

LaTeX for beginners

An introduction to T_EX and L^AT_EX

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Support documents at <https://www.edpif.org/documents/latex/beginners/>

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About commands

Commands in \LaTeX can be :

- \backslash followed by a single non-letter symbol :
 - Reserved characters preceded by a backslash, $\backslash\%$ gives %;
 - $\backslash_$ inserts an explicit space; $\backslash\!$ inserts a line-break (w optional space);
 - $\backslash,$, $\backslash!$, $\backslash>$, $\backslash:$, $\backslash;$, $\backslash/$ are spacing commands, see below.;
 - Diacritics can be entered as (avoid for western European languages):

cmd	\backslash'	$\backslash\grave{}$	$\backslash\^{}{}$	$\backslash"$	$\backslash\H$	$\backslash\sim$	$\backslash\c$	$\backslash\k$	$\backslash=$	$\backslash\mathfrak{b}$	$\backslash.$	$\backslash\mathrm{d}$	$\backslash\mathrm{r}$	$\backslash\mathrm{u}$	$\backslash\mathrm{v}$	$\backslash\mathrm{t}$
result	ò	ó	ô	ö	õ	õ	ç	ą	ō	◌̲	◌̇	◌̈	ă	ö	š	ô
 - $\backslash($ and $\backslash)$ delimit “inline” maths; $\backslash[$ and $\backslash]$ delimit “display” maths;
- \backslash followed by any string made from ASCII letters (a-z and A-Z).
 - They are case-sensitives : $\backslash\text{large}$ is not $\backslash\text{Large}$.
 - Digits are (usually) excluded, so $\text{\$}\backslash\text{sqrt}\{2\}\text{\$}=\text{\$}\backslash\text{sqrt}2\text{\$}\rightarrow\sqrt{2}$.
 - The @ char only in .sty files or inside $\backslash\text{makeatletter}\dots\backslash\text{makeatother}$.
- Special *active* characters (catcode 13) like \sim (see Babel section).

About declarations

- “Declarations” define settings (for formatting or sectioning, etc.) without printing any text. Examples: `\pagestyle{headings}`, `\large`, `\bfseries`, etc..
- Others commands operate on a given content (explicit or not) and print it according to their meaning. Examples: `\tableofcontents`, `\textbf{Some bold text}`, `\section[short title]{Long title of the first section}`.
- Both kinds can have none, one or several arguments. Usually optional argument are given before mandatory argument. Mandatory can sometimes be empty groups `{}` , but generally a meaningful value is expected. Example : `\section{}` is valid, `\pagestyle{}` isn't.
- Some declaration are global for the document and will generally be declared in the preamble. Some other are local to the enclosing group. `{\bfseries\small a text} \& another` → **a text** & another

Using counters

\TeX and \LaTeX use many **counters**, mostly for the numbering of (chapters) sections and children, pages, figures, equations, enumi, etc.

- Counters are *integers* only, between $2^{31} - 1$ and -2^{31} .
- A counter **cntname** is created by `\newcounter{cntname}` (no `\`); `\newcounter{cntname}[othercntname]` also request that is reset each time **othercntname** is increased. Initial value is 0.
- An existing counter can be modified by:
 - set to specified **value** : `\setcounter{cntname}{value}`
 - increment `\stepcounter{cntname}`
 - increment with label creation `\refstepcounter{cntname}`
 - add **incr** to present value `\addtocounter{cntname}{incr}`
 - `\resetcounter{cntname}` : set to zero
- The value of a counter can be printed with the macro `\the cntname`

For example, the command `\section` automatically does `\stepcounter{section}` (which reset the counters **subsection** and children, and also **equation**, **figure** etc. and then use `\thesection`.

Using lengths

- Length are defined in various units (internal length `|sp|` is very small !)

cm	mm	in	pt	em	ex	sp
0.394 pt	3.94 pt	25.4 mm	1/72.27 in	length(M)	height(x)	5.36 μ m

