Cluedump – LaTeX

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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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Basic Typesetting
- Good Practices
- Optional (but useful) packages
- LaTeX and Math
- Basic math typsetting
  - 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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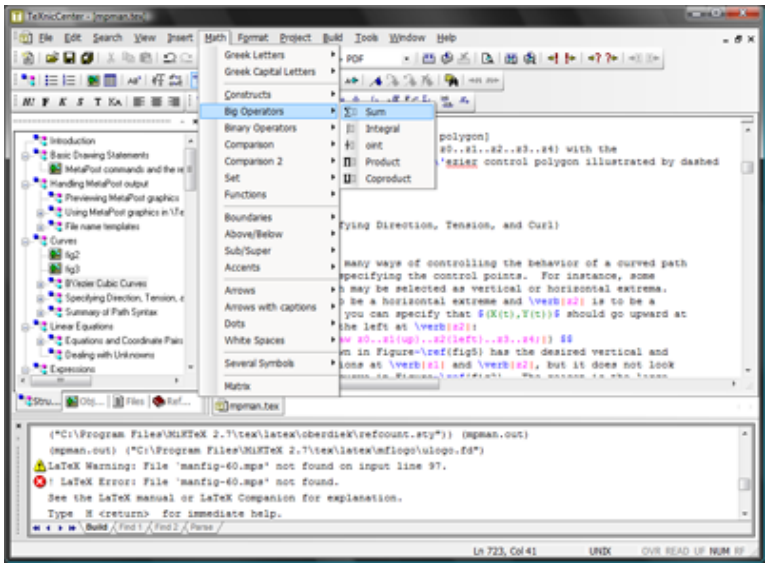
LaTeX on Linux

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

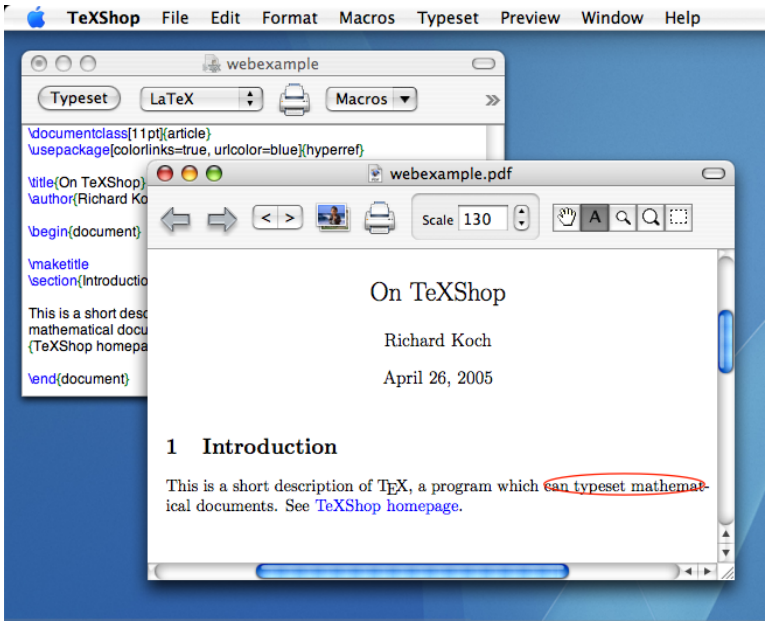
LaTeX on Windows

- proTEXt installs MiKTEX and TEXnicCenter
- Download from `http://www.tug.org/protext/`



LaTeX on Mac

- MacTeX (`http://www.tug.org/mactex/`)
- TeXShop (`http://pages.uoregon.edu/koch/texshop/`)



