

# epsilonwriter Version 1.09 – User Manual

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*English translation by Arnaud Delobelle  
Document written with epsilonwriter*

## Introduction

epsilonwriter is an applet running in a Web browser easily to create and modify documents with mathematical formulas. This applet is developed in Java and runs on Windows, MacOS and Linux. A standalone version of epsilonwriter will be available in spring, 2011.

*epsilonwriter allows:*

- To create and modify eplw documents,
- To save them on the local computer and on the epsilonwriter.com website,
- To print them,
- To create, fill and mark questionnaires,
- To produce HTML files with images and XHTML with MathML,
- To import Latex files,
- To perform numerical calculations.

## The popup

For certain actions, epsilonwriter suggests several results in **the popup** menu which works as described below. This behaviour depends on options (Settings menu):

- By default, the "Right", "Left", "Up", "Down", "Home", "End" keys allow navigating the popup; with the "Popup moves with Alt-arrows", it is necessary to type "Alt" simultaneously, otherwise the popup is exited and the cursor motion is performed instead.
  - The "Esc" key goes back to the initial choice and exits the popup.
  - The "Return" key exits the popup while applying the current choice.
  - Other keys exit the popup, applying the current choice (or going back to the initial position, depending of the options), and are applied as ordinary keyboard input.
    - The popup can also be navigated by hovering over the options with the mouse.
    - A mouse click in the popup applies the current choice and exits the popup.
    - A mouse click outside the popup applies the current choice (or goes back to the initial position, depending of the options), and exits the popup.

If the popup is hidden, it can be revealed by typing the Alt+C.

The popup choices are red for formulas and blue for text.

## The choice buttons

Red buttons produce formulas. White buttons insert a character and preserve the text/formula type of the current item.

Some buttons produce several propositions with the popup.

## Entering operators by name

Most of the operators can be input by typing their name also called "commands". There are two sorts of commands;

- "full word" commands where the word can be international, like "sin", or in the local language, like "or",
- Latex commands with completion; words begin by "\" and continue with letters. When 2 or 3 letters are typed, the operators whose names start with these letters are suggested in the popup.

Certain operators can be entered by typing symbols like: "+" "/" "[" "{" .

The "Operators | Operators and commands" displays a table of the operators and their commands in a separate window which you can keep open while editing.

## Undo, redo

It is possible to undo with the "Round left arrow" button or using **Ctrl+Z**. It undoes the interpretation of the last action if any, then undoes the last action, then all previous actions in reverse order. It is also possible to redo with the "Round right arrow" button or using **Ctrl+Y**.

Undo and redo can be performed up to 100 times.

## Saving

**Save your work** every five minutes on the local computer in order to avoid losing it, whether it is a document or an email. Select "Save as" in the file menu for a new document, or "save" or **Ctrl+S** for a previously saved document. This is particularly important with the applet as a page refresh loses the content. An \* after the file name at the top of the window indicates a that the current document has been modified since the last save.

## Text and math

With epsilonwriter, if one types: **Peter has 2/3 of the age of Paul**

One gets: **Peter has  $\frac{2}{3}$  of the age of Paul**

Because epsilonwriter automatically interprets some inputs as math.

In text areas, the cursor is blue; in math formulas, the cursor is red and the formula is framed in red. A button on the left of the toolbar indicates the current mode. The three states of the button are

**Text, Math** and **T&M**

T&M means "Text and Math" and occurs when an area containing text and math is selected.

In formulas, missing arguments are represented as question marks, e.g.,  $\sqrt{?}$

When the cursor is in a formula, typing "space" exits from the formula (placing the cursor after the end of the formula).

Another way for exiting a formula is Ctrl+right-arrow which moves the cursor to the next word.

When the cursor is in a formula, typing "Return" exits from the formula and produces a line break. There is an exception for simultaneous equations where "Return" adds a line.

There is always a space or a line break between a word and a formula. If the space between text and math is deleted, the union of the two parts is represented as text or as a formula (see "math/text transformation and reverse" below). Both choices are given in the popup. Ctrl+Z allows cancelling the union.

The "tab" key does not currently work. The "F2" key inserts 4 "spaces".

## Transforming math into text and text into math

### *Transforming of math into text*

When the cursor is in a formula or a formula is selected, if one clicks on the "Math" button (to get "Text" ) or hits Alt+T (as in "to Text"), the formula is transformed into text. For example:

$$\sqrt{\frac{1+x^2}{1-\sin^2\theta}} \quad \text{produces:} \quad \sqrt{(1+x^2)/(1-\sin^2(\theta))}$$

The main use of this transformation is to transform into text a small set of characters which have been erroneously interpreted as math by epsilonwriter. However it is generally better to deny the interpretation as math in the popup or with "undo".

### *Transforming of text into math*

When the cursor is in text or some text is selected, if one clicks on the "Text" button (to get "Math" ) or hits Alt+M (as in "to Math"), epsilonwriter tries to transform the text into a formula.

The interest of this transformation is:

- To transform into a formula a small set of characters which have been erroneously interpreted as text by epsilonwriter. However it is generally better to select the correct interpretation as math using the popup.
- To be able to paste text from another application, then to transform some parts of it into formulas.