& bp, pc, dd, cc, nd, nc, cf. <https://en.wikibooks.org/wiki/LaTeX/Lengths>

- Definition and setting of lengths : `\newlength{\myln}`,
`\setlength{\myln}{12pt}`, `\addtolength{\myln}{-5cm}`,
`\settowidth{\myln}{some text}`.
- Many length are defined as “rubber length” :
`\setlength{\parskip}{1ex plus0.5ex minus0.2ex}`
- Useful predefined lengths : `\textheight`, `\textwidth`, `\linewidth`,
`\baselineskip`, `\parskip`, `\topskip`, `\parindent`, `\itemindent`
- Example: to see `\linewidth` do: `\the\linewidth` \rightarrow 320.53526pt
- Length can be multiplied by literal numbers, like `0.5\linewidth`.
- With `calc` : operations like `2cm-4pt` or `\widthof{blah}*real{0.6}`.
- `\dimexpr\linewidth-0.2\parskip-1cm\relax` can used where \LaTeX expect a length. Maximal length = 16384pt \approx 5,758 m

Some hints about (horizontal) spacing

- Successive spaces (including tabs and carriage returns) are interpreted as a single space with the following exceptions :
 - Blank spaces following a declaration are not typeset
 - Two consecutive carriage returns (i.e. blank line) close a paragraph, as does the `\par` command;
 - The explicit spaces `_` and the unbreakable `~` are observed. `\,` (or `\thinspace`) also produces a smaller unbreakable space (0.167 em).
 - In math mode, blank spaces are not significant.
- Larger horizontal space is obtained with `\enskip`, `\quad` or `\qquad` of respectively half, one or two ems.
- Arbitrary space obtained with `\hspace{length}` or `\hspace*{length}`, where `length` is either a literal or defined or computed length, than can be negative. It can also be a “rubber” length (see previous slide). The starred version can be used at the beginning or the end of a line.

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Babel translations

Package `babel` translates the *captions* of latex structure words like “Chapter” according to the language passed as an option. Some important translated strings:

String	english	french	
<code>\abstractname</code>	Abstract	Résumé	Other strings are also translated, like ordinals, and fields used by the <code>letter</code> class. And <code>\partfirst</code> , <code>\partsecond</code> , <code>\seename</code> , <code>\alsoname</code> etc.
<code>\appendixname</code>	Appendix	Annexe	
<code>\bibname</code> [†]	Bibliography	Bibliographie	
<code>\refname</code> *	References	Références	
<code>\chaptername</code>	Chapter	Chapitre	
<code>\contentsname</code>	Contents	Table des matières	
<code>\figurename</code>	Fig.	Figure	
<code>\tablename</code>	Table	Table	
<code>\glossaryname</code>	Glossary	Glossaire	
<code>\indexname</code>	Index	Index	
<code>\listfigurename</code>	List of Figures	Table des figures	* in <code>article</code>
<code>\listtablename</code>	List of Tables	Liste des tableaux	class ;
<code>\pagename</code>	Page	page	* in <code>report</code> and
<code>\prefacename</code>	Preface	Préface	<code>book</code> classes.
<code>\proofname</code>	Proof	Démonstration	

Babel usage

- Babel in conjunction with `\usepackage[T1]{fontenc}` enables the hyphenation for the main (last loaded) language.
- When loading several languages, the last one is active. Switch =
globally: `\selectlanguage{lan}`,
locally: `\foreignlanguage{lan}{text}`

- Babel also defines for each loaded language a macro named `\captionslan` enabling further customization like:

```
1 \addto\captionsfrench{\renewcommand{\figurename}{‘Fig.’}}
2 \addto\captionsfrench{\renewcommand{\bibname}{‘Articles’}}
```

Formating commands could be added to “Fig.” like “Fig. `\slshape`”.
But the proper way is to use `\captionsetup`.

- Babel (for French) also makes active the 4 double punctuation signs to ensure proper spacing before and after. This behavior can be toggled on/off with `\shorthandon{;:?!}` and `\shorthandoff{;:?!}`.

Babel for french

For French, `babel` adapts typesetting rules (if `french` is the main language):

- ① the first paragraph of each section is indented; the default mark in `itemize` is set to “—” instead of •, and the vertical spacing in lists is reduced.
- ② Footnotes are displayed « à la française ».
- ③ Beside activation of ; : ?, the space after `\dots` is removed.
- ④ French quotation marks can be entered by the commands `\og/\fg` or « / ».
- ⑤ « Boxed Sc » for Family names, with `\bsc{name}` (avoids hyphenation).
- ⑥ `\today` is translated & `\frenchdate{year}{month}{day}` gives a properly formatted date.
- ⑦ Ordinals `\ier`, `\iere`, `\iers`, `\ieres`, `\ieme`, `\iemes` resulting in e.g. 3^{es}; Latin enumeration with `\primo`, `\secundo`, and `\FrenchEnumerate{num}` for e.g. 1^o ; Abbreviations for « numéro(s) » `\No=No`, `\Nos`, `\no`, `\nos=nos` and symbols like `\degre=°` (angles) and `\degres=°` (temperature);
A generic command `\up` is provided for further superscripts.