What LaTeX is

- A typesetting system

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- Aimed at math and text

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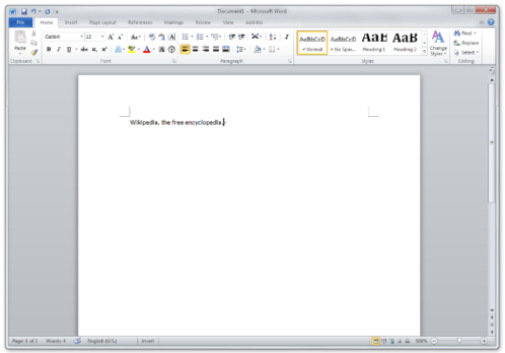
- Extensible

What LaTeX is

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

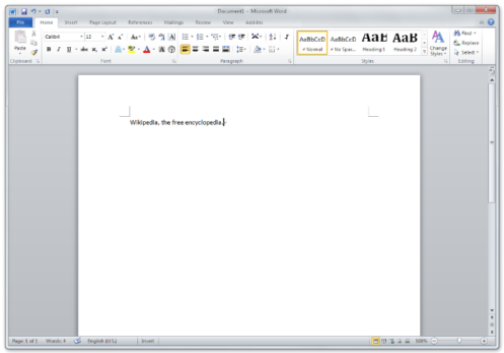
What LaTeX is not

- A WYSIWYG editor



What LaTeX is not

- A WYSIWYG editor



- A programming language

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

A_desc = chi_alloc_surface(A, X3000_INPUT, n, 1);
B_desc = chi_alloc_surface(B, X3000_INPUT, n, 1);
C_desc = chi_alloc_surface(C, X3000_OUTPUT, n, 1);
#pragma omp parallel target(x3000) shared(A,B,C)
    descriptor(A_desc,B_desc,C_desc) private(i)
{
  for (i=0; i<n/8; i++)
     __asm
     {
        shl.1.w    vr1 = i, 3
        ld.8.dw    [vr2..vr9] = (A, vr1, 0)
        ld.8.dw    [vr10..vr17] = (B, vr1, 0)
        add.8.dw   [vr18..r25] = [vr2..vr9], [vr10..vr17]
        st.8.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 LaTeX. 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 LaTeX 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 `\usepackage[`*(optional) Options*`]{`*Package name*`}`.

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

Optional (but useful) packages

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

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

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: `$\frac {1}{4}$` ($\frac{1}{4}$), `$\frac {1 + \frac {1}{3}}{2x + \frac {1}{5}}$` ($\frac{1+\frac{1}{3}}{2x+\frac{1}{5}}$)

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- Exponents and subscripts: `$x_1^2 + x_2^2 + \cdots + x_{11}^2$` ($x_1^2 + x_2^2 + \cdots + x_{11}^2$), `$(3x + 7)^{100}$` ($(3x + 7)^{100}$)

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- Trig functions: `$\cos (\sin x)$` ($\cos(\sin x)$)

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- Trig functions: `$\cos (\sin x)$` ($\cos(\sin x)$)
- Summations: `$\sum _{i = 0}^5 (ar^n)$` ($\sum_{i=0}^{5}(ar^n)$)

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- Summations: `$\sum _{i = 0}^5 (ar^n)$` ($\sum_{i=0}^{5}(ar^n)$)
- Integrals: `$\int _0^{\pi /2}e^x \ln x\,dx$` ($\int_0^{\pi/2} e^x \ln x \, dx$)

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- Integrals: `$\int _0^{\pi /2}e^x \ln x\,dx$` ($\int_0^{\pi/2} e^x \ln x \, dx$)
- Square roots and n^{th} roots: `$\sqrt {x^2 + 1}$` ($\sqrt{x^2 + 1}$), `$\sqrt [3]{8} = 2$` ($\sqrt[3]{8} = 2$)

