Comprehensive List of

Mathematical Symbols

MATH VAULT

Comprehensive List of Mathematical Symbols

For the corresponding **web guides**, see **Mathematical Symbols**.

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1 Constant

1.1 Key Mathematical Numbers

Symbols (Explanation)	LaTeX Code	Example
0 (Zero, additive identity)	`$0$`	$3 + 0 = 3$
1 (One, multiplicative identity)	`$1$`	$5 \times 1 = 5$
$\sqrt{2}$ (Square root of 2)	`$\sqrt{2}$`	$(\sqrt{2} + 1)^2 = 3 + 2\sqrt{2}$
e (Euler's constant)	`$e$`	$\ln(e^2) = 2$
π (Pi, Archimedes' constant)	`$\pi$`	$\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \cdots$
φ (Phi, golden ratio)	`$\varphi$`	$\varphi = \frac{1+\sqrt{5}}{2}$
i (Imaginary unit)	`$i$`	$(1 + i)^2 = 2i$

1.2 Key Mathematical Sets

Symbols (Explanation)	LaTeX Code	Example
$\varnothing$ (Empty set)	`$\varnothing$`	$\lvert\varnothing\rvert = 0$
$\mathbb{N}$ (Set of natural numbers)	`$\mathbb{N}$`	$\forall x, y \in \mathbb{N}, x + y \in \mathbb{N}$
$\mathbb{Z}$ (Set of integers)	`$\mathbb{Z}$`	$\mathbb{N} \subseteq \mathbb{Z}$

$\mathbb{Z}_+$ (Set of positive integers)	`$\mathbb{Z}_+$`	$3 \in \mathbb{Z}_+$
$\mathbb{Q}$ (Set of rational numbers)	`$\mathbb{Q}$`	$\sqrt{2} \notin \mathbb{Q}$
$\mathbb{R}$ (Set of real numbers)	`$\mathbb{R}$`	$\forall x \in \mathbb{R}\,(x^2 \geq 0)$
$\mathbb{R}_+$ (Set of positive real numbers)	`$\mathbb{R}_+$`	$\forall x, y \in \mathbb{R}_+\,(xy \in \mathbb{R}_+)$
$\mathbb{C}$ (Set of complex numbers)	`$\mathbb{C}$`	$\exists z \in \mathbb{C}\,(z^2 + 1 = 0)$
$\mathbb{Z}_n$ (Set of integer modulo n)	`$\mathbb{Z}_n$`	In the world of $\mathbb{Z}_2$, $1 + 1 = 0$.
$\mathbb{R}^3$ (Three-dimensional Euclidean space)	`$\mathbb{R}^3$`	$(5, 1, 2) \in \mathbb{R}^3$

1.3 Key Mathematical Infinities

Symbols (Explanation)	LaTeX Code	Example
$\aleph_0$ (Cardinality of natural numbers)	`$\aleph_0$`	$\aleph_0 + 5 = \aleph_0$
$\mathfrak{c}$ (Cardinality of real numbers)	`$\mathfrak{c}$`	$\mathfrak{c} = 2^{\aleph_0}$
ω (Smallest infinite ordinal number)	`$\omega$`	$\forall n \in \mathbb{N}\,(n < \omega)$

1.4 Other Key Mathematical Objects

Symbols (Explanation)	LaTeX Code	Example
$\mathbf{0}$ (Zero vector)	`$\mathbf{0}$`	$\forall \mathbf{v} \in V, \mathbf{v} + \mathbf{0} = \mathbf{v}$
e (Identity element of a group)	`$e$`	$e \circ e = e$
I (Identity matrix)	`$I$`	$AI = IA = A$
C (Constant of integration)	`$C$`	$\int 1 \, \mathrm{d}x = x + C$
$\top$ (Tautology)	`$\top$`	For each proposition P, $P \wedge \top \equiv P$.
$\bot$ (Contradiction)	`$\bot$`	For each proposition P, $P \wedge \neg P \equiv \bot$.
Z (Standard normal distribution)	`$Z$`	$Z \sim N(0, 1)$