Further “francisation” activated with `\frenchsetup{options}`, for available options see documentation `babel-french.pdf`.

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 - Lists
 - Tables and arrays
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L^AT_EX defines three type of lists (can be nested up to 4 levels)

Itemize

```
\begin{itemize}
  \item the first item formatted
    according French rules
  \item[•] the second item
  \item[2] the third item
\end{itemize}
```

- the first item formatted according French rules (fr)
- the second (en)
- 2 the third item

Enumerate

```
\begin{enumerate}
  \item the first item
  \item the second item
  \item the third item
\end{enumerate}
```

1. the first item
2. the second item
3. the third item

Description

```
\begin{description}
  \item[TeX] is a program
  \item[LaTeX] is a set of macros
  \item[Amsmath] enhances maths
\end{description}
```

TeX is a program
 LaTeX is a set of macros
 Amsmath enhances maths

Customized lists

- Lists can be customized with the `enumitem` package.

All the lengths, counters and labeling can be efficiently customized.

In the following example we have an enumerate with italic alphabetic labels protruding in the margin, and another with Greek labels*.

```

1 \setlist[enumerate]{leftmargin=*,nosep}
2 Lorem ipsum dolor \ldots
3 \begin{enumerate}[label=\emph{\alph*}],
4 labelindent=-1em,leftmargin=0pt]
5 \item Donec vehicula augue ...
6 \item Mauris ut leo.
7 \end{enumerate}
8 Lorem ipsum dolor \ldots
9 \begin{enumerate}[label=\cgreek* -]
10 \item Donec vehicula augue ...
11 \item Mauris ut leo.
12 \end{enumerate}

```

Lorem ipsum dolor ...
 a) Donec vehicula augue ...
 b) Mauris ut leo.
 Lorem ipsum dolor ...
 α - Donec vehicula augue ...
 β - Mauris ut leo.

- To create your own style, clone a standard list & set its properties:
`\newlist{myit}{itemize}{2}`, & `\setlist[myit]{label=\diamond}`.

* uses e.g. `upgreek` in addition to `enumiten`.

Environments tabular and array

tabular a text-only environment to create a tabular presentation*

array a math-only environment for aligned content like matrix or systems.

Separator Both use of the character & to delimit the cells in a row.

Examples :

```
1 \begin{tabular}{lccc}
2 Color: &red & green & blue\\
3 HTML : &\#F00 & \#0F0 & \#00F
4 \end{tabular}
```

Color: red green blue
HTML : #F00 #0F0 #00F

```
1 \[ \left (
2 \begin{array}{lcr}
3 123 & 0 & 321\\
4 0 & 123 & 0
5 \end{array}
6 \right ) \]
```

$$\left(\begin{array}{lcr} 123 & 0 & 321 \\ 0 & 123 & 0 \end{array} \right)$$

Notice the unusual alignment

* do not confuse with the **table** floating environment, described latter.

Alignment in tabular and array

- In the argument of the environment the tree letters **l**, **r**, **c** define the alignment of the cells of the corresponding rows.
- They can be interleaved with vertical bars **|** and/or **\hline** to draw the vertical/horizontal borders.

```

1 \begin{tabular}{|l|ccc|}
2 \hline
3 Color & red & green & blue \\
4 \hline
5 HTML & \#F00 & \#0F0 & \#00F \\
6 \hline
7 \end{tabular}

```

Color:	red	green	blue
HTML :	#F00	#0F0	#00F

- Repeated entries can be grouped with ***{num}{align}**. E.g. **|l|*{3}{c}** for the the previous tabular.
- The options **lcr**, typeset in LR-mode, can be replaced by **p{width}** which inserts a **\parbox[t]**, allowing vertical content (linebreaks and paragraphs).

Improved tabular and array

More column options and much more are enabled by the package `array`.

- In regular environment, `@{text}` prepends `text` to the next cell.
- `m{width}` & `b{width}` like `p{width}` but alignment middle/bottom
- With `array`, some formatting `code` can be prepended and appended the cells with `>{code}` and `<{code}`, and `{code}` replaces `|` by `code`.