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- Fractions: `$\frac {1}{4}$` ($\frac{1}{4}$), `$\frac {1 + \frac {1}{3}}{2x + \frac {1}{5}}$` ($\frac{1+\frac{1}{3}}{2x+\frac{1}{5}}$)
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- Square roots and n^{th} roots: `$\sqrt {x^2 + 1}$` ($\sqrt{x^2 + 1}$), `$\sqrt [3]{8} = 2$` ($\sqrt[3]{8} = 2$)
- Greek letters: `$\pi $` (π), `$\Omega $` (Ω), `$\omega $` (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
`\!`	`x \! y`	xy
`\,`	`x \, y`	$x\,y$
`\:`	`x \: y`	$x\:y$
`\;`	`x \; y`	$x\;y$
`\ `	`x \  y`	$x\ y$
`\quad`	`x \quad y`	$x \quad y$
`\qquad`	`x \qquad y`	$x \qquad y$

- How to box an answer (only in text mode):
  `\framebox[`*width*`][`*position (l, c, r)*`]{`*text*`}`
  For example, Einstein said, $\boxed{E = mc^2}$!

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: `#`, `$`, `%`, `^`, `&`, `_`, `{`, `}`, `~`, `\`. To typeset these, use this instead: `\#`, `\$`, `\%`, `\^{}`, `\&`, `\_`, `\{`, `\}`, `\~{}`, `\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
          \nonumber \\
       &= (3y - 1)^2 - 1
\end{align}
```

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

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

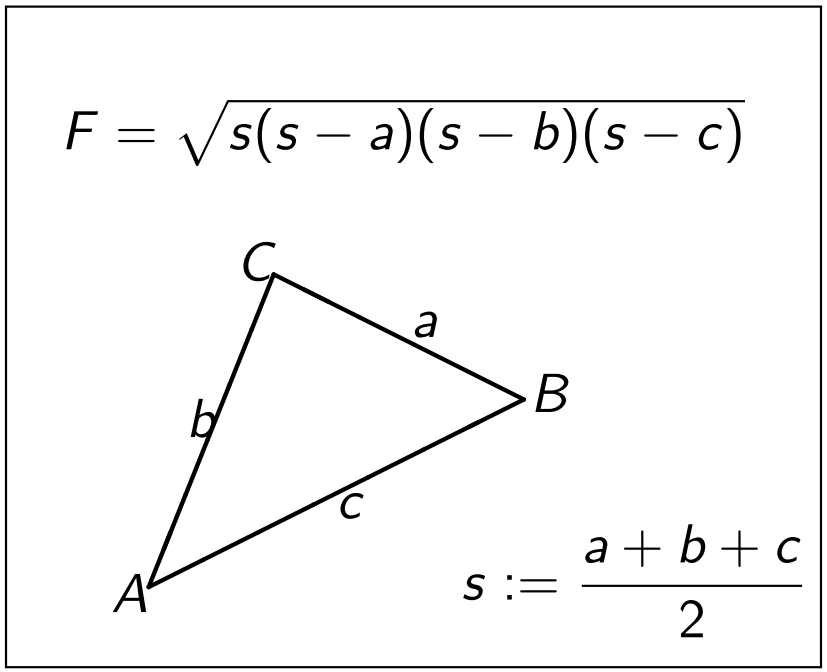
The simplest way is to `\usepackage{graphicx}` and then `\includegraphics{`*file name*`}`.
For example,

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

gives me

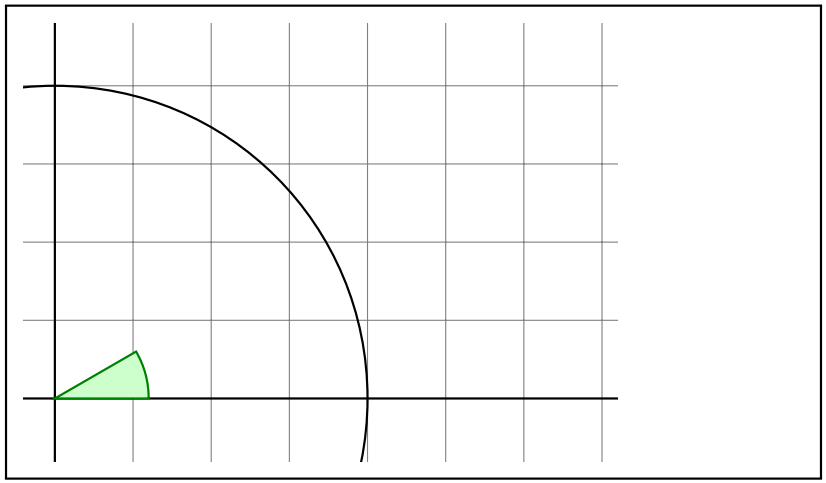
Picture

