Apache OpenOffice

Version 4.1

Math Guide

AOO Documentation Team

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Note for Mac Users

Some keystrokes and menu items differ 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.

Windows/Linux	***Mac equivalent***	***Effect***
Tools > Options menu selection	**OpenOffice > Preferences**	Access setup options
Right-click	*Control+click*	Open context menu
Ctrl (Control)	⌘ (Command)	Used with other keys
F5	*Shift+⌘+F5*	Open the Navigator
F11	*⌘+T*	Open Styles & Formatting window

Contents

What is Math?

Math is OpenOffice's component for writing mathematical 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 stand-alone. 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*.

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

Getting Started

To insert an equation in Writer, go to **Insert > Object > Formula**.

The equation editor opens at the bottom of the screen, and the floating Elements window may appear. You will also see a small box with a gray border in your document where the formula will be displayed, as shown in Figure 1.

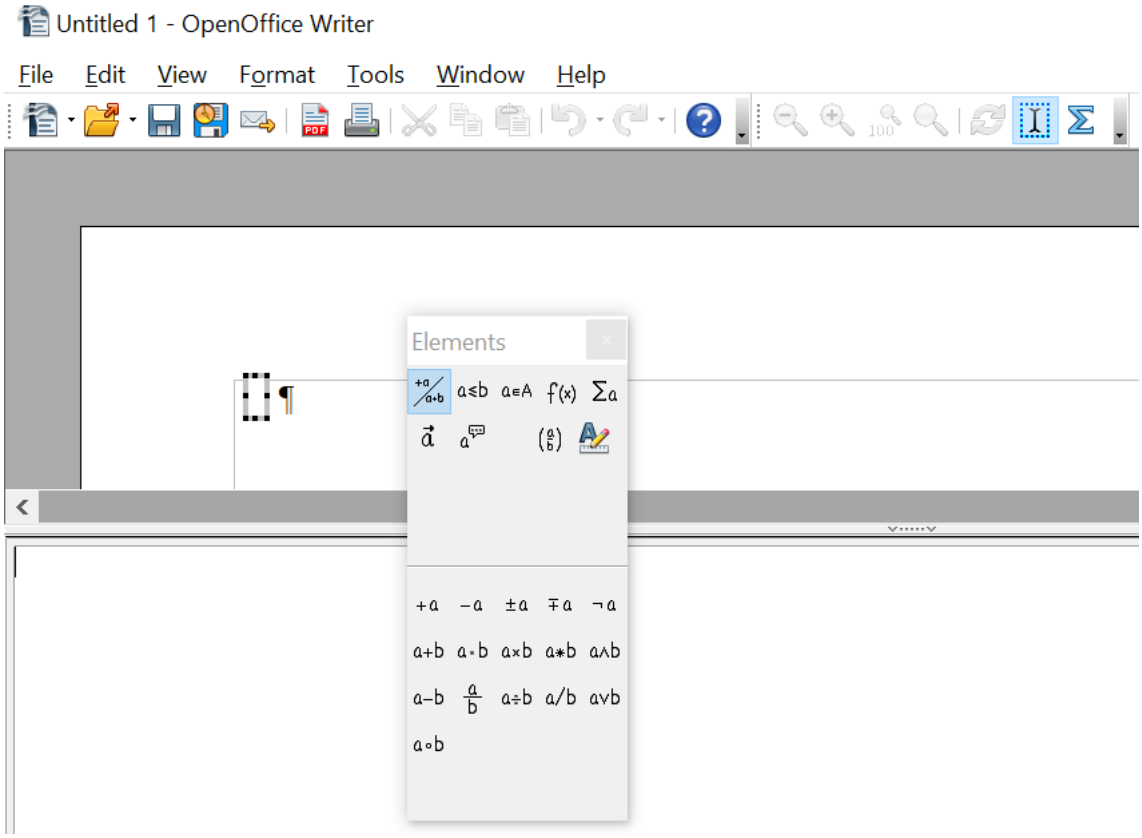

Figure 1: Equation Editor, Elements window, and location of resulting equation

Entering a Formula

The equation editor uses a markup language to represent formulas. For example, *%beta* creates the Greek character beta (β). This markup is designed to read similarly 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 AOO 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 way to enter a formula is through the Elements window.

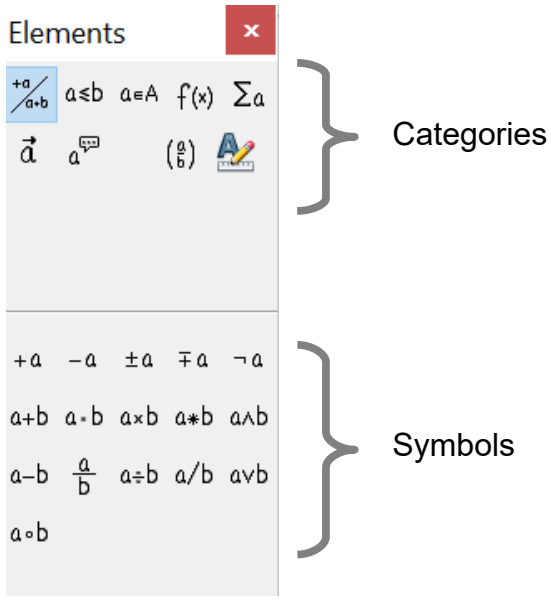

Figure 2: Symbols are divided into categories

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: 5×4

For this example, we will enter a simple formula: 5×4 . On the Elements window:

1) Select the top-left button of the categories (top) section to reveal operators requiring one or two operands.
2) Click on the multiplication symbol.