A stupid example:

```
\begin{tabular}{p{3em}%
>{\$\\sim}r<{\$: $kg}>{\$\\sim}r<{\$: $m}}
Man & 70 & 175 \\
Woman & 55 & 165 \\
Kid & 35 & 120
\end{tabular}
```

Man	~ 80 kg	~ 180 m
Woman	~ 55 kg	~ 170 m
Kid	~ 35 kg	~ 120 m

- Regularly used columns formats can be named : with `\newcolumntype{C}{>{\$}c<{\$}}`, `C` switches to math mode in `tabular` and to LR-mode in `array`
- option `[t]` & `[b]` : alignment with respect to surrounding text.

Improved tabular and array (again)

- Add colors with `>\color{colorname}`,
or with package `colortabl` and `>\cellcolor{colorname}`

Color	red	green	blue
HTML	#F00	#0F0	#00F

Color	red	green	blue
HTML	#F00	#0F0	#00F

- Define new column types :

```
\newcolumntype{R}{>\cellcolor{red}\color{blue}}c}
\newcolumntype{G}{ ... }
\newcolumntype{B}{ ... }
\begin{tabular}{|l|RGB|}
...

```

Color	red	green	blue
HTML	#F00	#0F0	#00F

- Use `booktabs` an suppress vertical lines:

```
\begin{tabular}{lDLA}
\toprule
Color & red & green & blue\\
\midrule
HTML & #DDB6B6 & #32CD32 & \# 40FFFF\\
\TeX{} & DarkRed & LimeGreen & Aqua\\
\bottomrule
\end{tabular}
```

Color	red	green	blue
HTML	#DDB6B6	#32CD32	#40FFFF
TeX	DarkRed	LimeGreen	Aqua

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Regulars floats : figure and table

A float is an environment placed by \TeX at an optimized position (after its definition), trying to keep the page organization as clever as possible.

- \LaTeX defines two floats: **figure** and **table**. The difference is semantics, as their content can be any thing that doesn't concern page breaking. (You can defines other floats with package **floats**).
- Example:

```

1 \begin{figure}[tbp]
2 \centering
3 \includegraphics[width=0.9\textwidth]{mafigure}
4 \caption{Ma belle figure}
5 \label{f-belle}
6 \end{figure}

```

- Floats have a *critical* option [**tbp**] defining the *allowed* positions: [**t**]/[**b**] top/bottom of pages, [**p**] full page of float(s), [**h**] here.

Notice the `\includegraphics[]{}{}`, the swiss-army-knife to insert external content. . .

Including (external) graphics : `graphicx` package

- Inclusion is performed by the macro `\includegraphics` defined in the (low level) `graphics` package.
- The `graphicx` package loads the former and defines high level interface for `\includegraphics` with the `key=value` syntax.
- Regular \LaTeX with `dvips` handles vectorial EPS and bitmap JPG. But `pdf\text{\LaTeX}` natively handles vectorial PDF and bitmaps PNG and JPG.
- The Bounding box of the picture is automatically read in the vectorial files, but pixel-size must be provided for bitmaps.
- On the fly conversion of EPS (to PDF) is performed by the package `epstopdf`. The same holds for SVG by using `svg` package and `\includesvg` (On The Fly conversion uses Inkscape by default).
- **Example:**

```
\includegraphics[width=0.8\linewidth, rotate=90, page=3,
                 trim=left bottom right top, clip]{nicepicture}
%other options bb, keepaspectratio, origin, draft
```

- For internally defined figures: `PStricks`, `pict2e`, `PFG/TikZ`...

Floats placement

Placement of floats is the worst headache that \LaTeX users can experience.

- The best position is generally `top`, but what ever you choose, it will interfere with page breaking control, and eventually \LaTeX could “float” the floats to the end of chapter or document.
- `[h]` & `[!h]` most often have *badness* maximal and must be avoided.
- To ensure that floats are not floated to the end one can:
 - Allows \LaTeX to be more tolerant about floats placement with `!` or:

```
\renewcommand{\topfraction}{0.9} % max fraction at top
\renewcommand{\bottomfraction}{0.6} % max fraction at bottom
\renewcommand{\textfraction}{0.1} % minimal text w. figs
\setcounter{topnumber}{2}\setcounter{bottomnumber}{2} % floats/page
```

- Force a float page with command `\afterpage{\clearpage}` (load `afterpage`)
- Package `placeins` defines `\FloatBarrier` which prevent to float further. Better : `\usepackage[section]{placeins}` adds `\FloatBarrier` to command `\section`.

