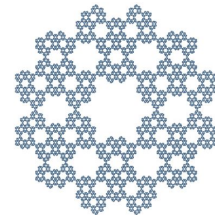# LaTeX Workshop

Mathematics Undergraduate Student Association

September 8th, 2020

Mathematics
Undergraduate
Student
Association

What is it?

LaTeX is a document preparation/typesetting system, used by students, professors, and professionals across the mathematical community.

It's pronounced *LAY-tek* or *LAH-tek*!

LaTeX is used for:

- Research Papers
- Homework and Problem Sets
- Resumes and CVs
- Posters and Presentations

$$\int_0^\infty \frac{1}{1+x^2}\, \mathrm{d}x = \frac{\pi}{2}$$

Why learn how to use it?

- Looks super fancy and professional

- Makes your math prettier than Microsoft Word

- Your grader can read your homework

- Easy to learn, handles formatting for you

- Tons of packages let you make any mathematical drawing or diagram you want
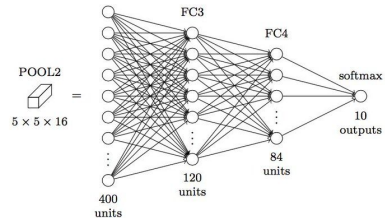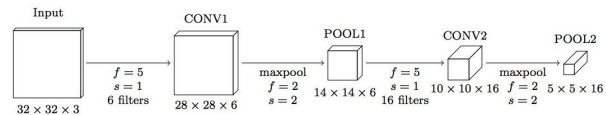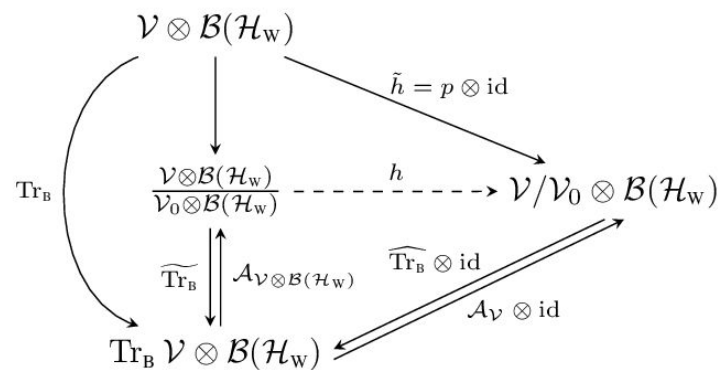
Getting Started

You can write LaTeX in a lot of different environments!

Today, we'll get set up with a free online editor called Overleaf.

Steps to get going:

1. Head to overleaf.com and make an account.
    a. If you use your Berkeley email, you'll get the professional version for free! This comes with some nice benefits like version tracking and integrations.
2. Once you've done that, click New Project > Blank Project.
3. You'll come up with a new project with some stuff in it.

Source   Rich Text

Recompile

main.tex

```
1  \documentclass{article}
2  \usepackage[utf8]{inputenc}
3
4  \title{First Project}
5  \author{Mason Haberle}
6  \date{February 2020}
7
8  \begin{document}
9
10 \maketitle
11
12 \section{Introduction}
13
14 \end{document}
15
```

