

# Package `math-operator` v. 1.3a Implementation

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## Overview

The `math-operator` package defines control sequences for roughly one hundred and fifty math operators, including special functions, probability distributions, pure mathematical constructions, and a variant of `\overline`. The package also provides an interface for users to define new math operators similar to the `amsopn` package. New operators can be medium or bold weight, and they may be declared as `\mathord` or `\mathop` subformulas.

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This file documents the code for the `math-operator` package. It is not a user guide! If you are looking for instructions on how to typeset math operators in your equations, please see `math-operator-user-guide.pdf`, which is included with the `math-operator` installation and is available on CTAN. The first three sections of this file deal with package setup and the commands to define new operators, and the remaining sections document the operators defined in this package. Section 4 covers several blackboard-bold letters, and Section 5 discusses categories. Section 6 deals with Jacobi elliptic functions, and Section 7 defines matrix groups and linear algebra operations. Section 8 defines the command to produce an overline. Section 9 defines a number of common probability distributions. Section 10 deals with special functions, and Section 11 covers other standard operators. Finally, Section 12 defines trigonometric functions. Version history and code index appear at the end of the document.

## 1 Setup

We begin with package declaration. The first 59 lines of `operator.sty` are comments.

```
60 \NeedsTeXFormat{LaTeX2e}
61 \ProvidesPackage{math-operator}[2025/09/10 v. 1.3a]
```

Create booleans that we'll use for option processing. One boolean per category of operator.

```
62 \newif\if@operator@bb % blackboard bold
63 \newif\if@operator@c  % category theory
64 \newif\if@operator@j  % Jacobi elliptic functions
65 \newif\if@operator@l  % linear algebra
66 \newif\if@operator@o  % overlining
67 \newif\if@operator@p  % probability distributions
68 \newif\if@operator@sf % special functions
69 \newif\if@operator@s  % standard operators
70 \newif\if@operator@t  % trigonometry
```

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Acknowledgements: Thanks to Andrew Baker for pointing out a bug in a previous version of `math-operator` and suggesting additional control sequences for the package.

Set all options to true by default.

```

71 \@operator@bbtrue
72 \@operator@ctrue
73 \@operator@jtrue
74 \@operator@ltrue
75 \@operator@otrue
76 \@operator@ptrue
77 \@operator@sftrue
78 \@operator@strue
79 \@operator@ttrue

```

Now declare and process options.

```

80 \DeclareOption{blackboard}{\@operator@bbtrue}
81 \DeclareOption{category}{\@operator@ctrue}
82 \DeclareOption{jacobi}{\@operator@jtrue}
83 \DeclareOption{linear}{\@operator@ltrue}
84 \DeclareOption{overbar}{\@operator@otrue}
85 \DeclareOption{probability}{\@operator@ptrue}
86 \DeclareOption{special}{\@operator@sftrue}
87 \DeclareOption{standard}{\@operator@strue}
88 \DeclareOption{trigonometry}{\@operator@ttrue}

```

The no- options prevent the package from defining certain operators.

```

89 \DeclareOption{no-blackboard}{\@operator@bbfalse}
90 \DeclareOption{no-category}{\@operator@cfalse}
91 \DeclareOption{no-jacobi}{\@operator@jfalse}
92 \DeclareOption{no-linear}{\@operator@lfalse}
93 \DeclareOption{no-overbar}{\@operator@ofalse}
94 \DeclareOption{no-probability}{\@operator@pfalse}
95 \DeclareOption{no-special}{\@operator@sffalse}
96 \DeclareOption{no-standard}{\@operator@sfalse}
97 \DeclareOption{no-trigonometry}{\@operator@tfalse}
98 \ProcessOptions*

```

A couple bookkeeping things. The count `\operatordefmode` determines the package behavior when the user calls one of the declaration commands on a control sequence that is already defined (and not an operator). When `\operatordefmode` is negative, the package overwrites the definition. Otherwise, the package behaves as follows:

- 0: Silently ignore (message written on the log file)
- 1 (default): issue a warning
- 2 or greater: issue an error message

We implement this behavior later in `\make@newop@cmd`.

```

99 \def\@operatorinfo#1{\wlog{Package operator Info: #1}}
100 \newcount\operatordefmode
101 \operatordefmode\@ne

```

Boolean that is false in general and true whenever we are typesetting a bold operator.

```
102 \newif\if@bfop@
103 \bfop@false
```

Commands to define protected macros. We check whether `\protected` is defined to avoid dependence on  $\varepsilon$ -TeX in the unlikely chance that someone is using L<sup>A</sup>T<sub>E</sub>X without  $\varepsilon$ -TeX.

```
104 \ifx\protected\@undefined
105   \let\@operator@robust@def\DeclareRobustCommand
106   \def\@operator@robust@gdef#1{%
107     \bgroup
108     \escapechar\m@ne
109     \xdef#1{\noexpand\protect
110       \expandafter\noexpand\csname\string#1 \endcsname}%
111     \expandafter
112     \egroup
113     \expandafter\gdef\csname\string#1 \endcsname}
114 \else
115   \def\@operator@robust@def{\protected\def}
116   \def\@operator@robust@gdef{\protected\gdef}
117 \fi
```

## 2 Extra User-Level Commands

Some math operators contain characters other than letters, and we define control sequences to access three expressions from the operator font:

- `\@operatorhyphen` typesets a hyphen in the `\fam`
- `\@operatortw@` typesets 2 in the `\fam`
- `\@operatorm@ne` typesets  $-1$  possibly in the `\fam`

Later in this section, we define user-level wrappers around these control sequences, and the user-level commands for squared and inverse operators format the expression as a superscript. I am assuming that the operator font contains the appropriate glyphs in the encoding slots for hyphen, 1, and 2, so we can define `\@operatorhyphen` and `\@operatortw@` as `\mathalpha` characters using `\mathchardef` or `\Umathchardef`. For the case where `\Umathchar` is undefined, we have to convert encoding slots for the hyphen and two numbers into hexadecimal. We use the same approach as `\set@mathchar` from the L<sup>A</sup>T<sub>E</sub>X kernel. First is the math-mode hyphen.

```
118 \def\defaultinverse{-1}
119 \ifx\Umathchar\@undefined
120   \begingroup
121     \@tempcntb=\number`\-\relax
122     \count@\@tempcntb
123     \divide\count@ by 16\relax
124     \@tempcnta\count@
125     \multiply\count@ by 16\relax
```

```

126   \advance\@tempcntb by -\count@
127   \global\mathchardef\operatorhyphen
128     "70\hexnumber@\@tempcnta\hexnumber@\@tempcntb\relax

```

Next is 2.

```

129   \@tempcntb=\number`2\relax
130   \count@\@tempcntb
131   \divide\count@ by 16\relax
132   \@tempcnta\count@
133   \multiply\count@ by 16\relax
134   \advance\@tempcntb by -\count@
135   \global\mathchardef\operator@tw@
136     "70\hexnumber@\@tempcnta\hexnumber@\@tempcntb\relax
137   \endgroup