Floats (not floating) in text

1.2 Carrière d'universitaire

En 1889, il enseigna au lycée Saint-Louis puis à partir de 1890 au Lycée Buffon. Il eut comme élève Maurice FRÉCHET et eut des contacts avec Émile BOREL à l'École normale, jusqu'au départ de ce dernier pour la faculté des sciences de Lille en 1893. Il obtint son doctorat en 1892, sous la direction d'Émile PICARD, pour des recherches sur les fonctions définies par séries de Taylor.

Il enseigne alors à la faculté des sciences de l'université de Bordeaux en tant que chargé de cours de juillet 1893 à février 1896 puis professeur titulaire. Il retourna ensuite à Paris en tant que maître de conférences (en remplacement de Paul PAINLEVÉ à la faculté des sciences de l'université de Paris, et obtient le titre de professeur adjoint en février 1900. En novembre 1897, il devient également suppléant de Maurice LÉVY à la chaire de mécanique analytique et mécanique céleste du Collège de France (à la suite de Paul PAINLEVÉ).



Jacques HADAMARD

Floats (not floating) in text

- Packages `wrapfig`, `picins` and `floatflt` allow to place small floating figures inside text as shown on previous slide.
- Specify the requested width, and optionally the placement (`r/l`).
- Example : The figure on last slide is produced by:

```

1 \subsection{Carrière universitaire}
2 \begin{floatingfigure}[r]{40mm}
3 \flushright
4 \includegraphics[width=35mm]{hadamard-pic}
5 {\centering Jacques\textsc{Hadamard}\par}
6 \end{floatingfigure}
7 En 1889, il enseigna au lycée Saint-Louis [...]
```

- These floats always conflict with lists, and often with sectioning commands.
- `wrapfig` is the most popular, but `wrapfig`, `picins` are said obsolete, and it is better to use `floatflt`.

Captions

- Floats generally include captions, explaining the content, defined by:

```

1 \begin{figure}[htbp]
2 \includegraphics[width=35mm]{hadamard-pic}
3 \caption[Portrait de Jacques Hadamard] % Short title for \lof
4 {Jacques \textsc{Hadamard}, photographie prise en 1898 à \ldots}
5 \end{figure}

```

- Package `caption` for genuine captions for “non-floating” stuff (with numbering etc.):

```

1 \usepackage{caption} % option [hycap=true] will be required latter
2 [...]
3 \begin{minipage}{14cm}
4 \includegraphics[width=35mm]{hadamard-pic}
5 \captionof{figure}{Portrait de Jacques Hadamard}
6 \end{minipage}

```

- Package `caption` enables customization with, for example:

```

1 \captionsetup[figure]{labelsep=endash,labelfont={rm,bf},%
2   textfont=sl,font=small}

```

which can be set globally or inside a given `figure`.

Subcaptions

- Package `subcaption` allows captioning of composite figures :

```

1 \usepackage{caption}
2 \usepackage{subcaption}
3 [...]
4 \begin{figure}
5   \begin{subfigure}[t]{0.7\textwidth}
6     \includegraphics[width=0.7\textwidth]{example-image-a}
7     \caption{of subfig a}
8   \end{subfigure}
9   \begin{subfigure}[t]{0.49\textwidth}
10    \includegraphics[width=0.7\textwidth]{example-image-b}
11    \caption{of subfig b}
12  \end{subfigure}
13  \caption{of whole figure}
14 \end{figure}

```

- The `subfigure` environment is defined in `subcaption`, but is not mandatory: any grouping is sufficient.
- Pack. `subfigure` & `subfig` : obsolete, incompatible with `hyperref`.

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Line breaking

- Three ways to break a line : `\newline`, `\linebreak` and `\\` (with an optional vertical spacing). Compare effects :

`\newline` Lorem ipsum dolor sit amet, consectetuer
adipiscing elit. Curabitur dictum gravida mauris.
or `\\`

`\linebreak` Lorem ipsum dolor sit amet, consectetuer
adipiscing elit. Curabitur dictum gravida mauris.

