The mdwmath* package

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1 User guide

1.1 Square root typesetting

`\sqrt` The package supplies a star variant of the `\sqrt` command which omits the vinculum over the operand (the line over the top). While this is most useful in simple cases like $\sqrt{2}$ it works for any size of operand. The package also re-implements the standard square root command so that it positions the root number rather better.

[Note that omission of the vinculum was originally a cost-cutting exercise because the radical symbol can just fit in next to its operand and everything ends up being laid out along a line. However, I find that the square root without vinculum is less cluttered, so I tend to use it when it doesn't cause ambiguity.]

1.2 Some maths symbols you already have

Having just tried to do some simple things, I've found that there are maths symbols missing. Here they are, in all their glory:

*The mdwmath package is currently at version 1.1, dated 11 April 1996.

Examples of the new square root command

$$\sqrt{2} \quad \text{rather than} \quad \sqrt{2}$$

$$\sqrt[3]{2} \quad \text{rather than} \quad \sqrt[3]{2}$$

$$\sqrt{x^3 + \sqrt[y]{\alpha}} - \sqrt[n+1]{a}$$

$$x = \sqrt[3]{\frac{3y}{7}}$$

$$q = \frac{2\sqrt{2}}{5} + \sqrt[\frac{n+1}{2}]{2x^2 + 3xy - y^2}$$

```
\[ \sqrt*{2} \quad \mbox{rather than} \quad \sqrt{2} \]
\[ \sqrt*[3]{2} \quad \mbox{ rather than } \quad \sqrt[3]{2} \]
\[ \sqrt{x^3 + \sqrt*[y]{\alpha}} - \sqrt*[n+1]{a} \]
\[ x = \sqrt*[3]{\frac{3y}{7}} \]
\[ q = \frac{2\sqrt*{2}}{5}+\sqrt[\frac{n+1}{2}]{2x^2+3xy-y^2} \]
```

&	`\&`	|	`\bitor`	&&	`\dbland`
&	`\bitand`	||	`\dblor`		

2 Implementation

This isn't really complicated (honest) although it is a lot hairier than I think it ought to be.

⟨*package⟩

2.1 Square roots

2.1.1 Where is the square root sign?

LaTeX hides the square root sign away somewhere without telling anyone where it is. I extract it forcibly by peeking inside the `\sqrtsign` macro and scrutinising the contents. Here we go: prepare for yukkiness.

```
\newcount\sq@sqrt
\begingroup
  \catcode`\|0 \catcode`\\12
  |def|sq@readrad#1"#2\#3|relax{|global|sq@sqrt"#2|relax}
  |expandafter|sq@readrad|meaning|sqrtsign|relax
|endgroup
\def\sq@delim{\delimiter\sq@sqrt\relax}
```

2.1.2 Drawing fake square root signs

TeX absolutely insists on drawing square root signs with a vinculum over the top. In order to get the same effect, we have to attempt to emulate TeX's behaviour.

\sqrtdel This does the main job of typesetting a vinculum-free radical.[1] It's more or less a duplicate of what TeX does internally, so it might be a good plan to have a copy of Appendix G open while you examine this.

We start off by using \mathpalette to help decide how big things should be.

```
\def\sqrtdel{\mathpalette\sqrtdel@i}
```

Read the contents of the radical into a box, so we can measure it.

```
\def\sqrtdel@i#1#2{%
  \setbox\z@\hbox{$\m@th#1#2$}% %%% Bzzzt -- uncramps the mathstyle
```

Now try and sort out the values needed in this calculation. We'll assume that ξ_8 is 0.6 pt, the way it usually is. Next try to work out the value of φ.

```
  \ifx#1\displaystyle%
    \@tempdima1ex%
  \else%
    \@tempdima.6\p@%
  \fi%
```

That was easy. Now for ψ.

```
  \@tempdimb.6\p@%
  \advance\@tempdimb.25\@tempdima%
```

Build the 'delimiter' in a box of height $h(x) + d(x) + \psi + \xi_8$, as requested. Box 2 will do well for this purpose.

```
  \dimen@.6\p@%
  \advance\dimen@\@tempdimb%
  \advance\dimen@\ht\z@%
  \advance\dimen@\dp\z@%
  \setbox\tw@\hbox{%
    $\left\sq@delim\vcenter to\dimen@{}\right.\n@space$%
  }%
```

Now we need to do some more calculating (don't you hate it?). As far as Appendix G is concerned, $\theta = h(y) = 0$, because we want no rule over the top.

```
  \@tempdima\ht\tw@%
  \advance\@tempdima\dp\tw@%
  \advance\@tempdima-\ht\z@%
  \advance\@tempdima-\dp\z@%
  \ifdim\@tempdima>\@tempdimb%
    \advance\@tempdima\@tempdimb%
    \@tempdimb.5\@tempdima%
  \fi%
```

Work out how high to raise the radical symbol. Remember that Appendix G thinks that the box has a very small height, although this is untrue here.

```
  \@tempdima\ht\z@%
  \advance\@tempdima\@tempdimb%
  \advance\@tempdima-\ht\tw@%
```

Build the output (finally). The brace group is there to turn the output into a mathord, one of the few times that this is actually desirable.

```
  {\raise\@tempdima\box\tw@\vbox{\kern\@tempdimb\box\z@}}%
}
```

[1] Note for chemists: this is nothing to do with short-lived things which don't have their normal numbers of electrons. And it won't reduce the appearance of wrinkles either.

