

# The $\text{\LaTeX}$ Typesetting System: A Brief Intro

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Dr. Mike Reese

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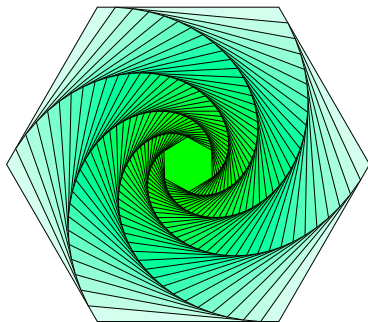
August 3, 2013

# Workshop Outline

- 1 Workshop Outline
- 2 Introduction
  - History of  $\text{\LaTeX}$
  - Why learn  $\text{\LaTeX}$ ?
  - Obstacles to Learning
  - $\text{\LaTeX}$  Resources
- 3  $\text{\LaTeX}$  Examples
- 4 Obtaining  $\text{\LaTeX}$
- 5 How to Use  $\text{\LaTeX}$ 
  - The Editing Cycle
  - $\text{\LaTeX}$  Commands
  - Special Symbols
  - Spacing
  - Math Type
- 6 Exam Document Class Example
- 7 Summary
- 8 Works Cited

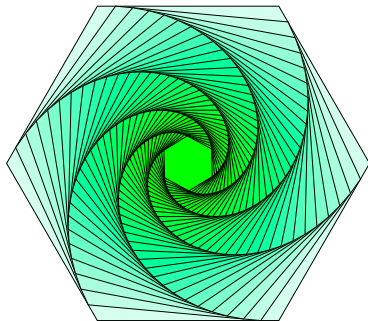
# Workshop SLO

- Know what L<sup>A</sup>T<sub>E</sub>X is



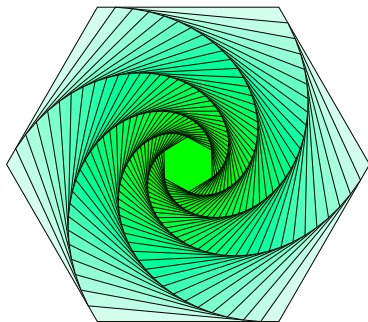
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- Know what L<sup>A</sup>T<sub>E</sub>X is
- Know why you might want to use L<sup>A</sup>T<sub>E</sub>X



# Workshop SLO

- Know what L<sup>A</sup>T<sub>E</sub>X is
- Know why you might want to use L<sup>A</sup>T<sub>E</sub>X
- Know how to obtain and install L<sup>A</sup>T<sub>E</sub>X
- Know where to get help with L<sup>A</sup>T<sub>E</sub>X
- Process some source code



# History of $\TeX$ and $\LaTeX$

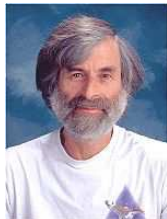
## Donald Knuth: the inventor of $\TeX$

- $\TeX$  is a language for typesetting mathematical and scientific articles.



# History of $\text{\TeX}$ and $\text{\LaTeX}$

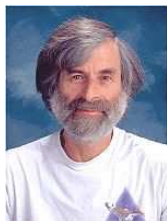
## Leslie Lamport



# History of $\TeX$ and $\LaTeX$

## Leslie Lamport

- An important boost to the popularity of  $\TeX$  came in 1986 with the introduction of  $\LaTeX$  by Leslie Lamport.

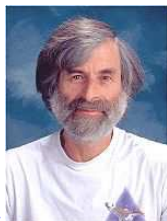




# History of $\TeX$ and $\LaTeX$

## Leslie Lamport

- An important boost to the popularity of  $\TeX$  came in 1986 with the introduction of  $\LaTeX$  by Leslie Lamport.
- $\LaTeX$  is a set of commands that allows authors to interact with the system at a higher level than Knuth's original command set (called Plain  $\TeX$ ).



## Definition (What is $\text{\LaTeX}$ ?)

- $\text{\LaTeX}$  is a document markup language and document preparation system for the  $\text{\TeX}$  typesetting program.

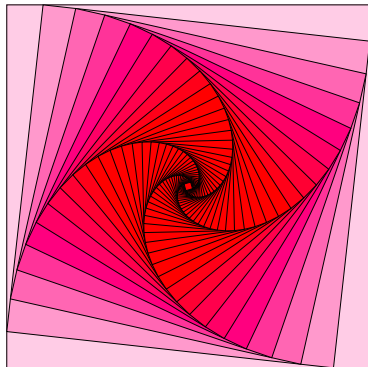
## Definition (What is L<sup>A</sup>T<sub>E</sub>X?)

- L<sup>A</sup>T<sub>E</sub>X is a document markup language and document preparation system for the T<sub>E</sub>X typesetting program.
- The term L<sup>A</sup>T<sub>E</sub>X refers only to the language in which documents are written, not to the editor used to write those documents.

## Definition (What is L<sup>A</sup>T<sub>E</sub>X?)

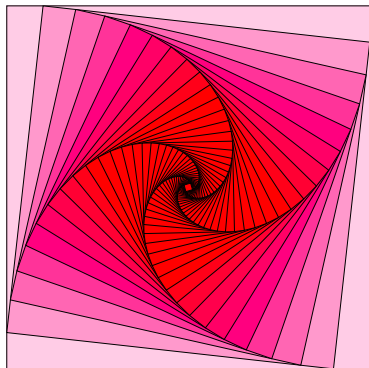
- L<sup>A</sup>T<sub>E</sub>X is a document markup language and document preparation system for the T<sub>E</sub>X typesetting program.
- The term L<sup>A</sup>T<sub>E</sub>X refers only to the language in which documents are written, not to the editor used to write those documents.
- In order to create a document in L<sup>A</sup>T<sub>E</sub>X, a .tex file must be created using some form of text editor.

# Why learn $\text{\LaTeX}$ ?



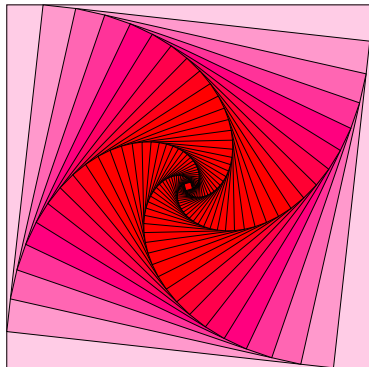
# Why learn L<sup>A</sup>T<sub>E</sub>X?

Create a local community of users.



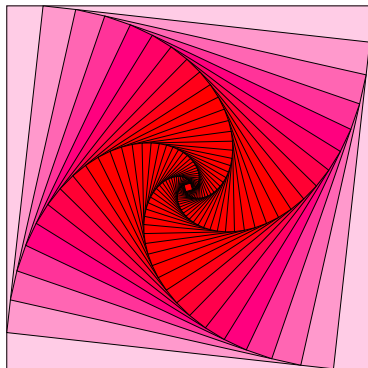
# Why learn L<sup>A</sup>T<sub>E</sub>X?

