# Basic mathematical symbols and structures

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### 1 Standard mathematical symbols

We will use the robust single dollar environment for these

Math versions of text symbols:  $\$_{\ddagger} \{ \P \dots \} \S \dagger \mathcal{L}$ 

Keyboard symbols: +- = <> / :!'|[]()

But for longer tests we will use the equation environment so that we don't overrun the line if we increase the font size. We'll do a basic macro test in section 2.2.

Greek:

$$\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\tag{1}$$

Upper case Greek:

$$\Gamma\Delta\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$$
 (2)

Normal, lower case:

$$abcdefghijklmnopqrstuvwxyz$$
 (3)

Normal, upper case:

$$ABCDEFGHIJKLMNOPQRSTUVWXYZ$$
 (4)

Bold using boldmath, lower case:

$$abcdefghijklmnopqrstuvwxyz$$
 (5)

Bold using boldmath, upper case:

$$ABCDEFGHIJKLMNOPQRSTUVWXYZ$$
 (6)

Italic, lower case:

$$a b c d e f g h i j k l m n o p q r s t u v w x y z$$
 (7)

Italic, upper case:

$$A B C D E F G H I J K L M N O P Q R S T U V W X Y Z$$

$$(8)$$

2

Roman, lower case:

Roman, upper case:

Bold using bf, lower case:

Bold using bf, upper case:

Calligraphic (upper case only):

$$ABCDEFGHIJKLMNOPQRSTUVWXYZ$$
 (13)

Binary operators:

$$\pm \mp \times \div \cdot * \star \dagger \ddagger \coprod \cap \cup \uplus \sqcap \sqcup \vee \wedge \oplus \ominus \otimes \circ \bullet \Diamond \bigcirc \bigcirc \bigcirc \triangle \triangledown \triangleleft \triangleright \setminus \rangle \tag{14}$$

Relations:

$$\leq \leq \ll \subset \subseteq \subseteq \in \vdash \vdash \geq \geq \gg \supset \supseteq \subseteq \ni \dashv \bot \neq \dot{=} \approx \cong \equiv \propto \prec \preceq \parallel \parallel \sim \simeq \asymp \smile \frown \bowtie \succ \vdash \mid$$

$$(15)$$

Negated which do not stop conversion but may not be displayed in Word:

Arrows:

$$\leftarrow\leftarrow\leftarrow\rightarrow\rightarrow\Rightarrow\leftrightarrow\leftrightarrow\leftarrow\leftarrow\leftarrow\rightarrow\Longrightarrow$$
 (17)

$$\longleftrightarrow \longleftrightarrow \hookrightarrow \to \to \to \uparrow \uparrow \downarrow \downarrow \downarrow \uparrow \uparrow \uparrow \downarrow \checkmark$$
 (18)

Other:

$$\aleph \hbar i j \ell_{\wp} \Re \Im i \emptyset \nabla \sqrt{\partial \top} \bot \vdash \vdash \forall \exists \neq \flat \mathsf{LL} \| \angle \setminus \triangle \clubsuit \lozenge \heartsuit \spadesuit \infty \tag{19}$$

Symbols with two sizes:

$$\Sigma \int \int \Pi \Pi \cap U \cap V \wedge O \otimes \oplus \Theta$$

$$\sum \int \oint \prod \coprod \bigcap \bigcup \bigcup \bigvee \bigwedge \bigodot \bigotimes \bigoplus \biguplus$$
 (20)

Function names:

$$\arccos \arcsin \arctan \arg \cos \cosh \cot \coth \csc \deg \det$$
 (21)

$$\dim \exp \gcd \hom \inf \ker \lg \lim \lim \inf \limsup \log$$
 (22)

$$\max \min \Pr \sec \sin \sinh \sup \tan \tanh$$
 (23)

Those with under-subscript available:

$$\det_a \gcd_a \inf_a \lim_a \lim_a \lim_a \max_a \max_a \Pr_a \sup_a$$
 (24)

Modulus:

$$a \bmod b \qquad a \pmod b$$
 (25)

Accents and under/over:

Symbols left and right can be applied to:

Manual sizing:

Dots:

$$a \dots a \quad a : a \quad a \cdots a \quad a \cdots a$$
 (32)

Horizontal spacing:

#### 2 Standard mathematical structures

Three different ways to inline  $A_{i,j,k}^{2^n}$   $A_{i,j,k}^{2^n}$   $A_{i,j,k}^{2^n}$ 

Four different ways to displaymath.