**Warning:** The transformation of text into math is not safe: it can fail or produce an unwanted formula.

## The basics on mathematical formulas

A mathematical formula is an atomic element (variable or number) or is an operator applied to elements which are mathematical formulas.

### Operators overview

Math operators can be obtained by typing a command or by clicking on a button. Some commands (some buttons) give access to several operators, e.g., "=" gives access to "=" and "≠" while "[" gives

access to intervals and matrixes. Some operators can be obtained by several commands, e.g., a matrix can be obtained by “[” and by “mat”. The “Operator” menu shows the list of all commands.

When there are several interpretations, the non-interpreted version is usually in the list and can be selected quickly using “undo”.

In formulas, missing arguments of operators are represented as “?”. So, when one type “=” in a blank area, one gets:  $? = ?$

It is possible to transform a “?” into a small space (and inversely) by typing Ctrl+K or using the menu “Edit | Hide/Show ?”.

In formulas, Latin letters which do not constitute an operator name and Greek letters are treated as variables (in a general meaning including indeterminates and parameters) except  $\pi$  which is treated as a constant.

Operators made of letters are displayed in normal style, lowercase variables are in italic style, uppercase variables are in normal style. So, in  $\sin(x + \pi)$  one has the sine operator while in  $\sin(x + \pi)$  one has the product of “s”, “i”, “n” and  $(x + \pi)$

The product *sin* can be selected from the popup.

epsilonwriter shows the structure of the expressions. When hovering over an operator with the mouse, it is framed in red and its arguments are framed in blue.

## Basic operators

“+” has two arguments or more;  $a + b + c$  is a sum of 3 arguments; it can also be prefixed as in  $+ 5$  or on its own as in  $\mathbb{R}^+$

“-” has one argument (unary operator);  $a - b$  is treated as the sum of  $a$  and  $-b$ ; it can also be on its own as in  $\mathbb{R}^-$

There are several forms of products: implicit, with a cross, with a dot and with a hat (for vector product). Several forms can be combined, e.g.,  $2 \times 3xy \cdot z$   $2 \times \vec{u} \wedge \vec{v}$

There are several forms for “divide”:  $\frac{a}{b}$   $a/b$   $a \div b$   $a : b$  obtained by typing “/” or “:” then selecting from the popup if necessary.

Exponents are described further down.

Functions (sin, log, arcsin, etc.) can be written with the argument in brackets or not.

In the formula  $\sin 2x + \pi$ , the argument of “sin” is  $2x$

There is an exception to the product priority when there are other functions, so  $\sin a \cos b$  is the product of  $\sin a$  and  $\cos b$  as commonly understood in mathematical notation.

These notions of priority are not important when one just wants to produce documents to read. They become important when one makes calculations or interpret answers to questionnaires.

For example, asking for approximate calculations, one gets:

$$\sin \frac{\pi}{3} - \frac{\pi}{4} \simeq 0.08062724$$

$$\sin\left(\frac{\pi}{3} - \frac{\pi}{4}\right) \approx 0.25881905$$

## Brackets

Brackets have their usual meaning and can be written one at a time at any place. When a bracket is unbalanced, it appears in red.

Brackets are the only surrounding sign which can be inserted one at a time to allow more flexibility in modifying the mathematical structure of an expression. The other surrounding signs ("absolute value", "interval", "set", etc.) can only be inserted and removed both at a time.

The size of brackets automatically increases with the size of its argument.

When a bracket is deleted, the popup gives the option to delete its balancing counterpart as well.

## Subscripts and exponents

Subscripts are obtained using the commands “\_” and “sub”. Exponents (or superscripts) are obtained using commands “^” and “pow”. Examples:

Examples:  $x_i$   $y^n$   $x_i^3$

The  $x_i^3$  formula is obtained as follows:

- either by typing first  $x_i$  which produces  $x_i$ , the right-arrow to move the cursor, then  $^3$
- or by typing first  $x^3$  which produces  $x^3$ , the right-arrow to move the cursor, then  $_i$

It is possible to have subscripts and superscripts on certain operators, e.g.:

$\cos^2 x$   $\log_a b$   $\log_2^3 x$

## Roots

A root is obtained by typing "root" or by clicking on a button. A square root is obtained. The popup allows to get a higher order root:  $\sqrt[n]{a}$

When it is not done at the beginning, it is possible to add an order to  $\sqrt{a}$  by placing the cursor in front of  $a$  and by typing "^" or by selecting the operator with Ctrl+click then using the popup.

In order to put a root over an existing expression, select the expression then click on the "root" button.

The root sign in  $\sqrt{a}$  can be deleted by placing the cursor in front of (or behind) the V of the root sign and typing Del (or Backspace).

The 3 of  $\sqrt[3]{a}$  can be deleted with Del or Backspace.

# Lists, tuples, sets and intervals

## Lists

Lists are combinations of expressions with the "," or ";" operator, e.g.:

$$1, x, x^2, \dots, x^n$$

$$x \mapsto x+2; x \mapsto x^2; x \mapsto 2^x$$

"," and ";" are true operators as one can see by flying over them with the mouse.