Use your mouse less.



# Why learn L<sup>A</sup>T<sub>E</sub>X?

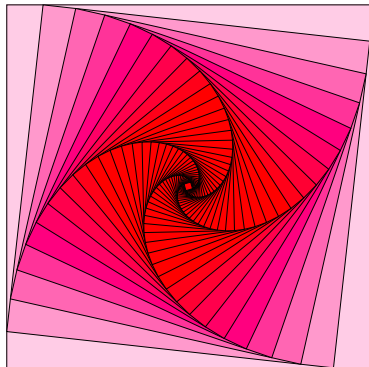
It's a logically oriented approach to document production.





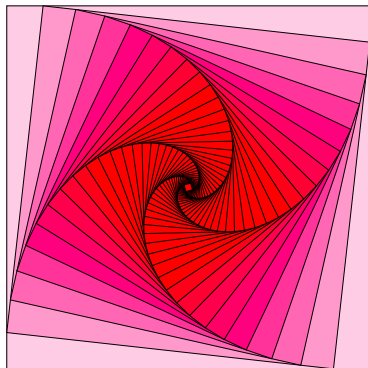
# Why learn L<sup>A</sup>T<sub>E</sub>X?

ASCII files are small and easy to send in email, ftp, etc., i.e., no hidden control characters



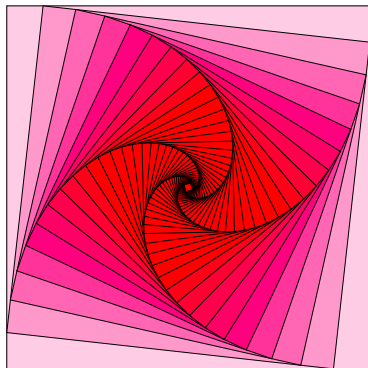
# Why learn L<sup>A</sup>T<sub>E</sub>X?

Automatic generation and updating of  
bibliography, tables of contents, figures and  
tables, references, etc.



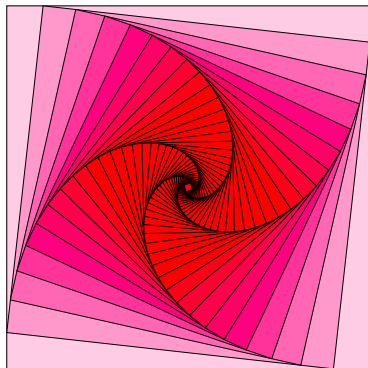
# Why learn L<sup>A</sup>T<sub>E</sub>X?

It's available on all platforms.



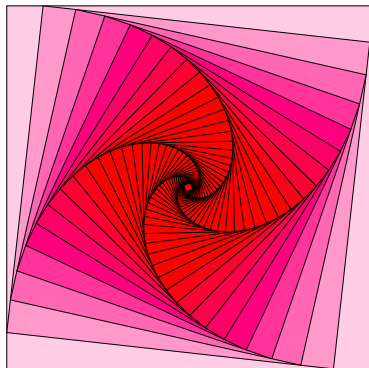
# Why learn L<sup>A</sup>T<sub>E</sub>X?

It's Free!



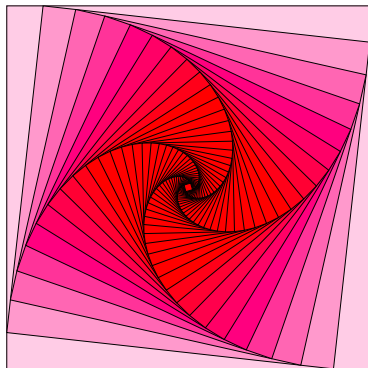
# Why learn $\text{\LaTeX}$ ?

Latex outputs high quality documents.



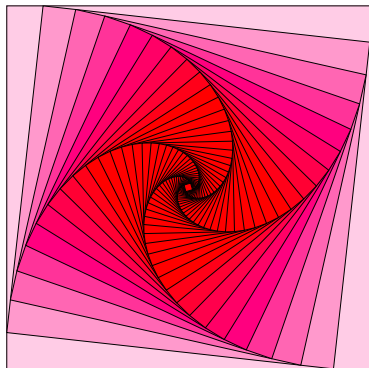
# Why learn L<sup>A</sup>T<sub>E</sub>X?

It's required by some institutions.



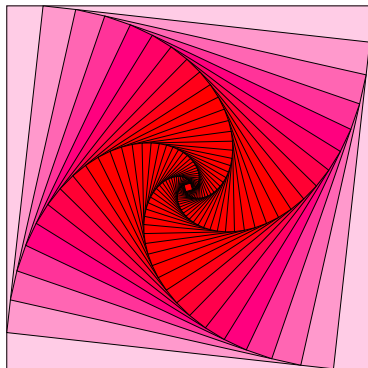
# Why learn L<sup>A</sup>T<sub>E</sub>X?

De facto standard in research and industry



# Why learn L<sup>A</sup>T<sub>E</sub>X?

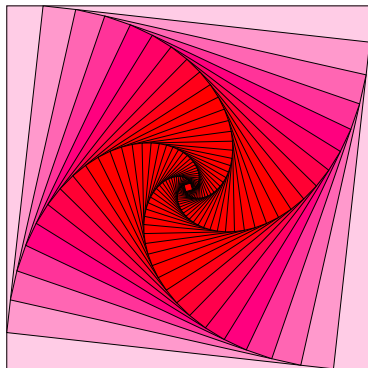
There are a vast number of resources available for help





# Why learn L<sup>A</sup>T<sub>E</sub>X?

It's Highly Extensible!



# Obstacles to Learning $\text{\LaTeX}$

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

History of  $\text{\LaTeX}$   
Why learn  $\text{\LaTeX}$ ?

**Obstacles to Learning**

$\text{\LaTeX}$  Resources

$\text{\LaTeX}$  Examples

Obtaining  $\text{\LaTeX}$

How to Use  
 $\text{\LaTeX}$

The Editing Cycle

$\text{\LaTeX}$  Commands

Special Symbols

Spacing

Math Type

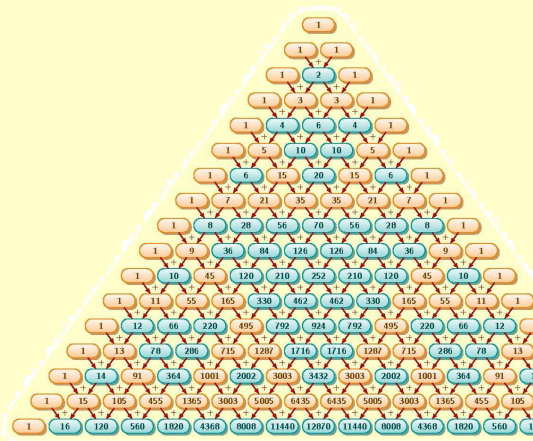
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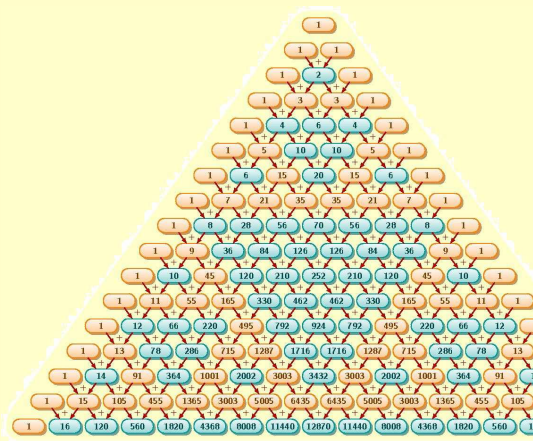
The Editing Cycle  
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## The steep learning curve



