

Learn how to [learn] L^AT_EX

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This document is available at <http://web.mit.edu/jgross/Public/2010cluedump/Slideshow.pdf>.

Outline

Getting Started

Installing \LaTeX

What is \LaTeX ?

Getting Help

Basic Setup

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- Installing \LaTeX

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- Basic Setup

Basic Typesetting

- Good Practices

- Optional (but useful) packages

- \LaTeX and Math

- Basic math typesetting

 - Ways to get into math mode

 - A few common math things

 - A few not so common math things

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Miscellaneous

- Things to watch out for

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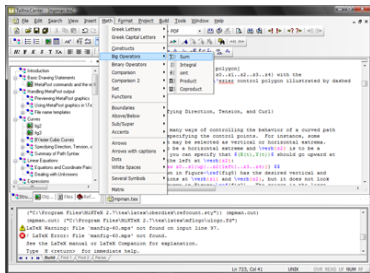
- Things to watch out for

L^AT_EX on Linux

- ▶ Usually comes preinstalled
- ▶ T_EXLive can be downloaded from <http://www.tug.org/texlive/>
- ▶ Use your favorite text editor (vim, emacs, etc.), OR
- ▶ Specialized editors for L^AT_EX, e.g. kile (<http://kile.sourceforge.net/>)
 - ▶ `sudo apt-get install kile okular`

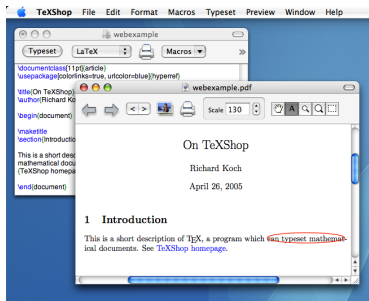
L^AT_EX on Windows

- ▶ proT_EXt installs MiK_TE_X and T_EXnicCenter
- ▶ Download from <http://www.tug.org/protext/>



L^AT_EX on Mac

- ▶ MacT_EX (<http://www.tug.org/mactex/>)
- ▶ T_EXShop (<http://pages.uoregon.edu/koch/texshop/>)



What \LaTeX is

- ▶ A typesetting system

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- ▶ Aimed at math and text

What \LaTeX is

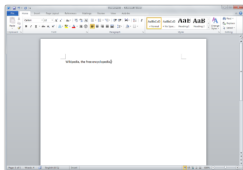
- ▶ A typesetting system
- ▶ Aimed at math and text
- ▶ Extensible

What \LaTeX is

- ▶ A typesetting system
- ▶ Aimed at math and text
- ▶ Extensible
- ▶ A macro-based Turing complete programming language

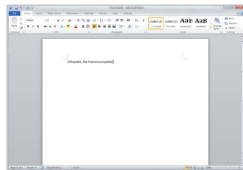
What L^AT_EX is not

- ▶ A WYSIWYG editor



What L^AT_EX is not

- ▶ A WYSIWYG editor



- ▶ A programming language

```

int *A = malloc(n);
int *B = malloc(n);
int *C = malloc(n);

A_desc = chl_alloc_surface(A, X1000_INPUT, n, 1);
B_desc = chl_alloc_surface(B, X1000_INPUT, n, 1);
C_desc = chl_alloc_surface(C, X1000_OUTPUT, n, 1);
#pragma omp parallel target(x1000) shared(A,B,C)
  descriptor(A_desc,B_desc,C_desc) private(i)
  {
    for (i=0; i<n/8; i++)
      _asm
      {
        mhl.l.w  vr1 = i, 3
        ld.s.dw  [vr2..vr9] = {A, vr1, 0}
        ld.s.dw  [vr10..vr17] = {B, vr1, 0}
        add.s.dw [vr18..r25] = [vr2..vr9], [vr10..vr17]
        st.s.dw  [C, vr1, 0] = [vr18..vr25]
      }
  }
#pragma omp parallel for shared(D,E,F) private(i)
  {
    for (i=0; i<n; i++)
      F[i] = D[i] + E[i];
  }
  
```

Finding Help

- ▶ *lshort*: This is the biggest beginner help file available on the web for L^AT_EX. Go to `http://mirror.ctan.org/info/lshort/english/lshort.pdf`. Alternatively, Google *lshort* and it will come up.
- ▶ Google: One of the best help files out there. Google anything you want to accomplish along with L^AT_EX and you will get something. Unless of course you type "Build a time machine" latex.
- ▶ `http://www.ctan.org`: Gives the full documentation for any package, the source code, etc.
- ▶ `http://detexify.kirelabs.org/classify.html`. Slightly more useful for tablets, but useful nonetheless.

