

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

## Things You May Want to Know

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Thanks to Jarrod Pas for helpful comments

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1 Pictures and TikZ

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# Pictures

$\LaTeX$  can input .jpg, .png, and .pdf files. To do this we need to put the following in our preamble:

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\usepackage{graphicx}  
\graphicspath{images/}
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# Pictures

$\LaTeX$  can input .jpg, .png, and .pdf files. To do this we need to put the following in our preamble:

```
\usepackage{graphicx}  
\graphicspath{images/}
```

Then we can insert the file `mypicture.png` by using

```
\begin{figure}  
\includegraphics{mypicture}  
\end{figure}
```

# Pictures

Doing important work:

```
\\  
\begin{figure}  
\includegraphics{mypicture}  
\end{figure}
```

Doing important work:



# Pictures

Doing important work:

```
\\  
\begin{figure}  
\includegraphics[scale=0.35]{  
mypicture}  
\end{figure}
```

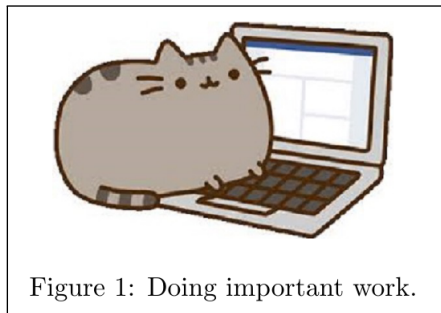
Doing important work:



# Pictures

We could give him a caption:

```
\begin{figure}  
\includegraphics[scale=0.35]{  
mypicture}  
\caption{Doing important work.}  
\end{figure}
```



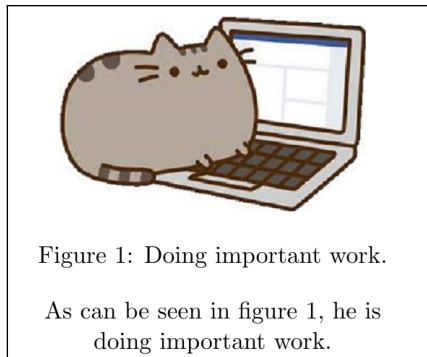


# Pictures

We could also reference him later:

```
\begin{figure}  
\includegraphics[scale=0.35]{  
mypicture}  
\caption{Doing important work.}  
\label{myfigure1}  
\end{figure}
```

As can be seen in figure `\ref{myfigure1}`, he is doing important work.



# Pictures

L<sup>A</sup>T<sub>E</sub>X sometimes has a habit of putting your pictures where you don't expect them to be. This can be solved by using

```
\begin{figure}[h!]  
\includegraphics{mypicture}  
\end{figure}
```

# Pictures

$\LaTeX$  sometimes has a habit of putting your pictures where you don't expect them to be. This can be solved by using

```
\begin{figure}[h!]  
\includegraphics{mypicture}  
\end{figure}
```

The approach we have been using so far will result in left-aligned pictures. We often want them to be centered so we use

```
\begin{figure}  
\includegraphics{mypicture}  
\centering  
\end{figure}
```

# Pictures

For small pictures, wrapping the text can look good. This can be accomplished by adding

```
\usepackage{wrapfig}
```

to the preamble.

# Pictures

For small pictures, wrapping the text can look good. This can be accomplished by adding

```
\usepackage{wrapfig}
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to the preamble.

```
\begin{wrapfigure}{r}{0.25\textwidth}  
  \includegraphics[scale=0.2]{mypicture}  
\end{wrapfigure}
```

He is doing important work. He is doing important work. He is doing important work. He is doing important work. He is doing important work. He is doing important work. He is doing important work...



The TikZ package is useful for creating diagrams and plots directly in  $\text{\LaTeX}$ .

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```
\usepackage{tikz}  
\usetikzlibrary{positioning,calc,cd}
```



# TikZ

The TikZ package is useful for creating diagrams and plots directly in  $\text{\LaTeX}$ . To use it, add the following to the preamble:

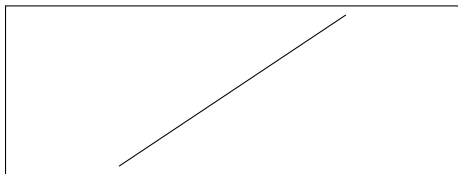
```
\usepackage{tikz}  
\usetikzlibrary{positioning,calc,cd}
```

