

**LibreOffice**  
The Document Foundation

## Getting Started Guide

# *Chapter 9*

## *Getting Started with Math*

*LibreOffice's Equation Editor*

## Copyright

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## Acknowledgments

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## Publication date and software version

Published 21 June 2012. Based on LibreOffice 3.5.4.

## Note for Mac users

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Some keystrokes and menu items are different on a Mac from those used in Windows and Linux. The table below gives some common substitutions for the instructions in this chapter. For a more detailed list, see the application Help.

<i>Windows or Linux</i>	<i>Mac equivalent</i>	<i>Effect</i>
<b>Tools &gt; Options</b> menu selection	<b>LibreOffice &gt; Preferences</b>	Access setup options
<i>Right-click</i>	<i>Control+click</i>	Opens a context menu
<i>Ctrl (Control)</i>	<i>⌘ (Command)</i>	Used with other keys
<i>F5</i>	<i>Shift+⌘+F5</i>	Opens the Navigator
<i>F11</i>	<i>⌘+T</i>	Opens the Styles and Formatting window

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## What is Math?

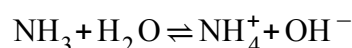
Math is LibreOffice's component for writing mathematical and chemical equations. It is most commonly used as an equation editor for text documents, but it can also be used with other types of documents or as a stand-alone editor. When used inside Writer, the equation is treated as an object inside the text document.

### Note

The equation editor is for writing equations in symbolic form, as in equation 1. If you want to evaluate a numeric value, see the *Calc Guide*.

$$\frac{df(x)}{dx} = \ln(x) + \tan^{-1}(x^2) \quad (1)$$

or



## Getting started

You can create an equation (formula) as a separate document or insert it into a document in Writer or another component of LibreOffice.

### Creating an equation as a separate document

To create an equation as a separate document, open Math component using one of these methods:

- On the menu bar, choose **File > New > Formula**.
- On the standard toolbar, click the triangle to the left of the **New** icon and choose **Formula**.
- From the Start Center, click **Formula**.

An empty formula document opens (see Figure 1).

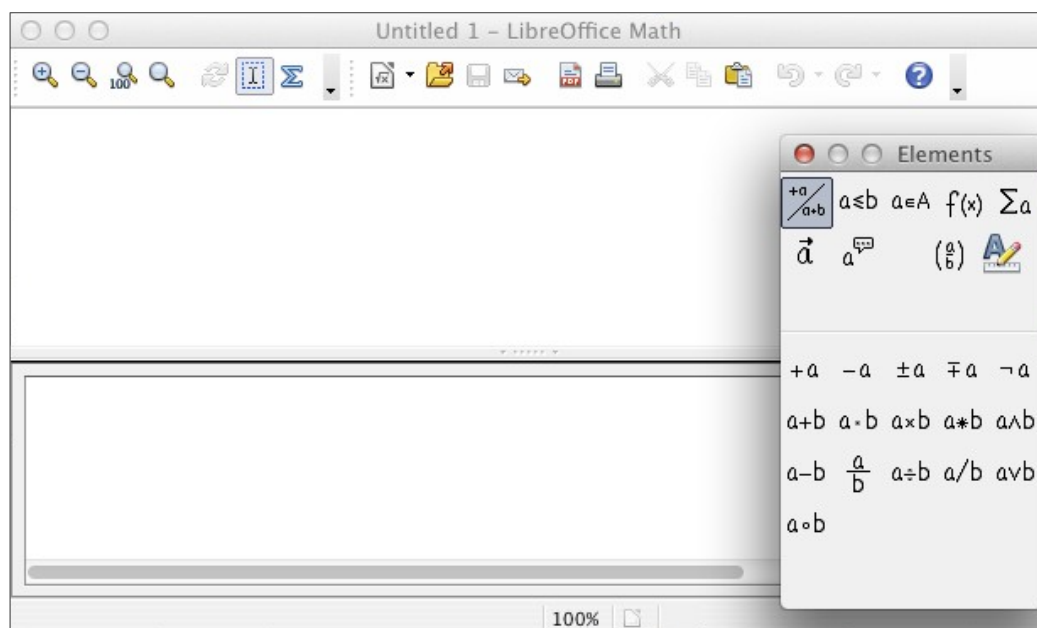


Figure 1: An empty formula document

The upper area is the preview window, where the equation will appear during and after input. The lower area is the equation editor, where the markup code for the equation is entered. The floating Elements window will also appear.

## Inserting a formula into a Writer document

To insert a formula into a Writer document, open the document and then choose **Insert > Object > Formula** from the menu bar.

The formula editor opens at the bottom of the Writer window, and the floating Elements window appears. You will also see a small box with a gray border in your document, where the formula will be displayed, as shown in Figure 2.

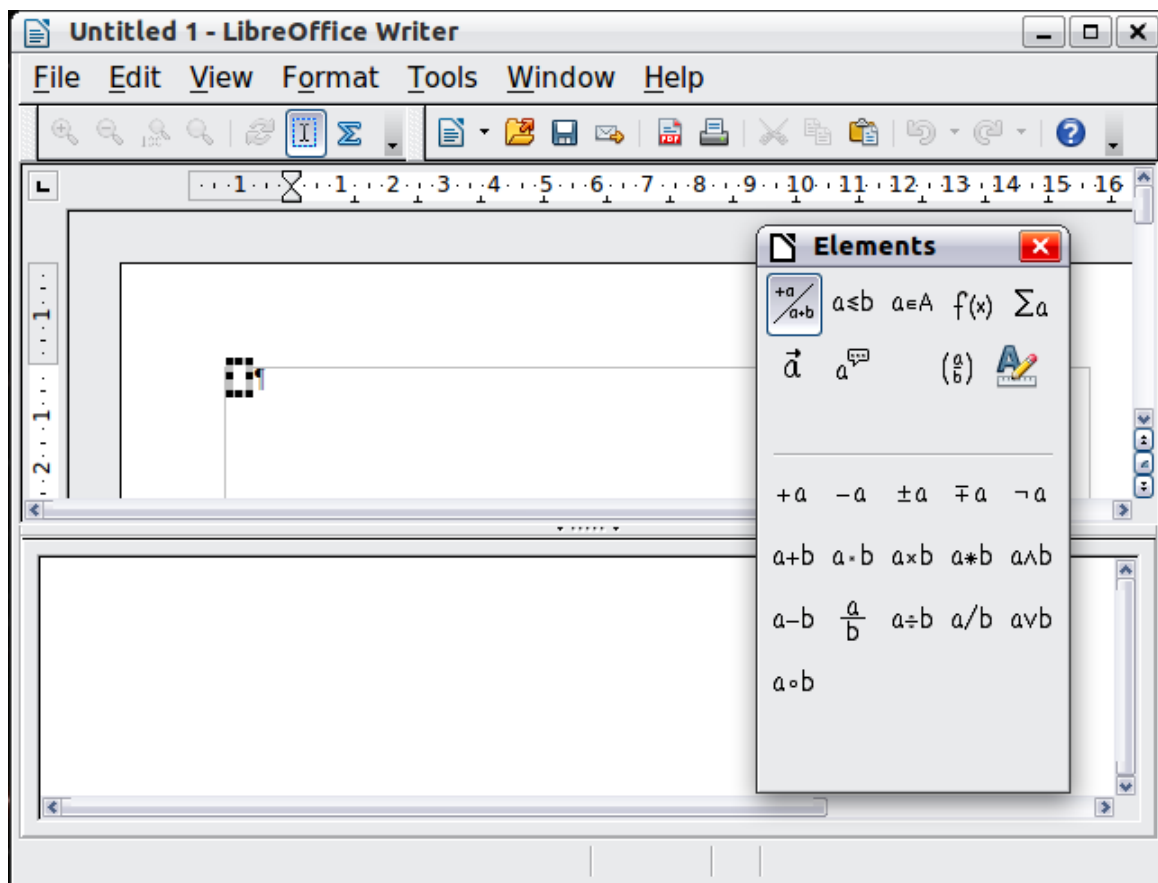


Figure 2: Equation Editor, Elements window, and location of resulting equation

When you are done entering the formula, you can close the editor by pressing the *Esc* key or by clicking an area outside the formula in the main document. A double-click will open the editor again, so you can edit the formula.

