LaTeX Tutorial

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Outline

- LaTeX is a typesetting package that is used to make high quality documents
- It can be used to make scientific and mathematical documents
- It can be used to make letters, books, and many other types of documents (e.g. this presentation!)

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LaTeX is available for most computers, from PC to Mac to UNIX

We are not here to learn how to install and set up a LaTeX system, but to learn how to write a document so that it can be processed by LaTeX.

TEX

TEX is a computer program created by Donald E. Knuth to typeset text and mathematical formulae.

LATEX enables the author to typeset and print their work at the highest typographical quality, using a predefined, professional layout.

LATEX uses the TEX formatter as its typesetting engine.

LaTeX vs. MS Word and OpenOffice

Word processors (e.g. MS Word and OpenOffice) are WYSIWYG programs.

LaTeX is a WYSIWYW program. LaTeX does the role of formatting and designing the document. (You do not see the final product until you compile the document!)

But LaTeX is only a program, and the user/author has to provide information about the structure of the document using LaTeX commands.

So why use LaTeX?

With WYSIWYG systems, authors often generate aesthetically pleasing documents with very little or inconsistent structure.

LaTeX prevents such formatting errors by forcing the author to declare the logical structure of the document. LaTeX then chooses the most suitable layout and use of the page.

Advantages

- Complex mathematical formulae are supported in a simple way
- Users only need to learn a few basic commands to specify the structure of the document
- Complex structures like footnotes, bibliographies, tables of contents, etc. are easily generated
- Internal referencing within a document is incredibly easy
- Free add-on packages exist (e.g. to typeset a particular bibliography format)
- Documents look professional!

Disadvantages

- Designing a completely new document layout is difficult
- The learning curve can be steep for those who do grasp the concept of logical markup right away

Preliminaries

Whitespace

- *Whitespace* characters such as blank, tab, or space are treated the same by LaTeX
- *Whitespace* at the start of a line is usually ignored
- A single line break is treated as *Whitespace*
- An empty line between two lines of text defines a paragraph
- Several empty lines are treated the same as *one* empty line

Special characters

- The following symbols are reserved by LaTeX and have special meaning:

  `# $ % ^ & _ { } ~ \`

LaTeX commands

- LaTeX commands are case sensitive
- commands start with a \ and then have a name consisting of letters only
- commands are terminated by a space, a number or any other 'non-letter'
- Some commands require a parameter given between { }
- Some commands take optional parameters between [ ]

  e.g. *command*[*optional parameters*]{*parameter*}

LaTeX commands

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- commands are terminated by a space, a number or any other 'non-letter'
- Some commands require a parameter given between { }
- Some commands take optional parameters between [ ]

  e.g. *command*[*optional parameters*]{*parameter*}
- Many commands exist in a 'starred variant', where the '*' is appended to the command name

  e.g. \section*{Introduction}

Comments...just like MATLAB

- LaTeX comments are indicated by %
- You can also indicate multiple lines of comments by using the **comment** environment

e.g.

```
\begin{comment}
  Everything written within the environment begin and end is a
comment!
\end{comment}
```

or

```
\includegraphics{myFigure.pdf} % This is also a comment.
```

LaTeX input file

When LaTeX processes an input file it expects a few commands in a certain order:

1. \documentclass{...} % this specifies the document type
2. \usepackage{...} % this adds functionality
3. \begin{document} % start the body of the text
4. \end{document} % end the body of the text; anything after this is ignored by LaTeX

