

# LONGDIVISION

Hood Chatham  
hood@mit.edu

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The LONGDIVISION package defines two main commands: `\longdivision` and `\intlongdivision`. The usage for both is `\longdivision[⟨options⟩]{⟨dividend⟩}{⟨divisor⟩}`. The difference is that `\longdivision` divides until the remainders repeat or the quotient has too many digits to fit the page, whereas `\intlongdivision` does integer division and leaves the remainder. The command `\longdivisionkeys{⟨options⟩}` is also defined to set default options. At most 20 division steps worth of work will be displayed and at most 60 digits worth of division output will be produced. Thanks to Mike Jenck, Cameron McLeman, and Yu-Tsung Tai for emailing me with bug reports and feature requests.

Here is an example usage:

```
\longdivision{100}{22}
\quad
\intlongdivision{100}{22}
```

$$\begin{array}{r} 4.\overline{54} \\ 22 \overline{)100.00} \\ \underline{88} \phantom{00} \\ 12.0 \phantom{00} \\ \underline{11.0} \phantom{00} \\ 1.00 \phantom{00} \\ \underline{88} \phantom{00} \\ 12 \phantom{00} \end{array} \qquad \begin{array}{r} 4 \\ 22 \overline{)100} \\ \underline{88} \\ 12 \end{array}$$

These commands have several key-value options:

**max extra digits** =  $\langle \text{nonnegative integer} \rangle$

This key determines the maximum amount of “extra” zeroes to add to the end of the dividend in the process of division – if the quotient has more digits before it repeats, the division will just stop. This is only an option for `\longdivision`, the command `\intlongdivision{⟨dividend⟩}{⟨divisor⟩}` is equivalent to `\longdivision[max extra digits=0]{⟨dividend⟩}{⟨divisor⟩}`. For brevity, this option has the short form where just the value is provided: `\longdivision[2]{⟨dividend⟩}{⟨divisor⟩}` is the same as `\longdivision[max extra digits=2]{⟨dividend⟩}{⟨divisor⟩}`.

```
\longdivision[max extra digits = 2]{10.0}{7} \quad
\longdivision[1]{10.0}{7}
```

$$\begin{array}{r} 1.428 \\ 7 \overline{)10.000} \\ \underline{7} \phantom{000} \\ 3.0 \phantom{00} \\ \underline{2.8} \phantom{00} \\ 20 \phantom{00} \\ \underline{14} \phantom{00} \\ 60 \phantom{00} \\ \underline{56} \phantom{00} \\ 4 \phantom{00} \end{array} \qquad \begin{array}{r} 1.42 \\ 7 \overline{)10.00} \\ \underline{7} \phantom{00} \\ 3.0 \phantom{00} \\ \underline{2.8} \phantom{00} \\ 20 \phantom{00} \\ \underline{14} \phantom{00} \\ 6 \phantom{00} \end{array}$$

**stage** =  $\langle \text{nonnegative integer} \rangle$

This controls how many steps worth of division to do. Thanks to Cam McLeman for suggesting this feature.

```

\longdivision[stage=0]{1}{7} \quad
\longdivision[stage=1]{1}{7} \quad
\longdivision[stage=2]{1}{7} \quad
\longdivision[stage=3]{1}{7} \quad
\longdivision[stage=4]{1}{7} \quad
\longdivision[stage=5]{1}{7} \quad
\longdivision[stage=6]{1}{7}

```

$7 \overline{)1}$	$7 \overline{)1.0}$ $\begin{array}{r} 7 \\ \hline 3 \end{array}$	$7 \overline{)1.00}$ $\begin{array}{r} 7 \\ \hline 30 \\ 28 \\ \hline 2 \end{array}$	$7 \overline{)1.000}$ $\begin{array}{r} 7 \\ \hline 30 \\ 28 \\ \hline 20 \\ 14 \\ \hline 6 \end{array}$	$7 \overline{)1.0000}$ $\begin{array}{r} 7 \\ \hline 30 \\ 28 \\ \hline 20 \\ 14 \\ \hline 60 \\ 56 \\ \hline 4 \end{array}$	$7 \overline{)1.00000}$ $\begin{array}{r} 7 \\ \hline 30 \\ 28 \\ \hline 20 \\ 14 \\ \hline 60 \\ 56 \\ \hline 40 \\ 35 \\ \hline 5 \end{array}$	$7 \overline{)1.000000}$ $\begin{array}{r} 7 \\ \hline 30 \\ 28 \\ \hline 20 \\ 14 \\ \hline 60 \\ 56 \\ \hline 40 \\ 35 \\ \hline 50 \\ 49 \\ \hline 1 \end{array}$
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**style** =  $\langle style \rangle$

