Variable-sized operators The summation $\sum_{j=0}^{3} j^2$ `\sum_{j=0}^3 j^2` and the integral $\int_{x=0}^{3} x^2\,dx$ `\int_{x=0}^3 x^2\,dx` expand when displayed.

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

These do the same.

$\int$	`\int`	$\iiint$	`\iiint`	$\bigcup$	`\bigcup`
$\iint$	`\iint`	$\oint$	`\oint`	$\bigcap$	`\bigcap`

Fences

$(\,)$	`()`	$\langle\,\rangle$	`\langle\rangle`	$\vert\,\vert$	`| |`
$[\,]$	`[]`	$\lfloor\,\rfloor$	`\lfloor\rfloor`	$\Vert\,\Vert$	`\\| \\|`
$\{\,\}$	`\{\}`	$\lceil\,\rceil$	`\lceil\rceil`		

Fix the size with `\big`, `\Big`, `\bigg`, or `\Bigg`.

$$\Big[\sum_{k=0}^{n} e^{k^2}\Big] \quad \texttt{\textbackslash Big[\textbackslash sum\_\{k=0\}\textasciicircum n e\textasciicircum\{k\textasciicircum 2\}\textbackslash Big]}$$

To have them grow with the enclosed formula, use `\left` and `\right` (although sometimes `\big`, etc., are necessary).

$$\left\langle i, 2^{2^i} \right\rangle \quad \texttt{\textbackslash left\textbackslash langle i,2\textasciicircum\{2\textasciicircum i\}\textbackslash right\textbackslash rangle}$$

Every `\left` must match a `\right` and they must end on the same line in the output. For a one-sided fence, put a `\left.` or `\right.` on the other side.

$$\left.\frac{df}{dx}\right|_{x_0} \quad \texttt{\textbackslash left.\textbackslash frac\{df\}\{dx\}\textbackslash right|\_\{x\_0\}}$$

Arrays, Matrices Make an array of mathematical text as you make a table of plain text.

$$\begin{array}{rcl} 0 & \leftrightarrow & 0 \\ 1 & \leftrightarrow & 1 \\ 2 & \leftrightarrow & 4 \\ \vdots & & \vdots \end{array}$$

```
\begin{array}{rcl}
  0 &\leftrightarrow &0 \\
  1 &\leftrightarrow &1 \\
  2 &\leftrightarrow &4 \\
  \vdots &  &\vdots
\end{array}
```

Definition by cases is an array with two columns.

$$f_n = \begin{cases} a & \text{if } n=0 \\ r\cdot f_{n-1} & \text{else} \end{cases}$$

```
f_n=
\begin{cases}
 a     &\text{if $n=0$} \\
 r\cdot f_{n-1} &\text{else}
\end{cases}
```

A matrix is an array with fences. With a `pmatrix` environment, you need not specify column alignments.

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

```
\begin{pmatrix}
  a  &b \\
  c  &d
\end{pmatrix}
```

For the determinant use `|A|` inline and `vmatrix` in display.

Spacing in mathematics Improve $\sqrt{2}x$ to $\sqrt{2}\,x$ with a thin space, as in `\sqrt{2}\,x`. Slightly wider are `\:` and `\;` (the three are in ratio $3:4:5$). Get the improvement of $n/\log n$ instead of $n/\log n$ by using a negative thin space, as in `n/\!\log n`. Bigger spaces are: `\quad` for $\rightarrow\quad\leftarrow$, and `\qquad` for $\rightarrow\qquad\leftarrow$, which are useful between parts of a display. Get arbitrary space as in `\hspace*{0.5cm}`.

Displayed equations The `equation*` environment puts an equation on a separate line.

$$S = k\cdot\lg W$$

```
\begin{equation*}
  S=k\cdot\lg W
\end{equation*}
```

You can break into multiple lines.

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$$

```
\begin{multline*}
  \sin (x)=x-\frac{x^3}{3!} \\
      +\frac{x^5}{5!}-\cdots
\end{multline*}
```

Align equations using `align*`

$$\begin{aligned} \nabla\cdot\boldsymbol{D} &= \rho \\ \nabla\cdot\boldsymbol{B} &= 0 \end{aligned}$$

```
\begin{align*}
  \nabla\cdot\boldsymbol{D} &= \rho \\
  \nabla\cdot\boldsymbol{B} &= 0
\end{align*}
```

(the left or right side of an alignment can be empty). For each environment, get a numbered version by dropping the asterisk from the name.

Calculus examples The last three here are display style.

$f\colon \mathbb{R}\to\mathbb{R}$ `f\colon\mathbb{R}\to\mathbb{R}`

$9.8\ \mathrm{m/s^2}$ `9.8~\text{m}/\text{s}^2`

$\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ `\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}`

$\int x^2\,dx = x^3/3+C$ `\int x^2\,dx=x^3/3+C`

$\nabla = \boldsymbol{i}\frac{d}{dx}+\boldsymbol{j}\frac{d}{dy}+\boldsymbol{k}\frac{d}{dz}$ `\nabla=\boldsymbol{i}\frac{d}{dx}+\cdots`

Discrete mathematics examples There are four modulo forms: $m \bmod n$ is from `m\bmod n`, and $a \equiv b \pmod m$ is from `a\equiv b\pmod m`, and $a \equiv b \mod m$ is from `a\equiv b\mod m`, and $a \equiv b\ (m)$ is from `a\equiv b\pod m`.

For combinations the binomial symbol $\binom{n}{k}$ is from `\binom{n}{k}`. This resizes to be bigger in a display (to require the display version use `\dbinom{n}{k}` and require the inline version with `\tbinom{n}{k}`).

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

Statistics examples

$\sigma^2 = \sqrt{\sum(x_i-\mu)^2/N}$ `\sigma^2=\sqrt{\,\sum (x_i-\mu)^2/N}`

$E(X) = \mu_X = \sum(x_i - P(x_i))$ `E(X)=\mu_X=\sum (x_i-P(x_i))`

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.

```
\frac{1}{sqrt{2\sigma^2\pi}}
  \,e^{-\frac{(x-\mu)^2}{2\sigma^2}}!.
```

For more See also the Comprehensive LaTeX Symbols List at `mirror.ctan.org/info/symbols/comprehensive` and DeTeXify at `detexify.kirelabs.org/classify.html`.

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