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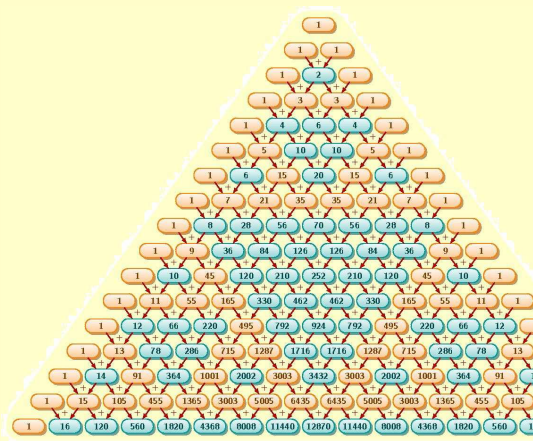
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It's programming, hence you have to debug it.



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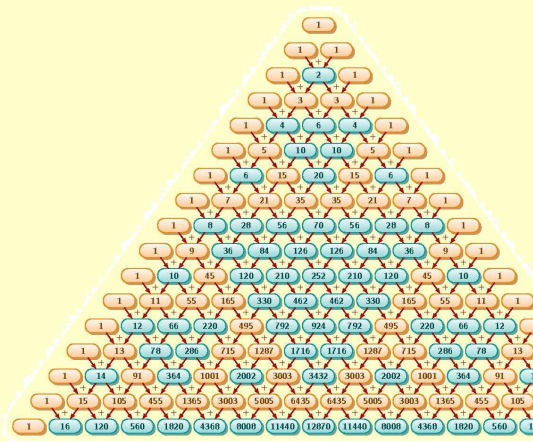
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Some communities don't have many users yet.



# Online $\text{\LaTeX}$ Resources

- [tug.org](http://tug.org)

# Online L<sup>A</sup>T<sub>E</sub>X Resources

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- [More Math Into  \$\LaTeX\$ , Grätzer](#) [3]

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# Typeset Expressions and Equations

$$\begin{pmatrix} 1 & 2 \\ 9 & 10 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1 \\ \pi \end{pmatrix}$$

$$f'(x) = \frac{d}{dx} \left( \frac{1}{2} x e^{x^2} \right)$$

$$A = \lim_{n \rightarrow \infty} \left[ \sum_{k=1}^n f(x_k) \Delta x \right]$$

$$\int_a^b \frac{2^x}{1+4^x} dx \quad \frac{\sqrt[5]{x^2-1}}{2x^7-\pi}$$

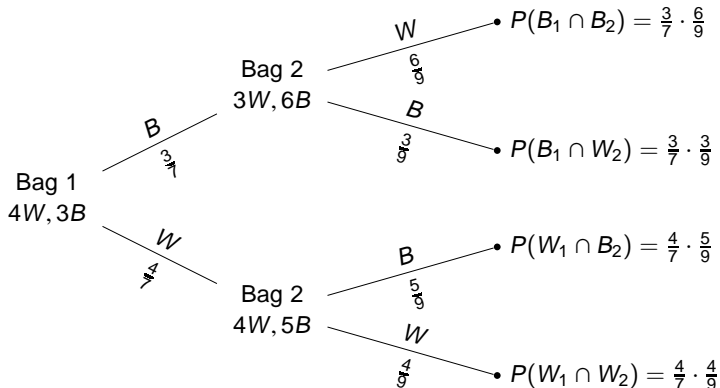
$$\cos(2x) = 25 - \tan^{-1} \left( \frac{\sqrt{2}}{2} \right)$$



$$\begin{array}{r}
 1x^2 + 4x + 2 \\
 x - 3 \overline{) \begin{array}{r} x^3 + x^2 - 10x + 8 \\ -(x^3 - 3x^2) \\ \hline 4x^2 - 10x - 2 \\ -(4x^2 - 12x) \\ \hline 2x + 8 \\ -(2x - 6) \\ \hline 14 \end{array}}
 \end{array}$$

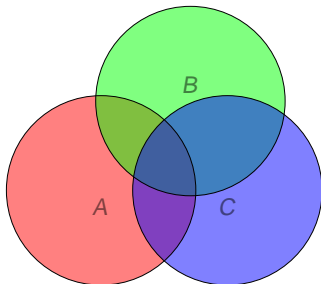
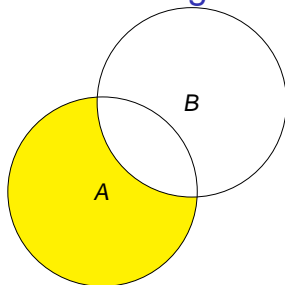
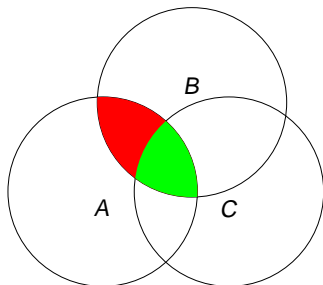
$$3 \overline{) \begin{array}{r} 1 \quad 1 \quad -10 \quad 8 \\ \quad 3 \quad 12 \quad 6 \\ \hline 1 \quad 4 \quad 2 \quad 14 \end{array}}$$

## Probability Tree



[click here to view the latex code](#)

## Sketch Venn Diagrams

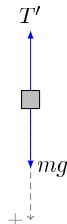
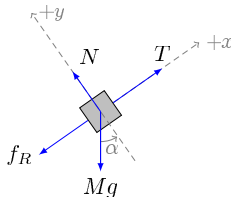
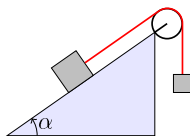


[click here to view the latex code](#)

