

0.1 General Information

The files *math.sty* and *preamble.sty* should provide you a simple yet effective suite of macros for quick writing of mathematical/scientific papers. To properly load them you should include the following in your preamble:

```
1 \usepackage{preamble}
2 \usepackage{math}
```

It is important that you maintain the order of the packages, since *math.sty* uses some packages included in *preamble.sty*. Other than providing an extensive list of mathematical operators from *math*, there are some useful commands in *preamble.sty* too. The one that I myself use quite often is `\col{<color>}{<text>}`. Although *xcolor* defines `\textcolor`, it can get kind of "clunky" in tables or similar, so I wrote a shorter command.

0.2 Symbol Index

Symbol	Math-Mode	Result	Symbol	Math-Mode	Result
Symbol			Math-Mode		Result
<i>Vectors</i>					
Column Vector	<code>\pvec{x_1}{x_2}</code>	$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$	Dot-Product	<code>\dotp{x_1}{x_2}</code>	$\langle x_1, x_2 \rangle$
Column Vector		<code>\tvec{x_1}{x_2}{x_3}</code>			$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$
Row Vector		<code>\rvec{x_1}{x_2}</code>			$\begin{bmatrix} x_1 & x_2 \end{bmatrix}$
Row Vector		<code>\rtvec{x_1}{x_2}{x_3}</code>			$\begin{bmatrix} x_1 & x_2 & x_3 \end{bmatrix}$
<i>Matrices</i>					
Matrix	<code>\mat{M}</code>	M	Matrix (greek letters)	<code>\gmat{M}</code>	ϕ
Determinant	<code>\det</code>	det			
Row Operation (arrow)	<code>\longleadsto{0.7}</code>	\rightsquigarrow	Row Operation	<code>\rtrf{r_2: -2r_1}</code>	$r_2: -2r_1$ \rightsquigarrow
Matrix-Rank (de)	<code>\Rang</code>	Rang	Matrix-Rank (en)	<code>\Rank</code>	Rank
Matrix-Trace (de)	<code>\Spur</code>	Spur	Matrix-Trace (en)	<code>\Trace</code>	Trace
Adjunct-Matrix	<code>\Adj</code>	Adj	Cofactor-Matrix	<code>\Cof</code>	Cof
Identity-Matrix (de)	<code>\imate</code>	E	Identity-Matrix (en)	<code>\imati</code>	I

<i>Calculus and Functions</i>					
Differential d	<code>\diff</code>	d	Exterior Derivative	<code>\extd</code>	D
Divergence	<code>\divs</code>	div			
Derivative	<code>\der{f}{x}</code>	$\frac{df}{dx}$	Partial Derivative	<code>\per{f}{x_1}</code>	$\frac{\partial f}{\partial x_1}$
n-th Derivative	<code>\ner{f}{x}{n}</code>	$\frac{d^n f}{dx^n}$	n-th Partial Derivative	<code>\pnr{f}{x_1}{n}</code>	$\frac{\partial^n f}{\partial x_1^n}$
Curl (de)	<code>\rot</code>	rot	Curl (en)	<code>\curl</code>	curl
Limit (noarg)	<code>\lims</code>	lim	Limit	<code>\lim{n}{\infty}</code>	$\lim_{n \rightarrow \infty}$
Infimum (noarg)	<code>\infs</code>	inf	Infimum	<code>\inf{M}</code>	$\inf(M)$
Supremum (noarg)	<code>\sups</code>	sup	Supremum	<code>\sup{M}</code>	$\sup(M)$
Limes Inferior (noarg)	<code>\liminfs</code>	lim inf	Limes Inferior	<code>\liminf{n}{\infty}</code>	$\liminf_{n \rightarrow \infty}$
Limes Superior (noarg)	<code>\limsups</code>	lim sup	Limes Superior	<code>\limsup_{n \rightarrow \infty}</code>	$\limsup_{n \rightarrow \infty}$
Function Image (de)	<code>\Bild</code>	Bild	Function Image (en)	<code>\Img</code>	Img
<i>Additional Trigonometric Functions</i>					
Area Sinus hyperbolicus		<code>\Arsinh</code>		Arsinh	
Area Cosinus hyperbolicus		<code>\Arcosh</code>		Arcosh	
Area Tangens hyperbolicus		<code>\Artanh</code>		Artanh	
Area Cotanges hyperbolicus		<code>\Arcoth</code>		Arcoth	
Arcus Cotanges	<code>\arccot</code>	arccot			
Arcus Secans	<code>\arcsec</code>	arcsec	Arcus Cosecans	<code>\arccsc</code>	arccsc
<i>Logic</i>					
Bijunction	<code>\bij</code>	\leftrightarrow			
Equivalent	<code>\eqv</code>	\Leftrightarrow	Not Equivalent	<code>\neqv</code>	\nleftrightarrow
Right Subjunction	<code>\subj</code>	\rightarrow	Left Subjunction	<code>\lsubj</code>	\leftarrow
Not Right Subjunction	<code>\nsubj</code>	\nrightarrow	Not Left Subjunction	<code>\nlsubj</code>	\nleftarrow
Right Implication	<code>\implies</code>	\Rightarrow	Left Implication	<code>\limplies</code>	\Leftarrow
Not Right Implication	<code>\nimplies</code>	\nRightarrow	Not Left Implication	<code>\nlimplies</code>	\nLeftarrow
Symbol for True (de)	<code>\dtrue</code>	W	Symbol for True (en)	<code>\ettrue</code>	T
Symbol for False (de)	<code>\dfalse</code>	F	Symbol for False (en)	<code>\efalse</code>	F
<i>Equations</i>					
Should be equal to	<code>\feq</code>	$\stackrel{!}{=}$			
<i>Constants</i>					
Imaginary Unit	<code>\i</code>	i	Jimaginary Unit (EE)	<code>\j</code>	j
Euler's Number	<code>\e</code>	e			
<i>Number Theory</i>					
GCD (de)	<code>\ggT</code>	ggT	GCD (en)	<code>\gcd</code>	gcd
LCM (de)	<code>\kgV</code>	kgV	LCM (en)	<code>\lcm</code>	lcm
<i>Signal Transforms</i>					
Laplace Transform	<code>\ltr{x}</code>	\bar{x}	Z Transform	<code>\ztr{x}</code>	\tilde{x}
Laplace Transform	<code>\lap{x}</code>	$\mathcal{L}\{x\}(s)$	Laplace Transform (inv)	<code>\ilap{x}</code>	$\mathcal{L}^{(-1)}\{x\}$