"," has higher priority than";". So,  $a; b, c; d$  is a list of 3 elements, the second element being the list  $b, c$

Please, note that when the decimal separator is a "," (as in France, Italy and some other countries), "," has two meanings and that the user has to choose the correct one. Hitting "," after  $a$  produces  $a, ?$  (a list) and  $a \times ??$  (product of  $a$  and a decimal number which digits have to be typed) in the popup. Hitting "," after 1 produces  $1, ?$  (a decimal number) and  $1, ?$  (a list) in the popup.

It is possible to change a list with "," into a list with ";" (and conversely) by selecting the "," with Ctrl+click then using the popup.

## Tuples

A tuple is a list in brackets, e.g.:

$$(1; 2; 4; 8)$$

$$(a, b)$$

## Sets

A set is a list in curly brackets, e.g.:

$$\{1; 2; 4; 8\} \quad \{a, b\}$$

A new set is obtained by typing "{ " (which also gives simultaneous equations) or the "{a;b}" button. Use the popup to select the form you require.. It is possible to transform a list into a set by selecting the list and typing "{ " then using the popup.

## Intervals

An interval is a list of two elements surrounded by square brackets, e.g.:

$$] - \infty ; 0 [ \quad ] - 1 ; 1 [ \quad [ 0 ; \pi ]$$

A new interval is obtained by typing "[" (which also provides matrixes) or the "[a;b]" button. Use the popup to get the required form. It is possible to transform a list into an interval by selecting the list and typing "[" or "]", then use the popup.

## Systems, matrixes and tables

## Systems

A system is represented with a "{", e.g.:

$$\begin{cases} x + 2y = 0 \\ y = \frac{x}{2} + 1 \end{cases}$$

A new system is obtained by typing "{ " (which also provides sets) or the adequate button.

Use "enter" to add a line to the system.

In order to transform a "and" like the one of  $2x + 1 = 0$  and  $x = 5$  into a system, select the "and" with Ctrl+clik then change with the popup.

## Binomials

Binomials are represented in brackets. Use the "(" key, e.g.,  $\binom{n}{k}$

## Matrices and determinants

Matrixes are represented between "(" or "[" or "{" and determinants between "|", e.g.:

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \begin{cases} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{cases} \quad \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

A new matrix is obtained by typing "( " or "[ " or "{ " or "| " or the "matrix" button or the menu "Table".

A matrix can be transformed into another sort of matrix, a determinant or a mathematical table. To do this, select the edge of the matrix with Ctrl+clik then use the popup.

Matrixes and determinants have the properties of mathematical tables, see below.

Use commands of the "Table" menu to add or remove lines or columns.

## Mathematical tables

Mathematical tables contain formulas and are possible arguments of formulas. The content of the cells is horizontally and vertically centered.

There is also a general table, called "table" which is described below. (General) tables allow writing text and formulas in the cells. This makes them more flexible.

There are five ways to display a table as illustrated below.:

1	2	3	4
	x	y	
$\sqrt{2}$			$\sqrt{3}$

1	2	3	4
	x	y	
$\sqrt{2}$			$\sqrt{3}$

1	2	3	4
	x	y	
$\sqrt{2}$			$\sqrt{3}$

1	2	3	4
	x	y	
$\sqrt{2}$			$\sqrt{3}$

$$\begin{array}{cccc}
 1 & 2 & 3 & 4 \\
 & x & y & \\
 \sqrt{2} & & & \sqrt{3}
 \end{array}$$

The 5 ways to display a table: (1) all lines and columns have borders, (2) only the first two columns have borders, (3) only the first column has borders, (4) none of the columns have borders (5) with no border.

A new mathematical table can be created by typing "tabM" or a command of the "Table" menu.

Use commands of the "Table" menu to add or remove lines or columns.

"?" can be changed into white cells (and conversely) with Ctrl+K or the menu "Edit | Hide/show ?", applied to a selection or a single "?".

It is possible to place a short text in a cell by transforming it into text with Alt+T or the "Math" button.

The edge of a table can be changed by selecting it with Ctrl+click, then using the popup. A mathematical table can also be transformed into a matrix or a determinant in this way.

Example of a complex mathematical table:

$x$	$-\infty$	$-1$	$0$	$1$	$+\infty$
$f'(x) = \frac{-2x}{(x^2-1)^2}$	+		+ 0 -		-
$f(x) = \frac{x^2}{x^2-1}$	1 ↗ +∞		-∞ ↗ 0 ↘ -∞		+∞ ↘ 1

In this table there are white cells, double bars, big ascending and descending arrows.

It is possible to insert a mathematical table into the cell of a mathematical table.

It is suggested to use mathematical tables instead of (general) tables:

- when there are only formulas to write in the cells (or very little text).
- when they are included in a formula as in:

$$\begin{array}{|c|c|c|} \hline a & b & c \\ \hline d & e & f \\ \hline \end{array} + \begin{array}{|c|c|c|} \hline a & b & c \\ \hline d & e & f \\ \hline \end{array} = 2 \times \begin{array}{|c|c|c|} \hline a & b & c \\ \hline d & e & f \\ \hline \end{array}$$

It is possible to transform a mathematical table into a (general) table without losing information (menu "Table").

## Sums, integrals and other "big operators"

"Big operators" are operators looking like  $\sum_{k=0}^n k$  with a possible subscript and superscript. There are:

"sum", "product", coproduct", "integral" (several forms), and certain forms of "union", "intersection",

"logical and", logical or".