# Latex Example: Project Code for CS Class

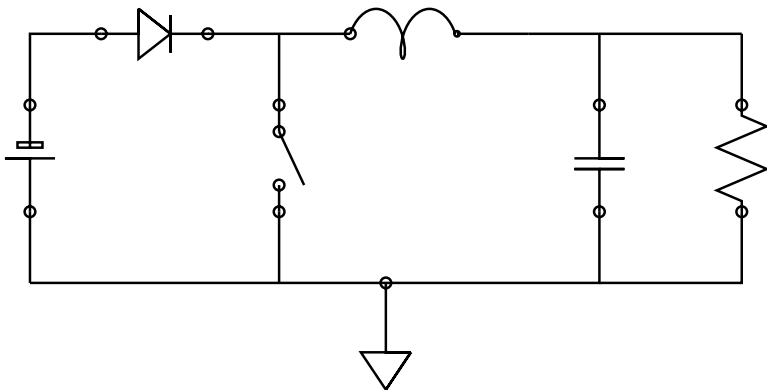
```
1 % comment with some LATEX in it:  $\pi x^2$ 
2   for i = 1:j
3       w = ...
4           linspace((i-1)*3.1416/(1-R),i*3.14158/(1-R),11000);
5       if rotate_frame
6           if isequal(mod(i,mod_number),0)
7               k = mod_number;
8           else
9               k = mod(i,mod_number);
10          end
11          plot(XX(w,A,R),YY(w,A,R),'color',color_code(k,:))
12          hold on % to plot another graph on top
13          clear w;
14      else
15          if isequal(mod(i,mod_number),0)
16              k = mod_number;
17          else
18              k = mod(i,mod_number);
19          end
20          plot(B(w,A,R),C(w,A,R),'color',color_code(k,:))
21          hold on
22          clear w;
23      end
end
```

# Free-Body Diagrams can be Constructed with L<sup>A</sup>T<sub>E</sub>X's pgf (tikz) package



[click here to view the latex code](#)

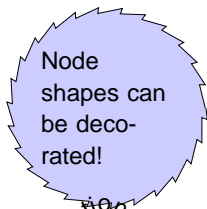
# Circuit Diagrams for your Physics or Linear Algebra Class



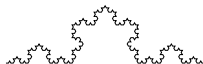
[click here to view the latex code](#)

Also, see the [circuitikz](#) package for more info on sketching and labeling a custom diagram which has bipoles, tripoles, logic gates and ports, amplifiers, currents, voltages, transistors, etc.,

# Decorations



Decorations can draw text that follows an arbitrary curve



[click here to view the latex code](#)

# Decorations

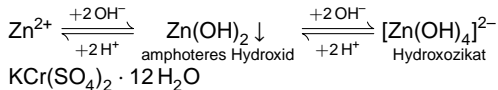
For  
a time I stood pondering on circle sizes. The large  
computer mainframe quietly processed all of its assembly code.  
Inside my entire hope lay for figuring out an elusive expansion. Value: pi.  
Decimals expected soon. I nervously entered a format procedure. The mainframe  
processed the request. Error. I, again entering it, carefully retyped. This iteration gave  
zero error printouts in all-success. Intently I waited. Soon, roused by thoughts within me,  
appeared narrative mnemonics relating digits to verbiage! The idea appeared to exist but only in  
abbreviated fashion-little phrases typically. Pressing on I then resolved, deciding firmly about a  
sum of decimals to use-likely around four hundred, presuming the computer code soon halted!

Pondering these ideas, words appealed to me. But a problem of zeros did exist. Pondering more, solution  
subsequently appeared. Zero suggests a punctuation element. Very novel! My thoughts were culminated.  
No periods, I concluded. All residual marks of punctuation = zeros. First digit expansion answer then came  
before me. On examining some problems unhappily arose. That imbecilic bug! The printout I possessed  
showed four nine as foremost decimals. Manifestly troubling. Totally every number looked wrong. Repairing  
the bug took much effort. A pi mnemonic with letters truly seemed good. Counting of all the letters probably  
should suffice. Reaching for a record would be helpful. Consequently, I continued, expecting a good final  
answer from computer. First number slowly displayed on the flat screen-3. Good. Trailing digits appar-  
ently were right also. Now my memory scheme must probably be implementable. The technique was  
chosen, elegant in scheme: by self reference a tale mnemonically helpful was ensured. An able title  
suddenly existed-"Circle Digits." Taking pen I began. Words emanated uneasily. I desired more  
synonyms. Speedily I found my (alongside me) Thesaurus. Rogets is probably an essential in  
doing this, instantly I decided. I wrote and erased more. The Rogets clearly assisted  
immensely. My story proceeded (how lovely!) faultlessly. The end, above all,  
would soon joyfully overtake. So, this memory helper story is incon-  
testably complete. soon I will locate publisher. There a narrative  
will I trust immediately appear, producing fame.

The end.



# Typeset Chemical Reactions, Chemical Molecular Formulae and Chemical Equations with the mhchem and mychemistry packages



For more examples of diagrams generated with the mychemistry package, see

- [mirrors.ibiblio.org/CTAN/macros/latex/contrib/mychemistry/examples.pdf](http://mirrors.ibiblio.org/CTAN/macros/latex/contrib/mychemistry/examples.pdf)
- [mychemistry.eu/known-packages/](http://mychemistry.eu/known-packages/)

$$\begin{array}{r}
 1x^2 + 4x + 2 \\
 x - 3 \overline{) \begin{array}{r} x^3 + x^2 - 10x + 8 \\ -(x^3 - 3x^2) \\ \hline 4x^2 - 10x - 2 \\ -(4x^2 - 12x) \\ \hline 2x + 8 \\ -(2x - 6) \\ \hline 14 \end{array}}
 \end{array}$$

$$3 \overline{) \begin{array}{r} 1 \quad 1 \quad -10 \quad 8 \\ \quad 3 \quad 12 \quad 6 \\ \hline 1 \quad 4 \quad 2 \quad 14 \end{array}}$$

# Animate Concepts with the animate package

# Animate Definitions in PDF with the **animate** package

[click here to view the latex code](#)

# Embed Video and Sound in your pdf with the **Media9** package.

Workshop  
Outline

Introduction

History of L<sup>A</sup>T<sub>E</sub>X  
Why learn L<sup>A</sup>T<sub>E</sub>X?  
Obstacles to Learning  
L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

How to Use  
L<sup>A</sup>T<sub>E</sub>X

The Editing Cycle  
L<sup>A</sup>T<sub>E</sub>X Commands  
Special Symbols  
Spacing  
Math Type

Exam  
Document  
Class Example

Summary

Works Cited

# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

History of L<sup>A</sup>T<sub>E</sub>X  
Why learn L<sup>A</sup>T<sub>E</sub>X?  
Obstacles to Learning  
L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

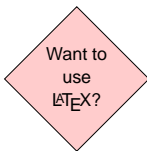
How to Use  
L<sup>A</sup>T<sub>E</sub>X

The Editing Cycle  
L<sup>A</sup>T<sub>E</sub>X Commands  
Special Symbols  
Spacing  
Math Type

Exam  
Document  
Class Example

Summary

Works Cited



# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

- History of L<sup>A</sup>T<sub>E</sub>X
- Why learn L<sup>A</sup>T<sub>E</sub>X?
- Obstacles to Learning
- L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