$$\sum_{i=1}^{15} x_i^2 = x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 + x_7^2 + x_8^2 + x_9^2 + x_{10}^2 + x_{11}^2 + x_{12}^2 + x_{13}^2 + x_{14}^2 + x_{15}^2$$
 (100)

$$x_1^2 = x_2^2 = x_3^2 = x_4^2 = x_5^2 = x_6^2 = x_7^2 = x_8^2 = x_9^2 = x_{10}^2 = x_{11}^2 = x_{12}^2 = x_{13}^2 = x_{14}^2 = x_{15}^2$$

$$\prod_{i=1}^{15} x_i^2 = x_1^2 \ x_2^2 \ x_3^2 \ x_4^2 \ x_5^2 \ x_6^2 \ x_7^2 \ x_8^2 \ x_9^2 \ x_{10}^2 \ x_{11}^2 \ x_{12}^2 \ x_{13}^2 \ x_{14}^2 \ x_{15}^2$$

$$\prod_{i=1}^{15} x_i^2 = x_1^2 \cdot x_2^2 \cdot x_3^2 \cdot x_4^2 \cdot x_5^2 \cdot x_6^2 \cdot x_7^2 \cdot x_8^2 \cdot x_9^2 \cdot x_{10}^2 \cdot x_{11}^2 \cdot x_{12}^2 \cdot x_{13}^2 \cdot x_{14}^2 \cdot x_{15}^2$$

One of the forms is numbered equation 100.

$$\sqrt{\sum_{i=1}^{13} x_i^2} = \sqrt{x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 + x_7^2 + x_8^2 + x_9^2 + x_{10}^2 + x_{11}^2 + x_{12}^2 + x_{13}^2}$$

$$\sqrt{\sum_{i=1}^{13} x_i^2} = \left(x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 + x_7^2 + x_8^2 + x_9^2 + x_{10}^2 + x_{11}^2 + x_{12}^2 + x_{13}^2\right)^{\frac{1}{2}}$$

Now for an equation array:

$$\sum_{i=1}^{13} 2^{i} = 2^{1} + 2^{2} + 2^{3} + 2^{4} + 2^{5} + 2^{6} + 2^{7} + 2^{8} + 2^{9} + 2^{10} + 2^{11} + 2^{12} + 2^{13}$$

$$= 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 512 + 1024 + 2048 + 4096 + 8192$$

$$= 16382$$
(101)

$$\sum_{i=1}^{13} 2^{i} = 2^{1} + 2^{2} + 2^{3} + 2^{4} + 2^{5} + 2^{6} + 2^{7} + 2^{8} + 2^{9} + 2^{10} + 2^{11} + 2^{12} + 2^{13}$$

$$=$$
 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 512 + 1024 + 2048 + 4096 + 8192

= 16382 here is some text in the formula to fill up the line at 12pt font

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

$$\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = (1 \times 4) - (2 \times 3)$$

$$= 4 - 6 = -2$$

$$\sqrt{a + \sqrt{\frac{b + c + d}{e}} + f}$$

$$\overline{\underline{a} + \overline{b} + \underline{c} + \overline{d} + \overline{\overline{e}}}$$

$$\underbrace{a + \underbrace{b + c}_{=0} + d}_{\text{text}}$$

$$a + \frac{1}{b + \frac{1}{c + \frac{1}{d + \frac{1}{e + \frac{1}{f + \frac{1}{g + \frac{1}{h}}}}}}} \qquad a + \frac{1}{b + \frac{1}{c + \frac{1}{d + \frac{1}{e + \frac{1}{f + \frac{1}$$

#### 2.1 Testing line breaking

a = b = c = d = e = f = g = h = i = j = k = l = m = n = o = p = q = r = s = t a < b < c < d < e < f < g < h < i < j < k < l < m < n < o < p < q < r < s < t a > b > c > d > e > f > g > h > i > j > k > l > m > n > o > p > q > r > s > t  $a \le b \le c \le d \le e \le f \le g \le h \le i \le j \le k \le l \le m \le n \le o \le p \le q \le r \le s \le t$   $a \ge b \ge c \ge d \ge e \ge f \ge g \ge h \ge i \ge j \ge k \ge l \ge m \ge n \ge o \ge p \ge q \ge r \ge s \ge t$  a + b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u a - b - c - d - e - f - g - h - i - j - k - l - m - n - o - p - q - r - s - t - u  $a \times b \times c \times d \times e \times f \times g \times h \times i \times j \times k \times l \times m \times n \times o \times p \times q \times r \times s \times t \times u$  a \* b \* c \* d \* e \* f \* g \* h \* i \* j \* k \* l \* m \* n \* o \* p \* q \* r \* s \* t \* u \* v \* w \* x \* y  $a \cdot b \cdot c \cdot d \cdot e \cdot f \cdot g \cdot h \cdot i \cdot j \cdot k \cdot l \cdot m \cdot n \cdot o \cdot p \cdot q \cdot r \cdot s \cdot t \cdot u \cdot v \cdot w \cdot x \cdot y \cdot z \cdot a \cdot b \cdot c$  a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, a, b, c, d, e, f, g, h, i, j, k, l

## 2.2 Testing new commands

$$x_1x^2x_2$$