Then to make pictures we use

```
\begin{tikzpicture}  
some code  
\end{tikzpicture}
```

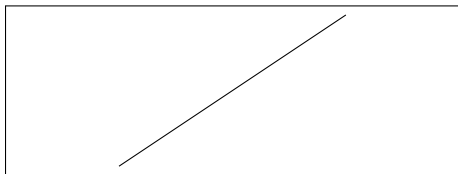
So what can we do with TikZ?

```
\begin{tikzpicture}  
\draw (0,0) -- (3,2);  
\end{tikzpicture}
```

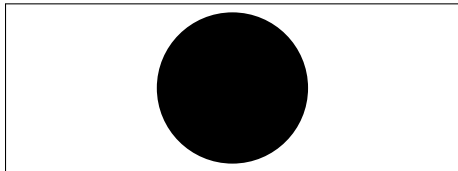


So what can we do with TikZ?

```
\begin{tikzpicture}  
\draw (0,0) -- (3,2);  
\end{tikzpicture}
```

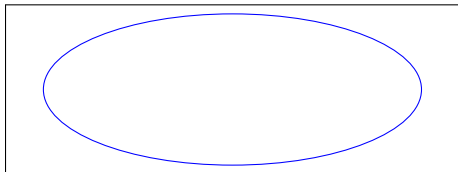


```
\begin{tikzpicture}  
\fill (0,0) circle (1cm);  
\end{tikzpicture}
```



# TikZ

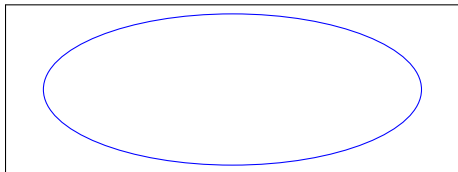
```
\begin{tikzpicture}  
\draw[blue] (0,0) ellipse  
(2.5cm and 1cm);  
\end{tikzpicture}
```



```

\begin{tikzpicture}
\draw[blue] (0,0) ellipse
(2.5cm and 1cm);
\end{tikzpicture}

```

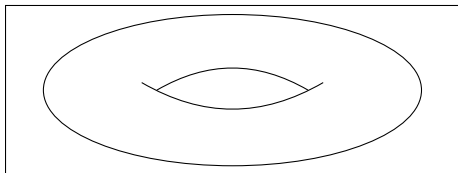


```

\begin{tikzpicture}
\draw (0,0) ellipse (2.5cm
and 1cm);

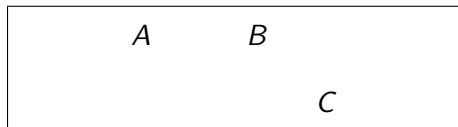
\draw (-1,0) to[bend left]
(1,0);
\draw (-1.2,.1) to[bend right
] (1.2,.1);
\end{tikzpicture}

```



It is often very useful to place *nodes* to organize a picture:

```
\begin{tikzpicture}
  \node (a) at (0,0){$A$};
  \node (b) [right=1cm of a
  ]{$B$};
  \node (c) [below right=0.5
  cm of b]{$C$};
\end{tikzpicture}
```



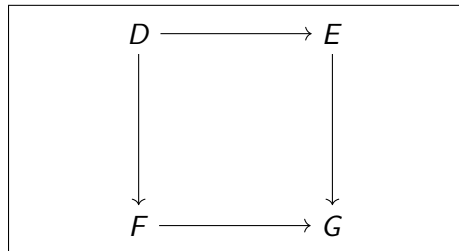
This is a great way to create commutative diagrams:

```

\begin{tikzpicture}
\node (d) at (0,0){$D$};
\node (e) [right=2cm of d] {$E$};
\node (f) [below=2cm of d] {$F$};
\node (g) [below=2cm of e] {$G$};

\draw[->] (d) -- (e);
\draw[->] (d) -- (f);
\draw[->] (e) -- (g);
\draw[->] (f) -- (g);
\end{tikzpicture}

```



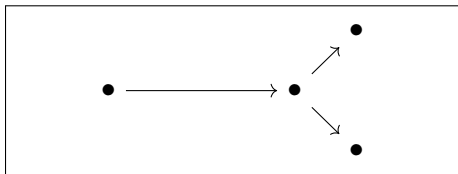
## Graphs as well!

```

\begin{tikzpicture}
  \node (h) at (0,0){$\bullet$};
  \node (i) [right=2cm of h]
    {$\bullet$};
  \node (j) [below right=0.5
    cm of i]{$\bullet$};
  \node (k) [above right=0.5
    cm of i]{$\bullet$};

  \draw[->] (h) to (i);
  \draw[->] (i) to (j);
  \draw[->] (i) to (k);
\end{tikzpicture}