```
\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}
```

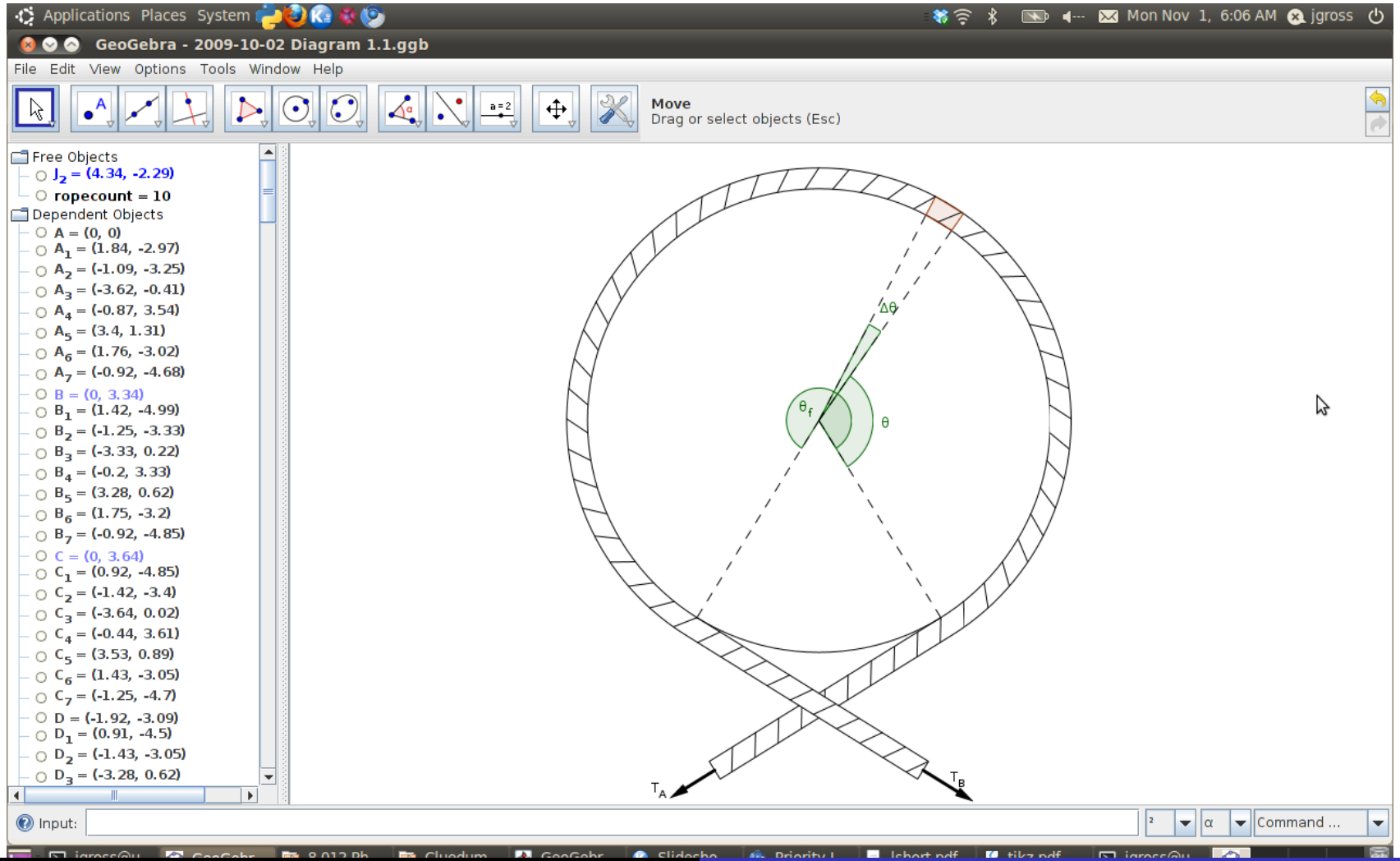


pgf/tikz

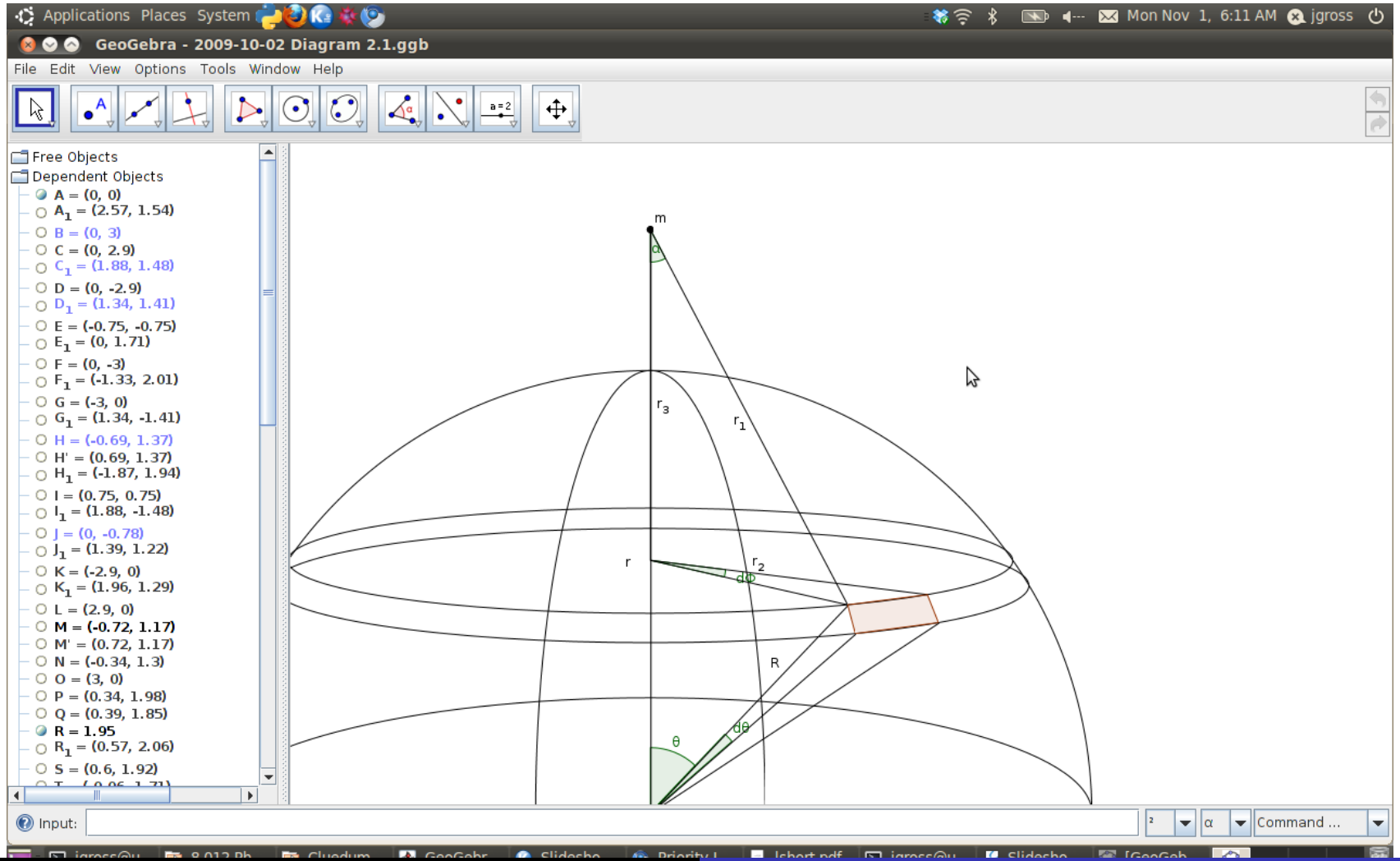
```
\begin{tikzpicture}[scale=2]
\clip (-0.1,-0.2)
rectangle (1.8,1.2);
\draw[step=.25cm,gray,very thin]
(-1.4,-1.4) grid (3.4,3.4);
\draw (-1.5,0) -- (2.5,0);
\draw (0,-1.5) -- (0,1.5);
\draw (0,0) circle (1cm);
\filldraw[fill=green!20!white,
draw=green!50!black]
(0,0) -- (3mm,0mm)
arc (0:30:3mm) --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



