard.
- **Copy** takes whatever is between the editing lines and copies it to the clipboard.
- **Paste** takes whatever is on the clipboard and places it into your worksheet, either into a placeholder or into the blank space between equations.

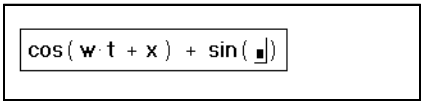
The following example shows how to use **Copy** and **Paste** to eliminate retyping.

Suppose you want to build the expression

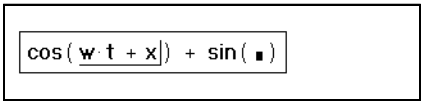
$$\cos(wt + x) + \sin(wt - x)$$

The argument to the sine function is nearly identical to that of the cosine function. You can take advantage of the similarity between the arguments of these two functions by doing the following:

- Build the first term, then leave a placeholder where the argument to the sine should go. Type **sin()** to do this.

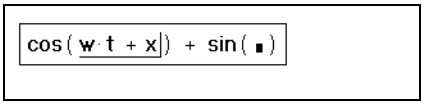


- Click in the argument to the cosine function and press [**Space**] until the editing lines hold the argument between them. The expression looks like that shown on the right.

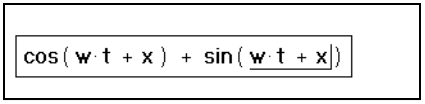


- Choose **Copy** from the **Edit** menu.

- Click on the placeholder inside the sine function.



- Choose **Paste** from the **Edit** menu. The expression now looks like that shown on the right.

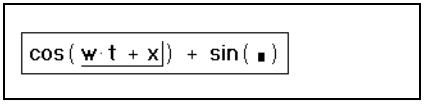


Now replace the "+" with a "–".

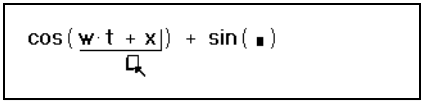
The **Copy** and **Paste** commands described above use the clipboard to move expressions from one place to another. There may, however, be times when you don't want to disturb the clipboard. You can bypass the clipboard by using Mathcad's drag and drop feature.

Suppose, as in the previous example, that you want to copy the expression $w \cdot t + x$ and place it in the placeholder inside the sine function.

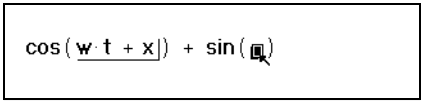
- Select the argument to the cosine function. The expression looks like that shown on the right.



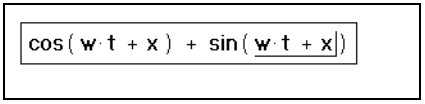
- Press and hold down the [**Ctrl**] key and the mouse button. The pointer changes as shown on the right to indicate that it carries the selected expression with it. It continues to carry the selected expression until you release the mouse button.



- With the mouse button still held down, drag the small box at the arrow's tip over the placeholder.



- Release the mouse button. The pointer drops the expression into the placeholder. It then recovers its original form to indicate that its contents have been discharged.



You can drag and drop expressions into placeholders in other expressions or into any blank space in your worksheet. Just be sure you don't let go of the mouse button before you've dragged the pointer wherever you want to drop the expression. If you're trying to drop the expression into a placeholder, be sure to position the hollow box carefully over the placeholder.

If you don't want to leave behind a copy of the expression as shown in the above example, follow the same procedure using the [**Shift**] key instead of the [**Ctrl**] key.

Deleting parts of an expression

You can avoid having to repeatedly backspace over parts of an expression by choosing **Cut** from the **Edit** menu. This will delete whatever is between the editing lines place it on the clipboard.

The following example shows how you can use the cut command to delete a significant part of an expression.

Suppose you want to change the expression

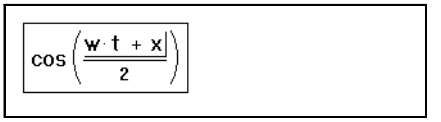
$$\cos\left(\frac{w \cdot t + x}{2}\right)$$

into

$$\cos\left(\frac{x}{2}\right)$$

Rather than repeatedly backspacing, you can do the following:

- Select the numerator as shown on the right.