A simple example

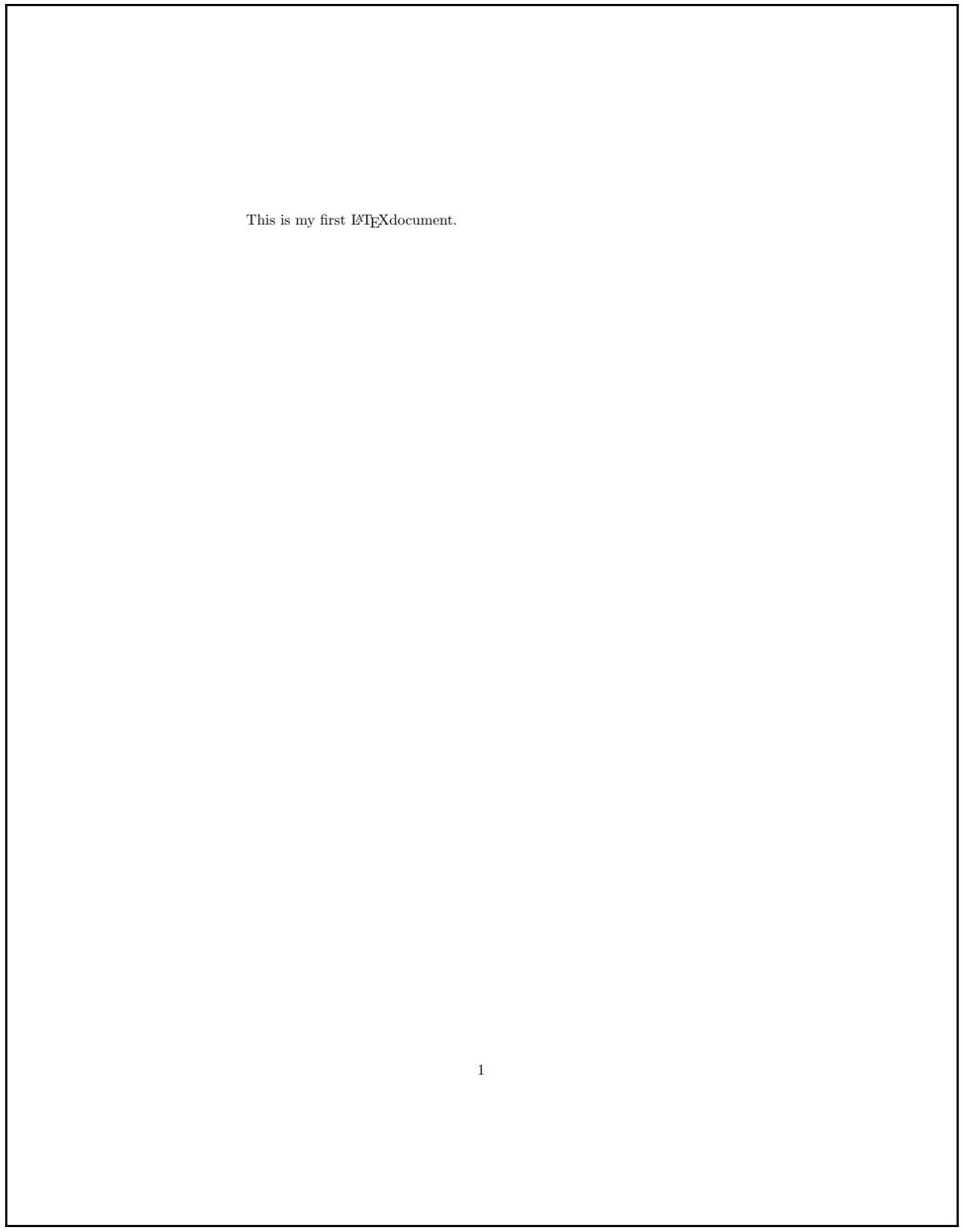
Make a file called myFirstLatex.tex[1] and put the following in the file.

```
\documentclass{article}
\begin{document}
This is my first \LaTex document.
\end{document}
```