## Sums

Sums are represented with  $\sum$  e.g.,  $\sum_{k=0}^n k^2$   $\sum x_i$

A new sum is obtained by typing "sum" or clicking on the adequate button. Use the popup in order to obtain a form with or without subscript and superscript.

Subscripts and superscripts work like subscripts and superscripts of functions. They can be deleted with Del and Backspace.

A subscript can be obtained in  $\sum x_i$  by placing the cursor before  $x$  and hitting "\_", one gets:  $\sum x_i$ . A superscript can be obtained by placing the cursor before  $x$  and hitting "^".

Sums have lower priority than  $+$  and  $\times$ . So considering  $\sum x_i + y_i$  the  $+$  sign is inside the  $\sum$  sign.

There is an exception to this rule when other "big operators" appear in the expression. So,  $\sum x_i + \sum y_i$  is a "+" between  $\sum x_i$  and  $\sum y_i$

The  $\sum$  operator can be changed by selecting it (Ctrl+click) then using the popup. It can be changed to  $\sum?$  or  $\prod$  or  $\coprod$

## Integrals

Integrals are represented with integral signs, e.g.:

$$\int_{-2}^2 x^2 dx \quad \iint f(x, y) dx dy$$

A new integral is obtained by typing "itg" or with an adequate button.

Subscripts and superscripts can be added as with sums.

An integral operator can be changed by selecting it (Ctrl+click) then using the popup. The choices include adding subscript and superscript, or replacing the integral with a double or triple integral sign.

## The other "big operators"

A product  $\prod$  is obtained by "prod" or a button, a coproduct by "prod" or a button.

A "big union"  $\bigcup_i P_i$  is obtained by "union", a "big intersection"  $\bigcap_i P_i$  is obtained by "inter".

A "big logical and"  $\bigwedge_i q_i$  is obtained by "gand", a "big logical or"  $\bigvee_i q_i$  is obtained by "or".

All these operators can be manipulated in the same way as "sum". They can be changed selecting them (Ctrl+click) and using of the popup.

## Images

Images can be inserted into the document with the menu "File / Import an image". It is also possible to paste images copied from other applications. The supported formats include png, jpeg, gif, bmp.

Images are treated as mathematical objects. So, it is possible to put them in formulas and mathematical tables, e.g.:



It is possible to perform search and replace on images.

The content of images are saved in the eplw file (unlike HTML).

## Tables

Tables are analogous to mathematical tables at the structure level, but the cells contain paragraphs which can include text, formulas, images, etc. The default alignment of paragraphs is left. They can be centered by the user.

A table is obtained with the "tabT" command or the "Table | Insert a table" menu. It is possible to add, delete, and shift lines and columns using the "Table" menu.


It is possible to adjust the width of a column by dragging its right edge. This works even for hidden edges. When the mouse is over the right edge of a column, the cursor becomes a double horizontal arrow. The edge can then be dragged left or right (by pressing the left mouse button and moving the mouse while the left button remains pressed).

As for mathematical tables, it is possible to change the form of a table with a Ctrl+click on the top or bottom edge.

Differences between tables and mathematical tables:

	<b>Table</b>	<b>Mathematical table</b>
Content of a cell	paragraphs	a formula
Horizontal alignment	left	centered
Vertical alignment	top	centered
The width of a column can be changed	yes	no
Can include images	yes	yes

Example of table:

Cell containing text and formulas	Centered cell (at the request of the user) containing a table and a mathematical table	Cell containing an image																		
Count all the expressions matching $2x^n$ for any $x$ and $n$ can be done with the search panel and the expression $2 \textcircled{x} \textcircled{n}$	<table border="1" data-bbox="544 342 1038 450"> <tr> <td>un</td> <td>deux</td> <td>trois</td> <td>quatre</td> </tr> <tr> <td>one</td> <td>two</td> <td>three</td> <td>four</td> </tr> </table> <table border="1" data-bbox="651 461 916 562"> <tr> <td><math>x</math></td> <td><math>2x</math></td> <td><math>\frac{x}{2}</math></td> <td><math>x^2</math></td> <td><math>\sqrt{x}</math></td> </tr> <tr> <td>16</td> <td>32</td> <td>8</td> <td>256</td> <td>4</td> </tr> </table>	un	deux	trois	quatre	one	two	three	four	$x$	$2x$	$\frac{x}{2}$	$x^2$	$\sqrt{x}$	16	32	8	256	4	
un	deux	trois	quatre																	
one	two	three	four																	
$x$	$2x$	$\frac{x}{2}$	$x^2$	$\sqrt{x}$																
16	32	8	256	4																

It is possible to transform a table into a mathematical table with the "Table" menu. In each cell, the first item is kept (and transformed into math if it is not math), the other items are lost.

It is possible to transform a mathematical table (if it is not embedded in a larger formula) into a table with the "Table" menu.

At the present time, it is not possible to select columns. This will be possible soon.

## Selecting expressions, cut, copy, paste, drag & drop

### Overview

Selection in formulas is structured: only sub-expressions can be selected (for example, it is not possible to select  $x + 3$  in  $4x + 3y$ ).

In order to select an area which is not a sub-expression, it is necessary to make it a sub-expression by inserting brackets or "," or ";".