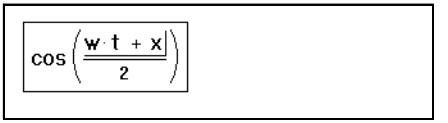
- Choose **Cut** from the **Edit** menu. This removes the numerator and leaves behind a placeholder.

- Type **x** in the placeholder.

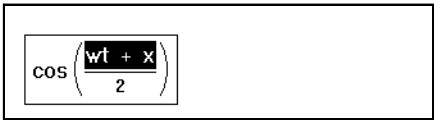
You can also delete part of an expression by using either the [**Delete**] key or the [**BkSp**] key. If you use this method however, whatever you delete will *not* go to the clipboard. This is useful when you intend to replace whatever you delete with whatever is currently on the clipboard.

To delete part of an expression *without* placing it on the clipboard:

- Select the numerator as shown on the right. Note that the vertical editing line is to the right.



- Press [**BkSp**]. Mathcad highlights your selection to indicate what you've proposed to delete. Mathcad takes this extra step since once you delete, you'll have to retype the expression to get it back.



- Press [**BkSp**] one more time. This removes the numerator and leaves behind a placeholder.

To use the [**Delete**] key instead of the [**BkSp**] key, follow the preceding instructions but place the vertical editing line on the *left* side of the expression.

Rearranging your worksheet

This section describes how to rearrange expressions, graphics and text in your worksheets. The techniques described here work equally well for everything in your worksheet: equations, plots, sketches and text. Before you use the methods in this section, click in the empty space between regions to turn the cursor into a crosshair.

You can get an overall view of how your worksheet looks by choosing **Zoom** from the **View** menu and choosing a magnification from the Zoom dialog box. Set the magnification:

- Less than 100% to zoom out for an overall view.
- Greater than 100% to zoom in for a close-up view.

Selecting, cutting, pasting and aligning regions work the same way regardless of the magnification you choose.

Selecting regions

Before you can move or copy one or more regions, you must select them. To do so:

- Press and hold down the mouse button to anchor one corner of the selection rectangle.
- Without letting go of the mouse button, move the mouse so as to enclose everything you want to select inside the selection rectangle.
- Once the selection rectangle encloses everything you want to select, release the mouse button. Mathcad encloses those regions you have selected.

Figure 3-2 shows how the worksheet might look just before you release the mouse button.

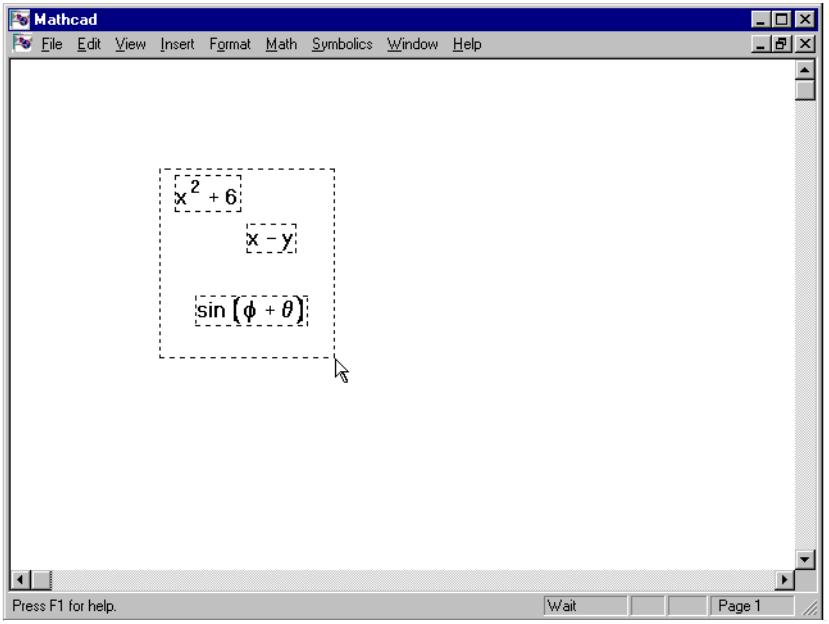


Figure 3-2: Several regions enclosed in a selection rectangle.