First Project

Mason Haberle

February 2020
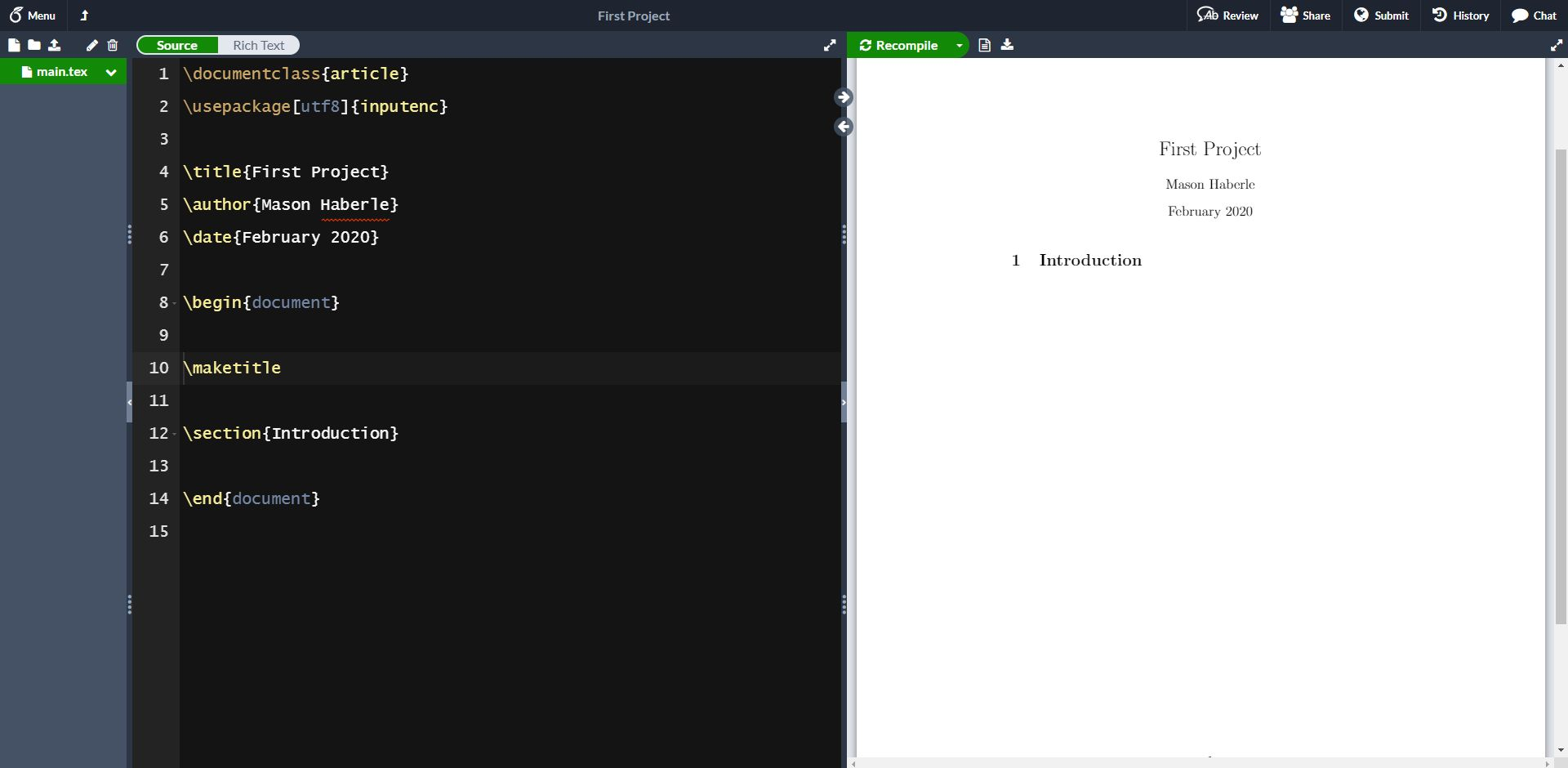
1   Introduction

The Overleaf Environment

Writing Text

Stuff between the lines "\begin{document}" and "\end{document}" is shown as text!

Write down a sentence after the "\section{Introduction}" line.

Hit "Recompile" for it to show up on the right.

Notice that LaTeX doesn't care about extra spaces, and to go to a new line you can either put \\ at the end of the line, or press enter/return twice.

```
12  \section{Introduction}
13
14  Notice that                Latex
15  doesn't care about whitespace.    \\
16  Unless I have a double backslash!
17
18  Or press enter twice for a new paragraph.
```

1 Introduction

Notice that Latex doesn't care about whitespace. Unless I have a double backslash!
    Or press enter twice for a new paragraph.

Writing Math

To write math in LaTeX, all you need to do is surround your equation!

For nicely formatted equations, do $$insert math here$$.

➔   For example: Try typing $$x^2 + y^2 = 1$$

For mathematical expressions in the middle of the line, do $insert math here$

➔   For example: Try typing "The circle $x^2 + y^2 = 1$ has radius 1."

This is enough to do a lot, but some math symbols require special commands.

More Math Symbols

Commands in LaTeX start with \ and tell LaTeX to write something different.

If you want to make a math symbol, the command \symbolname will work a lot of the time. Sometimes the command has a different name.

Try some of the following. Remember to put them in mathmode! ($$ $$ or $ $)

\lim   \sum   \int   \pi   \Psi   \infty   \to   \Rightarrow

\in   \subset   \subseteq   \emptyset   \geq   \leq   \neq

Now, search "Detexify" on Google and go to the first link.

Draw any math symbol and see what command you should use for it!

Subscripts, Superscripts, Braces

If you want to make a subscript or a superscript, use _ or ^.

➔ For example, try the following: $f_1 : A \to B, f_1(n) = \int_0^1 x^n dx$

If you want to put more than one symbol in a subscript or a superscript,
you can group things with curly braces { }. These are also used for commands!

➔ For example, try the following: $x^217 \neq x^{217}$

➔ For example, try the following: $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$

More Nice Commands

We just saw \sqrt{}. Some other commands are \frac{}{}, \overline{}, and \mathbf{}.

➔ Try them! Put a symbol or expression inside each curly brace spot.

There are other useful commands like \sin , \cos , \mod , \log , \pm .

Don't just type the words in without the \ or they'll show up in italics!

➔ For example: $$ \sin \frac{\theta}{2} = \pm \sqrt{ \frac{ 1 - \cos \theta }{2}} $$

➔ Overleaf helps you to find when you're missing a curly brace in your code!

Delimiters

( ) and [ ] work in mathmode. What if you want curly braces { }?

If you try ${ z | z^k = 1 }$ then the braces don't show up. Use \{ and \} instead.

Unfortunately, delimiters can act a little weird when you have big expressions.