Z-Transform	<code>\zat{x}</code>	$\mathcal{Z}\{x\}(z)$	Z-Transform (inv)	<code>\izat{x}</code>	$\mathcal{Z}^{(-1)}\{x\}$
Fourier Transform	<code>\frt</code>	$\xleftrightarrow{\text{FT}}$			
Fourier Transform	<code>\fat{x}</code>	$\mathcal{F}\{x\}(\omega)$	Fourier Transform (inv)	<code>\ifat{x}</code>	$\mathcal{F}^{(-1)}\{x\}$
Fourier Series (de)	<code>\frr</code>	$\xleftrightarrow{\text{FR}}$	Fourier Series (en)	<code>\frs</code>	$\xleftrightarrow{\text{FS}}$
DFT	<code>\dft</code>	$\xleftrightarrow{\text{DFT}}$	DTFT	<code>\dtft</code>	$\xleftrightarrow{\text{DTFT}}$
<i>Custom TikZ-Symbols for Signal Transforms</i>					
Laplace Transform	<code>\ltrnsf</code>	$\bigcirc\text{---}\bullet$	Laplace Transform (inv)	<code>\Ltrnsf</code>	$\bullet\text{---}\bigcirc$
Z Transform	<code>\ztrnsf</code>	$\square\text{---}\blacksquare$	Z Transform (inv)	<code>\Ztrnsf</code>	$\blacksquare\text{---}\square$
<i>Sets</i>					
Natural Numbers	<code>\N</code>	\mathbb{N}	Integers	<code>\Z</code>	\mathbb{Z}
Rational Numbers	<code>\Q</code>	\mathbb{Q}	Irrational Numbers	<code>\I</code>	\mathbb{I}
Real Numbers	<code>\R</code>	\mathbb{R}	Complex Numbers	<code>\C</code>	\mathbb{C}
Set of Primes	<code>\P</code>	\mathbb{P}	Transcendental Numbers	<code>\T</code>	\mathbb{T}
General Field (de)	<code>\K</code>	\mathbb{K}	General Field (en)	<code>\F</code>	\mathbb{F}

Table 1: All symbols and operators from math.sty

As you might have noticed, some of the entries in the table above feature either (de) or (en). These typically refer to language-dependent Operators. A classic example is the Curl of a Vector-Field. In English, the operator is either $\nabla \times \mathbf{V}$ or $\text{curl}(\mathbf{V})$. In German however, the cross-product $\nabla \times \mathbf{V}$ is referred to as *Rotation von \mathbf{V}* ¹. Hence the Operator $\text{rot}(\mathbf{V})$.

There also exist some limits which take no arguments, which is listed with (noarg). This was mostly done to provide a simple text command for just the operator. If you e.g. just want to write: *The limes superior refers to the largest ...* and want to use the symbol \limsup in text without any subscript.

0.3 A Word on Tables

Tables in L^AT_EX can be quite a pain, especially correct vertical spacing and alignment. To avoid maximum frustration, the package `cellspace` is loaded. It allows to define a minimal distance to the top and the bottom of a row. To enable this functionality in your tables, you need to modify your column-list by adding `s` in front of your column type, e.g. `\begin{tabular}{Sc sI sR}`. **Note:** If you have `siunitx` loaded² you need to write `cc` instead.

