

The L^AT_EX Tutorial

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Chapter 1

Introduction

1.1 Welcome to L^AT_EX!

This file is designed for all of you who have never heard of L^AT_EX, or don't know it very well. Now, don't panic - you won't need to learn L^AT_EX to use L^AT_EX. That is, after all, the whole point of L^AT_EX: to provide an almost-WYSIWYG interface to L^AT_EX. There are some things you will need to learn, however, in order to use L^AT_EX effectively.

Some of you probably found your way to this document because you tried to put two spaces after a “.” or tried to put 3 blank lines between paragraphs. You found out you couldn't and in fact, you'll find out that most of the little tricks you're accustomed to use in other word processors won't work in L^AT_EX. That's because most word processors you've used before allow you to manually enter all spacings, font changes, and so on. So you end up not only writing a document but typesetting it, too. L^AT_EX does the typesetting for you, in a consistent fashion, letting you focus on the important things, like the content of your writing.

So read on to learn more about L^AT_EX. Reading this tutorial is definitely worth the time.

1.2 What the Tutorial *is* and what it *isn't*

Before we get started with this section, we want to make a quick note of something. The *Tutorial* uses the notation outlined in the *Introduction* manual. If you came to this manual first, please read the *Introduction* before you

continue with the *Tutorial*.

Now that you know which fonts mean what, we want to talk a bit about what this *Tutorial* is for.

1.2.1 Getting the most out of the Tutorial

This tutorial consists of examples and exercises. To get the most out of this document, you should read through the document, typing all the little things we're telling you to type and trying out all of the exercises to see if you get them right. For convenience, you might want to print out the PDF version of this document.

If you are familiar with L^AT_EX, you'll probably be able to read the *Tutorial* somewhat faster, since many L^AT_EX ideas are just L^AT_EX ideas in disguise. However, L^AT_EX have features you'll want to learn about. Even if you don't feel like reading the rest of the *Tutorial*, you should definitely check out Section 5.2, which is specifically written for experienced L^AT_EX users.

1.2.2 What you *won't* find

- Detailed explanations of all of L^AT_EX's features.

Look in the *User's Guide* when you need this.

- Detailed explanations of L^AT_EX.

Unnecessary. If you want to learn some of the neat tricks you can do with L^AT_EX in L^AT_EX, you can have a look at the *Embedded Objects* manual.

It's time to move onwards, time for your first document ...

Chapter 2

Getting started with L^AT_EX

2.1 Your first L^AT_EX document

OK. You're ready to start writing. Before you do, there are a few things we need to mention, which will hopefully make the Tutorial more instructive and useful.

Because there is information we can't give you in the Tutorial, the *first* thing that you need to do is find the other help files. This is very simple: Start up L^AT_EX, Choose the *User's Guide* from the **Help** menu. You may want to load the *Tutorial* as well (if you're not reading it within L^AT_EX already). This way, you can read them while you're writing your own file.¹ Note that once you've got more than one document open, you can use the **View** menu or the document tabs to switch between them.

In this Tutorial, we're going to assume that you have a fully working version of L^AT_EX, as well as a L^AT_EX-distribution, a DVI-, and a PDF-viewer. This should be the case on all major Linux- and BSD-distribution, as well as on Windows, where this is setup by the L^AT_EX installer.

Finally, we've written a file to let you practice your L^AT_EX skills on, it's called `example_raw.lyx`. Imagine that it was typed by someone who didn't know about any of L^AT_EX's great features. As you learn new L^AT_EX functions, we'll suggest that you fix those parts of `example_raw.lyx`. It also contains "subtle" hints about how to fix things.² If you want to cheat, or check what you've done, there's also a file called `example_lyxified.lyx` which contains

¹They can also serve as good examples of how to use the many features of L^AT_EX.


²The hints are located in yellow "Notes". Access the text in a note by clicking on it.

the same text written and typeset by a L^AT_EX master.

The example files can be found in the `examples` directory of L^AT_EX's installation folder. Open the raw document, and use **File**▷**Save As** to save a copy in your own directory for you to work on. As you fix parts of the raw document, check to see how those changes affect the DVI output.

By the way, the `examples` directory contains lots of other examples files. They will show you how to do various fancy things with L^AT_EX. After you read the Tutorial, or when you're confused about how to do something fancy in L^AT_EX, take a look at these files.

2.1.1 Typing, Viewing, and Exporting


- Open a new file with **File**▷**New**
- Type a sentence like: **This is my first L^AT_EX document!**
- Save your document with **File**▷**Save As**.
- Run L^AT_EX to create a DVI file, with **View**▷**DVI** or the toolbar button . L^AT_EX will open a DVI-viewer program displaying your document looking like when printed.³
- Export the ready to print document with **File**▷**Export** to a format you want.



Congratulations! You've written your first L^AT_EX document. All of the rest is just details, which is covered in the other manuals.

2.1.2 Simple Operations




L^AT_EX can of course do most of the things you're used to do with a word processor. It will word-wrap and indent paragraphs automatically. Here's a quick description of how to do some simple actions.


Undo L^AT_EX has multiple levels of undo, which means you can undo everything you've done since your current editing session started, by selecting

³You can save time by leaving the DVI-viewer running in the background. Then, you can use **View**▷**Update**▷**DVI** or the toolbar button  and just click on the DVI-viewer window (or unminimize it) after L^AT_EX finishes running.

Edit▷Undo (toolbar button ) over and over again. If you undo too much, just select **Edit▷Redo** (toolbar button ) to get it back.

Currently, undo is limited to 100 steps. Undo also doesn't work for *everything*; for instance, not for changes to the document layout what is really a L^AT_EX bug.

Cut/Paste/Copy Use **Edit▷Cut** (toolbar button ) , **Edit▷Copy** (toolbar button ) , and **Edit▷Paste** (toolbar button ) to cut, copy, and paste. Or automatically paste selected text (including selections from other programs) with the *middle mouse button*.