2 Variables

2.1 Variables for Numbers

Symbols (Explanation)	LaTeX Code	Example
m, n, p, q (Integers and natural numbers)	`$m$`, `$n$`, `$p$`, `$q$`	$m + n - q = 1$

a, b, c (Coefficients for functions and equations)	`$a$, $b$, $c$`	$ax + by = 0$
x, y, z (Unknowns in functions and equations)	`$x$, $y$, $z$`	If $2x + 5 = 3$, then $x = -1$.
Δ (Discriminant)	`$\Delta$`	$\Delta = b^2 - 4ac$ for quadratic polynomials
i, j, k (Index variables)	`$i$, $j$, $k$`	$\sum_{i=1}^{10} i = 55$
t (Time variable)	`$t$`	At $t = 5$, the velocity is $v(5) = 32$.
z (Complex numbers)	`$z$`	$z\bar{z} = \|z\|^2$

2.2 Variables in Geometry

Symbols (Explanation)	LaTeX Code	Example
P, Q, R, S (Vertices)	`$P$, $Q$, $R$, $S$`	$\overline{PQ} \perp \overline{QR}$
ℓ (Lines)	`$\ell$`	$\ell_1 \parallel \ell_2$
α, β, γ, θ (Angles)	`$\alpha$, $\beta$, $\gamma$, $\theta$`	$\alpha + \beta + \theta = 180^\circ$

2.3 Variables in Calculus

Symbols (Explanation)	LaTeX Code	Example

$f(x)$, $g(x,y)$, $h(z)$ (Functions)	`$f(x)$, $g(x,y)$, $h(z)$`	$f(2) = g(3,1) + 5$
a_n, b_n, c_n (Sequences)	`$a_n$, $b_n$, $c_n$`	$a_n = \dfrac{3}{n+2}$
h, Δx (Limiting variables in derivatives)	`$h$, $\Delta x$`	$\lim_{h \to 0} \dfrac{e^h - e^0}{h} = 1$
δ, ε (Small quantities in proofs involving limits)	`$\delta$, $\varepsilon$`	For all $\varepsilon > 0$, there is a $\delta > 0$ such that $\lvert x \rvert < \delta$ implies that $\lvert 2x \rvert < \varepsilon$.
$F(x)$, $G(x)$ (Antiderivatives)	`$F(x)$, $G(x)$`	$F'(x) = f(x)$

2.4 Variables in Linear Algebra

Symbols (Explanation)	LaTeX Code	Example
$\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$ (Vectors)	`$\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$`	$3\mathbf{u} + 4\mathbf{v} = \mathbf{w}$
A, B, C (Matrices)	`$A$, $B$, $C$`	$AX = B$
λ (Eigenvalues)	`$\lambda$`	$A\mathbf{v} = \lambda\mathbf{v}$

2.5 Variables in Set Theory and Logic

Symbols (Explanation)	LaTeX Code	Example
A, B, C (Sets)	`$A$, $B$, $C$`	$A \subseteq B \cup C$

a, b, c (Elements)	`$a$, $b$, $c$`	$a \in A$
P, Q, R (Propositions)	`$P$, $Q$, $R$`	$P \vee \neg P \equiv \top$

2.6 Variables in Probability and Statistics

Symbols (Explanation)	LaTeX Code	Example
X, Y, Z (Random variables)	`$X$, $Y$, $Z$`	$E(X+Y) = E(X) + E(Y)$
μ (Population means)	`$\mu$`	$H_0 : \mu = 5$
σ (Population standard deviations)	`$\sigma$`	$\sigma_1 = \sigma_2$
s (Sample standard deviations)	`$s$`	$s \neq \sigma$
n (Sample sizes)	`$n$`	For $n \geq 30$, use the normal distribution.
ρ (Population correlations)	`$\rho$`	$H_a : \rho < 0$
r (Sample correlations)	`$r$`	If $r = 0.75$, then $r^2 = 0.5625$.
π (Population proportions)	`$\pi$`	$\pi = 0.5$
p (Sample proportions)	`$p$`	$p = \frac{X}{n}$

3 Delimiters

3.1 Common Delimiters

Symbols (Explanation)	LaTeX Code	Example
. (Decimal separator)	`$.$`	25.9703
: (Ratio indicator)	`$:$`	$1:4:9=3:12:27$
, (Object separator)	`$,$`	$(3,5,12)$
(), [], {} (Order-of-operation indicators)	`$()$`, `$[]$`, `$\{ \}$`	$(a+b)\times c$
(), [] (Interval indicators)	`$()$`, `$[]$`	$3\notin(3,4]$, $4\in(3,4]$

