The `asciimth` package

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1 Introduction

The `asciimth` package provides a more readable way to typeset mathematics in LaTeX. We provide a few environments to replace those provided by LaTeX and `amsmath`:

- The `asciimth` and `asciimth*` environments act like `equation` and `equation*`, except that the math inside uses the asciimth syntax.
- The `alignA` and `alignA*` environments act like `align` and `align*`: formatting is done by `&` and `\\`, but the math inside is written using `asciimth`'s syntax.

For example, we can use the following code to typeset a formula for the root of a cubic polynomial (via Wikipedia):

```
When `x^3+a x^2+b x+c`, one of the roots is
\begin{asciimth*}
-1/3( a +root3( (m + sqrt(m^2-4k^3) ) / 2 )
        +root3( (m - sqrt(m^2-4k^3) ) / 2 ))
\end{asciimth*}
where:
\begin{alignA*}
m &= 2a^3-9a,\\
k &= a^2-3b.
\end{alignA*}
```

It renders as:

When $x^3 + ax^2 + bx + c$, one of the roots is

$$-\frac{1}{3}\left(a + \sqrt[3]{\frac{m + \sqrt{m^2 - 4k^3}}{2}} + \sqrt[3]{\frac{m - \sqrt{m^2 - 4k^3}}{2}}\right)$$

where:

$$m = 2a^3 - 9a,$$
$$k = a^2 - 3b.$$

Additionally, any text surrounded by left-quotes (`...`) will be parsed by the `asciimth` engine. For example, typing `` `(x-1)^(2x)/(4-3)` `` in the middle of a paragraph produces $\frac{(x-1)^{2x}}{4-3}$.

That notation can be mixed with standard TEX math commands by inserting a left-quoted expression in the middle of an existing expression or equation. For example, `$\frac{1}{2}-‘3/4‘$` is typeset as $\frac{1}{2}-\frac{3}{4}$. It can also be embedded into display math (`$$` or `\[`) or a math environment such as `multiline` or `align`.

For compatibility with the common use of left-quotes, the empty expression `` `` `` is typeset as the begin-quotes symbol (“). However, if you really need them, we provide the macros `\makeQuoteOther` and `\makeQuoteActive` which turn that special behavior off and on, respectively.

This document displays a range of example equations as typeset by `asciimth`. It serves both as documentation and as a comprehensive test of the package.

2 Tables

Simple commands

`` `9+alpha` ``	$9+\alpha$
`` `gamma>2 implies gamma*gamma>4` ``	$\gamma > 2 \implies \gamma * \gamma > 4$
`` `x ge 0 implies x x ge 0` ``	$x \geq 0 \implies xx \geq 0$
`` `t` ``	t
`` `1-a` ``	$1-a$
`` `1 234` ``	1234
`` `a b - a\,b` ``	$ab - a\,b$
`` ` (9)` ``	(9)
`` `9+(4-(alpha))` ``	$9+(4-(\alpha))$
`` `(-)` ``	$(-)$
`` `[2,3)` ``	$[2,3)$
`` `"Im"(f) " such that " f>0` ``	$\mathrm{Im}(f)$ such that $f > 0$
`` ` ` ``	
`` `` ``	“

Fractions and parentheses

`` `9/2` ``	$\frac{9}{2}$
`` `(1//2]/(7//4)` ``	$\frac{1/2}{7/4}$
`` `(9)/(7) + ((8))/(((15)))` ``	$\frac{9}{7} + \frac{(8)}{((15))}$
`` ` 24/3 + ((alpha+2)/2 * 5)/7` ``	$\frac{24}{3} + \frac{\frac{\alpha+2}{2} * 5}{7}$
`` `2/3/3` ``	$\frac{2}{3}/3$
`` `-5/zeta` ``	$-\frac{5}{\zeta}$
`` `z/((q*(2/beta to gamma)))` ``	$\frac{z}{\left(q * \left(\frac{2}{\beta} \to \gamma\right)\right)}$
`` `([2/3])/7` ``	$\frac{\left[\frac{2}{3}\right]}{7}$
`` `Phi = 1+1/(1+1/(1+cdots))` ``	$\Phi = 1 + \frac{1}{1 + \frac{1}{1+\cdots}}$
`` `left< 2/3 right|` ``	$\left\langle \frac{2}{3} \right\|$
`` `(7 middle| 2/3 right.` ``	$\left(7 \middle\| \frac{2}{3}\right.$

Fonts

`` `hat(a) + tilde(b) + bar(c) + widehat(a b c)` ``	$\hat{a} + \tilde{b} + \bar{c} + \widehat{abc}$
`` `cal(T) [bf(x)] in bb(R)^n` ``	$\mathcal{T}[\mathbf{x}] \in \mathbb{R}^n$