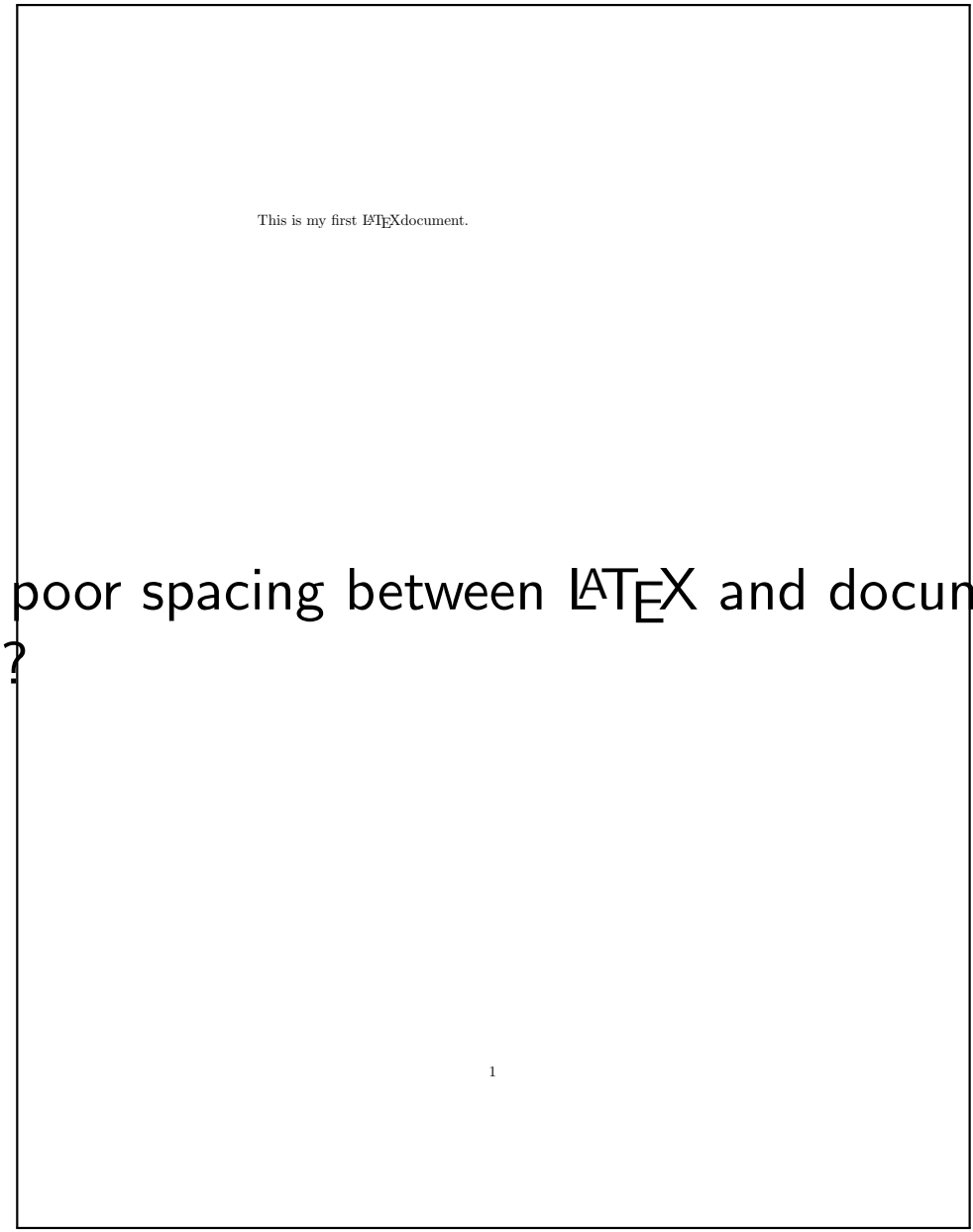
Then run the command *pdflatex myFirstLatex.tex* in the command line (or compile this with your preferred LaTeX IDE.)

[1] You can go to *Example1/* in the *Resources/* folder in the git repository to find myFirstLatex.tex.

The output



The output



We notice the poor spacing between LaTeX and document. How can we fix this?

