

1 Introduction to L^AT_EXclass

Welcome to the Introduction to L^AT_EXclass! This class should get you started on the basics of learning to type math using the program L^AT_EX (pronounced “Lay-tek” or “Lah-tek”).

There is no text for this class, but I recommend that you download the file “A Not-so-Short Introduction to Latex” from the web at

www.ctan.org/tex-archive/info/lshort/english/lshort.pdf.

Also, there is a book by Leslie Lamport called “Latex: A document preparation system, User’s guide and reference manual” that is really excellent. That said, quite a few people just manage by using the many references and guides posted on the internet.

2 Source files vs output files

Every L^AT_EX document starts as a “.tex” file. This is the file you actually type, using either WinEdt, TexShop, or any other simple text editor. For example, this file I’m typing right now is called “basic.tex.”

Then you compile the tex file using MikTeX, TexShop, or any other L^AT_EX program. When it is compiled it creates three new files: basic.aux, basic.log, and basic.pdf. The aux and log files are not important to us right now. The pdf file is the thing you are actually viewing right now.

So essentially, you create the tex file, run it through the L^AT_EX program, and you get the pdf file. Then you can print the pdf file, e-mail it to a journal, etc.

Each Latex file has a basic skeleton structure:

```
\documentclass[11pt]{article}

\begin{document}

\end{document}
```

The first line must always be the document class declaration. Anything between the document class declaration and the `\begin{document}` is called the *preamble*. You type the *body* of your file between the `\begin{document}` and `\end{document}`. Anything typed after the `\end{document}` will be completely ignored.

All special commands in Latex start with a `\` (backslash). For example, in the above, the begin and end commands started with the backslash symbol. If you wish to write comments to yourself, begin the line with a `%` symbol. Everything on the line after the `%` will be ignored.

Try typing the above three lines into your editor and then texing it up. Type some words into the body of the file and tex it again. Try changing the 11pt to 12pt. Instead of the word article, try changing it to book, report, or slides.

3 Math Mode versus Text Mode

There are two modes in the body of a Latex file, math mode and text mode. Text mode is what you have been typing in. Any time you want to type an equation, a greek letter, or a mathematical symbol, you must switch to math mode. There are a couple of ways to do this.

In regular math mode, the equation appears within the paragraph like this: $a^2 + b^2 = c^2$. To use normal math mode, you enclose the mathematics within dollar signs:

```
$ a^2+b^2=c^2 $
```

or enclose the mathematics within `\(...\)`:

```
\( a^2+b^2=c^2 \)
```

In display math mode, the equation is set apart from the paragraph and centered. It is displayed more prominently.

$$a^2 + b^2 = c^2$$

To display your math, put it inside double dollar signs:

```
$$ a^2+b^2=c^2 $$
```

or enclose it within `\[...\]`:

```
\[ a^2+b^2=c^2 \]
```

Finally, you can use the equation mode, which displays and numbers the equation, so you can refer to it later.

$$a^2 + b^2 = c^2 \tag{1}$$

```
\begin{equation} a^2+b^2=c^2 \end{equation}
```

4 Fun Math Symbols

Now that you can type a simple file and use math mode, you can do lots of fun stuff. First of all, there are all the greek letters. Those must all be typed in math mode and the commands could not be simpler. Basically, to type a greek letter you use a backslash followed by the name of the letter.

For example, to get a π you type `\pi` in the source file. Similarly for `\alpha` (α), `\beta` (β), etc. Note that if you are already in math mode, you do not need the dollar signs!

What about the letters that have two forms, a big and a small? Also very easy: just capitalize the first letter of the name. For example, `\Lambda` gives you a big Λ and `\lambda` gives you a little λ .

See the following table for lots of other simple math mode commands:

Type of command	Latex	Example Input	Output
Subscripts	<code>Base_{Subscript}</code>	<code>x_1, I_{j,k},</code> <code>\theta_{\alpha}</code>	$x_1, I_{j,k},$ θ_α
Superscripts	<code>Base^{Superscript}</code>	<code>x^2, A^*,</code> <code>\lambda^{n(n-1)}</code>	$x^2, A^*,$ $\lambda^{n(n-1)}$
Fractions	<code>\frac{numerator}{denominator}</code>	<code>\frac{1}{x},</code> <code>\frac{dx}{dt},</code> <code>\frac{x+1}{(y-1)^2}</code>	$\frac{1}{x},$ $\frac{dx}{dt},$ $\frac{x+1}{(y-1)^2}$
Integrals	<code>\int equation dx</code>	<code>\int \sin x dx</code> <code>\int (\ln(y))^2 dy</code>	$\int \sin x dx$ $\int (\ln(y))^2 dy$
Summations	<code>\sum_{lower}^{upper} equation</code>	<code>\sum_{i=1}^3 i^2</code>	$\sum_{i=1}^3 i^2$

If you notice, the fractions, integrals and summations are all a little crowded looking. That is because they are in normal math mode. This mode, also called *in-text* math mode, writes all equations to fit on a single line. My personal preference is to write integrals and other big symbols in *display math* mode. You can do this by adding a `\displaystyle` to the beginning of the equation. For example,

<code>\displaystyle\frac{1}{x},</code>	$\frac{1}{x},$
<code>\displaystyle\frac{dx}{dt},</code>	$\frac{dx}{dt},$
<code>\displaystyle\frac{x+1}{(y-1)^2}</code>	$\frac{x+1}{(y-1)^2}$
<code>\displaystyle\int \sin x dx</code>	$\int \sin x dx$
<code>\displaystyle\int (\ln(y))^2 dy</code>	$\int (\ln(y))^2 dy$
<code>\displaystyle\sum_{i=1}^3 i^2</code>	$\sum_{i=1}^3 i^2$

Much nicer looking!!

There are many many more math symbols. You can find charts listing all the math symbols on pages 39-44 of the Lamport book or on pages 62-69 of the Not-So-Short Intro.