3.2 Other Delimiters

Symbols (Explanation)	LaTeX Code	Example
(), [], $\begin{pmatrix} x & y \end{pmatrix}$, $\begin{bmatrix} a \\ b \end{bmatrix}$ (Vector/matrix indicators)	`$()$`, `$[]$`, `$\begin{pmatrix} x & y \end{pmatrix}$`, `$\begin{bmatrix} a \\ b \end{bmatrix}$`	$\begin{pmatrix} 1 & 4 \\ 3 & 6 \end{pmatrix}$
{} (Set builder)	`$\{ \}$`	$\{\pi, e, i\}$
|, : (“Such that” markers)	`$\mid$`, `:$`	$\{x\in\mathbb{R} \mid x^2-2=0\}$

$\|\|, \|\|\|$ (Metric-related operators)	`$\| \|, \\| \\|$`	$\|(3,4)\| = 5$
$\begin{cases} f(x) & x \geq a \\ g(x) & x < a \end{cases}$ (Piecewise-function marker)	`$\begin{cases} f(x) & x \ge a \\ g(x) & x < a \end{cases}$`	$f(x) = \begin{cases} 1 & x \geq 0 \\ 0 & x < 0 \end{cases}$
$\langle\rangle$ (Inner product operator)	`$\langle \rangle$`	$\langle ka, b\rangle = k\langle a, b\rangle$
$\lceil\rceil$ (Ceiling operator)	`$\lceil \rceil$`	$\lceil 2.476 \rceil = 3$
$\lfloor\rfloor$ (Floor operator)	`$\lfloor \rfloor$`	$\lfloor \pi \rfloor = 3$

4 Operators

4.1 Common Operators

Symbols (Explanation)	LaTeX Code	Example
$x + y$ (Sum)	`$x+y$`	$2a + 3a = 5a$
$x - y$ (Difference)	`$x-y$`	$11 - 5 = 6$
$-x$ (Additive inverse)	`$-x$`	$-3 + 3 = 0$
$x \times y$, $x \cdot y$, xy (Product)	`$x \times y$, $x \cdot y$, $xy$`	$(m + 1)n = mn + n$
$x \div y$, x/y (Quotient)	`$x \div y$, $x/y$`	$152 \div 3 = 50.\overline{6}$

$\frac{x}{y}$ (Fraction)	`$\displaystyle \frac{x}{y}$`	$\frac{53+5}{6} = \frac{53}{6} + \frac{5}{6}$
x^y (Power)	`$x^y$`	$3^4 = 81$
$x \pm y$ (Plus and minus)	`$x \pm y$`	$\frac{-b \pm \sqrt{\Delta}}{2a}$
$\sqrt{x}$ (Positive square root)	`$\sqrt{x}$`	$\sqrt{2} \approx 1.414$
$\|x\|$ (Absolute value)	`$\|x\|$`	$\|x-3\| < 5$
$x\%$ (Percent)	`$x \%$`	$x\% \doteq \frac{x}{100}$

4.2 Function-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\operatorname{dom} f$ (Domain)	`$\operatorname{dom} f$`	If $g(x) = \ln x$, then $\operatorname{dom}(g) = \mathbb{R}$.
$\operatorname{ran} f$ (Range)	`$\operatorname{ran} f$`	If $h(y) = \sin y$, then $\operatorname{ran}(h) = [-1.1]$.
$f(x)$ (Image of an element)	`$f(x)$`	$g(5) = g(4) + 3$
$f(X)$ (Image of a set)	`$f(X)$`	$f(A \cap B) \subseteq f(A) \cap f(B)$
$f \circ g$ (Composite function)	`$f \circ g$`	If $g(3) = 5$ and $f(5) = 8$, then $(f \circ g)(3) = 8$.

