

# Introduction to LaTeX

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# Hello, world

The simplest document written in LaTeX looks like this:

```
\documentclass[a4paper, 12pt]{article}
```

```
\begin{document}
```

```
  Hello world!
```

```
\end{document}
```

# The simplest formulas

I know for sure that  $2+2=4$

I know for sure that  $\{2+2=4\}$

**I know for sure that  $2 + 2 = 4$**

**I know for sure that**

$$2 + 2 = 4$$

# The simplest formulas

`\command`, `\command{arg}`, `\command[opt_arg]{arg1}{arg2}`

```
\[\int_{-\infty}^{\infty} e^{-\frac{x^2}{2}} dx = \sqrt{2 \pi}\]
```

$$\int_{-\infty}^{+\infty} e^{-\frac{x^2}{2}} dx = \sqrt{2\pi}$$

# Indexes

The upper and lower indexes are generated as follows:

```
\[x_n, x^k, x_n^k, x^k_n, x_{i+j}^{2024}\]
```

$$x_n, x^k, x_n^k, x_n^k, x_{i+j}^{2024}$$

# Greek letters

The upper and lower indexes are generated as follows:

```
\\alpha, \\beta, \\Gamma, \\Delta, \\Omega, \\epsilon, \\xi, \\phi\\
```

$\alpha, \beta, \Gamma, \Delta, \Omega, \epsilon, \xi, \phi$

# Binary operations

`\times` ( $\times$ ), `\ge` ( $\geq$ ), `\cong` ( $\cong$ ), `\oplus` ( $\oplus$ ), `\sim` ( $\sim$ )

$$\left[\frac{\frac{1}{2} + \frac{3}{4}}{\frac{1}{8}} = \frac{5}{4} \cdot 8 = 10\right]$$

$$\frac{\frac{1}{2} + \frac{3}{4}}{\frac{1}{8}} = \frac{5}{4} \cdot 8 = 10$$

# Operators

`$\sin x$`, `$$\mathrm{sin}{x}$$`, `$$\sin{x}$$`

*$\sin x$* ,  $\sin x$ ,  $\sin x$



# Brackets

`\left(\frac{\pi}{2}\right),`

`\big(\frac{\pi}{2}\big),`

`\bigg(\frac{\pi}{2}\bigg),`

`\left(\frac{\pi}{2}\right),`

`\left\{\frac{\pi}{2}\right\},`

`\left[\frac{\pi}{2}\right]`

$$\left(\frac{\pi}{2}\right), \big(\frac{\pi}{2}\big), \bigg(\frac{\pi}{2}\bigg), \left(\frac{\pi}{2}\right), \left\{\frac{\pi}{2}\right\}, \left[\frac{\pi}{2}\right]$$

# Document structuring

```
\section{My section}
```

```
\subsection{My subsection}
```

```
\dots % Usually, two levels of nesting are enough.
```

```
\subsection*{Subsection, but without a number}
```

```
\dots % Such commands can be used as subheadings.
```

```
\subsubsection{Another subsection with a number}
```

```
\dots % The numbering will not be broken!
```

# Text style

Using commands:

```
\textbf{Bold}, \textit{italic}, regular.
```

**Bold**, *italic*, regular.

Using scopes and modifiers:

```
{\bfseries \itshape is highlighted here}, but not here.
```

***is highlighted here***, but not here.

# Size and font

`{\Large Large text}`, smaller text, `{\small very small}`

**Large text**, smaller text, very small

Modifier	Command	Result
<code>\rmfamily</code>	<code>\textrm{ }</code>	<b>Font</b>
<code>\sffamily</code>	<code>\textsf{ }</code>	<b>Font</b>
<code>\ttfamily</code>	<code>\texttt{ }</code>	<b>Font</b>
<code>\scshape</code>	<code>\textsc{ }</code>	<b>FONT</b>

# The simplest environments

```
\begin{center}
```

This text will be centered.

```
\end{center}
```

```
\begin{flushright}
```

And this one is shifted to the right.

```
\end{flushright}
```

This text will be centered.

And this one is shifted to the right.

# Theorems

```
\usepackage{amsthm}
\theoremstyle{plain}
\newtheorem{theorem}{Theorem}
\newtheorem{lemma}{Lemma}

\begin{lemma} 1 + 1 = 3. \end{lemma}

\begin{theorem} 2 + 2 = 5. \end{theorem}
```

**Lemma 1.**  $1 + 1 = 3.$

**Theorem 1.**  $2 + 2 = 5.$

# Indentation

Horizontal `\hspace{10pt}`indentation

Vertical

`\vspace{15pt}` indentation

left `\hfill` right

Horizontal indentation

Vertical

indentation

left

right

# Switching to a new line

A body remains at rest, or in motion  
at a constant speed in a  
straight line, except insofar as it is  
acted upon by a force

A body remains at rest, or in motion at a  
constant speed in  
a straight line, except insofar as it is acted upon  
by a force



# Creating tables

```
\begin{tabular}{|| c | c || r | l ||}  
1 & x & aligned & aligned \\  
\hline  
y & x & to the right & to the left  
\end{tabular}
```

1	x	aligned	aligned
y	x	to the right	to the left

# Inserting images

```
\usepackage{graphicx}
\graphicspath{ {./images/} }
\includegraphics{meme}
\includegraphics[scale=0.2]{images/meme.jpg}
\includegraphics[width=5cm, height=4cm]{images/meme.jpg}
```

# Creating commands

```
\usepackage{amsfonts,amsmath,amssymb,amsthm}
```

```
\newcommand{\deriv}[2]{\frac{\partial #1}{\partial #2}}
```

```
\newcommand{\R}{\mathbb R}
```

```
\[\forall x, y \in \R: df(x, y) = \deriv{f}{x}(x, y)dx + \deriv{f}{y}(x, y)dy\]
```

$$\forall x, y \in \mathbb{R} : df(x, y) = \frac{\partial f}{\partial x}(x, y)dx + \frac{\partial f}{\partial y}(x, y)dy$$

# Redefining commands

```
\renewcommand{\phi}{\varphi}
```

```
\renewcommand{\epsilon}{\varepsilon}
```

```
{\phi, \epsilon}
```

$\varphi, \varepsilon$

# Operators

```
\DeclareMathOperator{\Ker}{Ker}
\DeclareMathOperator{\Im}{Im}
\[\dim \Ker \phi + \dim \Im \phi = \dim V]
```

$$\dim \operatorname{Ker} \phi + \dim \operatorname{Im} \phi = \dim V$$

# Numbered and bulleted lists

```
\begin{itemize}
```

```
\item The first item
```

```
\item The second item
```

```
\end{itemize}
```

```
\begin{enumerate}
```

```
\item The first item with a number \item The second item with a number
```

```
\end{enumerate}
```

- The first item

- The second item

1. The first item with a number

2. The second item with a number

# Numbering of formulas

Commutativity:

```
\begin{equation}
```

$$xy = yx.$$

```
\end{equation}
```

Commutativity:

```
\begin{align}
```

$$xy \neq yx, \ \backslash$$
$$ab \neq ba.$$

```
\end{align}
```

# Numbering managment

```
\[F = \frac{dp}{dt} \tag{III ZN} \]
```

$$F = \frac{dp}{dt} \quad (\text{III})$$



Thank you for your attention!