# The LyX Tutorial

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# Chapter 1

# Introduction

## 1.1 Welcome to LyX!

This workshop is designed for all of you who have never heard of LaTeX, or don't know it very well. You won't need to learn LaTeX to use LyX. That is, after all, the whole point of LyX: to provide an almost-What You See Is What You Get (WYSIWYG) interface to LaTeX. There are some things you will need to learn, however, in order to use LyX effectively.

You'll find out that most of the little tricks you're accustomed to use in other word processors won't work in LyX. 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. LyX 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 LyX. Reading these notes is definitely worth the time.

## 1.2 What is LyX?

LyX is a document preparation system. It excels at letting you create complex technical and scientific articles with mathematics, cross-references, bibliographies, indices, etc. It is very good at documents of any length in which the usual processing abilities are required: automatic sectioning and pagination, spell checking, and so forth. It is definitely not the best tool for creating banners, flyers, or advertisements (we'll explain why later), though

with some effort all these can be done, too. Some examples of what it is used for: memos, letters, dissertations and theses, lecture notes, seminar notebooks, conference proceedings, software documentation, books, articles in refereed scientific journals, scripts for plays and movies, business proposals, presentations ...

LyX is a program that provides a modern approach to writing documents with a computer by using a markup language paradigm, an approach that breaks with the obsolete tradition of the "typewriter concept". It is designed for authors who want professional output quickly with a minimum of effort without becoming specialists in typesetting. The job of typesetting is done mostly by the computer, not the author; with LyX, the author can concentrate on the contents of his writing.

The basic idea behind LyX is: specify *what* you're doing, not *how* to do it. Instead of "What You See Is What You Get," the LyX model is "What You See Is What You *Mean*" or "WYSIWYM." It's a powerful idea that greatly simplifies the mechanics of writing documents. This is also why LyX isn't so good for creating posters and flyers. In this case, you *do* want to specify exactly where everything goes, because there are no functional units like paragraphs, sections, etc. This doesn't mean LyX is missing some cool function. It simply means that it isn't the right tool for the job — you don't use a screwdriver to drive in nails.

## 1.3 Differences between LyX and Other Word Processors

Here's a list of things you won't find in LyX:

- The document ruler
- Tab stops
- Extra whitespace (i. g. hitting Enter or Space two or more times)

Tab stops, along with a ruler showing you the position of things on the page, are useless in LyX. The program worries about where things go on the page, not you. Extra whitespace is similar; LyX adds them where necessary, depending on context. Not being able to type two blank lines in a row

will be annoying at first, but it makes more sense once you're thinking in WYSIWYM terms.

Here are some things that exist in LyX, but aren't used as you might think:

- Indenting controls
- Page breaks
- Line spacing (e. g. single spaced, double spaced, etc.)
- Whitespace, horizontal and vertical
- Fonts and font sizes
- Typefaces (bold, italic, underline, etc.)

Although they exist in LyX, you generally don't need them. LyX will take care of these things for you, depending on what you're doing. Different parts of the document are automatically set in a different typeface and font size. Paragraph indenting is context dependent; different types of paragraphs get indented differently. Page breaks get handled automatically, as well. In general, the space between lines, between words, and between paragraphs is variable, set by LyX.

Lastly, there are a few areas where we believe LyX (and LaTeX) surpasses many word processors:

- Hyphenation
- Lists of any type
- Mathematics
- Tables
- Cross-referencing

Granted, many modern word processors can handle mathematical symbols, tables, and hyphenation, and many have moved towards style definitions and the WYSIWYM concept. However, they've only recently been able to do so, whereas LyX is built upon the LaTeX document preparation system. LaTeX has been around for over 20 years, and *works*.

## 1.4 What is LaTeX?

LaTeX is a document preparation system designed by Leslie Lamport in 1985. It was built up from a typesetting language called TeX, created by Donald Knuth in 1984. TeX takes a sequence of typesetting commands, written in a script in an ASCII file, and executes them. Many of the "tricks" of the printing trade were modeled by Knuth as computer algorithms and incorporated into TeX, thus its excellent printed appearance. What comes directly out of TeX is the portable document format *pdf* or the so-called "device independent" format file *dvi*. The dvi format is often used for previews and can later be converted to other formats like PostScript.

TeX isn't only a typesetting engine, it also allows you to define macros. Most people who use TeX are actually using a macro package which Knuth created to hide a lot of the typesetting details. This is where Leslie Lamport enters our story. He wanted a macro package that was more user- and less typesetter-oriented, with a set of commands that consistently typeset things like sections, tables or math formulas in an uniform, consistent fashion. This is how LaTeX was born.