- Line ending can be hinted with conditional hyphenation `\-adi\-piscing` Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Curabitur dictum gravida mauris.
`adipisc\-ing` Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Curabitur dictum gravida mauris.
- `\hfill`, `\hrulefill`, `\dotfill` can also influence line breaking :
Lorem ipsum dolor sit amet, consectetueradipiscing elit.
Curabitur This was a `\dotfill`, and here is `\hrulefill` ____!

Vertical spacing

- Between lines : `\baselineskip` (do not modify!)
If you really need larger spacing : `\usepackage{setspace}` and `\doublespacing` or `\onehalfspacing`
- Between paragraph : `\parskip` (do not modify!)
- Fixed skips : `\smallskip`, `\medskip`, `\bigskip`
There are also `\smallbreak`, `\medbreak`, `\bigbreak` with the same effect, plus reducing break-page penalty.
- Line breaking with space:

<code>\\[6pt]</code>	<p>Lorem ipsum dolor sit amet, consectetur</p> <p>adipiscing elit. Curabitur dictum gravida mauris.</p>
<code>\\[-1ex]</code>	<p>Lorem ipsum dolor sit amet, consectetur</p> <p>adipiscing elit. Curabitur dictum gravida mauris.</p>
- Arbitrary skip : `\vspace{length}` or `\vspace*{length}`, like `\hspace`
- `\vfill` acting like `\hfill` but in vertical direction.

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Math in standard L^AT_EX(I)

By conception, T_EX is specially efficient for typesetting math. Only the basic maths of L^AT_EX are described here, and enhanced mathematical typesetting is deferred to another workshop.

- TeX defines “mathmode” in two version and four styles:
 - *In-line* mode, with \dots , or $\langle \dots \rangle$, or environment `math`.
 - *Display* mode, with $\left[\dots \right]$ or environment `displaymath`.
 - `\displaystyle`, `\textstyle`, `\scriptstyle` and `\scriptscriptstyle`, mostly related to size of symbols.
- In mathmode, each letter is supposed to be single variable, so that `abs` gives abs and not $ab\,s$.
- T_EX ignores the types spaces and adds the required spacing according to the class of symbols, variables, operators, delimiter, binary relations, etc. Tweaking this spacing is sometimes required, with the commands:

Math in standard L^AT_EX(II)

Basic math constructions

- Indices and exponents:

<code>\$2^3=8\$</code> → $2^3 = 8$	<code>$\delta_{ij}=\pm 1$</code> → $\delta_{ij} = \pm 1$
<code>a^3^2</code> → Error	<code>$a^{\left(3^2\right)}=a^{\left\{9\right\}}$</code> → $a^{(3^2)} = a^9$
<code>$C_2^4=6$</code> → $C_2^4 = 6$	<code>$\mathrm{H_3O^+}$</code> → $\mathrm{H_3O^+}$

- Primes :

<code>$x'=1$</code> → $x' = 1$	<code>$(x^2)'=2x$</code> → $(x^2)' = 2x$
<code>$x''=0$</code> → $x'' = 0$	<code>$\left\{(x^3)'\right\}=3x^2$</code> → $(x^3)' = 3x^2$

- Fractions and roots :

<code>$\frac{a}{b}$</code> → $\frac{a}{b}$	<code>$\sqrt{4}=2$</code> → $\sqrt{4} = 2$
<code>$\left[\frac{a}{b}\right]$</code> → $\frac{a}{b}$	<code>$\sqrt[3]{27}=3$</code> → $\sqrt[3]{27} = 3$

Math in standard L^AT_EX(III) : Integrals, sums and limitsThe Euler-Mascheroni constant γ

- In `\textstyle` (in-line math)

$$\gamma = \lim_{n \rightarrow \infty} \left(\sum_{k=1}^n \frac{1}{k} - \int_1^n \frac{dx}{x} \right)$$

is produced by the command :

`\lim_{n\to\infty}(\sum_{k=1}^n \frac{1}{k}-\int_1^n \frac{dx}{x})`

inserted in `\cdots` or `\(\cdots\)`

- A better result in `\displaystyle` :

$$\lim_{n \rightarrow \infty} \left(\sum_{k=1}^n \frac{1}{k} - \int_1^n \frac{dx}{x} \right)$$

is produced by the same code in `displaymath` environment or `\[\cdots\]`

Math in standard L^AT_EX(IV) Fonts

Regular math is in “*mathematical italic*” (`\lmmi` for `latinmodern`)

Styles and families work like in text, but with `\math<style>`:

