

L^AT_EX in the Classroom

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Problem:

This homework assignment written by an associate professor:

<http://pages.uoregon.edu/vvologod/hw3.pdf>

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Solution:

I created an packet of useful information and a one-hour talk designed to introduce \LaTeX by examining the challenges which face new teachers.

That packet can be found here: <http://pages.uoregon.edu/raies/latex.html>

You campaign in poetry. You govern in prose.

– *Mario Cuomo*

Today we want to look at some of the problems that a teacher who just learned \LaTeX might face. The goal is to look for solutions which are simple and accessible rather than those which are elegant and general.

Here is a sample of some early concepts that I won't discuss today:

- horizontal and vertical spacing
- units (the `siunitx` package)
- margins, headers, and footers
- labels and the `hyperref` package
- equation numbering (or not)
- creating custom commands
- beamer

Problem:

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Why?

Different sections of exams often need different instructions but the numbering should be contiguous throughout.

Solution:

The `enumitem` package and the `resume` option provides exactly the desired behavior.

```
\documentclass{article}
\usepackage{enumitem}

\begin{document}
\begin{enumerate}
\item One
\item Two
\end{enumerate}

\begin{enumerate}[resume]
\item Three
\item Four
\end{enumerate}
\end{document}
```


True or False:

1. All p -groups are solvable.
2. A_5 has a unique Sylow 5-subgroup.

Fill in the blank:

3. D_3 has _____ normal subgroups.
4. S_5 has _____ conjugacy classes.

The `enumitem` package also provides options to change the labels in the `enumerate` environment.

```
% Labels will look like (I), (II), ...  
\begin{enumerate}[label=(\Roman*)]  
\item One  
\item Two  
\end{enumerate}
```

Note: The `enumitem` and `enumerate` packages conflict.

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Why?

"I wrote 23 homework assignments. Then I decided to change the spacing between the questions so I changed all 23 homework assignments. Then I realized that I forgot to put a place for their names so I changed all 23 homework assignments. Then a student noticed a typo in the footer..."

Solution:

Of the many solutions to this problem, a common preamble is my preference in a teaching environment (until Kaveh saves the day).

```
\documentclass{article}
\input{math112_hw_preamble}
\begin{document}
%content
\end{document}
```

A file called `math112_hw_preamble.tex` should contain whatever would normally go in the preamble.

To the source code!

The `input` command is extremely useful for creating modular documents.

```
\documentclass{article}
\begin{document}
\input{introduction}
\input{chapter1}
\input{chapter2}
\input{chapter3}
\end{document}
```

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Why?

After giving an exam an instructor might provide solutions to his or her students. Most instructors do this by creating and compiling a second `.tex` file. However, it is usually a bad idea to put identical content in two different places.

Solution 1:

The solution below is best for a homework assignment where there is no spacing between questions.

```
%preamble to compile an "assignment"
\newcommand{\answer}[1]{}

%% OR %%

%preamble to compile a "key"
\newcommand{\answer}[1]{\fbox{Answer:} #1}

...

%body
What is the capitol of Oregon? \answer{Salem}
```

Solution 2:

The solution below is best for an exam where the document leaves room for students' answers.

```
%preamble to compile an "exam"
\newcommand{\KC}[2]{#1}

%% OR %%

%preamble to compile a "key"
\newcommand{\KC}[2]{#2}

...

%body
What is the capitol of Oregon?

\KC{\vfill}{\answer{Salem}}
```

To the source code!

A similar trick can be used to manage different versions of an exam.

```
%preamble to compile "version 1"
\newcommand{\VC}[2]{#1}

%%% OR %%%

%preamble to compile "version 2"
\newcommand{\VC}[2]{#2}

...

%body
What is the capitol of \VC{Ohio}{Oregon}?

\KC{\vfill}{\answer{\VC{Columbus}{Salem}}}
```

Problem:

How can I put the graph of a function in my \LaTeX document?

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Why?

... because I'm a mathematician...

Half-Hearted Solution:

The `includegraphics` command allows the user to import graphics from other sources.

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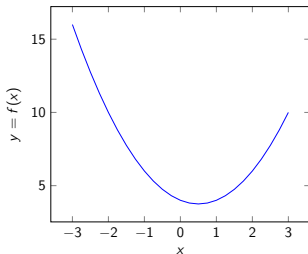
The `includegraphics` command allows the user to import graphics from other sources.

... but there are advantages to creating graphics within \LaTeX .

Research Solution:

There are many. The `pgfplots` package provides one shown below.

```
\begin{tikzpicture}[scale=0.5]
\begin{axis}[xlabel={x},ylabel={y=f(x)}]
\addplot[blue,domain=-3:3]{x^2-x+4};
\end{axis}
\end{tikzpicture}
```



Teaching Solution:

The `tikz` package and `plot`.

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The `tikz` package and `plot`.

First: What is different about teaching?

The other solutions provide high-level (`*ahem*`) computation and a convenient (`*ahem*`) syntax. However, when teaching we can often sacrifice those luxuries for visual control.

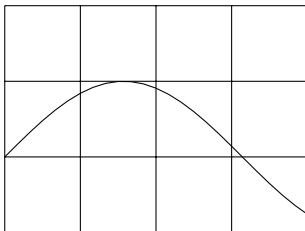
So how do we do it?

As with the `pgfplots` package, the magic happens within a `tikzpicture` environment.

