Sample math symbols

Son To

May 28, 2017

Contents

Chapter 1

Single equations

Add a squared and b squared to get c squared. Or, using the more mathematical approach: $a^2 + b^2 = c^2$

TEX is pronounced as $\tau\epsilon\chi$

100 m^3 of water

This comes from my *heartsuit*

Add a squared and b squared to get c squared. Or, using the more mathematical approach:

$$a^2 + b^2 = c^2 \tag{1.1}$$

Einstein says

$$E = mc^2 \tag{1.2}$$

He didn't say

$$1 + 1 = 3 \qquad \text{(bollocks)}$$

This is a reference to (1.2).

Add a squared to b squared to get c squared. Or, using a more mathematical approach

$$a^2 + b^2 = c^2$$

or you can type less for the same effect

$$a^2 + b^2 = c^2$$

This is text style: $\lim_{n\to\infty} \sum_{k=1}^{n} \frac{1}{k^2} = \frac{\pi^2}{6}$. And this is the display style:

$$\lim_{n\to\infty} \sum_{k=1}^{n} \frac{1}{k^2} = \frac{\pi^2}{6} \tag{1.3}$$

A $d_{e_{e_p}}$ mathematical expression followed by a $h_{i_{g_h}}$ expression. As opposed to a smashed $d_{e_{e_p}}$ expression followed by a $h_{i_{g_h}}$ expression.

$\forall x \in \mathbf{R}: \qquad x^2 \geq 0$

$x^2 \geq 0 \qquad$ for all $x \in \mathbf{R}$

$x^2 \geq 0$ for all $x \in \mathbb{R}$

$p_{ij}^3 \quad m_{\mathrm{Knuth}} \quad \sum_{k=1}^{n} k$

$\mathrm{a}^x + y \neq a^{x+y} \quad e^{x^2} \neq e^{x2}$

$\sqrt{2} \Leftrightarrow x^{1/2} \quad \sqrt[3]{2} \quad \sqrt{x^2 + \sqrt{y}} \quad \sqrt{x^2 + y^2}$

$\Psi = v_1 \cdot v_2 \cdot \ldots \quad n! = 1 \cdot 2 \cdots (n-1) \cdot n$

$0.\overline{3} = \underline{\underline{1/3}}$

$$\overbrace{\underbrace{a+b+c}_{\text{Advanced Calculus}} \cdot \overbrace{d+e+f}^{9}}^{6} = 54$$

$f(x) = x^2 \quad f'(x) = 2x \quad f''(x) = 2$

$\hat{XY} \quad \widehat{XY} \quad \bar{x}_0 \quad \underline{\bar{x}_0}$

$\vec{a} \quad \vec{AB} \quad \overrightarrow{AB}$

$$lim_{x \to 0} \frac{\sin x}{x} = 1$$

$$\mathrm{JamesComey} = \mathrm{nutjob}_{x=D.Trump}$$

$a \bmod b$

$x \equiv a \pmod{b}$

In in-line equations, the fraction $\frac{1}{2}$(text style) is shrunk to fit the line. The reverse of which is $\dfrac{1}{2}$(display style). A built-in fraction is $\tfrac{1}{2}$

$$\sqrt{\frac{x^2}{k+1}} \qquad x^{\frac{2}{k+1}} \qquad \frac{\partial^2 f}{\partial x^2}$$

Pascal's rule is

$$\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$$

$$f_n(x) \overset{d}{\succ} f_m(x)$$

$$\int_0^{\frac{\pi}{2}} x^2 \, \mathrm{d}x \qquad \sum_{i=1}^{n} i \qquad \prod_{\epsilon}$$

$$\sum_{\substack{0<i<n \\ j \subseteq i}}^{n} P(i,j) = Q(i,j)$$

$$a, b, c \neq \{a, b, c\}$$

$$1 + \left(\frac{1}{1-x^2} \right)^3 \qquad \ddagger \text{-} \Big)$$

$$\Big((x+1)(x-1)\Big)^3$$

$$a+b+c+d+e+f+g+h+i+z+x+v+n+m+1+2+3+4 = j+k+l+m+n \quad (1.4)$$

Chapter 2

Multiple equations

align env

$$a = b + c \tag{2.1}$$
$$= d + e \tag{2.2}$$

$$a = b + c \tag{2.3}$$
$$= d + e \tag{2.4}$$

Interpretation: & is more standard in the use of system of equations.
Its downfall:

$$a = b + c \tag{2.5}$$
$$= d + e + f + g + h + j + j + u + j + k + s + c$$
$$+ c + r + e + g + t + y + z \tag{2.6}$$
$$= p + q + r + s \tag{2.7}$$

A better solution:

$$\begin{aligned} a &= b + c && (2.8)\\ &= d + e + g + r + h + j + j + k \\ &\quad + l + b + m + v + v + c + f + h && (2.9)\\ &= p + q + r + s && (2.10) \end{aligned}$$

There are two troubles:
Trouble I:

$$a = a = a \tag{2.11}$$

Trouble II:(the spacing between j^2 is big!)

$$\begin{aligned} a &= b + c && (2.12)\\ &= z + x + v + n + o + m + n + b + t + r + e + t + i^2 + j^2 + l && (2.13) \end{aligned}$$

In addtionally, we are provided with \lefteqn when the LHS is too long:

$$\begin{aligned} a+b+c+r+e+d+f+g+d+e+t+f+g+h+d \\ = \quad a+b+c+m+j+k \qquad (2.14) \\ = \quad n+o+p+q+r+s \qquad (2.15) \end{aligned}$$

However, this still sucks as the RHS is too short and the array is not properly centered:

$$\begin{aligned} a+b+c+e+f+g+h+j+k+l \\ = \quad r+s \qquad (2.16) \end{aligned}$$

Our new remedy will be ...

