Typst Math for Undergrads

This is a Typst port of *ETEX Math for Undergrads* by Jim Hefferon. The original version is available at https://gitlab.com/jim.hefferon/undergradmath.

Meaning of annotations

2023-03-31 🗙

This is unavailable. Last check date is 2023-03-31.

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Get this in a tricky way. Need a simpler method.

No idea 😕

Don't know how to get this.

Rule One Any mathematics at all, even a single character, gets a mathematical setting. Thus, for "the value of x is 7" enter the value of x is \$7\$.

Template Your document should contain at least this.

-- document body here --

Common constructs

$$\begin{array}{lll} x^2 \ x^{2} & \sqrt{2}, \sqrt[\eta]{3} \ \text{sqrt(2), root(n, 3)} \\ x_{i,j} \ x_{_}(\text{i, j}) & \frac{2}{3}, 2 \ / \ 3 \ \text{2 / 3, 2 } \ / \ 3 \ \text{or 2 slash 3} \end{array}$$

Calligraphic letters Use as in \$cal(A)\$.

ABCDEFGHIJKLMNOPQRSTUVWXYZ

Getting script letters is $2023-03-31 \times$.

Greek

lpha alpha	ξ,Ξ xi, Xi
eta beta	o omicron
γ,Γ gamma, Gamma	π,Π pi,Pi
δ,Δ delta, Delta	arpi pi.alt
ϵ epsilon.alt	ho rho
arepsilon epsilon	arrho rho.alt
ζ zeta	σ, Σ sigma, Sigma
η eta	ς \u{03C2} 💝
$ heta, \Theta$ theta, Theta	au tau
artheta theta.alt	v,Υ upsilon, Upsilon
ι iota	ϕ,Φ phi.alt,Phi
$\kappa \mathrm{K}$	arphi phi
λ,Λ lambda, Lambda	χ chi
μ mu	ψ,Ψ psi, Psi
u nu	ω,Ω omega, Omega

Sets and logic

\cup union	\mathbb{R} RR, bb(R)	∀ forall
∩ sect	\mathbb{Z} ZZ, bb(Z)	\exists exists
\subset subset	\mathbb{Q} QQ, bb(Q)	\neg not
\subseteq subset.eq	\mathbb{N} NN, bb(N)	∨ or
⊃ supset	\mathbb{C} CC, bb(C)	\wedge and
\supseteq supset.eq	arnothing diameter	⊢ tack.r
\in in	\emptyset nothing	⊨ models
∉ in.not	ℵ alef	\ without

Negate an operator, as in $\not\subset$, with subset.not. Get the set complement A^c with A^(sans(c)) (or A^c with A^(complement), or \overline{A} with overline(A)).

Remark Using diameter for \varnothing may cause some confusion. However, 上下X also uses ∅ (\u{2300}) instead of ∅ (\u{2205}), see newcm §13.3. Another solution is to use text(font: "Fira Sans", nothing), but the resul-

tant glyph \emptyset is subtly different from the widely used one. Ultimately, The choice is always **your decision**.

Decorations

```
f' f', f prime \dot{a} dot(a) \tilde{a} tilde(a) f'' f prime.double \ddot{a} diaer(a) \bar{a} macron(a) \Sigma^* Sigma^* \hat{a} hat(a) \vec{a} arrow(a)
```

If the decorated letter is i or j then some decorations need $\{106A4\}$ and $\{106A5\}$ as in \vec{i} with arrow($\{106A4\}$). Some authors use boldface for vectors: $\{106A4\}$).

Entering overline(x + y) produces $\overline{x+y}$, and hat(x + y) gives $\widehat{x+y}$. Comment on an expression as here (there is also overbrace(...)).

$$\underbrace{x+y}_{|A|}$$
 underbrace(x + y, |A|)

Dots Use low dots in a list $\{0,1,2,\ldots\}$, entered as $\{0,1,2,\ldots\}$. Use centered dots in a sum or product $1+\cdots+100$, entered as 1+ dots.h.c + 100. You can also get vertical dots dots.v, diagonal dots dots.down and anti-diagonal dots dots.up.

Roman names Just type them!

\sin sin	\sinh sinh	rcsin arcsin
\cos cos	\cosh \cosh	rccos arccos
an tan	anh tanh	rctan arctan
\sec sec	\coth coth	\min min
csc csc	\det det	\max max
\cot cot	$\dim\;dim$	inf inf
\exp exp	ker ker	\sup sup
\log log	\deg deg	lim inf liminf
\ln ln	arg arg	\limsup limsup
lg lg	\gcd gcd	lim lim

Other symbols

< <, lt	\angle angle	· dot.op
\leq <=, lt.eq	\measuredangle angle.arc	\pm plus.minus
> >, gt	ℓ ell	\mp minus.plus
≥ >=, gt.eq	∥ parallel	imes times
\neq !=, eq.not	45° 45 degree	÷ div
\ll <<, lt.double	\cong tilde.eqq	* *,ast.op
\gg >>, gt.double	≇ tilde.eqq.not	divides
pprox approx	\sim tilde.op	∤ divides.not
≍ \u{224D} 💝	\simeq tilde.eq	<i>n</i> ! n!
\equiv ident	≁ tilde.not	∂ diff
≺ prec	\oplus plus.circle	abla nabla
≼ prec.eq	\ominus minus.cirle	\hbar planck.reduce
> succ	⊙ dot.circle	∘ circle.stroked.tiny
≽ succ.eq	\otimes times.circle	★ star.op
\propto prop		√ sqrt("")
≐ \u{2250} 💝	├ harpoon.tr	√ checkmark

Use a divides b for the divides relation, $a \mid b$, and a divides.not b for the negation, $a \nmid b$. Use \mid to get set builder notation $\{a \in S \mid a \text{ is odd}\}$ with $\{a \text{ in S } \mid a \text{ "is odd"}\}$.