There are two ways to extend LaTeX: classes and styles. A *class* is a set of LaTeX macros describing a new type of document, like a book, or an article. There are classes for slides, for physics and math journals... many universities even have a class for their thesis format! A *style* differs from a class in that it doesn't define a new type of document, but a different type of *behavior* that any document can use. For example, LyX controls page margins and line spacing using two different LaTeX style-files designed for these purposes. There are style-files for a whole slew of things: printing labels or envelopes, changing indentation behavior, adding new fonts, manipulating graphics, designing fancy page headings, customizing bibliographies, altering the location and appearance of footnotes, tables, and figures, customizing lists, etc.

Here is a summary:

**TeX:** Typesetting language with macro capability.

**LaTeX:** Macro package built upon TeX.

**classes:** Descriptions of a type of document, using LaTeX.

**styles:** Alters the default behavior of LaTeX in some way.

**LyX:** Visual, WYSIWYM word-processor that uses LaTeX to do its typesetting.

This section attempts to account for the difference between LyX and other word processors. Simply put, LaTeX is the difference. By using LaTeX as its backend, LyX helps you think more about *what* (as in the *words*) you write. The computer then handles *how* they should look.

## 1.5 What the Workshop *is* and what it *isn't*

Before we get started, we want to make a quick note of something.

### 1.5.1 The Format of the Notes

The note uses the notation outlined below. You'll occasionally notice things in different fonts. You need to know which fonts mean what:

- *Emphasized Style* is used for general emphasis, generic arguments, book titles, names of sections of other manuals, and notes from the authors.
- `Typewriter` is used for program and file names, LyX code and functions.
- Sans Serif is used for menu, button, or dialog box names, and the names of keyboard keys.
- Noun Style is used for people's names.
- **Bold** is used for LaTeX code

### 1.5.2 Getting the most out of the Workshop

This workshop consists of examples and exercises. To get the most out of it, you should read through the notes, 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.

### 1.5.3 What you *won't* find

- Detailed explanations of all of LyX's features.
- Detailed explanations of LaTeX.

# Chapter 2

# Getting started with LyX

## 2.1 Your first LyX document

OK. You're ready to start writing. We assume that you have a fully working version of LyX, as well as a LaTeX-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 LyX installer. We've written a file to let you practice your LyX skills on, it's called `example_raw.lyx`. Imagine that it was typed by someone who didn't know about any of LyX's great features. As you learn new LyX functions, we'll suggest that you fix those parts of `example_raw.lyx`. It also contains "subtle" hints about how to fix things.

### 2.1.1 Typing, Viewing, and Exporting

- Open a new file with File ▷ New
- Type a sentence like: `This is my first LyX document!`
- Save your document with File ▷ Save As.
- Run LaTeX to create a DVI file, with View ▷ DVI or the toolbar button . LyX will open a DVI-viewer program displaying your document looking like when printed.[1]

[1] You 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

- Export the ready to print document with File ▷ Export to a format you want.

Congratulations! You've written your first LyX document.

### 2.1.2 Simple Operations

LyX 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** LyX has multiple levels of undo, which means you can undo everything you've done since your current editing session started, by selecting 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 LyX 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.[2] 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

window (or unminimize it) after LaTeX finishes running.

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

(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 LyX

One of the hardest things for new users to get used to is the way that LyX handles whitespace. As many times as you hit Return, you'll only get one blank line. As many times as you hit Space, you'll only get one space. On a blank line, LyX 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.

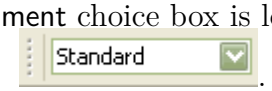
Many word processors are based on the WYSIWYG principle: "What You See Is What You Get." LyX, on the other hand, is based on the principle that "What You See Is What You *Mean*." You type what you mean, and LyX will take care of typesetting it for you, so that the output looks nice. A Return grammatically 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 LyX does not support it. Using LyX, you'll spend more of your time worrying about the *content* of your document, and less time worrying about the *format.*

## 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 LyX. 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.[3] 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.

[3] You 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.