Formulas are inserted as OLE objects. In a Writer document, the formula is inserted as a default character, so it is embedded in the continuous text. You can, as with any other OLE object, change the anchor and make the formula floating. In Impress and Draw documents, formulas are embedded as floating OLE objects.

If you frequently need to insert formulas, it is advisable to add the Formula icon to the Standard toolbar or create a keyboard shortcut. See Chapter 14, Customizing LibreOffice, for more information.

## Entering a formula

The equation editor uses a markup language to represent formulas. For example, `%beta` creates the Greek character beta (  $\beta$  ). This markup is designed to read in a similar way to English

whenever possible. For example, `a over b` produces a fraction:  $\frac{a}{b}$ .

You can enter a formula in three ways:

- Select a symbol from the Elements window.
- Right-click on the equation editor and select the symbol from the context menu.
- Type markup in the equation editor.

The context menu and the Elements window insert the markup corresponding to a symbol. This provides a convenient way to learn the Math markup.

### Note

Click on the document body to exit the formula editor.  
Double-click on a formula to enter the formula editor again.

## The Elements window

The simplest method for entering a formula is the Elements window.

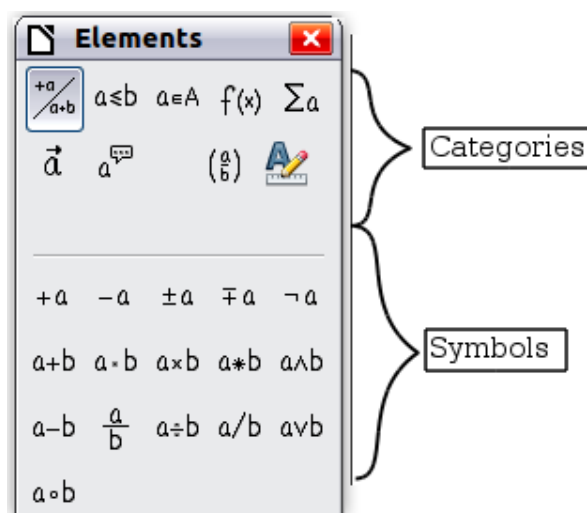


Figure 3: Symbols are divided into categories

The Elements window is divided into two main parts.

- The **top** shows the symbol categories. Click on these to change the list of symbols.
- The **bottom** shows the symbols available in the current category.

### Tip

You can hide or show the Elements window with **View > Elements**.

### Example 1: $5 \times 4$

For this example we will enter a simple formula:  $5 \times 4$ . On the Elements window:

- 1) Select the top-left button of the categories (top) section.
- 2) Click on the multiplication symbol.

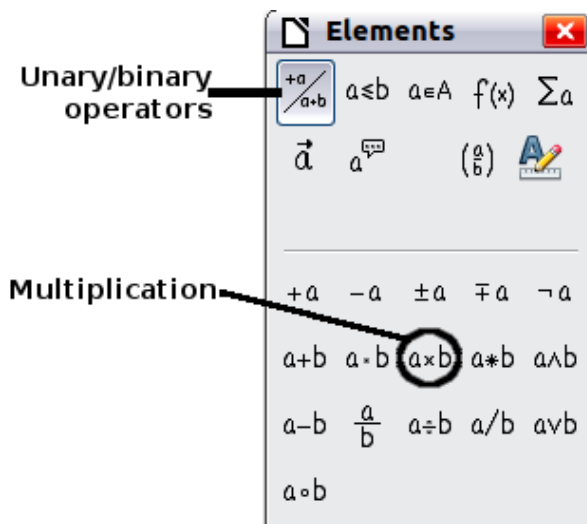


Figure 4: Selecting the multiplication symbol

When you select the multiplication symbol on the Elements window, two things happen:

- The equation editor shows the markup:  $\langle ? \rangle \text{ times } \langle ? \rangle$
- The body of the document shows a gray box like this:  $\square \times \square$

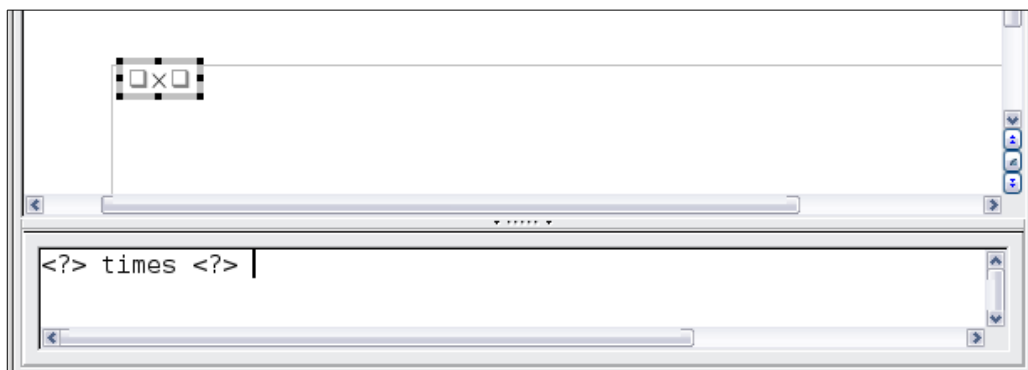


Figure 5: Result of selecting the multiplication symbol

The  $\langle ? \rangle$  symbols shown in Figure 5 are placeholders that you can replace by other text, for example **5** and **4**. The equation will update automatically, and the result should resemble Figure 6.

### Tip

To keep the equation from updating automatically, select **View > AutoUpdate display**. To update a formula manually, press **F9** or select **View > Update**.

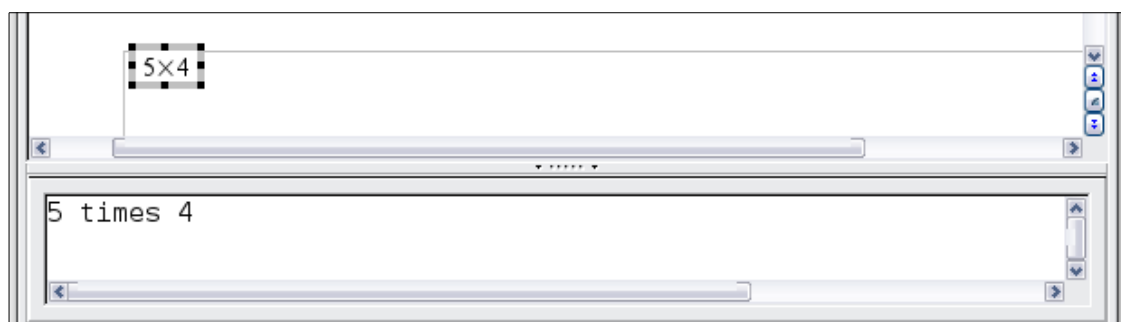


Figure 6: Result of entering 5 and 4 next to the times operator



## Right-click (context) menu

Another way to access mathematical symbols is to right-click on the equation editor. This pops up the menu shown in Figure 7. The items in this menu correspond exactly to those in the Elements window.

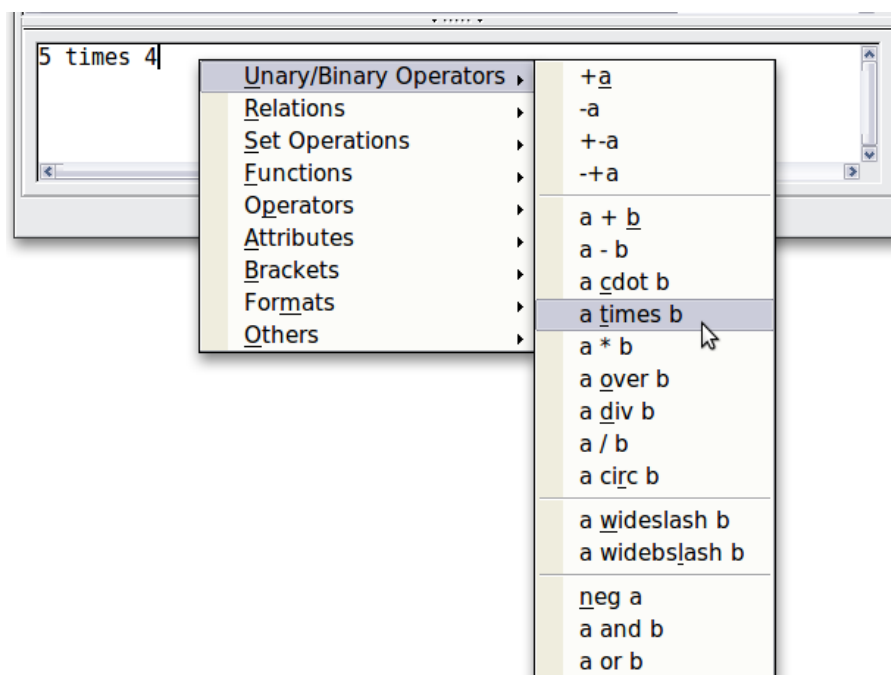


Figure 7: Right-click (context) menu

### Note

Neither the window elements, nor the context menu contains a complete list of commands. Some seldom-used commands, you must always enter the markup. For a complete list of commands can be found in Appendix A to this manual.