```

For the inverse symbol, we just use `\defaultinverse`.

```

138   \def\@operator@m@ne{\begingroup\fam@m@ne\defaultinverse\endgroup}

```

Things are simpler when we have access to Unicode.

```

139 \else
140   \Umathchardef\operatorhyphen=+7+0+`-\relax
141   \Umathchardef\operator@tw@=+7+0+`2\relax

```

The minus sign is tricky because it may change its location depending on the encoding. For  $-1$ , we first check if the `\fam` contains a glyph in slot "2212. If yes, we typeset  $-1$  in the operator font, and if not, we forget about the operator font entirely and typeset `\defaultinverse` (which is  $-1$  by default) with `\fam = -1`.

```

142   \def\@operator@m@ne{%
143     \ifnum\fam>\m@ne
144       \mathchoice{%
145         \iffontchar\textfont\fam"2212\relax
146         \Umathchar+0+\fam"2212\relax % minus sign
147         \Umathchar+0+\fam "31\relax % 1
148       \else
149         \begingroup\fam@m@ne\defaultinverse\endgroup
150       \fi}%
151     {\iffontchar\textfont\fam"2212\relax
152     \Umathchar+0+\fam"2212\relax % minus sign
153     \Umathchar+0+\fam "31\relax % 1
154     \else
155     \begingroup\fam@m@ne\defaultinverse\endgroup
156     \fi}%
157     {\iffontchar\scriptfont\fam"2212\relax
158     \Umathchar+0+\fam"2212\relax % minus sign
159     \Umathchar+0+\fam "31\relax % 1
160     \else
161     \begingroup\fam@m@ne\defaultinverse\endgroup

```

```

162     \fi}%
163     {\iffontchar\scriptscriptfont\fam"2212\relax
164       \Umathchar+0+\fam"2212\relax % minus sign
165       \Umathchar+0+\fam "31\relax % 1
166     \else
167       \begingroup\fam\m@ne\defaultinverse\endgroup
168     \fi}%
169 \else
170   \defaultinverse
171 \fi}
172 \fi

```

Now provide user-level access to those three control sequences. Each command has a starred version, which typesets the characters in bold if possible. The default, unstarred version can appear anywhere in an equation. The general idea behind both starred and unstarred versions is to first check whether `\if@bfop@` is true and then fill in values accordingly. When `\if@bfop@` is true, we can type a hyphen directly, and otherwise, we use `\@bfop@choices` or `\@operatorhyphen` depending on whether we want bold or medium weight.

```

173 \@operator@robust@def\operatorhyphen{\@ifstar
174   \@operatorhyphen@bf\@operatorhyphen@@}
175 \def\@operatorhyphen@bf{%
176   \if@bfop@
177     -%
178   \else
179     \mathchoice{}{}{}{}
180     {\@init@bfopfont\@bfop@choices{-}}
181   \fi}
182 \def\@operatorhyphen@@{%
183   \if@bfop@
184     -%
185   \else
186     {\operator@font\@operatorhyphen}
187   \fi}

```

Same thing for the power of 2. When `\if@bfop@` is true, we use a `\textsuperscript`, and when it is false, we expect to be in M mode and can use `^` directly.

```

188 \@operator@robust@def\operatorssquared{\@ifstar
189   \@operatorssquared@bf\@operatorssquared@@}
190 \def\@operatorssquared@bf{%
191   \if@bfop@
192     \textsuperscript{2}%
193   \else
194     ^{\@init@bfopfont\@bfop@choices{2}}
195   \fi}
196 \def\@operatorssquared@@{%
197   \if@bfop@

```

```

198   \textsuperscript{2}%
199   \else
200   ~{\operator@font\@operator@tw@}
201   \fi}

```

And inverse operation. This control sequence is once again more complicated because of the issue with the minus sign. As in `\operator@squared`, we use `\textsuperscript` and type out the  $-1$  directly when `\if@bfop@` is true, and if that boolean is false, we use `~` and `\@bfop@choices` or `\@operator@one`. Unlike with `\operator@squared`, typing out  $-1$  involves checks to determine whether the font contains a minus sign in slot "2212. If yes, we type  $-1$  with `\Uchar`, and if not, we use `\defaultinverse`.

```

202 \@operator@robust@def\operatorinverse{\@ifstar
203   \operatorinverse@bf\operatorinverse@@}
204 \def\operatorinverse@bf{%
205   \if@bfop@
206     \textsuperscript{%
207       \ifx\Uchar\@undefined
208         $\defaultinverse$%
209       \else
210         \iffontchar\font"2212\relax
211         \Uchar"2212\relax 1%
212       \else
213         $\defaultinverse$%
214       \fi
215     \fi}%
216   \else
217     ~{\@init@bfopfont\@bfop@choices{%
218       \ifx\Uchar\@undefined
219         $\defaultinverse$%
220       \else
221         \iffontchar\font"2212\relax
222         \Uchar"2212\relax 1%
223       \else
224         $\defaultinverse$%
225       \fi
226     \fi}}
227   \fi}
228 \def\operatorinverse@@{%
229   \if@bfop@
230     \textsuperscript{%
231       \ifx\Uchar\@undefined
232         $\defaultinverse$%
233       \else
234         \iffontchar\font"2212\relax
235         \Uchar"2212\relax 1%
236       \else

```

```

237     $\defaultinverse$%
238     \fi
239     \fi}%
240 \else
241   ^{\operator@font\@operator@ne}
242 \fi}

```

Finally, we make a new name for pilcrow symbol because `math-operator` may overwrite `\P`.

```

243 \@operator@robust@def\pilcrow{\ifmmode
244   \textparagraph\else\mathparagraph\fi}

```

### 3 Defining New Operators

We begin with the user-level operator declarations. Each of these commands expects the `#1` argument to be a single control sequence, and the `#2` argument should be the text of the operator. These macros all serve as wrappers around `\make@newop@cmd`, which does the work of defining the operator and expects two arguments. The first argument is the `#1` control sequence, and the second argument is code that defines `#1` as some expression involving `#2`. (We execute this code inside `\make@newop@cmd` if `#1` is a valid operator name.) In the first user-level command here, the control sequence should expand to `{\operator@font<text>}`, which simply typesets `#2` in the operator font. More complicated cases use different definitions.

```

245 \ifx\protected\@undefined
246   \def\@tempa{\DeclareRobustCommand\DeclareMathText [2]}
247 \else
248   \def\@tempa{\protected\def\DeclareMathText##1##2}
249 \fi
250 \@tempa{\make@newop@cmd{#1}
251   {\@operator@robust@def#1{\operator@font #2}}}}