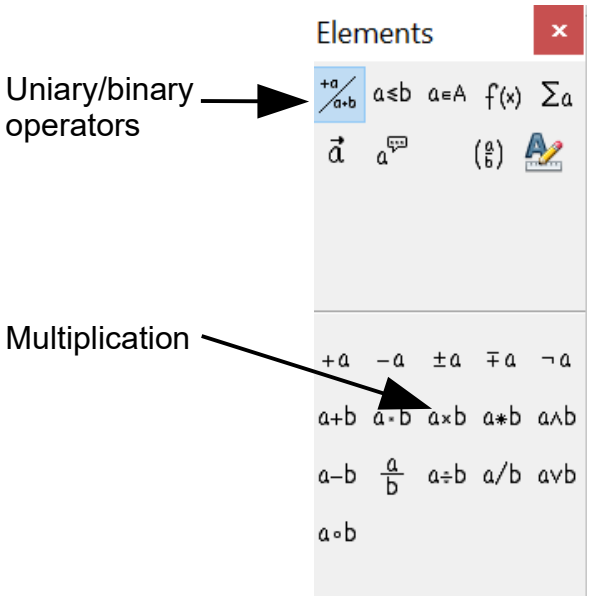

Figure 3: Selecting the multiplication symbol

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

- The equation editor shows the markup: *<?> times <?>*
- The body of the document shows a gray box like this: ❑×❑

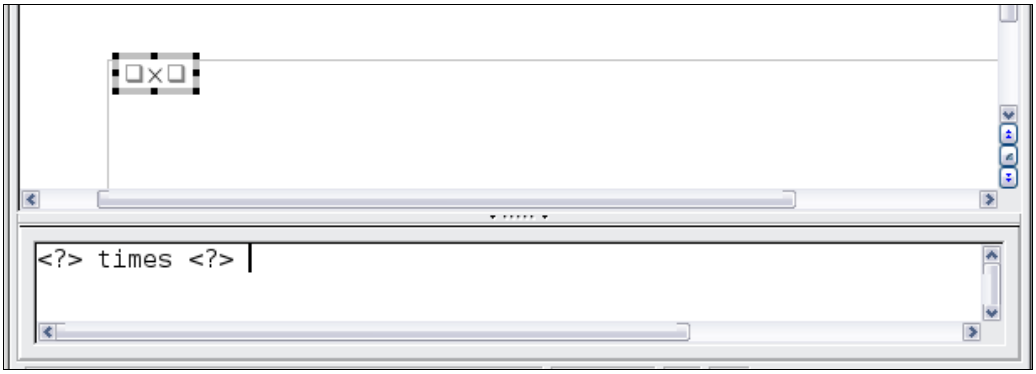

Figure 4: Result of selecting the multiplication symbol

The <?> symbols shown in Figure 4 are placeholders that you can replace with other text, for example, `5` and `4`. The equation will update automatically, and the result should resemble Figure 5.

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

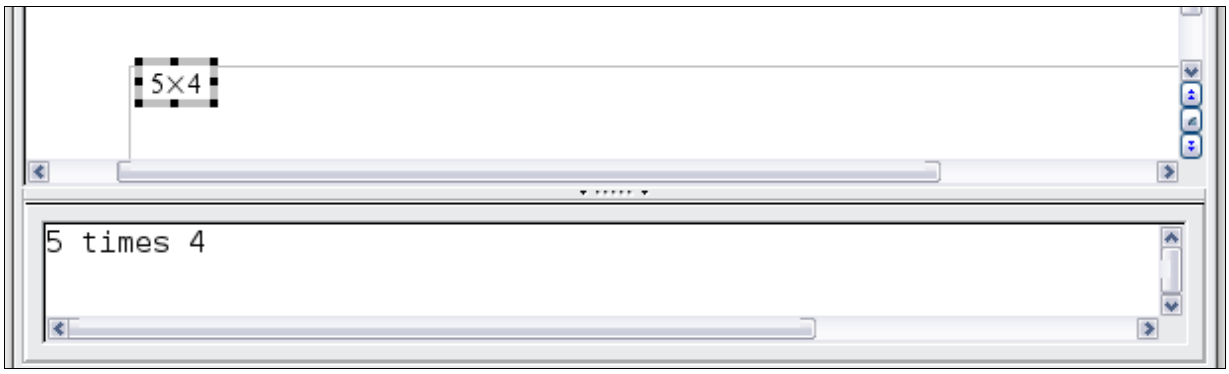

Figure 5: Result of entering 5 and 4 next to the times operator

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 6. The items in this menu correspond exactly to those in the Elements window.