It is possible to cut, copy, paste and drag & drop. Paste and drop do not work for text inside math.

When the applet has been loaded without **\*\*\*functioning restriction\*\*\***, cut, copy and paste use the system clipboard. It is then possible to copy text in an application and to paste it in epsilonwriter.

Paste in math on a selected expression works as a substitution; brackets may be inserted automatically. For example, if  $x + 3$  is pasted in  $3yz$  when  $y$  is selected, one gets  $3(x + 3)z$ .

Paste on a cursor position in math often produces several propositions in the popup corresponding to different operator used to combine the pasted object.

For example, if  $u + 2$  has been copied and is pasted in  $2x + 3y = 5$ , the cursor being before 5, one gets the following choices:

- $2x + 3x = u + 2 + 5$  which is "paste with plus",
- $2x + 3x = -(u + 2) + 5$  which is "paste with minus",
- $2x + 3x = (u + 2) \times 5$  which is "paste with times",
- $2x + 3y = \frac{u + 2}{5}$  which is "paste with fraction".

## Copy for other applications

For other applications, epsilonwriter puts in the clipboard a representation in text format. Formulas are represented in a linear way with Unicode (UTF8) characters.

For example, if one copies in text format the following:

**Here is a fraction:**  $\frac{1}{1 + \frac{1}{1 + \frac{1}{2}}}$  **and a square root:**  $\sqrt{\frac{x+1}{1-\sqrt{x}}}$

and pastes it in another application, one gets:

**Here is a fraction:** 1/(1+1/(1+1/2)) **and a square root:** √((x+1)/(1-√x))

## Copy of a formula for Word2007/2010

When a single formula is copied, the chosen representation for the other applications is MathML or text. An option in the "Settings" menu allows choosing this representation. The MathML representation provides well displayed formulas in Word2007 and Word2010 documents when they are in ".docx" format.

## Copy a questionnaire

When the document is a questionnaire, it is possible to copy as "questionnaire" or as "test" using the "Edit" menu (this copies the selection or all if nothing is selected). Then, it is possible to paste in another epsilonwriter window where the mode is set to questionnaire or test. This is a simple action which allows trying the questionnaires when they are written.

## Pasting text

Text coming from any application can be pasted in epsilonwriter. Integer and decimal numbers are automatically interpreted as formulas, the rest as text.

It is possible to move from word to word with Ctrl+Right-Arrow and to convert into formulas with Alt+M when required.

## Pasting an image

It is possible to paste an image which has been copied from another application.

## Search

### Traditional Search and replace

The Search panel appears when "Edit | Search" is chosen or Ctrl+F is typed.

If a small part of the document was selected, it is copied in the "Find" field.

When the insertion point is in one of the "Find" and "Replace by" fields, certain menus are disabled; in particular this is the case of the "Edit" and "Style" menus. However, it is still possible to do cut,

copy and paste using keys Ctrl+X, Ctrl+C, Ctrl+V. The style is removed when paste in applied to the "Find" or "Replace by" field.

In addition to the traditional button for "Find" and "Replace", the panel includes a button for counting the occurrence of the content of the "Find" field.

The "Find" field can contain one or several items (an item being a part of text without space, or a formula) on one or several lines. Items on several lines are treated as if they were on the same line. When there are several items, the search is performed with whole words and formulas. When there is only one item, the way the search is performed depends on the options ticked in the checkboxes.

The parameters of the search are:

- Uppercases: if this box is checked, the search is case sensitive; otherwise it is case-insensitive.
- Accents: if this box is checked, the search considers accents in the text, otherwise they are disregarded. This includes double letters like "œ" compared to "oe".
- Punctuation: if this box is left unchecked, the characters " ' , ; : ! ? . - \_ " are ignored in the search. In this case **re-writing** will match with **rewriting**.
- Whole word: if this box is checked, whole words are searched, otherwise part of words are searched.
- Whole formula: if this box is checked, whole formulas are searched, otherwise sub-expressions in formulas are searched.

In formulas, the search is always case sensitive and considers accents as well.

## Search and replace with template, rewriting

It is possible to use "template variables" which are also called "match variables" in the "Find" area. A "match variable" is a lowercase circled letter like  $\textcircled{u}$  which is obtained using the  $\textcircled{x}$  button of the "Operators" panel or by typing "var" on the keyboard. These variables will match with any

mathematical formula. If  $\textcircled{u}^2$  is searched in  $\frac{3y^2}{2}$  it is found with  $y$  matching with  $\textcircled{u}$

During the matching process, brackets are ignored (but the structure is respected). So,  $\textcircled{x}\textcircled{y}$  is found in  $2 + 5(a^2 + 1)$  with  $5$  matching with  $\textcircled{x}$  and  $a^2 + 1$  matching with  $\textcircled{y}$

During the matching process, the three representations of "times" (cross, point or nothing) are considered equivalent.