```

**Bold** is more complicated for reasons discussed later in this section. The definition of `#1` in this case has three parts. First, the `\mathchoice` ensures that we are in math mode without adding anything to the current math formula. Then `\@init@bfopfont` sets up the bold operator font, and `\@bfop@choices` typesets `#2` in boldface.

```

252 \ifx\protected\@undefined
253   \def\@tempa{\DeclareRobustCommand\DeclareBoldMathText [2]}
254 \else
255   \def\@tempa{\protected\def\DeclareBoldMathText##1##2}
256 \fi
257 \@tempa{\make@newop@cmd{#1}
258   {\@operator@robust@def#1{\mathchoice{}{}{}{\@init@bfopfont
259     {\@bfop@choices{#2}}}}}

```

For the two commands that make a proper operator, i.e. a `\mathop` subformula, we allow for a starred version. A star means the operator is typeset with `\limits`, so any superscripts or subscripts will be directly above or below the operator. No star (the default version) means

the operator is typeset with `\nolimits`, and any superscripts and subscripts will appear normally.

```
260 \@operator@robust@def\DeclareMathOperator{\relax\@ifstar
261   \@operatorlim\@operatornolim}
```

Operator with bold text.

```
262 \@operator@robust@def\DeclareBoldMathOperator{\relax\@ifstar
263   \@bfoperatorlim\@bfoperatornolim}
```

Next are the four commands that actually call `\make@newop@cmd` inside the previous two control sequences. They are analogous to `\DeclareMathText` and `\DeclareBoldMathText` above, except now we specify `\mathop`. We include an empty `\kern` to ensure that the subformula contains more than a single character, and this forces the baseline of the operator to line up with the rest of the equation. If  $\TeX$  encounters an expression like `\mathop{\langle single char \rangle}`, it will vertically center the `\langle single char \rangle` in the middle of the equation because it thinks you're typesetting something like an integral or summation sign.

```
264 \def\@operatorlim#1#2{%
265   \make@newop@cmd{#1}
266   {\@operator@robust@def#1{\mathop{\operator@font\kern\z@#2}\limits}}}
```

Same thing with `\nolimits`.

```
267 \def\@operatornolim#1#2{%
268   \make@newop@cmd{#1}
269   {\@operator@robust@def#1{\mathop{\operator@font\kern\z@#2}\nolimits}}}
```

The bold operator works the same way as `\DeclareBoldMathText`: ensure we're in math mode (and raise an error if not), then call `\@init@bfopfont` and `\@bfop@choices` to typeset the operator.

```
270 \def\@bfoperatorlim#1#2{%
271   \make@newop@cmd{#1}
272   {\@operator@robust@def#1{\mathchoice{}{}{}{} \@init@bfopfont
273     \mathop{\@bfop@choices{#2}}\limits}}}
```

Same thing with `\nolimits`.

```
274 \def\@bfoperatornolim#1#2{%
275   \make@newop@cmd{#1}
276   {\@operator@robust@def#1{\mathchoice{}{}{}{} \@init@bfopfont
277     \mathop{\@bfop@choices{#2}}\nolimits}}}
```

We store the list of control sequences that code for operators in `\operator@list`. Initially the macro contains the operator control sequences from the  $\LaTeX$  kernel.

```
278 \def\operator@list{\log\lg\ln
279   \lim\limsup\liminf
280   \sin\arcsin\sinh
281   \cos\arccos\cosh
282   \tan\arctan\tanh
283   \cot\coth
284   \sec\csc}
```



```

285 \max\min\sup\inf
286 \arg\ker\dim\hom\det
287 \exp
288 \Pr
289 \gcd\deg}

```

Command to add to the list of operators.

```

290 \def\addto@operator@list#1{\expandafter
291 \def\expandafter\operator@list\expandafter{\operator@list#1}}

```

The macro `\@ifoperator` accepts a single control sequence and checks whether it appears in `\operator@list`.

```

292 \def\@ifoperator#1{%
293 \expandafter\in@\expandafter#1\expandafter{\operator@list}%
294 \ifin@
295 \expandafter\@firstoftwo
296 \else
297 \expandafter\@secondoftwo
298 \fi}

```

Error and warning messages for `\make@newop@cmd`.

```

299 \def\OperatorBadNameError#1{%
300 \def\@tempa{#1}%
301 \@onelevel@sanitize\@tempa
302 \PackageError{math-operator}{Invalid name\MessageBreak
303 "\@tempa" for new operator}
304 {I was expecting the name of the new operator\MessageBreak
305 to be a single control sequence, but instead\MessageBreak
306 you typed "\@tempa." \MessageBreak
307 This doesn't work. To resolve this error, \MessageBreak
308 make sure the first argument of the operator \MessageBreak
309 declaration is a single control sequence. \MessageBreak}}
310 \def\OperatorCSDefWarning#1{%
311 \PackageWarning{math-operator}{Control sequence \MessageBreak
312 \string#1\space is already defined. Your \MessageBreak
313 operator declaration was \MessageBreak ignored}}
314 \def\OperatorCSDefError#1{%
315 \PackageError{math-operator}{Control sequence \MessageBreak
316 \string#1\space already defined. Your \MessageBreak
317 operator declaration was ignored}
318 {You tried to define the control sequence \MessageBreak
319 \string#1\space to be a new \MessageBreak
320 operator even though it already has a \MessageBreak
321 definition. I'm currently set to raise an \MessageBreak
322 error when that happens. To resolve the \MessageBreak
323 error, either pick a different control \MessageBreak
324 sequence or set \string\operatordefmode\space to a \MessageBreak
325 negative number to overwrite the definition. \MessageBreak}}

```

The `\make@newop@cmd` macro does the work of defining the new operator. It accepts two arguments: `#1` a control sequence and `#2` a statement defining `#1` to be something. The previous user-level `\Declare⟨stuff⟩` macros provide the appropriate definitions, so we include `#2` by itself in two places. The main job of `\make@newop@cmd` is to check whether `#1` is a single control sequence and not already defined as something besides an operator.

```
326 \def\make@newop@cmd#1#2{%
327   \expandafter\ifx\expandafter\@nnil\@gobble#1\@nnil % is #1 one token?
328   \ifcat\relax\noexpand#1 % does #1 start with cs?
```

If `#1` is already an operator, we can redefine it no problem.

```
329   \@ifoperator{#1}
330     {\@operatorinfo{Redefining \string#1\space operator.}
331     #2} % <-- new definition happens here
```

If not, we first check whether `#1` is undefined. If yes, we define it and add it to `\operator@list`.

```
332     {\ifx#1\@undefined
333       \@operatorinfo{Defining new operator \string#1.}
334       \addto@operator@list{#1}
335       #2 % <-- new definition happens here
```

Otherwise, we consult the value of `\operatordefmode`. When this count is negative, we redefine the control sequence and turn it into an operator.

```
336     \else % if #1 is already defined...
337       \ifnum\operatordefmode<\z@ % case < 0: redefine
338         \@operatorinfo{Overwriting definition of \string#1.}
339         \addto@operator@list{#1}
340         #2 % <-- new definition happens here
```