4.3 Elementary Functions

Symbols (Explanation)	LaTeX Code	Example
$k_n x^n + \cdots + k_0 x^0$ (Polynomial)	`$k_n x^n + \cdots + k_0x^0$`	The polynomial $x^3 + 2x^2 + 3$ has a root in $(-3, -2)$.
e^x, $\exp x$ (Natural exponential function)	`$e^x$, $\exp x$`	$e^{x+y} = e^x \cdot e^y$
b^x (General exponential function)	`$b^x$`	$2^x > x^2$ for large x.
$\ln x$ (Natural logarithmic function)	`$\ln x$`	$\ln(x^2) = 2 \ln x$
$\log x$ (Common logarithmic function)	`$\log x$`	$\log 10000 = 4$
$\log_b x$ (General logarithmic function)	`$\log_b x$`	$\log_2 x = \frac{\ln x}{\ln 2}$
$\sin x$ (Sine function)	`$\sin x$`	$\sin \pi = 0$
$\cos x$ (Cosine function)	`$\cos x$`	$\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$
$\tan x$ (Tangent function)	`$\tan x$`	$\tan x = \frac{\sin x}{\cos x}$

4.4 Algebra-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\gcd(x, y)$ (Greatest common factor)	`$\gcd (x,y)$`	$\gcd(35, 14) = 7$

$\lfloor x \rfloor$ (Floor operator)	`$\lfloor x \rfloor$`	$\lfloor 3.6 \rfloor = 3$
$\lceil x \rceil$ (Ceiling operator)	`$\lceil x \rceil$`	$\lceil \pi \rceil = 4$
$\min(A)$ (Minimum)	`$\min (A)$`	If $\min(A) = 3$, then $\min(A + 5) = 8$.
$\max(A)$ (Maximum)	`$\max (A)$`	$\max(A \cup B) \geq \max(A)$
$x \bmod y$ (Modulo operator)	`$x\bmod y$`	$36 \bmod 5 = 1$
$\displaystyle\sum_{i=m}^{n} a_i$ (Summation)	`$\displaystyle \sum_{i=m}^n a_i$`	$\displaystyle\sum_{i=1}^{5} i^2 = 55$
$\displaystyle\prod_{i=m}^{n} a_i$ (Pi Product)	`$\displaystyle \prod_{i=m}^n a_i$`	$\displaystyle\prod_{i=1}^{n} = n!$
$[a]$ (Equivalence class)	`$[a]$`	$[a] \doteq \{x \mid xRa\}$
$\deg f$ (Degree of polynomial)	`$\deg f$`	$\deg(2x^2 + 3x + 5) = 2$
$\bar{z}$ (Complex conjugate)	`$\bar{z}$`	$\overline{5 - 8i} = 5 + 8i$
$\|z\|$ (Absolute value of complex number)	`$\|z\|$`	$\|e^{\pi i}\| = 1$
$\arg z$ (Arguments of complex number)	`$\arg z$`	$\arg(1 + i) = \frac{\pi}{4} + 2\pi n$

4.5 Geometry-related Operators

Symbols (Explanation)	LaTeX Code	Example

$\angle ABC$ (Angle)	`$\angle ABC$`	$\angle ABC = \angle CBA$
$\measuredangle ABC$, $m\angle ABC$ (Measure of angle)	`$\measuredangle ABC$, $m\angle ABC$`	$\measuredangle ABC = \measuredangle A'B'C'$
$\overleftrightarrow{AB}$ (Infinite line)	`$\overleftrightarrow{AB}$`	$\overleftrightarrow{AB} = \overleftrightarrow{BA}$
$\overline{AB}$ (Line segment)	`$\overline{AB}$`	If $B \neq B'$, then $\overline{AB} \neq \overline{AB'}$.
$\overrightarrow{AB}$ (Ray)	`$\overrightarrow{AB}$`	$\overrightarrow{AB} \cong \overrightarrow{CD}$
$\|AB\|$ (Distance between two points)	`$\|AB\|$`	$\|AB\| < \|A'B'\|$
$\triangle ABC$ (Triangle)	`$\triangle ABC$`	$\triangle ABC \cong \triangle A'B'C'$
$\square ABCD$ (Quadrilateral)	`$\square ABCD$`	$\square ABCD = \square DCBA$

