LaTeXQuick Start Guide

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This guide assumes you already have LaTeXand a compiler installed on your computer. The best way to follow this guide is to read this as a pdf while also comparing with the .tex file. Then read the comments written there and try tweaking a few things to see how things change. You should start by reading the header of the .tex file now up until you get to this part of the text. I'll make references in the text to how the .tex file is written.

For example, note how in the .tex file I've skipped a line to get a new paragraph, but in the pdf the skip isn't there! We can change that by telling LaTeXwe want a skip, of varying size:

See?

It's not too hard...

To add some space!

Of course, we can put a few together to get different skip sizes total.

Writing in plaintext is pretty self-explanatory after that. You've also got **bold text** and *italics* if you like, or even underlined text. We'll divide the rest of this guide into sections to make it easier to read.

1 Math Mode

One of the most important aspects of writing in LaTeXis writing mathematics! To do this, we use "math mode."

Math mode is activated by typing a $ and ends when you type a second $, no matter how many spaces or indents you have. Anything inside gets "stylized" into a more mathematical format. In particular, text gets italicized (so variables look nicer) and certain math commands can be displayed that would normally result in a compiling error if written outside of math mode. For example: $x^2 - 3x + 1 = 0$. Note even the hyphen gets elongated into a good minus sign! Compare - with $-$.

In math mode, you can use "calculator syntax" to write all sorts of nice algebraic formulas. Here are some more examples:

$y^2 = y \cdot y$
$\sqrt{81} = 9$

$\sqrt[3]{64} = 4$
$f(x) = \sin^2(x) \implies f'(x) = 2\sin(x)\cos(x)$

Sometimes you don't want to write math in-text, but rather on its own line to emphasize an equation, or otherwise make smaller notation a bit bigger. The solution in LaTeXis quite simple: instead of the $ math mode, use the command \[to start math mode on its own nicer line, and \] to end it. For example,

$$\sqrt{x^2 + y^2} = r.$$

Compare with: $\sqrt{x^2 + y^2} = r$. It's easy for these types of formulas to get lost in a block of text.

2 Common Math Commands

Here are some other common math commands you should know to get on your way to typing good math in LaTeX. We'll use the "itemize" environment in the .tex file to create a nice bullet list.

- Fractions, which look much nicer in the latter math mode described above:

$$\frac{10}{2} = 5.$$

  They can also be a bit more complicated:

$$\frac{\sqrt{x^3 - 1}}{\sin(x)} < |\cos(x)\tan(y)|.$$

  We can simulate derivatives using these as well:

$$\frac{d}{dx}(e^x) = e^x.$$

- Integrals:

$$\int x^n dx = \frac{1}{n+1} \cdot x^{n+1}.$$

- Subscripts can be accessed via the _ key:

$$x_1 = 1, x_2 = 4, x_3 = 9, ..., x_{n+1} = (n+1)^2.$$

  We can combine with the integral to get definite integrals:

$$\int_{-\infty}^{17} e^{-x^2} dx.$$

- Other notions of equality/similarity: we have $\equiv$ used for congruences, like:

$$17 \equiv 2 \bmod 5$$

And another common one is similarity:

$$a \sim b.$$

Not to mention, $a \approx b$. Of course, there are inequalities too like $a \geq b$ and $c \leq d$.

- Set notation. If S is a set, and x is an element of S, we write that as $x \in S$. We can also define S like

$$S = \{x : x \text{ an even integer}\}.$$

We also talk of functions from a set S to a set T. We write this as $f : S \to T$. We can compare sets as usual, for example: $S \subseteq T$ or $A \supset B$. The empty set is $\varnothing$. We can do our usual $A \cup B$ and $S \cap T$.

- If we want to cross out some notation to negate a math symbol, we can do that easily: $x \notin S$, or $x \neq y$, or $a \not\sim b$. Though "not equal" is so commonly used, it has a shorter special command for it: $x \neq y$.

3 Special Letters

Part of writing math includes writing well beyond the English alphabet. Typing these in LaTeXis simple. For example, the commonly used Greek letters can be typed using their name as a command. For example:

σ is lowercase sigma, while Σ is uppercase sigma.

We've got $\alpha, \beta, \gamma, \delta, \epsilon, ...$ and of course π!

You may not like the default ϵ and ϕ, so there are variants: ε and φ.

What about special symbols that don't belong to an alphabet, like the integers? We can use the AMS package "mathbb" for Blackboard Bold letters. Observe:

$$\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}, \mathbb{C}.$$

You can also write some fancy calligraphic characters, like $\mathcal{A}, \mathcal{M}, \mathcal{S}$. There are lots of different ways to get fancy letters from other packages too!

4 Some Other Useful Environments

The above is quite a bit to get started, but there's one last very useful set of ideas you should know for using LaTeX- there are lots of environments that help organize text in very smart ways.

1. The "enumerate" environment is similar to itemize, but instead of bullets it'll number the list for you. The best part is, if you insert an item somewhere in the middle, then the numbers get relabeled after recompiling! Always use this environment to number any list.

2. The align and align* environments are great for showing calculations step by step. The normal one makes each line numbered, whereas the * gets rid of the numbering (most commonly used). Here's a demo:

$$\begin{aligned} 3x - 3 &= 5x - 7 \\ 3x &= 5x - 4 \\ -2x &= -4 \\ x &= 2. \end{aligned}$$

   Don't be afraid of breaking up some align* environments with some narration to explain what's happening!

3. The "array" environment is very flexible in making tables, but also functions well for presenting matrices. For example:

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 0 & \pi & x \end{pmatrix}.$$

   Check the comments for how to do it!

5 Final Tips

Suppose you want to write $\mathbb{Z}$ a lot if you're talking about the integers often. The command isn't too long, but are there any shortcuts? The good news is you can create your own! Add \newcommand{\ZZ}{\mathbb{Z}} as it appears here to the header, under the usepackage commands. Then you can type \ZZ inside any math mode to get $\mathbb{Z}$! You can use this idea to make your own commands and write faster.

A few times now you've seen me write special symbols like \$ and \ which have a precise meaning to the LaTeXcompiler. How'd I get away with it? For most of these, you can just add a \ in front to "escape" the character - i.e. not have it interpreted with its special meaning by the compiler. This applies to e.g. \$, %, &, and more. Some special exceptions include \ of course.

Compile frequently, as you create the document, so you can debug any errors and check that what's being displayed is actually what you envisioned. Fix these things as you go so they don't become unbearable to manage at the end.

The more you practice, the easier it becomes to remember the syntax for writing what you want. The above gives some of the most standard things you'd want to type mathematically.

However, if you're looking for more, try searching the Internet for solutions to what you're trying to do. LaTeXis very powerful, so chances are what you want already exists and is easy to learn.