

# What is LaTeX?

LaTeX is a typesetting system that is widely used for creating documents with complex mathematical equations and formulas. It provides a high level of control over document formatting and produces professionally typeset output. LaTeX is popular among academics, scientists, and researchers for writing scientific papers, presentations, and technical documents.





# Creating a Document with LaTeX/LibreOffice

```
\documentclass{article}

% You can also use "book" class for a book-like format

% Preamble: Packages and settings \usepackage{lipsum}

% For generating dummy text \title{Sample LaTeX Document} \author{Your Name}
% \date{\today}

\begin{document}

% Title, author, date \maketitle

% Preface/Abstract section

\begin{abstract} This is a sample document demonstrating the structure of a LaTeX document using the article class. \end{abstract}

% Section 1 \section{Introduction} LaTeX is a typesetting system commonly used for the production of scientific and mathematical documents due to its powerful handling of formulas and references.

% Section 2 \section{Main Content} Here is some random text generated using the \texttt{lipsum} package: \lipsum[1-3].

% Section 3 \section{Comments in LaTeX} % This is a comment. It won't be shown in the compiled document. Comments in LaTeX are denoted by the percentage symbol.

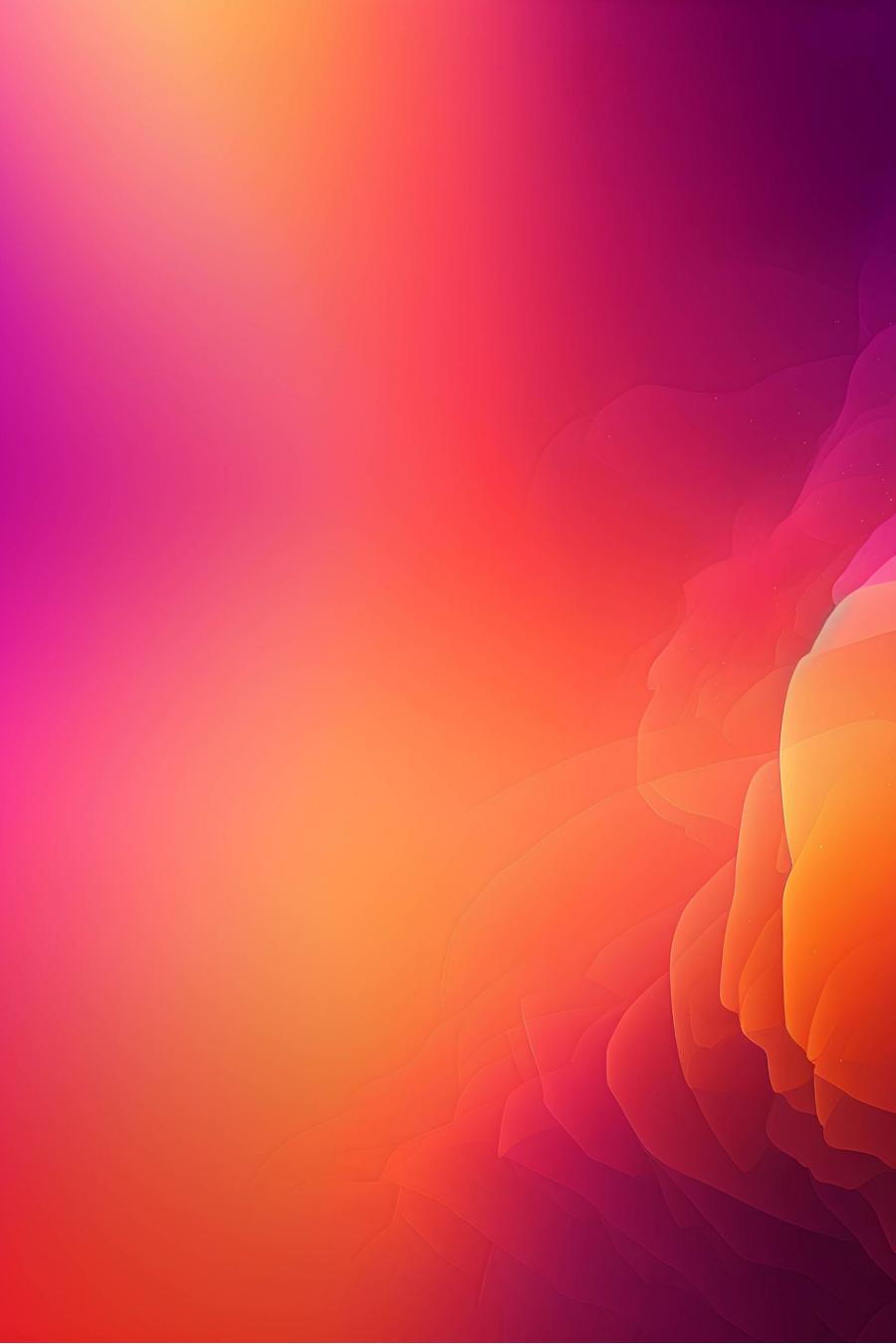
% Section 4 \section{Handling Errors} \LaTeX{} will provide error messages if there are issues with your code. It's important to read these messages carefully and fix the errors.

% Section 5 \section{Conclusion} In conclusion, LaTeX is a versatile typesetting system that allows for the creation of professional-looking documents with ease.

\end{document}
```

