Writing with LaTeX

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Abstract

If you will be writing technical documents, even just for your courses at Macalester, you should consider learning to use LaTeX. Most professional mathematicians write using the software LaTeX. A brief introduction to producing documents in LaTeXis given.

1 What is LaTeX?

LaTeXis a typesetting language that gives you great capability and flexibility for manipulation of formulas, graphics, even structure of papers. It produces a document that looks just like a published article in a research journal. In fact, many journals now are produced with Latex.

LaTeXis not a WYSIWYG (what you see is what you get) language like Word. You type commands that instruct the printer what to do. For example, if you want to type the formula for a parabola, you might type

```
$y = ax^2 + b x + c$
```

but what is printed looks like $y = ax^2 + bx + c$. You type the dollar signs to indicate that there is a formula, and then Latex knows to italicize, raise the exponent, space properly.

Fortunately it is easy to learn to write in LaTeX. Every student I have ever introduced LaTeXto has come to love it within a couple of days, including high school students.

1.1 How do I know what the actual document will look like?

You have to compile your document, which (depending on your software) will produce it as a pdf or dvi file.

2 How do I learn LaTeXcommands?

The best way to learn it is the way everyone does. You find a LaTeXdocument that contains a variety of features that you want in your writing, and just copy

the commands. For example, you could look at the source code for this very document if you want to see how sections and subsections (numbered automatically) were created, or the title, abstract, and bibliography. In fact, this document was produced just so you can steal from it. If you need more features, you can search online or ask someone who knows more LaTeXthan you. There are hundreds of good online help sources.

3 Examples to copy

You might want to enumerate.

1. The difference between inline math such as $x^2 + y^2$ and displayed math (on its own line and centered) such as

   $$x^2 + y^2.$$

   The inline formula was surrounded by single dollar signs

   ```
   $x^2+y^2$
   ```

   but the displayed math was surrounded by double dollars

   ```
   $$x^2+y^2$$
   ```

2. How to type limits and integrals

   $$\lim_{A\to\infty} \int_0^A e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

3. How to type other formulas such as

   $$(1+x)^n = \sum_{k=0}^{n} \binom{n}{k} x^k$$

   or

   $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

4. For every $\epsilon > 0$ there exists $\delta > 0$ such that $|x - a| < \delta$ implies $|f(x) - f(a)| < \epsilon$.

5. How to cite a bibliographical reference such as [1].

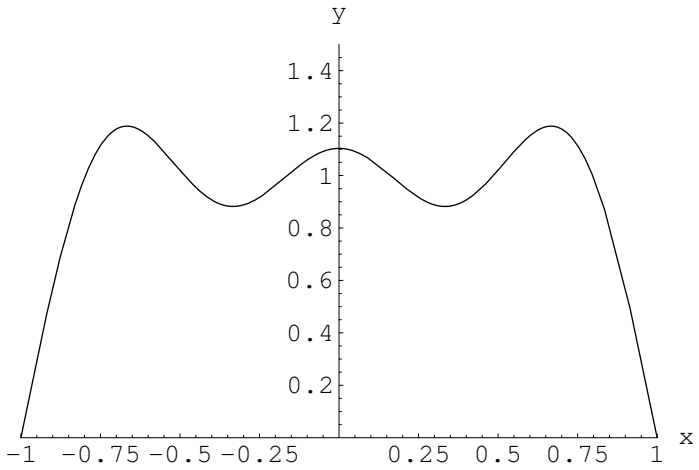
6. A matrix (known to Latex as an array)

   $$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$$

7. You can import a graphics file. There are options for placement, scaling, captions, etc. It can be a bit tedious to get everything arranged just the way you might like. Be sure to include the command

   ```
   \usepackage{graphicx}
   ```

   in the preamble of the document as you can see in the source code for this document. The following is a Mathematica graph.



   If you are compiling with LaTeX, you need to import .eps files. If you are compiling with pdflatex or TeXShop, then you should import .pdf, .jpg, or .png files. You must specify a scale for pdf files and height or width for jpg and png files, as follows:

   ```
   \includegraphics[scale =0.4]{fouriergraph.pdf}

   \includegraphics[height=80mm]{fouriergraph.jpg}

   \includegraphics[width=120mm]{fouriergraph.png}
   ```

4 Where can I get LaTeX?

Fortunately LaTeXis open source and free. You do have to link the editor you use on your computer to the LaTeXsoftware, which is the trickiest step for your professor. Once set up, though, it is easy and rewarding to use LaTeX. The following programs are free for students to download.

For PC users: Some ideas are at www.miktex.org, follow the links to Documentation/Manual and then to "Getting Started." The MikTeX (compiler, http://www.miktex.org) and TeXnicCenter (editor, http://www.toolscenter.org)

are a reasonable combination. TeXnicCenter is made with MikTex in mind, so I think it automatically links itself when it is installed,

For Mac users: TeXShop editor is included as part of a larger package, available here:

http://tug.ctan.org/cgi-bin/getFile.py?fn=/systems/mac/ mactex/ MacTeX-20060608.dmg

5 Exercise

You are a textbook writer. Pick a small topic, a definition or theorem or skill, from a first year calculus class. Write a page (or at the very most two pages) in Latex to teach this topic, or to begin teaching the topic, to a student who is ready for it. Include title and abstract, a reference, and two (short) sections. Include some mathematical typing and a figure. If a mathematical diagram does not seem appropriate for your topic, then find a picture of a mathematician on the internet and include that in your paper for inspiration. Do not strain for deep mathematics. The object is to write enough to see how Latex works. As always when writing, strive to be crystal clear. Clarity may be the highest expository goal.

References

[1] David Bressoud. *A Radical Approach to Real Analysis*. Mathematical Association of America, 1994.

[2] Helmut Kopka and Patrick W. Daly. *A Guide to LaTeX, third ed.* Addison-Wesley, 1999.