2.1 IEEEeqnarray Environment

$$\begin{aligned} a &= b+c && (2.17) \\ &= d+e+f+b+t+g+h \\ &\quad +j+k+l && (2.18) \\ &= p+q+r+s && (2.19) \end{aligned}$$

Addtional spaces can be added with . and /and ? in an increasing order. We now show how IEEEeqnarray solves (2.13) and (2.16).
For 2.13, we add \IEEEeqnarraynumspace:

$$\begin{aligned} a &= b+c && (2.20) \\ &= z+x+v+n+o+m+n+b+t+r+e+t+i^2+j^2+l && (2.21) \end{aligned}$$

For 2.16, we replace the faulty \lefteqn with \IEEEeqnarraymulticol,

$$\begin{aligned} a+b+c+e+f+g+h+j+k+l \\ = r+s \qquad (2.22) \end{aligned}$$

Finally, we can add number, or subnumber to IEEEeqnarray* environment,

$$\begin{aligned} a &= b+c && (2.23) \\ &= d+e && (2.23a) \\ &= f+g && (2.23b) \end{aligned}$$

Chapter 3

Arrays and Matrices

A typical array environment:

$$\mathbf{X} = \begin{pmatrix} x_1 & x_2 & \dots \\ x_3 & x_4 & \dots \\ \vdots & \vdots & \ddots \end{pmatrix}$$

It can also be used to write piecewise functions,

$$|x| = \begin{cases} -x & \text{if } x < 0 \\ 0 & \text{if } x = 0 \\ x & \text{if } x > 0 \end{cases}$$

Chapter 4

Spacing in Math Mode

$$\int_1^2 \ln x \mathrm{d}x$$
$$\int_1^2 \ln x \,\mathrm{d}x$$

We can write a new command to use with \newcommand{command}{program} and put it in the preamble.
Let's test:

$$\int_a^b f(x)\,\mathrm{d}x$$

With multiple integrals,

$$\int\int f(x)g(y)\,\mathrm{d}x\,\mathrm{d}y$$
$$\iint f(x)g(y)\,\mathrm{d}x\,\mathrm{d}y$$
$$\iint f(x)g(y)\,\mathrm{d}x\,\mathrm{d}y$$

4.1 Phantom

Using \phantom can help reserve character that does not show up in the final output.
Example:

$${}^{14}_{6}\mathrm{C} \qquad \text{versus} \qquad {}^{14}_{6}\mathrm{C}$$

4.2 Fiddling with Math Fonts

$\Re$ $\mathcal{R}$ $\mathfrak{R}$ $\mathbb{R}$
123 123 123 123

$$P = \frac{\sum_{i=1}^{n}(x_i - x)(y_i - y)}{\left[\sum_{i=1}^{n}(x_i - x)^2 \sum_{i=1}^{n}(y_i - y)^2\right]^{1/2}}$$

4.2.1 Bold Symbols

\mathbf{} only works for upright letters!
\boldmath{} only works outside of math mode!
\boldsymbol{} is more versati!
Examples:
μ, M $\mu, \mathbf{M}$ $\boldsymbol{\mu}, \boldsymbol{M}$ $\boldsymbol{\mu}, \boldsymbol{M}$ $\boldsymbol{\mu}, \boldsymbol{M}$

Chapter 5

Theorems,Lemmas,. . .

Law 5.1. Don't hide in the witness box

Jury 5.2 (The bullshit lemma)**.** *It could be you! So beware and see 5.1.*

Margaret. No, No, No.

We now write some "proof" formats.

Proof. Trivial, use

$$\boldsymbol{E = mc^2.}$$

□

Now using \qedhere,

Proof. Trivial, use

$$\boldsymbol{E = mc^2.}$$ □

Unfortunately, this does not work for IEEEeqnarray due to the 2 invisible columns placed on both sides of the array.

Proof. This is a proof that ends with an equation array.

$$\begin{aligned} \boldsymbol{a} &= \boldsymbol{b} + \boldsymbol{c} \\ &= \boldsymbol{d} + \boldsymbol{e}. \end{aligned}$$ □

The remedy for this will be to define the stretchable spaces explicitly,

Proof. This is a proof that ends with an equation array.

$$\begin{aligned} \boldsymbol{a} &= \boldsymbol{b} + \boldsymbol{c} \\ &= \boldsymbol{d} + \boldsymbol{e}. \end{aligned}$$ □

The simmilar problem occurs with placing the QED mark in the numbered equations. Compare

Proof. This is a proof that ends with a numbered equation:

$$\boldsymbol{a} = \boldsymbol{b} + \boldsymbol{c} \tag{5.1}$$

□

to

Proof. This is a proof that ends with a numbered equation:

$$\boldsymbol{a} = \boldsymbol{b} + \boldsymbol{c} \tag{5.2}$$

□

We aim to have the latter form of the proof. Hence, for the case of IEEEeqnarray, let's fix the following problem

Proof. This is a proof that ends with numbered equations:

$$\begin{aligned} \boldsymbol{a} &= \boldsymbol{b} + \boldsymbol{c} && (5.3)\\ &= \boldsymbol{e} + \boldsymbol{f} && (5.4) \end{aligned}$$

□

by the following solution

Proof. This is a proof that ends with numbered equations:

$$\begin{aligned} \boldsymbol{a} &= \boldsymbol{b} + \boldsymbol{c} && (5.5)\\ &= \boldsymbol{d} + \boldsymbol{e} && (5.6) \end{aligned}$$

□

Hence, this completes our documentation of the Sample Math Symbols