## Features of LaTeX

- Mastering mathematical equations and symbols to produce accurate and visually appealing content.
- Efficient bibliography management for academic and research papers.
- Creating tables and figures with precision and customization.



# PACKAGES:

```
\usepackage [options] {pkgs}
```

`pkgs` A list of packages to be loaded. The standard packages include:

- `amsmath` for enhanced mathematical formatting and features.
- `graphicx` for including and manipulating images in your document.
- `amstex` for advanced mathematical formulas and features.

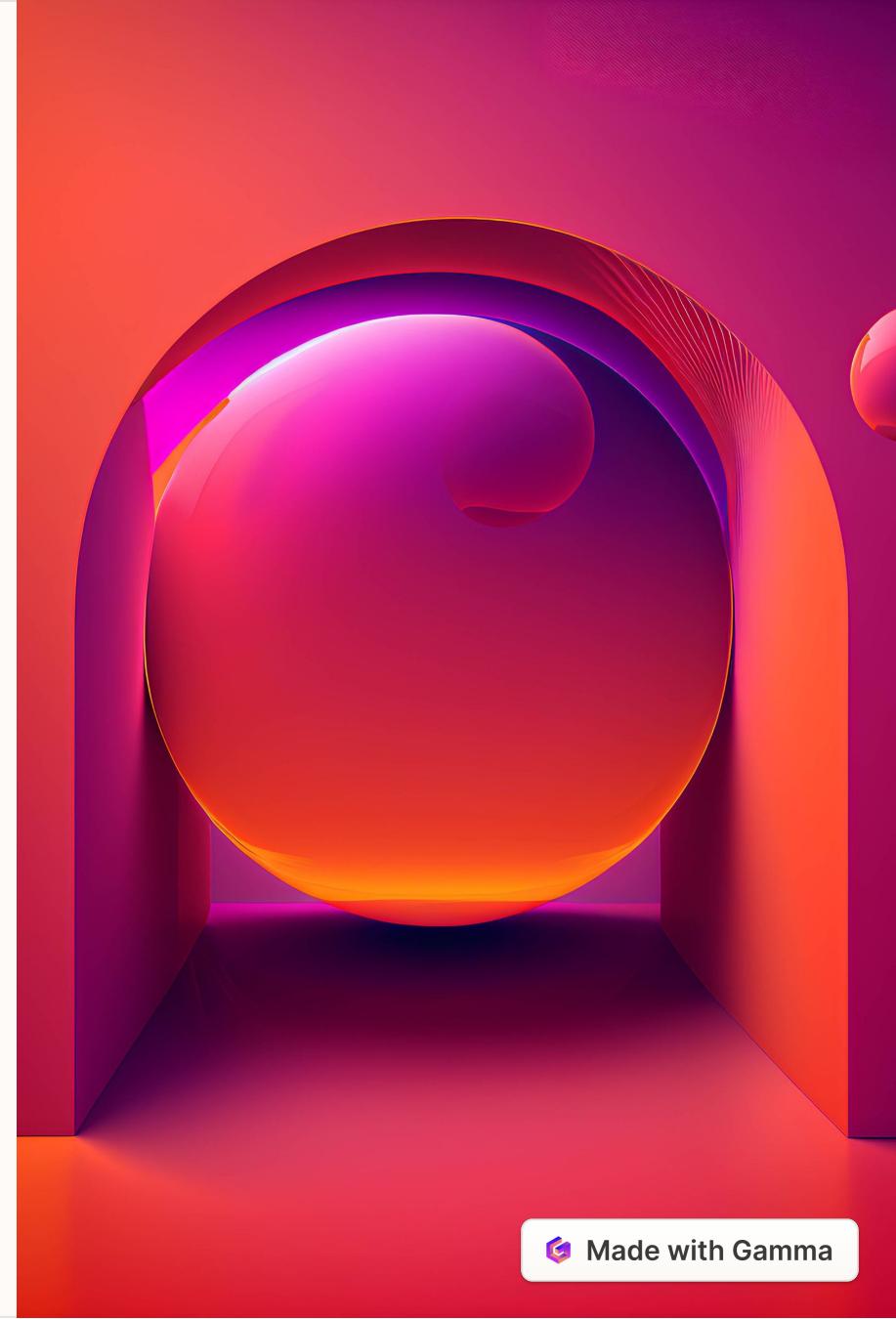


# Setting margins

In LaTeX, margins refer to the blank spaces around the edges of a page. They define the distance between the text or content and the page borders. The primary parameters that control margins are:

**\textwidth:** This parameter defines the width of the text block. It determines how much space is available for the actual content of the document horizontally. By changing this parameter, you can adjust the width of the text to your liking.

**\textheight:** This parameter defines the height of the text block. It determines how much space is available for the actual content of the document vertically. By changing this parameter, you can adjust the height of the text to your liking.



# Headers and Footers in LATEX

Headers and footers in LaTeX can be customized to include information such as page numbers, chapter or section titles, and even custom text or graphics.

## Default article class headers and footers:

```
\documentclass{article}
% Choose a conveniently small page size
\usepackage[paperheight=16cm,paperwidth=12cm,textwidth=10cm]{geometry}
\usepackage{lipsum}% for some dummy text
\title{An article class example}
\author{Overleaf}
\begin{document}
\maketitle

\section{In the beginning...}
\lipsum[2]

\section{Another section}
\lipsum[1]

\section{Yet another}
\lipsum[1]
```

