The \texttt{skmath} package\textsuperscript{*†}

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Version 0.5a

Abstract The skmath package provides improved and new math commands for superior typesetting with less effort.

1 Introduction

This package intends to provide helpful (re-)definitions of commands related to typesetting mathematics, and specifically typesetting them in a more intuitive, less verbose and more beautiful way. It was originally not intended for use by the public, and as such there may be incompatibilities with other packages of which I am not aware, but I figured it could be useful to other people as well.

2 Usage

2.1 Options

As of version v0.5a, the package provides two key-value options.

\begin{description}
\item[commonsets] \texttt{true,false} \hspace{1cm} (false)
Optionally define \texttt{\set N, \set Z, \set Q, \set R} and \texttt{\set C} as blackboard variants of the respective letters, to represent the common sets of numbers.
\item[notation] \texttt{iso,english,german,legacy} \hspace{1cm} (legacy)
This option controls the style of a few typographic elements that differ between countries and standards (such as the style of integrals, derivatives and greek letters).
\end{description}

\textsuperscript{*}Available on \url{http://www.ctan.org/pkg/skmath}.
\textsuperscript{†}Development version available on \url{https://github.com/urdh/skmath}.

\begin{center}
\textit{The \texttt{skmath} package, v0.5a}
\end{center}
2.2 New commands

The package defines a number of new commands that aid in typesetting certain mathematical formulae.

\N \Z \Q \R \C

These commands are only available if the commonsets option is given. They typeset the set of natural, integer, rational, real and complex numbers respectively.

Example:

\begin{equation*}
N, Z, Q, R, C.
\end{equation*}

\ii \jj

These commands typeset the imaginary unit (either $i$ as used in mathematics or $j$ as used in electrotechnology). While normal use of the package simply results in italic characters, setting the notation option to iso will set these upright.

\ee

This command typesets Euler’s number $e = \sum_{n=0}^{\infty} \frac{1}{n!}$. The style is affected by the notation option in the same way as \exp.
The commands \texttt{\textbackslash norm} and \texttt{\textbackslash abs}, quite expectedly, typeset the norm ans absolute value of an expression, respectively. They have one mandatory argument (the expression), and different norms can be achieved by appending a subscript after the argument of \texttt{\textbackslash norm}.

Example:

\[
\|x\|_p = \left( \sum_{i=1}^{n} |x_i|^p \right)^{1/p}
\]

\begin{equation*}
\|\vec{x}\|_p = \left( \sum_{i=1}^{n} \abs{x_i}^p \right)^{\sfrac{1}{p}}
\end{equation*}

There is also a command \texttt{\textbackslash d}, with one mandatory argument, that typesets the differential part of an integral.

Example:

\[
\int_{\mathbb{R}} \frac{\sin(x)}{x} \, dx
\]

\begin{equation*}
\int_{\mathbb{R}} \frac{\sin(x)}{x} \, d\{x\}
\end{equation*}

This macro typesets a partial derivative. The starred variant typesets derivatives as subscripts, i.e. \(f_{xyy}\), while the unstarred variant typesets full fractions.
Example:

\[ \frac{\partial^{m+n} f}{\partial x^m \partial y^n} \]

\begin{equation*}
\pd{f}{x^m,y^n}
\end{equation*}

As the example shows, the comma-separated list of variables also supports superscripts to denote the number of derivatives, and the sum of the variables is automatically calculated.

\texttt{\td \{\textit{function}\}\{\textit{var}\}}

This macro typesets a total derivative. Unlike \texttt{pd}, this macro does not have a starred variant, and only typesets full fractions:

Example:

\[ \frac{d^m f}{dx^m} \]

\begin{equation*}
\td{f}{x^m}
\end{equation*}

\texttt{\E \{\textit{expression}\}}

The command \texttt{E} typesets the expectation of a random variable.

Example:

\[ \E[\hat{\mu}] = \mu \]

\begin{equation*}
\E[\hat\mu] = \mu
\end{equation*}

\texttt{\P \{\textit{expression}\} \given \{\textit{expression}\}}

The \texttt{P} command typesets a probability. The \texttt{given} command can be used to typeset conditional probabilities, within \texttt{P}.

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Example:

\[
P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}
\]

\begin{equation*}
\var{A \mid B} = \frac{\var{B \mid A} \var{A}}{\var{B}}
\end{equation*}

\var{⟨expression⟩}
\cov{⟨expression⟩}{⟨expression⟩}

The commands \var and \cov typeset the variance and covariance of an expression.

Example:

\[
\begin{align*}
\var{X} &= \mathbb{E}[(X - \mu)^2] \\
\cov{X}{Y} &= \mathbb{E}[XY] - \mathbb{E}[X] \mathbb{E}[Y]
\end{align*}
\]

\begin{gather*}
\var{X} = \mathbb{E}[(X - \mu)^2] \\
\cov{X}{Y} = \mathbb{E}[XY] - \mathbb{E}[X] \mathbb{E}[Y]
\end{gather*}

2.3 Improved commands

In addition to adding new commands, this package also redefines already existing commands in a mostly backwards-compatible way to improve their usefulness.