If a matching variable is written several times in the "Find" part, it will correspond to the same formulas in the solutions of the search. For example  $\textcircled{u} + \textcircled{u}$  is found in  $5(3x^2 + 3x^2)$  but not in  $3x^2 + 4x^2$

The result of a search with matching variables which succeeds is composed of a formula and a substitution (association between matching variables and formulas). During the replacement, the found formula is replaced by the formula of the "Replace by" field on which the substitution is applied. For example, if the "Find" formula is  $\sin\left(\frac{\pi}{2} - \textcircled{x}\right)$  and the "Replace by" formula is  $\cos\textcircled{x}$ , the search

succeeds on  $2 \sin\left(\frac{\pi}{2} - \frac{\theta}{\sqrt{2}}\right)$  and the replacement provides  $2 \cos \frac{\theta}{\sqrt{2}}$

A replacement corresponds to the notion of rewriting.

It is possible to use matching variables in the formulas of the document, but they will not be reached by the search process.

When there is a selection, "Count" and "Replace all" apply to the selection. Otherwise, they apply to the entire document.

## Calculations

The "Calculation" menu allows to have calculations performed by epsilonwriter for the selected expressions (which can be a sub-expression). Currently, it is possible to get exact calculations:

- on integers for operators + - \* ^
- on decimals for operators + - \* ^
- on rational numbers for operators + - \* / ÷ : ^

and it is possible to get approximate calculations for many operators including logarithm and sine.

It is possible to switch between the decimal and fractional representation of numbers.

When the selected expression cannot be calculated with the selected process, sub-expressions which can be calculated are calculated. Thus, if "integer calculations" is requested for  $(2+4)x+3*5+2.7$  one gets  $6x+15+2.7$

The result of the calculation can be inserted in the document in two possible ways: the first one replaces the original expression by the calculated expression, the second one writes  $A = B$  or  $A \simeq B$  where A is the original expression and B the calculated expression.

Please, note that  $A = B$  is not built as a formula, but with A, a space, an "=" sign alone, a space and then B. This way the result can be modified more easily. For example, if one selects  $4 + 2$  in  $2x = 4 + 2$  and asks for integer calculations, one gets:  
 $2x = 4 + 2 = 2x = 6$  where the "=" between the two equations can easily be replaced by "thus".

## Files, messages, publishing, printing

### Saving

Documents can be saved on the local computer. The file extension is ".eplw" and the files are in a specific format.

*Saving documents on the computer is the safest method of keeping them.*

When a document is stored in a different manner, e.g. on the web server of the epsilonwriter.com site, it is important to save it locally as well.

### *Save your documents every five minutes*

In its current version, the applet loses all its content if on a browser page refresh. Therefore it is important to save the documents often. The standalone version, which will be available in Spring 2011, will have no refresh problem.

## **Links, publishing**

The epsilonwriter applet allows to get links. In that case, epsilonwriter saves the document in the website database and provides a link that can be used to view and edit the document. This link can be used to publish the document on the web and can be easily pasted onto web pages, social networking sites, message boards, etc.

## **Messages**

In the epsilonwriter applet, with the "Send | send" menu option, you can send the document (or the selected part) in an email message. The message will be sent in HTML format with images and will look very similar to the original document. However, some webmail clients such as Horde do not display such messages. A link is provided that allows the recipient to view the document on the epsilonwriter portal and also to reply using and modifying the formulas in the original message.

In the epsilonwriter applet, with the "Send | copy to paste in email", you can copy the document in order to paste it in an email using a format which works on every platform. This format is made of two parts: the first one is a text representation of the message and the second an eplw representation of the message. People receiving the message can read the text representation (especially for simple messages). However, it is better to copy the entire message and to paste it in epsilonwriter in order to get the original form and to be able to modify it.

## **Forum**

The epsilonwriter portal contains forums which use the epsilonwriter applet for reading and writing.

## **Export in HTML with images**

The *Save in HTML with images* command of the file menu allows to produce an HTML file which can be displayed by browsers. Formulas are transformed into images. When the file is named xxx.html, a folder with name xxxHTML is created for saving the images.

This HTML file can be placed on a web site, with the folder containing the images besides.

Images representing formulas are placed in the text with a preservation of the baseline. In order to avoid overlapping of lines when the window is narrowed, the automatic line feed is cancelled. The length of the lines is the width of the window at the time the file was created. It is recommended to avoid big widths.

When the document contains paragraphs "Header1" or "Header 2", a summary is added at the beginning of the document with links giving access to the sections.

## **Export in XHTML with MathML**

The *Save in XHTML with MathML* command in the file menu produces an XHTML file in which formulas are encoded in MathML. These files can be read by some web browsers (Firefox, Opera, Amaya, Internet Explorer with the MathPlayer plugin - the plugin must be installed and its execution must be allowed). When the document includes images or questions, a folder is created where all the images will be saved. If the file is named yyy.xhtml, the folder will be named yyyXHTML and will be created in the same directory as yyy.xhtml.

This XHTML file can be placed on a web site together with the folder containing the images.

The MathML representation produces better displayed formulas and requires less storage place. It is left to the browser to break up paragraphs into lines. This means that the length of lines will adapt to the size of the viewing window (as in epsilonwriter).

When the document contains paragraphs with style "Header1" or "Header 2", a table of content is inserted at the beginning of the document with links giving access to the sections.

Please note that:

- Firefox is slow when loading files with a lot of formulas,
- Amaya can be used to edit the file.

## **Printing epsilonwriter documents**

epsilonwriter documents can be printed using the "File | Print" menu option.