# Organizing a document into multiple columns

One way to organize a document into multiple columns in LaTeX is by using the "multicol" package. This package provides the "multicols" environment, which allows for easy creation of multiple columns. To use this package, you will need to include the line "\usepackage{multicol}" in the preamble of your LaTeX document.

```
\documentclass{article}
\usepackage{blindtext}
\usepackage{multicol}
\title{Multicols Demo}
\author{Overleaf}
\date{April 2021}

\begin{document}
\maketitle

\begin{multicols}{3}
[
\section{First Section}
All human things are subject to decay. And when fate summons, Monarchs must obey.
]
\blindtext\blindtext
\end{multicols}

\end{document}
```

# OUTPUT:

## Multicols Demo

Overleaf

April 2021

### 1 First Section

All human things are subject to decay. And when fate summons, Monarchs must obey.

  Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat.

  Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vi-

  vamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

# Designing:-

## Formatting text

### Bold:-

Use the `\textbf{}` command in LaTeX to make text bold. This can be used for emphasizing important information or headings in your document.

### Italic:-

To italicize text in LaTeX, use the `\textit{}` command. Italicized text can be useful for indicating titles, foreign words, or emphasis within a document.

### Underline:-

To underline text in LaTeX, you can use the `\underline{}` command. However, it is not recommended to use underlining in professional documents as it can be visually distracting.

### Emphasize:-

Another way to emphasize text in LaTeX is by using the `\emph{}` command. This command not only changes the font style, but also adjusts the spacing around the emphasized text to give it more prominence within the document. It is often preferred over underlining for highlighting text.

## Adding colours to a block of text/ page

To add color to a block of text or page in LaTeX, you can use the `\colorbox{}` command. This command allows you to specify the desired color and apply it to the text or page element. Color can be a great way to visually distinguish and highlight important information in your document.