If `\operatordefmode` is nonnegative, we do not redefine `#1` and instead do nothing, issue a warning, or issue an error depending on the count value.

```
341     \else
342       \@operatorinfo{Leaving \string#1\space as is.}
343       \ifcase\operatordefmode % case 0: do nothing
344       \or % case 1: warning
345         \OperatorCSDefWarning{#1}
346       \else % case >= 2: error
347         \OperatorCSDefError{#1}
348       \fi
349     \fi
350   \fi}
351 \else
352   \OperatorBadNameError{#1}
353 \fi
354 \else
355   \OperatorBadNameError{#1}
356 \fi}
```

Bold text in math mode is complicated because  $\LaTeX$  doesn't provide direct access to a bold version of the operator font. My solution is to extract the operator font information from the `nfss` and then use that font family in boldface inside an `\hbox`. Doing so is an effective way to ensure that we are typesetting bold text, as opposed to bold math, in the operator font family. The other option would be to change the `\fam`, either with `\mathbf` or with a direct call to `\fam`, but that approach has two main drawbacks. First, `\mathbf` is intended to produce bold variable names, such as vectors in physics, not necessarily bold text, and the same may be true of other bold symbol fonts. In traditional  $\LaTeX$ , `\mathbf` does produce a bolded version of the operator font, but that may not be true in general. Second, it may not be obvious whether the `NFSS` has even declared a bold version of the operator font as a symbol font, and I do not want to hack the `NFSS` to determine this when we have an easier and more reliable alternative.

To implement this approach, we need three `\font` commands (which we call `\@bfoptf`, `\@bfopsf`, and `\@bfopssf`) that switch to the bold operator font in H mode at different sizes: one size for `\textstyle` and `\displaystyle`, one size for `\scriptstyle`, and one size for `\scriptscriptstyle`. We implicitly assume that the operator font family does not change after `\begin{document}` (but it can change in the preamble), but the user may freely enlarge or shrink the text. For these three `\font` commands, we store their sizes in `\operator@tf`, `\operator@sf`, and `\operator@ssf`, and if these macros do not match the size of the current `\textfont`, `\scriptfont`, or `\scriptscriptfont` respectively, we redefine all three `\font` commands at the correct size. The idea here is that we make new `\font` commands if the surrounding text size has changed since the user's most recent bold operator. Finally, we pick the right size in the current equation by putting the operator text inside `\mathchoice`.

```
357 \let\operator@tf\relax
358 \let\operator@sf\relax
359 \let\operator@ssf\relax
```

The macro `\@init@bfopfont` (re)defines the font-change commands. We start by checking whether the sizes of `\@bfoptf`, `\@bfopsf`, and `\@bfopssf` match `\tf@size`, `\sf@size`, and `\ssf@size`. If yes, this command does nothing, and if not, we need to redefine the three `\font` commands to have the correct font size.

```
360 \def\@init@bfopfont{%
361   \@tempswatrue           % reset sizes by default
362   \ifx\operator@tf\tf@size
363     \ifx\operator@sf\sf@size
364       \ifx\operator@ssf\ssf@size
365         \@tempswafalse % don't reset sizes if unnecessary
366       \fi
367     \fi
368   \fi
```

If we do need to change the font size, we switch to the operator font inside a group and get rid of the `\escapechar`, then do fun things.

```
369   \if@tempswa
370     \begingroup
371       \operator@font
372       \escapechar\m@ne
```

The macro `\set@bf@@` accepts three arguments. The `##1` argument should be a control sequence, the `##2` argument is `\textfont`, `\scriptfont`, or `\scriptscriptfont`, and the `##3` argument is a font size (a number). This is the command that finds the operator font in the NFSS and converts it to bold, and it defines `##1` to be the `\font` command that produces this font.

```
373 \def\set@bf@@##1##2##3{%
374 \edef\@tempa{\expandafter\string\the##2\fam}
375 \expandafter\split@name\@tempa\@nil
376 \DeclareFixedFont##1\fontencoding\fontfamily\bfdefault\fontshape##3}
```

Here is where we actually make the font-change commands. We call our “text font” `\@bfoptf`, our “script font” `\@bfopsf`, and our “script script font” `\@bfopssf`.

```
377 \set@bf@@\@bfoptf\textfont\fontsize
378 \set@bf@@\@bfopsf\scriptfont\fontsize
379 \set@bf@@\@bfopssf\scriptscriptfont\fontsize
```

Now save the sizes of the current font-change commands for the next bold operator.

```
380 \global\let\operator@tf\fontsize
381 \global\let\operator@sf\fontsize
382 \global\let\operator@ssf\fontsize
383 \endgroup
384 \fi}
```

The `\@bfop@choices` macro accepts a single argument, which should be the text of an operator to be typeset in bold. The `#1` argument goes inside an `\hbox` with a font-change command that depends on the current math style. To keep things working properly in the NFSS, we also update the internal macros that store the font information. The macro `\operator@update@font` calls `\split@name` on the current `\font`. We need to set the `\escapechar` to `-1` because `\split@name` does not expect the leading backslash from the current `\font`.

```
385 \def\operator@update@font{\begingroup
386 \escapechar\m@ne
387 \expandafter\expandafter\expandafter
388 \endgroup
389 \expandafter\expandafter\expandafter
390 \split@name\expandafter\string\the\font\@nil}
```

Now define `\@bfop@choices`. We initially set `\if@bfop@` to true. We don’t have to reset it because `\@bfop@choices` always appears in a group, so this change is necessarily local.

```
391 \def\@bfop@choices#1{\@bfop@true
392 \mathchoice{\hbox{\@bfoptf\operator@update@font#1}}
393 {\hbox{\@bfoptf\operator@update@font#1}}
394 {\hbox{\@bfopsf\operator@update@font#1}}
395 {\hbox{\@bfopssf\operator@update@font#1}}}
```

Finally, we make the operator declaration commands preamble only. Is this necessary? Probably not, but operator declaration distinctly feels like something that should happen only in the preamble.

```

396 \@onlypreamble\DeclareMathText
397 \@onlypreamble\DeclareBoldMathText
398 \@onlypreamble\DeclareMathOperator
399 \@onlypreamble\DeclareBoldMathOperator
400 \@onlypreamble\@operatorlim
401 \@onlypreamble\@operatornolim
402 \@onlypreamble\@boperatorlim
403 \@onlypreamble\@boperatornolim
404 \@onlypreamble\make@newop@cmd