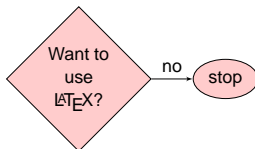
How to Use  
L<sup>A</sup>T<sub>E</sub>X

- The Editing Cycle
- L<sup>A</sup>T<sub>E</sub>X Commands
- Special Symbols
- Spacing
- Math Type

Exam  
Document  
Class Example

Summary

Works Cited



# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

- History of L<sup>A</sup>T<sub>E</sub>X
- Why learn L<sup>A</sup>T<sub>E</sub>X?
- Obstacles to Learning
- L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

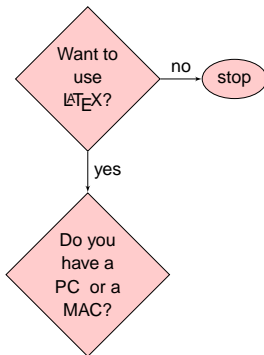
How to Use  
L<sup>A</sup>T<sub>E</sub>X

- The Editing Cycle
- L<sup>A</sup>T<sub>E</sub>X Commands
- Special Symbols
- Spacing
- Math Type

Exam  
Document  
Class Example

Summary

Works Cited





# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

## Workshop Outline

### Introduction

- History of L<sup>A</sup>T<sub>E</sub>X
- Why learn L<sup>A</sup>T<sub>E</sub>X?
- Obstacles to Learning
- L<sup>A</sup>T<sub>E</sub>X Resources

### L<sup>A</sup>T<sub>E</sub>X Examples

### Obtaining L<sup>A</sup>T<sub>E</sub>X

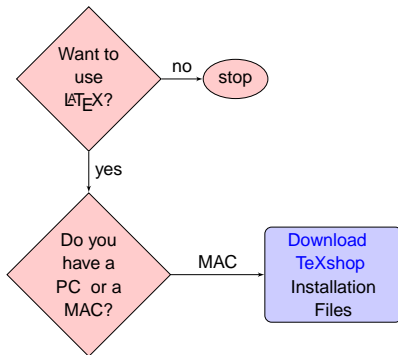
### How to Use L<sup>A</sup>T<sub>E</sub>X

- The Editing Cycle
- L<sup>A</sup>T<sub>E</sub>X Commands
- Special Symbols
- Spacing
- Math Type

### Exam Document Class Example

### Summary

### Works Cited



# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

## Workshop Outline

### Introduction

- History of L<sup>A</sup>T<sub>E</sub>X
- Why learn L<sup>A</sup>T<sub>E</sub>X?
- Obstacles to Learning
- L<sup>A</sup>T<sub>E</sub>X Resources

### L<sup>A</sup>T<sub>E</sub>X Examples

### Obtaining L<sup>A</sup>T<sub>E</sub>X

### How to Use L<sup>A</sup>T<sub>E</sub>X

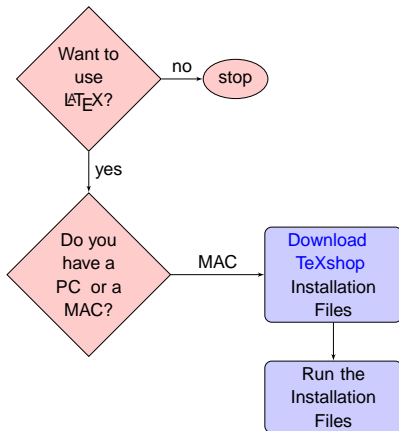
- The Editing Cycle
- L<sup>A</sup>T<sub>E</sub>X Commands
- Special Symbols
- Spacing
- Math Type

### Exam

- Document
- Class Example

### Summary

### Works Cited



# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

History of L<sup>A</sup>T<sub>E</sub>X  
Why learn L<sup>A</sup>T<sub>E</sub>X?  
Obstacles to Learning  
L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

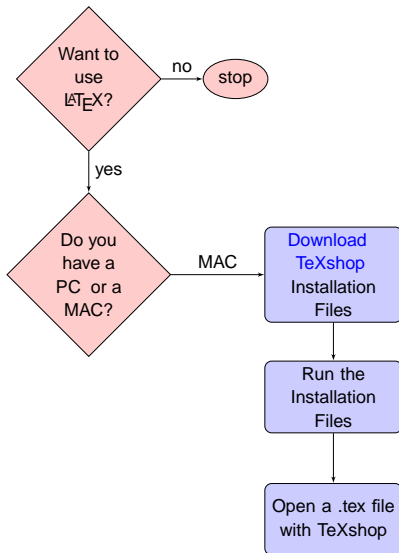
How to Use  
L<sup>A</sup>T<sub>E</sub>X

The Editing Cycle  
L<sup>A</sup>T<sub>E</sub>X Commands  
Special Symbols  
Spacing  
Math Type

Exam  
Document  
Class Example

Summary

Works Cited



# The L<sup>A</sup>T<sub>E</sub>X Typesetting System: A Brief Intro

Tim Busken  
Dr. Mike Reese

Workshop  
Outline

Introduction

History of L<sup>A</sup>T<sub>E</sub>X  
Why learn L<sup>A</sup>T<sub>E</sub>X?  
Obstacles to Learning  
L<sup>A</sup>T<sub>E</sub>X Resources

L<sup>A</sup>T<sub>E</sub>X Examples

Obtaining L<sup>A</sup>T<sub>E</sub>X

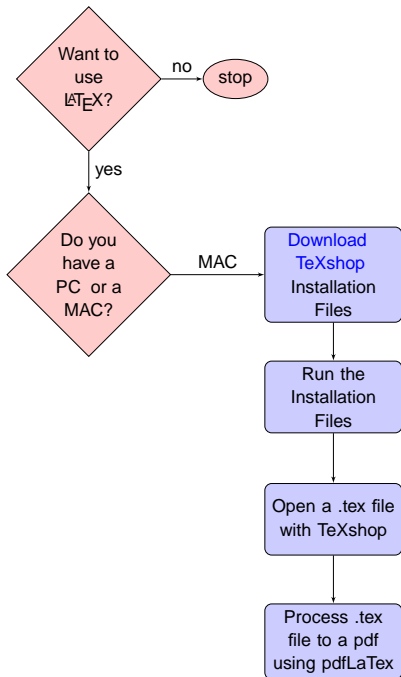
How to Use  
L<sup>A</sup>T<sub>E</sub>X