# Inserting mathematical expressions – subscripts, superscripts, fractions, binomials...

To insert mathematical expressions with subscripts, superscripts, fractions, binomials, and other symbols in LaTeX, you can use various mathematical environments and commands.

## Subscripts:-

To add subscripts to your mathematical expressions in LaTeX, you can use the underscore (\_) character followed by the subscript text. For example, to write "x sub 1", you can write "x\_1" in your LaTeX document.

For superscripts, you can use the caret (^) character followed by the superscript text. For example, to write "x to the power of 2", you can write "x^2" in your LaTeX document.

To add fractions, you can use the \frac command followed by the numerator and denominator enclosed in curly brackets. For example, to write the fraction "1/2", you can write "\frac{1}{2}" in your LaTeX document.

For binomial coefficients, you can use the \binom command followed by the two values inside curly brackets. For example, to write "n choose k", you can write "\binom{n}{k}" in your LaTeX document.

## Superscripts:-

To write superscripts in LaTeX, you can use the caret (^) character followed by the superscript text. For example, to write "x to the power of 2", you can write "x^2" in your LaTeX document. You can also use curly brackets to include multiple characters in the superscript, such as "x^{2a+1}" to represent "x raised to the power of 2a+1".

Example:

```
\[ (a^n)^{r+s} = a^{nr+ns} \]
```

Output:

$$(a^n)^{r+s} = a^{nr+ns}$$

## Fractions:-

To write fractions in LaTeX, you can use the "\frac" command followed by the numerator and denominator separated by a comma inside a pair of curly brackets. For example, to write "1/2", you can write "\frac{1}{2}" in your LaTeX document. You can also use the shorthand notation for fractions such as "\frac12" to represent the same.

## Binomials:-

To write binomials in LaTeX, you can use the "\binom" command followed by the two expressions separated by a comma inside a pair of curly brackets. For example, to write a binomial coefficient such as "n choose k", you can write "\binom{n}{k}" in your LaTeX document. This will generate the binomial coefficient symbol and properly format it.

## Aligning Equations:-

To align equations in LaTeX, you can use the "align" environment. Within this environment, you can use the "&" symbol to indicate the point of alignment. For example, to align multiple equations at the equal sign, you can write:

```
\begin{align} 3x + 2y &= 10 \\ 2x - y &= 5 \end{align}
```

This will align the equations at the equal sign and display them with proper spacing.

## Operators:-

LaTeX supports a wide range of mathematical operators that can be used in equations such as summation, integration, and limits. These operators can be added to your LaTeX document using specific commands such as "\sum", "\int", and "\lim". By using these commands, you can easily add these operators to your equations with the correct formatting.

## Greek and mathematical symbols:-

In addition to mathematical operators, LaTeX also supports Greek letters and other mathematical symbols. You can use commands such as "\alpha", "\beta", and "\gamma" to insert Greek letters into your document. Similarly, you can use commands like "\infty", "\forall", and "\Rightarrow" to insert symbols representing infinity, universal quantification, and implication, respectively. These symbols can help you express complex mathematical concepts in a concise and precise manner.

## Mathematical Fonts:-

LaTeX provides a variety of mathematical fonts that can be used to enhance the presentation of mathematical equations. These fonts are designed specifically for mathematical notation and provide a professional and polished look for your equations. Some commonly used mathematical fonts in LaTeX include mathbb, mathcal, and mathscr. You can easily use these fonts by enclosing the text in the respective command and applying appropriate formatting.

# Creating lists in LATEX

An environment starts with `\begin{environment-name}` and ends with `\end{environment-name}` where `environment-name` might be `figure`, `tabular` or one of the list types: `itemize` for unordered lists or `enumerate` for ordered lists.

## Unordered lists

Unordered lists are produced by the `itemize` environment. Each list entry must be preceded by the `\item` command, as shown below:

```
\documentclass{article}
\begin{document}
\begin{itemize}
\item The individual entries are indicated with a black dot, a so-called bullet.
\item The text in the entries may be of any length.
\end{itemize}
\end{document}
```

This example produces the following output:

- The individual entries are indicated with a black dot, a so-called bullet.
- The text in the entries may be of any length.