Find/Replace Use **Edit▷Find & Replace** (toolbar button ) to search. In the dialog, search with the **Find Next** button, and use the **Replace** button to replace a word you've found.⁴ If you like, you can specify whether to make the search case-sensitive, or to search for only complete words; you can also search backwards through the document.

Character Formatting You can *emphasize* text (which will by default print characters in italics), set it in **bold face**, or in **NOUN STYLE** (usually small caps, used for people's names) from the toggle buttons in the **Edit▷Text Style** dialog (toolbar button **ab**).

Toolbar There are buttons on the toolbar (just below the menus) which allow you to do some of the more popular functions, such as **Paste** and **Print**.

Of course, you haven't yet written enough to make most of these functions useful. As you write more, though, try undoing, pasting, etc.

2.1.3 WYSIWYM: Whitespace in L^AT_EX

One of the hardest things for new users to get used to is the way that L^AT_EX handles whitespace. As many times as you hit **Return**, you'll only get one

⁴Close the window when you're done or leave it open if you find it more convenient. Most dialog boxes in L^AT_EX can operate like this. Just be sure you have the right window focus when you're trying to type in the main L^AT_EX window or a L^AT_EX dialog.

blank line. As many times as you hit **Space**, you'll only get one space. On a blank line, L^AT_EX won't let you type even one space. The **Tab** key won't move you forward one tab stop; in fact there *are* no tab stops! There's no ruler at the top of the page to let you set tabs or margins, either.

Many word processors are based on the WYSIWYG principle: "What You See Is What You Get." L^AT_EX, on the other hand, is based on the principle that "What You See Is What You *Mean*." You type what you mean, and L^AT_EX will take care of typesetting it for you, so that the output looks nice. A **Return** grammatically separates paragraphs, and a **Space** grammatically separates words, so there is no reason to have several of them in a row; a **Tab** has no grammatical function at all, so L^AT_EX does not support it. Using L^AT_EX, you'll spend more of your time worrying about the *content* of your document, and less time worrying about the *format*. See the *Introduction* for more information on the WYSIWYM concept.


L^AT_EX does have (many) ways to fine-tune the formatting of your document. After all, L^AT_EX might not typeset *exactly* what you mean. The *User's Guide* has information about all that. It includes **H**Fills and vertical space — which are more powerful and versatile than multiple spaces or blank lines — and ways to change font sizes, character styles, and paragraph alignments by hand. The idea, though, is that you can write your whole document, focusing on content, and just worry about that fine-tuning at the end. With standard word processors, you'll be distracted by document formatting throughout the writing process.

2.2 Environments

Different parts of a document have different purposes; we call these parts *environments*. Most of a document is made up of regular text. Section titles (chapter, subsection, etc.) let the reader know that a new topic or subtopic will be discussed. Certain types of documents have special environments. A journal article will have an abstract and a title. A letter will have neither of these, but will probably have an environment that gives the writer's address.

Environments are a major part of the "What You See Is What You Mean" philosophy of L^AT_EX. A given environment may require a certain font style, font size, indenting, line spacing, and more. This problem is aggravated, because the exact formatting for a given environment may change: one journal may use boldface, 18 point, centered type for section titles while another uses

italicized, 15 point, left justified type; different languages may have different standards for indenting; and bibliography formats can vary widely. LyX lets you avoid learning all the different formatting styles.

The **Environment** choice box is located on the left end of the toolbar and looks like this: . It indicates which environment you're currently writing in. While you were writing your first document, it said "Standard," which is the default environment for text. Now you will put a number of environments in your new document so that you can see how they work.

2.2.1 Sections and Subsections

Type the word **Introduction** on the first line of your LyX file, and select **Section** in the **Environment** box.⁵ Be sure to use **Section** and *not* **Section***, which will be covered below. LyX numbers the section "1" and typesets the section heading (title) in a larger font. Now hit **Return**. Note that the **Environment** box changes from "Section" back to "Standard". Section headings, like most environments, are assumed to end when you type **Return**. Type the document introduction:

This is an introduction to my first LyX document.

Hit **Return** again, and select **Section** from the **Environment** box again. LyX writes a "2" and waits for you to type a title. Type "**More Stuff**", and you'll see that LyX again sets it as a section title.

It gets better. Go to the end of Section 1 again (after "my first LyX document") and hit **Return** again, and select **Section** from the **Environment** box again. Again, LyX writes "2" and waits for you to type a title. Type **About This Document**. Section "More Stuff", which used to be Section 2, has been automatically renumbered to Section 3! In true WYSIWYM fashion, you just need to identify the text that makes up the section titles, and LyX takes care of numbering the sections and typesetting them.

Hit **Return** to get back to the **Standard** environment, and type the following five lines:

⁵You don't have to *select* the line. If nothing is selected, LyX changes the paragraph you are currently in to the selected environment. Alternatively, you can change several paragraphs to a different environment by selecting them before picking an environment.

Sections and subsections are described below.

Section Description

Sections are bigger than subsections.

Subsection description

Subsections are smaller than sections.

Click on the second line and select **Subsection** from the **Environment** box. L^AT_EX numbers the subsection “2.1”, and typesets it in a font which is bigger than regular text but smaller than the section title. Change the fourth line **Subsection** environment as well. As you probably expected, L^AT_EX automatically numbered the section “2.2”. If you put yet another section before Section 2, Section 2 will be renumbered as Section 3, and the subsections will be renumbered to “3.1” and “3.2”.

Further levels of sectioning include **Subsubsection**, **Paragraph**, and **Subparagraph**. We’ll let you play with these on your own. You may notice that paragraph and subparagraph headings are not numbered by default, and that subparagraphs are indented; see the *User’s Guide* for an explanation and how to change this. **Chapter** headings are actually the highest level of sectioning, above **Sections**, but you’re only allowed to use them in certain types (text classes) of L^AT_EX documents (see Section 3.1).