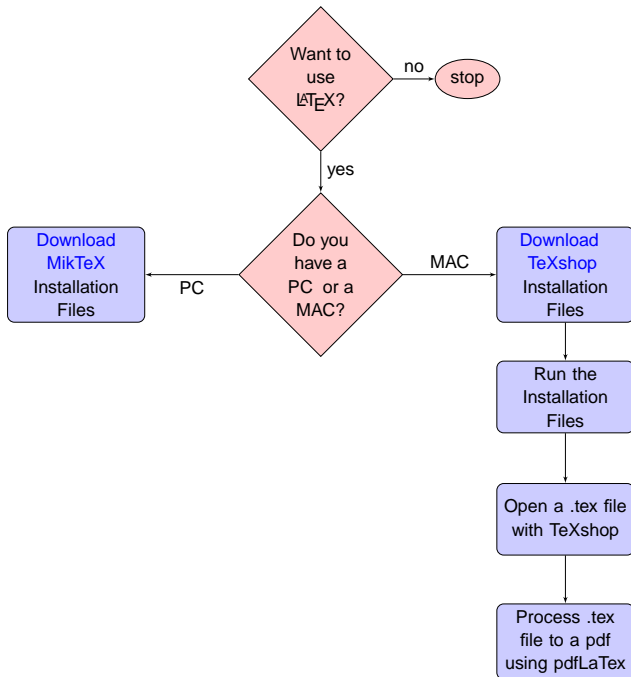
The Editing Cycle  
L<sup>A</sup>T<sub>E</sub>X Commands  
Special Symbols  
Spacing  
Math Type

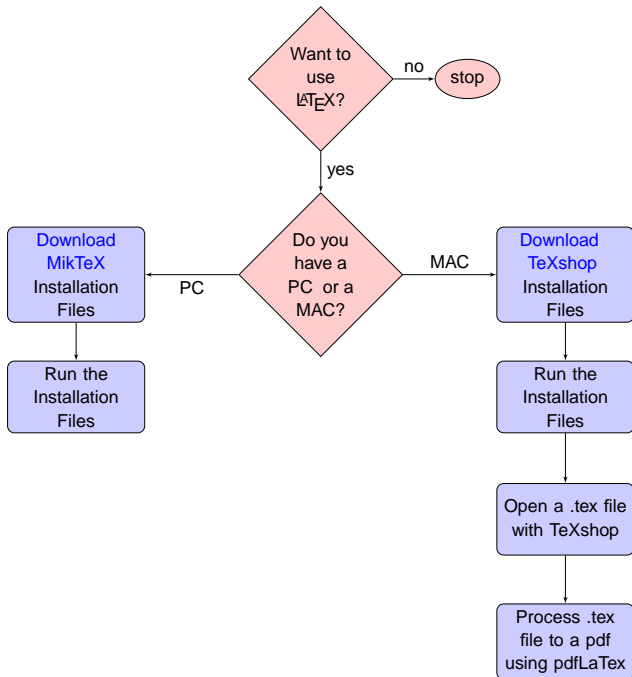
Exam  
Document  
Class Example

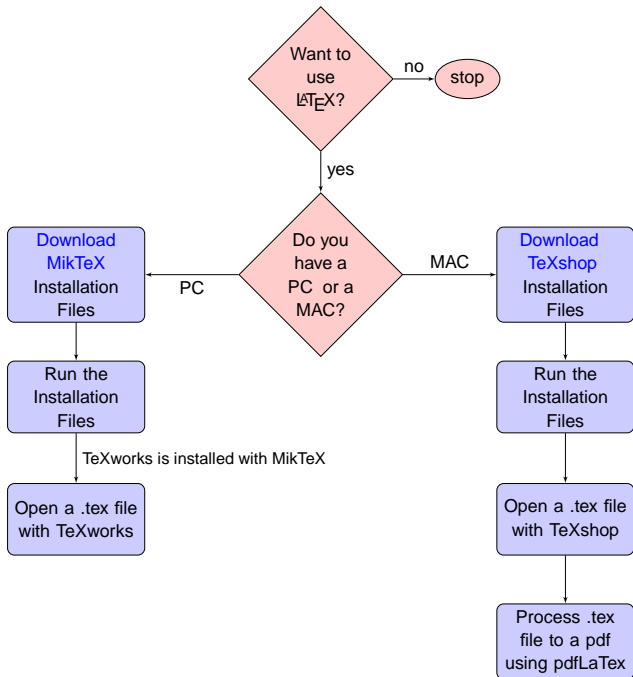
Summary

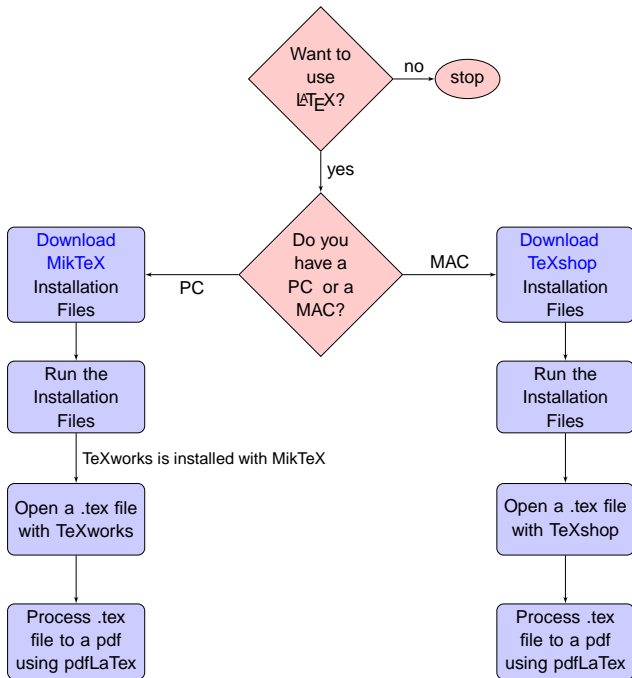
Works Cited













# How to Use L<sup>A</sup>T<sub>E</sub>X

## Source Files

A source file is a .tex file type. A .tex file is composed of text, math (formulas), and instructions (commands) to L<sup>A</sup>T<sub>E</sub>X. [3]

# How to Use L<sup>A</sup>T<sub>E</sub>X

## Processing Source Files to PDF Files

Provided the .tex file is written with the correct syntax, when you press the publish button in your tex editor (*e.g.*, TeXworks or TeXshop), the compiler of your T<sub>E</sub>Xsystem (*e.g.*, MikTeX or TeX Live) builds your pdf file.

# How to Use L<sup>A</sup>T<sub>E</sub>X

## Processing Source Files to PDF Files

For instance, if you process a document called [mydocument.tex](#) by pressing the publish (pdfLaTeX) button, the pdf file named [mydocument.pdf](#) is constructed and placed in the same folder as the source code.

# How to Use L<sup>A</sup>T<sub>E</sub>X

## Auxiliary Files

In addition to fabricating the pdf file, the compiler also builds a bunch of auxiliary files, e.g.,

- [mydocument.log](#),
- [mydocument.bak](#),

to name only a couple. This is why I recommend saving your source file (.tex) in its own folder. (I also recommend you make a subfolder within that named images for all of your pictures and video.)