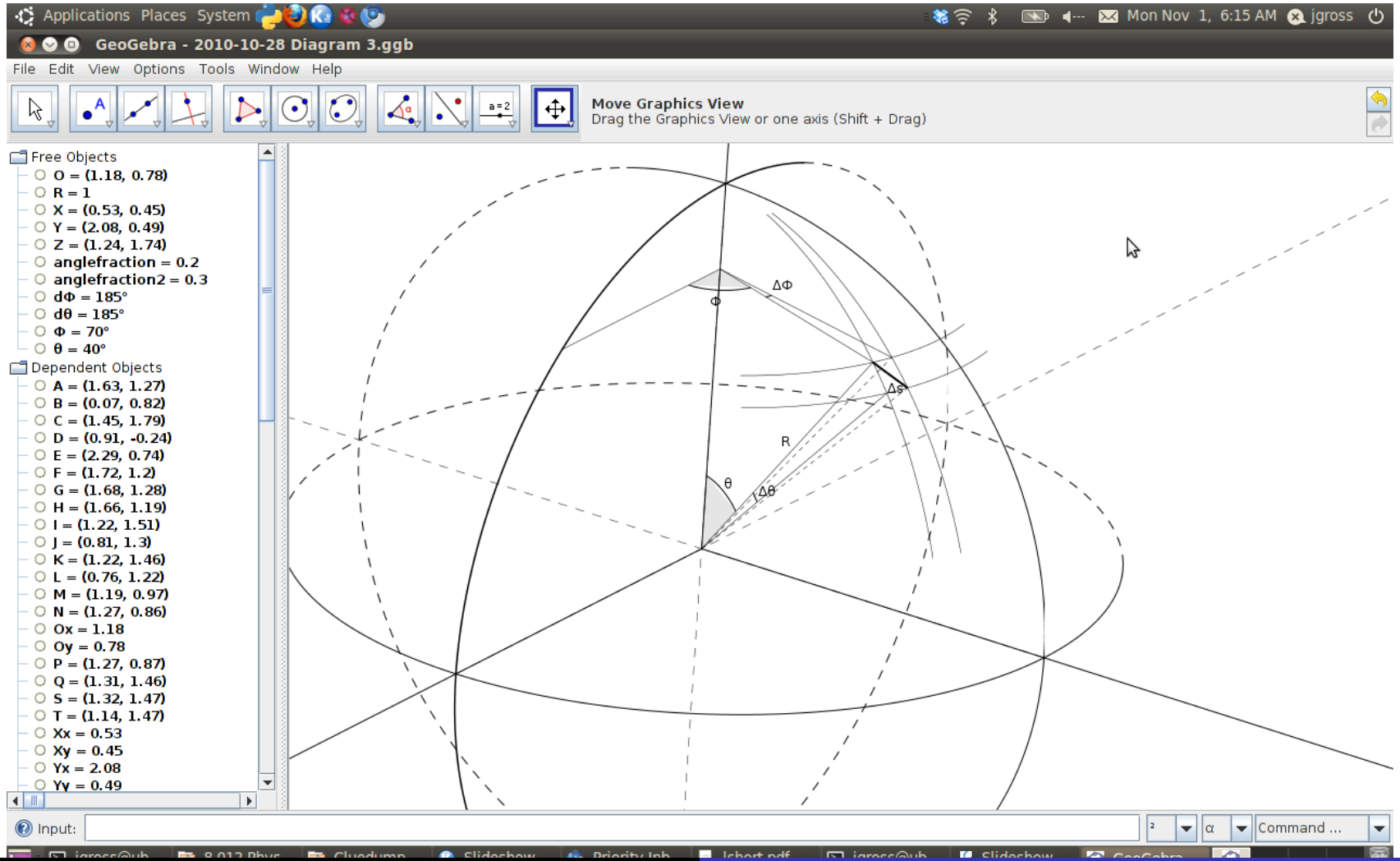
Geogebra


Applications Places System
Mon Nov 1, 6:06 AM jgross
GeoGebra - 2009-10-02 Diagram 1.1.ggb
File Edit View Options Tools Window Help
Move
Drag or select objects (Esc)
Free Objects
J2 = (4.34, -2.29)
ropecount = 10
Dependent Objects
A = (0, 0)
A1 = (1.84, -2.97)
A2 = (-1.09, -3.25)
A3 = (-3.62, -0.41)
A4 = (-0.87, 3.54)
A5 = (3.4, 1.31)
A6 = (1.76, -3.02)
A7 = (-0.92, -4.68)
B = (0, 3.34)
B1 = (1.42, -4.99)
B2 = (-1.25, -3.33)
B3 = (-3.33, 0.22)
B4 = (-0.2, 3.33)
B5 = (3.28, 0.62)
B6 = (1.75, -3.2)
B7 = (-0.92, -4.85)
C = (0, 3.64)
C1 = (0.92, -4.85)
C2 = (-1.42, -3.4)
C3 = (-3.64, 0.02)
C4 = (-0.44, 3.61)
C5 = (3.53, 0.89)
C6 = (1.43, -3.05)
C7 = (-1.25, -4.7)
D = (-1.92, -3.09)
D1 = (0.91, -4.5)
D2 = (-1.43, -3.05)
D3 = (-3.28, 0.62)
Δθ
θf
θ
TA
TB
Input:
Command ...

Geogebra


Applications Places System
Mon Nov 1, 6:11 AM jgross
GeoGebra - 2009-10-02 Diagram 2.1.ggb
File Edit View Options Tools Window Help
Free Objects
Dependent Objects
A = (0, 0)