4.6 Logic-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\neg P$ (Negation)	`$\lnot P$`	$\neg(1 = 2)$
$P \land Q$ (Conjunction)	`$P \land Q$`	$P \land Q \equiv Q \land P$
$P \lor Q$ (Disjunction)	`$P \lor Q$`	$\pi^e \in \mathbb{Q} \lor \pi^e \notin \mathbb{Q}$
$P \to Q$ (Conditional)	`$P \to Q$`	$P \to Q \equiv (\neg P \lor Q)$
$P \leftrightarrow Q$ (Biconditional)	`$P \leftrightarrow Q$`	$P \leftrightarrow Q \implies P \to Q$

$\forall x P(x)$ (Universal statement)	`$\forall x P(x)$`	$\forall y \in \mathbb{N}\,(y+1 \in \mathbb{N})$
$\exists x P(x)$ (Existential statement)	`$\exists x P(x)$`	$\exists z\,(z^2 = -\pi)$

4.7 Set-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\overline{A}$, A^c (Complement)	`$\overline{A}$`, `$A^{c}$`	$\overline{\overline{A}} = A$
$A \cap B$ (Intersection)	`$A \cap B$`	$\{2,5\} \cap \{1,3\} = \varnothing$
$A \cup B$ (Union)	`$A \cup B$`	$\mathbb{N} \cup \mathbb{Z} = \mathbb{Z}$
A/B, $A - B$ (Set difference)	`$A/B$`, `$A-B$`	In general, $A - B \neq B - A$.
$A \times B$ (Cartesian product)	`$A \times B$`	$(11, -35) \in \mathbb{N} \times \mathbb{Z}$
$\mathcal{P}(A)$ (Power set)	`$\mathcal{P}(A)$`	$\mathcal{P}(\varnothing) = \{\varnothing\}$
$\lvert A \rvert$ (Cardinality)	`$\lvert A \rvert$`	$\lvert\mathbb{N}\rvert = \aleph_0$

4.8 Vector-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\lVert \mathbf{v} \rVert$ (Norm of vector)	`$\lVert \mathbf{v} \rVert$`	$\lVert(3,4)\rVert = 5$

$\mathbf{u} \cdot \mathbf{v}$ (Dot product)	`$\mathbf{u} \cdot \mathbf{v}$`	$\mathbf{u} \cdot \mathbf{u} = \|\mathbf{u}\|^2$
$\mathbf{u} \times \mathbf{v}$ (Cross product)	`$\mathbf{u} \times \mathbf{v}$`	$\mathbf{u} \times \mathbf{u} = \mathbf{0}$
$\text{proj}_{\mathbf{v}} \mathbf{u}$ (Projection vector)	`$\operatorname{proj}_{\mathbf{v}} \mathbf{u}$`	$\text{proj}_{(0,1)}(5,4) = (0,4)$
$\text{span}(S)$ (Span of vectors)	`$\operatorname{span}(S)$`	$\text{span}(\{\mathbf{i}, \mathbf{j}\}) = \mathbb{R}^2$
$\dim(V)$ (Dimension of vector space)	`$\dim(V)$`	$\dim(\mathbb{R}^3) = 3$

4.9 Matrix-related Operators

Symbols (Explanation)	LaTeX Code	Example
$A + B$ (Matrix sum)	`$A+B$`	$A + X = B$
$A - B$ (Matrix difference)	`$A-B$`	In general, $A - B \neq B - A$.
$-A$ (Additive inverse)	`$-A$`	$B + (-B) = 0$
kA (Scalar product)	`$kA$`	$(-1)A = -A$
AB (Matrix product)	`$AB$`	$AI = IA = A$
A^T (Matrix transpose)	`$A^T$`	$I^T = I$
A^{-1} (Matrix inverse)	`$A^{-1}$`	$(AB)^{-1} = B^{-1}A^{-1}$
$\text{tr}(A)$ (Trace of matrix)	`$\operatorname{tr}(A)$`	$\text{tr}(A^T) = \text{tr}(A)$

$\det(A)$, $\lvert A\rvert$, $\begin{vmatrix} x & y \\ w & z \end{vmatrix}$ (Determinant)	`$\det(A)$, $\|A\|$, $\begin{vmatrix} x & y \\ w & z \end{vmatrix}$`	$\begin{vmatrix} 1 & 4 \\ 3 & 2 \end{vmatrix} = 2 - 12 = -10$

