LaTeX

Math 225 Modern Algebra
Prof. D. Joyce, Clark University

September 2017

LaTeX is a typesetting program. I use it to produce all my notes for classes. It's much better for anything that uses mathematical notation than any wordprocessor. LaTeX is used by publishers for research journals in science and math as well as many textbooks. The disadvantage of LaTeX is that you have to know more about it to use it. It's worth it.

Look at the source file for this note. It's in the file `latex.tex`. You're reading the file `latex.pdf`. In order to convert the source file, I use a latex program on our linux machines in the department lab. I just gave it the instruction

```
pdflatex latex.tex
```

and it created the pdf file you're reading. The `latex.tex` file itself I created using a simple editor.

The best way to learn how to use LaTeX is to look at documents and their source files. There are also lots of books on how to use it, and if you're going to use LaTeX a lot, you'll want to get one. But for just writing up homework assignments, you wont need to know much.

Parts of a LaTeX source file. You need to declare the kind of document at the beginning of the file. This one has

```
\documentclass {article}
```

on it because it's just a short article. That's all you need to write up homework and other short things. Next is

```
\begin{document}
```

and at the very end of the file there's a matching

```
\end{document}
```

This document has a title section, and I put that in so you could see how to create titles. Notice how the double backslash forces a new line in the title.

Creating mathematical expressions. One of the main reasons to use LaTeX is to make the mathematical expressions look right. Traditionally, variables like a and x are in italic fonts in printed texts to distinguish them from letters a and x. It doesn't matter whether they're really variables or constants, so, for instance, e should always appear in italics when it means that number about 2.71. Also, spaces should appear before and after plus, minus, and equal signs as in the equation $x^2 + 3x - 2/3 = 0$, but not when multiplication or division are used, and of, course, the exponent 2 in x^2 has to be raised and in a smaller size.

With a word processor, you have to be constantly fiddling with the fonts, spacing, size, and position to get mathematical expressions to look right, but it's all taken care of in LaTeX. Just put dollar signs before and after the expression to indicate that it's a mathematical expression. To get $x^2 + 3x - 2/3 = 0$, just use

```
$x^2+3x-2/3=0$
```

Sometimes you want to display a large equation on a separate line. Delimit the equation with double dollar signs for that. For example, to get

$$\int_2^3 \frac{\sqrt{x^2-4}}{x}\,dx = \sqrt{5} - 2\arccos\frac{2}{3}$$

use

```
$$\int_2^3 \frac{\sqrt{x^2-4}}{x}\,dx=
\sqrt5-2\arccos\frac{2}{3}$$
```

Note how easy square roots, division, and integrals are.

Quotients. Write a simple faction, like $\frac{2}{3}$, as

```
$\frac23$
```

Display more complicated ones, like

$$\frac{x^2-3}{x+2}$$

so that they appear larger.

Some important math symbols. The binary relations $<$, $=$, and $>$ can just be typed as they appear. You can also use

```
\lt
```

for $<$ and

```
\gt
```

for $>$. For $\leq$ use

```
\leq
```

for $\geq$ use

```
\geq
```

and for $\neq$ use

```
\neq
```

For square roots, $\sqrt{\ }$ use

```
\sqrt
```

and then enclose the value inside the square root with curly braces, like

```
\sqrt{x^2+3}
```

for $\sqrt{x^2+3}$. For cube roots and other roots include the optional order number in square brackets, like

```
\sqrt[3]{x^2+3}
```

for $\sqrt[3]{x^2+3}$. The infinity symbol is

```
\infty
```

∞.