Document Structure

```
\documentclass{document class}  
preamble  
\begin{document}  
document body  
\end{document}
```


Document Structure

```
\documentclass{article}  
\usepackage{amsmath}  
\begin{document}  
  Your stuff goes here!  
\end{document}
```

The default given is the `article` document type, but there are others available: `report`, `book`, `letter`, `slides`. You can also set options for your document:

```
\documentclass[11pt, letterpaper, landscape, twoside]
{article}. Refer to the help files for more details.
```

Guiding Principles I

- ▶ You're not a professional typesetter! Don't override \LaTeX 's default formatting (including font sizes) unless you have a *very good* reason for doing so.
- ▶ The default margins are large. It is easier to read papers if there are no more than 80 characters on a line; this is why newspapers have multiple columns.
- ▶ \LaTeX (mostly) ignores duplicated white space. If you have two or more returns in a row, this makes a new line. Don't tell \LaTeX to make multiple blank lines because it knows how to make things more readable. The one major exception to this rule is math mode.

Guiding Principles II

- ▶ Every so often in the source code press enter (to make it readable - about every 80 characters). This won't affect your output because \LaTeX doesn't render single line breaks.
- ▶ Use logical structure in your documents. Don't hardcode (too much) formatting into your document; use predefined \LaTeX commands (like `\subsection{}`, etc.).
- ▶ (For advanced \LaTeX users) Don't define too many macros, use obscure packages not on CTAN, and do other weird things like that. If you do, publishers won't like you very much.

Optional (but useful) packages

Packages provided added functionality for your \LaTeX code. To include a package use the command $\text{\usepackage}[(optional\ Options)]{Package\ name}$.

Package name	Description
<code>amsmath</code>	Gives an environment for typesetting math formulas. Namely $\text{\begin{equation}}$ $\text{\end{equation}}$, among other things.
<code>amssymb</code>	Gives mathematical symbols that may not be built into \LaTeX
<code>amsthm</code>	Gives an environment for typing theorems in a standard format

Optional (but useful) packages

Package name	Description
<code>graphicx</code>	Can insert pictures from .jpg, .pdf, .png, .eps, among others using the <code>\includegraphics[(optional) Options]{filename}</code>
<code>hyperref</code>	Lets you make hyperlinks
<code>geometry</code>	Lets you change the margins
<code>enumerate</code>	Lets you control the <code>enumerate</code> environment for lists and outlines

You'll want to load `amsmath` and `amssymb` for any sort of math typesetting.

Ways to get into math mode

- ▶ As you are typing regular text, put any math mode commands (or math) between $\$$ like so: $\$\frac{3}{4}\$$ (this will look like $\frac{3}{4}$). This can be inserted right in the middle of text:
 The answer is $x = 3$.
- ▶ Use the package `amsmath` and then use `\begin{equation}\end{equation}` (numbers your lines between the two commands) or `\begin{equation*}\end{equation*}` (does not number your lines).
- ▶ Place math between `\[insert math here\]` or $\$ \$insert math here \$ \$$ to get it centered on a new line.

A few common math things

A more exhaustive list can be found through the lshort reference.

- ▶ Fractions: $\frac{1}{4}$, $1 + \frac{1}{3}$
 $2x + \frac{1}{5}$

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 $(3x + 7)^{100}$

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- ▶ Trig functions: $\cos(\sin x)$

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- ▶ Square roots and n^{th} roots: $\sqrt{x^2 + 1}$, $\sqrt[3]{8} = 2$

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- ▶ Integrals: $\int_0^{\pi/2} e^x \ln x \, dx$
- ▶ Square roots and n^{th} roots: $\sqrt{x^2 + 1}$, $\sqrt[3]{8} = 2$
- ▶ Greek letters: π , Ω , ω

A few not so common math things

- ▶ Spaces in math mode are tricky. Here are some ways to fix up spaces:

Symbol	Code	Example
$\!$	<code>x \! y</code>	xy
$\,$	<code>x \, y</code>	$x y$
$\:$	<code>x \: y</code>	$x y$
$\;$	<code>x \; y</code>	$x y$
$\$	<code>x \ y</code>	$x y$
\quad	<code>x \quad y</code>	$x y$
\qquad	<code>x \qquad y</code>	$x y$

- ▶ How to box an answer (only in text mode):
`\framebox[width][position (l, c, r)]{text}`

For example, Einstein said, $E = mc^2$!