Control the style for typesetting the result of long division. The options are **default**, **standard**, **tikz**, or **german**. The option **default** is the same as **tikz** if **TikZ** is loaded and otherwise is the same as **standard**. You probably should load **TikZ** because the **TikZ** version looks significantly better. If you use this option, you'll probably want to set the style once and for all in your preamble with `\longdivisionkeys{style= $\langle style \rangle$ }`.

```

\intlondivision[style = tikz    ]{100.0}{13} \quad
\intlondivision[style = standard]{100.0}{13} \quad
\intlondivision[style = german  ]{100.0}{13}

```

$13 \overline{)100.0}$ $\begin{array}{r} 7.6 \\ \hline 91 \\ \hline 9.0 \\ 7.8 \\ \hline 1.2 \end{array}$	$13 \overline{)100.0}$ $\begin{array}{r} 7.6 \\ \hline 91 \\ \hline 9.0 \\ 7.8 \\ \hline 1.2 \end{array}$	$100.0:13 = 7.6$ $\begin{array}{r} 7.6 \\ \hline 91 \\ \hline 9.0 \\ 7.8 \\ \hline 1.2 \end{array}$
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You can define your own typesetting style by saying `\longdiv_define_style:nn{ $\langle style name \rangle$ }{ $\langle code \rangle$ }`. This can use the commands `\longdivdividend` which contains the dividend, `\longdivdivisor` which contains the divisor, `\longdivquotient` which contains the quotient, and `\longdivwork:` which contains the division work. For instance, a simplified version of the **german** style is:

```

\longdivdefinestyle{my style}{%
  \begin{tabular}{@{}l@{}}
    \longdivdividend : \, \longdivdivisor \, = \longdivquotient \\
    \longdivwork
  \end{tabular}
}
\longdivision[style = my style]{2}{3}

```

$$\begin{array}{r}
 2.0: \quad 3 = 0.\overline{6} \\
 \underline{1.8} \\
 2
 \end{array}$$

Send me an email if you cannot figure out how to make a style to your liking.

**repeating decimal style** =  $\langle style \rangle$

Control the way that repeating decimals are typeset. The options are **overline**, **dots**, **dots all**, **parentheses**, or **none**. The default is **overline**. The **parentheses** style creates ugly spacing problems and the **dots** style is insufficiently visible, so the **overline** style is the best. If you use this option, you'll probably want to set the style once and for all in your preamble with `\longdivisionkeys{recurring decimal style= $\langle style \rangle$ }` `\longdivisionkeys{style= $\langle style \rangle$ }`. Like the **style** key, this is designed to be extensible. However, the process of creating new **repeating decimal styles** is a bit involved. Send me an email if you want a new **repeating decimal style**.

```

\longdivision[repeating decimal style = overline ]{5.3}{37} \quad
\longdivision[repeating decimal style = dots      ]{5.3}{37} \quad
\longdivision[repeating decimal style = dots all   ]{5.3}{37} \quad
\longdivision[repeating decimal style = parentheses]{5.3}{37} \quad
\longdivision[repeating decimal style = none       ]{5.3}{37}

```

$\begin{array}{r} 0.1\overline{432} \\ 37 \overline{)5.3000} \\ \underline{3.7} \phantom{00} \\ 1.60 \phantom{0} \\ \underline{1.48} \phantom{0} \\ 120 \phantom{0} \\ \underline{111} \phantom{0} \\ 90 \phantom{0} \\ \underline{74} \phantom{0} \\ 16 \end{array}$	$\begin{array}{r} 0.14\overline{32} \\ 37 \overline{)5.3000} \\ \underline{3.7} \phantom{00} \\ 1.60 \phantom{0} \\ \underline{1.48} \phantom{0} \\ 120 \phantom{0} \\ \underline{111} \phantom{0} \\ 90 \phantom{0} \\ \underline{74} \phantom{0} \\ 16 \end{array}$	$\begin{array}{r} 0.14\overline{32} \\ 37 \overline{)5.3000} \\ \underline{3.7} \phantom{00} \\ 1.60 \phantom{0} \\ \underline{1.48} \phantom{0} \\ 120 \phantom{0} \\ \underline{111} \phantom{0} \\ 90 \phantom{0} \\ \underline{74} \phantom{0} \\ 16 \end{array}$	$\begin{array}{r} 0.1(432) \\ 37 \overline{)5.3\ 000} \\ \underline{3.7} \phantom{00} \\ 1.6\ 0 \phantom{0} \\ \underline{1.4\ 8} \phantom{0} \\ 1\ 20 \phantom{0} \\ \underline{1\ 11} \phantom{0} \\ 90 \phantom{0} \\ \underline{74} \phantom{0} \\ 16 \end{array}$	$\begin{array}{r} 0.1432 \\ 37 \overline{)5.3000} \\ \underline{3.7} \phantom{00} \\ 1.60 \phantom{0} \\ \underline{1.48} \phantom{0} \\ 120 \phantom{0} \\ \underline{111} \phantom{0} \\ 90 \phantom{0} \\ \underline{74} \phantom{0} \\ 16 \end{array}$
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