# How to Use L<sup>A</sup>T<sub>E</sub>X

## Auxiliary Files

Fortunately, you don't need to know much about auxiliary files to get started creating pdf documents with L<sup>A</sup>T<sub>E</sub>X right now. Just don't delete any of the auxiliary files that are generated, because they are important for cross referencing, bibliographies and table of contents.

# How to Use L<sup>A</sup>T<sub>E</sub>X

## Auxiliary Files

If L<sup>A</sup>T<sub>E</sub>X finds a mistake when typesetting the source file (.tex), it opens a new window, displayed at the bottom of your tex editor. An error message is displayed in the window and the error is recorded in the log (auxiliary) file.

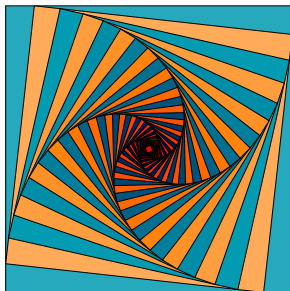
# How to Use L<sup>A</sup>T<sub>E</sub>X

## The Editing Cycle

- 1 A text editor is used to create a L<sup>A</sup>T<sub>E</sub>X source file ([mydocument.tex](#) )
- 2 The source file is typeset ([mydocument.pdf](#)) and then viewed on the computer monitor.
- 3 A change is made to the source file. The source file is typeset again.
- 4 The editing cycle continues until the typeset version (the pdf) is satisfactory.

# L<sup>A</sup>T<sub>E</sub>X Commands and Environments

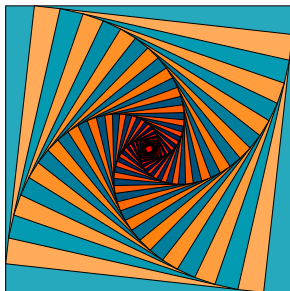
Comments in the .tex file are preceded by the % symbol





# $\LaTeX$ Commands and Environments

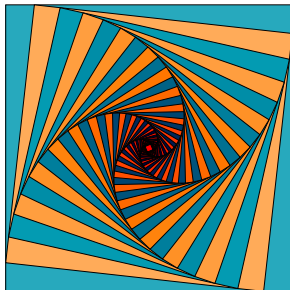
$\LaTeX$  commands start with a backslash (`\`), e.g.,



# $\text{\LaTeX}$ Commands and Environments

$\text{\LaTeX}$  commands start with a backslash (`\`), e.g.,

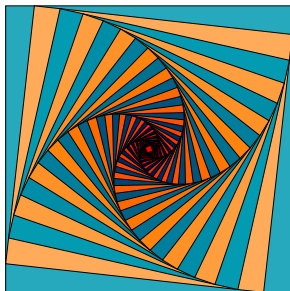
- `\newpage` to insert a page break



# L<sup>A</sup>T<sub>E</sub>X Commands and Environments

L<sup>A</sup>T<sub>E</sub>X commands start with a backslash (`\`), e.g.,

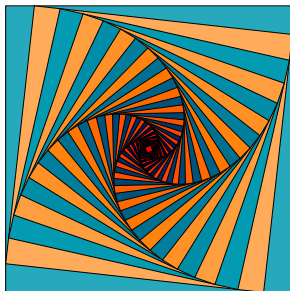
- `\newpage` to insert a page break
- `\newline` to insert a new line



# $\LaTeX$ Commands and Environments

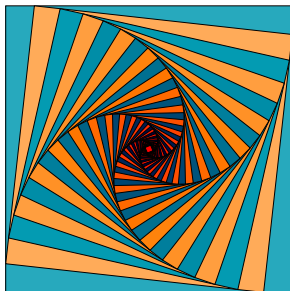
$\LaTeX$  commands start with a backslash (`\`), e.g.,

- `\newpage` to insert a page break
- `\newline` to insert a new line
- `\textbackslash` to insert a back slash



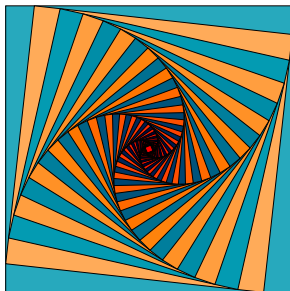
# L<sup>A</sup>T<sub>E</sub>X Commands and Environments

Some L<sup>A</sup>T<sub>E</sub>X commands are followed by a set of braces, for the inputting of text, math type and other L<sup>A</sup>T<sub>E</sub>X commands and environments. *e.g.*, `\textbf{my text}` typesets the text string “my text” in bold face, but you must use `\mathbf{. . . }` to typeset your math in bold.



# $\text{\LaTeX}$ Commands and Environments

Another instruction to  $\text{\LaTeX}$  is called an environment, e.g.,



# $\text{\LaTeX}$ Commands and Environments

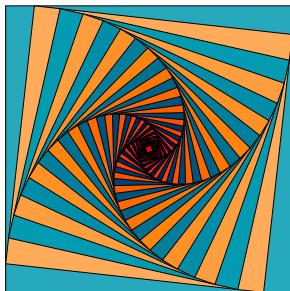
Another instruction to  $\text{\LaTeX}$  is called an environment, e.g.,

```
\begin{document}
```

...

```
\end{document}
```

is the document environment



# L<sup>A</sup>T<sub>E</sub>X Commands and Environments

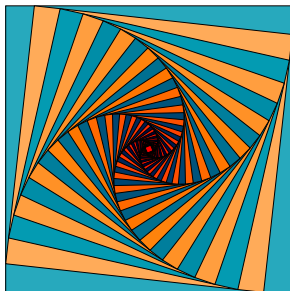
Another instruction to L<sup>A</sup>T<sub>E</sub>X is called an environment, e.g.,

```
\begin{center}
```

...

```
\end{center}
```

centers your content (or another environment)





# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\#` for # and `\$` for \$ in the pdf.

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type \% for % and \& for &.

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\textasciitilde` for `~` and `\_` for `_`

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\^` for `^` and `\{` for `{` in the pdf.

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\}` for } and `@` for @ (@ requires no special command)

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\textbar` for | (unless you are in a math environment)

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

Type `\textquotedblleft` for “ and `\textquotedblright` for ”

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)





# Special Symbols

There are 13 special keys that are mostly used in  
L<sup>A</sup>T<sub>E</sub>X commands:

# \$ % & ~ \_ ^ { } @ " | \*

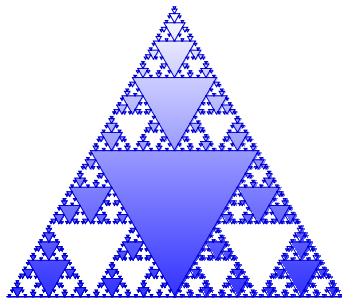
Type `$\ast$` for \*

[Click here for the Comprehensive L<sup>A</sup>T<sub>E</sub>X Symbol List](#)



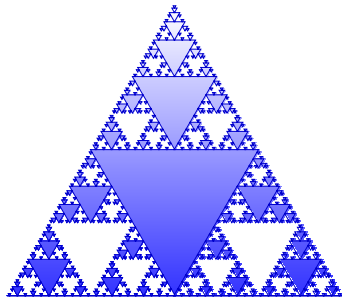
# Spacing

Many spaces on a line in the tex file will equal one horizontal space in the associated pdf.



