Learning LaTeX

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The code for this document can be found here:
`https://www.overleaf.com/read/zkfgxndfnbcb#34b88b`

This document provides an extremely minimal introduction to using LaTeX. You can view this document in Overleaf so that you can also examine the code used in writing this article. In Overleaf, the code is on the left side, and a preview of the result after typesetting is what you see on the right side.

Formatting and paragraphs

In general, you should let LaTeX deal with the main document formatting like margins, page breaks, paragraph spacing and indentation, etc. Taking care of that is a key feature of LaTeX.

To tell LaTeX you want a new paragraph, you skip one line (or more) in the code. Here's a quick example of some code followed by the result.

Example: Paragraphs

```
This is the first paragraph. Notice that just moving to
a new line in the code does
not start a new paragraph. Incidentally, you
can sometimes use this to organize
your code.

However, leaving a blank line will produce to a new paragraph.
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Math modes

To write math *inline* with text, you use dollar signs. Here's an example.

Example: Inline math

```
If we let $f(x) = \arctan x$, then $f'(x)= \frac{1}{1+x^2}$
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Every once in a while you will want to *display* math on a line by itself. To do that, you can use `\[` and `\]`. But in general, try to avoid too much displayed math.

Example: Displayed math

```
The code \[ (A\wedge B) \implies (B \vee C) \]
produces math that is centered and on its own line.
```

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Aligning Math

To align symbols, use the `align*` environment (or `align` if you want numbered equations). Use `&` to indicate where alignment occurs and `\\` to indicate where to end a line.

Example: Aligned math

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

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

Sub/superscripts, fractions, and roots

Subscripts and superscripts are created using underscores and carrots (_ and ^), respectively. If a sub/superscript contains more that one character, enclose it in braces.

Example: Subscripts and superscripts

```
Let $x_1, \ldots, x_{10} \in \mathbb{R}$.
Define $y_1, \ldots, y_{10}$ so that
\[y_i = e^{x_i - 1}.\]
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$$y_i = e^{x_i - 1}.$$

The relevant commands for fractions and square roots are `\frac{ }{ }` and `\sqrt{ }`. For n^{th} roots, you can use `\sqrt[n]{ }`.

Example: Fractions and roots

```
The real solutions to $x^2-x-1 = 0$ are $\frac{1 \pm \sqrt{5}}{2}$;
whereas, $x^3 = 2$ has only one real solution: $\sqrt[3]{2}$.
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Tables

For basic tables, you can use the `tabular` environment. As with aligning math, use `&` to indicate where alignment occurs and `\\` to indicate where to end a line.

Example: Tables

```
\begin{tabular}{c|c|c}
$x$ & $\sin(x)$ & $\cos(x)$\\\hline
$0$ & 0 & 1\\
$\frac{\pi}{2}$ & 1 & 0
\end{tabular}
```

x	$\sin(x)$	$\cos(x)$
0	0	1
$\frac{\pi}{2}$	1	0

Lists

List are implemented via the `enumerate` (numbered list), `itemize` (bulleted list), and `description` (labeled list) environments. Here's an example with all three.

Example: Lists

```
An enumerated list:
\begin{enumerate}
\item first numbered item
\item second numbered item
\item and so on
\end{enumerate}

An itemized list:
\begin{itemize}
\item first bulleted item
\item second bulleted item
\end{itemize}

A description list:
\begin{description}
\item[Core classes:] Math 35, Math 108,\ldots
\item[Elective classes:] Math 102, Math 161,\ldots
\end{description}
```

An enumerated list:

1. first numbered item
2. second numbered item
3. and so on

An itemized list:

- first bulleted item
- second bulleted item

A description list:

Core classes: Math 35, Math 108,...

Elective classes: Math 102, Math 161,...

Finding new commands

Typical ways to find the names of new LaTeX commands are to ask someone who has been writing in LaTeX for a while, look for commands in other LaTeX documents you have, or google it (e.g. try "latex implies" to get the command to produce $\implies$). The following guides might be a good start too:

- `https://www.cmor-faculty.rice.edu/~heinken/latex/symbols.pdf`
- `https://tug.ctan.org/info/short-math-guide/short-math-guide.pdf`.