Wissenschaftliches Programmieren

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- Montags 11:15 HS 5
- A-Woche Donnerstag 13:15 HS 5



About LaTeX

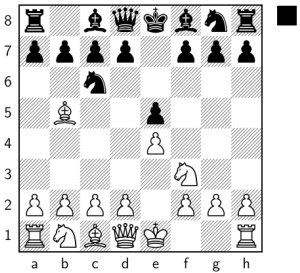
LaTeX is a software system for typesetting documents, based on TeX. — Wikipedia

- De-facto standard for preparing scientific publications in math, large parts of physics, computer science and similar disciplines.
- Variants of LaTeX's mathematical typesetting language are used in Markdown (e.g., Wikipedia), MathJax (Webpages) etc.
- LaTeX manuscripts accepted by many science publishers.
- Free, portable, open software.
- Vast collection of add-on packages (diagrams, chemical formulae, music scores, special effects,...)

```
\usepackage{xskak}

\newgame
\mainline{1. e4 e5 2. Nf3 Nc6 3. Bb5}\\
\chessboard
```

1 e4 e5 2 ♘f3 ♘c6 3 ♗b5



```latex
\documentclass[10pt]{article}
\usepackage{mathtools}
\usepackage{xcolor}
\usepackage[a5paper,top=0.5cm,bottom=2cm,left=1.5cm,right=1.5cm]{geometry}

\title{\bfseries The \textcolor{red}{$\tau$} Manifesto}
\author{Alice A.\ Algebra\thanks{Supported by $\tau$--fans everywhere.}}
\date{\today}

\begin{document}
\maketitle
\thispagestyle{empty}

\section*{Why $\pi$ is wrong}
The familiar constant $\pi$ gives only \emph{half} a circle.
A full turn deserves its own constant:
\[
\tau = 2\pi \approx \textcolor{red}{6.283185307179586\ldots}
\]

\section*{Benefits of $\tau$}
\begin{itemize}
\item The arc-length of a full unit circle is simply $\tau$.
\item A quarter turn is $\tau/4$, an eighth is $\tau/8$---no more
    ``mysterious'' $\pi/2$.
\item Euler's identity becomes crystal clear:
\[
e^{i\tau} = \textcolor{teal}{1}
\]
One trip around the unit circle lands you back at \textcolor{teal}{one}.
\end{itemize}

\section*{Conclusion}
Switch to $\tau$ and make trigonometry \textcolor{orange!80!black}{intuitive}.
Your angles (and students) will thank you.

\begin{flushright}
\small\color{gray}
Happy $\tau$ Day!
\end{flushright}

\end{document}
```

The τ Manifesto

Alice A. Algebra*

October 15, 2026

Why π is wrong

The familiar constant π gives only *half* a circle. A full turn deserves its own constant:

$$\tau = 2\pi \approx 6.283185307179586\ldots$$

Benefits of τ

- The arc-length of a full unit circle is simply τ.
- A quarter turn is $\tau/4$, an eighth is $\tau/8$—no more "mysterious" $\pi/2$.
- Euler's identity becomes crystal clear:

$$e^{i\tau} = 1$$

  One trip around the unit circle lands you back at one.

Conclusion

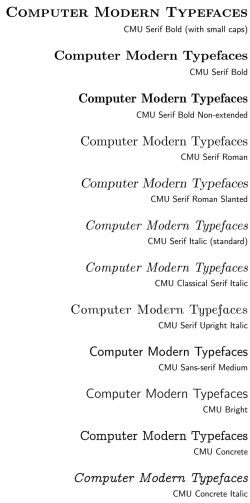
Switch to τ and make trigonometry intuitive. Your angles (and students) will thank you.

Happy τ Day!

*Supported by τ–fans everywhere.

History

- 1978-82: Donald Knuth creates TEX (pronounced $\tau\varepsilon\chi$).
- As part of that, he also created
  - new algorithms for justification and hyphenation,
  - Metafont, a digital font definition language,
  - the “Computer Modern” font family,
  - … and made all this free & open source.
- 1985: Leslie Lamport publishes LATEX, a system of TeX macros making it more user-friendly and with a better separation of *style* and *content*.
- 1990: release of TeX 3.0
  current version is TeX 3.141592653 released 2021
- LaTeX is now maintained and further developed by the LATEX Project team. Current release: LaTeX 2026-06-01.



