

\LaTeX tutorial

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- an editor (like Eclipse, TexNic Center)

Sample \LaTeX code:

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Sample L^AT_EX code:

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\documentclass{article}  
\usepackage{fullpage}    %This is a package.
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- `article` is commonly used for general stuff
- `report` is commonly used mainly for formal papers, such as theses

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The arguments of a command are usually enclosed in curly brackets.

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- The command for L^AT_EX is `\LaTeX`.
- The command for $\sin \theta$ is `\sin\theta`.
- The command for ε is `\varepsilon`.

arguments

The arguments of a command are usually enclosed in curly brackets.

- The commands `\begin` and `\end` take exactly one argument, which is the name of the environment they are beginning and ending.

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- The commands `\begin` and `\end` start and end an environment, respectively.
- `document` represents the document environment.
- Putting text inside the `multicols` environment splits the text into two columns.

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- The packages will be used are declared BEFORE the document environment begins.
- We used the `fullpage` package in the previous example.
- The most commonly-used packages for mathematics are `amsfonts`, `amsmath`, `amssymb` and `amsthm`.
- You may opt to automatically download packages as needed.

dollar sign

Enclosing text using single dollar signs makes inline Math equations.

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Enclosing text using double dollar signs makes display style Math equations.

- You may also use `\[` and `\]` instead of double dollar signs.

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example: Let $\alpha \in \mathbb{C}$ with $|\alpha| < 1$.

dollar sign dollar sign

Enclosing text using double dollar signs makes display style Math equations.

- You may also use $\left[$ and $\right]$ instead of double dollar signs.

example:

$$\sum_{n=1}^{\infty} \frac{n}{(1+i)^n}$$

We now discuss the `enumerate` environment.

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 - We may nest these environments within each other!

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- ② We may also use bulleted lists...
 - ...using the `itemize` environment.
 - We may nest these environments within each other!
 - Environmentception!

fonts

As shown, we have a couple of fonts available.

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- `\textit` produces *italicized fonts*.

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- `\textit` produces *italicized fonts*.
- `\textbf` produces **bold fonts**.

How do we make L^AT_EX display stuff like

$$\lim_{x \rightarrow x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

or

$$\int_0^{2\pi} \sqrt{(-r \sin \theta)^2 + (r \cos \theta)^2} d\theta$$

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Hints

- To make an nth root symbol, append the index in between `\sqrt` and the argument. (ex: `\sqrt[n]{x}` for $\sqrt[n]{x}$)
- `\sum` is the command for the summation and `\infty` are valid commands.

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left and right

We may use commands `\left` and `\right` to fix this.

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```

will now output $\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{2}$.

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y - 2 = 3(x - 1) \\
y - 2 = 3x - 3 \\
y = 3x - 1
```

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align

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\begin{align}
y - 2 &= 3(x - 1) \\
y - 2 &= 3x - 3 \\
y &= 3x - 1
\end{align}
```


align

We may use the `align` environment to align them in an elegant manner. We use ampersands to tell the compiler which parts to align.

```
\begin{align}
y - 2 &= 3(x - 1) \\
y - 2 &= 3x - 3 \\
y &= 3x - 1
\end{align}
```

should output

$$y - 2 = 3(x - 1) \tag{1}$$

$$y - 2 = 3x - 3 \tag{2}$$

$$y = 3x - 1 \tag{3}$$

remarks

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- If we do not like the equations to be numbered automatically, we may use the `align*` environment.

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- If we do not like the equations to be numbered automatically, we may use the `align*` environment.
- Both `align` and `align*` environments are under Math mode by default, no need for dollar signs.

Identity Matrix

Use the `\bmatrix` environment to display

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Piecewise Function

Use the `\cases` environment to display

$$|x| = \begin{cases} x & , x \geq 0 \\ -x & , x < 0 \end{cases}$$

Hints

- `\geq` and `\leq` are valid commands for \geq and \leq .
- The `\cases` environment does not default to Math mode.