Finally, you may want to have sections or subsections that are not numbered. There are environments for this as well. If you change one of your section headings to the **Section*** environment (you may have to scroll down in the **Environment** box to find it), L^AT_EX will use the same font size for the heading as it uses for a regular section, but it won’t number that section. There are corresponding “starred” heading environments for **Subsection** and **Subsubsection**. Try changing some of your sections or subsections to the starred environments, and note how the other sections’ numbers are updated.

Exercise: Fix the section and subsection headings in `example_raw.lyx`.

2.2.2 Lists and sublists

L^AT_EX has several different environments for typesetting lists. The various list environments free you from hitting **Tab** a million times when writing an outline, or from renumbering a whole list when you want to add a point in the middle of the list. Different types of documents logically require different list environments:

- A slide presentation might use the **Itemize** environment’s bulleted lists to describe different points.
- An outline would use the **Enumerate** environment’s numbered lists (and lettered sublists).
- A document describing several software packages could use the **Description** environment, where each item in the list begins with a bold-faced word.
- The **List** environment is a slightly different form of the **Description** environment.

Let’s write a list of reasons why **LyX** is better than other word processors. Somewhere in your document, type:

LyX is better than other word processors because:
and hit **Return**. Now select **Itemize** from the **Environment** box. **LyX** writes a “bullet” on the line. Type in your reasons:

Typesetting is done for you.
Math is WYSIWYG
Lists are very easy to create!

List environments, unlike headings, do not end when you type **Return**. Instead, **LyX** assumes you’re going on to the next item in the list. The above will therefore result in a three-item list. If you want more than one paragraph within one list *item*, one way is to use the **Protected Break**, which you get by typing **Ctrl+Return**. In order to get out of the list, you need to reselect the **Standard** environment (or just use the keybinding, **Alt+P S**).

You’ve got a beautiful itemized list. You might want to run **L^AT_EX** to see how the list looks when printed out. But what if you wanted to number the reasons? Well, just select the whole list⁶ and choose **Enumerate** from the **Environment** box. Pow! As we mentioned, if you add or delete a list item, **LyX** will fix the numbering.

While the list is still selected, you can change to the other two list environments, **Description** and **List**, in order to see what they look like. For

⁶**LyX** won’t let you select the first bullet unless you also select the paragraph *before* the list, which you probably don’t want to do. Similarly, you can’t select the actual number in a numbered section title. This is on purpose because the bullet or number depends on the document settings or text position, respectively.

those two environments, each list item is made up of a term, which is the item's first word, followed by a definition, which is the rest of the paragraph (until you hit **Return**.) The term is either typeset in boldface (**Description**) or separated by a “Tab”⁷ (**List**) from the rest of the paragraph. If you want to have more than one word in the definition, then separate the words with **Protected Blanks**.

Exercise: Typeset the list in `example_raw.lyx`

You can nest lists within each other in all sorts of interesting ways. An obvious example would be writing outlines. Numbered and bulleted lists will have different numbering and bulleting schemes for sublists. See the *User's Guide* for details on the different sorts of lists and for examples of nestings.

2.2.3 Other environments: Verses, Quotations, and more

There are two environments for setting quotations apart from surrounding text: **Quote** for short quotes and **Quotation** for longer ones. Computer code (the **L^AT_EX-Code** environment⁸) is written in a **typewriter** font; this environment is the only place in L^AT_EX where you're allowed to use multiple spaces to allow code indenting. You can even write poetry using the **Verse** style, using **Return** to separate stanzas, and **Ctrl+Return** to separate lines within a stanza. See the *User's Guide* for more complete descriptions of all of the available L^AT_EX environments.

Exercise: Correctly typeset the **Quote**, **L^AT_EX-Code**, and **Verse** in `example_raw.lyx`

⁷But a typesetter's tab, which will change to fit the size of the largest term, not a pathetic, rigid, unchangeable typewriter Tab.

⁸used in this Tutorial for the long typing examples

Chapter 3

Writing Documents

The previous chapter hopefully allowed you to get used to writing in L^AT_EX. It introduced you to the basic editing operations in L^AT_EX, as well as the powerful method of writing with environments. Most people who use L^AT_EX, though, will want to write documents: papers, articles, books, manuals, or letters. This chapter is meant to take you from simply writing text with L^AT_EX to writing a complete document. It will introduce you to text classes, which allow you to write different sorts of documents. It will then describe many of the additions that turn text into a document, such as titles, footnotes, cross references, bibliographies, and tables of contents.

3.1 Document Classes

Different sorts of documents should be typeset differently. For example, books are generally printed double-sided, while articles are single-sided. In addition, many documents contain special environments: letters contain some environments — such as the sender’s address and the signature — which do not make sense in a book or article. The L^AT_EX *document class*¹ takes care of these large scale differences between different sorts of documents. This Tutorial, for example, was written in the **Book** document class. Document classes are another major part of the WYSIWYM philosophy; they tell L^AT_EX how to typeset the document, so you don’t need to know how.

Your document is probably being written in the **Article** document class.²

¹for L^AT_EX users: this is equivalent to the L^AT_EX document class

²That’s usually the default document class

Try changing to other document classes (using the **Document**▷**Settings** dialog) to see how they are typeset differently. If you change your document to the **Book** document class and look at the **Environment** box, you'll see that most of the allowed environments are the same. However, you can now use the **Chapter** environment. If you are ever unsure about which environments you can use in a given document class, just consult the **Environment** box.

Font sizes, one- or two-column printing, and page headings are just some of the ways journals' typesettings differ from one another. As the Computer Age continues to mature, journals have begun accepting electronic submissions, creating L^AT_EX “style files” so that authors can submit correctly typeset articles. L^AT_EX is set up to support this as well. For example, L^AT_EX supports typesetting (and extra environments) for the American Mathematics Society journals using the **Article (AMS)** document class.

Here is a very quick reference to some of the document classes. See the *Special Document Classes* section of the *Additional Features* manual for many more details.

Name	Notes
article	one-sided, no chapters
article (AMS)	layout & environments for American Math Society
report	longer than article, two-sided
book	report + front and back matter
presentation	transparencies
letter	lots of extra environments for address, signature...