Just a few reminders/cautions:

- ▶ \LaTeX is case-sensitive (for the most part), so if you are getting strange compiler errors, check your capitalization.
- ▶ Some characters are only available in math mode (e.g. $<$, $>$)
- ▶ Special characters that \LaTeX will get angry about: $\#$, $\$$, $\%$, \wedge , $\&$, $_$, $\{$, $\}$, \sim , \backslash . To typeset these, use this instead: $\backslash\#$, $\backslash\$$, $\backslash\%$, $\backslash\wedge$, $\backslash\&$, $\backslash_$, $\backslash\{$, $\backslash\}$, $\backslash\sim$, $\backslash\textbackslash$

The list environment

- ▶ Lists: Here are two examples of lists and their output:

```
\begin{itemize}  
  \item Math  
  \item Chemistry  
  \item Physics  
\end{itemize}
```

- ▶ Math
- ▶ Chemistry
- ▶ Physics

Another list environment

```
\begin{enumerate}  
  \item Math  
  \item Chemistry  
  \item Physics  
\end{enumerate}
```

1. Math
2. Chemistry
3. Physics

The tabular environment

► Tables:

```
\begin{tabular}{l|cc}
  Number & Numeral & Roman \\
  \hline
  Five & $5$ & $V$ \\
  Ten & $10$ & $X$ \\
\end{tabular}
```

Number	Numeral	Roman
Five	5	V
Ten	10	X

Aligned equations

- ▶ Aligned equations:

```
\begin{align}
  f(x) &= 9y^2 - 6y \nonumber \\
  &= (9y^2 - 6y + 1) - 1 \\
  &\quad \nonumber \\
  &= (3y - 1)^2 - 1 \\
\end{align}
```

$$\begin{aligned}
 f(x) &= 9y^2 - 6y \\
 &= (9y^2 - 6y + 1) - 1 \\
 &= (3y - 1)^2 - 1 \quad (1)
 \end{aligned}$$

The section command

► Sections:

```
\section{Scientists}
  \subsection{Euler}
    He knew everything.
  \subsection{Newton}
    He knew gravity.
\section{Students}
  \section{MIT Students}
    \subsubsection*{Jason}
      He knows \LaTeX.
    \subsubsection*{Piper}
      She's running cluedumps.
```

1 Scientists

1.1 Euler

He knew everything.

1.2 Newton

He knew gravity.

2 Students

2.1 MIT Students

Jason

He knows \LaTeX .

Piper

She's running cluedumps.

graphicx

The simplest way is to `\usepackage{graphicx}` and then `\includegraphics{file name}`.

For example,

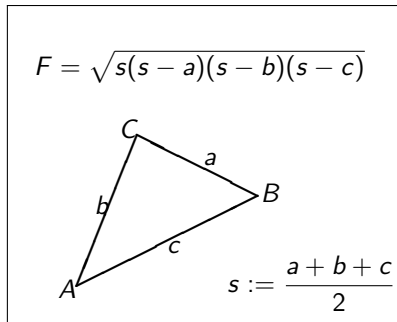
```
\begin{center}
\includegraphics[height=0.5\textheight]{grumpyfuzzball}
\end{center}
```

gives me



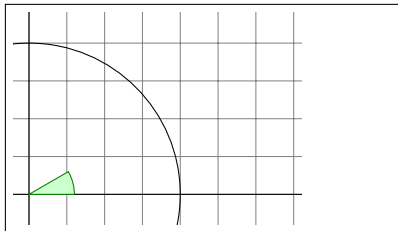
Picture

```
\setlength{\unitlength}{0.8cm}  
\begin{picture}(6,5)  
\thicklines  
\put(1,0.5){\line(2,1){3}}  
\put(4,2){\line(-2,1){2}}  
\put(2,3){\line(-2,-5){1}}  
\put(0.7,0.3){$A$}  
\put(4.05,1.9){$B$}  
\put(1.7,2.95){$C$}  
\put(3.1,2.5){$a$}  
\put(1.3,1.7){$b$}  
\put(2.5,1.05){$c$}  
\put(0.3,4){$F=$  
\sqrt{s(s-a)(s-b)(s-c)}$}  
\put(3.5,0.4){$\displaystyle s:=\frac{a+b+c}{2}$}  
\end{picture}
```