The standard value for space to top/bottom is 4pt. You can change this by modifying the corresponding commands in `preamble.sty`:

- `\setlength\cellspacetopline` controls the spacing to the top
- `\setlength\cellspacebottomline` controls the spacing to the bottom

`preamble` also includes the `longtable` package. This allows for tables to perform pagebreak. A pagebreak can be manually inserted by typing `\pagebreak` in the table-contents. In order for this to work, the `longtable`-environment mustn't be in a table-environment. So wrap your `longtable` in a `center` and put the caption as a row element. See `readme.tex` for an example.

¹Rotation of \mathbf{V}

²`preamble` loads this package

0.4 Augmented Matrices and Row Operations

We now support augmented matrices. I took this beautiful solution from Stefan Kottwitz³:

```
1 \makeatletter
2 \renewcommand*\env@matrix[1][*\c@MaxMatrixCols c]{%
3   \hspace{-\arraycolsep}
4   \let\@ifnextchar\new@ifnextchar
5   \array{#1}}
6 \makeatother
```

I found this solution on StackExchange⁴. This modifies the amsmath-matrix environment, such that you can add a column-specification (like for tables) e.g. [cc|c] and after the second column, a line will be drawn. A simple example:

```
1 \begin{bmatrix}[cc|c]
2   m_{11} & m_{12} & b_1 \\
3   m_{21} & m_{21} & b_2
4 \end{bmatrix}
```

Produces:

$$\left[\begin{array}{cc|c} m_{11} & m_{12} & b_1 \\ m_{21} & m_{21} & b_2 \end{array} \right]$$

The good part about Kott's solution is, that you can still call `\begin{bmatrix}` and related without any column-specifications, so the following still works:

```
1 \begin{bmatrix}
2   m_{11} & m_{12} & b_1 \\
3   m_{21} & m_{21} & b_2
4 \end{bmatrix}
```

Which produces:

$$\left[\begin{array}{cc} m_{11} & m_{12} & b_1 \\ m_{21} & m_{21} & b_2 \end{array} \right]$$

For Row operations, I found Jake's⁵ solution in this⁶ thread. It allows you to draw a squiggly arrow with a specified length, which is passed as an argument to the call `\longleadsto{<length>}`.

0.5 Pseudo-Code and Algorithms

`preamble.sty` defines the language `pseudo`, which covers some common keywords for pseudo-code. Here are all defined keywords:

```
1 control:
2   1) for      2) begin 3) end      4) input
3   5) if       6) then  7) output  8) return
4   9) while   10) name
5 stack/list operations:
6   1) view    2) push  3) pop      4) insert
7   5) delete
8 basic types:
9   1) bool    2) int   3) float   4) double
10  5) string  6) data
11
```

Table 2: Defined Keywords in `pseudo`

To complete the pseudo-code, I found another beautiful solution here⁷. A simple example:

³<https://tex.stackexchange.com/users/213/stefan-kottwitz>[12.3.2021]

⁴<https://tex.stackexchange.com/questions/2233/whats-the-best-way-make-an-augmented-coefficient-matrix>[12.3.2021]

⁵<https://tex.stackexchange.com/users/2552/jake>[12.3.2021]

⁶<https://tex.stackexchange.com/questions/12678/squiggly-arrows-in-tikz/442036#442036>[12.3.2021]

⁷<https://tex.stackexchange.com/questions/111116/what-is-the-best-looking-pseudo-code-package>

```

1 name: hanoi
2 input: index n, Rod a, Rod b, Rod c
3 hanoi(n, a, b, c):
4   if ( n > 0 ) begin
5     hanoi(n-1, a, c, b)
6     move(a, c)
7     hanoi(n-1, b, a, c)
8   end
9

```

Alg 0.5.1: Towers of Hanoi, recursive

The caption-name can be overwritten with a simple `renewcommand{algcaption}{<name>}`. The environment accepts all `lstlisting` arguments as-well as `caption`:

```

1 \begin{algorithm}[language=pseudo,caption={Towers of Hanoi, recursive}]
2   name: hanoi
3   input: index n, Rod a, Rod b, Rod c
4   hanoi(n, a, b, c):
5   if ( n > 0 ) begin
6     hanoi(n-1, a, c, b)
7     move(a, c)
8     hanoi(n-1, b, a, c)
9   end
10 \end{algorithm}

```

0.6 Authors Note

Since I am currently studying Information and Computer Engineering, I've only written macros for corresponding fields (i.e. electrical engineering). So currently there are no neat macros for Chemistry or advanced Physics, etc. Since this repository is public you can Issue a feature request and given some time, it should be implemented in a corresponding style.