Source: Blythwood, CC BY-SA 4.0, via Wikimedia Commons

TeX Engines

- `pdflatex` traditional TeX font system, fastest engine
- `xelatex` adds native support for Unicode and OpenType fonts
- `lualatex` similar to xelatex in its native Unicode and modern font support, embeds the Lua scripting language into the engine —

  future standard engine, some new packages *need* the Lua extensions

LaTeX basics

- LaTeX reads plain text `*.tex` files.
- The text will be *typeset*:
  - Multiple spaces are treated like a single space.
  - Newlines are treated as a space.
  - Empty lines separate paragraphs (just like the `\par` command).
- LaTeX commands and variables start with a backslash (`\`), followed either by a sequence of letters or a single non-letter character.
- LaTeX commands may have one or more mandatory arguments which are separately enclosed in { and }.
- LaTeX commands may have one or more optional arguments which are separately enclosed in [and].

```
\fbox{\parbox[c][6em]{10em}{Some text in a box which is 10em wide and 6em high.}}
```

Some text in a box which is 10em wide and 6em high.

Structure of a LaTeX document

```
\documentclass[10pt]{article}      % ------------------------------------------
                                   %                                    |
\usepackage{mathtools}             %                                preamble
\usepackage[a4paper,left=1.5cm,right=1.5cm]{geometry}
\usepackage[T1]{fontenc}           % for pdflatex                       |
\usepackage[utf8]{inputenc}        % for pdflatex                       |
%\usepackage{fontspec}             % for xelatex/lualatex               |
\title{A great paper}
\author{A. X. Axolot}              %                                    ↓
% ----------------------------------------------------------------------------
\begin{document}
\maketitle
\section{Introduction}
\subsection{General Remarks}

\begin{itemize}
    \item First point.
    \item Second point.
\end{itemize}
\end{document}
```

Special characters

character	used for	command to print it
#	macro parameter	`\#`
$	delimits inline math	`\$`
%	starts a comment	`\%`
&	tabulator mark	`\&`
~	no-break space	`\~{}`
^	superscript	`\^{}`
_	subscript	`\_`
{	begin group	`\{`
}	end group	`\}`
\	command prefix	`\textbackslash`
\\	force linebreak	

Accented characters

`\‘o`	ò	grave accent
`\’o`	ó	acute accent
`\^o`	ô	circumflex
`\”o`	ö	umlaut
`\H{o}`	ő	Hungarian umlaut
`\~o`	õ	tilde
`\c{c}`	ç	cedilla
`\k{a}`	ą	ogonek
`\l{}`	ł	barred l
`\=o`	ō	macron accent

`\b{o}`	o̲	bar under the letter
`\.o`	ȯ	dot over the letter
`\d{u}`	ụ	dot under the letter
`\r{a}`	å	ring
`\u{o}`	ŏ	breve
`\v{s}`	š	caron/háček
`\t{oo}`	o͡o	”tie”
`\o{}`	ø	slashed o
`{\i}`	ı	dotless i

- Modern LaTeX allows direct input of characters such as ä, Ä, ø, è, etc.
- Using accent commands can be useful when accents are needed infrequently and direct Unicode input is complicated.

Text styles

Command	Alternative	Style (using Computer Modern)
`\textnormal{...}`	`{\normalfont ...}`	the default
`\emph{...}`	`{\em ...}`	*emphasis, typically italics*
`\textrm{...}`	`{\rmfamily ...}`	roman (serif) type
`\textsf{...}`	`{\sffamily ...}`	sans serif type
`\texttt{...}`	`{\ttfamily ...}`	`teletype (monospaced)`
`\textit{...}`	`{\itshape ...}`	*italics*
`\textsl{...}`	`{\slshape ...}`	*slanted*
`\textsc{...}`	`{\scshape ...}`	Small Capitals
`\textbf{...}`	`{\bfseries ...}`	**boldface**

Text sizes

`\tiny`	Example Text
`\scriptsize`	Example Text
`\footnotesize`	Example Text
`\small`	Example Text
`\normalsize`	Example Text
`\large`	Example Text
`\Large`	Example Text
`\LARGE`	Example Text
`\huge`	Example Text
`\Huge`	Example Text