

# LyX Tips and Tricks

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# General overview

## Purpose of LyX

TL;DR: LyX makes it easy to create good-looking technical papers.

LyX is designed using the WYSIWYM (what you see is what you mean) paradigm, versus standard word processors like MS Word, which use WYSIWYG (what you see is what you get). This means that when you want to add a section heading, you select 'Section' in the drop-down menu to the top left, and LyX will take care of the formatting. It also has a very powerful and flexible math typesetting system. LyX takes a bit of adjustment, but it means that you don't have to remember which font size you've been using for headings, or futz around with spacing. It isn't always the right tool for a particular job; it's good at making great-looking technical papers and reports, but it's much harder to fiddle around with graphic placement and fonts like you might want to for a poster.

If you've ever used L<sup>A</sup>T<sub>E</sub>X, you should be right at home—LyX is built as a graphical interface on top of L<sup>A</sup>T<sub>E</sub>X, abstracting away the class declarations and control symbols that clutter up L<sup>A</sup>T<sub>E</sub>X source files and instead showing you something that's closer to the final result. You can still enter raw L<sup>A</sup>T<sub>E</sub>X (called ERT for Evil Red Text in LyX) as needed with the Ctrl+I<sup>1</sup> shortcut, and LyX continuously maintains a L<sup>A</sup>T<sub>E</sub>X source file (click *View*→*Source Pane*) so you can see what's going on under the hood. LyX has been around for 15 years and most functions are available within the GUI, so you shouldn't need to use ERT too often.

You can either download LyX from [lyx.org](http://lyx.org) and install it on a personal machine, or use the version installed on the CAE Windows and Linux lab computers. The CAE version has several quirks, so I recommend installing and using LyX on a personal laptop or desktop.

## Hello, world

To jump right into LyX, start by clicking the *New document* icon in the top left of the screen. You can also use the shortcut<sup>2</sup> Ctrl+n, or select *File*→*New*. Enter a title by selecting *Title* in the drop-down box to the top left, and then typing your desired title text. Hit enter/return, select *Author* from the drop-down, and type in your own name. Hit enter again and select *Section* if you'd like a section heading for your document (or subsection, or whatever's needed). Hit enter once again (the drop-down box<sup>3</sup> should now say *Standard*) and start typing your body text. You'll notice right away that LyX doesn't allow you to enter multiple spaces or returns, since it takes care of inter-sentence and inter-line spacing. If

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<sup>1</sup>When I refer to shortcuts, capitalization is meaningful. Lowercase letters should be typed as written, and uppercase letters should be typed as shift+[letter].

<sup>2</sup>You'll find that most common keyboard shortcuts behave as expected, e.g. Ctrl+s to save, Ctrl+f to find, Ctrl+z to undo, and Ctrl+x/c/v to cut/copy/paste. Hovering over menu items will display a tooltip which includes the item's shortcut if available.

<sup>3</sup>You can access this drop-down menu quickly with Alt+p <spacebar>; type to filter the entries.

you *really* need multiple spaces or returns, use Ctrl+Space/Return. After you've typed a bit, hit *View* (googly eyes button to the top left) to generate a pdf file you can save or print. If you make changes to the LyX file, click the *Update* icon (next to *View*) to update the pdf. Note that saving the output doesn't save the LyX file—you'll need to save both.

## Using LyX on CAE lab computers

Happily, CAE recently decided to install LyX on the Windows lab computers. It can be found in the start menu under *Programs*→*Productivity*→*LyX*. However, the LyX installation is a bit mangled, making it more likely to produce errors. Two known errors:

- If you try to compile a document without changing any settings on the CAE computers, you may get an obscure-looking error that says something about 'Babel language package'. To fix this, go to *Documents*→*Settings*→*Language* and change the language package from 'Default' to 'None'.
- For some reason, the CAE LyX install doesn't like long filenames on graphics included in LyX. To avoid running into errors, try to keep filenames quite short (e.g. gaussquad.png)

## Document settings

If you need to change the appearance or behavior of the document you're writing, click *Document*→*Settings* to open the Document Settings menu (surprise!). There are many options available here, but you won't need to worry about most of them. First and foremost is the document class—for short papers, use *Article (Standard Class)*, while *Report (Standard Class)* is appropriate for longer documents. Click the document class drop-down and start typing the class name to filter the drop-down list, then select the class. Greyed-out document classes aren't available on your LyX installation—if you want to use them, you'll need to download and install class definition files, then refresh LyX with *Tools*→*Reconfigure*. Googling will provide a more detailed guide to the process, but you really shouldn't need to install other class files. You can also play with *Fonts*, *Text Layout*, *Page Layout*, *Page Margins*, *Numbering & TOC*, and *Float Placement*. Other menu items might require reading the (very useful, but lengthy) LyX user's guide, Googling, or asking me.

