LEARNING LaTeX
THE ESSENTIALS

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The code for this document can be found here:
https://www.sharelatex.com/project/588ec497176beb641c2a79b9

This document provides a very basic introduction to using LaTeX. I recommend opening this document in ShareLaTeX so that you can also exmaine the code used in writing *this* article.

1. Math modes

To write math "inline", you use dollar signs; an example is below. Remember, the "code" is what you type (on the left side in ShareLaTeX), and the "result" after typesetting is what you see in the pdf (on the right side in ShareLaTeX). So, for example, the code

```
$x+y = 2$
```

yields the result $x + y = 2$, and the code

```
$\frac{d}{dx} \arctan x= \frac{1}{1+x^2}$
```

is typeset as $\frac{d}{dx} \arctan x = \frac{1}{1+x^2}$.

Every once in a while you will want to "display" math by itself. To do that, you can use double dollar signs or \[and \]. Here's an example; both lines of code below

```
$$(A\wedge B) \implies (B \vee C)$$
\[(A\wedge B) \implies (B \vee C)\]
```

yield the same thing, which is now displayed centered and on its own line below

$$(A \wedge B) \implies (B \vee C)$$

In general, try to avoid "displaying" math, and aim to write in paragraph form. That said, there are definitely times when displaying math is appropriate. You will learn with experience.

2. Aligning Math

To align a bunch of equal signs, use the "align" environment (or "align*" if you don't want numbered equations). The "&" tells the code where the alignment should happen, and the "\\" tells the code where to end each line. Here is the code, which is immediately followed by the result.

```
\begin{align*}
5 &= 2+2+1\\
&= 1+1+1+1+1 \\
&= 1+2+2\\
&= 5.
\end{align*}
```

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$$\begin{aligned} 5 &= 2 + 2 + 1 \\ &= 1 + 1 + 1 + 1 + 1 \\ &= 1 + 2 + 2 \\ &= 5. \end{aligned}$$

3. Roots, fractions, summations, superscripts, and subscripts

Study the following code, which is immediately followed by the result.

```
Let $X_1, X_2, \ldots, X_n$ be a sequence of independent and identically distributed
random variables with $\text{E}[X_i] = \mu$ and $\text{Var}[X_i] = \sigma^2 < \infty$,
and let
$$S_n = \frac{X_1 + X_2 + \cdots + X_n}{n}
      = \frac{1}{n}\sum_{i}^{n} X_i$$
denote their mean. Then as $n$ approaches infinity, the random variables
$\sqrt{n}(S_n - \mu)$ converge in distribution to a normal $\mathcal{N}(0, \sigma^2)$.
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3.1. Lists: enumerate, itemize, and description.

As before, here is the code followed by the result.

```
\begin{enumerate}
\item Here is a list with automatic numbering
\item second point\ldots
\end{enumerate}

\begin{itemize}
\item This has one\ldots
\item two\ldots
\item three bullet points
\end{itemize}

\begin{description}
\item[Idea] Or like this, with words and definitions, or
\item[Concept] Explanation
\end{description}
```

1. Here is a list with automatic numbering
2. like this…

- This has one…
- two…
- three bullet points

Idea: Or like this, with words and definitions, or
Concept: Explanation

4. Tables

Use the tabular command for basic tables. Here is a simple example:

```
\begin{tabular}{c|c}
Item & Quantity \\\hline
Widgets & 42 \\
Gadgets & $12 - 2$
\end{tabular}
```

Item	Quantity
Widgets	42
Gadgets	$12 - 2$

5. Finding new commands

But how do you find the names of new LaTeX commands? My favorite options are (1) to guess, (2) to look for them in a document you already have, and (3) to google them.

For example, what is the command for $\implies$? Try guessing; I bet you got it. If not, look in the "code" for **this** document; it's there. But of course, googling "latex implies" will find you some options for the command as well as some discussions about the options. (Yes `\implies` is correct.)

Finally, if you like having a cheat sheet, try downloading this `http://mirror.hmc.edu/ctan/info/short-math-guide/short-math-guide.pdf`.