Fixing the simple example

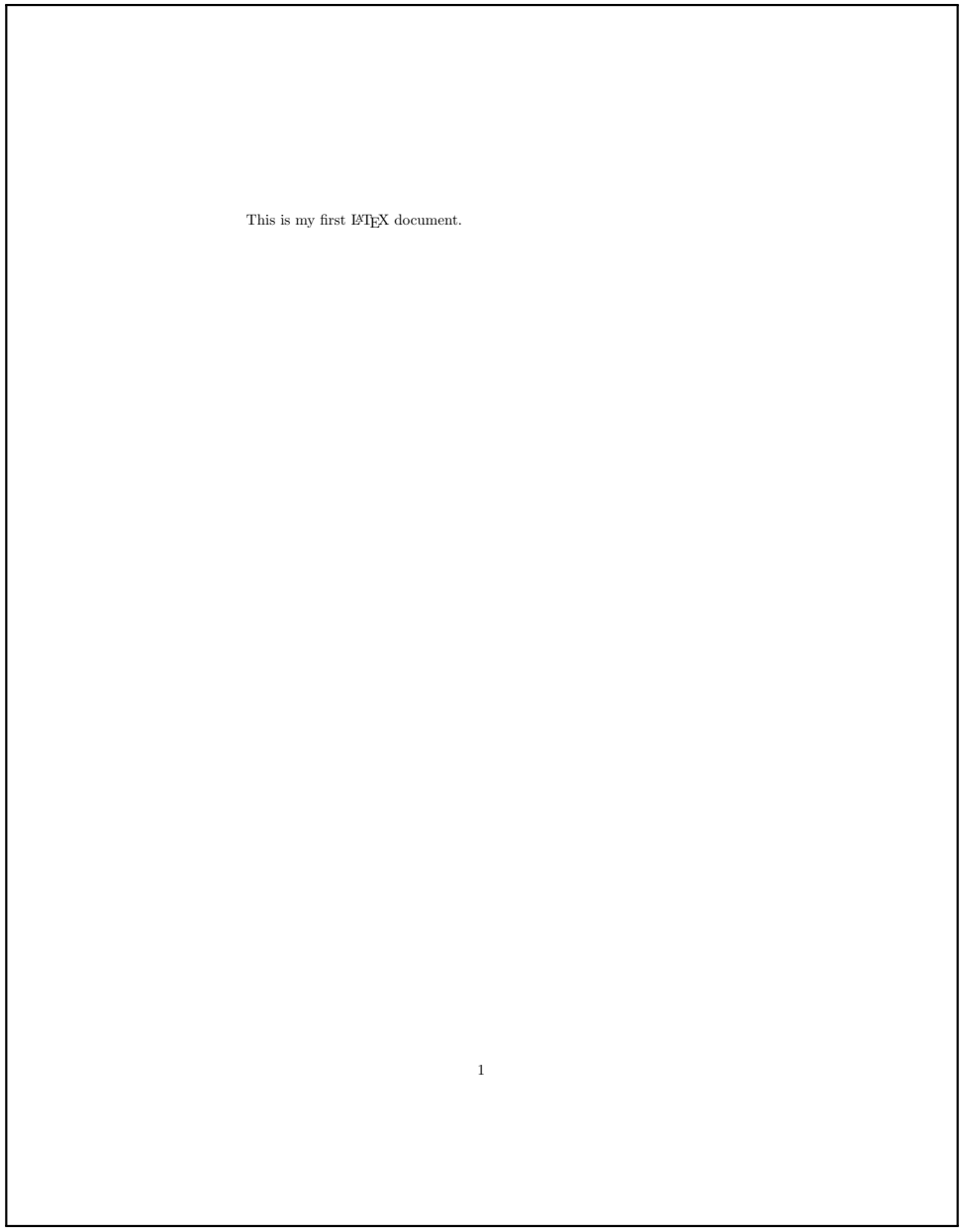
Make a file called mySecondLatex.tex[1] and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\begin{document}
This is my first \LaTex \xspace document.
\end{document}
```

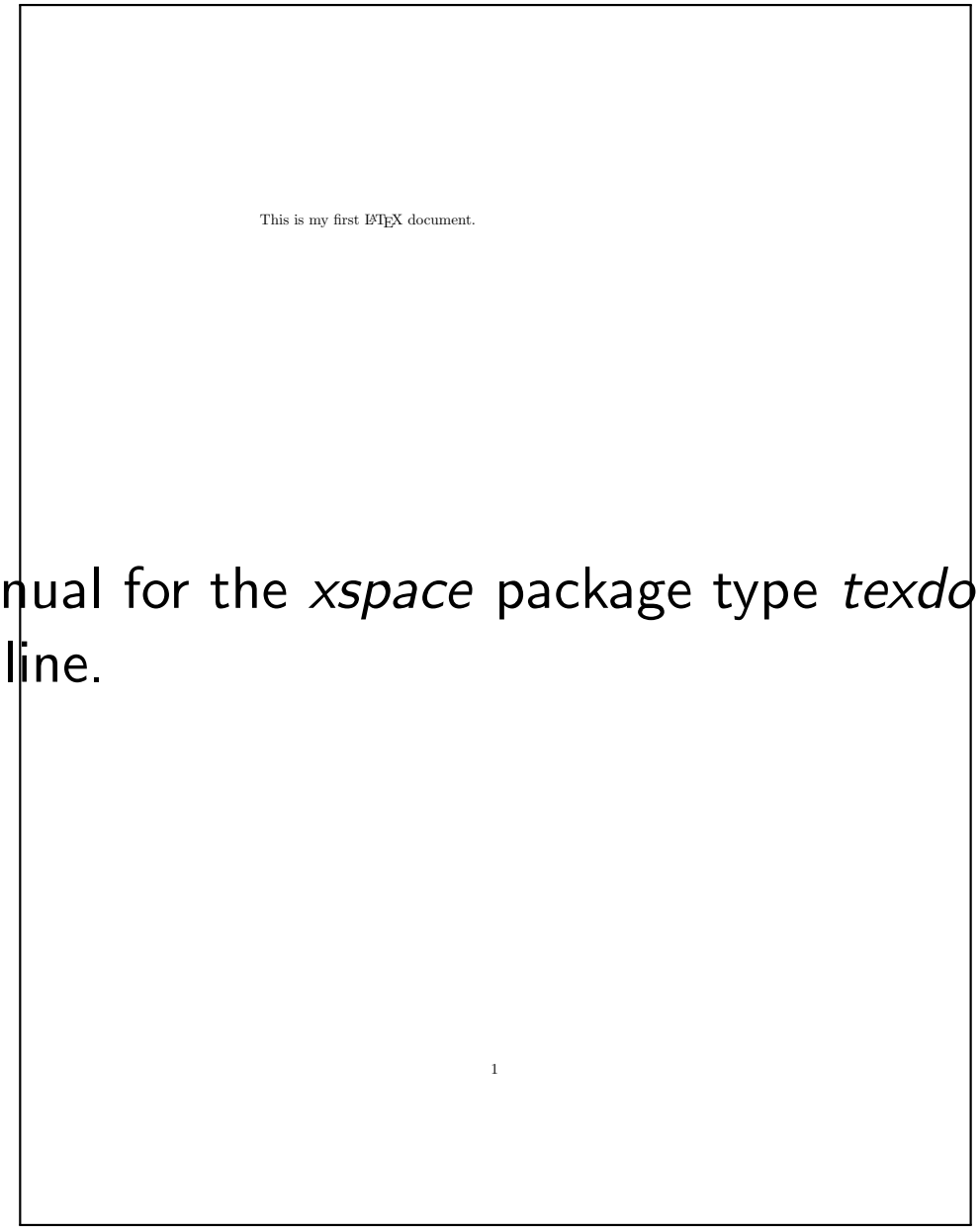
Then run the command *pdflatex mySecondLatex.tex* in the command line (or compile this with your preferred LaTeX IDE.)