3.2 Templates: Writing a Letter

One way to write a letter would be to open a new file, and choose a **Letter** class in the **Document**▷**Settings** dialog. While this is the most obvious way to write a letter, it seems like extra work. Every time you write a business letter, you want to have your address, the address you're sending to, a body, a signature, etc. L^AT_EX therefore has a *template* for letters, which contains a sample letter; once you have a template, you can just replace a couple parts of the letter with your text each time you write a letter.

Open a new file with **File**▷**New from Template**. Select `letter.lyx` as the template. Save and print the file to see how the various environments are typeset.

When you look at the **Environment** box, you'll see several environments, like the **My Address** environment, which don't even exist in most other document classes. Others, like **Quote** and **Description**, are familiar. You can play around for a while to figure out how the various environments work. You'll notice for example that the **Signature** environment has the word "Signature:" in red before the actual text of the signature. This word doesn't show up in the actual letter, as you'll see if you view/export the file. It's just there to let you know where the signature goes. Also, note that it doesn't matter where in the file the **Signature** line is placed. Remember, **LyX** is WYSIWYM; you can put the **Signature** environment anywhere you want, but **LyX** knows that in the printout, the signature should be at the end.

A template is just a regular **LyX** file. This means you can fill in your address and signature and save the file as a new template. From now on, any time you want to write a letter, you can use the new template to save time. We don't have to suggest an actual "exercise" here; just write a letter to someone!³

Templates can be a huge time-saver, and we urge you to use them whenever possible. In addition, they can help a person learn how to use some of the fancier document classes. Finally, they may be useful for a person who is configuring **LyX** for a bunch of less computer-aware users. When they're first learning **LyX**, it will be much less intimidating if they have a letter template customized for their company, for example.

3.3 Document Titles

LyX (like **LaTeX**) considers the title — which may contain the actual title, the author, the date, and even an abstract of a paper — to be a separate part of the document.

Go back to your **LyX** document and make sure it's using the **Article** document class.⁴ Type a title on the first line, and change the line to the **Title** environment. On the next line, type your name and change it to the **Author**

³One warning, if you're writing from a template. If you erase all of the text in an environment — for example, if you erase the whole **My Address** field so that you can replace it with your own — and then you move the cursor without writing any text, the environment may disappear. This is because most environments cannot exist without any text in them. Just reselect the environment from the **Environment** box to get it back.

⁴You should not be using the letter any more, since the **Letter** document class doesn't allow titles.


environment. On the next line, write the date in the **Date** environment. Type a paragraph or two summarizing your document using the **Abstract** environment. Notice how the title is presented when it's printed out. If you changed the document format to Book, you'll get a separate title page, like the first page of this tutorial.

Exercise: Fix the title, date, and author in `example_raw.lyx`

3.4 Labels and Cross-References

You can label section headings, list items, formulas, footnotes, and floats⁵ in your document. Once you do so, you can refer to this section in other parts of the document, using cross-references. You can refer either to the section's number, or to the page that the section appears on. As with section numbering, L^AT_EX also takes care about cross-reference numbering for you. Automatic labels and cross-references are one of the best advantages of L^AT_EX (and L^AT_EX) over conventional word processors.

3.4.1 Your first label

Go to our second section, whose title is “About This Document”. Click at the end of the section title line, and select **Insert** > **Label** or the toolbar button . A dialog asks you for a label name, and gives you a suggestion. When you click on **OK**, the label name will be placed in a box next to the section title.

By the way, you could have put the label right anywhere within the section as well; section references will refer to the last section or subsection whose heading comes before the label. However, putting it on the same line as the section title (or, perhaps, on the first line of the section's text) ensures that page references will reference the beginning of the section.


So far you haven't done anything — the DVI output will look exactly the same, since labels don't show up in the printed document. However, now that you have added a label, you can refer to that label with cross-references. We'll do that next.

⁵Floats are explained in the *User's Guide* and the *Embedded Objects* manual.

3.4.2 Your first cross-reference

Place the cursor somewhere in section 2 of your document. Type

If you want to know more about this document, then see
section, which can be found on page.

Now set the cursor after the word “section” and choose **Insert**▷**Cross Reference** or the toolbar button . The **Cross-reference** dialog pops up. It shows a list of the possible labels you can reference. At the moment, there should be only one, “sec:About-This-Document”. Select it (it may be selected by default), and click **Apply**. Now put the cursor after the word “page”, and change the reference format to use the page number then click **Apply**. (To be really correct, you should put a **Protected Blank** in between the word “Section” and the reference. Same for the page reference.)

Alternatively to that method, you can right-click on a label and use in the appearing context menu **Copy as Reference**. The cross-reference to this label is now in the clipboard and can be copied to the actual cursor position via the menu **Edit**▷**Paste** (shortcut **Ctrl+V**).

LyX puts the references in a box right where the cursor was. In the printed document, this reference marker will be replaced with either the page or section number (depending on what you selected in the **Cross-reference** dialog). View your document as DVI, and you’ll see that on the last page we refer to “Section 2” and “Page 1” (or whatever page Section 2’s title is on).

Conveniently, a cross-reference acts as a hyperlink when you are editing a document in LyX; clicking on it will pop up the **Cross-Reference** dialog, clicking **Go to Label** will move the cursor to the referenced label.

3.4.3 More fun with labels

We told you that LyX takes care about numbering cross-references; now you can test that. Add a new section before Section 2. Update the DVI view, and — voilà! — the section cross reference changed to “3”! Change the section “About this Document” to a subsection, and the cross-reference will reference Subsection 2.1 instead of Section 3. The page reference won’t change unless you add a whole page of text before the label, of course.



If you want some more practice with labels, then try putting a new label where your first cross-reference was, and refer to that label from elsewhere

in the document. If you'll be inserting cross-references often, it may be convenient to leave the **Cross-reference** dialog open.