Exponents and subscripts

`` `5^14` ``	5^{14}
`` `5_14` ``	5_{14}
`` `(9^-74)` ``	$\left(9^{-74}\right)$
`` ` 125^-74` ``	125^{-74}
`` `1/125^74` ``	$\frac{1}{125^{74}}$
`` `(1/125)^74` ``	$\left(\frac{1}{125}\right)^{74}$
`` `alpha^(2+3)/5` ``	$\frac{\alpha^{2+3}}{5}$
`` `x^n y_1^-t alpha^-(beta-z)` ``	$x^n y_1^{-t} \alpha^{-(\beta-z)}$
`` `(q r s)_(123)^-[456/z]` ``	$(qrs)_{123}^{-\left[\frac{456}{z}\right]}$
`` `a_1^2` ``	a_1^2
`` `(x)_-i + q^r_(s)` ``	$(x)_{-i} + q_s^r$
`` `(a+b)_(k_1)^(x+2)` ``	$(a+b)_{k_1}^{x+2}$
`` `sum_(n=1)^infty 1/n^2` ``	$\sum_{n=1}^{\infty} \frac{1}{n^2}$
`` `int_pi^infty 1/(sin x)^2\,d x` ``	$\int_{\pi}^{\infty} \frac{1}{(\sin x)^2}\, dx$
`` `lim_substack(x to 0\\ y to 1) x^2(y-1)^2` ``	$\lim_{\substack{x \to 0 \\ y \to 1}} x^2(y-1)^2$

Square roots

`` `sqrt 2` ``	$\sqrt{2}$
`` `sqrt(2+4/5)` ``	$\sqrt{2+\frac{4}{5}}$
`` `2/sqrt(3alpha)` ``	$\frac{2}{\sqrt{3\alpha}}$
`` `sqrt sqrt 3` ``	$\sqrt{\sqrt{3}}$
`` `(2+3)/sqrt sqrt sqrt 3` ``	$\frac{2+3}{\sqrt{\sqrt{\sqrt{3}}}}$
`` `root n (x^2+1)` ``	$\sqrt[n]{x^2+1}$
`` `(-b pm sqrt(b^2-4a c))/(2a)` ``	$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$
`` `sqrt x^3` ``	$\sqrt{x}^3$

Symbols

`` `a_1...a_n` ``	$a_1 \cdots a_n$
`` `a_1,...,a_n` ``	$a_1, \ldots, a_n$
`` `f:bb(R)^2->bb(R)` ``	$f : \mathbb{R}^2 \to \mathbb{R}$
`` `>= <= => != -= ~ ~= ~~ ~-` ``	$\geq \leq \Longrightarrow \neq - = \sim \cong \approx \simeq$

Matrices

`` `matrix[y]` ``	$\begin{bmatrix} y \end{bmatrix}$
`` `matrix(a,1,c)` ``	$\begin{pmatrix} a & 1 & c \end{pmatrix}$
`` `matrix(3a;b^2;c-5d)` ``	$\begin{pmatrix} 3a \\ b^2 \\ c-5d \end{pmatrix}$
`` `matrix[2, sqrt(x^3), x^3/(7-x); (d),e,f]` ``	$\begin{bmatrix} 2 & \sqrt{x^3} & \frac{x^3}{7-x} \\ (d) & e & f \end{bmatrix}$
`` `matrix[x;y; z right.` ``	$\begin{bmatrix} x \\ y \\ z \end{bmatrix}$
`` `matrix[A_(1,1), ... ,A_(1,n); vdots,ddots,vdots; A_(m,1), ... ,A_(m,n)]` ``	$\begin{bmatrix} A_{1,1} & \cdots & A_{1,n} \\ \vdots & \ddots & \vdots \\ A_{m,1} & \cdots & A_{m,n} \end{bmatrix}$

Embedded LaTeX environments

`` `x/env{pmatrix}(2 & 3 \\ 4 & 5)` ``	$\frac{x}{\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}}$
`` `env{cases}(sqrt(x) & " if " x >= 0\\ "undefined" & " otherwise.")` ``	$\begin{cases} \sqrt{x} & \text{if } x \geq 0 \\ 0 & \text{otherwise.} \end{cases}$

The `raw` command lets you embed raw TeX commands inside of an asciimth environment. Unlike for other commands, curly braces must be used for `raw`.

This command is also useful for adding commands like `\label` inside of an `alignA` environment.

Braces and raw commands

`` `2^(3+y) + raw{\frac{5}{6x}}` ``	$2^{3+y} + \frac{5}{6x}$
`` `2^raw{\frac78}` ``	$2^{\frac{7}{8}}$
`` `2 + raw{\begin{pmatrix}2\\3 \end{pmatrix}}` ``	$\frac{2}{\begin{pmatrix}2\\3\end{pmatrix}}$
`` `t*{2+alpha}^2` ``	$t * 2 + \alpha^2$
`` `t*{(2+alpha)}^2` ``	$t * (2 + \alpha)^2$
`` ` {2+x}/{gamma^2beta}` ``	$\frac{2+x}{\gamma^2\beta}$
`` ` \{2/(x+y)\}^3` ``	$\left\{\frac{2}{x+y}\right\}^3$

3 Layout tests

These examples cover a few issues which are caused by the fact that we always use `\left` and `\right` delimiters:

- Using `\left(...\right)` causes different spacing than `(...)`. That issue has been resolved.
- The parentheses around the inner $\sum$ in the last example are too large; they unnecessarily grow to cover the subscript j.

Parenthesis tests

`` `f(x)+g(x/y)` ``	$f(x) + g\left(\frac{x}{y}\right)$
`` `(x+y)(x-y)` ``	$(x+y)(x-y)$
`` `f(x^2)+f(2^(2/y))` ``	$f\left(x^2\right) + f\left(2^{\frac{2}{y}}\right)$
`` `(x^2)^2` ``	$\left(x^2\right)^2$
`` `sum(x_i)+sum(x/y).` ``	$\sum(x_i) + \sum\left(\frac{x}{y}\right).$
`` `sum_i(sum_j(2*x))` ``	$\sum_i\left(\sum_j(2 * x)\right)$