papers01.tex:

```
\documentclass{report}  
\begin{document}  
\chapter{Introduction} % 1
```

papers01.tex:

```
\documentclass{report}  
\begin{document}  
\chapter{Introduction}      % 1  
\chapter{Preliminaries}    % 2
```

papers01.tex:

```
\documentclass{report}  
\begin{document}  
\chapter{Introduction}      % 1  
\chapter{Preliminaries}    % 2  
\section{Stuffs}           % 2.1
```


papers01.tex:

```
\documentclass{report}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\section{More Stuff}       % 2.2
```

papers01.tex:

```
\documentclass{report}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\section{More Stuff}s}    % 2.2
\chapter{Inception}       % 3
```

papers01.tex:

```
\documentclass{report}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\section{More Stuff}s}    % 2.2
\chapter{Inception}        % 3
\section{We Must}          % 3.1
```

papers01.tex:

```
\documentclass{report}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\section{More Stuff}       % 2.2
\chapter{Inception}        % 3
\section{We Must}          % 3.1
\subsection{Go Deeper}    % 3.1.1
```

papers01.tex:

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\documentclass{report}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\section{More Stuffs}      % 2.2
\chapter{Inception}        % 3
\section{We Must}          % 3.1
\subsection{Go Deeper}    % 3.1.1
\end{document}
```

Table of Contents

\LaTeX automatically generates a table of contents based on the sectioning via the `\tableofcontents` command.

An example is on `papers02.tex`

Labelling and Cross-Referencing

- We use the command `\label` to label a chapter (chap), section (sec), subsection (subsec), equation (eq), etc.

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- To reference to the command, we use `\ref` and the argument we pass is the same format as the label.

An example is on papers03.tex

papers03.tex:

```
\chapter{Introduction}
```

We will talk about stuffs on section `\ref{sec:stuffs}`.

```
\chapter{Preliminaries}
```

```
\section{Stuffs}
```

```
\label{sec:stuffs} Here are the stuffs!
```

newtheorem

- We use the command `\newtheorem` command to create an environment.

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- The second argument is the printed output.

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- We put this in the preamble (before the `\begin{document}` command.)

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- The first argument is the name of the new environment.
- The second argument is the printed output.
- We put this in the preamble (before the `\begin{document}` command.)

```
\usepackage{amsthm}  
\newtheorem{rem}{Remark}  
\begin{document}
```

Using the environment.

- As always we use the environment name and the `\begin` and `\end` tags.
- The `\begin` tag takes an optional argument – the printed name of the “theorem”.

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```
\begin{rem}
```

```
This is a remark.
```

```
\end{rem}
```

```
\begin{rem}[Childrens]
```

```
Childrens are cute.
```

```
\end{rem}
```

Using the environment.

- As always we use the environment name and the `\begin` and `\end` tags.
- The `\begin` tag takes an optional argument – the printed name of the “theorem”.

```
\begin{rem}
```

```
This is a remark.
```

```
\end{rem}
```

```
\begin{rem}[Childrens]
```

```
Childrens are cute.
```

```
\end{rem}
```

Note that this automatically labels the remarks as remarks 1 and 2.

Changing the counter

- The `\newtheorem` command takes an optional argument: the numbering style.
- The optional argument tells when to restart the numbering.

```
\newtheorem{rem}{Remark}
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\begin{rem}                 % Remark 1
This is a remark.
\end{rem}
\begin{rem}[Childrens]     % Remark 2
Childrens are cute.
\end{rem}
\chapter{Inception}        % 3
\begin{rem}                 % Remark 3
Inception is a movie.
\end{rem}
```



```
\newtheorem{rem}{Remark}[chapter]
\begin{document}
\chapter{Introduction}      % 1
\chapter{Preliminaries}    % 2
\section{Stuffs}           % 2.1
\begin{rem}                 % Remark 2.1
This is a remark.
\end{rem}
\begin{rem}[Childrens]     % Remark 2.2
Childrens are cute.
\end{rem}
\chapter{Inception}        % 3
\begin{rem}                 % Remark 3.1
Inception is a movie.
\end{rem}
```

Seatwork

Replicate the following (papers_sw01.pdf):

Contents

- 1 Introduction
- 2 Preliminaries
 - 2.1 The Group of Rational Points

Chapter 2

Preliminaries

2.1 Elliptic Curves

Theorem 1 (Hasse, 1933). *The order of any elliptic curve over*

2.2 The Group of Rational Points

Remark 2.1. *The sum of two points $P_1 : (x_1, y_1)$ and*

Theorem 2. *From theorem 1, we have*

Problem

$$\mathit{cis}\theta = \cos\theta + i\sin\theta$$

```
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```

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c, i and s are treated as variables.

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```
cis\theta = \cos\theta + i\sin\theta
```

c, i and s are treated as variables.

Naive Solution

```
\text{cis}\theta = \cos\theta + i\sin\theta
```

Better Solution

- Declare a Math operator!

Better Solution

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- We use the `\DeclareMathOperator` command on the preamble.