```

## 4 Blackboard Bold

Make the blackboard-bold letters. This package isn't designed to load fonts, so we're implementing each  $\langle letter \rangle$  assuming the user has or will at some point request a package that defines `\mathbb`. We leave each blackboard-board letter undefined until the first time it appears in math mode. If `\mathbb` is still undefined at that point, `math-operator` raises a `\NoBBError`, and otherwise it defines  $\langle letter \rangle$  to be `\mathbb{\langle letter \rangle}`. For a traditional L<sup>A</sup>T<sub>E</sub>X approach that implements `\mathbb` as a new math alphabet, i.e. by changing the font of certain letters without changing their encoding slots, it would arguably be better to find the math family that corresponds to `\mathbb` and use `\mathchardef`. However, modern Unicode-based implementations may also change the encoding slot to something from the Letterlike Symbols or Math Alphanumeric Symbols blocks by locally setting new `\Umathcode`'s for Latin letters. Without examining the underlying code, it's impossible to know which form of `\mathbb` we're looking at, so `math-operator` sticks to calling `\mathbb` for maximum compatibility with other packages. If a package defines `\mathbb` to do something besides switch to blackboard bold, that will break the control sequences here.

```

405 \wlog{}
406 \if@operator@bb
407   \operatorinfo{Defining blackboard-bold letters.}
408   \def\NoBBError#1{\PackageError{math-operator}
409     {Missing \string\mathbb\space command}
410     {It looks like you're trying to make\MessageBreak
411     a blackbold-board "#1." However, I\MessageBreak
412     can't define blackboard-bold letters\MessageBreak
413     because I don't see a definition for\MessageBreak
414     \string\mathbb, which is what I would use to\MessageBreak
415     do it. To resolve this error message,\MessageBreak
416     try loading a package that provides\MessageBreak
417     blackboard-bold font support such as\MessageBreak
418     amssymb or mathfont.\MessageBreak}}

```

To keep the code simple, we use `\@makebbchar` for the actual definitions. Here `#1` is the letter we use.

```

419 \def\@makebbchar#1{%
420   \operatorinfo{Predefining

```

```

421     \expandafter\string\csname #1\endcsname\space
422     for use later.}
423 \expandafter\@operator@robust@def\csname #1\endcsname{%
424     \ifx\mathbb\@undefined
425         \NoBBError{#1}%
426     \else
427         \@operatorinfo{Setting up \expandafter
428             \string\csname#1\endcsname\space for use.}%
429         \expandafter\@operator@robust@gdef\csname #1\endcsname{\mathbb{#1}}%
430         \@nameuse{#1}%
431     \fi}}
432 \@makebbchar{N}
433 \@makebbchar{Z}
434 \@makebbchar{Q}
435 \@makebbchar{R}
436 \@makebbchar{C}
437 \@makebbchar{F}

```

Defining  $\backslash H$  and  $\backslash O$  is more complicated because these commands already do something in text mode, and we want to preserve that definition. We take the usual approach of making them robust macros that expand differently in M mode versus H or V mode.

```

438 \@operatorinfo{Predefining \string\H\space for use later.}
439 \@operatorinfo{Predefining \string\O\space for use later.}
440 \let\textH\H
441 \let\textO\O
442 \def\mathH{%
443     \ifx\mathbb\@undefined
444         \NoBBError{H}%
445     \else
446         \@operatorinfo{Setting up \string\H\space for use.}%
447         \gdef\mathH{\mathbb{H}}%
448         \mathH
449     \fi}
450 \def\mathO{%
451     \ifx\mathbb\@undefined
452         \NoBBError{O}%
453     \else
454         \@operatorinfo{Setting up \string\O\space for use.}%
455         \gdef\mathO{\mathbb{O}}%
456         \mathO
457     \fi}
458 \@operator@robust@def\O{\ifmmode\mathO\else\expandafter\textO\fi}
459 \@operator@robust@def\H{\ifmmode\mathH\else\expandafter\textH\fi}

```

For probability and expected value operators, we take a slightly different approach because we want these characters to show up as operators rather than  $\backslash mathord$  atoms. We use

`\@makebbop`, which is similar to `\@makebbchar`, except that it includes a `\mathop` specification.

```

460 \def\@makebbop#1{%
461   \@operatorinfo{Predefining
462     \expandafter\string\csname #1\endcsname\space
463     for use later.}
464   \expandafter\@operator@robust@def\csname#1\endcsname{%
465     \ifx\mathbb\@undefined
466       \NoBBError{#1}%
467     \else
468       \@operatorinfo{Setting up \expandafter
469         \string\csname#1\endcsname\space for use.}%
470       \expandafter\@operator@robust@gdef\csname#1\endcsname{%
471         \mathop{\kern\z@\mathbb{#1}}}%
472       \@nameuse{#1}%
473     \fi}}
474 \@makebbop{E}
475 \@makebbop{P}

```

And add all these letters to `\operator@list`.

```

476 \addto@operator@list{\N\Z\Q\R\C\F\mathO\mathH\E\P}
477 \else
478   \@operatorinfo{Skipping blackboard-bold letters.}
479 \fi

```

## 5 Categories

A selection of categories. Serious category theorists will undoubtedly want to declare their own categories beyond these.

```

480 \if@operator@c
481   \wlog{}
482   \@operatorinfo{Defining category theory notation.}
483   \DeclareBoldMathText{\Ab}{Ab}
484   \DeclareBoldMathText{\Alg}{Alg}
485   \DeclareBoldMathText{\Bialg}{Bialg}
486   \DeclareBoldMathText{\Cat}{Cat}
487   \DeclareBoldMathText{\CGH}{CGH}
488   \DeclareBoldMathText{\CGWH}{CGWH}
489   \DeclareBoldMathText{\Coalg}{Coalg}
490   \DeclareBoldMathText{\Comod}{Comod}
491   \DeclareBoldMathText{\CRing}{CRing}
492   \DeclareBoldMathText{\Field}{Field}
493   \DeclareBoldMathText{\FinGrp}{FinGrp}
494   \DeclareBoldMathText{\FinHilb}{FinHilb}

```

```

495 \DeclareBoldMathText{\FinVect}{FinVect}
496 \DeclareBoldMathText{\FinSet}{FinSet}
497 \DeclareBoldMathText{\Frm}{Frm}
498 \DeclareBoldMathText{\Grp}{Grp}
499 \DeclareBoldMathText{\Haus}{Haus}
500 \DeclareBoldMathText{\HeytAlg}{HeytAlg}
501 \DeclareBoldMathText{\Hilb}{Hilb}
502 \DeclareBoldMathText{\HopfAlg}{HopfAlg}
503 \DeclareBoldMathText{\Lat}{Lat}
504 \DeclareBoldMathText{\LieAlg}{LieAlg}
505 \DeclareBoldMathText{\LieGrp}{LieGrp}
506 \DeclareBoldMathText{\Loc}{Loc}
507 \DeclareBoldMathText{\Man}{Man}
508 \DeclareBoldMathText{\Mat}{Mat}
509 \DeclareBoldMathText{\Met}{Met}
510 \DeclareBoldMathText{\Mod}{Mod}
511 \DeclareBoldMathText{\Mon}{Mon}
512 \DeclareBoldMathText{\Ord}{Ord}
513 \DeclareBoldMathText{\Pos}{Pos}
514 \DeclareBoldMathText{\Rel}{Rel}
515 \DeclareBoldMathText{\Ring}{Ring}
516 \DeclareBoldMathText{\Set}{Set}
517 \DeclareBoldMathText{\Top}{Top}
518 \DeclareBoldMathText{\Topos}{Topos}
519 \DeclareBoldMathText{\Vect}{Vect}
520 \DeclareMathOperator{\cocone}{cocone}
521 \DeclareMathOperator*{\colim}{colim}
522 \DeclareMathOperator{\cone}{cone}
523 \DeclareMathOperator{\Ho}{Ho}
524 \DeclareMathOperator{\Hom}{Hom}
525 \DeclareMathOperator{\Ob}{Ob}
526 \DeclareMathOperator{\PSh}{PSh}
527 \DeclareMathOperator{\Sh}{Sh}
528 \@operatorinfo{Defining new operator \string\op.}
529 \addto@operator@list{\op}
530 \@operator@robust@def\op{^{\operator@font op}}
531 \else
532 \@operatorinfo{Skipping category theory notation.}
533 \fi