## Markup

You can type the markup directly in the equation editor. For example, you can type **5 times 4** to obtain  $5 \times 4$ . If you know the markup, this can be the fastest way to enter a formula.

### Tip

The formula markup resembles the way the formula reads in English.

Below is a short list of common equations and their corresponding markup.

<i>Display</i>	<i>Command</i>	<i>Display</i>	<i>Command</i>
$a = b$	a = b	$\sqrt{a}$	sqrt {a}
$a^2$	a^2	$a_n$	a_n
$\int f(x) dx$	int f(x) dx	$\sum a_n$	sum a_n
$a \leq b$	a <= b	$\infty$	infinity
$a \times b$	a times b	$x \cdot y$	x cdot y

## Greek characters

Greek characters ( $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\theta$ , etc) are common in mathematical formulas. *These characters are not available in the Elements window or the right-click menu.* Fortunately, the markup for Greek characters is simple: Type a % sign followed by the name of the character, in English.

- To write a *lowercase* character, type the name of the character in lowercase.
- To write an *uppercase* character, type the name of the character in uppercase.

A complete table of Greek characters is provided in the *Math Guide*. See the table below for some examples.

<b>Lowercase</b>	<b>Uppercase</b>
%alpha → $\alpha$	%ALPHA → $A$
%beta → $\beta$	%BETA → $B$
%gamma → $\gamma$	%GAMMA → $\Gamma$
%psi → $\psi$	%PSI → $\Psi$
%phi → $\phi$	%PHI → $\Phi$
%theta → $\theta$	%THETA → $\Theta$

Another way to enter Greek characters is by using the Symbols catalog window. Choose **Tools > Catalog**. This window is shown in Figure 8. Under *Symbol set*, select **Greek** and double-click on a Greek letter from the list. The markup name of the character is shown below the list window.

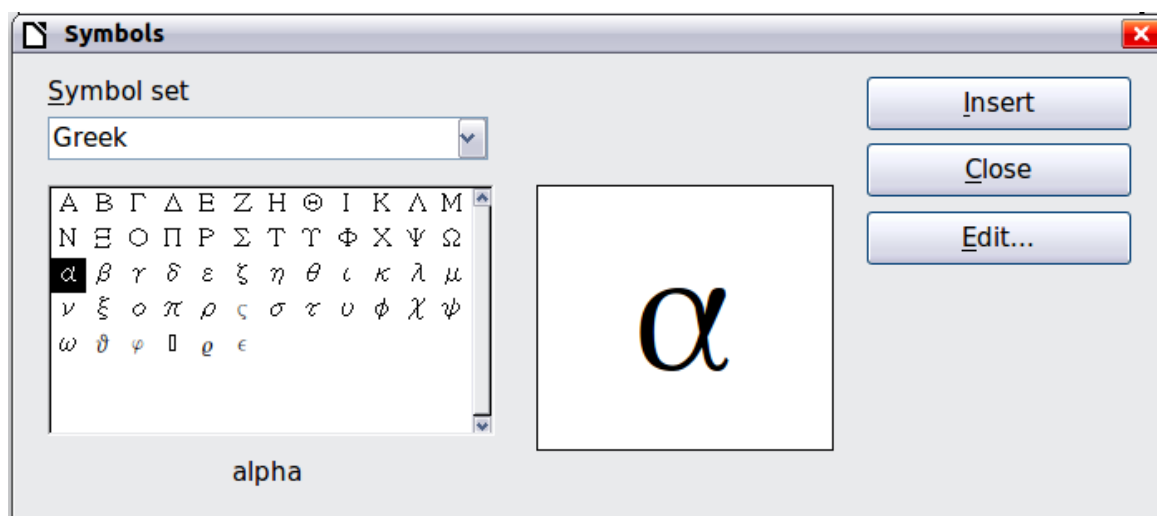


Figure 8: Symbols catalog, used for entering Greek characters and some special symbols

### Example 2: $\pi \simeq 3.14159$

For this example we will suppose that:

- We want to enter the above formula (the value of pi rounded to 5 decimal places).
- We know the name of the Greek character (pi).
- But we do not know the markup associated with the  $\simeq$  symbol.

**Step 1:** Type % followed by the text **pi**. This displays the Greek character  $\pi$ .

**Step 2:** Open the Elements window (**View > Elements**).

**Step 3:** The  $\simeq$  symbol is a relation, so we click on the Relations button. If you hover the mouse over this button you see the tooltip *Relations* (Figure 9).

Figure 10 shows the Selection window after clicking the Relations button. The symbol we want is circled.

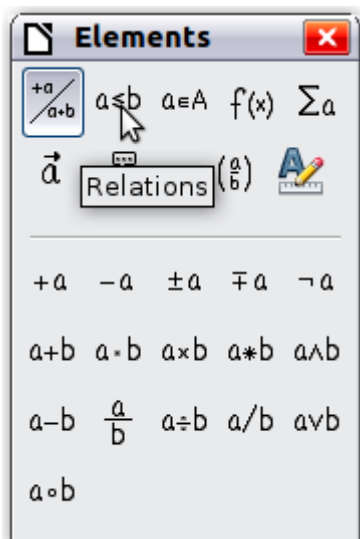


Figure 9: Tooltip indicates the Relations button

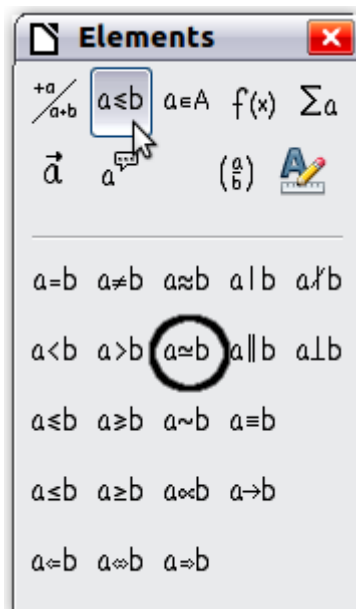


Figure 10: After selecting Relations

**Step 4:** Click on the  $a \simeq b$  symbol. The equation editor now shows the markup `%pi<?> simeq <?>`.

**Step 5:** Delete the `<?>` text and add **3.14159** at the end of the equation. We end up with the markup `%pi simeq 3.14159`. The result is shown in Figure 11.



Figure 11. Final result

## Changing a formula

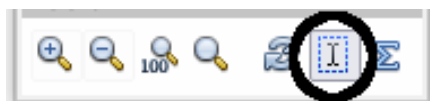
You can change a formula at any time. To switch into edit mode, double-click on the formula.

## Choosing the region to alter

To get to the appropriate section in the markup code, do any one of the following:

- In the equation editor, click on the location.
- Select an area of the markup code that you wish to change.
- Click on an element in the preview area; the cursor will automatically move to the corresponding point in the equation editor.
- Double-click on an element in the preview area; the corresponding section in the equation editor will be selected.

To be able to work in the upper (preview) area in the stand-alone Math window (Figure 1), the formula cursor must be activated. Use the Formula Cursor button on the Tools toolbar.



## Carrying out changes

You can change an equation by overwriting selected text or by inserting new markup code at the cursor position.

### Tip

LibreOffice also provides a means of carrying out alterations directly in the preview area. This is still under development and therefore counts as “experimental”. In order to make use of it, you must first carry out the following configuration change: go to **Tools > Options > LibreOffice > General** and check the box for **Enable experimental (unstable) features**.