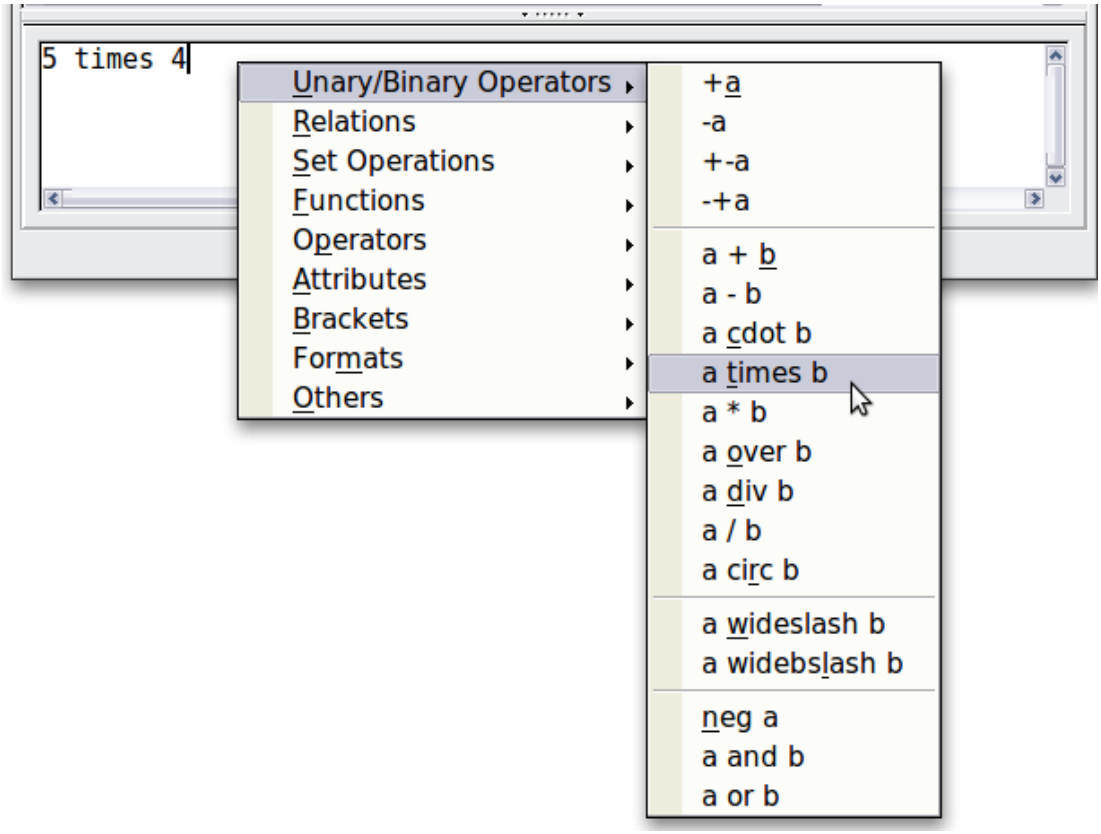

Figure 6: Right-click (context) menu

Markup

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

Tip	Formula markup will always resemble the way a formula reads in English.

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

Display	Command	Display	Command
$a=b$	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	∞	infinity
$a \times b$	a times b	$x \cdot y$	x cdot y

Greek Characters

Greek characters (α , β , γ , θ , 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 character's name 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 on page 27. See the table below for some examples.

Lowercase			Uppercase		
%alpha	→	α	%ALPHA	→	A
%beta	→	β	%BETA	→	B
%gamma	→	γ	%GAMMA	→	Γ
%psi	→	ψ	%PSI	→	Ψ
%phi	→	ϕ	%PHI	→	Φ
%theta	→	θ	%THETA	→	Θ

Another way to enter Greek characters is by using the Symbols catalog window. Choose **Tools > Catalog**. This window is shown in Figure 7. Under *Symbol set*, select **Greek** and double-click on a Greek letter from the list. The character's markup name is shown below the list window.

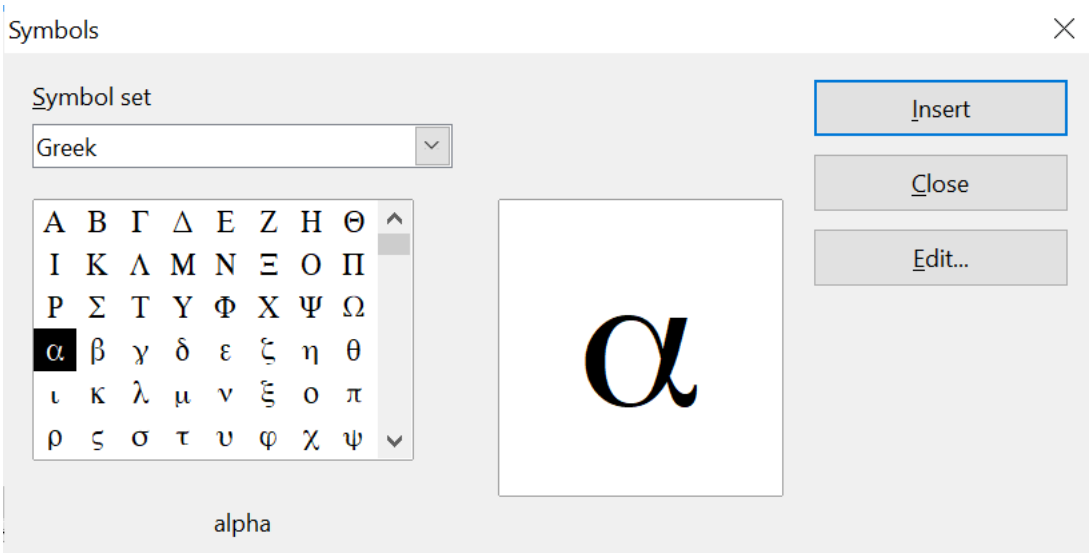

Figure 7: Symbols catalog, used for entering Greek characters and some special symbols

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 π .

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 8).

Figure 9 shows the Selection window after clicking the Relations button. The symbol we want is circled.