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

```
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. LyX 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, LyX 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. 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 LyX 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, LyX 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

LyX 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 LaTeX to see how the list looks when printed out. But what if you wanted to number the reasons? Well, just select the whole list[4] 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

[4] 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"[5] (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.

### 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 LyX-Code environment [6]) is written in a `typewriter` font; this environment is the only place in LyX 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.

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

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

[6]used in this Tutorial for the long typing examples

# Chapter 3

# Writing Documents

Most people who use LyX, though, will want to write documents: papers, articles, books, manuals, or letters. This chapter is meant to take you from simply writing text with LyX 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 LyX *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 LyX 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] Try changing to other document classes (using the Document ▷ Settings dialog) to see how they are typeset differently. If you change your document

[1] for LaTeX users: this is equivalent to the LaTeX document class

[2] That's usually the default document class

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 LaTeX "style files" so that authors can submit correctly typeset articles. LyX is set up to support this as well. For example, LyX 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.

| 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. LyX 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 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

[3] One 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.

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

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 floats 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, LyX also takes care about cross-reference numbering for you. Automatic labels and cross-references are one of the best advantages of LyX (and LaTeX) 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.

### 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, thensee
```

```
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 will see that 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 somewhere to

the clipboard, and Paste the it into your document.[5]

**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, LaTeX, 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 button[6] 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.

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"

[5] By 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.

[6] It 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.

- 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 Workshop, by CAS 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 "lyxworkshop" 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 "lyxworkshop" (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.

**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 $\frac{a+b}{c}$ 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 ▷ 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, "^". 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 ▷ Math or Insert ▷ Math menus.

The math toolbar is shown when the cursor is in a formula and can also be turned on manually in the menu View ▷ 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.

### 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. LyX 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 LyX 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 LyX, 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. LyX 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 TEX mode: Limits, log, sin and others

Because letters in math mode are considered to be variables, if you type "sin" in math mode, LyX 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, LyX 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 $\overset{\exp}{\tan}$ and then on "sin" in the appearing function list. The word "sin" is displayed in LyX 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.

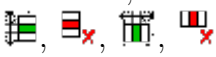
The function list include other trigonometric functions and their inverses, hyperbolic functions, logarithms, limits, and quite a few others. These functions can take subscripts and superscripts, important for typing "$\cos^2\theta$" or "$\lim_{n\to\infty}$".

**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. LyX prints 6 insertion points in a $2 \times 3$ 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 ▷ Rows & Columns or the math toolbar buttons  .

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, 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 LaTeX 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 like[1]:

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

[1] After you've done it the hard way, give Insert ▷ Math ▷ Cases Environment a try.

# Chapter 5

# Miscellaneous

## 5.1 Other major LyX Features

We haven't gone through all the possible commands in LyX, and we aren't planning on it. We'll just mention a couple more major things LyX can do:

- LyX 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.
- LyX 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 LyX will automatically generate lists of figures and/or tables.
- LyX is heavily configurable. Everything from how the LyX window looks to how the output comes out can be configured in a number of ways. Much configuration is done through Tools ▷ Preferences.
- LyX is being developed by a team of programmers on five continents. Therefore, LyX 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 LyX to show its menus and error messages in other languages.

- The LyX 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.
- LyX can read LaTeX documents. See section 5.2.2.
- Spellchecking, thesaurus, and word count facilities are available.
- Generation of indexes and nomenclatures/glossaries is supported.

## 5.2 LyX for LaTeX Users

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

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

### 5.2.1 TeX Mode

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

In a math formula, TeX mode is handled a bit differently. TeX 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 TeX mode by typing Space or some other non-alphabetic character, like a number, underscore, caret, or parenthesis. Once you exit TeX mode, if LyX knows the

TeX command you've typed in, it will convert it to WYSIWYM. So if you type "`\gamma`" in a formula and then press Space, LyX will change the red "gamma" to a blue "$\gamma$". 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 LaTeX users.

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

LyX can't do absolutely everything that LaTeX can do. Some fancy functions are not supported at all, while some work but aren't WYSIWYM. TeX mode allows users to get the full flexibility of LaTeX, while having all the convenient features of LyX, like WYSIWYM math, tables, and editing. LyX could never support every LaTeX 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 LaTeX Documents — `tex2lyx`

You can import a LaTeX file into LyX by using the File ▷ Import ▷ LaTeX (plain) menu in LyX. 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 LaTeX, but not everything. It will leave things it doesn't understand in TeX 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 LaTeX 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 LaTeX

You might wish to convert a LyX Document to a LaTeX file. For example, a co-worker or co-author who doesn't have LyX might want to read it. Select File ▷ Export ▷ LaTeX. This will create a file `whatever.tex` from the

`whatever.lyx` file you are editing. LyX always creates temporary LaTeX files when viewing or printing files.

### 5.2.4 LaTeX 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 LaTeX file, you can use them in a LyX document as well. Select Document ▷ Settings ▷ LaTeX Preamble and type in the dialog window (or from the document settings dialog, depending on the frontend). Anything you type will (like with TeX mode) be sent directly to LaTeX.

### 5.2.5 BibTeX

LyX has support for BibTeX, which allows you to build databases of bibliographical references to be used in multiple documents. Select Insert ▷ List / TOC ▷ BibTeX Bibliography to include a `BibTeX` file. In the Database field you load BibTeX files, in the Style field you can load BibTeX 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 BibTeX. The box in the Citation dialog will show a list of all the references in your `BibTeX` file.

## 5.3 Errors!

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