## **Importing Latex files**

Source Tex/Latex files can be imported into epsilonwriter. However, there are latex commands which are not interpreted: in particular tables and images are not interpreted in the current version. This import function should be seen as a way to retrieve an important part of files but is not a full "Latex to eplw function".

The import is made when opening the file (open command). The file must begin with `\documentclass`.

Tables and figures are replaced with the words TABULAR and FIGURE written in red; formulas which produce an error are replaced with the word ERROR written in red. Unknown commands in formulas are ignored or written in red (depending on an option in the Setting menu). Unknown commands in text are silently ignored.

This function will be improved later.

## **Miscellaneous**

### **Delete unnecessary brackets**

The menu "Edit | Delete unnecessary brackets" removes unneeded brackets in the formulas included in the selection. However, brackets surrounding an entire formula are kept and so are arguments of a

product (so that  $f(x)$  which is represented as a product is not transformed into  $fx$  ).

## Splitting a formula

The menu "Edit | Split formula" allows to split a formula in two at the position of the cursor.

## Style

epsilonwriter contains some style elements which are accessible via the "Style" menu. Bold, italic, font size changes can be applied to parts of texts.

The style of formulas is automatic. Letters in operators such as "sin" are roman; other letters are roman (uppercase) and italic (lowercase).

It is possible to change the font size and weight (but not italic) of a formula, but for the entire formula only.

Colour is black except for quote and some elements of questionnaires (scores, explanations, annotations).

Paragraphs can be aligned to the left or centred.

There are four predefined paragraph styles:

- Normal: roman, normal size, aligned to the left,
- Title: roman, big size, centred
- Header 1: roman, big size, aligned to the left,
- Header 2: roman, medium size, aligned to the left.

## Zoom

With the zoom menu one can adjust the level of magnification of the document.

## Vertical bars

A vertical bar can be obtained with the "bar" and "|" commands.

A double vertical bar can be obtained with the "dbar" and "||" commands.

In mathematical tables, the height of bars adjusts according to the height of the cells they are in.

## Localization

The decimal separator is "." or "," depending of the language.

Switching languages changes the operators which are words of the language. For example, when switching from English to French, the formula:

$x > 1.3$  and  $p = \text{true}$

is transformed into:

$x > 1,3$  et  $p = \text{vrai}$

## Quotation

Paragraphs can be quoted. Quoted paragraphs are displayed in a different colour. There are 4 quotation levels and 4 colours.

- "Ctrl+K" increases the quotation level of the current paragraph or the selected paragraphs.
- "Alt+K" decreases the quotation level of the current paragraph or the selected paragraphs.

## Settings

In the "Settings" certain functioning parameters of epsilonwriter can be changed :

- whether or not to use the "Alt" key for movements in the popup,
- whether or not a popup suggestion needs to be validated with a click or the "Return" key,
- whether or not unknown Latex command should be displayed when Latex files are opened.

## Questionnaires: creation

To create a questionnaire, insert an "Open answer" or a "Multiple choice" using the "Questionnaire" menu. It is also possible to insert a header or a calculation area. When one of these items is present, the document has the "questionnaire" status and the color of the tool panel turns from green to blue.

### Open answers

An open answer accepts a formula. The author must provide :

- The expected answer,
- The score
- The comparison level:
  - 1 for a direct comparison
  - 2 for taking into account a generalized associativity
  - 3 for taking into account commutativity as well
  - 4 for taking into account neutral elements as well
  - 5 for taking into account integer calculations with  $+$   $-$   $*$   $^$  as well
  - 6 for taking into account decimal calculations with  $+$   $-$   $*$   $^$  as well
  - 7 for taking into account rational calculations with  $+$   $-$   $*$   $/$   $\div$   $:$   $^$  as well
- The case sensitivity (Title:  $XY=xy$ ). When 1 is provided, X and x are treated as identical.
- The substitutable letters. If x is a substitutable letter, any free letter will be accepted in its place.

In order to have 012 accepted when the expected answer is 12, the comparison level must be 4 or more.

In order to have 1.20 accepted when the expected answer is 1.2 the comparison level must be 4 or more.

### Several expected answers with the same criteria

It is possible to accept several expected answers with the same criteria in the "Expected answer" field. To do this, use the "Questionnaire / Insert an "or" for expected answers" menu option. It draws a Meta "or" operator (a line and 4 dots) between expected answers.

## Several expected answers with different criteria

To accept several expected answers with different criteria, it is necessary to add lines to the table containing expected answers. It is possible, for example, to have a first line with 4 as expected answer, a score of 3 and a level of comparison equal to 1, then a second line with 4 as expected answer, a score of 2 and a level of comparison equal to 7. In this case, a student answering 4 gets a score of 3 while a student answering 2+2 gets a score of 2.

When there are several lines, the score of the question is the maximum of the scores of the lines. The right answer which will be displayed to the student is the first answer having the maximum score. The student score is the maximum of the lines having an expected answer which matches the student's answer.

## Explanations

The author may also provide an explanation in the frame where "explanation" is written. Explanations are displayed in the assessment mode of the questionnaire.