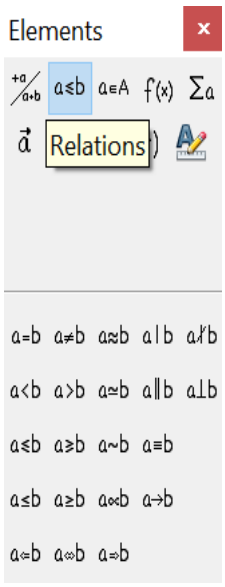

Figure 8: Tooltip indicates the Relations button

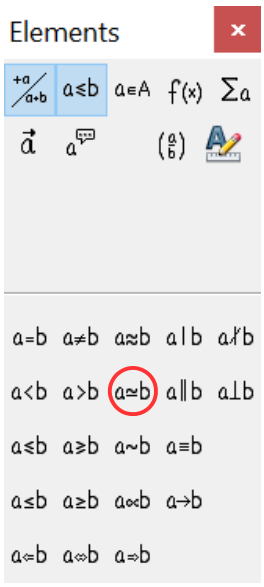

Figure 9: After selecting Relations

Step 4: Click on the a ≃ 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`, as shown in Figure 10.

Figure 10. Final result

Customizations

Formula Editor as a Floating Window

The formula editor can cover most 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 11.
2) Press and hold the *Control* key, then double-click.

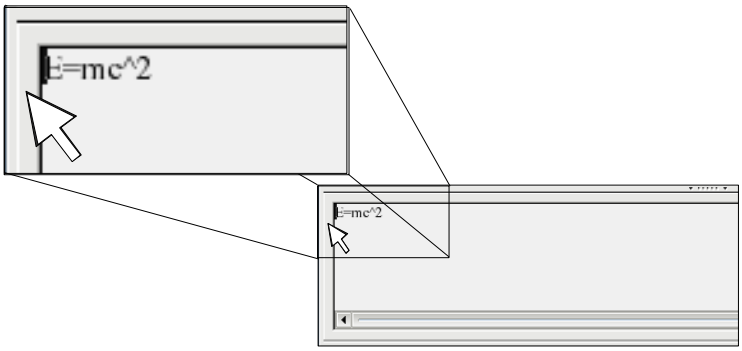

Figure 11: Turning the formula editor into a floating window

Figure 12 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 12: Formula editor as a floating window

How Can I Make a Formula Bigger?

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 13).
2) Select a larger font size under *Base size* (top-most entry) (Figure 14).

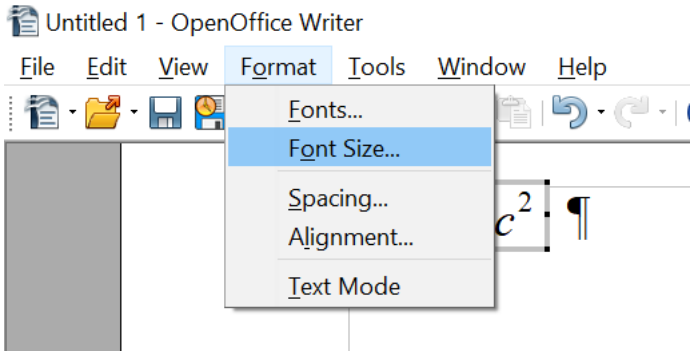

Figure 13: Changing the font size for a formula

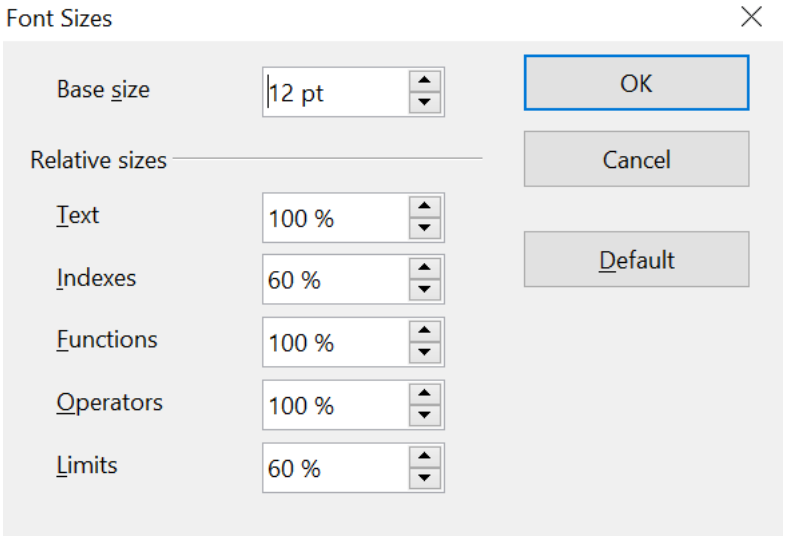

Figure 14. Edit Base size (top) to make a formula bigger

Figure 15 illustrates the result of this change.

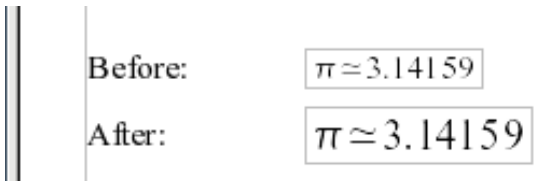

Figure 15. Result of changing the base font size

Formula Layout

The hardest part of using AOO Math involves writing complicated formulas. This section provides some advice.