2.1.3 The new square root command

This is where we reimplement all the square root stuff. Most of this stuff comes from the PLAIN TeX macros, although some is influenced by AMS-TeX and LaTeX 2$_\varepsilon$, and some is original. I've tried to make the spacing vaguely automatic, so although it's not configurable like AMS-TeX's version, the output should look nice more of the time. Maybe.

`\sqrt` LaTeX says this must be robust, so we make it robust. The first thing to do is to see if there's a star and pass the appropriate squareroot-drawing command on to the rest of the code.

```
\DeclareRobustCommand\sqrt{\@ifstar{\sqrt@i\sqrtdel}{\sqrt@i\sqrtsign}}
```

Now we can sort out an optional argument to be displayed on the root.

```
\def\sqrt@i#1{\@ifnextchar[{\sqrt@ii{#1}}{\sqrt@iv{#1}}}
```

Stages 2 and 3 below are essentially equivalents of PLAIN TeX's `\root`...`\of` and `\r@@t`. Here we also find the first wrinkle: the `\rootbox` used to store the number is spaced out on the left if necessary. There's a backspace after the end so that the root can slip underneath, and everything works out nicely. Unfortunately size is fixed here, although doesn't actually seem to matter.

```
\def\sqrt@ii#1[#2]{%
  \setbox\rootbox\hbox{$\m@th\scriptscriptstyle{#2}$}%
  \ifdim\wd\rootbox<6\p@%
    \setbox\rootbox\hb@xt@6\p@{\hfil\unhbox\rootbox}%
  \fi%
  \mathpalette{\sqrt@iii{#1}}%
}
```

Now we can actually build everything. Note that the root is raised by its depth – this prevents a common problem with letters with descenders.

```
\def\sqrt@iii#1#2#3{%
  \setbox\z@\hbox{$\m@th#2#1{#3}$}%
  \dimen@\ht\z@%
  \advance\dimen@-\dp\z@%
  \dimen@.6\dimen@%
  \advance\dimen@\dp\rootbox%
  \mkern-3mu%
  \raise\dimen@\copy\rootbox%
  \mkern-10mu%
  \box\z@%
}
```

Finally handle a non-numbered root. We read the rooted text in as an argument, to stop problems when people omit the braces. (AMS-TeX does this too.)

```
\def\sqrt@iv#1#2{#1{#2}}
```

`\root` We also re-implement PLAIN TeX's `\root` command, just in case someone uses it, and supply a star-variant. This is all very trivial.

```
\def\root{\@ifstar{\root@i\sqrtdel}{\root@i\sqrtsign}}
\def\root@i#1#2\of{\sqrt@ii{#1}[#2]}
```

2.2 Some magic new maths characters

This is all really easy.

```
\DeclareMathSymbol{&}{\mathbin}{operators}{`\&}
\DeclareMathSymbol{\bitand}{\mathbin}{operators}{`\&}
\def\bitor{\mathbin\mid}
\def\dblor{\mathbin{\mid\mid}}
\def\dbland{\mathbin{\mathrel\bitand\mathrel\bitand}}
```

2.3 Biggles

Now for some user-controlled delimiter sizing. The standard bigness of plain TEX's delimiters are all right, but it's a little limiting.

The biggness of delimiters is based on the size of the current `\strut`, which LATEX keeps up to date all the time. This will make the various delimiters grow in proportion when the text gets bigger. Actually, I'm not sure that this is exactly right – maybe it should be nonlinear,

`\bbigg` `\bbiggl` `\bbiggr` `\bbiggm`

This is where the bigness is done. This is more similar to the plain TEX big delimiter stuff than to the amsmath stuff, although there's not really a lot of difference.

The two arguments are a multiplier for the delimiter size, and a small increment applied *before* the multiplication (which is optional).

This is actually a front for a low-level interface which can be called directly for efficiency.

```
\def\bbigg{\@bbigg\mathord}
\def\bbiggl{\@bbigg\mathopen}
\def\bbiggr{\@bbigg\mathclose}
\def\bbiggm{\@bbigg\mathrel}
```

`\@bbigg`

This is an optional argument parser providing a front end for the main macro `\bbigg@`.

```
\def\@bbigg#1{\@ifnextchar[{\@bigg@i{#1}}{\@bigg@i{#1}[\z@]}}
\def\@bigg@i#1[#2]#3#4{#1{\bbigg@{#2}{#3}{#4}}}
```

`\bbigg@`

This is it, at last. The arguments are as described above: an addition to be made to the strut height, and a multiplier. Oh, and the delimiter, of course.

This is a bit messy. The smallest 'big' delimiter, `\big`, is the same height as the current strut box. Other delimiters are $1\frac{1}{2}$, 2 and $2\frac{1}{2}$ times this height. I'll set the height of the delimiter by putting in a `\vcenter` of the appropriate size.

Given an extra height x, a multiplication factor f and a strut height h and depth d, I'll create a vcenter with total height $f(h + d + x)$. Easy, isn't it?

```
\def\bbigg@#1#2#3{%
  \hbox{$%
    \dimen@\ht\strutbox\advance\dimen@\dp\strutbox%
    \advance\dimen@#1%
    \dimen@#2\dimen@%
    \left#3\vcenter to\dimen@{}\right.\n@space%
  $}%
}
```

\big \Big \bigg \Bigg

Now for the easy macros.

```
\def\big{\bbigg@\z@\@ne}
\def\Big{\bbigg@\z@{1.5}}
\def\bigg{\bbigg@\z@\tw@}
\def\Bigg{\bbigg@\z@{2.5}}
```

That's all there is. Byebye.

```
⟨/package⟩
```

Mark Wooding, 11 April 1996

Appendix

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