[1] You can go to *Example2* in the *Resources/* folder in the git repository to find mySecondLatex.tex.

The output



The output



To see the manual for the *xspace* package type *texdoc xspace* at the command line.

Making your own LaTeX command

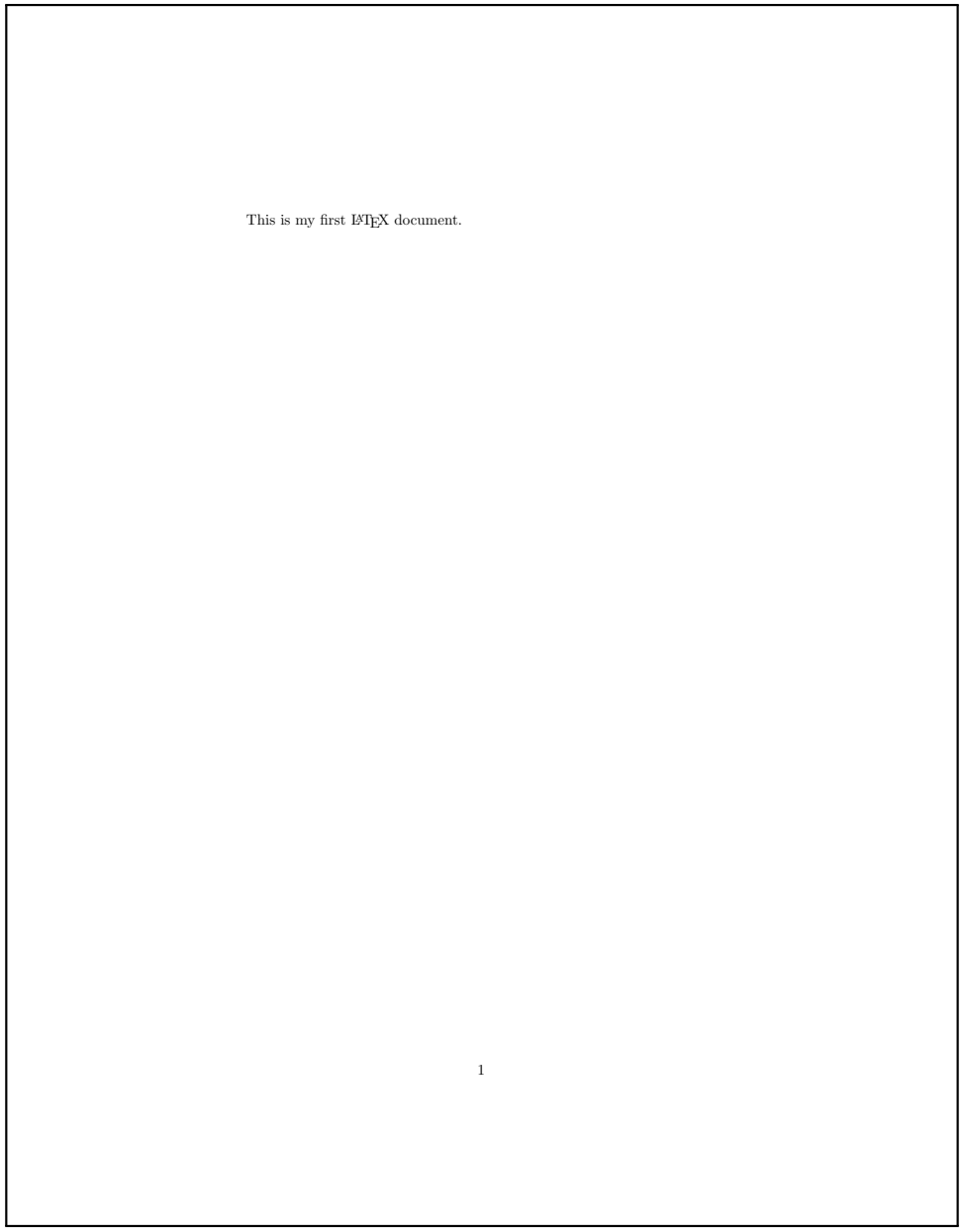
Make a file called myThirdLatex.tex[1] and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\newcommand{\latex}{\LaTeX\xspace}
\begin{document}
This is my first \latex document.
\end{document}
```