The activation of this option makes it impossible, by clicking on a formula element, to gain access to the corresponding position in the markup code.

### Caution



The use of experimental features can lead to program crashes and/or loss of data. Only make the above change if you can accept this risk.

## Text mode

Larger formulas should always be in a paragraph of their own, separated from the text. When you use formula elements in running text, they can often be higher than the letter height.

However, if it is necessary to place a formula within running text, switch into the equation editor and go to **Format > Text** mode. Math will try to shrink the formula to fit the letter height. The numerators and denominators of fractions are shrunk, and the limits of integrals and sums are placed beside the integral/sum sign.

### Example:

A formula in a separate paragraph:

$$\sum_{i=2}^5 i^2$$

and the same formula embedded in text mode:  $\sum_{i=2}^5 i^2$

## Customizations

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### Formula editor as a floating window

The formula editor can cover a large part of the Writer window. To turn the formula editor into a floating window, do this:

- 1) Hover the mouse over the editor frame, as shown in Figure 12.
- 2) Hold down the *Control* key and double-click.

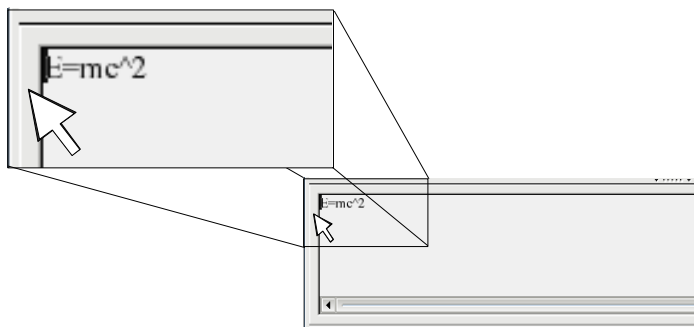


Figure 12: Turning the formula editor into a floating window

Figure 13 shows the result. You can dock the floating window again by using the same steps. Hold down the *Control* key and double-click the window frame.

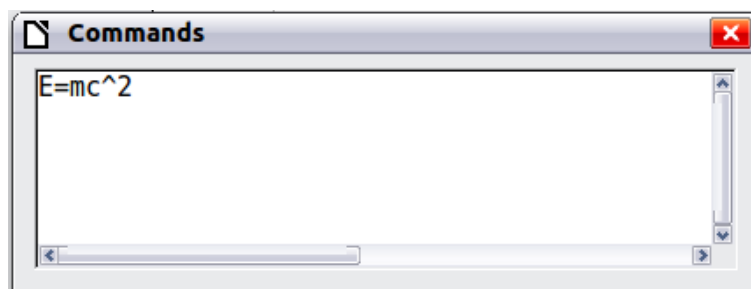


Figure 13: Formula editor as a floating window

### Space at the end of a formula

The grave accent ` inserts a small additional space into the formula; the tilde ~ inserts a larger one. In the basic installation, these symbols are ignored when they occur at the end of a formula. However, when working with running text, it may be necessary to include spacing at the end of formulas as well. This customization is only available when you are working with a Math document, and not when you are embedding a Math object.

Open a Math document with **File > New > Formula**. Open the customisation dialog with **Tools > Options** and choose **LibreOffice Math**. On the **Settings** page, uncheck the option **Ignore ~ and ` at the end of the line**.

### Formula layout

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The most difficult part of using LibreOffice Math comes when writing complicated formulas. This section provides some advice.

## Brackets are your friends

Math knows nothing about order of operation. You *must* use brackets to state the order of operations explicitly. Consider the following example.

Markup	Result	Markup	Result
2 over x + 1	$\frac{2}{x} + 1$	2 over {x + 1}	$\frac{2}{x+1}$
- 1 over 2	$-\frac{1}{2}$	- {1 over 2}	$-\frac{1}{2}$

In the first example, Math has recognized that the **2** before and the **x** after the **over** belong to the fraction, and has represented them accordingly. If you want **x+1** rather than **x** to be the denominator, you must bracket them together so that both will be placed there.

In the second example, Math has recognized the minus sign as a prefix for the **1** and has therefore placed it in the numerator of the fraction. If you wish to show that the whole thing is negative, with the minus sign in front of the fraction, you must put the fraction in brackets in order to signify to Math that the characters belong together.

The braces belong solely to the layout of the markup code and are not printed. If you wish to use braces in the formula, use the commands **lbrace** and **rbrace**.

Compare the following examples:

Markup	Result	Markup	Result
x over {-x + 1}	$\frac{x}{-x+1}$	x over lbrace -x + 1 rbrace	$\frac{x}{\{-x+1\}}$

## Recognizing functions in Math

In the basic installation, Math outputs variables in italics. If you enter a function, Math usually recognizes it and outputs it normally. If Math fails to recognize a function, you can inform Math about it. Enter the markup code **func** before the function, and the following text will be recognized as a function.

When Math has recognized a function, it expects this to be followed by numbers or variables. If these are missing, Math puts an inverted question mark in their place, which you can only remove by entering a variable or number, or a pair of empty braces { } as a placeholder.

## Equations over more than one line

Suppose you want to type an equation covering more than one line. For example: 
$$\begin{array}{l} x=3 \\ y=1 \end{array}$$

Your first reaction would be to simply press the *Enter* key. However, if you do this, the markup goes to a new line but the resulting equation does not. You must type the newline command explicitly. This is illustrated in the table below.

Markup	Result
<code>x = 3</code> <code>y = 1</code>	$x=3$ $y=1$
<code>x = 3</code> newline <code>y = 1</code>	$x=3$ $y=1$

If you want to continue the calculation on a new line without writing a complete new equation, this is not directly possible, because Math expects a term on the left hand side of an equals sign. You can substitute:

- Empty quotes `""`. This will automatically cause the line to be left-justified.
- Empty braces `{ }`. The following line will then be centered.

The alignment of equals signs under each other is described on page 18.

## How do I add limits to my sum/integral?

The sum and int commands can (optionally) take the parameters *from* and *to*. These are used for lower and upper limits respectively. These parameters can be used singly or together. Limits for integrals are usually treated as subscripts and superscripts.

Markup	Result
<code>sum from k = 1 to n a_k</code>	$\sum_{k=1}^n a_k$
<code>int from 0 to x f(t) dt</code> or <code>int_0^x f(t) dt</code>	$\int_0^x f(t) dt$ or $\int_0^x f(t) dt$
<code>int from Re f</code>	$\int_{\mathbb{R}} f$
<code>sum to infinity 2^{-n}</code>	$\sum_{n=0}^{\infty} 2^{-n}$

### Note

For more details on integrals and sums, see the *Math Guide*.

## Brackets with matrices look ugly!

For background, we start with an overview of the matrix command.

Markup	Result
<code>matrix { a # b ## c # d }</code>	$\begin{matrix} a & b \\ c & d \end{matrix}$

### Note

Rows are separated by two #’s and entries within each row are separated by one #.

The first problem people have with matrices is that brackets do not scale with the matrix:

Markup	Result
<code>( matrix { a # b ## c # d } )</code>	$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

Math also provides scalable brackets that grow in size to match the size of their contents. Use the commands *left()* and *right()* to make scalable brackets.

Markup	Result
<code>left( matrix { a # b ## c # d } right)</code>	$\left( \begin{matrix} a & b \\ c & d \end{matrix} \right)$

**Tip** Use *left[* and *right]* to obtain scalable square brackets.

**Tip** If you want all brackets to be scalable, go to **Format > Spacing**. Then in the Spacing dialog, choose the category Brackets and check the option Scale all brackets.

## How do I write a derivative?

Writing derivatives essentially comes down to one trick: *Tell LibreOffice it's a fraction*.

In other words, you have to use the *over* command. Combine this with either the letter *d* (for a total derivative) or the *partial* command (for a partial derivative) to achieve the effect of a derivative.

**Note** Notice that we have to use braces (squiggly brackets) to make the derivative.

Markup	Result
<code>{df} over {dx}</code>	$\frac{df}{dx}$
<code>{partial f} over {partial y}</code>	$\frac{\partial f}{\partial y}$
<code>{partial^2 f} over {partial t^2}</code>	$\frac{\partial^2 f}{\partial t^2}$

To write function names with primes, as is usual in school notation, you must first add the signs to the catalog. Using single and double quotes is typographically ugly. See “Customizing the catalog” in the *Math Guide*.