## Adding graphics and tables

To add a graphic (picture, graph, etc.) to the document, go to *Insert*→*Graphics*, click the Insert Graphics (borderless triangle-circle-square) icon, or use Alt+i+g. LyX outputs graphics pixel-for-pixel, so if you have a very large graphic, it will probably be far too large in the pdf output. To shrink graphics down to a more reasonable size, click on the graphic, click the 'Set width' checkbox in the popup that appears, and enter an appropriate width. The body text is 16.5 cm wide by default; I resize most graphics to be 6-12 cm wide.

To add a table, go to *Insert*→*Table*, click the Insert Table (grid) icon, or use Alt+i+t. To paste text from Excel or another spreadsheet, create a table of same dimensions as the copied spreadsheet cells, put the cursor in the upper-left cell, and use Ctrl+Shift+v.

Most 'professional' technical reports and articles use figure/table floats, which set the figure/table apart from body text and append a figure/table number and description. Add floats through *Insert*→*Float*→... or the float icons, which are the Insert Graphics/Insert Table icons but with a dotted border around the outside.

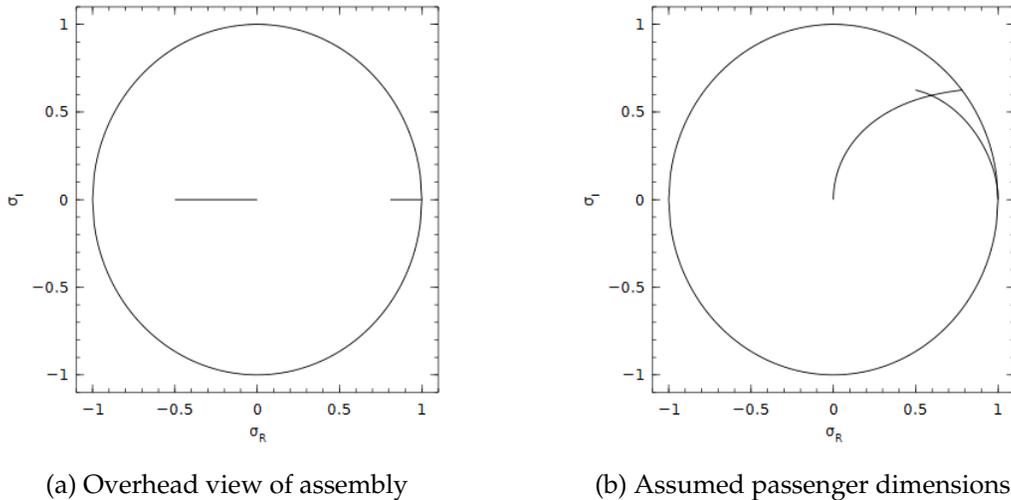


Figure 1: Assumptions and definitions

To refer to the figure from elsewhere in the text, place the cursor in the float description box, insert a label (*Insert*→*Label* or Alt+i+l), and enter a descriptive label. Then, create the reference with *Insert*→*Cross-Reference* or Alt+i+r

LyX sometimes has strange opinions about where figures should go within the text. To change the default location of figures (relative to the insertion point) for the entire document, go to *Document*→*Settings*→*Float Placement*. To change the location of an individual figure, right-click on the 'float: Figure' box heading and select 'Settings' from the drop-down menu.

## Further reading

The [LyX Essentials](#) goes into greater depth than this summary, although it doesn't describe available shortcuts. Check it out if you're concerned with bulleted or numbered lists, cross-referencing and citations, or bibliographies.

The [LaTeX Mathematics Companion](#) covers basically every aspect of L<sup>A</sup>T<sub>E</sub>X math typesetting. If you have a math formatting question that Google can't answer, you can probably find the solution here.

The built-in manuals are also worth a look; they can either be viewed in L<sup>A</sup>T<sub>E</sub>X or compiled into a PDF. Find them in the 'Help' section of the top menu bar.

## Math maneuvers

One of L<sup>A</sup>T<sub>E</sub>X's great strengths is the ease (and eventually, speed) with which math can be typed. The following text is half tutorial, half style guide.