Then run the command *pdflatex myThirdLatex.tex* in the command line (or compile this with your preferred LaTeX IDE.)

[1] You can go to *Example3* in the *Resources/* folder in the git repository to find myThirdLatex.tex.

The output



A complete document

Make a file called myFourthLatex.tex[1] and put the following in the file.

```
\documentclass{article}
\usepackage{xspace}
\newcommand{\latex}{\LaTeX\xspace}
\author{Dylan Mikesell} % define the author
\title{\latex Tutorial} % define the title
% end the PREAMBLE
\begin{document}
\maketitle % generate the title
\tableofcontents % make a table of contents
\section{My first section} % make a section for the table c
% type some words
This is my first \latex document.
\section{Adios} % make a final section
\ldots{} and that's it.
\end{document}
```

The output

LaTeX Tutorial

Dylan Mikesell

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Contents

1 My first section

This is my first LaTeX document.

2 Adios

. . . and that's it.

Adding a figure

Open the file called myFifthLatex.tex.

```
\documentclass{article}
\usepackage{graphicx} % need to include the 'graphicx'
\graphicspath{{./Figs/}} % Tell LaTeX where it should look
for your figures...
\begin{document}
\maketitle...
This is my first \latex document. And this is my first
figure reference (Fig.~\ref{fig:firstFigure}).
\begin{figure}
\centering
\includegraphics[width=0.5\columnwidth]{LaTeXLogo.png}
\caption{This is my first figure.}
\label{fig:firstFigure}
\end{figure}
```

The output

Figure 1: This is my first figure.

1 My first section

This is my first LaTeX document. And this is my first figure reference (Fig. 1).

Adding a table

Open the file called mySixthLatex.tex.

```
\documentclass{article}
\usepackage{graphicx} % need to include the 'graphicx'
\graphicspath{{./Figs/}} % Tell LaTeX where it should look
for your figures...
\begin{document}
\maketitle...
This is my first table (Tab.~\ref{tab:firstTable}).
\begin{table}[b]
\begin{tabular}{l|c|r}
$a \approx b$ & $a \ne b$ & $a = \int_{t_0}^{t_1} \frac{g(t
\textbf{column 1} & \textbf{column 2} & \textbf{column 3} \
\end{tabular}
\caption{I just made my first table!}
\label{tab:firstTable}
\end{table}
```

The output

Figure 1: This is my first figure.

1 My first section

This is my first LaTeX document. And this is my first figure reference (Fig. 1).
This is my first table (Tab. 1).

$a \approx b$	$a \neq b$	$a = \int_{t_0}^{t_1} \frac{g(t)}{t} dt$
column 1	**column 2**	**column 3**

Table 1: I just made my first table!

Adding equations

Open the file called mySeventhLatex.tex.

```
$$ a = \frac{1}{N} $$

\begin{equation}
A\mathbf{x} = \mathbf{y}
\label{eqn:equation}
\end{equation}

\begin{eqnarray}
\nonumber
A\mathbf{x} = \mathbf{y} \\
while \ x_{i} \ge 0
\label{eqn:eqnarray}
\end{eqnarray}
```

The output

Figure 1: This is my first figure.

1 My first section

This is my first LaTeX document. And this is my first figure reference (Fig. 1).
This is my first table (Tab. 1).
We can make an inline equation with *$$ arg $$*, but the equation will not have a number associated with it. e.g.

$$a = \frac{1}{N}$$

We can add an equation using the equation environmnt (e.g. eq. 1).

```
\begin{equation}
A\mathbf{x} = \mathbf{y}
\label{eqn:equation}
\end{equation}
```

$$A\mathbf{x} = \mathbf{y} \tag{1}$$

We could also make an equation using the eqnarray environment (e.g. eq. 2).

```
\begin{eqnarray}
\nonumber
A\mathbf{x} = \mathbf{y} \\
while \ \mathbf{x}_{i} \ge 0
\label{eqn:eqnarray}
\end{eqnarray}
```

$$\begin{aligned} A\mathbf{x} &= \mathbf{y} \\ while\ x_i &\geq 0 \end{aligned} \tag{2}$$

$a \approx b$	$a \neq b$	$a = \int_{t_0}^{t_1} \frac{g(t)}{t} dt$
column 1	**column 2**	**column 3**

Table 1: I just made my first table!