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- We use the `\DeclareMathOperator` command on the preamble.
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- It creates a new command based on what you wrote.

Better Solution

- Declare a Math operator!
- We use the `\DeclareMathOperator` command on the preamble.
- It has two arguments: the name of the command and the printed output.
- It creates a new command based on what you wrote.

Example (papers06.tex)

```
\DeclareMathOperator{\cis}{cis}
\begin{document}
\cis\theta = \cos\theta + i\sin\theta
```

Problem

Suppose we want to print Mazur's theorem.

Problem

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Theorem (Mazur's torsion theorem)

The only possible torsion groups of the group of rational points of an elliptic curve over the rational numbers are as follows:

$\mathbb{Z}_1, \dots, \mathbb{Z}_{10}, \mathbb{Z}_{12}, \mathbb{Z}_2 \times \mathbb{Z}_2, \mathbb{Z}_2 \times \mathbb{Z}_4, \mathbb{Z}_2 \times \mathbb{Z}_6$ and $\mathbb{Z}_2 \times \mathbb{Z}_8$.

Problem

Suppose we want to print Mazur's theorem.

Theorem (Mazur's torsion theorem)

The only possible torsion groups of the group of rational points of an elliptic curve over the rational numbers are as follows:

$\mathbb{Z}_1, \dots, \mathbb{Z}_{10}, \mathbb{Z}_{12}, \mathbb{Z}_2 \times \mathbb{Z}_2, \mathbb{Z}_2 \times \mathbb{Z}_4, \mathbb{Z}_2 \times \mathbb{Z}_6$ and $\mathbb{Z}_2 \times \mathbb{Z}_8$.

```

 $\mathbb{Z}_1, \dots, \mathbb{Z}_{10},$ 
 $\mathbb{Z}_{12}, \mathbb{Z}_2 \times$ 
 $\mathbb{Z}_2, \mathbb{Z}_2 \times$ 
 $\mathbb{Z}_4, \mathbb{Z}_2 \times$ 
 $\mathbb{Z}_6$  and  $\mathbb{Z}_2$ 
 $\times \mathbb{Z}_8$ .
  
```

Solution

We use `\newcommand`.

Solution

We use `\newcommand`.

Preamble

We put this in the preamble:

Solution

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```
\newcommand{\IZ}{\mathbb{Z}}
```


Solution

We use `\newcommand`.

Preamble

We put this in the preamble:

```
\newcommand{\IZ}{\mathbb{Z}}
```

Body

And use this instead:

```

 $\IZ_1$ ,  $\ldots$ ,  $\IZ_{10}$ ,
 $\IZ_{12}$ ,  $\IZ_2 \times \IZ_{2}$ ,  $\IZ_2$ 
 $\times \IZ_{4}$ ,  $\IZ_2 \times \IZ_{6}$ $
and  $\IZ_2 \times \IZ_8$ $.

```

Arguments

- The `\newcommand` command takes an optional argument - the number of arguments for your new command.
- The arguments are then replaced in the code on the required argument. The first argument replaces `#1`, the second replaces `#2`, and so on.

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Preamble

```
\newcommand{\Zmod}[1]{\dfrac{\IZ}{#1\IZ}}
```

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Preamble

```
\newcommand{\Zmod}[1]{\dfrac{\IZ}{#1\IZ}}
```

Body

```
$\Zmod_1, \ldots, \Zmod_{10},  

\Zmod_{12}, \Zmod_2 \times \Zmod_{2}, \Zmod_2  

\times \Zmod_{4}, \Zmod_2 \times \Zmod_{6}$  

and $\Zmod_2 \times \Zmod_8$.
```

Output

$$\frac{\mathbb{Z}}{1\mathbb{Z}}, \dots, \frac{\mathbb{Z}}{10\mathbb{Z}}, \frac{\mathbb{Z}}{12\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{2\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{4\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{6\mathbb{Z}} \text{ and } \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{8\mathbb{Z}}$$

Output

$$\frac{\mathbb{Z}}{1\mathbb{Z}}, \dots, \frac{\mathbb{Z}}{10\mathbb{Z}}, \frac{\mathbb{Z}}{12\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{2\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{4\mathbb{Z}}, \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{6\mathbb{Z}} \text{ and } \frac{\mathbb{Z}}{2\mathbb{Z}} \times \frac{\mathbb{Z}}{8\mathbb{Z}}$$

Exercise

Here is a list of all elements of $GL(2, \mathbb{Z}_2)$.

$$GL(2, \mathbb{Z}_2) = \left\{ \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \right\}$$

What is Beamer?

- Beamer is a \LaTeX document class for creating presentations.

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- Beamer is a \LaTeX document class for creating presentations.
- It is somewhat like a Powerpoint presentation.
- The “slides” are called frames.
- Most of the commands used in \LaTeX can also be used here.

Sample Beamer Code