```

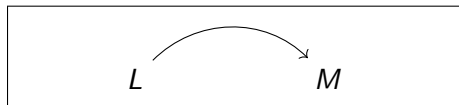




One can also exert greater control on the arrows:

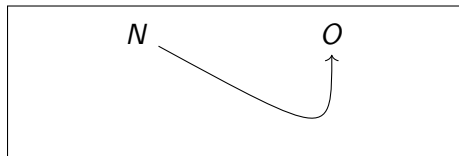
```
\begin{tikzpicture}
  \node (l) at (0,0){ $L$ };
  \node (m) [right=2cm of l]
  { $M$ };

  \draw[->] (l) to[out=45, in
  =135] (m);
\end{tikzpicture}
```



```
\begin{tikzpicture}
  \node (n) at (0,0){ $N$ };
  \node (o) [right=2cm of n
 ]{ $O$ };
  \node (p) [below=1cm of o
 ]{};

  \draw[->] (n) .. controls (
p) .. (o);
\end{tikzpicture}
```

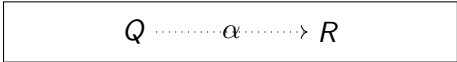


```

\begin{tikzpicture}
  \node (q) at (0,0){$Q$};
  \node (r) [right=2cm of q
]{$R$};

  \draw[->, dotted] (q) -- (r
) node[pos=0.5]{$\alpha$};
\end{tikzpicture}

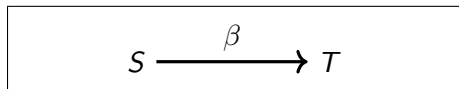
```



$$Q \cdots \alpha \cdots \rightarrow R$$

```
\begin{tikzpicture}
  \node (s) at (0,0){ $S$ };
  \node (t) [right=2cm of s]
    { $T$ };

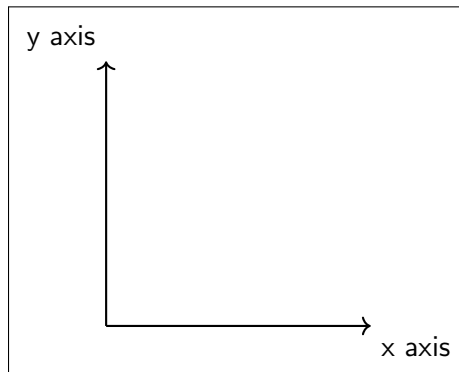
  \draw[->, very thick] (s)
    -- (t) node[pos=0.5,above]
    { $\beta$ };
\end{tikzpicture}
```



Additionally, TikZ can plot functions. Let's make a Cartesian plane first

```
\begin{tikzpicture}
\draw[thick,->] (0,0) --
(3.5,0) node[pos=1, anchor=
north west] {x axis};

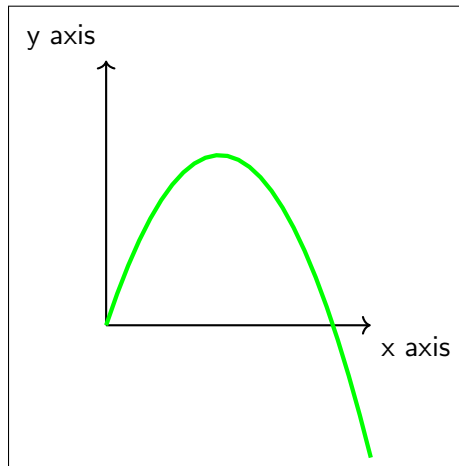
\draw[thick,->] (0,0) --
(0,3.5) node[pos=1, anchor=
south east] {y axis};
\end{tikzpicture}
```



Now we can plot some nice functions on it

```
\begin{tikzpicture}
\draw[thick,->] (0,0) --
(3.5,0) node[pos=1, anchor=
north west] {x axis};
\draw[thick,->] (0,0) --
(0,3.5) node[pos=1, anchor=
south east] {y axis};

\draw[green, ultra thick,
domain=0:3.5] plot (\x, {3*\x
-\x*\x});
\end{tikzpicture}
```



Note that just as with out pictures, TikZ will be left-aligned by default. Unfortunately, adding `\centering` to TikZ does not work. We can instead do something like

```
\begin{tikzpicture}  
some code  
\end{tikzpicture}
```

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4 A Last Section



Beamer is the standard way to create slideshows in  $\text{\LaTeX}$ . Creating slides is an important way to share your work and Beamer will help it be as professional as possible.