If you want to make sure that the cross-referencing gets the pages right even for larger documents, **Copy** a couple pages of text from the *User's Guide* to the clipboard, and **Paste** the stolen text into your document.⁶

Exercise: Fix the references in `example_raw.lyx`


3.5 Footnotes and Margin Notes

Footnotes can be added using the toolbar button  or the menu **Insert** > **Footnote**. Click at the end of the word “LyX” somewhere in your document and click the  button. A footnote box appears where you can enter the text of the footnote. LyX should place the cursor at the beginning of the footnote box. Type

LyX is a typesetting word processor.


Now click on the button labelled “foot”. The footnote box is closed, leaving the button showing where the footnote marker will be in the printed text; this is called “folding” the footnote. You can unfold the footnote at any time and re-edit its text by clicking again on the “foot” button.

You may wonder why the footnote button is a word instead of a number. The answer is that LyX takes care about the footnote numbering for you in the printed text. You can see this yourself by looking at the DVI file (or printout). If you add other footnotes, LyX will renumber the footnotes. Since LyX (well, L^AT_EX, actually) takes care of the footnote numbering, there's really no need to put the numbers in the LyX file.

A footnote can be cut and pasted like normal text. Go ahead; try it! All you need to do is select the footnote button⁷ and **Cut** and **Paste** it. In addition, you can change regular text to a footnote, by selecting it and hitting the  button; change a footnote to regular text by hitting the **Backspace** key when the cursor is in the first position of a footnote, or by hitting the **Delete** key when the cursor is in the very last position of the footnote, respectively.

⁶By the way, copying a chapter title may cause an error, because chapters aren't allowed in the article class, see section 3.1. If this happens, just delete the chapter title.

⁷It may be easier to select it using the keyboard. You might accidentally open the footnote if you're trying to select the marker itself with the mouse.

Margin notes can be added using the menu **Insert**▷**Marginal Note** or the toolbar button . Margin notes are like footnotes, except that:

- the on-screen boxes say “margin” instead of “foot”
- the notes will be placed in the margin, instead of below the text
- margin notes are not numbered


Change your **LyX** footnote back to text, then select and change it to a margin note. Run **LaTeX** again to see what the margin note looks like.

Exercise: Fix the footnote in `example_raw.lyx`

3.6 Bibliographies

Bibliographies (at least in the exact sciences) are similar to cross references. The bibliography contains a list of references at the end of the document, and they can be referenced from within the document. Like section titles, **LyX** and **LaTeX** make your job easier by automatically numbering the bibliography items and changing citations when the item numbers change.

Go to the end of the document and switch to the **Bibliography** environment. Now, each paragraph you type will be a reference. Type “**The Lyx Tutorial, by the LyX Documentation Team**” as your first reference. Note that **LyX** automatically puts a number in a box before each reference. Click on the boxed reference number, and the **Bibliography item** dialog box appears. The **Key** is to refer to this reference within the **LyX** document, the **Label** appears in output. When no **Label** is set (default), you will see the number of the bibliography in the output. Change now the **Key** field to “lyxtutorial” to make it easy to remember.

Now pick somewhere in your document that you would like to insert a reference. Do so with **Insert**▷**Citation** or the toolbar button . A **Citation** dialog appears. The right panel in this dialog lists all the bibliography entries, and this field allows you to choose which bibliography item you want to cite. Select “lyxtutorial” (right now, that’s the only item in the bibliography), then use the **Add** button in the center to insert it. (You can have multiple citations in the same place by transferring a number of keys this way.) Now view your file as DVI, and you’ll see that the citation appears in brackets in the text, referring to the bibliography at the end of the document.


The **Text after** field in the **Citation** dialog will put a remark (such as a reference to a page or chapter within the referenced book or article) in the brackets after the reference. If you want the references to have labels instead of numbers in the printed output (for example, some journals would use “[Smi95]” to refer to a paper written by Smith in 1995), use the **Label** field in the **Bibliography** item dialog. As usual, see the *User’s Guide* for details.

Exercise: Fix the bibliography and citation in `example_raw.lyx`

3.7 Table of Contents

You may want to put a table of contents at the beginning of your document. LyX makes this very easy to do. Just hit **Return** after your document title and before your first section title and choose **Insert** ▸ **List / TOC** ▸ **Table of Contents**. The words “Table of Contents” will appear in a button on the first line of the document.

This may not appear to be very useful. However, if you look at your DVI file, you will see that a table of contents has been generated, listing the various sections and subsections in your document. As usual, if you reorder sections or create new ones, you will see those changes in the DVI file when you update it.

The table of contents is not printed in the on-screen version of the document to keep the overview in your file. But you can display the table of contents in a separate window by clicking on the table of contents button, or by using **Document** ▸ **Outline** or the toolbar button . This menu will work even if you don’t have a table of contents inset in your document. This is a very useful tool where you can move around your document parts. Clicking on a (sub)section title in the **Outline** window will highlight that line and move the display (in the LyX editing window) to that place in the document. You can also use the arrow keys to move up and down in the table of contents. You may therefore find it convenient to leave this window open throughout editing sessions. You can get similar functionality from the **Navigate** menu, though, where the table of contents appears automatically.

To get rid of the Table of Contents, you can delete the table of contents button just like any other text.

Exercise: Fix the table of contents in `example_raw.lyx`

Chapter 4

Using Math


\LaTeX is used by many scientists because it outputs great looking equations, avoiding the control characters used by word processors and their equation editors. Many of these scientists are frustrated, however, because writing equations in \LaTeX is more like programming than writing. Happily, LyX has WYSIWYM support for equations. If you are used to \LaTeX , you'll find that all of the usual \LaTeX math commands can be typed in normally, but they will show up in a WYSIWYM fashion. If, on the other hand, you've never written in \LaTeX , then the **Math Panel** will allow you to write professional-looking math quickly and easily.

4.1 Math Mode

Somewhere in your LyX document, type:

I like what Einstein said, $E=mc^2$, because it's so simple.

Now, that equation doesn't look very good in LyX and in the output; there's no space between the letters and the equals sign, and you'd like to write an actual superscript for the "2". That bad typesetting happened because we didn't tell LyX that we were writing a mathematical expression, so it typeset the equation like regular old text.

