# Basic LaTeX Walkthrough

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Before doing anything, try typesetting this TeX document. What that means is, it'll turn all of this code into a PDF that hopefully looks the way you want it to look. In MiKTeX the shortcut is control+t.

**Plain Text** Anyway, this is how you type plain text. Nothing fancy, right? There are a few things to note. First, it will only render one space. So if you use a lot of spaces, most of the spaces will disappear when you typeset. Similarly, if you enter a lot of empty lines between two paragraphs, it will just start a new paragraph without a line between them. (Try it!)

If you want to **bold** something, you'll use the \textbf{} command. To *emphasize* something, use the \emph{} command. (There is a \textit{} command to italicize, but if you're trying to emphasize something, use \emph{} instead.) To underline text, use \underline{}.

We can break up the document into different sections and subsections with \section{} and \subsection{} commands. They'll automatically be numbered for you unless you put an asterisk at the end, like \section*{}. We can also title paragraphs with \paragraph{}, as seen above. I'll start a new section right now.

# 1 Math

## 1.1 In-Line

We can put math directly into a paragraph, which is called **in-line** math. To do so, enter a dollar sign $, then type in your math, then enter another $ as soon as you want to use text again. For instance, $y=x^2$ will output

as $y = x^2$. If you don't like using the dollar signs, you can use \(y=x^2\), which will look exactly the same.

## 1.2   Display Environment

For larger equations, you'll want to use **displayed** math. It will display the math on a new line below the paragraph you were just writing. This is also good if you want to show a short string of (in)equalities. To do so, use the form \[y=x^2\] and you'll get

$$y = x^2$$

## 1.3   Common Commands

- For a times symbol, use \times. For a dot product symbol, use \dot.

- If you're in-line, write fractions as a/b. If you're in display mode, you can write fractions with \frac{a}{b} to get
$$\frac{a}{b}.$$
  If you try the latter in-line, you'll get tiny fractions that are difficult to read, e.g. $\frac{a}{b}$.

- Use _ for subscripts and ^ for superscripts. For instance, $x_1^2$. If you want an entire expression in the subscript or superscript (or generally for any command), put the entire expression in {}. For instance, $x_1^{2y-5}$ will render as $x_1^{2y-5}$.

- Write square roots with \sqrt{}. For instance, $\sqrt{-1} = i$.

- Write strict inequalities with < and >, non-strict with \leq and \geq. Note that you can express "not greater than" by prefacing it with \not, for instance $5 \not> 6$. (I think you can put \not on pretty much anything, although there is a special command neq for $\neq$.)

- Most Greek letters are straightforward. \delta will give you a $\delta$, and \Delta will give you a $\Delta$.

- For fancier letters, you'll usually use either the `\mathbb{}` or `\mathcal{}` commands. For instance, `\mathbb{R}` gives you the fancy real number symbol $\mathbb{R}$.

- Subsets and supersets are `\subset` and `\superset`, respectively. Add `eq` at the end to make them non-strict, e.g. $A \subseteq B$. To take an arbitrary element from a set, use `\in`, so $x \in X$. Unions are given with `\cup` and intersections are given with `\cap`, for instance,

$$(A \cup B)^c = A^c \cap B^c.$$

  The empty set is simply `\emptyset`.

- Use `\{ ... \}` for curly brackets.

- For a partial derivative, use `\partial`, e.g. $\partial z / \partial y$.

- For limits, use `\lim` with a subscript explaining what the limit is doing, e.g.
$$\lim_{x \to \infty}$$
  Infinity is given by `\infty` and the arrow is `\rightarrow`. If you try putting the limit in-line, it'll look kinda weird.

- Use `\sum` for sums. You'll usually want to try to use sums in the display environment because they can be bulky, for instance

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}.$$

- Write integrals with `\int` with sub and superscripts for the limit. You'll want to put these in the display environment most of the time as well:

$$\int_{-\infty}^{\infty} \frac{1}{\pi(1+x^2)} \, dx = 1.$$

- Sometimes you'll want really big parentheses. For instance,

$$(\sum_{i=1}^{n} i)^2$$

just looks weird. In this case, put `\left` before the left parenthesis and `\right` before the right parenthesis.:

$$\left( \sum_{i=1}^{n} i \right)^2$$

- If you want to display a dollar sign or a percentage or some other symbol that's used as code, try putting a \ before it. Then we can display $ and & and % and so forth.

## 1.4  New Commands

Typing `\mathbb{R}` for $\mathbb{R}$ over and over again gets old very quickly. What we can do is create a new command that allows us to just type, say, `\R` instead. If you look in the preamble in this file, you'll see a handful of new commands I've made for this purpose.

# 2  Other Stuff

Yeah, I'll add some other stuff as need warrants.