## Isolated and unpaired brackets

Math expects that for every opening bracket there will be a closing one. If you forget a bracket, Math places an inverted question mark by the corresponding bracket. This disappears when all brackets are matched. Sometimes forgetting a bracket causes the whole structure of the formula to



fall apart. However an unpaired bracket is sometimes necessary. In such cases, you have two options:

With non-scalable brackets, use a preceding backslash \ to indicate that the following character should not be regarded as a bracket but as a literal character. So the half-open interval  $[a; b[$  is represented by  $\backslash[a;b\backslash[$  — try comparing this with  $[a;b[$

Scalable brackets can also be unpaired. The same half-open interval is represented by

**left [ a; b right [**

For scalable brackets, you can also use the command **none** to replace a non-existent paired bracket.

$$|x| = \begin{cases} x & \text{for } x \geq 0 \\ -x & \text{for } x < 0 \end{cases}$$

can be represented by

`abs x = left lbrace stack {x "for" x >= 0 # -x "for" x < 0} right none`

## Markup characters as regular characters

Characters that are used for controlling markup cannot be entered directly as normal characters. The characters concerned are: %, {, }, &, |, \_, ^ and ". So, for example, you cannot write **2% = 0.02** or **1" = 2.56cm**. Two methods are available to overcome this limitation:

- Use double quotes to mark the character as text, for example **2"% = 0.02**. Obviously this is not possible for the double-quote character itself.
- Add the character to the catalog. See the section on Customizing the catalog on p....

In some cases you can use commands:

- **lbrace** and **rbrace** give you literal braces {}.
- **Mline** gives you the vertical line, for example **2 mline 3** for  $(2|3)$

Conversion into an entity as in html or the use of an escape character is not possible in Math.

## Text in a formula

To include text in a formula, enclose it in straight double-quotes:

`abs x = left lbrace matrix {x # "for " x >= 0 ## -x # "for " x < 0}  
right none`

$$|x| = \begin{cases} x & \text{for } x \geq 0 \\ -x & \text{for } x < 0 \end{cases}$$

All characters except double quotes are permissible in text. Unfortunately the Special Characters dialog is not available. If necessary, you can write the text in a text document and copy it into the equation editor using the clipboard. In this way smart quotes can be inserted, as shown in Figure 14.

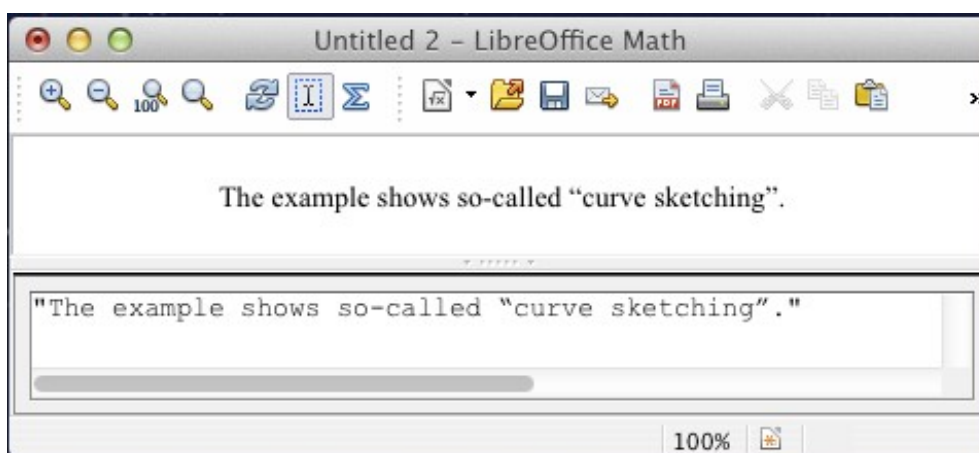


Figure 14: Smart quotes included by copy and paste from Writer.

Text is shown in the font that was selected from the Text list in the Fonts dialog (compare with the section below on changing the font in a formula). To use a font from the lower window of the equation editor, set the attribute **Serif**, **Sans** or **Fixed** before the text.

By default, text is left-justified. You can change the justification with **alignc** or **alignr**.

Commands are not interpreted within text. Use quotes to break up the text if you wish to use special formatting commands.

"In" color blue bold "isosceles" "triangles, the base angles are equal"

In **isosceles** triangles, the base angles are equal

## How do I align my equations at the equals sign?

Math does not have a command for aligning equations on a particular character, but you can use a matrix to do this, as shown below.

Markup	Result
<pre>matrix{   alignr x+y # {}={} # alignl 2 ##   alignr x   # {}={} # alignl 2-y }</pre>	$\begin{array}{rcl} x+y & = & 2 \\ x & = & 2-y \end{array}$

The empty braces around the = sign are necessary because = is a binary operator and thus needs an expression on each side.

You can reduce the spacing around the = sign by changing the intercolumn spacing of the matrix:

- 1) With the equation editor open, choose **Format > Spacing** from the menu bar.
- 2) In the Spacing dialog (Figure 15), click the **Category** button and select **Matrices** in the drop-down menu.
- 3) Enter **0%** for *Column spacing* and click **OK**.

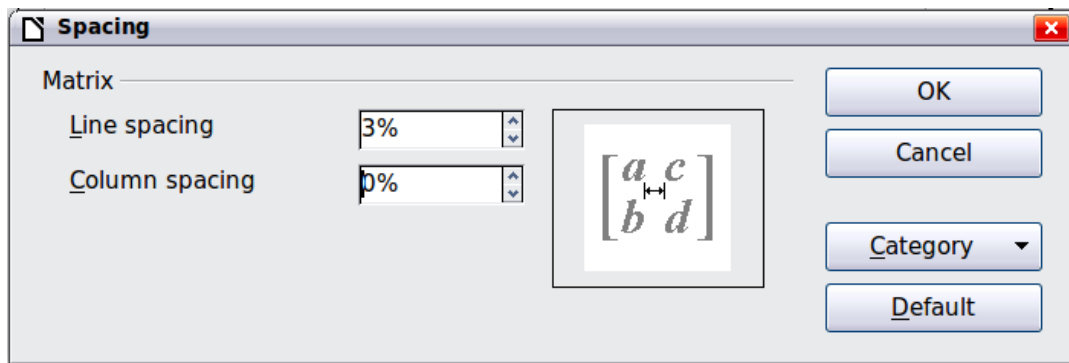


Figure 15: Changing spacing in a matrix formula

## Changing the appearance of formulas

### Changing the font

The fonts used in formulas can be changed using **Format > Fonts**.

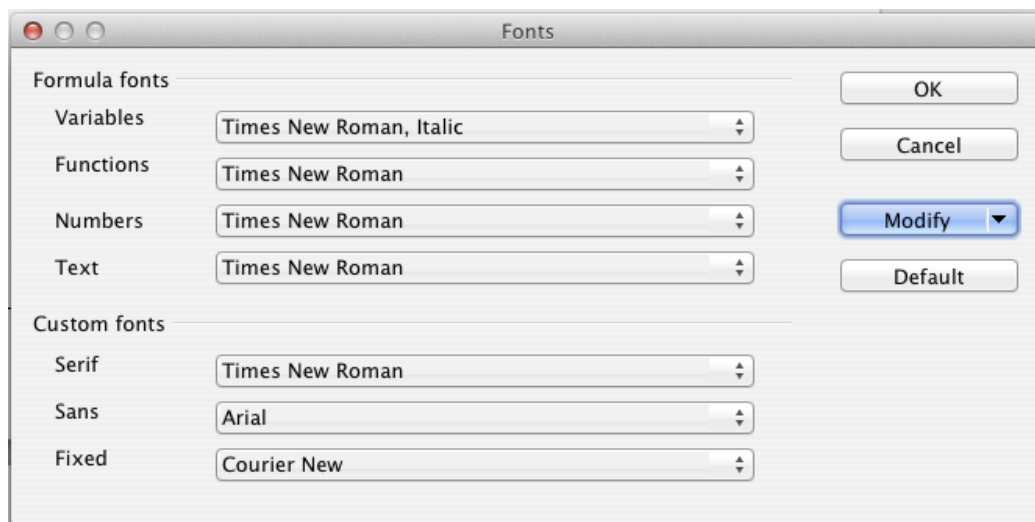
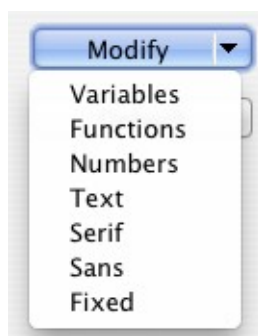


Figure 16: Fonts dialog

The *Formula fonts* section refers to the three specified formula elements. The font for operators, relationships and brackets is not affected, as these elements normally come from the OpenSymbol font. Similarly elements from the catalog continue to be displayed in the font specified there.