Instead, we create a formula that will get typeset properly. In order to create a formula, just click the toolbar button  or use the menu **Insert** ▸ **Math** ▸ **Inline Formula**. LyX will insert a little blue square, which is an empty

math formula. Now just type $E=mc^2$ again. The expression is typed in blue, and the blue square disappears as soon as the formula is not empty. Now type **Esc** to leave the equation. The purple markers disappear, leaving the cursor to the right of the expression, and now if you type something, it will be regular text.

Run \LaTeX and look at the output. Notice that the expression was typeset nicely, with spaces between the letters and the equals sign, and a superscript “2”. Letters in math mode are assumed to be variables, and come out in italics. Numbers are just numbers.

This math editor is another example of the WYSIWYM philosophy. In \LaTeX , you write a mathematical expression using text and commands like `\sqrt`; this can be frustrating, because you can’t see what an expression looks like until you \LaTeX the file, and may have to spend time to find e.g. missing brackets. LyX doesn’t attempt to get the expression to look perfect (WYSIWYG), but it gives you an extremely good idea of what the expression will look like. \LaTeX then takes care of the professional typesetting.

4.2 Navigating an Equation

Now let’s change $E = mc^2$ to $E = 1 + mc^2$. Use the arrow keys to move the cursor into the expression. Note that when you enter the expression, the purple markers appear to let you know you’re editing math. Now you can use **Left** and **Right** to move the cursor past the equals sign, and just type “1+”. Again, you can use the arrow keys or **Esc** to leave the formula.

Other than the special keys described below, typing in math mode is like editing regular text. Use **Delete** (or **Backspace**) to delete things. Select text either with the arrow keys or with the mouse. **Edit** \triangleright **Undo** works in math mode as well as cut and paste. One thing to be careful of: If you are left or right outside a formula and you press **Delete** or **Backspace**, respectively, you delete the whole formula. Luckily, you can just use **Undo** to get it back.

What if you want to change $E = mc^2$ to $E = mc^{2.5} + 1$? Again, you can use the mouse to click in the right place. However, you can also use the arrow keys. If the cursor is just after the “c” but before the “2”, then press **Up** and the cursor is moved to the level of the superscript, just before the “2”. Add the “.5”. Now, hitting **Down** will move the cursor back to the regular level. When you hit **Space** instead of **Down**, the cursor will be placed *after* the superscript (so that you can then type the “+1”).

4.3 Exponents and Indices

An exponent can be entered from the **Math Toolbar** (see below), but it's actually simpler just to type the caret key, “ \wedge ”. LyX will place another blue rectangle in the superscript, so that whatever you write next will be superscripted, and in a smaller font size. Everything you type until you hit a **Space** (or **Esc** to exit the formula entirely) will be in the superscript.

Writing a subscript (index) is just as easy — start one by typing the underscore key, “ $_$ ”. You can subscript and superscript both subscripts and superscripts like this: $A_{a_0+b^2} + C^{a_0+b^2}$.

Exercise: Put equation 1 of `example_raw.lyx` into math mode.

4.4 The Math Toolbar

The **Math Toolbar** is a convenient way to enter symbols or to perform complicated formula operations. Many of these operations can be accomplished from the keyboard or the **Edit** \triangleright **Math** or **Insert** \triangleright **Math** menus. However, we're going to concentrate on using the **Math Toolbars**, just to let you know what's out there; you can learn keyboard shortcuts later, from other manuals.


The **math toolbar** is shown when the cursor is in a formula and can also be turned on manually in the menu **View** \triangleright **Toolbars**. When you click there on “Math” the toolbar will be shown permanently at the bottom; this state is visualized in the **Toolbars** menu with a checkmark. When you click in this state again on “Math” in the **Toolbars** menu, the **math toolbar** is only shown when the cursor is within a formula; this state is visualized by the renaming of the menu entry from “Math” to “Math (auto)”.


4.4.1 Greek and symbols


The **Math Toolbar** which allow you to choose from a large array of symbols used in math: various arrows, relations, operators, and sums and integrals. Note that subscripting and superscripting allow you to put lower and upper limits on sums and integrals.

“Nothing you can do that can't be done... All you need is \heartsuit .”

4.4.2 Square roots, accents, and delimiters

To type a square root, just click on the button . The square root appears, and the cursor is in a new insertion point inside the square root. You can type variables, numbers, other square roots, fractions, whatever you want. L^AT_EX will automatically resize the square root to fit what's inside.


Accenting a character (\vec{v}) or group of characters ($\overrightarrow{a+b}$) is done the same way. Decorations are available from the toolbar via the button . Click on a decoration, and L^AT_EX will insert that decoration with an insertion point under (or over) it. Just type what you want in the insertion point. There are two sets of decorations: those that resize with the text you type, and those that have fixed size, and are most appropriate for a single letter.

Delimiters such as parentheses, brackets, and braces work similarly, but are a bit more complicated. Hit the delimiter button  to pop up the **Delimiter** dialog. Your current selection of delimiters is displayed in a box. It's a pair of parentheses by default, but you can choose a pair of braces, a brace and a parenthesis, or choose the empty square to have something like “ $a = \langle 7$ ” (the empty delimiter is displayed as a broken line in L^AT_EX, but won't show up in the output).

If you're lazy, you can type actual parentheses in math mode, rather than using the **Delimiter** dialog. However, those parentheses will be the same size as regular text, which will look bad if you have a big fraction or matrix inside the parentheses. So better use in this case one of the three delimiter buttons that insert directly e. g. a $()$ pair.

You can also put delimiters or a square root sign or a decoration on already existing formula parts. Select the portion of the formula that you want to adjust, and then click on the button you want from the **Math Toolbar**. Try using this to change Newton's second law from scalar to vector form ($f = ma$ to $\vec{f} = m\vec{a}$). Once you've learned about matrices, this is how you'll put parentheses or brackets around them.