A1 = (2.57, 1.54)
B = (0, 3)
C = (0, 2.9)
C1 = (1.88, 1.48)
D = (0, -2.9)
D1 = (1.34, 1.41)
E = (-0.75, -0.75)
E1 = (0, 1.71)
F = (0, -3)
F1 = (-1.33, 2.01)
G = (-3, 0)
G1 = (1.34, -1.41)
H = (-0.69, 1.37)
H' = (0.69, 1.37)
H1 = (-1.87, 1.94)
I = (0.75, 0.75)
I1 = (1.88, -1.48)
J = (0, -0.78)
J1 = (1.39, 1.22)
K = (-2.9, 0)
K1 = (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
R1 = (0.57, 2.06)
S = (0.6, 1.92)
m
r3
r1
r
r2
dφ
R
θ
dθ
Input:
Command ...

Geogebra


Applications Places System
Mon Nov 1, 6:15 AM jgross
GeoGebra - 2010-10-28 Diagram 3.ggb
File Edit View Options Tools Window Help
Move Graphics View
Drag the Graphics View or one axis (Shift + Drag)
Free Objects
O = (1.18, 0.78)
R = 1
X = (0.53, 0.45)
Y = (2.08, 0.49)
Z = (1.24, 1.74)
anglefraction = 0.2
anglefraction2 = 0.3
dΦ = 185°
dθ = 185°
Φ = 70°
θ = 40°
Dependent Objects
A = (1.63, 1.27)
B = (0.07, 0.82)
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)
Xx = 0.53
Xy = 0.45
Yx = 2.08
Yy = 0.49
ΔΦ
Φ
Δs
R
θ
Δθ
Input:
Command ...