pgf/tikz

```
\begin{tikzpicture}[scale=2]
\clip (-0.1,-0.2)
rectangle (1.8,1.2);
\draw[step=.25cm,gray,very thin]
(-1.4,-1.4) grid (3.4,3.4);
\draw (-1.5,0) -- (2.5,0);
\draw (0,-1.5) -- (0,1.5);
\draw (0,0) circle (1cm);
\filldraw[fill=green!20!white,
draw=green!50!black]
(0,0) -- (3mm,0mm)
arc (0:30:3mm) -- cycle;
\end{tikzpicture}
```



Geogebra

The screenshot shows the GeoGebra application window titled "GeoGebra - 2009-10-02 Diagram 1.1.ggb". The interface includes a menu bar (File, Edit, View, Options, Tools, Window, Help), a toolbar with various geometric tools, and a main workspace. On the left, a "Free Objects" list contains:

- $I_2 = (4.34, -2.29)$
- ropecount = 10

The "Dependent Objects" list contains numerous points labeled A through D, each with its coordinates. The main workspace displays a large circle with a shaded sector. The center of the circle is labeled $B = (0, 3.34)$. The radius is labeled r . The angle of the shaded sector is labeled θ . The angle between the radius and the chord of the sector is labeled $\theta/2$. The chord is labeled c . The arc length of the sector is labeled s . The area of the sector is labeled A . The area of the triangle formed by the radius and the chord is labeled T . The area of the segment is labeled S . The area of the circle is labeled C . The area of the shaded region is labeled A_{shaded} . The area of the unshaded region is labeled $A_{unshaded}$. The area of the triangle is labeled $T_{triangle}$. The area of the segment is labeled $S_{segment}$. The area of the circle is labeled C_{circle} . The area of the shaded region is labeled A_{shaded} . The area of the unshaded region is labeled $A_{unshaded}$. The area of the triangle is labeled $T_{triangle}$. The area of the segment is labeled $S_{segment}$. The area of the circle is labeled C_{circle} .

The bottom of the window shows an "Input:" field and a "Command ..." dropdown menu.

Geogebra

The screenshot shows the GeoGebra application window titled "GeoGebra - 2009-10-02 Diagram 2.1.ggb". The interface includes a menu bar (File, Edit, View, Options, Tools, Window, Help), a toolbar with various geometric tools, and a left-hand panel for object management. The main workspace displays a 3D diagram of a sphere with several lines and points. A vertical line is labeled m , and a horizontal line is labeled r . Other lines are labeled r_1 , r_2 , and R . A small orange shaded region is visible on the sphere's surface. Two angles are highlighted in green: one labeled θ and another labeled ϕ . The left panel lists "Free Objects" and "Dependent Objects". The "Dependent Objects" list includes:

- $A = (0, 0)$
- $A_1 = (2.57, 1.54)$
- $B = (0, 3)$
- $C = (0, 2.9)$
- $C_1 = (1.88, 1.48)$
- $D = (0, -2.9)$
- $D_1 = (1.34, 1.41)$
- $E = (-0.75, -0.75)$
- $E_1 = (0, 1.71)$
- $F = (0, -3)$
- $F_1 = (-1.33, 2.01)$
- $G = (-3, 0)$
- $G_1 = (1.34, -1.41)$
- $H = (-0.69, 1.37)$
- $H' = (0.69, 1.37)$
- $H_1 = (-1.87, 1.94)$
- $I = (0.75, 0.75)$
- $I_1 = (1.88, -1.48)$
- $J = (0, -0.78)$
- $J_1 = (1.39, 1.22)$
- $K = (-2.9, 0)$
- $K_1 = (1.96, 1.29)$
- $L = (2.9, 0)$
- $M = (-0.72, 1.17)$
- $M' = (0.72, 1.17)$
- $N = (-0.34, 1.3)$
- $O = (3, 0)$
- $P = (0.34, 1.98)$
- $Q = (0.39, 1.85)$
- $R = 1.95$
- $R_1 = (0.57, 2.06)$
- $S = (0.6, 1.92)$
- $T = (-0.66, -1.71)$

The bottom of the window features an "Input:" field and a "Command ..." dropdown menu.