Brackets are Your Friends

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

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

Equations Over More Than One Line

Suppose you want to type an equation covering more than one line. For example:

$x=3$
$y=1$

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

Markup	Result
`x = 3` `y = 1`	$x=3\ y=1$
`x = 3 newline` `y = 1`	$x=3$ $y=1$

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
`sum from k = 1 to n a_k`	$\sum_{k=1}^{n} a_k$

`int from 0 to x f(t) dt`
or
`int_0^x f(t) dt`
	$\int_{0}^{x} f(t)\,dt$ or $\int_0^x f(t)\,dt$

`int from Re f`	$\int_{\Re} f$
`sum to infinity 2^{-n}`	$\sum^{\infty} 2^{-n}$

Note For more details on integrals and sums, see page 22.

Brackets with Matrices Look Ugly!

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

Markup	Result
`matrix { a # b ## c # d }`	$\begin{matrix} a & b \\ c & d \end{matrix}$

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
`( matrix { a # b ## c # d } )`	$(\begin{matrix} a & b \\ c & d \end{matrix})$

AOO Math provides scalable brackets. That is, the brackets expand to match the size of their contents. Use the commands *left(* and *right)* to create scalable brackets.

Markup	Result
`left( matrix { a # b ## c # d } right)`	$\left(\begin{matrix} a & b \\ c & d \end{matrix}\right)$

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

How Do I Make a Derivative?

Making derivatives essentially comes down to one trick: *Tell AOO 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
`{df} over {dx}`	$\frac{df}{dx}$
`{partial f} over {partial y}`	$\frac{\partial f}{\partial y}$
`{partial^2 f} over {partial t^2}`	$\frac{\partial^2 f}{\partial t^2}$

How Do I Align My Equations at the Equals Sign?

AOO 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

`matrix{`
`  alignr x+y # {}={} # alignl 2 ##`
`  alignr x  # {}={} # alignl 2-y`
`}`
	$\begin{matrix} x+y & = & 2 \\ x & = & 2-y \end{matrix}$

The empty braces around = are necessary because = is a binary operator. That means it needs an expression on each side.

You can reduce the spacing around = if you change the inter-column spacing of the matrix: $\begin{matrix} x+y=2 \\ x=2-y \end{matrix}$

1) With the equation editor open, choose **Format > Spacing** from the menu bar.
2) In the Spacing dialog (Figure 16), click the **Category** button and select **Matrices** in the drop-down menu.
3) Enter **0%** for Column spacing and click **OK**.

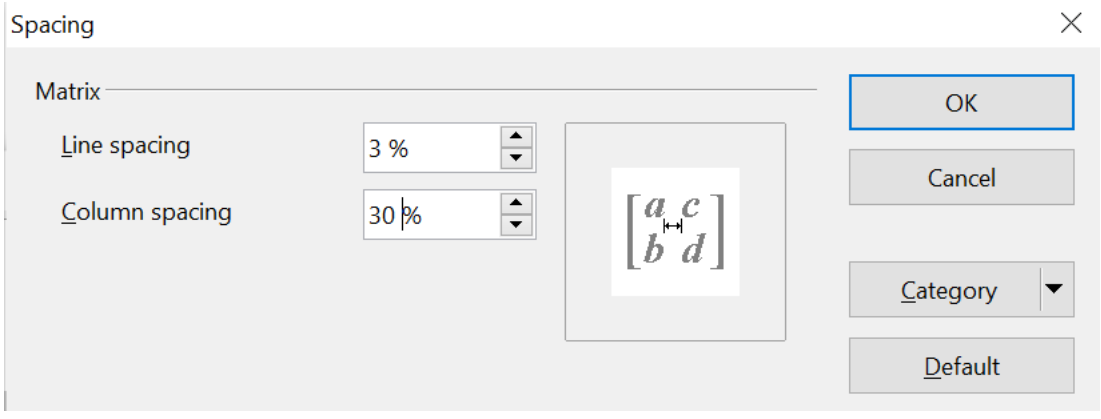

Figure 16: Changing spacing in a matrix formula

Numbering Equations

Equation numbering is one of AOO Math's best hidden features. The steps are simple, but not necessarily intuitive:

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

The *fn* is replaced by a numbered formula:

$$E = mc^2 \tag{2}$$

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

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

You can reference an equation (for example, "as shown in Equation (2)") with these steps:

1) Choose **Insert > Cross-reference** from the menu bar.
2) On the *Cross-references* tab (Figure 17), under *Type*, select *Text*.
3) Under *Selection*, select the equation number.
4) Under *Format*, select *Reference*.

Click **Insert**.

Done! If you 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* instead of *Reference* under *Format.*

