# Workshop 1: Writeup and Introduction to LaTeX

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## 1 Getting Started with LaTeX

LaTeXis how mathematicians are able to type their work quickly, with clean formatting. It's not like typing in Word, where there's lots of buttons to change your formatting, and what you see is what you get. It's much more like coding: when you want to change any formatting, or insert a symbol, there's no button for that. You have to insert the right code into your document. Furthermore, typing in LaTeXrequires two windows: one for typing your code, and the other for the output with all the correct formatting. This worksheet should help introduce you to LaTeX, and give you some basic practice in some of the most common situations you'll use it.

- Create an account on ShareLaTeX.com - you can do just fine with a free account. You won't need all the bells and whistles of the paid accounts, at least not for this class.
- Create a new, blank project, titled Your Name Workshop 1. For example, mine would be named Chloe Wawrzyniak Workshop 1.
- Every LaTeX document starts with a preamble or header. LaTeX compilers can do a lot of things, and the preamble sets the scene. it tells your compiler what sorts of things you need it to do - if it had to load all of its capabilities every time, it would take a *really* long time. It also gives you the chance to set up some formatting, create your own commands, and put in some meta-data like title and author.

  Start your preamble by typing at the top of your document (if it isn't there automatically):

  ```
  \documentclass[12pt]{article}
  ```

  For now, the next line of your preamble should be declaring the environment for the text of the document:

  ```
  \begin{document}
  ```

  Environments in LaTeX are parts of the document enclosed between a begin and an end command. The structure of the environment is applied to everything appearing between these two commands.

  Add some text (a short paragraph about anything). And then close the environment with

  ```
  \end{document}
  ```

As you add text and commands to your document, click the blue “Recompile” button (it may say ”Compile” the first time you click it, instead of “Recompile”) to run your code and generate the PDF. You may also click this button at any point while you're working to check your code.

- In order to use many of the commands that we will find useful, we will need to load their packages. One of the most useful will be the package which allows us to use basic mathematical symbols.

  After the document class, but before the beginning of the document environment, enter the following line:

  ```
  \usepackage{amsmath}
  ```

  This tells the compiler that we will be using commands and environments from the amsmath package, so it should load that information. You can add more packages after this line, by adding another line like the one you just entered, just replacing “amsmath” with the name of the package you want to use. Some of the most common ones that I use are amsfonts, amssymb, and amsthm. You will find that as your documents get more complicated, you'll need more packages.

- There are two basic ways to input mathematics expressions: inline (as part of the text) and offset (given their own line). Inline expressions are enclosed with $ signs, as below:

  Input: The unit circle has area `$\pi$`

  Output: The unit circle has area $\pi$

  Offset expressions have a few options. You may either use double $ signs, or enclose the expression in the symbols `\[` and `\]`, or you can put the expression in the “equation” environment. Note that the equation environment will automatically number the equations.

  Input the below mathematical expressions in your document. Experiment with in-line, offset, and the equation environment to see the differences. You may need to search for some of the symbols, either in the LaTeX Cheat-Sheet (link on my website), online, or using DeTexify (link on my website). You might also need to add some more packages to your document.

  $y = \frac{3x}{8}$

  $y = \sqrt{3x+2}$

  $y = 4x^2 + 3x - 5$

  $y = (x-9)(x+\frac{2}{3})$

  $0 = (x-9)(3x+2)$ implies that $(x-9) = 0$ or $(3x+2) = 0$

  $C = 2\pi r$ and $c = r\theta$

  $$x = \frac{\pm\sqrt{25}}{4}$$

  $$-1 = e^{\pi i} \tag{1}$$

  $\mathbb{Q} \subseteq \mathbb{R} \subset \mathbb{C}$

- We use the "enumerate" environment to generate a numbered list, where `\item` is used to indicate where each item on the list starts. Below the equations that you typed above, answer the following questions, and number them using the enumerate environment. You will likely need to look the answers to these questions up online. You may also need to use the "verbatim" environment to type the code, without compiling it:

  1. I mentioned above that the equation environment automatically numbers each occurence. This is not the only command that does this. `\section{}` and `\subsection{}` are two more examples that automatically number. How do you alter these commands to turn off the numbering?
  2. Make sure one of the equations you typed above uses the equation environment, and is numbered. Then, write a sentence that references it. The numbering should be inserted automatically - you should not merely type the number of the equation, but rather type a command which inserts the number of the equation, and will update if the equation's number changes.
  3. Use the itemize environment to make a list of mathematics courses that you have taken at the university level. Within one of the items, after you list the course create another itemize environment to list some of the topics covered in that course.
  4. Suppose you want to add some space between the courses in your list. How would you do it?
  5. Write a short paragraph about what you hope to get from taking this course, and center it.
  6. As much as LaTeXis great at writing mathematics, it is also pretty good at writing regular text. Find a method to do each of the following:
     (a) Change a word to boldface.
     (b) Increase and decrease the font size of a word.
     (c) Change a word to italics
     (d) Type an email address or webpage link in Courier or True Type Font
  7. Add title, author, date and sections to your document. You may use whatever you like for your title and section titles.

## 2 Workshop Problem

Once you've completed all of the instructions from section 1, add another section titled "Workshop Problems". In that section, type your solutions to the below problems. Note that I'm not looking for mathematically precise solutions to the below problems. I want to see that you have a sense of what's going on, even if you can't explain it precisely (in fact, you haven't yet learned some of the terms you need to be able to describe it precisely).

1. Suppose I start listing numbers $\frac{1}{2}, \frac{1}{2}+\frac{1}{4}, \frac{1}{2}+\frac{1}{4}+\frac{1}{8}, \frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}, \ldots$ and so on. What happens as I continue to list numbers? Do they keep getting larger (in other words, do they go off to $\infty$)? Do they bunch up? If they bunch up, are they getting closer and closer to just one number? What number is that?

2. **Zeno's Paradox:** Suppose I want to walk across a room. Zeno points out that I must first walk halfway there. But once I've reached halfway, I then have to walk half of the remaining distance, and then half of the remaining distance after that, and so on and so

forth. At each point in my walk, I must first walk half of the remaining distance before I can reach the other side of the room. Therefore, I can never actually reach the other side of the room.

But we know that it's perfectly possible for me to walk from one side of the room to the other. So what's wrong with Zeno's argument?

## 3 Completing the Document

Once you've completed sections 1 and 2 of this instruction sheet, click the "Recompile" button once more. You can then download a PDF (one of the options next to the blue Recompile button). Print your PDF, make sure your pages are stapled together (if there is more than one page), and bring it to class on Thursday, January 25 to turn in.