Copying regions

Once the regions are selected, you can copy them:

- by using **Copy** and **Paste**, or
- if the regions start out in either an Electronic Book or in a locked area, by dragging them with the mouse

To use the **Copy** and **Paste** commands:

- Select the regions as described in the previous section.
- Choose **Copy** from the **Edit** menu. This copies the selected regions into the clipboard.
- Click the mouse wherever you want to place a copy of the regions. You can click either someplace else in your worksheet or in a different worksheet altogether. Make sure you've clicked in an empty space. You should see the crosshair.
- Choose **Paste** from the **Edit** menu.

If the regions you want to copy are coming from a locked area or from an Electronic Book, you can also copy them by dragging them with the mouse. To do so:

- Select the regions as described in the previous section.
- Place the pointer on the border of any selected region. It should turn into a small hand.
- Hold down the mouse button.

- Without letting go of the button, move the mouse. You'll see the rectangular outlines of the selected regions move as you move the mouse.

At this point, you can either copy the selected regions to another spot in the worksheet, or you can copy them into another worksheet.

To copy the selected regions to another spot in the worksheet, move the rectangular outlines to wherever you want to place the regions and let go of the mouse button. If you want to copy the region to a spot beyond what you can see in the window, just drag the regions in the appropriate direction. Mathcad will automatically scroll in that direction.

To copy the selected regions into another worksheet, press the mouse button and drag the rectangular outlines toward the destination worksheet. Do not linger near the window's frame; drag the regions decisively across the frame and into the destination worksheet. Mathcad responds to hesitation near the window's frame by autoscrolling the document in the indicated direction.

Moving regions

Once the regions are selected, you can move them by:

- dragging with the mouse or,
- using **Cut** and **Paste**.

To drag regions with the mouse:

- Select the regions as described in the previous section.
- Place the pointer on the border of any selected region. The pointer will turn into a small hand.
- Press and hold down the mouse button.
- Without letting go of the button, move the mouse. You'll see the rectangular outlines of the selected regions following the mouse pointer.

At this point, you can either drag the selected regions to another spot in the worksheet, or you can drag them to another worksheet.

To move the selected regions to another spot in the worksheet, move the rectangular outlines to wherever you want to place the regions and let go of the mouse button. If you want to move the region to a spot beyond what you can see in the window, just drag the regions in the appropriate direction. Mathcad will automatically scroll in that direction.

To copy the selected regions into another worksheet, press the mouse button and drag the rectangular outlines toward the destination worksheet. Do not linger near the window's frame; drag the regions decisively across the frame and into the destination worksheet. Mathcad responds to hesitation near the window's frame by autoscrolling the document in the indicated direction.

You can also move the selected regions by using **Cut** and **Paste**. To do so:

- Select the regions as described in the previous section.

- Choose **Cut** from the **Edit** menu. This deletes the selected regions and puts them on the clipboard.
- Click the mouse wherever you want the regions moved to. Make sure you've clicked in an empty space. You can click either someplace else in your worksheet or in a different worksheet altogether. Make sure the cursor looks like a crosshair.
- Choose **Paste** from the **Edit** menu.

Aligning Regions

Once regions are selected, you can align them either horizontally or vertically by choosing **Align Regions** from the **Format** menu. This is a pull-right menu. Drag the mouse to the right to display two additional choices: **Across** and **Down**. You can also choose these commands by clicking on the appropriate button on the toolbar.

When you choose **Align Regions⇒Down** from the pull-right menu, Mathcad does the following:

- Mathcad draws an invisible vertical line halfway between the right edge of the right-most selected region and the left edge of the left-most selected region.
- All selected regions to the right of this line are moved left until their left edges are aligned with this line.
- All selected regions to the left of this line are moved right until their left edges are aligned with this line.