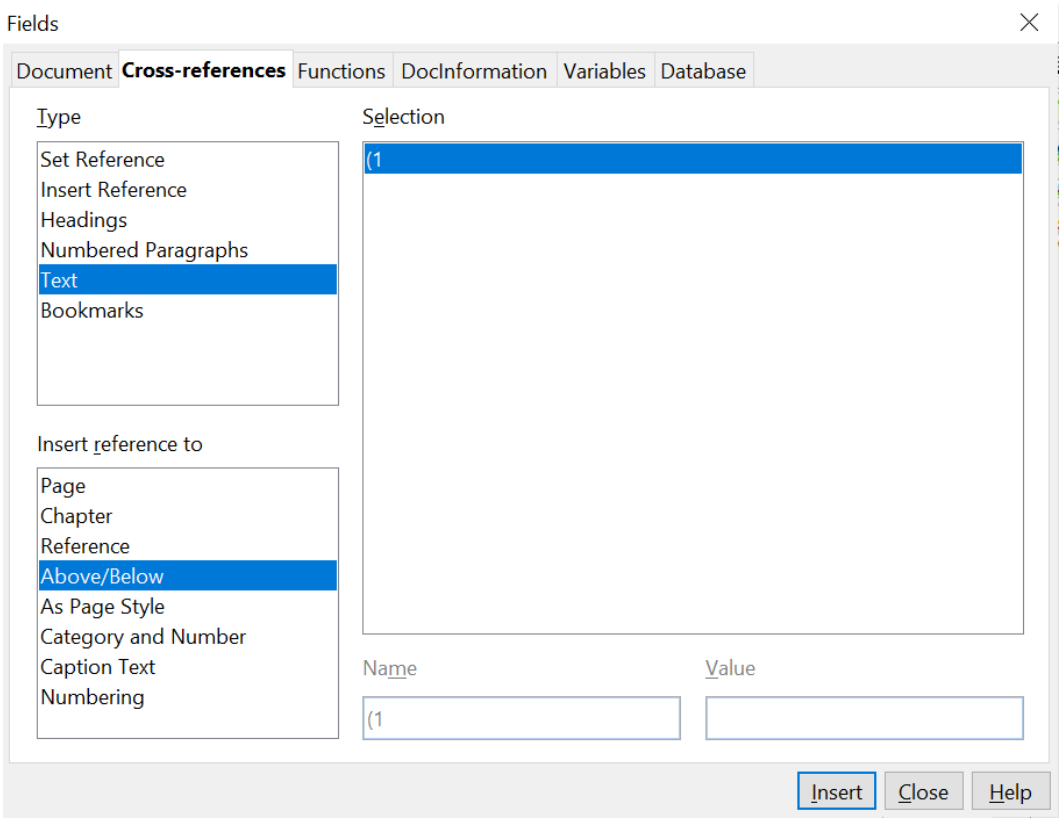

Figure 17. Inserting a cross-reference to an equation number

Math Commands – Reference

Unary and Binary Operators

Operation	***Command***	***Display***
+sign	+1	$+1$
–sign	–1	-1
+/– sign	+–1	± 1
–/+ sign	–+1	∓ 1
Boolean not	neg a	$\neg a$
Addition +	a + b	$a+b$
Dot product	a cdot b	$a \cdot b$
Multiplication (X)	a times b	$a \times b$
Multiplication (asterisk)	a * b	$a * b$
Boolean ‘and’	a and b	$a \wedge b$
Subtraction (–)	a – b	$a-b$
Division (as a fraction)	a over b	$\frac{a}{b}$
Division (as an operator)	a div b	$a \div b$
Division (with a slash)	a / b	a/b
Boolean ‘or’	a or b	$a \vee b$
Concatenation	a circ b	$a \circ b$

Relational Operators

Operation	*Command*	*Display*
Is equal	a = b	$a=b$
Is not equal	a <> b	$a \neq 2$
Approximately	a approx 2	$a \approx 2$
Divides	a divides b	$a \mid b$
Does not divide	a ndivides b	$a \nmid b$
Less than	a < 2	$a < 2$
Greater than	a > 2	$a > 2$
Similar to or equal	a simeq b	$a \simeq b$
Parallel	a parallel b	$a \parallel b$
Orthogonal to (i.e. Independent if)	a ortho b	$a \perp b$
Less than or equal to	a leslant b	$a \leqslant b$
Greater than or equal to	a geslant b	$a \geqslant b$
Similar to	a sim b	$a \sim b$
Congruent	a equiv b	$a \equiv b$
Less than or equal to	a <= b	$a \leq b$
Greater than or equal to	a >= b	$a \geq b$
Proportional	a prop b	$a \propto b$
Toward	a toward b	$a \rightarrow b$
Arrow left	a dlarrow b	$a \Leftarrow b$
Double arrow left and right	a dlrarrow b	$a \Leftrightarrow b$
Arrow right	a drarrow b	$a \Rightarrow b$

Set Operations

Operation	*Command*	*Display*
Is in	a in B	$a \in B$
Is not in	a notin B	$a \notin B$
Owns	A owns b	$A \ni b$
Empty set	emptyset	$\varnothing$
Intersection	A intersection B	$A \cap B$
Union	A union B	$A \cup B$
Difference	A setminus B	$A \setminus B$
Quotient	A slash B	A / B
Aleph (the integer which is the smallest cardinal number in the set)	aleph	$\aleph$
Subset	A subset B	$A \subset B$
Subset or equal to	A subseteq B	$A \subseteq B$
Superset	A supset B	$A \supset B$
Superset or equal to	A supseteq B	$A \supseteq B$
Not subset	A nsubset B	$A \not\subset B$
Not subset or equal	A nsubseteq B	$A \not\subseteq B$
Not superset	A nsupset B	$A \not\supset B$
Not superset or equal	A nsupseteq B	$A \not\supseteq B$
Set of natural numbers	setN	$\mathbb{N}$
Set of integers	setZ	$\mathbb{Z}$
Set of rational numbers	setQ	$\mathbb{Q}$
Set of real numbers	setR	$\mathbb{R}$
Set of complex numbers	setC	$\mathbb{C}$