```

## 6 Jacobi Elliptic Functions

Pretty straightforward. The standard classes define `\sc` as a legacy (deprecated) command to access small caps, and we overwrite that definition. I do not feel bad about overwriting



deprecated commands.

```

534 \if@operator@j
535   \wlog{}
536   \@operatorinfo{Defining Jacobi elliptic functions.}
537   \DeclareMathOperator{\cd}{cd}
538   \DeclareMathOperator{\cn}{cn}
539   \DeclareMathOperator{\cs}{cs}
540   \DeclareMathOperator{\dc}{dc}
541   \DeclareMathOperator{\dn}{dn}
542   \DeclareMathOperator{\ds}{ds}
543   \DeclareMathOperator{\nc}{nc}
544   \DeclareMathOperator{\nd}{nd}
545   \DeclareMathOperator{\ns}{ns}
546   \let\sc\@undefined
547   \DeclareMathOperator{\sc}{sc}
548   \DeclareMathOperator{\sd}{sd}
549   \DeclareMathOperator{\sn}{sn}
550 \else
551   \@operatorinfo{Skipping Jacobi elliptic functions.}
552 \fi

```

## 7 Linear Algebra

Some standard functions and operators from linear algebra. For the matrix groups defined here, we use `\DeclareMathText` rather than `\DeclareMathOperator` because these groups should be `\mathord` subformulas, not `\mathop`. We say `\spanop` instead of `\span` because `\span` is already defined. (It's a TeX primitive dealing with tabular entries. Please do not redefine `\span`.)

```

553 \if@operator@l
554   \wlog{}
555   \@operatorinfo{Defining operators from linear algebra.}
556   \DeclareMathOperator{\adj}{adj}
557   \DeclareMathOperator{\Cl}{Cl}
558   \DeclareMathOperator{\codim}{codim}
559   \DeclareMathOperator{\coker}{coker}
560   \DeclareMathText{\GL}{GL}
561   \DeclareMathOperator{\nullity}{nullity}
562   \DeclareMathText{\Orthogonal}{O}
563   \DeclareMathOperator{\Pin}{Pin}
564   \DeclareMathOperator{\proj}{proj}
565   \DeclareMathOperator{\rank}{rank}
566   \DeclareMathText{\SL}{SL}
567   \DeclareMathText{\SO}{SO}
568   \DeclareMathText{\SU}{SU}

```

```

569 \DeclareMathOperator{\Sp}{Sp}
570 \DeclareMathOperator*{\spanop}{span}
571 \DeclareMathOperator{\Spin}{Spin}
572 \DeclareMathOperator{\tr}{tr}
573 \@operatorinfo{Defining new operator \string\T.}
574 \addto@operator@list{\T}
575 \@operator@robust@def\T{^{\operator@font T}}
576 \DeclareMathText{\Unitary}{U}
577 \else
578 \@operatorinfo{Skipping operators from linear algebra.}
579 \fi

```

## 8 Overlining

In this section, we define the `\overbar` command, which produces an overline whose length lies somewhere between `\bar` and `\overline`. The user-level command is a short wrapper around the internal command `\@overb@r`. First, we define `\overbaroffset`, which will determine the placement of the overline over the argument of `\overbar`. As is standard in  $\TeX$ , we store `\overbaroffset` as a count, which we identify with a scale factor because we divide it by 1000 when we use its value in `\@overb@r`.

```

580 \if@operator@o
581 \wlog{}
582 \@operatorinfo{Defining \string\overbar.}
583 \newcount\overbaroffset
584 \overbaroffset=800\relax

```

Version 1.0 of this package called the count `\operatorbaroffset` instead of `\overbaroffset`. We provide access to the old name for backwards compatibility.

```

585 \let\operatorbaroffset\overbaroffset

```

Now for the user-level command. We start by checking whether we are in math mode. If the user follows `\overbar` with an asterisk, we use 500 as the placement value, and otherwise, we take the value of `\overbaroffset`. If the user does not specify an optional argument, we use the default value of 0.8.

```

586 \@operator@robust@def\overbar{\mathchoice{}{}{}{}%
587 \ifstar
588 {\@ifnextchar[%
589 {\@overb@r{500}}
590 {\@overb@r{500}[0.8]}}
591 {\@ifnextchar[%
592 {\@overb@r{\overbaroffset}}
593 {\@overb@r{\overbaroffset}[0.8]}}}

```

Now we come to the macro that does the actual work of making the overline. The command `\@overb@r` accepts three arguments: `#1` is the scale argument that determines the horizontal placement of the overline; `#2` is a decimal that determines the size of the overline; and `#3`

is the subformula to be overlined. Note that #1 is only specified internally, and the user controls #1 indirectly through `\overbaroffset`. Just to be safe, we put the contents of `\@overb@r` inside a group since we're making liberal use of scratch registers. The general idea is that inside a `\mathchoice`, we put the subformula in an `\hbox` in the correct style and then manually position the overline using the box dimensions and the #1 and #2 arguments.

```
594 \def\@overb@r#1[#2]#3{\begingroup
595   \mathchoice
596     {\setbox\@tempboxa\hbox{${\displaystyle#3\m@th$}
597       \@tempdima\wd\@tempboxa
598       \@tempdimb\ht\@tempboxa
599       \@tempdimc\dp\@tempboxa
```

We will use `\dimen@` to store the glue that we insert to the left of the `\overline` command. We start with the width of `\@tempboxa`, shrink by the width of the overbar, and then take a fraction of the remaining space based on #1 (which is typically `\overbaroffset`). Then we subtract the width of `\@tempboxa` because we are inserting this glue right after `\unhboxing \@tempboxa`.

```
600   \dimen@\@tempdima
601   \advance\dimen@ by -#2\@tempdima
602   \divide\dimen@ by 1000
603   \multiply\dimen@ by #1
604   \advance\dimen@ by -\@tempdima
```

