Simple example

Justus Sagemüller

April 22, 2013

1 Hello

This is a simple example using the HaTeX library and some math stuff.

1.1 Arithmetics with infix operators

$$4^{\left(2^3\right)^2} - 10000 \cdot 10000 \cdot (10000 \cdot 10000) \cdot (10000 \cdot 10000 \cdot 10000)$$

is $3.403 \cdot 10^{38}$. For $x = 19$ and $\tau = 2 \cdot \pi$,

$$2 + 7 \cdot (6 - \tau) - e^{5 - \sqrt{x^2 + \frac{4}{\pi}}} \approx 1.77 \cdot 10^{-2}.$$

$$2 + i \cdot (-1) = 2 - i$$

$$-e^{\ln\, 2 + \frac{i \cdot \pi}{4}} \approx -1.414 - 1.414 \cdot i$$

1.2 Simple finite sums / products

$$\sum_{n \in \{0,1,4,5\}} \tfrac{5}{2} - n = 0$$

$$\sum_{n=1}^{4} \tfrac{5}{2} - n = 0$$

$$\sum_{j=1}^{40} \cos\left(\frac{2 \cdot \pi}{40} \cdot j\right) \approx -2.33 \cdot 10^{-15}$$

$$\Re\left(\sum_{j=1}^{40} e^{i \cdot \left(\frac{2 \cdot \pi}{40} \cdot j\right)}\right) \approx -2.33 \cdot 10^{-15}$$

$$2 \cdot \sum_{i=1}^{6} i^2 + i = 224$$

$$\left(\sum_{i=1}^{6} i^2 + i \right) \cdot 2 = 224$$

$$\sum_{i=1}^{6} i^2 + i \cdot 2 = 133$$

$$\sum_{i=1}^{6} \sum_{j=1}^{6} i \cdot j = 441$$

$$\sum_{i=1}^{6} i \cdot \sum_{j=1}^{6} j = 441$$

$$\sum_{i=1}^{6} \sum_{j=1}^{i} i \cdot j = 266$$

$$\sum_{i=1}^{6} \prod_{j=1}^{i} i \cdot j \approx 3.397 \cdot 10^7$$

1.3 Checking some simple identities

$$\arcsin(\sin(\arccos(\cos(\arctan(\tan\ 0)))))$$

is 0,

$$\operatorname{arcsinh}\left(\sinh\left(\operatorname{arccosh}\left(\frac{\cosh(\operatorname{arctanh}(\tanh\ 0))}{2}\right)\right)\right)$$

is not. (Test passed.)

A simple equations chain:

$$\begin{aligned} 10^{18} &= 10^9 \cdot 10^9 \\ &= 10^{3^2} \cdot 10^5 \cdot 10^4 \\ &= 1000000000000000000. \end{aligned}$$

(Test passed.)

Another equations chain, this time using floats:

$$\begin{aligned}10^{(-18)} &= 10^{(-9)} \cdot 10^{(-9)} \\ &= 10^{\left(-3^2\right)} \cdot 10^{(-5)} \cdot 10^{(-4)} \\ &= \frac{1}{1000000000000000000}.\end{aligned}$$

(**Test failed**[1].)

Equation-chains can also be approximate ("rough"):

$$\begin{aligned}10^{(-18)} &\approx 10^{(-9)} \cdot 10^{(-9)} \\ &\approx 10^{\left(-3^2\right)} \cdot 10^{(-5)} \cdot 10^{(-4)} \\ &\approx \frac{1}{999998765432100000}.\end{aligned}$$

(Test passed.)

Complex exponential identities. (Writing only rough-equalities to avoid problems with the floating-point comparisons, as at the moment only `double` can be used as the underlying data type for the complex arithmetics.)

$$\begin{aligned}e^{\frac{3}{4} \cdot i \cdot \pi} &\approx e^{\frac{11}{4} \cdot i \cdot \pi} \\ &\approx \frac{-\sqrt{2} + i \cdot \sqrt{2}}{2}\end{aligned}$$

(Test passed.)

[1] Even true mathematical identities may not show to hold when using floating-point arithmetics.