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To use Beamer, we start with

```
\documentclass{beamer}
```

(instead of `\documentclass{article}` or whatever you usually use).

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```
\documentclass{beamer}
```

(instead of `\documentclass{article}` or whatever you usually use).  
From here on, our main tool is the `\frame` environment:

```
\verb\begin{frame}  
\frametitle{A Fabulous Title}  
Here is my content, it is world-changing.  
\verb\end{frame}
```

Please ignore the `\verb` commands, Beamer doesn't like being so meta.

# A Fabulous Title

Here is my content, it is world-changing.

The command `\pause` will create multiple slides which are very convenient for presenting.

The command `\pause` will create multiple slides which are very convenient for presenting. For example,

```
\verb\begin{frame}  
\frametitle{Yet Another Fabulous Title}  
This content is OK.\  
\pause  
This content is awful.\  
\pause  
\begin{figure}  
\centering  
\includegraphics[scale=0.025]{mypicture}  
\end{figure}  
\verb\end{frame}
```

# Yet Another Fabulous Title

This content is OK.



# Yet Another Fabulous Title

This content is OK.

This content is awful.

# Yet Another Fabulous Title

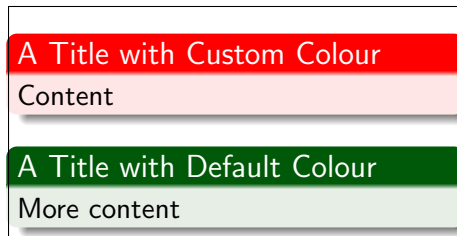
This content is OK.

This content is awful.



It is common to include blocks in presentations:

```
{  
  \setbeamercolor{block title}{  
    bg=red}  
  \begin{block}{A Title with  
    Custom Colour}  
    Content  
  \end{block}  
}  
  
  \begin{block}{A Title with  
    Default Colour}  
    More content  
  \end{block}
```



The braces around the first bunch of  $\text{T}_{\text{E}}\text{X}$  demonstrates how we can change the colour for only a specific block.

We can utilize hyperlinks

```
Hey \href{https://cumc.math.  
ca/2018/home}{click me!}
```

Hey click me!

We can utilize hyperlinks

```
Hey \href{https://cumc.math.  
ca/2018/home}{click me!}
```

Hey click me!

or we can link to other slides in our presentation *if* we label them. In this case I have added

```
\label{slide31}
```

to the previous slide. Now we can use

```
Please don't \hyperlink{slide  
31}{click me!}
```

Please don't click me!

The title page is created by

```
\title{Intermediate \LaTeX}  
\subtitle{Things You May Want to Know}  
  
\author{Evan~J.~A.~Sundbo}  
  
\institute{Department of Mathematics and Statistics \\  
University of Saskatchewan}  
  
\date{Canadian Undergraduate Mathematics Conference, July 12  
2018}
```

and then

```
\frame{\titlepage}
```

In a similar way the table of contents is created by

```
\frame{\tableofcontents}
```

provided that you are using `\section` and `\subsection` structure.

In a similar way the table of contents is created by

```
\frame{\tableofcontents}
```

provided that you are using `\section` and `\subsection` structure. We also note that there are many different *styles* to use with Beamer. This presentation was made by using

```
\usestyle{Madrid}
```

in the preamble.



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3 **BIBTEX**

4 A Last Section

We use BIB<sub>T</sub>E<sub>X</sub> to manage and typeset our references (fairly) painlessly.

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We use BIBTEX to manage and typeset our references (fairly) painlessly. The main thing we need to create is a `.bib` file. This is where all the information about our references will be stored. Open a fresh `.tex` file, put the correct information into it and *save it as a .bib file*. Let's call ours `mybibliography.bib`.

What is the “correct information”?

What is the “correct information”? It looks like