Arrows

```
\begin{array}{lll} \rightarrow & ->, \operatorname{arrow.r} & \longmapsto & |->, \operatorname{arrow.r.bar} \\ \rightarrow & \operatorname{arrow.r.long} & \longmapsto & \operatorname{arrow.r.long.bar} \\ \rightarrow & \operatorname{arrow.r.double} & \longleftarrow & <-, \operatorname{arrow.l.r} \\ \Rightarrow & \operatorname{arrow.r.double.not} & \downarrow & \operatorname{arrow.b} \end{array}
```

The right arrows in the first column have matching left arrows, such as arrow.l.not, and there are some other matches for down arrows, etc.

Variable-sized operators The summation $\sum_{j=0}^{3} j^2$ sum_(j = 0)^3 j^2 and the integral $\int_{x=0}^{3} x^2 \, \mathrm{d}x$ integral_(x = 0)^3 x^2 dif x expand when displayed.

$$\sum_{j=0}^{3} j^2 \qquad \int_{x=0}^{3} x^2 \, \mathrm{d}x$$

These do the same.

$$\iint \text{ integral } \iiint \text{ integral.triple} \bigcup \text{ union.big } \iint \text{ integral.cont } \bigcap \text{ sect.big}$$

Fences

() ()
$$\langle \rangle$$
 angle.l angle.r || abs("") || [] [] || floor("") || morm("") || {} {} {} {}

Fix the size with the 1r function.

$$\left[\sum_{k=0}^{n} e^{k^2}\right] \operatorname{lr}([\operatorname{sum}_{(k = 0)^n e^{(k^2)}], size: #50%)}$$

To have them grow with the enclosed formula, also use the lr function.

$$\left\langle i,2^{2^{i}}
ight
angle$$
 lr(angle.l i, 2^(2^i) angle.r)

Fences scale by default if entered directly as codepoints, and don't scale automatically if entered as symbol notation.

$$\left(rac{1}{n^{lpha}}
ight)$$
 (1 / n^(alpha))
$$\left(rac{1}{n^{lpha}}
ight)$$
 paren.l 1 / n^(alpha) paren.r

The 1r function also allows to scale unmatched delimiters and one-side fences.

$$\frac{\mathrm{d}f}{\mathrm{d}x}\Big|_{x_0}$$
 lr(frac(dif f, dif x) |)_(x_0)

Arrays, Matrices Get a matrix with the mat function. You can pass an array to it.

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$$
 \$ mat(a, b; c, d) \$

In Typst, <u>array</u> is a sequence of values, while in \LaTeX , array is a matrix without fences, which is $\texttt{mat}(\texttt{delim}: \texttt{\#none}, \ldots)$ in Typst.

For the determinant use |A|, text operator det det or mat(delim: "|", ...).

Definition by cases can be easily obtained with the cases function.

$$f_n = \begin{cases} a & \text{if } n = 0 \\ r \cdot f_{n-1} & \text{else} \end{cases} \quad \begin{array}{c} \$ \text{ f_n = cases(} \\ a \text{ \&"if" n = 0,} \\ r \text{ dot.op f_(n - 1) \&"else"} \\ \end{cases}$$

Spacing in mathematics Improve $\sqrt{2}x$ to $\sqrt{2}x$ with a thin space, as in sqrt(2) thin x. Slightly wider are medium and thick (the three are in ratio 3:4:5). Bigger space is quad for \rightarrow \leftarrow , which is useful between parts of a display. Get arbitrary space with the h function. For example, use #h(2em) for \quad in \mathemathtarrow{F}X and #h(-0.1667em) for \!

Displayed equations Display equations in a block level using \$. . . \$ with at least one space separating the math content and the \$.

$$S = k \cdot \lg W$$
 \$ S = k dot.op lg W \$

You can break into multiple lines.

$$\begin{split} \sin(x) &= x - \frac{x^3}{3}! \\ &+ \frac{x^5}{5}! - \cdots \end{split} \qquad \begin{array}{l} &\text{$$\sin(x) = x - x^3 / 3! \setminus $} \\ &+ x^5 / 5! - \text{dots.h.c} \end{array} \label{eq:sin_x}$$

Align equations using &

$$\begin{array}{lll} \nabla \cdot D = \rho & \text{\$ nabla dot.op bold(D) \&= rho \setminus} \\ \nabla \cdot B = 0 & \text{nabla dot.op bold(B) \&= 0 \$} \end{array}$$

(the left or right side of an alignment can be empty). Get a numbered version by #set math.equation(numbering: ..).

Calculus examples The last three here are display style.

f:
$$\mathbb{R} \to \mathbb{R}$$
 f: RR -> RR 9.8 m/s² "9.8" "m/s"^2 \Leftrightarrow
$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0$$

Discrete mathematics examples For modulo, there is a symbol \equiv from ident and a text operator mod from mod.

For combinations the binomial symbol $\binom{n}{k}$ is from binom(n, k). This resizes to be bigger in a display.

For permutations use $n^{\underline{r}}$ from n^(underline(r)) (some authors use P(n,r), or ${}_nP_r$ from ""_n P_r).

Statistics examples

$$\begin{split} \sigma^2 &= \sqrt{\sum(x_i - \mu)^2 \, / \, N} & \text{sigma^2 = sqrt(sum(x_i - mu)^2 \/ N)} \\ E(X) &= \mu_X = \sum(x_i - P(x_i)) & \text{E(X) = mu_X = sum(x_i - P(x_i))} \end{split}$$

The probability density of the normal distribution

$$\frac{1}{\sqrt{2\sigma^2\pi}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

comes from this.

For more See also the Typst Documentation at https://typst.app/docs.