Inside another `\hbox`, we typeset `\@tempboxa` and manually convert it into an `\rlap`. Then we add `\hskip`, the overline, and an `\hfil`. In total, this `\hbox` will have the same width as the original subformula. We do all of this inside a second `\hbox` because we want  $\TeX$  to treat everything as a single subformula and also to prevent extra interatom space in the unlikely event that `\Umathordordspacing` is nonzero. (Please do not set `\Umathordordspacing` to something nonzero.)

```
605   \hbox to \@tempdima{\unhbox\@tempboxa\hskip\dimen@
```

Now make a math expression that contains just an overline of the correct width above a zero-width `\vrule`, which ensures that the overline occurs at the correct height.

```
606     $\overline{%
607       \vrule width \z@ height \@tempdimb depth \@tempdimc
608       \hskip#2\@tempdima}\m@th$%
609     \hfil}}
```

Same thing with `\textstyle`.

```
610   {\setbox\@tempboxa\hbox{${\textstyle#3\m@th$}
611     \@tempdima\wd\@tempboxa
612     \@tempdimb\ht\@tempboxa
613     \@tempdimc\dp\@tempboxa
614     \dimen@\@tempdima
615     \advance\dimen@ by -#2\@tempdima
616     \divide\dimen@ by 1000
617     \multiply\dimen@ by #1
```

```

618     \advance\dimen@ by -\@tempdima
619     \hbox to \@tempdima{\unhbox\@tempboxa\hskip\dimen@
620         $\overline{%
621             \vrule width \z@ height \@tempdimb depth \@tempdimc
622             \hskip#2\@tempdima}\m@th$%
623     \hfil}}

```

And `\scriptstyle`.

```

624     {\setbox\@tempboxa\hbox{${\scriptstyle#3}\m@th$}
625         \@tempdima\wd\@tempboxa
626         \@tempdimb\ht\@tempboxa
627         \@tempdimc\dp\@tempboxa
628         \advance\dimen@ by -#2\@tempdima
629         \divide\dimen@ by 1000
630         \multiply\dimen@ by #1
631         \advance\dimen@ by -\@tempdima
632         \hbox to \@tempdima{\unhbox\@tempboxa\hskip\dimen@
633             $\overline{%
634                 \vrule width \z@ height \@tempdimb depth \@tempdimc
635                 \hskip#2\@tempdima}\m@th$%
636         \hfil}}

```

And finally `\scriptscriptstyle`.

```

637     {\setbox\@tempboxa\hbox{${\scriptscriptstyle#3}\m@th$}
638         \@tempdima\wd\@tempboxa
639         \@tempdimb\ht\@tempboxa
640         \@tempdimc\dp\@tempboxa
641         \advance\dimen@ by -#2\@tempdima
642         \divide\dimen@ by 1000
643         \multiply\dimen@ by #1
644         \advance\dimen@ by -\@tempdima
645         \hbox to \@tempdima{\unhbox\@tempboxa\hskip\dimen@
646             $\overline{%
647                 \vrule width \z@ height \@tempdimb depth \@tempdimc
648                 \hskip#2\@tempdima}\m@th$%
649         \hfil}}
650     \endgroup}
651 \else
652     \operatorinfo{Skipping \string\overbar.}
653 \fi

```

## 9 Probability Distributions

A selection of common probability distributions. We say `\Betaop` and `\Gammaop` instead of `\Beta` and `\Gamma` because they are or may be defined to be capital Greek letters.

```

654 \ifoperator@p
655   \wlog{}
656   \@operatorinfo{Defining probability distributions.}
657   \DeclareMathOperator{\Bernoulli}{Bernoulli}
658   \DeclareMathOperator{\Betaop}{Beta}
659   \DeclareMathOperator{\Binomial}{Binomial}
660   \DeclareMathOperator{\Boltzmann}{Boltzmann}
661   \DeclareMathOperator{\Burr}{Burr}
662   \DeclareMathOperator{\Categorical}{Categorical}
663   \DeclareMathOperator{\Cauchy}{Cauchy}
664   \DeclareMathOperator{\chiop}{\chi}
665   \@operator@robust@def\ChiSq{\chiop~{\operator@font\@operatortw@}}
666   \DeclareMathOperator{\Dagum}{Dagum}
667   \DeclareMathOperator{\Exponential}{Exponential}
668   \DeclareMathOperator{\Erlang}{Erlang}
669   \DeclareMathOperator{\Gammaop}{Gamma}
670   \DeclareMathOperator{\Gompertz}{Gompertz}
671   \@operator@robust@def\InvChiSq{%
672     \mathop{\operator@font
673       Inv\@operatorhyphen\chiop}%
674     \nolimits~{\operator@font\@operatortw@}}
675   \DeclareMathOperator{\InvGamma}
676     {Inv\@operatorhyphen Gamma}
677   \DeclareMathOperator{\Kolmogorov}{Kolmogorov}
678   \DeclareMathOperator{\LogLogistic}{Log\@operatorhyphen Logistic}
679   \DeclareMathOperator{\LogNormal}{Log\@operatorhyphen Normal}
680   \DeclareMathOperator{\Logistic}{Logistic}
681   \DeclareMathOperator{\Lomax}{Lomax}
682   \DeclareMathOperator{\MaxwellBoltzmann}
683     {Maxwell\@operatorhyphen Boltzmann}
684   \DeclareMathOperator{\Multinomial}{Multinomial}
685   \DeclareMathOperator{\NegBinomial}{Neg\@operatorhyphen Binomial}

```

We can't use  $\mathcal{N}$  for calligraphic  $\mathcal{N}$  because we're already using it for natural numbers. Alas, we will settle for  $\text{\Normal}$ . This one is also more complicated because of the \*-ed version of the command.

```

686   \@operatorinfo{Defining new operator \string\Normal.}
687   \addtooperator@list{\Normal}
688   \def\operator@N{\mathop{\kern\z@\mathcal{N}}\nolimits}
689   \def\operator@normal{\mathop{\operator@font Normal}\nolimits}
690   \@operator@robust@def\Normal{%
691     \mathchoice{}{}{}{}
692     \ifstar\operator@normal\operator@N}
693   \DeclareMathOperator{\Pareto}{Pareto}
694   \DeclareMathOperator{\Poisson}{Poisson}
695   \DeclareMathOperator{\Weibull}{Weibull}

```

```

696 \DeclareMathOperator{\Zipf}{Zipf}
697 \else
698 \operatorinfo{Skipping probability distributions.}
699 \fi

```

## 10 Special Functions

Some common special functions.

```

700 \ifoperator@sf
701 \wlog{}
702 \operatorinfo{Defining special functions.}
703 \DeclareMathOperator{\Ai}{Ai}
704 \DeclareMathOperator{\Bi}{Bi}
705 \DeclareMathOperator{\Ci}{Ci}
706 \DeclareMathOperator{\ci}{ci}
707 \DeclareMathOperator{\Chiop}{Chi}
708 \DeclareMathOperator{\Ei}{Ei}
709 \DeclareMathOperator{\erf}{erf}
710 \operator@robust@def\erfinv{\erf^{\operator@font\operator@ne}}
711 \DeclareMathOperator{\erfc}{erfc}
712 \operator@robust@def\erfcinv{\erfc^{\operator@font\operator@ne}}
713 \DeclareMathOperator{\Li}{Li}
714 \DeclareMathOperator{\li}{li}
715 \DeclareMathOperator{\Log}{Log}
716 \DeclareMathOperator{\sgn}{sgn}
717 \DeclareMathOperator{\Si}{Si}
718 \DeclareMathOperator{\si}{si}
719 \DeclareMathOperator{\Shi}{Shi}