4.4.3 Fractions


To create a fraction, click on the fraction button  in the **Math Toolbar**. L^AT_EX writes two insertion points in a fraction. As you would expect, you can use arrow keys or the mouse to move around a fraction. Click on the top square and type “1”. Now hit **Down** and type “2”. You've made a fraction!

Of course you can type anything within each of the two boxes: variables with exponents, square roots, other fractions, whatever.

Exercise: Put equation 2 of `example_raw.lyx` into math mode.

4.4.4 T_EX mode: Limits, log, sin and others


Because letters in math mode are considered to be variables, if you type “sin” in math mode, L^AT_EX thinks you are typing the product of the three variables s , i , and n . The three letters will be typeset in italics, when what you really wanted was the word “sin” typeset in Roman. In addition, L^AT_EX won’t put a space between the word “sin” and the “x” (pressing **Space** will exit the formula). So how do you get “sin(x)” instead of “ $sin(x)$ ”?

Click on the **Math Toolbar** button  and then on “sin” in the appearing function list. The word “sin” is displayed in L^AT_EX in black, and set in upright roman type. The whole word is treated as one symbol, so if you type **Backspace**, it will delete the whole word. Now type “(x)”, which will be written in blue italics, like you expect in a formula. In the output, the expression will be correctly typeset. Try it out.





The function list include other trigonometric functions and their inverses, hyperbolic functions, logarithms, limits, and quite a few others. These functions can take subscripts and superscripts, important for typing “ $\cos^2 \theta$ ” or “ $\lim_{n \rightarrow \infty}$ ”.

Exercise: Put equation 3 of `example_raw.lyx` into math mode.

4.4.5 Matrices

Click on the matrix button  in the **Math Toolbar**. The appearing dialog allows you to choose how many rows and columns you want in your matrix. Choose 2 rows and 3 columns and hit **OK**. L^AT_EX prints 6 insertion points in a 2×3 matrix. As usual, you can put any sort of formula expression (a square root, another matrix, etc.) in each insertion point. You can also leave some of the insertion points empty if you want.


Tab can be used to move horizontally between the columns of a matrix. Alternatively, you can use the arrow keys to move around - hitting **Right** at the end of one box will move to the next box, **Down** will move to the next row, etc.

If you need to change the number of rows and columns, use the menu **Edit**▷**Math**▷**Rows & Columns** or the math toolbar buttons , , , .

See the *User's Guide* for information on how to change the horizontal alignment of each column, and how to change the vertical position of the whole matrix. Note that if you want to write a table containing text, you should use LyX's wonderful table support, rather than trying to write text in a matrix.

4.4.6 Display mode

All of the expressions we have written so far have been on the same line as the text that came before and after them, otherwise known as inline expressions. This is fine for short, simple expressions, but if you want to write larger ones, or if you want your expressions to stand out from the text, you need to write them in display mode. In addition, only displayed expressions can be labeled and numbered (see the *User's Guide*), and multi-line equations must be in display mode.

Click on the display button  in the **Math Toolbar**, which represents a couple lines of text before and after a centered blue box. LyX inserts a formula, but the insertion point is on a new line, and it's centered within that line. Now type an expression and run **L^AT_EX** to see how it looks. The display button is actually a toggle; use it now to change a couple of your expressions to display mode and back.

Display mode has a couple differences from inline mode:

- The default font is larger for a few symbols, like \sum and \int
- Subscripts and superscripts for limits and sums (but not integrals) are written under rather than next to the symbols
- Text is centered

Other than these differences, though, displayed expressions and inline expressions are very similar.

One final note about the way displayed formulas are typeset: Be careful about whether you're putting your equation into a new paragraph or not. If your formula is in the middle of a sentence or paragraph, then don't press

Return. Doing so will cause the text *after* the formula to start a new paragraph. That text will therefore eventually be indented, depending on your document paragraph settings, which is probably not what you want.

Exercise: Put the various equations in `example_raw.lyx` into display mode, and see how they’re typeset differently.

Exercise: Using various tools you’ve learned in this section, you should be able to write an equation like¹:

$$f(x) = \begin{cases} \log_8 x & x > 0 \\ 0 & x = 0 \\ \sum_{i=1}^5 \alpha_i + \sqrt{-\frac{1}{x}} & x < 0 \end{cases}$$

4.5 More Math Stuff

LyX’s math editor can do plenty more. By now, you’re familiar with the basics, so we refer to the *User’s Guide* for tips on how to:

- Labeling and numbering expressions
- Multi-line equations
- Change typefaces, e.g. to write bold-face text in an expression.
- Fine-tune font sizes and spacing within an expression. (Don’t worry about this until your final draft!)
- Write macros. These are very powerful, because you just define them once at the top of the document, and then you can use them throughout the document.
- Do lots of other things that can’t be mentioned in this Tutorial.



¹After you’ve done it the hard way, give `Insert > Math > Cases Environment` a try.

Chapter 5

Miscellaneous

5.1 Other major L^AT_EX Features

We haven't gone through all the possible commands in L^AT_EX, and we aren't planning on it. As usual, see the *User's Guide* and the *Embedded Objects* manual for more information. We'll just mention a couple more major things L^AT_EX can do:

- L^AT_EX has WYSIWYM support for tables. Use the **Insert**▷**Table** (toolbar button ) to get a table. Click on the table with the *right button* to get a **Table Settings** dialog box which allows extensive table editing.
- L^AT_EX also supports including pictures in any format within documents. (You guessed it: **Insert**▷**Graphics** (toolbar button ). Then browse for the figure file, rotate or scale it, etc.) Tables and figures can have captions, and L^AT_EX will automatically generate lists of figures and/or tables.
- L^AT_EX is heavily configurable. Everything from how the L^AT_EX window looks to how the output comes out can be configured in a number of ways. Much configuration is done through **Tools**▷**Preferences**. For more information on this, check out **Help**▷**Customization**.
- L^AT_EX is being developed by a team of programmers on five continents. Therefore, L^AT_EX has better support for non-English languages (such as Dutch, German, French, Greek, Czech, Turkish, ...) than many word

processors. Even the right-to-left languages Arabic, Farsi, and Hebrew and the Asian languages Chinese Japanese, and Korean are supported. You can write documents in other languages and you can also configure L^AT_EX to show its menus and error messages in other languages.