Geogebra

The screenshot shows the GeoGebra application window titled "GeoGebra - 2010-10-28 Diagram 3.ggb". The interface includes a menu bar (File, Edit, View, Options, Tools, Window, Help), a toolbar with various geometric tools, and a "Move Graphics View" button. The main workspace displays a 3D diagram of a sphere with several intersecting planes and lines. Key features in the diagram include:

- A vertical axis with a point O at the top.
- A horizontal axis with a point θ at the origin.
- A point ϕ on the vertical axis.
- A point $\Delta\phi$ on a line extending from ϕ .
- A point $\Delta\theta$ on a line extending from θ .
- A point R on a line extending from θ .
- A point B on a line extending from θ .
- A point $\Delta\theta$ on a line extending from θ .

 The left sidebar lists objects categorized into "Free Objects" and "Dependent Objects":

- Free Objects:**
 - $O = (1.18, 0.78)$
 - $R = 1$
 - $X = (0.53, 0.45)$
 - $Y = (2.08, 0.49)$
 - $Z = (1.24, 1.74)$
 - $\text{anglefraction} = 0.2$
 - $\text{anglefraction2} = 0.3$
 - $d\phi = 185^\circ$
 - $d\theta = 185^\circ$
 - $\phi = 70^\circ$
 - $\theta = 40^\circ$
- Dependent Objects:**
 - $A = (1.63, 1.27)$
 - $B = (0.07, 0.52)$
 - $C = (1.45, 1.79)$
 - $D = (-0.91, -0.24)$
 - $E = (2.29, 0.74)$
 - $F = (1.72, 1.2)$
 - $G = (1.68, 1.28)$
 - $H = (1.66, 1.19)$
 - $I = (1.22, 1.51)$
 - $J = (0.81, 1.3)$
 - $K = (1.22, 1.46)$
 - $L = (-0.76, 1.22)$
 - $M = (1.19, 0.97)$
 - $N = (1.27, 0.86)$
 - $Ox = 1.18$
 - $Oy = 0.78$
 - $P = (1.27, 0.87)$
 - $Q = (1.31, 1.46)$
 - $S = (1.32, 1.47)$
 - $T = (1.14, 1.47)$
 - $Ox = 0.53$
 - $Oy = 0.45$
 - $Ox = 2.08$
 - $Oy = 0.49$

 The bottom of the window shows an "Input:" field and a "Command ..." dropdown menu. The system tray at the bottom indicates the date and time as "Mon Nov 1, 6:15 AM" and the user as "jgross".

Geogebra

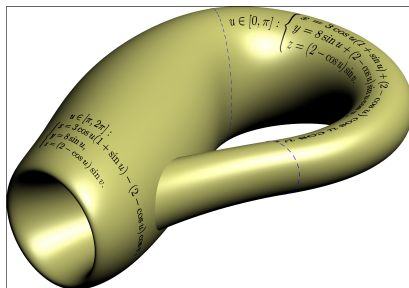
- ▶ Exports to pgf/tikz, pdf, png, and others.
- ▶ Great for geometrical figures.
- ▶ Allows labeling with (almost) arbitrary LaTeX formulas.
- ▶ Sometimes requires a bit of manual tweaking.

Inkscape + inkscape2tikz + TeXText

- ▶ Great for arbitrary vector graphics.
- ▶ Good when you want to draw a diagram by hand.
- ▶ Doesn't seem to support exporting text as tikz, though TeXText lets you insert LaTeX for export as pdf.

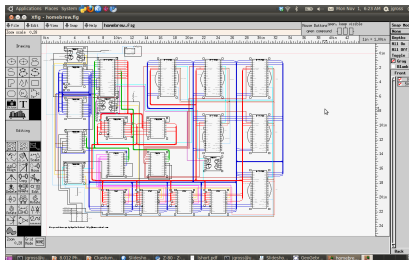
Asymptote

- ▶ Standard for \LaTeX diagrams
- ▶ Extraordinarily powerful
- ▶ Requires an extra program to \TeX your documents



xfig

- ▶ Good for very large files
- ▶ Old and not very good interface
- ▶ Steep learning curve



Exercises

- ▶ Should take you 2–20 hours
- ▶ Email me if you want help
- ▶ Can be found at <http://web.mit.edu/jgross/Public/2010cluedump/exercises.pdf>

Thank You

Thank You!