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\sin [(power)]{(expression)}  \arcsin {(expression)}  
\cos [(power)]{(expression)}  \arccos {(expression)}  
\tan [(power)]{(expression)}  \arctan {(expression)}  
\cot [(power)]{(expression)}  
\sinh [(power)]{(expression)}  \cosh [(power)]{(expression)}  \tanh [(power)]{(expression)}

The trigonometric functions have been redefined to typeset more easily. They typeset \textit{(expression)} as an argument of the expression, and (if applicable) \textit{(power)} as a superscript between the function and its argument, \textit{e.g.} sin\(^2\) (\(\phi\)). When the argument is empty, no parentheses are emitted: \cos.

\ln {(expression)}

The natural logarithm macro \texttt{ln} has also been redefined to require an argument which is typeset as the argument of the logarithm.

\log [(base)]{(expression)}

The related macro \texttt{log} is redefined in a similar way, but also accepts an optional argument denoting the base of the logarithm: log\(_2\) (\(x\)). As with the trigonometric functions, no parentheses are emitted if the mandatory argument is empty: log.

\exp *{(expression)}

The exponential, \texttt{exp}, is redefined to typeset its argument as a superscript of \(e\) in some display styles, and as an argument of \texttt{exp} otherwise:

\(e^{\sqrt{2}\exp(x)}\)

Additionally, it is possible to force the \texttt{exp} mode by using the starred variant.

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The maximum/minimum macros have been redefined in a manner similar to the trigonometric functions. They typeset \( \langle \text{expression} \rangle \) inside curly brackets (the starred version omits the brackets), with the optional \( \langle \text{domain} \rangle \) typeset in a subscript after the operator (e.g. \( \min_{x \in \mathbb{R}^+} f(x) \)). Argument variants are also provided, and the \( \langle \text{expression} \rangle \) is centered underneath the operator if possible:

\[
\arg \min_{x \in \mathbb{R}^+} f(x)
\]

### 2.4 Stylistic changes

Some commands have been redefined in a completely backwards-compatible way to improve the end result of their typesetting.

\[ \frac{\langle \text{numerator} \rangle}{\langle \text{denominator} \rangle} \]

The \( \frac \) command has been changed to improve typesetting, allowing displaystyle math in some settings.

\[ \bar{\langle \text{expression} \rangle} \]

\[ \vec{\langle \text{expression} \rangle} \]

The \( \bar \) command has been changed to cover the entire \( \langle \text{expression} \rangle \) (i.e. \( \pi \)), and \( \vec \) has been changed to match the \( \text{vector sym} \) command provided by isomath.

\[ \Re \{ \langle \text{expression} \rangle \} \]

\[ \Im \{ \langle \text{expression} \rangle \} \]

These commands typeset the real and imaginary part of a number. Standard use of the package takes definitions roughly from amsmath, while
setting the notation option to isochanges the definitions to match ISO 80000-2.

3 Known issues

A list of current issues is available in the Github repository of this package\(^1\), but as of the release of v0.5a, there is one known issue.

\#15 The package is incompatible with (at least) blindtext, when including math in the blind text. This is due to the redifinition of \texttt{\sin} (and friends), which is incompatible with the original amsmath definition. This is a feature, not a bug.

\#29 The spacing between operator names and parentheses is typographically incorrect. A work-around until this is fixed in skmath is to use the \texttt{\mleft\mright} macro from mleftright to redefine \texttt{\left} and \texttt{\right}.

If you discover any bugs in this package, please report them to the issue tracker in the skmath Github repository.

\(^1\)https://github.com/urdh/skmath/issues

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4 Installation

The easiest way to install this package is using the package manager provided by your \LaTeX{} installation if such a program is available. Failing that, provided you have obtained the package source (skmath.tex and Makefile) from either CTAN or Github, running make install inside the source directory works well. This will extract the documentation and code from skmath.tex, install all files into the TDS tree at TEXMFHOME and run mktexlsr.

If you want to extract code and documentation without installing the package, run make all instead. If you insist on not using make, remember that packages distributed using skdoc must be extracted using pdflatex, not tex or latex.

5 Changes

\textbf{v0.1}

General: Initial version.

\textbf{v0.1c}

General: Moved package from docstrip to skdoc.

\textbf{v0.1d}

General: Fixed fatal documentation and package errors.

\textbf{v0.1e}

General: Added statistics commands.

\textbf{v0.1g}

General: Documentation fixes.

\textbf{v0.2}

General: Use expl3 functionality throughout the package.

\textbf{v0.3}

General: Added \texttt{\textbackslash min/\textbackslash max} and friends. Added \texttt{\textbackslash pd}.

\textbf{v0.3a}

General: Added \texttt{\textbackslash sinh, \textbackslash cosh} and \texttt{\textbackslash tanh}.

\textbf{v0.3b}

General: Detect empty arguments in trigonometric and logarithmic functions, fix \texttt{\textbackslash ln}.

\textit{The skmath package, v0.5a}
General: Added notation option, macros for complex numbers.

General: Replaced deprecated/removed expl3 constructs.

General: Track expl3 changes (thanks to Joseph Wright).

General: Added \td.

General: Track expl3 changes (thanks to Phelype Oleinik).

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