

# Getting Started with L<sup>A</sup>T<sub>E</sub>X

CSc 245

Summer 2020

This tutorial will be written with the expectation that you are using Overleaf to typeset in Latex. However, there are offline software options, such as Texworks, that you can also use if you prefer. If you are not using overleaf skip ahead to section 2.

Before starting the tutorial, make sure you have downloaded the homework template from the course website. It will be a .zip file. Depending on your browser, it may automatically unzip the file. You will need to re-zip it into a folder.

## 1 Overleaf

Overleaf is a free website that allows you to create and store Latex projects. To get started, go to <https://www.overleaf.com/> and sign up for an account.

### 1.1 Uploading Homework Template

Once you have an account, you can upload the homework template by clicking "New Project" on the left sidebar. It will give you several options for creating a project; you want to select "Upload Project". This will bring up a file selector in which you will select the zip file containing the homework template that you downloaded from the course webpage.

### 1.2 Compiling the Document

Once you have loaded the project, click on the file "main.tex" from the left sidebar. This will open the latex document in the left side of the window. On the right side, if you click "Recompile" it will compile the latex document into the corresponding PDF. Now you are ready to start editing the latex document.

## 2 Filling out the Template

A typical problem will look like this in the homework template:

- What is the answer to Life, the Universe, and Everything?

**TODO: Your Answer Here**

To answer the question, simply replace the statement

`{\color{red} TODO: Your Answer Here}`

with your answer.

### 3 A Quick Introduction to L<sup>A</sup>T<sub>E</sub>X

L<sup>A</sup>T<sub>E</sub>X is a tool which is designed to make it easy to produce extremely nice-looking structured documents. In addition, it has extensive support for mathematical symbols, and will produce very nicely formatted mathematical expressions. It is used widely in academia; many of the academic papers published each year are composed using it.

Unfortunately, it has a steep learning curve to get there. Since it is not a WYSIWYG editor, you can't sit down and just type a sentence, willy-nilly; you must write a bit of boiler-plate code. I encourage you to check out Dr. McCann's L<sup>A</sup>T<sub>E</sub>X resource page, at

<http://u.arizona.edu/~mccann/classes/latex.html>

To make your life easier, I have provided the boilerplate code for you; you don't need to define the structure of your document, or figure out to properly format it. All you need to do is to fill in the document any place you see a "TODO" marker.

But to help you understand what is going on, here are a few pointers:

- Generally (as with HTML), text that you type is simply printed out. Whitespace is (mostly) ignored, except that you may indicate a paragraph break by placing one (or more) completely empty lines in the source file.
- L<sup>A</sup>T<sub>E</sub>X commands always start with a backslash, followed by the command name, and then (sometimes) followed by arguments inside curly braces, like this:

`\command`

or this:

`\command{args...}`

- Many commands come in matched pairs; one for beginning, and one for ending a block of text. Most of these are "environments", using the `\begin` and `\end` commands, like this:

`\begin{center} MY TEXT \end{center}`

- Mathematical expressions use a special text mode. You can activate this in one of two ways; either inline (for short expressions which you want to mix right into your paragraph), or in a separate line (for longer expressions which need to stand alone).

- To insert a short expression, simply surround it with `$` at both ends. For example, this line of  $\text{\LaTeX}$  source

The variables  $a, b, c$  are all TRUE.

produces the following output:

The variables  $a, b, c$  are all TRUE.

- To insert a line which is set aside from the rest of the text, begin and end the expression with the `\[` and `\]` commands. For example, this line of  $\text{\LaTeX}$  source

According to Theorem 12, we can conclude that  $x * y = z$  for all legal combinations of the elements.

produces the following output:

According to Theorem 12, we can conclude that
$$x * y = z$$
for all legal combinations of the elements.

## 4 $\text{\LaTeX}$ Cheat Sheet

This section lists a lot of handy hints and symbols that you might want to use in your homework at some point during the class. I will include it in each homework, to make it easier to compose your answers.