Bibliography

1 My first section

You can reference Section 4 on page 4 by labeling your section and calling it, e.g.

```
\section{Check the hyperref package out!}
\label{sec:hyper}

Section~\ref{sec:hyper}

page~\pageref{sec:hyper}
```

2 Bibtex

You can also reference the volcano tomography work of Lees (2007) using

```
\citet{Lees2007}
```

Check the *natbib* texdocs to see the complete list of citation styles. There is also a pdf in the main BSU_LaTeX_Thesis_Template folder.

3 How to make the bibliography

We can make the reference list with

```
\bibliography{myBibFile.bib}
\bibliographystyle{authordate1}
```

where *myBibFile.bib* is my bibtex library file that contains:

```
@article{Lees2007,
author = {Lees, Jonathan M.},
doi = {10.1016/j.jvolgeores.2007.06.008},
isbn = {0377-0273},
issn = {03770273},
journal = {Journal of Volcanology and Geothermal Research},
number = {1-4},
pages = {37--56},
title = {{Seismic tomography of magmatic systems}},
volume = {167},
year = {2007}
}
```

and *authordate1* is the format I want to use.

3

[1] You can go to *Example8* in the *Resources/* folder in the git repository to find myEightLatex.tex.

natbib package

4.1 Basic Citation Commands

`\citet` `\citep`

The `natbib` package has two basic citation commands, `\citet` and `\citep` for *textual* and *parenthetical* citations, respectively. There also exist the starred versions `\citet*` and `\citep*` that print the full author list, and not just the abbreviated one. All of these may take one or two optional arguments to add some text before and after the citation.

`\citet{jon90}`	⇒	Jones et al. (1990)
`\citet[chap.~2]{jon90}`	⇒	Jones et al. (1990, chap. 2)
`\citep{jon90}`	⇒	(Jones et al., 1990)
`\citep[chap.~2]{jon90}`	⇒	(Jones et al., 1990, chap. 2)
`\citep[see][]{jon90}`	⇒	(see Jones et al., 1990)
`\citep[see][chap.~2]{jon90}`	⇒	(see Jones et al., 1990, chap. 2)
`\citet*{jon90}`	⇒	Jones, Baker, and Williams (1990)
`\citep*{jon90}`	⇒	(Jones, Baker, and Williams, 1990)

The starred versions can only list the full authors if the `.bst` file supports this feature; otherwise, the abbreviated list is printed.

In standard LaTeX, the `\cite` command can only take a single optional text for a note after the citation; here, a single optional text is a post-note, while two are the pre- and post-notes. To have only a pre-note, it is necessary to provide an empty post-note text, as shown above.

Multiple citations may be made as usual, by including more than one citation key in the `\cite` command argument. *If adjacent citations have the same author designation but different years, then the author names are not reprinted.*

`\citet{jon90,jam91}`	⇒	Jones et al. (1990); James et al. (1991)
`\citep{jon90,jam91}`	⇒	(Jones et al., 1990; James et al. 1991)
`\citep{jon90,jon91}`	⇒	(Jones et al., 1990, 1991)
`\citep{jon90a,jon90b}`	⇒	(Jones et al., 1990a,b)

These examples are for author–year citation mode. In numerical mode, the results are different.

`\citet{jon90}`	⇒	Jones et al. [21]
`\citet[chap.~2]{jon90}`	⇒	Jones et al. [21, chap. 2]
`\citep{jon90}`	⇒	[21]
`\citep[chap.~2]{jon90}`	⇒	[21, chap. 2]
`\citep[see][]{jon90}`	⇒	[see 21, 1990]
`\citep[see][chap.~2]{jon90}`	⇒	[see 21, chap. 2]
`\citep{jon90a,jon90b}`	⇒	[21, 32]

The authors can only be listed if the `.bst` file supports author–year citations. The standard `.bst` files, such as `plain.bst` are numerical only and transfer no author–year information to LaTeX. In this case, `\citet` prints "**(author?)** [21]."