`\mathrm`, `\mathtt`, `\mathsf`, `\mathbf`, `\mathit`

Symbols are not embolden by `\mathbf`:

`\mathbf{\sum\int\beta}` $\rightarrow \sum \int \beta$ `\sum\int\beta`

Use instead package `\bm` and `\bm{\sum\int\beta}` $\rightarrow \sum \int \beta$

Other styles (with packages)

- `\mathcal{ABCDEFGH}` $\rightarrow \mathcal{A}\mathcal{C}\mathcal{D}\mathcal{E}\mathcal{F}\mathcal{G}\mathcal{H}$ (uppercase only, `latex`)
- `\mathbbm{ABCNR12abc}` $\rightarrow \mathbb{A}\mathbb{B}\mathbb{C}\mathbb{N}\mathbb{R}12abc$ (`\bm`)
- `\upalpha\upbeta\upmu\cdots` $\rightarrow \alpha\beta\mu\cdots$ (`\upgreek`)
- `\mathfrak{ABCNR12abc}` $\rightarrow \mathfrak{A}\mathfrak{B}\mathfrak{C}\mathfrak{N}\mathfrak{R}12abc$ (`\amsfonts`)
- `\mathscr{ABCD}` $\rightarrow \mathcal{A}\mathcal{B}\mathcal{C}\mathcal{D}$ (uppercase only, `\mathrsfs`)
- etc.

Math in standard L^AT_EX (V): operators and relations

“Binary operators”, “Binary relations” and “unary operators”. E.g.:

Bin ops, automatically surrounded by medium space (4 mu):

<code>\pm</code>	\pm	<code>\cap</code>	\cap	<code>\diamond</code>	\diamond	<code>\times</code>	\times
<code>\mp</code>	\mp	<code>\cup</code>	\cup	<code>\ast</code>	\ast	<code>\div</code>	\div
<code>\bullet</code>	\bullet	<code>\cdot</code>	\cdot	<code>\setminus</code>	\setminus	<code>\otimes</code>	\otimes etc.

Bin rel, automatically surrounded by small space (3 mu):

<code>=</code>	$=$	<code>\equiv</code>	\equiv	<code>\approx</code>	\approx	<code>\sim</code>	\sim
<code>></code>	$>$	<code>\leq</code>	\leq	<code>\ll</code>	\ll	<code>\simeq</code>	\simeq
<code><</code>	$<$	<code>\geq</code>	\geq	<code>\gg</code>	\gg	<code>\propto</code>	\propto

Log-like, automatically preceded by small space (3 mu):

<code>\arccos</code>	\arccos	<code>\cos</code>	\cos	<code>\exp</code>	\exp	<code>\lim</code>	\lim	<code>\min</code>	\min
<code>\arcsin</code>	\arcsin	<code>\cosh</code>	\cosh	<code>\deg</code>	\deg	<code>\gcd</code>	\gcd	<code>\ln</code>	\ln
<code>\cot</code>	\cot	<code>\det</code>	\det	<code>\log</code>	\log	<code>\sec</code>	\sec	<code>\tan</code>	\tan

Math in standard L^AT_EX (VI): symbols, arrows, delimiters

L^AT_EX also has various kind of symbols. Some examples :

Symbols (variable-sized) automatically surrounded by space:

`\sum` Σ `\bigcap` \cap `\bigodot` \odot `\prod` \prod
`\bigcup` \cup `\bigotimes` \otimes `\coprod` \coprod `\bigsqcup` \sqcup

Arrows : (no space added)

`\leftarrow` \leftarrow `\longleftarrow` \longleftarrow `\uparrow` \uparrow
`\Leftarrow` \Leftarrow `\Longleftarrow` \Longleftarrow `\Uparrow` \Uparrow
`\rightarrow` \rightarrow `\longrightarrow` \longrightarrow `\downarrow` \downarrow

Delimiters automatically surrounded by small space (3 mu):

`(` $($ `)` $)$ `\{` $\{$ `\uparrow` \uparrow `\Uparrow` \Uparrow
`[` $[$ `]` $]$ `\}` $\}$ `\downarrow` \downarrow `\Downarrow` \Downarrow

Big delims obtained with:

`\Bigg(\bigg(\Big(\big(() \big)\Big)\bigg)\Bigg)` $\left(\left(\left(\left(()\right)\right)\right)\right)$
 but the correct spacing would require:
`\Biggl(\biggl(\Bigl(\bigl(() \bigr)\Bigr)\biggr)\Biggr)`