### 4.1 Basic Layout

- Whitespace is generally ignored
- Commands begin with a backslash, and proceed to the end of the token
- Use empty lines for paragraph breaks
- Comments start with `%` and proceed to the end of the line, as follows: (there is a message in the source file that you cannot see)

- Equation mode is used to draw “pretty” equations, logical expressions, etc.
  - To make the equation be inline with the rest of the text, use `$ $`
  - To make the equation stand out on a single line, use `\[ \]`
- Curly braces `{ }` can be used to group things together (sort of like how parentheses are used in other languages). **This is especially useful in equations!**

## 4.2 Basic Mathematical Expressions

Notice that most of the simple math expressions can be written using the normal operators; no special  $\text{\LaTeX}$ code is required. (But notice the syntax for declaring a fraction.)

Output	$\text{\LaTeX}$
$x + y$	<code>x + y</code>
$x - y$	<code>x - y</code>
$x * y$	<code>x * y</code>
$x / y$	<code>x / y</code>
$(x)$	<code>(x)</code>
$\frac{x}{y}$	<code>\frac{x}{y}</code>
$\frac{a+b}{x+y}$	<code>\frac{a+b}{x+y}</code>
$x = y$	<code>x = y</code>
$x \neq y$	<code>x \neq y</code>
$x < y$	<code>x &lt; y</code> (outside math mode: <code>x \textless y</code> )
$x > y$	<code>x &gt; y</code> (outside math mode: <code>x \textgreater y</code> )
$x \leq y$	<code>x \leq y</code>
$x \geq y$	<code>x \geq y</code>
$x \equiv y$	<code>x \equiv y</code>
$x \equiv y \pmod{z}$	<code>x \equiv y \pmod{z}</code>
$\sqrt{x}$	<code>\sqrt{x}</code>

### 4.3 Logical Operators & Quantization

Output	L <sup>A</sup> T <sub>E</sub> X	Meaning
$x \wedge y$	<code>x \land y</code>	AND
$x \vee y$	<code>x \vee y</code>	OR
$\neg y$	<code>x \neg y</code>	NOT
$\bar{x}$	<code>\overline { x }</code>	NOT
$x \oplus y$	<code>x \oplus y</code>	XOR
$x \implies y$	<code>x \implies y</code>	Implication
$x \iff y$	<code>x \iff y</code>	Biimplication
$\forall x$	<code>\forall x</code>	Universal Quantification
$\exists x$	<code>\exists x</code>	Existential Quantification

### 4.4 Set Operators

Output	L <sup>A</sup> T <sub>E</sub> X	Meaning
$x \in y$	<code>x \in y</code>	Element-of, a.k.a “in”
$x \cap y$	<code>x \cap y</code>	Set Intersection
$x \cup y$	<code>x \cup y</code>	Set Union
$x \setminus y$	<code>x \setminus y</code>	Set Minus
$\bar{x}$	<code>\overline { x }</code>	Set Complement
$ x $	<code>\mid x \mid</code>	Set Cardinality
$x \subset y$	<code>x \subset x</code>	Strict Subset
$x \supset y$	<code>x \supset x</code>	Strict Superset
$x \subseteq y$	<code>x \subseteq x</code>	Subset
$x \supseteq y$	<code>x \supseteq x</code>	Superset
$\emptyset$	<code>\emptyset</code>	Empty Set

### 4.5 Matrices and Vectors

Output	L <sup>A</sup> T <sub>E</sub> X	Meaning
$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$	<code>\begin{bmatrix} a &amp; b \\ c &amp; d \end{bmatrix}</code>	Matrix layout
$x \cdot y$	<code>x \cdot y</code>	Dot product, or old-fashioned multiplication

## 4.6 Other Miscellaneous Symbols and Modifiers

Output	L <sup>A</sup> T <sub>E</sub> X	Meaning
$\mathbb{Z}$	<code>\mathbb{Z}</code>	“Blackboard Bold”
$x_y$	<code>x_y</code>	Subscript
$x^y$	<code>x^y</code>	Superscript, exponent
$x_{long}$	<code>x_{long}</code>	Use <code>{ }</code> to group things together
$\{foo\}$	<code>\{ foo \}</code>	Pass curly braces to the output (for set builder notation)
$\left(\frac{a}{b}\right)$	<code>\left( \frac {a} {b} \right)</code>	Tall parentheses ( <b>must</b> be paired!)
$a, b, c \dots$	<code>a,b,c \ldots</code>	Ellipsis
$\alpha, \beta, etc.$	<code>\alpha, \beta, etc.</code>	Greek letters
$italicTextnormalText$	<code>italicText \text { normalText }</code>	Insert normal (non-italic) text in an equation