Choosing **Align Regions⇒Across** works in much the same way. Mathcad draws an invisible horizontal line halfway between the top edge of the uppermost region and the bottom edge of the lowest region. Selected regions below and above this line are moved up and down respectively until the midpoints of their left edges are on this line.

Note that this means it is possible to inadvertently make regions overlap. If, for example, the regions you select are almost horizontally aligned, choosing **Align Regions⇒Down** may result in overlapping regions.

Deleting regions

To delete one or more regions:

- Select the regions by dragging.
- Choose **Cut** from the **Edit** menu.

Choosing **Cut** removes the selected regions from your worksheet and puts them on the clipboard. If you don't want to disturb the contents of your clipboard or if you don't want to save the selected regions, choose **Delete** from the **Edit** menu instead.

Alternative ways to select regions

There are actually three different ways to select regions. Which one you choose depends on the arrangement of the regions you want to select.

The most common, selection by dragging the mouse, was discussed in a previous section. This is useful when the regions you want to select are not too far apart, and can be enclosed in a rectangle.

The two additional methods are:

- Shift-clicking on the regions you want to select.
- Marking the two endpoints of a selection by clicking on them with the [**Ctrl**] key held down.

Shift-clicking is useful when you want to select or deselect a region without affecting any other regions. For example, you should shift-click when:

- You can't easily enclose the regions you want to select inside a rectangle. For example, if one region is near the top of a worksheet and the other is near the bottom, you cannot enclose them both in a rectangle without also enclosing many other regions in between.
- You want to add several more regions to a collection of regions you may have selected some other way.
- Several regions are selected and you want to deselect one of them.

To select regions by shift-clicking, do the following:

- Move the mouse pointer to the first region you want to select,
- Press and hold down the [**Shift**] key and click the mouse button.

Mathcad surrounds the selected region in a selection rectangle. To select additional regions, repeat these steps with the mouse on the region you want to select. Make sure you hold down the [**Shift**] key while clicking. If you don't, Mathcad will select whatever you shift-click on, but deselect all other selected regions.

When there are a lot of regions to select, the selection rectangle may become unwieldy. In such cases, you can fill in your selection by control-clicking as follows:

- Select one or more regions either by shift-clicking, or by using the selection rectangle.
- With the [**Ctrl**] key held down, click on the last region in your selection.

Mathcad selects all regions between the first selected region and whatever region you control-clicked on. This may include regions beyond the right or left edges of your window. You can think of control-clicking as a quick way to shift-click every region between the first and last regions selected.

The last region selected need not be the one you control-click on. If you control-click on a region between two selected regions, Mathcad selects all regions between the two selected regions.

Inserting or deleting blank lines

You can easily insert one or more blank lines into your worksheet. The procedure is as follows:

- Click on the blank line below which you want to insert one or more blank lines. Make sure the cursor looks like a crosshair.
- Press [↵] to insert a blank line and move the cursor to the left margin. Do this as many times as you want to insert lines.

To delete one or more blank lines from your worksheet:

- Click above the blank lines you want to delete. Make sure the cursor looks like a crosshair and that there are no regions to the right or left of the cursor.
- Press [**Delete**] as many times as there are lines you want to delete. Mathcad deletes blank lines below your cursor.
- Alternatively, press [**BkSp**] as many times as there are lines you want to delete. Mathcad deletes blank lines *above* your cursor.

If you press either [**Delete**] or [**BkSp**] and nothing seems to be happening, check to make sure that the cursor is on a line all by itself. If any region in your worksheet extends into the line you are trying to delete, Mathcad won't be able to delete that line.

Separating regions

As you move and edit the regions in a Mathcad worksheet, they may end up overlapping one another. Overlapping regions don't interfere with each other's calculations, but they do make worksheets hard to read.

A good way to determine whether regions overlap is to choose **Regions** from the **View** menu. Mathcad will display blank space in gray and leave the regions in white. Figure 3-3 shows an example.

To separate all overlapping regions, choose **Separate Regions** from the **Format** menu. Wherever regions overlap, this command will move the regions in such a way as to avoid overlaps while preserving the order of the calculations.

