

# LATEX BASICS

LaTeX is a markup language used to create scientific documentation.

## Document Structure

```
% Basic document structure
\documentclass{article} % Defines document type
\usepackage{amsmath}    % For advanced math features
\usepackage{graphicx}    % For including images

\title{Document Title}
\author{Author Name}
\date{\today}

\begin{document}
\maketitle

\section{Introduction}
This is the introduction.

\subsection{Subsection}
This is a subsection.

\end{document}
```

## Text Formatting

```
% Text formatting commands
\textbf{Bold Text}      % Bold formatting
\textit{Italic Text}    % Italic formatting
\underline{Underlined}  % Underlined text
\emph{Emphasized}       % Emphasized text (usually italic)
```

```
% Special text environments
\begin{verbatim}
Verbatim text exactly as typed
\end{verbatim}
```

## Lists

```
% Bullet point list
\begin{itemize}
  \item First item
  \item Second item
  \item Third item
\end{itemize}

% Numbered list
\begin{enumerate}
  \item First item
  \item Second item
  \item Third item
\end{enumerate}

% Description list
\begin{description}
  \item[Term] Description of term
  \item[Another] Another description
\end{description}
```

## Comment

```
% This is a comment
```

## Basic Notation

```
%Brackets
( )
[ ]
%addition sign
+
%substration sign
-
%multiplication sign
\times
\cdot
%division signs
/
:
% make a fraction
\frac{numerator}{denominator}
% inverse sign
^{-1}
%plus minus sign
\pm
%minus plus sign
\mp
%square root
\sqrt{}
%cube root
\sqrt[3]{}
%nth root
\sqrt[n]{}
%percent
\%
```

## Number sets

For futher explanation visit : [Mathématiques ensembles des nombres.](#)

```
% ensemble des entiers naturels
\mathbb{N}
% ensemble des entiers relatifs
\mathbb{Z}
% ensemble des décimaux
\mathbb{D}
% ensemble des rationnels
\mathbb{Q}
% ensemble des réels
\mathbb{R}
% ensemble des complexes
\mathbb{C}
% ensemble des quaternions
\mathbb{H}
% ensemble des octonions
\mathbb{O}
% ensemble des sédénions
\mathbb{S}
% ensemble des pathions
\mathbb{P}
% ensemble des chingons
\mathbb{X}
% ensemble des routons
\mathbb{U}
% ensemble des voudrons
\mathbb{V}
```

## Quantifiers

```
% forall
\forall
%it exists
\exists
%does not exist
\nexists
```

## Set construction

```
% Empty set  
\varnothing
```

## Set operations

```
%intersection  
\cap  
%union  
\cup  
%difference  
\setminus
```

## Figures and Tables

```
% Figure environment  
\begin{figure}[h]  
  \centering  
  \includegraphics[width=0.5\textwidth]{image.png}  
  \caption{Figure caption}  
  \label{fig:example}  
\end{figure}  
  
% Table environment  
\begin{table}[h]  
  \centering  
  \caption{Table caption}  
  \begin{tabular}{|c|c|c|c|}  

```

```

\hline
Header 1 & Header 2 & Header 3 \\
\hline
Data 1 & Data 2 & Data 3 \\
\hline
\end{tabular}
\label{tab:example}
\end{table}

```

## Mathematical Environments

```

% Numbered equation
\begin{equation}
E = mc^2
\label{eq:emc}
\end{equation}

% Aligned equations
\begin{align}
a &= b + c \\
d &= e + f + g \\
h &= i + j
\end{align}

% Inline math: $E = mc^2$
% Display math: \[ E = mc^2 \]

```

## References and Citations

```

% Cross-references
See Figure~\ref{fig:example} and Table~\ref{tab:example}.
Equation~\ref{eq:emc} shows the mass-energy equivalence.

% Citations

```

```
This was proven by Einstein~\cite{einstein1905}.
```

```
% Bibliography (in preamble)
```

```
\usepackage{natbib}
```

```
\bibliographystyle{plain}
```

```
% Bibliography entries
```

```
\begin{thebibliography}{9}
```

```
\bibitem{einstein1905}
```

```
  A. Einstein,
```

```
  \emph{On the Electrodynamics of Moving Bodies},
```

```
  Annalen der Physik, 1905.
```

```
\end{thebibliography}
```

## Useful Packages

```
% Essential packages
```

```
\usepackage{amsmath}
```

```
% Advanced math typesetting
```

```
\usepackage{graphicx}
```

```
% Including graphics
```

```
\usepackage{hyperref}
```

```
% Hyperlinks and PDF metadata
```

```
\usepackage{geometry}
```

```
% Page layout control
```

```
\usepackage{url}
```

```
% URL typesetting
```

```
% Additional useful packages
```

```
\usepackage{amsfonts}
```

```
% Additional math fonts
```

```
\usepackage{amssymb}
```

```
% Math symbols
```

```
\usepackage{xcolor}
```

```
% Color support
```

```
\usepackage{listings}
```

```
% Code listings
```

```
\usepackage{tabularx}
```

```
% Extended table features
```

## Footnotes and Margin Notes

```
% Footnotes
```

```
This is some text with a footnote\footnote{This is the footnote t
```

```
% Margin notes
```

```
This text has a margin note\marginpar{Note in the margin}.
```