To enter L<sup>A</sup>T<sub>E</sub>X's inline (as in  $y = mx + b$ ) math mode, click the  $\Sigma$  button at the top of the screen, or use Ctrl+m. To enter display math mode (for large or important math expressions), use Ctrl+M:

$$\ddot{x} + \frac{kx}{M} = 0$$

For multi-line equations, use Ctrl+M to enter display math mode, then Alt+m+a to create an aligned multi-line equation. You'll see a template with two boxes appear; the equations will be aligned along the division between the two boxes. It's good practice to always keep your equality signs on one side next to the inter-box division so your equalities are aligned in the output:

$$H_P = \sum_i \rho_i \times m_i \dot{r}_i$$

$$h_P = \sum_i \rho_i \times m_i \dot{p}_i$$

Once you've entered math mode, you'll see a math palette appear at the bottom of L<sup>A</sup>T<sub>E</sub>X with hundreds of common symbols and expressions. You can click items to add them to the text at your cursor's location. Hovering over items in the palette shows the shortcut key combo that produces the symbol. Learning these shortcuts will take some time, but doing so will allow you to enter math expressions into documents very rapidly.

To add number labels to a single displayed equation or all lines of a multi-line equation, use Alt+m+n. To add or remove numbering from a single line in a multi-line equation, use Alt+m+N.

$$\sigma_{rr} = \overbrace{\frac{p_i b^2}{a^2 - b^2} \left(1 - \frac{a^2}{r^2}\right)}^{\text{Internal pressure}} - \overbrace{\frac{p_o a^2}{a^2 - b^2} \left(1 - \frac{b^2}{r^2}\right)}^{\text{External pressure}} \quad (1)$$

$$\sigma_{\theta\theta} = \frac{p_i b^2}{a^2 - b^2} \left(1 + \frac{b^2}{r^2}\right) - \frac{p_o a^2}{a^2 - b^2} \left(1 + \frac{b^2}{r^2}\right) \quad (2)$$

If you want to refer to an equation from elsewhere in the document, insert a descriptive label (Alt+i+l) with your cursor inside the equation. For example, my label for equation 1 is `eq:sigma_rr`. The nice thing about referencing equations through labels is that if you add numbered equations to a document later on, L<sup>A</sup>T<sub>E</sub>X automatically updates the numbering of in-text references. As motivation, imagine manual updating, where you'd need to hunt through text for equation references and change them by hand after adding a new equation above.

## Shortcuts and special characters

Standard L<sup>A</sup>T<sub>E</sub>X uses the backslash `\` as a control character. Typing it in math mode will almost always make something happen. All Greek characters can be accessed by typing a backslash, then the character needed, e.g. `\alpha` for  $\alpha$ . Non-keyboard (integration, summation, product, etc.) math operators are accessed similarly, as in `\frac` for  $\frac{a}{b}$ , or `\sin` for  $\sin(a)$ . It's important to use the backslash version of math operators to distinguish them from the symbols they operate on—see  $\sin x$  vs.  $\sin x$ , or  $\lim x \rightarrow 3$  vs  $\lim_{x \rightarrow 3}$ .

To quickly access Greek letters, type `Alt + m + g + [roman character]`

For example, `Alt + m + g + a`  $\rightarrow \alpha$ ; `Alt + m + g + d`  $\rightarrow \delta$ .

Some Greek characters have unexpected shortcuts:

Character	$\epsilon$	$\varepsilon$	$\eta$	$\theta$	$\phi$	$\varphi$	$\psi$	$\Delta$
Alt+m+g+	e	E	h	v	f	j	y	D

Many other math characters can be accessed with `Alt + m + ...`, although some cannot.

Using  $\alpha$  and  $\beta$  as dummy characters:

Function	Integration	Sum	Multiply	Product	Vector	Hat	Infinity
L <sup>A</sup> T <sub>E</sub> X	<code>\int</code>	<code>\sum</code>	<code>\cdot</code>	<code>\times</code>	<code>\vec</code>	<code>\hat</code>	<code>\infty</code>
Output	$\int$	$\Sigma$	$\cdot$	$\times$	$\vec{\alpha}$	$\hat{\alpha}$	$\infty$
Alt+m+	i	u	—	—	v	h	8

Function	Partial	Fraction	Square root	Root	Time deriv.	2 <sup>nd</sup> time deriv
L <sup>A</sup> T <sub>E</sub> X	<code>\partial</code>	<code>\frac</code>	<code>\sqrt</code>	<code>\root</code>	<code>\dot</code>	<code>\ddot</code>
Output	$\partial$	$\frac{\alpha}{\beta}$	$\sqrt{\alpha}$	$\sqrt[\beta]{\alpha}$	$\dot{\alpha}$	$\ddot{\alpha}$
Alt+m+	p	f	s	r	. (period)	“ (quot. mark)

To get delimiters (`( )`, `{ }`, `[ ]`, etc.) which automatically resize to fit whatever they contain, type `Alt + m + {the opening delimiter}`, e.g. `'Alt + m + (` for auto-resizing parentheses. This ends up looking like

$$\sin\left(\frac{1}{x}\right) \text{ or } \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

It's best to not use auto-resizing delimiters if you know the expression will be standard (short) height, since auto-resizing adds extra space before and after the delimiters.