The *Custom fonts* section determines which font will be used when the attribute **font serif**, **font sans** or **font fixed** is specified.

To change a font, first click on the **Modify** listbox.



Choose the type of entry you wish to modify. The *Fonts* dialog opens, showing all the fonts available on your system.



If you enter an initial character in the upper text box, the list will jump to that place. By entering a few additional characters, you can specify the exact font that you want. If you do not know its name, use the scrollbar to scroll through them. Click on any name and the box below will show a preview.

Variables should be written in italics, so make sure that the *Italic* box is checked. For all other elements, use the basic (Roman) form. The style can be easily altered in the formula itself by using the commands **italic** or **bold** to set these characteristics and **nitalic** or **nbold** to unset them.

When you have chosen a new font for a formula, the old font remains in the list alongside the new one and can be selected again. This applies only to the current session; the old font is not stored permanently.

You can choose whatever fonts you like, but if you are exchanging documents with someone else, you should choose fonts that are present on your colleague's computer.

## Changing the font size

This is one of the most common questions people ask about Math. The answer is simple, but not intuitive:

- 1) Start the formula editor and choose **Format > Font size**.

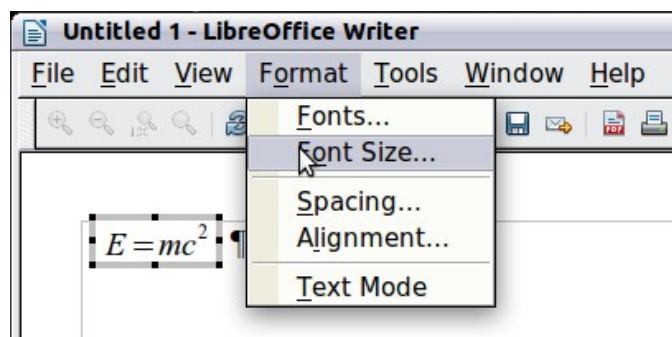


Figure 17: Changing the font size for a formula

- 2) Select a larger font size under *Base size* (top-most entry).

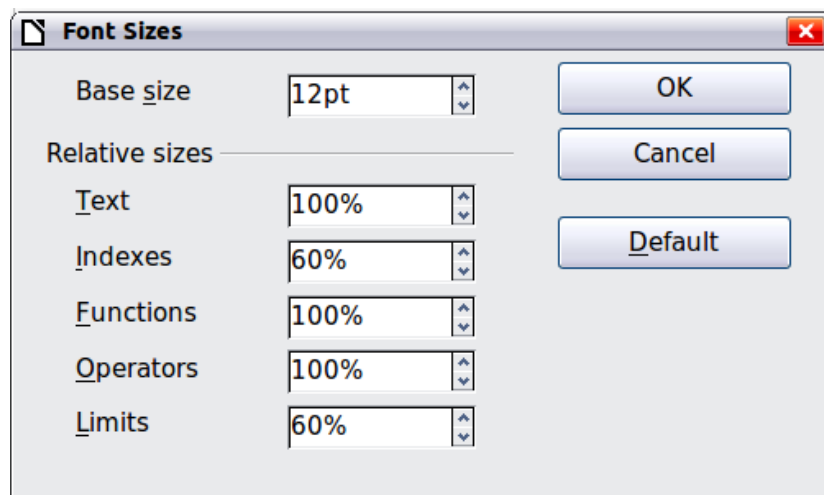


Figure 18. Edit Base size (top) to make a formula bigger

The result of this change is illustrated in Figure 19.

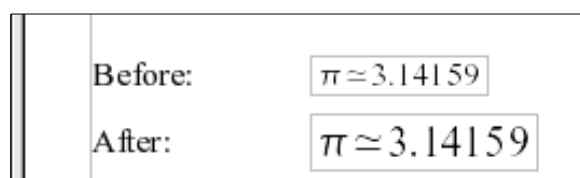


Figure 19. Result of changing the base font size

### Note

The change in font size applies only to the current formula. To change the font size generally, click on the **Default** button and then **OK**. A general change in the font size might, for example, make your work easier when you are preparing a big presentation and want all the formulas in it to have a base size of 28pt—but do not forget to set the font size back to its original value when the work is finished.

## Adjusting spacing in formulas

To increase or decrease spacing in formulas, do the following:

- 1) Go to **Format > Spacing**.
- 2) In the *Spacing* dialog, click the triangle next to **Category**, and choose an entry from the list.
- 3) Choose appropriate spacing values (the types of spacing that can be set depend on the category) and click **OK**.

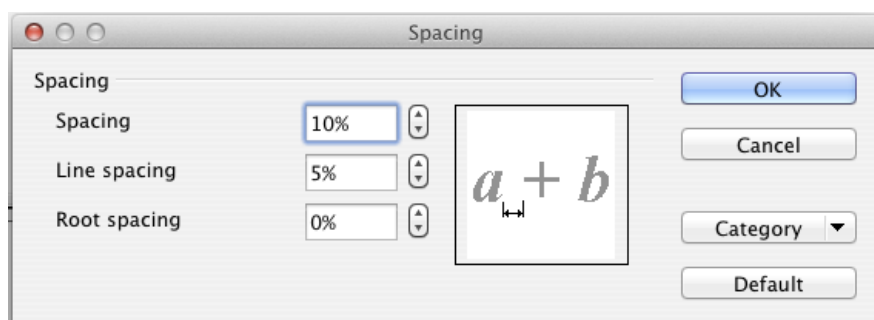


Figure 20: Spacing dialog

**Note**

Changes in spacing apply only to the current formula. To change spacing generally, click on the **Default** button and then **OK**.

Examples of spacing changes are shown in the *Math Guide*.

## Changing the alignment

The alignment settings determine how formula elements located above one another are aligned horizontally relative to each other. Use **Format > Alignment** to choose between *Left*, *Center* or *Right* on a global basis.

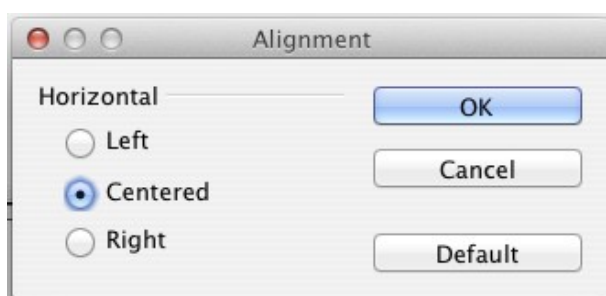


Figure 21: Alignment dialog

Here again you can use the **Default** button to make the change apply to all formulas and not just the current one. The following example shows the effect in different situations:

Alignment	Examples		
left	$\frac{x^2-9}{x}$	$\begin{pmatrix} 100 \\ 7 \end{pmatrix}$	$\begin{aligned} c^2 &= a^2 + b^2 - 2ab \cos \gamma \\ \cos \gamma &= \frac{c^2 - a^2 - b^2}{-2ab} \end{aligned}$
centered (Default)	$\frac{x^2-9}{x}$	$\begin{pmatrix} 100 \\ 7 \end{pmatrix}$	$\begin{aligned} c^2 &= a^2 + b^2 - 2ab \cos \gamma \\ \cos \gamma &= \frac{c^2 - a^2 - b^2}{-2ab} \end{aligned}$
right	$\frac{x^2-9}{x}$	$\begin{pmatrix} 100 \\ 7 \end{pmatrix}$	$\begin{aligned} c^2 &= a^2 + b^2 - 2ab \cos \gamma \\ \cos \gamma &= \frac{c^2 - a^2 - b^2}{-2ab} \end{aligned}$

It is not possible to align formulas on a particular character.