## Multiple choices

There are two forms of multiple choices: with two radio buttons and with checkboxes in front of each item. Checkboxes are more common. Radio buttons have the advantage of distinguishing an incorrect answer from a non answer. Each form can be changed into the other (and to a single choice in a list) with the menu "Questionnaire | Change the type of choice".

In multiple choices, the author has to provide:

- The text to be displayed
- The correct answer by checking or not the box or clicking on the clicking radio button
- Explanations to be displayed during the assessment phase
- The score, called "maximum score"
- The minimum score, usually 0, but it can be negative
- The coefficient for an incorrect answer (see explanation below)

An item can be added by placing the insertion point in the text or explanation area and using "Add item above" or "Add item below" of the "Questionnaire" menu.

When a multiple choice has a maximum score equal to  $S$ , a coefficient for incorrect answer equal to  $K$  and has  $N$  questions, the calculation of the score is made as follows:

- For each unanswered question (radio button only),  $S/N$  points are subtracted,
- For each incorrectly answered question,  $K(S/N)$  points are subtracted.

Using a coefficient for incorrect answer equal to 2, people who answer randomly will generally have a score close to zero.

Using a higher coefficient strengthens the need of answering correctly.

## Single choice in a list

Single choices in a list have a unique radio button in front each item. These choices do not allow

selecting several items.

A single choice in a list can be changed into a multiple choice with the menu "Questionnaire | Change the type of choice".

The coefficient for an incorrect answer is not used.

## **Calculation areas**

It is possible to insert calculation areas to let the students make their calculations and reasoning in the questionnaire before answering the question.

## **Header**

It is possible to insert a header to give a global score to the student. The author has to indicate the maximum score and the number of decimal digits of the global score.

The sum of the scores of the different questions is not required to be equal to the global score indicated in the header.

## **+ and - buttons**

To preview the document as seen by the student, click the "-" button.

To go back to authoring mode, click the "+" button.

## **Saving a questionnaire in author mode**

Normally, files are saved in "write" mode (with extension ".eplw"). It will then be possible to open and modify the file.

"Save in read-only mode" saves in "read" mode (with extension ".read.eplw"). It will be possible to open the file, but only to read it.

"Save as a questionnaire" saves in "question" mode (with extension ".question.eplw"). It will be possible to open the file, but only to answer to the questions in "question" mode (see below).

"Save as a test" saves in "test" mode (with extension ".test.eplw"). It will be possible to open the file, but only to answer to the questions in "test" mode (see below). Here, epsilonwriter requires an assessment password. An assessment password must be provided to prevent students from accessing the assessment phase ahead of time.

It is also possible to send a questionnaire by email ("Send" menu with the two modes already described) or to get a link and this for each of the four above modes.

## **Testing a questionnaire**

It is important that authors test their questionnaires, giving correct and incorrect answers, in order to verify:

- that there is no missing answer,
- that the correct answer is present,
- that the score corresponds to the author's wish.

Testing a questionnaire can be done question by question or with the entire questionnaire.

The simplest way to test a questionnaire is as follows. The questionnaire being in a window A, launch another epsilonwriter in a window B. In window A, choose "Send | Copy to paste in email as questionnaire" then paste in window B with Ctrl+V. Then, answer to the questionnaire in window B as a student would do.

## Questionnaires: answer

### Question mode

Question mode means practice mode. When a questionnaire is in question mode, the user can answer a group of questions, then go to the assessment of this group by clicking on the "+" button. He/she then gets the status (correct or not) of the answer, the correct answer, the score and the explanations. He/she can click on the "-" button and modify the answer.

At the end of the questionnaire, or when the user wants to stop, he/she can choose the "Result/Result" menu option to enter the result mode.

At this moment, he/she gets a global score. The answer cannot be modified.

The user can enter the assessment phase by choosing "Result / Correct". This allows writing annotations in specific areas and writing a "tutor score" for open answers.

Saving the questionnaire is done in the "result" mode. It is also possible to send the questionnaire or to ask for a link.

### Test mode

When a questionnaire is in test mode, the user can answer groups of questions (there is no "+" button).

At the end of the questionnaire, or when the user wants to stop, he/she can choose the "Result/Result" menu option to enter result mode.

If the questionnaire is protected with an assessment password, it must be provided before entering result mode. Then he/she gets a global score, and for each question, the status (correct or not) of the answer, the right answer, the score and the explanations.

A user who knows the assessment password can enter the assessment phase by choosing "Result / Assessment". This allows writing annotations in specific areas and writing a "tutor score" for open answers.

Saving the questionnaire is made:

- in "endTest" mode (with extension ".endTest.eplw") if the questionnaire has an assessment

password,  
- in "result" mode otherwise.

It is also possible to send the questionnaire or to get a link.

### **endTest mode**

Opening a file saved in "endTest" mode displays the student's work without scores, explanations, or annotations.

A user who knows the assessment password can enter the assessment mode with the menu option "Result / Assessment" to write annotations in specific areas and write a "tutor score" if desired in open questions.

Saving is made in the "Result" mode. It is also possible to send the document or to get a link.

### **Result mode**

Opening a file saved in "Result" mode displays the student's work with scores, explanations and annotations.

A user who knows the assessment password can enter the assessment mode with the menu "Result / Assessment" in order to modify annotations and tutor scores.

Saving is made in "Result" mode. It is also possible to send the document or to get a link.