## Making fractions fit

When typing inline equations with fractions, the standard `\frac` (Alt+m+f) will probably compress the characters in the fraction beyond the bounds of readability. It's better to use the forward slash (`1/2`) or use `\nicefrac`, which produces  $\frac{1}{2}$ . There are some exceptions—for example,  $\frac{\pi}{2}$  is perfectly legible inline. However, more-complicated fractions such as  $\frac{\alpha x + \beta}{\delta y + \delta}$  will force L<sup>A</sup>T<sub>E</sub>X to increase the inter-line spacing around the line, resulting in an ugly document. Better to use `\nicefrac`:  $\alpha x + \beta / \gamma y + \delta$ , or nothing at all:  $(\alpha x + \beta) / (\gamma y + \beta)$

To limit the size of a fraction in a displayed equation (non-inline), use `\tfrac` instead of `\frac`, which produces

$$3\frac{a}{b} + 5\frac{c}{d} \text{ and } \frac{1}{4} \sin x$$

instead of

$$3\frac{a}{b} + 5\frac{c}{d} \text{ and } \frac{1}{4} \sin x$$

It is only occasionally better to use `\tfrac` in a displayed equation, though—most of the time, especially in fractions with multiple characters, `\frac` works nicely:

$$\sin \frac{n\pi x}{4}$$

## Math operators

LyX has built-in templates for many math operators including fractions, exponents, subscripts, and sums. Shift+`_` produces a subscript, and Shift+`^` produces a superscript; add these to integrals to define bounds, or to sums to define conditions.

There are several different conventions for differentiation; pick whichever your professor/P.I./textbook seems to be attached to. Differentiation can be written as `dy` or `dy` (upright<sup>4</sup> or italic d), or with apostrophes as in  $f'(x)$ . When integrating, it is good practice to separate the differentials from the integrated expression with small spaces inserted using Ctrl + Space:

$$\int_0^3 \int_{-1}^1 x^2 y \, dx \, dy$$

Table 1: Common multiple integrals

$$\iint \quad \iiint \quad \oint \quad \oiint$$

`\iint`   `\iiint`   `\oint`   `\oiint`

When looking at multiple integrals with a single subscript used to describe the integrated area, it is good practice to typeset the subscript entirely below, typing `\iint\limits_A 3x \, dd\{A\}` to produce

$$\iint_A 3x \, dA$$

For closed surface integrals (and some multiple integrals), convention seems to be standard subscript notation, e.g.

$$\oint_L \text{ or } \iint_B$$

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<sup>4</sup>If using the **Physics package** to extend L<sup>A</sup>T<sub>E</sub>X math, the upright 'd' can be accessed with `\dd`. To automatically add proper spacing in front of the 'd' operator, enclose the operand with curly braces (e.g. `\int x \, dd\{x\}` for  $\int x \, dx$ )

When typing multiple stacked fractions, use `\cfrac`, which produces

$$a_0 + \frac{b_1}{a_1 + \frac{b_2}{a_2 + \frac{b_3}{a_3 + \dots}}}$$

If writing a sum with multiple indices, add a subscript to the sum, type `\substack`, and use Ctrl+Enter to add additional rows of indices as in the following example:

$$\sum_{\substack{0 \leq i \leq m \\ 0 < j < n}} P(i, j)$$

## Vectors

There are two main conventions for vectors: either an arrow above the vectorized character ( $\vec{\rho}$ ) or bolding the character ( $\boldsymbol{\rho}$ ). The former is standard behavior, accessed through Alt+m+v. If you want the latter instead, add the command

```
renewcommand{\vec}[1]{\bm{#1}}
```

to your L<sup>A</sup>T<sub>E</sub>X preamble in the Document Settings menu (described further on the following page in [Advanced Fiddling](#))

## Matrices

To insert a matrix, enter math mode with Ctrl+M, click the purple ‘Insert Matrix’ icon, and choose the numbers of rows and columns needed. To add vertical delimiters within the matrix, type `ccc` (for three columns) in the *Alignment*→*Horizontal*: text box, with a pipe character where the delimiter is wanted. For the matrix below, I inserted a 3-row, 4-column matrix, then typed ‘ccc|c’ in the text box.

$$\left( \begin{array}{ccc|c} 5/6 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 1 & 2 & 3 & 4 \end{array} \right)$$

To add pretty delimiters to a matrix (hugged around the numbers composing the matrix), select a *Decoration* in the math matrix creation window. Unfortunately, it doesn’t seem possible to use in-matrix delimiters and pretty delimiters simultaneously.