Default settings of alignment do not apply to text elements; they are always aligned left. In the following examples, the default alignment is *right* but the first example begins the second line with text (albeit empty text) and is therefore aligned left.

Markup Code	Result
<code>{1+2+3+4} over 5 + 2 over {60+70+80+90}</code> <code>newline</code> <code>" "=2+1 over 150</code>	$\begin{aligned} &\frac{1+2+3+4}{5} + \frac{\phantom{1+2+3+4}}{60+70+80+90} \\ &= 2 + \frac{1}{150} \end{aligned}$

Markup Code	Result
$\frac{1+2+3+4}{5} + \frac{2}{60+70+80+90}$ $\frac{2}{150}$	$\frac{1+2+3+4}{5} + \frac{2}{60+70+80+90}$ $= 2 + \frac{1}{150}$

Independent of the default alignment, it is possible to align formulas explicitly using the commands **alignl**, **alignnc** and **alignr**. This attribute also works for text elements.

## Numbering equations

Equation numbering is one of Math's best hidden features. The steps are simple, but obscure:

- 1) Start a new line.
- 2) Type **fn** and then press *F3*.

The *fn* is replaced by a numbered formula:

$$E = mc^2 \quad (2)$$

Now you can double-click on the formula to edit it. For example, here is the Riemann Zeta function:

$$\zeta(z) = \sum_{n=1}^{\infty} \frac{1}{n^z} \quad (3)$$

You can cross-reference an equation ("as shown in Equation (2)") with these steps:

- 1) Choose **Insert > Cross-reference** from the menu bar.
- 2) On the *Cross-references* tab (Figure 22), under *Type*, select *Text*.
- 3) Under *Selection*, select the equation number.
- 4) Under *Format*, select *Reference*.
- 5) Click **Insert**.

Done! If you later add more equations to the paper before the referenced equation, all the equations will automatically renumber and the cross-references will update.

### Tip

To insert the equation number without parentheses around it, choose *Numbering* under *Format* instead of *Reference*.

The AutoText inserted as a result of the above procedure consists of a 1x2 table. The left cell contains the formula and the right one the number. The number is treated as text. You can edit the AutoText if, for example, you prefer square rather than round brackets, or if you want formula and number to be separated by tabs rather than formatted as a table. Read the section on "Using AutoText" in Chapter 3 in the *Writer Guide* (Working with text).

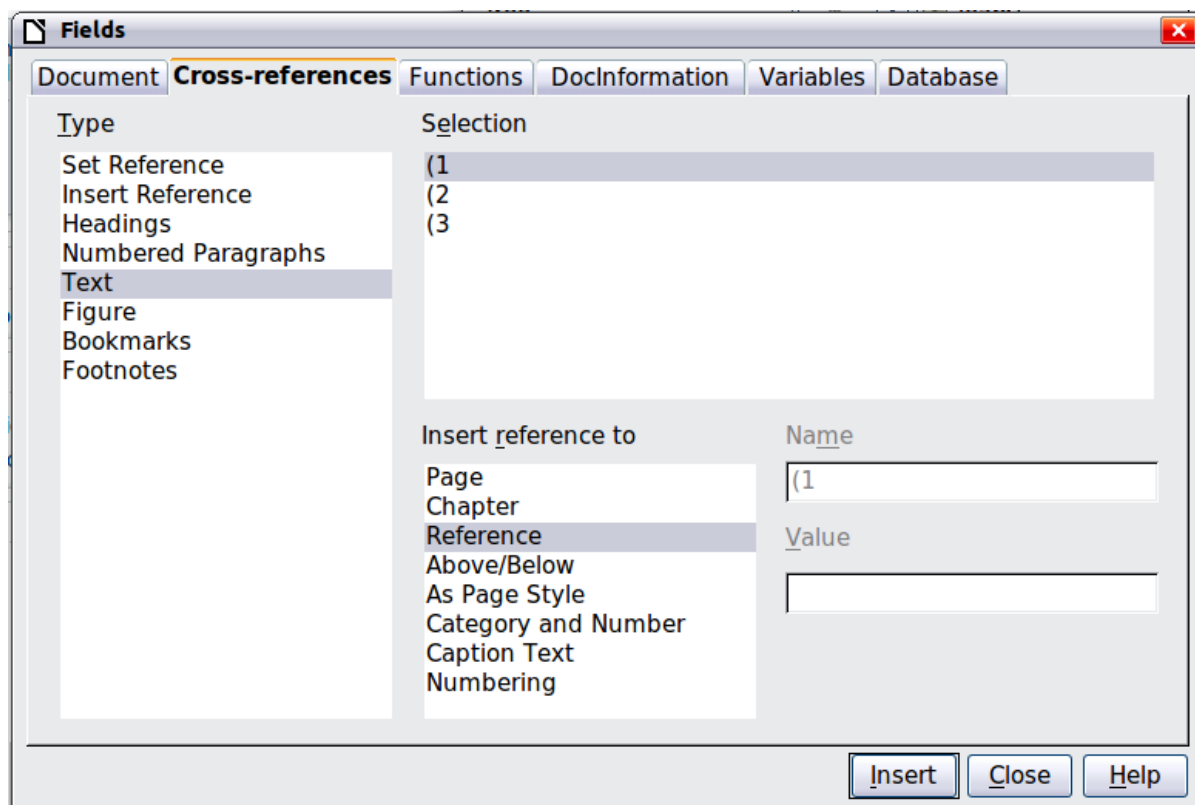


Figure 22. Inserting a cross-reference to an equation number

## Formulas in Writer documents

### Position

Normally a formula is anchored *As character* in a Writer document. But as with any other OLE object, you can change the anchoring mode to position the formula where you want it. For more information, see Chapter 11 of the *Getting Started* guide (Graphics, the Gallery, and Fontwork).

By default, formula objects anchored *As character* are automatically aligned vertically to the baseline of the surrounding text. To align the formula manually, go to **Tools > Options > LibreOffice Writer > Formatting Aids** and uncheck the option **Math baseline alignment**. This setting is stored with the document and applies to all formulas within it. New documents use the current setting from this dialog.

### Margins

An inserted Math object has margins to left and right of it, separating it from surrounding text. If you do not want this, it is best to alter the frame style for formulas, as this will apply simultaneously to all existing formulas and those still to be inserted in the document. Proceed as follows:

- 1) Press **F11**. The *Styles and Formatting* dialog opens.
- 2) Click on the *Frame Styles* tab.
- 3) Find the *Formula* frame style and right-click on it.
- 4) Choose *Modify* from the context menu. The *Frame Style* dialog opens.
- 5) Switch to the *Wrap* tab of the dialog. Change the values for *Left* and *Right* in the Spacing section to 0.00.
- 6) Click **OK** to close the dialog.



This changes the spacing for all formulas that have not had their spacing adjusted manually. You can find more information on using styles in Chapter 3 of the *Getting Started* guide (Styles and Formatting).

## Background, borders, and size

With regard to formatting, formulas are treated as objects of the *Frame Style* type with the Formula frame style. Background color and borders can be set using this style or directly with **Format > Frame/Object**, or by right-clicking the formula and choosing **Object** from the context menu. In the basic installation, formulas have a transparent background and no borders. The size of a formula cannot be adjusted; in a Writer document it depends directly on the way the formula is constructed.

## Creating a formula library

When you use the Math component of LibreOffice directly with **File > New > Formula**, you create documents with the file suffix .odf, each containing a single formula. You can use these to build up a library of frequently-used formulas. Embedded formulas can also be stored as separate Math documents by right-clicking on the formula and choosing **Save copy as** from the context menu. To insert such a Math document into a Writer document, use **Insert > Object > OLE Object**. Select the option *Create from file* and enter the pathname of the file or browse for it using your system's file manager by pressing the **Search** button.

### Note

You cannot insert the document by dragging and dropping with the mouse, nor by using **Insert > File**.

Formulas cannot be stored in the gallery because they are not in graphical format. You can however store a formula as autotext. Write the formula in a separate paragraph, select it and go to **Edit > AutoText**. For further information see “Using AutoText” in Chapter 3 in the *Writer Guide* (Working with Text).