Math in standard L^AT_EX(VII): Greek letters

<code>\alpha</code>	α	<code>\imath</code>	\imath	<code>\rho</code>	ρ	<code>\varepsilon</code>	ε
<code>\beta</code>	β	<code>\kappa</code>	κ	<code>\sigma</code>	σ	<code>\vartheta</code>	ϑ
<code>\gamma</code>	γ	<code>\lambda</code>	λ	<code>\tau</code>	τ	<code>\varkappa</code>	\varkappa
<code>\delta</code>	δ	<code>\mu</code>	μ	<code>\upsilon</code>	υ	<code>\varpi</code>	ϖ
<code>\epsilon</code>	ϵ	<code>\nu</code>	ν	<code>\phi</code>	ϕ	<code>\varsigma</code>	ς
<code>\zeta</code>	ζ	<code>\xi</code>	ξ	<code>\chi</code>	χ	<code>\varrho</code>	ϱ
<code>\eta</code>	η	<code>o</code>	o	<code>\psi</code>	ψ	<code>\varphi</code>	φ
<code>\theta</code>	θ	<code>\pi</code>	π	<code>\omega</code>	ω		
<code>\Gamma</code>	Γ	<code>\Lambda</code>	Λ	<code>\Sigma</code>	Σ	<code>\Psi</code>	Ψ
<code>\Delta</code>	Δ	<code>\Xi</code>	Ξ	<code>\Upsilon</code>	Υ	<code>\Omega</code>	Ω
<code>\Theta</code>	Θ	<code>\Pi</code>	Π	<code>\Phi</code>	Φ		
<code>\varGamma</code>	\varGamma	<code>\varLambda</code>	\varLambda	<code>\varSigma</code>	\varSigma	<code>\varPsi</code>	\varPsi
<code>\varDelta</code>	\varDelta	<code>\varXi</code>	\varXi	<code>\varUpsilon</code>	\varUpsilon	<code>\varOmega</code>	\varOmega
<code>\varTheta</code>	\varTheta	<code>\varPi</code>	\varPi	<code>\varPhi</code>	\varPhi		

Slanted capital are also obtained with `\mathnormal{\Gamma}` $\rightarrow \varGamma$

Math in standard L^AT_EX(VIII): more symbols

<code>\ldots</code>	...	<code>\cdots</code>	...	<code>\vdots</code>	:	<code>\ddots</code>	⋮
<code>\aleph</code>	ℵ	<code>\prime</code>	/	<code>\forall</code>	∀	<code>\infty</code>	∞
<code>\hbar</code>	ℏ	<code>\emptyset</code>	∅	<code>\exists</code>	∃	<code>\Box</code>	□ ^b
<code>\imath</code>	ı	<code>\nabla</code>	∇	<code>\neg</code>	¬	<code>\Diamond</code>	◇ ^b
<code>\jmath</code>	ȵ	<code>\surd</code>	√	<code>\flat</code>	♭	<code>\triangle</code>	△
<code>\ell</code>	ℓ	<code>\top</code>	⊤	<code>\natural</code>	♮	<code>\clubsuit</code>	♣
<code>\wp</code>	℘	<code>\bot</code>	⊥	<code>\sharp</code>	♯	<code>\diamondsuit</code>	◇
<code>\Re</code>	ℜ	<code>\ </code>		<code>\backslash</code>	\	<code>\heartsuit</code>	♥
<code>\Im</code>	ℑ	<code>\angle</code>	∠	<code>\partial</code>	∂	<code>\spadesuit</code>	♠
<code>\mho</code>	℧ ^b	.	.				

Math in standard L^AT_EX(XI) : Decorations

Math mode accents

\hat{a} \acute{a} \bar{a} \dot{a}
 \breve{a} \check{a} \grave{a} \vec{a}
 \ddot{a} \tilde{a}

Other constructions

\widetilde{abc} \widehat{abc}
 \overleftarrow{abc} \overrightarrow{abc}
 \overline{abc} \underline{abc}
 \overbrace{abc}^d \underbrace{efg}_h

Extensible delimiters The `\Bigg``\bigg``\Big``\big` delimiters are sometimes too small. Get larger delimiters as shown here with:

`\left<delim1> content \right<delim2>`

`\left` and `\right` must be paired but the delimiters `<delim1>` and `<delim2>` can differ. Use `.` for no visible delimiter.