`\cite`

In the original versions of `natbib`, the traditional `\cite` command was used for both textual and parenthetical citations. The presence of an empty optional

Bulleted list

```
\begin{itemize}
\item This is the default
bullet
\item[X] This is an X bullet
\item[\checkmark] This is
a \checkmark bullet from
\usepackage{amssym}
\end{itemize}
```

- This is the default bullet
- X This is an X bullet
- ✓ This is a ✓bullet from \usepackage{amssym}

Enumerated list

```
\begin{enumerate}
\item This is number 1
\item This is number 2
\item This is number 3
\end{enumerate}
```

1. This is number 1
2. This is number 2
3. This is number 3

TikZ diagrams

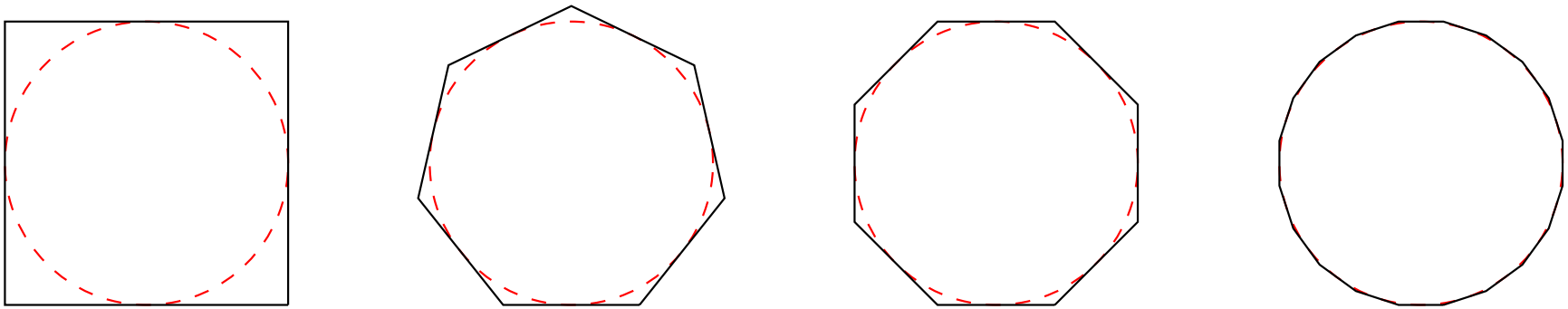

Figure: (from left to right) Polygons with 4 sides, 7 sides, 8 sides and 100 sides used to approximate the circle drawn in red.

```
\usepackage{tikz}
\usetikzlibrary{calc}
\newcommand{\polygon}[2]{%
  let \n{len} = {2*#2*tan(360/(2*#1))} in
 ++(0,-#2) ++(\n{len}/2,0) \foreach \x in {1,...,#1} { -- ++(\x*360/#1:\n{len})}}
...
\begin{tikzpicture}
\draw[red,dashed] (0,0) circle (1);
\draw (0,0) \polygon{4}{1};
\end{tikzpicture}
```

TikZ vector fields

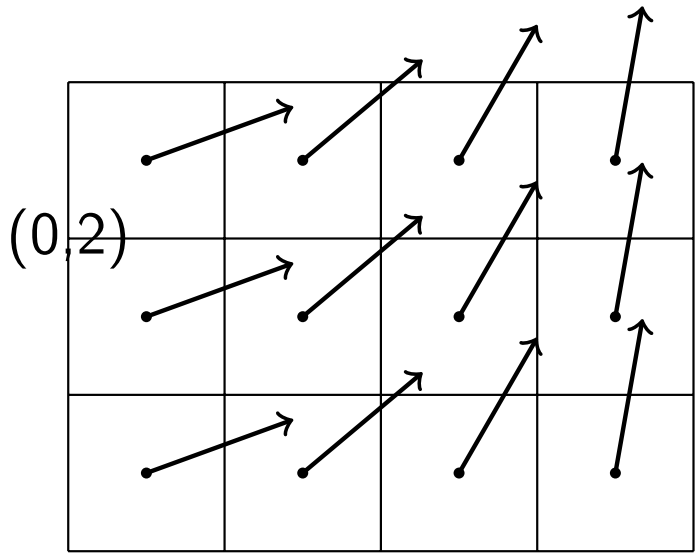

Figure: You can plot vector fields as well.

```
\begin{figure}
\begin{tikzpicture}
\draw (0, 0) grid (4, 3); % draw a grid
\foreach \x/\angle in {0.5/20, 1.5/40, 2.5/60, 3.5/80} { % loop over x and angle
    \foreach \y in {0.5, 1.5, 2.5} { % loop over y
        \fill (\x,\y) circle[radius=1pt]; % draw circle at grid center
        \draw[->,thick]  (\x, \y) -- ++(\angle:1); % draw line with arrowhead
     }
}
\node[draw,text width=4cm] at (0,2) {(0,2)} % annotate the plot
\end{tikzpicture}
\caption{You can plot vector fields as well.}
\label{fig:vectors}
\end{figure}
```

Useful links

- How to TikZ
- cross-referencing
- Math symbols
- Hyperlinks (e.g. for *mailto:*)
- bsulatex@cgiss.boisestate.edu

Ackowledgments

A lot of the introductory material presented here was taken from Tobi Oetiker's *The Not So Short Introduction to LaTeX* found here.

BSU thesis template

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