Use \left and \right with your delimiters and they'll resize appropriately.

➔   Unsized delimiters: $$ 3 \times   (\frac{1}{2} + 5   ) $$

➔   Resized delimiters: $$ 3 \times   \left(\frac{1}{2} + 5   \right) $$

Break Time

Take some time to experiment with what we've looked at.

Take a look at the LaTeX guides to try more commands and symbols!

Feel free to ask any of us if you have questions or run into problems.

Typing Your Homeworks: Lists

Let's talk about lists. We can either make bulleted lists or numbered lists.

These commands DO NOT go in mathmode! They go OUTSIDE the \[\] and $ $.

Bullets:

\begin{itemize}

\item This is a bullet.

\item This is another bullet.

\end{itemize}

Numbers:

\begin{enumerate}

\item This is the first thing.

\item This is the second thing.

\end{enumerate}

Typing Your Homeworks: Lists

Each item in a list can have as many lines after it as you like, and can have both inline math and formatted equations. So you can use lists to number your problems!

\begin{enumerate}

\item[1-1] The answer is $4 + 4 = 8$

\item[1-2] I couldn't figure out the answer to this problem \\

so I'm going to guess the answer is $\pi + e$.

\end{enumerate}

Typing Your Homeworks: The Preamble

The preamble is everything that comes before \begin{document}.

First line: \documentclass{article}

➔ Tells LaTeX how to format your document.
➔ We usually use article, but there are others like book, slides, letter, etc.

After that: \usepackage{packagename}

➔ Tells LaTeX what extra collections of commands you want to use.
➔ Under the current \usepackage, add another: \usepackage{amssymb}

Typing Your Homeworks: Definitions

Now that we've added the amssymb package, we can do blackboard letters!

➔ Between the begin/end document line, try $\mathbb{R} \mathbb{Q}$.

This is annoying to type if you're using the real numbers a lot!

Let's make our own nickname command for \mathbb{R}.

In the preamble, we use \def \yourcommandname { things you'd like to do }

➔ Under the \usepackage lines, add \def \R { \mathbb{R} }
➔ Try using your new \R command later in your document.

```latex
%Number sets
\def\N{\mathbb N}
\def\Z{\mathbb Z}
\def\R{\mathbb R}
\def\Q{\mathbb Q}
\def\C{\mathbb C}

%Set Letters
\def\O{\mathcal O}
\def\U{\mathcal U}
\def\V{\mathcal V}
\def\T{\mathcal T}


%Lowercase Symbols
\def\p{\phi}
\def\e{\varepsilon}
\def\d{\delta}
\def\a{\alpha}
\def\l{\ell}
\def\s{\psi}
\def\r{\rho}
\def\t{\theta}

%Nicknames
\def\uji{\bigcup_{j=1}^\infty}
\def\nl{\vskip 0.2cm}
\def\ran{{\rm ran}}
\def\span{{\rm span}}
\def\jac{\mathrm{Jac}\,}
\def\i{\infty}
\def\tr{\pitchfork}
\def\codim{\mathrm{codim}}
```
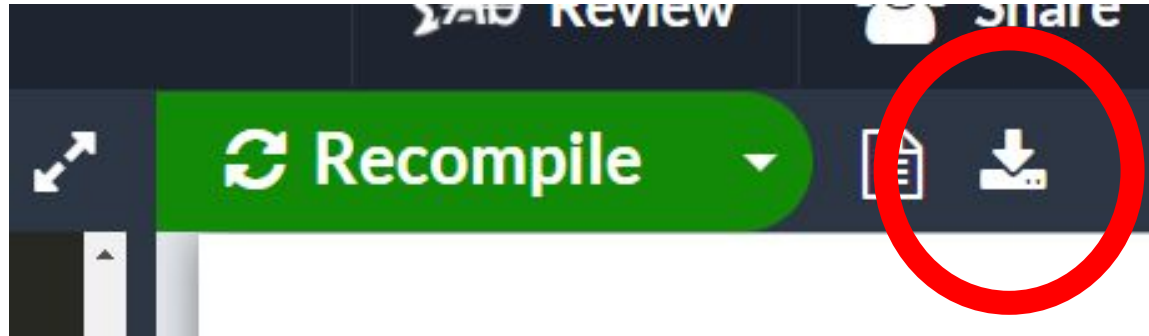
I'm Lazy

Sorry to literally anyone who ever has to read my LaTeX code

Downloading from Overleaf

Press the little "Download PDF" button above the document to download!

You can submit your PDF to Gradescope or bCourses or email it.

It will look really great!

Other Resources

- Detexify: We tried this, find symbols by drawing them.

- MathPix: Turn pictures into LaTeX.

- MathQuill: Turn your typing into LaTeX.

- TeX Stack Exchange: Lots of very smart people with strange opinions.

- texnique.xyz: Fun LaTeX typing game. Give it a go!

- Super useful packages:

  - amsmath, amssymb, etc: Very nice and important extra commands.

  - graphicx: Put images into your file.

  - tikz: Make cool diagrams.