

# Math 152: Intro to Mathematical Software – Lecture 7: LaTeX (part 2)

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January 25, 2017

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## 1 Announcements

Some announcements:

1. You should open `lectures/2017-01-25/2017-01-25.tex` in your project to follow along.
2. HW 2 peer grading due Thursday, January 26 at 8pm.
3. HW 3 due Tuesday, January 31 at 8pm.

## 2 Math formulas

L<sup>A</sup>T<sub>E</sub>X is massively different than a typical word processor (e.g., Microsoft Word). You focus entirely on the content and structure of what you are writing, not on how it looks. Also, the result is much more professional-looking. And you can define functions, e.g.,

Hello World, hello World !! - I say Hello to you, hello to you !! !  
Hello Kiran, hello Kiran !!

### 2.1 Some basics

Google “latex symbols”<sup>1</sup> for tables<sup>2</sup> giving how to typeset interesting symbols, like this:

$$\varphi, \Xi, \partial, \leftrightarrow, \bigoplus$$

Consider  $\varphi + \Xi^3$ .

Top hit (San Diego company interested in math education! Ask me about them later):

<https://www.artofproblemsolving.com/wiki/index.php/LaTeX:Symbols>

This webpage explains a lot of math typesetting. Here are some key things:

- Braces:  $\{x : x \in \mathbb{Q}\}$
- Powers:  $x^{2+3}$ ,  $x^2 + 3$ ,  $x^{(2+3)}$
- Subscripts:  $x_2, x_5, x_{2+3}$
- Both:  $x_5^{2+3}$
- A fraction:  $\frac{2+3Hello10,hello10!!}{5}$
- An integral:  $\int_0^{\pi+e^i} \sin(x)dx$
- A “displayed” integral:

$$\int_0^{\pi} \sin(x)dx$$

<http://detexify.kirelabs.org/classify.html>

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<sup>1</sup>Look in the tex file for how I did those quotes and this footnote.

<sup>2</sup>what is a table?

## 2.2 Using Sage

Given any object `obj` in a Sage worksheet you can (try to) do `latex(obj)` to see how to typeset `obj`. You already learned about `sagetex`, which uses this under the hood, on Monday.

$$x + \frac{1}{6}x^3 + \left(-\frac{1}{40}\right)x^5 + \left(-\frac{55}{1008}\right)x^7 + \mathcal{O}(x^8)$$

$$\begin{pmatrix} 1 & -2 & \frac{1}{2} \\ 1 & 0 & 0 \\ -2 & 0 & 1 \end{pmatrix}$$

**Exercise 2.1.** Use Sage to find a  $\text{\LaTeX}$  formula for the first few terms of the Taylor series of  $\tan(x)$  about zero.<sup>3</sup>

*yourserieshere!*

**Exercise 2.2.** Use Sage to find a  $\text{\LaTeX}$  formula for a matrix using Sage. Use the command `matrix` to make a matrix.

*yourmatrixhere!*

## 2.3 Use Some random webpage

If you do a Google search for `latex formula editor` you'll find (many) kind-of-ugly websites with various programs that let you graphically construct an equation, which show you the latex code.

This is an unusual new demo, where they use machine learning to recognize handwriting (it is pretty impressive):

<http://webdemo.myscript.com/#/demo/equation>

$$\frac{\Omega + \alpha^3}{2}$$

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<sup>3</sup>Hint: use `latex(tan(x).series(x, 10))` in a worksheet, then copy/paste.

### 3 Sectioning and cross referencing

This is Section 3. The next section is Section 4. You can reference anything, e.g., reminder 2 from Section 1.

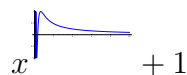
**Exercise 3.1.** *Try reordering the enumerate list above in some random way and or the sections (or adding new ones), then recompile and see all the cross reference numbers get updated.*

### 4 Including graphics

You can take any pdf, png, or jpg file, put it in the same directory as your tex file (+New, drag and drop), and display them as follows. (Photo taken by William Stein.)



Hello , hello  !!



**Exercise 4.1.** *Upload and insert an image of your choice below. It must be png or pdf.*

Sage can also produce pdf's of plots. E.g., if `g = plot(sin) + plot(cos)`, then `g.save('a.pdf')` will create a file `a.pdf` that you can include. This is a little more tedious than Sagetex, but you have more control.

**Exercise 4.2.** *Create a plot and save it to a file as above in a Sage worksheet, then include it below. (Remember, you can use the “Plots” menu in a worksheet to see some examples of plotting syntax.)*