For special matrices which aren’t natively supported by L<sub>Y</sub>X, enter ERT (Evil Red Text) mode with Ctrl+l and start a math environment from scratch. For example, to obtain a matrix with bordering characters, use the following ERT:

---

```
\[ \bordermatrix{~ & x & y \cr A & 1 & 0 \cr B & 0 & 1 \cr} \]
```

---

which produces

$$\begin{array}{c} x \quad y \\ A \left( \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array} \right) \\ B \left( \begin{array}{cc} 1 & 0 \\ 0 & 1 \end{array} \right) \end{array}$$

## Defining your own operators

Notice that when you type a common math operator with a backslash before it while in math mode (`\sin` or `\exp`), LyX typesets them without italics, which helps to set the operator apart from its target. If your work requires you to create an operator, you can predefine its behavior in LyX using math macros (the  $\stackrel{\text{foo}}{=}$  button in the top toolbar), then type carefree. Several examples are included in this doc. If you're reading a pdf version, open LyX and go to *Help*→*Math*, then search for 'math macros'.

When creating a macro, use the green *Append argument* button to... well, append arguments. Then, enter the expression you'd like to generate automatically, with an argument placeholder (typed as `\#1`, `\#2`, etc.) wherever needed. It's also possible to define a math macro without any arguments, which will just produce a pre-defined character.

If you use the same macros frequently, it's probably a good idea to create a LyX file that only contains the macro definitions, then include it at the very top of your active document with *Insert*→*File*→*Child Document*. You'll then be able to use the macros without redefining them for each new doc.

## Advanced Fiddling

As you might expect, nearly any LyX-related question can be answered by Google or StackOverflow. Search for 'lyx [keywords]' for UI-related questions, or 'latex [keywords]' for formatting-related questions. For example, when I wanted to figure out how to change the font of section and subsection headings, I searched for 'latex change section font' and implemented the first search result.

Much advanced fiddling will require changes to the document's L<sup>A</sup>T<sub>E</sub>X preamble, a plain-text file found at the bottom of Document Settings. My standard preamble is included at the end of the document.

## What I've discovered (and want to record)

### Left-aligned equations with `flalign`:

Change the equation environment with the right-click menu, then add a column with the table toolbar. Add a blank set `{ }` to the rightmost column, otherwise LyX will ignore the added column. See [here](#).

## Centering graphics inline:

When there's a piece of inline graphics that should be centered vertically with respect to the text, wrap the graphics with `\vcenter{\hbox{ and }}$`.

### Listing 1: Standard LyX preamble

---

```
\usepackage{multicol} % Make documents with multiple columns.
% To enter the multicol environment, use ERT (Ctrl+l) and type \begin{multicols}{2} % for two
  columns, or ...{3} for three columns, etc. Once finished. re-enter ERT
% and type \end{multicols}. To add divider lines between cols, add another ERT box
% with \setlength{\columnseprule}{0.4pt} immediately after \begin{multicols}{...}

\usepackage{bm} % Allows use of bold Greek characters
\usepackage{physics}
\renewcommand{\vec}[1]{\bm{#1}} % Redefines vector command to bold the vectorized character.

% Shrinks the spacing between bulleted and numbered lists
\let\oldenumerate=\enumerate
\def\enumerate{
\oldenumerate
\setlength{\itemsep}{-3pt}
}
\let\olditemize=\itemize
\def\itemize{
\olditemize
\setlength{\itemsep}{-3pt}
}

% Changes the section and subsection heading font families from roman to sans serif
\usepackage{titlesec}
\titleformat*{\section}{\Large\bfseries\sffamily}
\titleformat*{\subsection}{\large\bfseries\sffamily}

% Automatically centers figures inside figure floats
\usepackage{ifthen}
\renewenvironment{figure}[1][]{%
\ifthenelse{\equal{#1}{} }{%
\@float{figure}
}{%
\@float{figure}[#1]%
}%
}
\centering
}

% Automatically centers tables inside of table floats
\renewenvironment{table}[1][]{%
\ifthenelse{\equal{#1}{} }{%
\@float{table}
}{%
\@float{table}[#1]%
}%
}
\centering
}
\end@float
}
```

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