Functions

Operation	Command	Display
Exponential	func e^{a}	e^{a}
Natural logarithm	ln(a)	$\ln(a)$
Exponential function	exp(a)	$\exp(a)$
Logarithm	log(a)	$\log(a)$
Power	a^{b}	a^{b}
Sine	sin(a)	$\sin(a)$
Cosine	cos(a)	$\cos(a)$
Tangent	tan(a)	$\tan(a)$
Cotangent	cot(a)	$\cot(a)$
Square root	sqrt{a}	$\sqrt{a}$
Arcsine	arcsin(a)	$\arcsin(a)$
Arc cosine	arccos(a)	$\arccos(a)$
Arctangent	arctan(a)	$\arctan(a)$
Arc cotangent	arccot(a)	$\operatorname{arccot}(a)$
n^{th} root	nroot{a}{b}	$\sqrt[a]{b}$
Hyperbolic sine	sinh(a)	$\sinh(a)$
Hyperbolic cosine	cosh(a)	$\cosh(a)$
Hyperbolic tangent	tanh(a)	$\tanh(a)$
Hyperbolic cotangent	coth(a)	$\coth(a)$
Absolute value	abs{a}	$\lvert a \rvert$
Arc hyperbolic sine	arsinh(a)	$\operatorname{arsinh}(a)$
Arc hyperbolic cosine	arcosh(a)	$\operatorname{arcosh}(a)$
Arc hyperbolic tangent	artanh(a)	$\operatorname{artanh}(a)$
Arc hyperbolic cotangent	arcoth(a)	$\operatorname{arcoth}(a)$
Factorial	fact{a}	$a!$

Operators

All operators can be used with the limit functions *from* and *to*.

Operation	***Command***	***Display***
Limit	lim{a}	$lim\ a$
Sum	sum{a}	$\sum a$
Product	prod{a}	$\prod a$
Coproduct	coprod{a}	$\coprod a$
Upper and lower bounds shown with integral	int from {r_0} to {r_t} a	$\int_{r_0}^{r_t} a$
Integral	int{a}	$\int a$
Double integral	iint{a}	$\iint a$
Triple integral	iiint{a}	$\iiint a$
Lower bound shown with summation symbol	sum from{3}b	$\sum_{3} b$
Contour integral	lint a	$\oint a$
Double curved integral	llint a	$\oint\oint a$
Triple curved integral	lllint a	$\oint\oint\oint a$
Upper bound shown with product symbol	prod to{3} r	$\prod^{3} r$

Attributes

Operation	Command	Display
Acute accent	acute a	$\acute{a}$
Grave accent	grave a	$\grave{a}$
Reverse circumflex	check a	$\check{a}$
Breve	breve a	$\breve{a}$
Circle	circle a	$\mathring{a}$
Vector arrow	vec a	$\vec{a}$
Tilde	tilde a	$\tilde{a}$
Circumflex	hat a	$\hat{a}$
Line above	bar a	$\bar{a}$
Dot	dot a	$\dot{a}$
Wide vector arrow	widevec abc	$\overrightarrow{abc}$
Wide tilde	widetilde abc	$\widetilde{abc}$
Wide circumflex	widehat abc	$\widehat{abc}$
Double dot	ddot a	$\ddot{a}$
Line over	overline abc	$\overline{abc}$
Line under	underline abc	$\underline{abc}$
Line through	overstrike abc	~~abc~~
Triple dot	dddot a	$\dddot{a}$
Transparent (useful to get a placeholder of a given size)	phantom a	
Bold font	bold a	$\boldsymbol{a}$
Italic font[1]	ital “a”	a
Resize font	size 16 qv	qv
Following item in sans serif font[2]	font sans qv	qv
Following item in serif font	font serif qv	qv
Following item in fixed font	font fixed qv	$\mathtt{qv}$
Make color of following text cyan[3]	color cyan qv	qv

1 Unquoted text that is not a command is considered to be a variable. Variables are, by default, italicized.

2 There are three custom fonts: sans serif (without kicks), serifs (with kicks), and fixed (non-proportional). To change the actual fonts used for custom fonts and the fonts used for variables (unquoted text), numbers and functions, use **Format > Fonts**.

3 Color applies only to the text immediately following the command until the next space. To have the color apply to more characters, place the text you want in color in curly brackets.

Operation	Command	Display
Make color of following text yellow	color yellow qv	qv
Make color of following text white	color white qv	qv
Make color of following text green	color green qv	qv
Make color of following text blue	color blue qv	qv
Make color of following text red	color red qv	qv
Make color green returns to default color black	color green X qv	$X\ qv$
Brace items to change color of more than one item	color green {X qv}	$X\ qv$

Miscellaneous

Operation	Command	Display
Infinity	infinity	∞
Partial	partial	∂
Nabla	nabla	∇
There exists	exists	$\exists$
For all	forall	$\forall$
H bar	hbar	$\hbar$
Lambda bar	lambdabar	λ
Real part	re	$\Re$
Imaginary part	im	$\Im$
Weierstrass p	wp	$\wp$
Left arrow	leftarrow	$\leftarrow$
Right arrow	rightarrow	$\rightarrow$
Up arrow	uparrow	$\uparrow$
Down arrow	downarrow	$\downarrow$
Dots at bottom	dotslow	$\dots$
Dots at middle	dotsaxis	$\cdots$
Dots vertical	dotsvert	$\vdots$
Dots diagonal upward	dotsup	$\iddots$
Dots diagonal downward	dotsdown	$\ddots$