```
\documentclass{beamer}
```

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```
\documentclass{beamer}  
\usepackage{beamerthemeWarsaw}
```

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\usepackage{amsthm, amsfonts, amsmath, amssymb}
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\title{\textbf{\LaTeX tutorial}}
```

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\author[Asuncion, J.]{Jared Guissmo E. Asuncion}
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\date{\today}
```


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\author[Asuncion, J.]{Jared Guissmo E. Asuncion}
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\begin{document}
```

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\begin{document}
\begin{frame}
```

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\begin{document}
\begin{frame}
  \titlepage
```

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```

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\begin{frame}
    \titlepage
\end{frame}
\begin{frame}
```

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\begin{frame}
  \titlepage
\end{frame}
\begin{frame}
  Hello \textsc{Beamer}!
```

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\end{frame}
\begin{frame}
  Hello \textsc{Beamer}!
\end{frame}
\end{document}
```


\LaTeX tutorial

Jared Guissmo E. Asuncion

January 16, 2014

Hello BEAMER!

Making Blocks

We make these blocks with the block environment.

Making Blocks

We make these blocks with the block environment.

Code

```
\begin{frame}  
\begin{block}{Making Blocks}  
We make these blocks with the \texttt{block}  
environment.  
\end{block}  
\end{frame}
```

Remark

Commands defined using `\newtheorem` also appear as blocks.

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Code

```
\begin{frame}  
\begin{rem}  
Commands defined using \textbackslash  
\texttt{newtheorem} also appear as  
blocks.  
\end{rem}  
\end{frame}
```

Block 1

You can have multiple blocks per frame.

Block 2

OH YEAH!

Block 1

You can have multiple blocks per frame.

Block 2

OH YEAH!

Code

```
\begin{frame}  
  \begin{block}{Block 1}  
    You can have multiple blocks per frame.  
  \end{block}  
  \begin{block}{Block 2}  
    OH YEAH!  
  \end{block}  
\end{frame}
```


A very exciting command

You can create suspense using

A very exciting command

You can create suspense using the `\pause` command.

A very exciting command

You can create suspense using the `\pause` command.

Code

```
\begin{frame}  
\begin{block}{Suspense}  
You can create suspense using \pause  
the \cm{pause} command.  
\end{block}  
\end{frame}
```

A very exciting command

You can create suspense using the `\pause` command.

Code

```
\begin{frame}  
\begin{block}{Suspense}  
You can create suspense using \pause  
the \cm{pause} command.  
\end{block}  
\end{frame}  
% BTW I defined a newcommand cm  
% to avoid too much redundancy
```

Code

```
\begin{frame}  
\begin{block}{Math mode}  
Math mode is still pretty much the same.  
$$  
E:  $y^2 = x^3 + ax + b$   
$$  
\end{block}
```

Code

```
\begin{frame}  
\begin{block}{Math mode}  
Math mode is still pretty much the same.  
$$  
E: y^2 = x^3 + ax + b  
$$  
\end{block}
```

Math mode

Math mode is still pretty much the same.

$$E : y^2 = x^3 + ax + b$$

You can change colors!

You can change colors!

You can change colors!

You can change colors!

Code

```
\begin{frame}  
You can change \color<1>{black}  
\color<2>{red}\color<3>{blue}  
colors!  
\end{frame}
```

includegraphics

- We introduce the `\includegraphics` command.

includegraphics

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- This is a command defined in the `graphicx` package and hence we need to put `\usepackage{graphicx}` in the preamble.
- The `\includegraphics` command takes an optional argument.

includegraphics

- We introduce the `\includegraphics` command.
- This is a command defined in the `graphicx` package and hence we need to put `\usepackage{graphicx}` in the preamble.
- The `\includegraphics` command takes an optional argument. You can set the width of the image with respect to the text width.

Code

```
WE WANT CHANGE!\\  
\includegraphics[width=0.3\textwidth]{chang.jpg}
```

Code

```
WE WANT CHANGE!\\  
\includegraphics[width=0.3\textwidth]{chang.jpg}
```

WE WANT CHANGE!



Thank you for listening!