Be careful with the **Separate Regions** menu command since not only can it have far-reaching effects, it also cannot be undone. As an alternative, consider dragging regions individually, adding lines by pressing [**Insert**], or cutting and pasting the equations so they don't overlap.

Figure 3-4 shows the worksheet from Figure 3-3 after having chosen **Separate Regions** from the **Format** menu. To turn the blank space back into white, choose **Regions** from the **View** menu again.

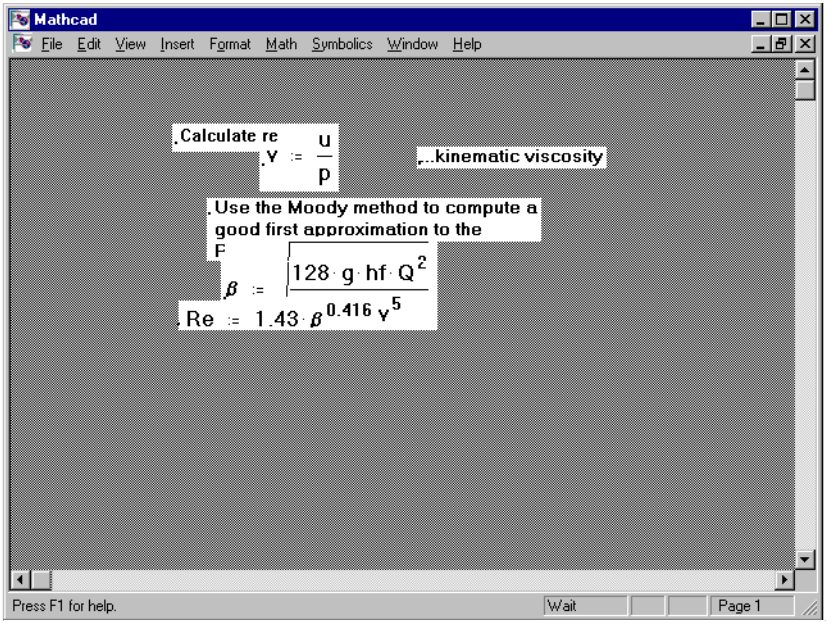


Figure 3-3: Worksheet with overlapping regions.

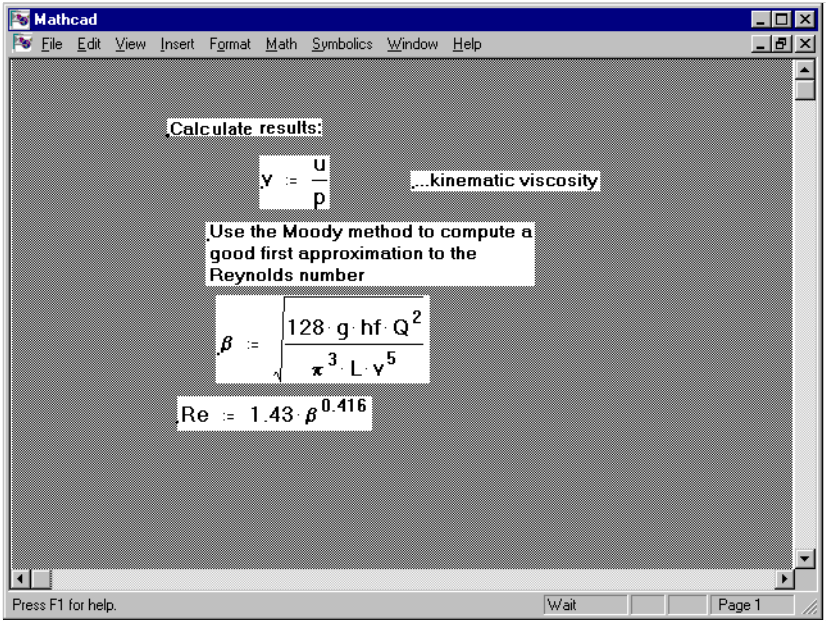


Figure 3-4: After separating the regions.