## Formulas in Calc, Impress, and Draw

### Graphical properties

Formula objects have similar properties in Calc, Impress, and Draw. They are always inserted with a transparent background and without borders. In Draw and Impress, they are assigned the *Default* graphical style; there is no assigned style for them in Calc and properties must be specified directly. The properties shown in the Styles and Formatting window, the context menu, and the **Format > Graphic** menu are limited, when available at all.

### Line, Area, Shadow

You can set values but the settings are completely ignored.

### Text attributes

All text attributes, such as font and alignment, refer not to the formula text but to the text element present in all graphical objects. For a selected object, this can be accessed via the *F2* key. For further information, read “Working with text in Draw” in Chapter 10 (Advanced Draw Techniques) of the *Draw Guide*.

## Position

A formula can be positioned anywhere you like. Use the mouse, the arrow keys, or the Position and Size dialog available from **Format > Position and Size**.

## Size

In documents a formula is not represented directly but replaced by a graphic. The size of this graphic is initially protected. To change the size, open the Position and Size dialog and, on the first page, in the *Protect* section, uncheck the **Size** checkbox. This activates the *Size* section directly above. Enter your modifications. When the dialog is closed, the size will immediately be protected again.

Changing the size does not affect the formula itself but only its graphical representation. In particular the basic font size of the formula does not change. To revert to the size determined by the formula content, use the *Original Size* option in the context menu. This allows sizing errors that are sometimes caused by inserting a formula from a different module to be corrected.

## Rotation, shear, and flipping

Rotation, shearing, and flipping (creating mirror images) are not possible; the corresponding dialog options are inactivated. If you need to do this, convert the formula to a *GDI metafile* graphic. Once you have done this, it is not a formula any more but an image. Copy the formula onto the clipboard. Choose **Edit > Paste Special** or, on the Standard Toolbar, use the Paste menu (available from the small triangle to the right of the Paste icon) and choose the option **GDI Metafile**.

## Combining formulas with text

Since a formula is an OLE object, you cannot insert it into the content of a spreadsheet cell, graphic or presentation object. Thus, unlike in Writer, you cannot integrate formulas with running text. Here are some alternatives:

## Text elements within the formula

You can write the text directly into the formula. For example:

The illustration of a parallelogram suggests the  
relationship  $\overrightarrow{AB} = \overrightarrow{CD} \Leftrightarrow \overrightarrow{AC} = \overrightarrow{BC}$ .  
But this does not constitute a proof.

The corresponding markup text is:

```
"The illustration of a parallelogram suggests the" newline  
"relationship " widevec AB = widevec CD dlrarrow widevec AC = widevec  
BC "." newline  
"But this does not constitute a proof."
```

Lines are not wrapped automatically; you must use the **newline** command.

You can use **Format > Fonts** to match the text to its surroundings. See “Changing the font” on page 19.

## Grouping formulas with graphic objects

Formulas can easily be combined with other objects into a group, which is not possible in text documents. See the *Math Guide* for an example.

## Formulas in Writer OLE objects

To be able to use all the facilities possible in text documents, create the formula and its text in Writer. Choose a page size that roughly matches your eventual objective. Do not write more than one page because page selection causes problems later. Save the document.

In Impress (or Draw or Calc), use **Insert > Object > OLE Object** and then choose the option *Create from file*. The formula is embedded as an OLE object in a document that is itself an OLE object. As a result, the formula cannot be modified in Impress. For that reason, you should always activate the option *Link to file*. Then if you need to make a change, open the text document and edit text and formula there. In Impress, use **Edit > Links** and then the **Update** button to display the stored version of the text document. Do not try to modify the formula in Impress; it causes the representation to become faulty.

## Formulas in charts

A chart is itself an OLE object. Therefore you cannot call up the equation editor within it. There is no freestanding module of LibreOffice that creates charts, so you cannot use anything similar to the above method using Writer either. However you can create a formula outside the charts editor, copy it to the clipboard, activate the chart for editing, and paste in the formula from the clipboard. This automatically converts the formula into a metafile graphic. If you wish to make further modifications, you must discard it and repeat the procedure.

## Export and import

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### Export as MathML

In addition to exporting documents as PDFs, as described in Chapter 10, Printing, Exporting, and Emailing, of the *Getting Started* guide, Math offers the possibility of exporting formulas as MathML. Unfortunately browsers do not follow this standard perfectly. If there are subsequent faults in display, the fault lies with your browser!

For an example, see the *Math Guide*.

### Microsoft file formats

The options in **Tools > Options > Load/Save > Microsoft Office** control how the import and export of Microsoft Office file formats is carried out in regard to formulas.

#### Loading

If [L] is checked, LibreOffice converts Microsoft formulas into native format when a document is loaded. This is possible if the formulas were created with MathType<sup>1</sup> (up to version 3.1) or with the Microsoft Equation Editor. The latter is a reduced, older version of MathType licensed by Microsoft and included in the Microsoft Office package.

Formulas created by newer versions of MathType or by the new Microsoft formula editor “OMML<sup>2</sup> Equation Editor” (Microsoft Office Suite 2010 and to some extent 2007) cannot be converted.

If a document created in Microsoft Office 2010 and containing an OMML formula is saved into a .doc file format, Microsoft Office converts the formula into a graphic. Only this graphic is then accessible to LibreOffice.

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1 <http://www.dessci.com/en/>

2 Office Math Markup Language

If you load a .docx document that contains OMML formulas, these fail in conversion whether [L] is checked or not.

Inside Microsoft Office, formulas created with MathType or Microsoft Equation Editor are treated as OLE objects. If [L] is not checked, LibreOffice maintains this. Double-clicking on the object launches MathType and new formulas can be inserted using **Insert > Object > OLE Object**. This setup is to be recommended if you have MathType installed and wish to use it to create and edit formulas.

## **Saving**

If [S] is checked, LibreOffice converts the formula into a form that can be read and modified by Microsoft Equation Editor and MathType. When [S] is not checked, the formula is treated as an OLE object on conversion into a .doc format, and remains linked to LibreOffice. A double-click on the object in Word will therefore attempt to launch LibreOffice.

If you save in the .docx format, formulas are not converted, whether [S] is checked or not.

## **Opening OpenDocument texts in Microsoft Word 2010**

When you use Microsoft Office 2010, it is possible to open LibreOffice files in .odt format. Microsoft Office 2010 reports an error but nevertheless displays a “repaired” document. In this document, any original formulas are converted to OMML. If you save it again in .odt format, Microsoft Office 2010 converts the formulas into MathML, and these formulas can then be edited in LibreOffice. Take care that symbols that belong together are enclosed in grouping brackets, even if these are not necessary for display in LibreOffice itself. This enables LibreOffice to correctly translate the formula into MathML. For example, use **sum from {i=1} to n {i^2}** rather than **sum from i=1 to n i^2**.

In this procedure, the annotation element is lost. As a result, LibreOffice no longer shows the original Math markup code in the equation editor, but instead generates a new markup code from the internal MathML notation.

## **XHTML**

The XHTML file format is available only as an export format. For this reason you will find the option under **File > Export** rather than **File > Save**. If this option is missing in your setup, you can install the necessary filter (run LibreOffice Setup, select **Modify**, and then select **Optional Components > XSLT Sample Filters**). The replacement graphic for the formula is embedded in the file, but the original Math markup code, included as an annotation element in MathML, is absent in this case (compare with the section on “Export as MathML” on page 27).

Whether the document is correctly displayed depends on the browser. Firefox shows the document correctly including the formulas. Opera and Internet Explorer have some problems with the embedded graphic.

The older filter “HTML Document (OpenOffice.org Writer)(.html)” does not save formulas at all but uses only a poorly resolved graphic in .gif file format.

## **Flat XML**

This format can be both read and saved by LibreOffice. If the option is not present under **File > Save** or **File > Save as**, you can install the necessary filter. In this format, the whole content of the document, including the template, is saved within an XML document. In other words, it is not a compressed folder, as is usually the case for saved OpenDocument files. Any formulas are included as MathML elements, similar to the results of exporting as MathML. However individual formulas are not saved, only the whole document including the formulas. This format is suitable for direct entry into an external version control system.

## Math commands reference

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For a full list of the commands available in Math, please see the *Math Guide*.

- Unary / binary operators
- Relational operators
- Set operations
- Functions
- Operators
- Attributes
- Miscellaneous
- Brackets
- Formats
- Characters – Greek
- Characters – Special