Brackets

Operation	Command	Display
Round Brackets	(a)	(a)
Square Brackets	[b]	$[b]$
Double Square Brackets	ldbracket c rdbracket	$[\![c]\!]$
Single line	lline a rline	$\lvert a \rvert$
Double line	ldline a rdline	$\lVert a \rVert$
Braces	lbrace w rbrace	$\{w\}$
Angle Brackets	langle d rangle	$\langle d \rangle$
Operator Brackets	langle a mline b rangle	$\langle a \mid b \rangle$
Group brackets (used for program control; also called curly braces)	{a}	a
Scalable round brackets (add the word “left” before a left bracket and “right” before a right bracket)	left (stack{a # b # z} right)	$\left(\begin{matrix} a \\ b \\ z \end{matrix} \right)$
Square brackets scalable (as above)	left [stack{ x # y} right]	$\left[\begin{matrix} x \\ y \end{matrix} \right]$
Double square brackets scalable	left ldbracket c right rdbracket	$\left[\!\left[c \right]\!\right]$
Line scalable	left lline a right rline	$\left\lvert a \right\rvert$
Double line scalable	left ldline d right rdline	$\left\lVert d \right\rVert$
Brace scalable	left lbrace e right rbrace	$\left\{ e \right\}$
Angle bracket scalable	left langle f right rangle	$\left\langle f \right\rangle$
Operator brackets scalable	left langle g mline h right rangle	$\left\langle g \middle\vert h \right\rangle$
Over brace scalable	{The brace is above} overbrace a	$\overbrace{\mathit{The\ brace\ is\ above}}^{a}$
Under brace scalable	{the brace is below}underbrace {f}	$\underbrace{\mathit{the\ brace\ is\ below}}_{f}$

Formats

Operation	Command	Display
Left superscript	a lsup{b}	${}^{b}a$
Center superscript	a csup{b}	$\overset{b}{a}$
Right superscript	a^{b}	a^{b}
Left subscript	a lsub{b}	${}_{b}a$
Center subscript	a csub{b}	$\underset{b}{a}$
Right subscript	a_{b}	a_{b}
Align character to left (text is aligned center by default)	stack { Hello world # alignl (a) }	$\begin{matrix} Hello\ world \\ (a) \end{matrix}$
Align character to center	stack{Hello world # alignc(a)}	$\begin{matrix} Hello\ world \\ (a) \end{matrix}$
Align character to right	stack { Hello world # alignr(a)}	$\begin{matrix} Hello\ world \\ (a) \end{matrix}$
Vertical stack of 2	binom{a}{b}	$\begin{matrix} a \\ b \end{matrix}$
Vertical stack, more than 2	stack{a # b # z}	$\begin{matrix} a \\ b \\ z \end{matrix}$
Matrix	matrix{ a # b ## c # d }	$\begin{matrix} a & b \\ c & d \end{matrix}$
Equations aligned at '=' (using 'matrix')	matrix{ a # "=" # alignl{b} ## {} # "=" # alignl{c+1} }	$\begin{matrix} a & =b \\ & =c+1 \end{matrix}$
Equations aligned at '=' (using 'phantom')	stack{ alignl{a} = b # alignl{phantom{a} = c+1} }	$\begin{matrix} a=b \\ =c+1 \end{matrix}$
New line	asldkfjo newline sadkfj	$\begin{matrix} asldkfjo \\ sadkfj \end{matrix}$
No gap	nospace { x + y }	$x+y$
Normal	x+y	$x+y$
Small gap (grave)	stuff `stuff	$stuff\ stuff$
Large gap (tilde)	stuff~stuff	$stuff\ \ stuff$

Caution

In localized versions of Writer, the markup names of Greek and special characters are localized. If this document is not localized to the same language, then the names below *may not work* for input. You may still use the Symbol catalog (Figure 7) to select the desired character by its glyph. This will also display the character's localized markup name.

Once entered, the characters will display properly in any language.

Characters – Greek

%ALPHA	A	%BETA	B	%GAMMA	Γ	%DELTA	Δ	%EPSILON	E
%ZETA	Z	%ETA	H	%THETA	Θ	%IOTA	I	%KAPPA	K
%LAMBDA	Λ	%MU	M	%NU	N	%XI	Ξ	%OMICRON	O
%PI	Π	%RHO	P	%SIGMA	Σ	%TAU	T	%UPSILON	Υ
%PHI	Φ	%CHI	X	%PSI	Ψ	%OMEGA	Ω		
%alpha	α	%beta	β	%gamma	γ	%delta	δ	%epsilon	ϵ
%varepsilon	ε	%zeta	ζ	%eta	η	%theta	θ	%vartheta	ϑ
%iota	ι	%kappa	κ	%lambda	λ	%mu	μ	%nu	ν
%xi	ξ	%omicron	o	%pi	π	%varpi	ϖ	%rho	ρ
%varrho	ϱ	%sigma	σ	%varsigma	ς	%tau	τ	%upsilon	υ
%phi	ϕ	%varphi	φ	%chi	χ	%psi	ψ	%omega	ω

Characters – Special

%and $\wedge$	%angle $\sphericalangle$	%element $\in$	%identical $\equiv$
%infinite ∞	%noelement $\notin$	%notequal $\neq$	%or $\vee$
%perthousand $‰$	%strictlygreaterthan $\gg$	%strictlylessthan $\ll$	%tendto $\rightarrow$