- The L^AT_EX menus feature keybindings. This means that you can do **File**▷**Open** by pressing **Alt+F** followed by **O** or by using the binding which is shown next to it in the menu (**Ctrl+O** by default). Keybindings are also configurable. For information on this, check out **Help**▷**Customization**.
- L^AT_EX can read L^AT_EX documents. See section 5.2.2.
- Spellchecking, thesaurus, and word count facilities are available.
- Generation of indexes and nomenclatures/glossaries is supported.

5.2 L^AT_EX for L^AT_EX Users

If you don't know anything about L^AT_EX, you don't have to read this section. Actually, you might want to *learn* about L^AT_EX, and then read this chapter. However, some who begin to use L^AT_EX will be familiar with L^AT_EX. If you are such a person, you may be wondering if L^AT_EX can really do everything L^AT_EX can do. The short answer is that L^AT_EX can do pretty much everything L^AT_EX can do in one form or another, and it definitely simplifies most parts of writing a L^AT_EX document.

Because this is just a tutorial, we are only going to mention things that new L^AT_EX users will most likely be interested in. In the interests of keeping the Tutorial short, we will give only minimal information here. The *Extended Features* and the *Embedded Objects* manual have a great deal of information on differences between L^AT_EX and L^AT_EX, and how to do various L^AT_EX tricks in L^AT_EX.

5.2.1 T_EX Mode

Anything that you enter in T_EX mode will be passed straight to L^AT_EX, and will be displayed in red on the screen. You can use T_EX commands in L^AT_EX by choosing **Insert**▷**T_EX Code** (toolbar button ). This creates a box where everything within it is passed straight to L^AT_EX.

In a math formula, T_EX mode is handled a bit differently. T_EX mode is there entered by typing a backslash. The backslash is not written out, but anything you type afterwards will be in red. You exit T_EX mode by typing **Space** or some other non-alphabetic character, like a number, underscore, caret, or parenthesis. Once you exit T_EX mode, if L^AX knows the T_EX command you’ve typed in, it will convert it to WYSIWYM. So if you type “\gamma” in a formula and then press **Space**, L^AX will change the red “gamma” to a blue “ γ ”. This will work for almost all, non-complicated math macros. This may be faster than using the **Math Toolbar**, and will be especially convenient for experienced L^AT_EX users.

As a special case, if you type a brace in T_EX mode, then the beginning *and* ending braces will be inserted in red, then take you *out* of T_EX mode and place the cursor between the braces. This makes it more convenient to type commands that L^AX doesn’t know which take an argument.

L^AX can’t do absolutely everything that L^AT_EX can do. Some fancy functions are not supported at all, while some work but aren’t WYSIWYM. T_EX mode allows users to get the full flexibility of L^AT_EX, while having all the convenient features of L^AX, like WYSIWYM math, tables, and editing. L^AX could never support every L^AT_EX package. However, by typing `\usepackage{foo}` in the preamble (see section 5.2.4.2), you can use any package you want — although you won’t have WYSIWYM support for that package’s features.

5.2.2 Importing L^AT_EX Documents — `tex2lyx`

You can import a L^AT_EX file into L^AX by using the **File**▷**Import**▷**L^AT_EX (plain)** menu in L^AX. This will call the program `tex2lyx` which will create a file `foo.lyx` from the file `foo.tex` and then open that file. If the translation doesn’t work, you can try calling `tex2lyx` from the command line, possibly using fancier options.

`tex2lyx` will translate most legal L^AT_EX, but not everything. It will leave things it doesn’t understand in T_EX mode, so after translating a file with `tex2lyx`, you can look for red text and hand-edit it to look right.

`tex2lyx` has its own manpage. Read it to find out about which L^AT_EX commands and environments aren’t supported, bugs (and how to get around them), and how to use the various options.

5.2.3 Converting LyX Documents to L^AT_EX

You might wish to convert a LyX Document to a L^AT_EX file. For example, a co-worker or co-author who doesn't have LyX might want to read it. Select **File**▷**Export**▷**L^AT_EX**. This will create a file `whatever.tex` from the `whatever.lyx` file you are editing. LyX always creates temporary L^AT_EX files when viewing or printing files.

5.2.4 L^AT_EX Preamble

5.2.4.1 Document Class

The **Document**▷**Settings** dialog takes care of many of the options that you would input in a `\documentclass` command. Change the class, default font size and paper size here. Put any extra options to the `\documentclass` command in the **Extra Options** area.

5.2.4.2 Other Preamble Matter

If you have special commands to put in the preamble of a L^AT_EX file, you can use them in a LyX document as well. Select **Document**▷**Settings**▷**L^AT_EX Preamble** and type in the dialog window (or from the document settings dialog, depending on the frontend). Anything you type will (like with T_EX mode) be sent directly to L^AT_EX.

5.2.5 BibT_EX

LyX has support for BibT_EX, which allows you to build databases of bibliographical references to be used in multiple documents. Select **Insert**▷**List / TOC**▷**BibT_EX Bibliography** to include a BibT_EX file. In the **Database** field you load BibT_EX files, in the **Style** field you can load BibT_EX style files.

After you've done this, you can use citations from any bibliographies you're including with **Insert**▷**Citation** (see section 3.6). LyX will take care of running BibT_EX. The box in the **Citation** dialog will show a list of all the references in your BibT_EX file.

5.3 Errors!

Sometimes when you \LaTeX a document, there will be errors, things that \LaTeX or \LaTeX can't understand. When this happens, \LaTeX will open a \LaTeX Errors dialog. Clicking on individual errors in this dialog will take you to the place in the \LaTeX document where the error occurs and also display the detailed \LaTeX error message.