```
@article {MR887284,  
  AUTHOR = {Hitchin, N. J.},  
  TITLE = {The self-duality equations on a {R}iemann surface  
  },  
  JOURNAL = {Proc. London Math. Soc. (3)},  
  FJOURNAL = {Proceedings of the London Mathematical Society.  
  Third Series},  
  VOLUME = {55},  
  YEAR = {1987},  
  NUMBER = {1},  
  PAGES = {59--126},  
  ISSN = {0024-6115},  
  MRCLASS = {32G13 (14F05 14H15 32L10 53C05 58E99 81E13)},  
  MRNUMBER = {887284},  
  MRREVIEWER = {Mitsuhiro Itoh},  
  URL = {https://doi.org/10.1112/plms/s3-55.1.59}, }
```

Don't panic! You can get this from  
<https://mathscinet.ams.org/mathscinet/>

Don't panic! You can get this from  
<https://mathscinet.ams.org/mathscinet/>



Publications Authors Journals Citations

**Search Terms**

Author	▼	hitchin	and ▼
Title	▼	self-duality equations	and ▼
MSC Primary	▼		and ▼
Anywhere	▼		



Select alternative format ▾

*Publications results for "Author=(hitchin) AND Title=(self-duality equations)"*

**MR0887284 (89a:32021)** Reviewed

Hitchin, N. J.(4-OXSC)

**The self-duality equations on a Riemann surface.**

*Proc. London Math. Soc. (3)* 55 (1987), no. 1, 59–126.

32G13 (14F05 14H15 32L10 53C05 58E99 81E13)

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**Select alternative format ▾**

Select alternative format

PDF

PDF for printing

**BibTeX**

AMSRefs

EndNote

*r=(hitchin) AND Title=(self-duality equations)"*

Reviewed

**ns on a Riemann surface.**

) 55 (1987), no. 1, 59–126.

[32G13](#) ([14F05](#) [14H15](#) [32L10](#) [53C05](#) [58E99](#) [81E13](#))[Review PDF](#) | [Clipboard](#) | [Journal](#) | [Article](#) | [Make Link](#)

```
@article {MR887284,  
  AUTHOR = {Hitchin, N. J.},  
  TITLE = {The self-duality equations on a {R}iemann surface},  
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  VOLUME = {55},  
  YEAR = {1987},  
  NUMBER = {1},  
  PAGES = {59--126},  
  ISSN = {0024-6115},  
  MRCLASS = {32G13 (14F05 14H15 32L10 53C05 58E99 81E13)},  
  MRNUMBER = {887284},  
  MRREVIEWER = {Mitsuhiko Itoh},  
  DOI = {10.1112/plms/s3-55.1.59},  
  URL = {https://doi.org/10.1112/plms/s3-55.1.59},  
}
```

The part that we will need to know to reference this is right at the beginning:

```
@article {MR887284,  
  AUTHOR = {Hitchin, N. J.},  
  ...
```

The part that we will need to know to reference this is right at the beginning:

```
@article {MR887284,  
  AUTHOR = {Hitchin, N. J.},  
  ...
```

Let's change it to something more memorable.

```
@article {Hitchin87,  
  AUTHOR = {Hitchin, N. J.},  
  ...
```

We are citing the paper `\cite{Hitchin87}`.

```
\bibliographystyle{plain}  
\bibliography{mybibliography}
```

```
We are citing the paper \cite{Hitchin87}.
```

```
\bibliographystyle{plain}  
\bibliography{mybibliography}
```

We are citing the paper [1].

## References

- [1] N. J. Hitchin. The self-duality equations on a Riemann surface. *Proc. London Math. Soc. (3)*, 55(1):59–126, 1987.

There is only one other complication. When using BIBTEX we can't just compile L<sup>A</sup>T<sub>E</sub>X normally.



There is only one other complication. When using BIB<sub>T</sub>E<sub>X</sub> we can't just compile L<sub>A</sub>T<sub>E</sub>X normally. We need to run the following sequence

```
LaTeX mymainfile.tex  
BibTeX mymainfile.tex  
LaTeX mymainfile.tex  
LaTeX mymainfile.tex
```

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```
LaTeX mymainfile.tex  
BibTeX mymainfile.tex  
LaTeX mymainfile.tex  
LaTeX mymainfile.tex
```

Note: If you are using BIB<sub>T</sub>E<sub>X</sub> and the whole thing stops working, delete your `.aux` file.

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# The End

Practice!

# The End

Practice! And utilize Google and LaTeX Stack Exchange.

Questions?