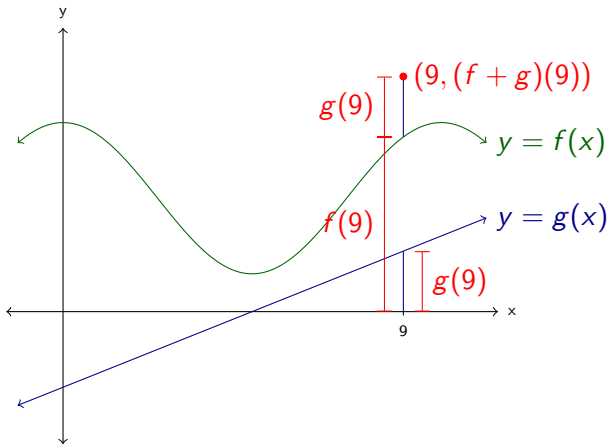
The code...

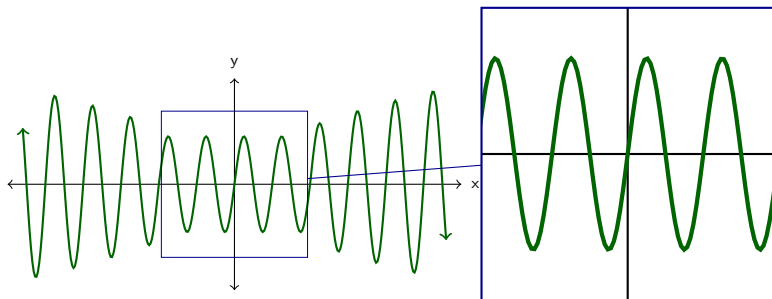
```
\begin{tikzpicture}
\draw (0,-1) grid (4,2);
\draw plot[domain=0:4]({\x},{sin(\x r)});
\end{tikzpicture}
```

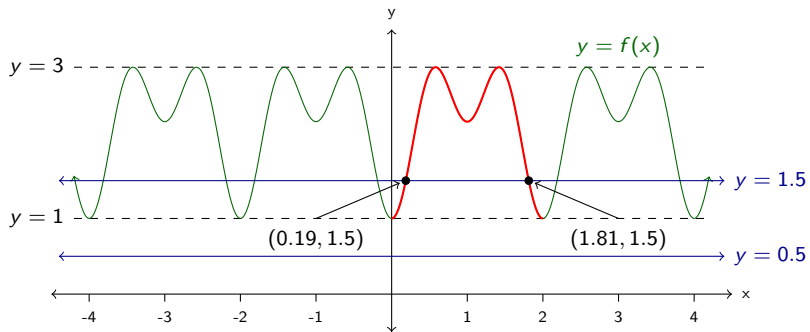
... produces...

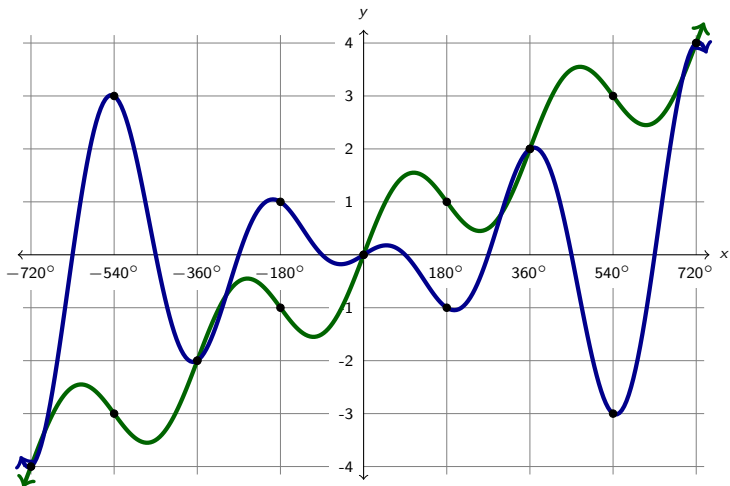


The next few frames are examples of graphs that I've used in which the `tikz` package thrives and other methods struggle.









The `tikz` package (with its relatives) is a wide net that catches many problems, though it doesn't always provide the “best” solution. It is my go-to package for...

- functions,
- geometry diagrams,
- commutative diagrams, and
- force diagrams.

There are, of course, many other applications.

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Why would I ever do that to myself?

Document creation is a valuable skill and L^AT_EX is cool.

Why is this a problem?

Our deepest fear is not that we are inadequate. Our deepest fear is that we are powerful beyond measure.

– Marianne Williamson

Solution:

My solution is writelatex.com.

There are two useful features:

- The unpleasant “installation” process is replaced with the easier and more familiar “sign-up” process.
- It is *trivial* to access students’ source code.

To the [internet!](#)

Unfortunately, writeL^AT_EX is the worst of all worlds for the experienced user.

- Compile timeouts suck. Like, a lot.
- The writeL^AT_EX front-end is very sad when compared to dedicated IDE's.
- Version control systems are likely preferred for collaboration. (Though writeL^AT_EX does support version control.)
- The paid version of writeL^AT_EX is noticeably more impressive than the free version.
- Unfortunately, writeL^AT_EX requires an internet connection. This also makes it slow.
- ... you get the point.

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There are, however, two places where I find writeL^AT_EX extremely useful:

- on my Android smartphone
- on an unfamiliar computer

I don't know half of you half as well as I should like; and I like less than half of you half as well as you deserve.

– *The Hobbit*