Geogebra

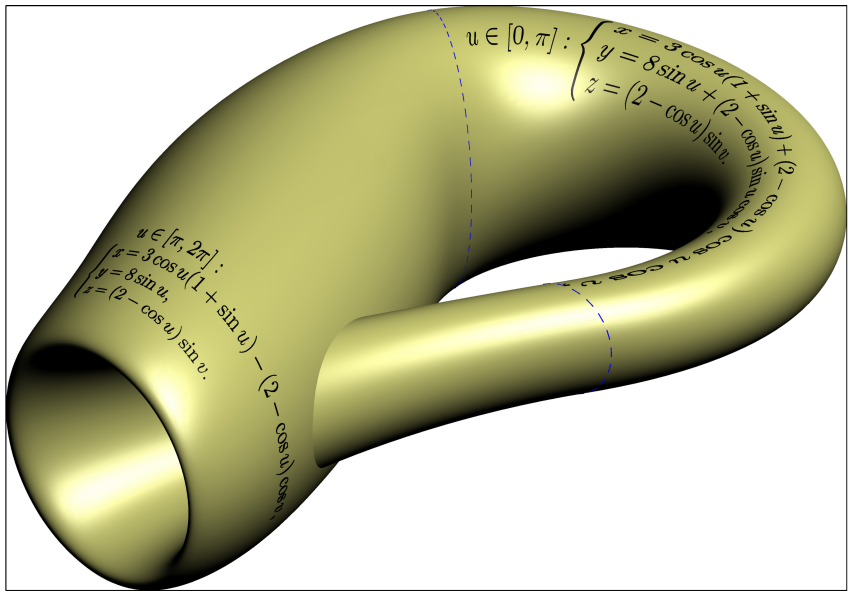
- Exports to pgf/tikz, pdf, png, and others.
- Great for geometrical figures.
- Allows labeling with (almost) arbitrary LaTeX formulas.
- Sometimes requires a bit of manual tweaking.

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.

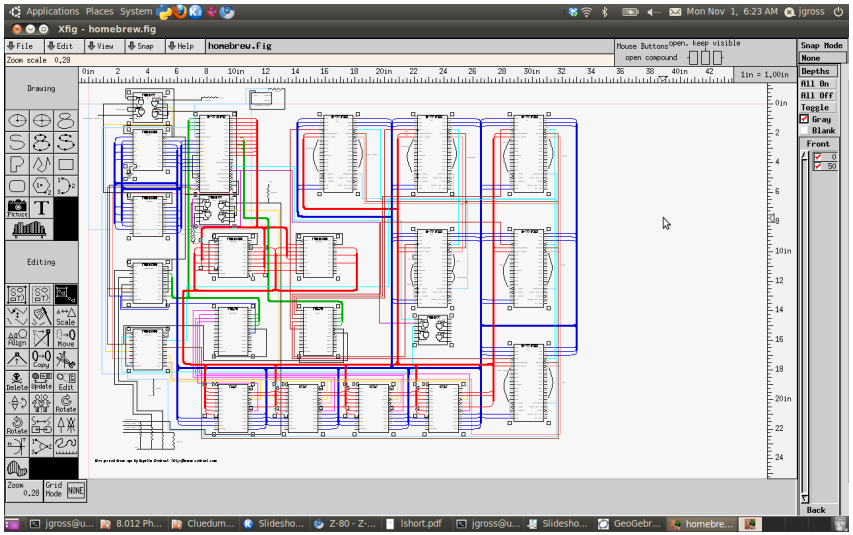
Asymptote

- 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!