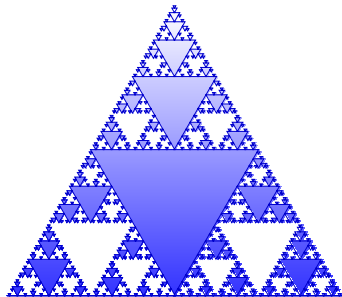
# Spacing

One way to get more horizontal spacing is to type `\hspace*{ ... }` where the argument of `hspace` is a numerical unit such as `2cm`, `0.2in`, `50pts`, etc.



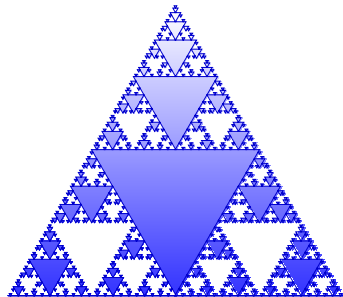
# Spacing

If you need a single extra space type an extra `\` (but it needs to be between a couple of spaces in the tex file).



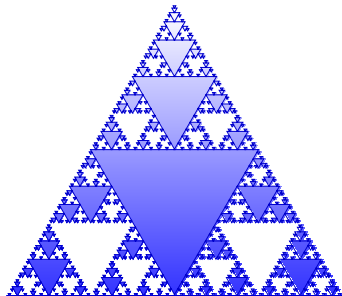
# Spacing

If you need a carriage return type `\newline` or two backslashes in a row, `\\`; or `\\[2in]` for a carriage return plus 2 inches.



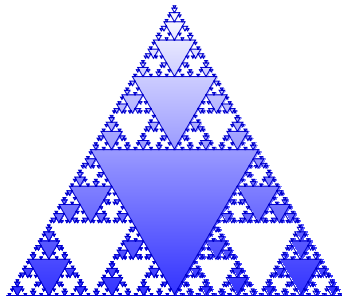
# Spacing

If you need some vertical spacing between content or lines, type `\vspace*{ ... }` where the argument of `hspace` is a numerical unit such as 2cm, 0.2in, 50pts, etc.



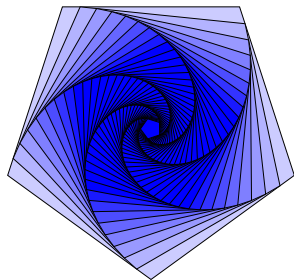
# Spacing

Numerical arguments of the `hspace` and `vspace` commands can be a negative quantity. This is often helpful when the goal is to suck up space or make content or objects closer to one another.



# Math Type

There are many different kinds of  $\text{\LaTeX}$  command environments for typesetting mathematical statements.

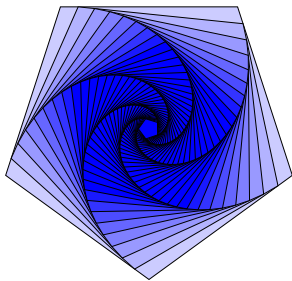




# Math Type

*Inline* environments are opened and closed with \$ symbols, e.g.,  $\int_a^b f(x) dx$  typesets  $\int_a^b f(x) dx$  in the same line as the text of the sentence.

(If the subscript or superscript of the integral symbol is longer than a single character then it is required to use braces around what is being super or subscripted, e.g.,  $a$  and  $b$ .)

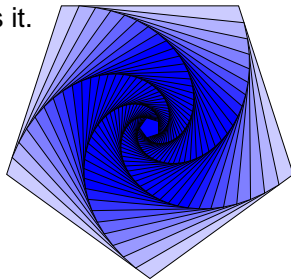


# Math Type

*Displayed* math environments open with `\[` and close with `\]`,  
e.g., `\[ \int_a^b f(x) dx \]` typesets

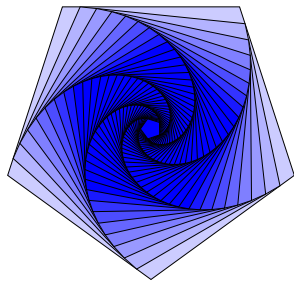
$$\int_a^b f(x) dx$$

the integral in a new line and centers it.



# Math Type

Other useful math environments for you to check out are `equation`, `equation*`, `align`, `align*`, `alignat`, etc.



# Exam Document Class Example

In the following exercise, we will process a source file, `sample-exam.tex`. The source file is written such that it calls for a jpeg image to be embedded into the multiple choice section of [sample-exam.pdf](#).

# Exam Document Class Example

- 1 Make a new folder on your desktop or flashdrive.
- 2 Also make a folder within your folder named “images.”
- 3 Navigate your internet browser to [here](#).
- 4 Right click on the image given on the html page from the above link, then left click on “save as.”
- 5 Make sure you save the jpeg image as testfig\_1.jpg and save it in your images subfolder.

# Example Using the Exam Class

- 6 Now open your text editor (TeXworks or TeXshop).
- 7 Copy and paste the code from [this html page](#) into your text editor. Save this file as `sample-exam.tex`.
- 8 Press the pdfLaTeX (play button).
- 9 This should process the `.tex` file and build [sample-exam.pdf](#).

# Homework

- Copy and paste some tex source file from [texample.net](http://texample.net) and process the source code.

# Summary

- Wrap up and answer questions
- Provide links of resources, installation guides, etc.



# One Last Note

We used the TeXworks editor for the purpose of this demonstration because it was free and quick (because TeXworks is simultaneously installed with the MikTeX compiler). However, I use WinEdt (which requires the MikTeX compiler) as my default text editor on my windows machine because it has better tool bars and other whistles and bells that TeXworks doesn't have. WinEdt is a \$40 product. There are other editors just as good that are free. I started using [WinEdt](#) in 2008, because that's what my master's thesis advisor used. For the same reason, when I typeset on my linux machine I use the Kile IDE. I don't typeset on my mac yet, but [Mike Reese](#) informs me the [TeXshop](#) editor is a good one.

Tim Busken



*The comprehensive tex archive network.*

<http://www.ctan.org/>.

Accessed: 01/12/13.



*The latex wikibook.*

<http://en.wikibooks.org/wiki/LaTeX>.

Accessed: 01/12/13.



*More math into latex.*

<ftp://ftp.tex.ac.uk/ctan/tex-archive/info/mil/mil>.

Accessed: 01/26/13.



*The stack exchange tex/latex discussion forum.*

<http://tex.stackexchange.com/about>.

Accessed: 01/12/13.



*The tex users group web site.*

<http://www.tug.org/>.

Accessed: 01/12/13.



*Texample resources for tex users.*

<http://www.texample.net/about/>.

Accessed: 01/12/13.