```

Inverse error function.

```

720 \else
721 \operatorinfo{Skipping special functions.}
722 \fi

```

## 11 Standard Operators

Some other standard (or standardish) functions and operations. Much more pure mathy than the special functions from the previous section. We say `\divop` instead of `\div` because `\div` is already defined.

```

723 \ifoperator@s
724 \wlog{}
725 \operatorinfo{Defining standard operators.}
726 \DeclareMathOperator*{\argmax}{arg\,max}
727 \DeclareMathOperator*{\argmin}{arg\,min}

```

```

728 \DeclareMathOperator{\Aut}{Aut}
729 \@operatorinfo{Defining new operator \string\c.}
730 \addto@operator@list{\mathc}
731 \let\textc\c
732 \def\mathc{^{\operator@font c}}
733 \@operator@robust@def\c{\ifmmode\mathc\else\expandafter\textc\fi}
734 \DeclareMathOperator{\cf}{cf}
735 \DeclareMathOperator{\cl}{cl}
736 \DeclareMathOperator{\conv}{conv}
737 \DeclareMathOperator{\corr}{corr}
738 \DeclareMathOperator{\cov}{cov}
739 \DeclareMathOperator{\curl}{curl}
740 \DeclareMathOperator{\divop}{div}
741 \DeclareMathOperator{\Ext}{Ext}
742 \DeclareMathOperator{\Gal}{Gal}
743 \DeclareMathOperator{\grad}{grad}
744 \DeclareMathOperator{\Hess}{\mathcal{H}}
745 \DeclareMathOperator{\id}{id}
746 \DeclareMathOperator{\img}{img}
747 \DeclareMathOperator{\Info}{\mathcal{I}}
748 \DeclareMathOperator{\interior}{int}
749 \DeclareMathOperator*\{lcm}{lcm}
750 \DeclareMathOperator{\Proj}{Proj}
751 \DeclareMathOperator{\Res}{Res}
752 \DeclareMathOperator{\Spec}{Spec}
753 \DeclareMathOperator{\st}{st}
754 \DeclareMathOperator{\supp}{supp}
755 \DeclareMathOperator{\Tor}{Tor}
756 \DeclareMathOperator{\Var}{Var}
757 \addto@operator@list{\varIm\varRe\Im\Re}
758 \@operatorinfo{Defining \string\varIm\space operator from \string\Im.}
759 \@operatorinfo{Defining \string\varRe\space operator from \string\Re.}
760 \let\varIm\Im
761 \let\varRe\Re
762 \DeclareMathOperator{\Im}{Im}
763 \DeclareMathOperator{\Re}{Re}
764 \else
765 \@operatorinfo{Skipping standard operators.}
766 \fi

```

## 12 Trigonometry

Finally, time for some trigonometry. We start by defining hyperbolic cosecant and secant.

```
767 \if@operator@t
```

```

768 \wlog{}
769 \@operatorinfo{Defining trigonometric functions.}
770 \DeclareMathOperator{\csch}{csch}
771 \DeclareMathOperator{\sech}{sech}

```

Round out the “arc” versions of standard trigonometric functions, then provide “arc” and “ar” versions of hyperbolic trigonometric functions.

```

772 \DeclareMathOperator{\arccsc}{arccsc}
773 \DeclareMathOperator{\arcsec}{arcsec}
774 \DeclareMathOperator{\arccot}{arccot}
775 \DeclareMathOperator{\arcsinh}{arcsinh}
776 \DeclareMathOperator{\arccosh}{arccosh}
777 \DeclareMathOperator{\arctanh}{arctanh}
778 \DeclareMathOperator{\arccsch}{arccsch}
779 \DeclareMathOperator{\arcsech}{arcsech}
780 \DeclareMathOperator{\arccoth}{arccoth}
781 \DeclareMathOperator{\arsinh}{arsinh}
782 \DeclareMathOperator{\arcosh}{arcosh}
783 \DeclareMathOperator{\artanh}{artanh}
784 \DeclareMathOperator{\arcsch}{arcsch}
785 \DeclareMathOperator{\arsech}{arsech}
786 \DeclareMathOperator{\arcoth}{arcoth}

```

Inverse functions with  $-1$  superscript.

```

787 \@operator@robust@def\sininv{\sin^{\operator@font\@operatorm@ne}}
788 \@operator@robust@def\cosinv{\cos^{\operator@font\@operatorm@ne}}
789 \@operator@robust@def\taninv{\tan^{\operator@font\@operatorm@ne}}
790 \@operator@robust@def\cscinv{\csc^{\operator@font\@operatorm@ne}}
791 \@operator@robust@def\secinv{\sec^{\operator@font\@operatorm@ne}}
792 \@operator@robust@def\cotinv{\cot^{\operator@font\@operatorm@ne}}

```

And for hyperbolic trigonometric functions.

```

793 \@operator@robust@def\sinhinv{\sinh^{\operator@font\@operatorm@ne}}
794 \@operator@robust@def\coshinv{\cosh^{\operator@font\@operatorm@ne}}
795 \@operator@robust@def\tanhinv{\tanh^{\operator@font\@operatorm@ne}}
796 \@operator@robust@def\cschinv{\csch^{\operator@font\@operatorm@ne}}
797 \@operator@robust@def\sechinv{\sech^{\operator@font\@operatorm@ne}}
798 \@operator@robust@def\cothinv{\coth^{\operator@font\@operatorm@ne}}
799 \else
800 \@operatorinfo{Skipping trigonometric functions.}
801 \fi
802 \wlog{}

```

Done!



## Version History

New features and updates with each version. Versions are chronological, and features are listed in no particular order.

### 1.0 ..... February 2025

—initial release

### 1.1 ..... March 2025

—bug fix in package declaration  
 —bug fix for operators with superscripts  
 —added `\operatorssquared` and  
`\operatorinverse`  
 —added `\Hess` and `\Info`  
 —changed `\operatorbaroffset` to  
`\overbaroffset`

### 1.2 ..... July 2025

—bug fix for `\operatorhyphen`  
 —changed `\Chi` to `\Chiop`  
 —removed dependence on  $\varepsilon$ -TeX

### 1.2a ..... July 2025

—bug fix for non-unicode engines

### 1.3 ..... August 2025

—added about 30 control sequences to  
 various classes of operators, mostly in  
 category theory  
 —removed a stray `\detokenize`

### 1.3a ..... September 2025

—bug fix for `\F`

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