## Ordered lists

Ordered lists use the same syntax as unordered lists but are created using the `enumerate` environment:

```
\documentclass{article}
\begin{document}
\begin{enumerate}
\item This is the first entry in our list.
\item The list numbers increase with each entry we add.
\end{enumerate}
\end{document}
```

This example produces the following output:

1. This is the first entry in our list.
2. The list numbers increase with each entry we add.

As with unordered lists, each entry must be preceded by the `\item` command which, here, automatically generates the numeric ordered-list label value, starting at 1.

# Tables and Figures:

To create tables in LaTeX, you can use the "tabular" environment. This environment allows you to specify the number of columns, alignment, and content of each cell. You can also add borders and adjust the size of the table.

## Tables:

The tabular environment is the default LATEX method to create tables. You must specify a parameter to this environment; here we use {c c c} which tells LaTeX there are three columns and the text inside each one of them must be centred.

The tabular environment provides additional flexibility; for example, you can put separator lines in between each column:

```
\begin{center}
\begin{tabular}{|c|c|c|}
\hline
cell1 & cell2 & cell3 \\
cell4 & cell5 & cell6 \\
cell7 & cell8 & cell9 \\
\hline
\end{tabular}
\end{center}
```

cell1	cell2	cell3
cell4	cell5	cell6
cell7	cell8	cell9

## Combining rows and columns

Rows and columns can be merged to create larger table cells. The following example uses the \multicolumn command to merge several columns:

```
\documentclass{article}
\usepackage{multirow}
\begin{document}
\begin{tabular}{|p{3cm}||p{3cm}|p{3cm}|p{3cm}|}
\hline
\multicolumn{4}{|c|}{Country List} \\
\hline
Country Name or Area Name& ISO ALPHA 2 Code &ISO ALPHA 3 Code&ISO numeric Code\\
\hline
Afghanistan &AF &AFG& 004\\
Aland Islands& AX &ALA &248\\
Albania &AL &ALB& 008\\
Algeria &DZ &DZA& 012\\
American Samoa& AS &ASM&016\\
Andorra&AD &AND &020\\
Angola&AO &AGO&024\\
\hline
\end{tabular}
\end{document}
```

Country List				
Country Name or Area Name	ISO Code	ALPHA 2	ALPHA 3	ISO numeric Code
Afghanistan	AF	AFG		004
Aland Islands	AX	ALA		248
Albania	AL	ALB		008
Algeria	DZ	DZA		012
American Samoa	AS	ASM		016
Andorra	AD	AND		020
Angola	AO	AGO		024

## Figures:

Latex can not manage images by itself, so we need to use the graphicx package. To use it, we include the following line in the preamble: \usepackage{graphicx}.

```
\documentclass{article}
\usepackage{graphicx}
\graphicspath{ {./images/} }

\begin{document}
The universe is immense and it seems to be homogeneous,
in a large scale, everywhere we look at.

```

```
\includegraphics{universe}
```

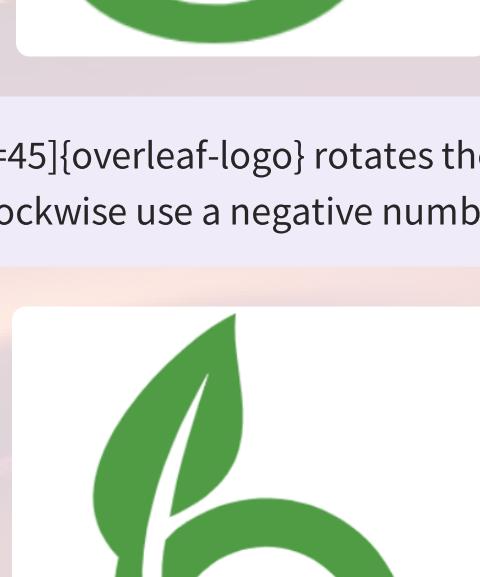
There's a picture of a galaxy above

```
\end{document}
```

The universe is immense and it seems to be homogeneous, in a large scale, everywhere we look at.



There's a picture of a galaxy above



```
\includegraphics[scale=1.5]{overleaf-logo} will include the image overleaf-logo in the document,
the extra parameter scale=1.5 will do exactly that, scale the image 1.5 of its real size.
```