## Footnotes and Margin Notes

```
% Logical symbols
```

```
\forall      % Universal quantifier
```

```
\exists, \exist % Existential quantifier
```

```
\in, \isin    % Element of
```

```
\notin        % Not element of
```

```
\complement   % Complement
```

```
% Set operations
```

```
\subset       % Subset
```

```
\emptyset, \empty % Empty set
```

```
\mid         % Such that or divides
```

```
% Logical operators
```

```
\land        % Logical AND
```

```
\lor         % Logical OR
```

```
\neg, \not   % Logical NOT
```

```
% Arrows and implications
```

```
\mapsto      % Maps to
```

```
\to          % Right arrow
```

```
\gets        % Left arrow
```

```
\leftrightharpoon % Left-right arrow
```

```
\implies     % Implies
```

```
\iff         % If and only if
```

```
\therefore   % Therefore
```

```
\because     % Because
```

```
% Set notation examples
```

```
\{x \mid x < \tfrac{1}{2}\}
```

```
\set{x \mid x < 5}
```



# LaTeX Mathematical Symbols Cheat Sheet

```
% LaTeX Mathematical Symbols Reference
% Common symbols and their LaTeX commands
```

```
% Quantifiers
```

```
∀   \forall      % For all
∃   \exists      % There exists
∄   \nexists     % There does not exist
```

```
% Set Theory
```

```
∈   \in          % Element of
∉   \notin       % Not element of
∅   \emptyset    % Empty set
∅   \varnothing  % Alternative empty set
⊂   \subset       % Subset
⊃   \complement  % Complement
```

```
% Logic Operators
```

```
∧   \land        % Logical and
∨   \lor         % Logical or
¬   \neg         % Logical not
¬   \not         % Alternative not
```

```
% Arrows and Implications
```

```
→   \to          % Right arrow
→   \implies     % Implies
←   \gets        % Left arrow
↔   \leftrightharpoon % Left-right arrow
↔   \iff         % If and only if
↦   \mapsto      % Maps to
```

```
% Set Notation Examples
```

```
\[ \{x \mid x < \tfrac{1}{2}\} \]      % Set with mid bar
\set{x \mid x < \tfrac{1}{2}}         % Alternative set notation
\{x \mid x < 5\}                      % Simple set
```

```
\set{x \leq 5}
```

```
% Alternative simple se
```

## LaTeX Dirac Bra-Ket Notation

```
% Dirac Bra-Ket Notation for Quantum Mechanics
```

```
% Requires \usepackage{braket} in preamble
```

```
% Basic Bra-Ket Notation
```

```
(| \bra{\phi} % Bra vector
```

```
|) \ket{\psi} % Ket vector
```

```
( | ) \braket{\phi | \psi} % Bra-ket inner product
```

```
% Scaled Bra-Ket Notation
```

```
( | \Bra{\phi} % Scaled bra vector
```

```
| ) \Ket{\psi} % Scaled ket vector
```

```
% Matrix Elements and Expectation Values
```

```
( \phi | A | \psi ) % Matrix element
```

```
\bra{\phi} A \ket{\psi} % Alternative matrix element
```

```
\braket{\phi | A | \psi} % Expectation value notation
```

```
% Complex Bra-Ket Example
```

```
( \phi | \frac{\partial^2}{\partial t^2} | \psi ) % Operator be
```

```
\Braket{ \phi | \frac{\partial^2}{\partial t^2} | \psi } % Scaled
```

```
% Note: The braket package provides proper spacing and scaling
```

```
% for quantum mechanical notation in LaTeX
```

## LaTeX Relation Symbols

```
% LaTeX Relation Symbols and Operators
```

```
% Mathematical relation symbols and their LaTeX commands
```

## % Equality and Equivalence

= % Equals  
`\equiv` % Equivalent  
`\fallingdotseq` % Falling dots equal  
`\eqcirc` % Equal with circle  
`\eqcolon` % Equal colon (or `\minuscolon`)  
`\eqqcolon` % Equal colon colon (or `\equalscolon`)  
`\eqsim` % Equal similar  
`\Equiv` % Equivalent (typo corrected: should be `\equiv`)

## % Inequality Relations

< % Less than  
> % Greater than  
`\ll` % Much less than  
`\gg` % Much greater than  
`\lessapprox` % Less approximately  
`\lesseqgtr` % Less equal greater  
`\lesseqqgtr` % Less equal equal greater  
`\lessgtr` % Less greater  
`\lesssim` % Less similar  
`\ggg` % Much much greater than  
`\gggtr` % Much greater than (alternative)

## % Subset and Superset Relations

`\subset` % Subset (or `\sub`)  
`\subseteq` % Subset or equal (or `\sube`)  
`\Subset` % Double subset  
`\supset` % Superset  
`\supseteq` % Superset or equal (or `\supe`)  
`\Supset` % Double superset  
`\sqsubset` % Square subset  
`\sqsupset` % Square superset

## % Order Relations

`\prec` % Precedes  
`\precapprox` % Precedes approximately  
`\preccurlyeq` % Precedes curly equal  
`\preceq` % Precedes or equal  
`\precsim` % Precedes similar  
`\succ` % Succeeds

```
\succapprox % Succeeds approximately
\succcurlyeq % Succeeds curly equal
\succeq      % Succeeds or equal
\succsim     % Succeeds similar

% Other Relations
\approx      % Approximately equal
\thickapprox % Thick approximately equal
\parallel    % Parallel
\perp        % Perpendicular
\pitchfork   % Pitchfork
\models      % Models
\vDash       % Double vertical bar equals
\Vdash       % Double vertical bar dash
\vdash       % Vertical bar dash
\asymp       % Asymptotically equal
\bowtie      % Bowtie
\Join        % Join
```