4.10 Probability-related Operators

Symbols (Explanation)	LaTeX Code	Example
$n!$ (Factorial)	`$n!$`	$4! = 4 \cdot 3 \cdot 2 \cdot 1$
nPr (Permutation)	`$nPr$`	$5P3 = 5 \cdot 4 \cdot 3$
nCr, $\binom{n}{r}$ (Combination)	`$nCr$, $\displaystyle \binom{n}{r}$`	$\binom{5}{2} = \binom{5}{3}$
$P(E)$ (Probability of event)	`$P(E)$`	$P(A \cup B \cup C) = 0.\overline{3}$
$P(A\|B)$ (Conditional probability)	`$P(A\|B)$`	$P(A\|B) = \frac{P(A \cap B)}{P(B)}$
$E(X)$ (Expected value of random variable)	`$E(X)$`	$E(X+Y) = E(X) + E(Y)$
$V(X)$ (Variance of random variable)	`$V(X)$`	$V(5X) = 25V(X)$

4.11 Statistics-related Operators

Symbols (Explanation)	LaTeX Code	Example

$\overline{X}$ (Sample mean)	`$\overline{X}$`	$\overline{3X} = 3\overline{X}$
s^2 (Sample variance)	`$s^2$`	$s^2 = \frac{\sum(X - \overline{X})^2}{n-1}$
σ^2 (Population variance)	`$\sigma^2$`	$\sigma^2 = \frac{\sum(X - \mu)^2}{n}$

4.12 Key Probability Functions and Distributions

Symbols (Explanation)	LaTeX Code	Example
$\text{Bin}(n, p)$ (Binomial distribution)	`$\operatorname{Bin}(n, p)$`	If X stands for the number of heads in 10 coin tosses, then $X \sim \text{Bin}(10, 0.5)$.
$\text{Geo}(p)$ (Geometric distribution)	`$\operatorname{Geo}(p)$`	$Y \sim \text{Geo}(1/5)$, then $E(Y) = 5$.
$U(a, b)$ (Continuous uniform distribution)	`$U(a,b)$`	If $X \sim U(3, 7)$, then $V(X) = \frac{(7-3)^2}{12}$.
$N(\mu, \sigma^2)$ (Normal distribution)	`$N(\mu, \sigma^2)$`	If $X \sim N(3, 5^2)$, then $\frac{X-3}{5} \sim Z$.
z_α (Critical z-score)	`$z_{\alpha}$`	$z_{0.05} \approx 1.645$
$t_{\alpha,\nu}$ (Critical t-score)	`$t_{\alpha, \nu}$`	$t_{0.05,1000} \approx z_{0.05}$
$\chi^2_{\alpha,\nu}$ (Critical Chi-squared-score)	`$\chi^2_{\alpha, \nu}$`	$\chi^2_{0.05,30} \approx 43.77$

F_{α,ν_1,ν_2} (Critical F-score)	`$F_{\alpha, \nu_1, \nu_2}$`	$F_{0.05,20,20} \approx 2.1242$

4.13 Calculus-related Operators

Symbols (Explanation)	LaTeX Code	Example
$\lim_{n\to\infty} a_n$ (Limit of sequence)	`$\displaystyle \lim_{n \to \infty} a_n$`	$\lim_{n\to\infty} \frac{n+3}{2n} = \frac{1}{2}$
$\lim_{x\to c} f(x)$ (Limit of function)	`$\displaystyle \lim_{x \to c} f(x)$`	$\lim_{x\to 3} \frac{\pi \sin x}{2} = \frac{\pi}{2} \lim_{x\to 3} \sin x$
$\sup(A)$ (Supremum)	`$\sup(A)$`	$\sup(\,[-3, 5)\,) = 5$
$\inf(A)$ (Infimum)	`$\inf(A)$`	If $B = \left\{\frac{1}{1}, \frac{1}{2}, \ldots\right\}$, then $\inf(B) = 0$.
f', f'', f''', $f^{(n)}$ (Derivative)	`$f'$, $f''$, $f'''$, $f^{(n)}$`	$(\sin x)''' = -\cos x$
$\int_a^b f(x)\,\mathrm{d}x$ (Definite integral)	`$\displaystyle \int_a^b f(x)\,\mathrm{d}x$`	$\int_0^1 \frac{1}{1+x^2} = \frac{\pi}{4}$
$\int f(x)\,\mathrm{d}x$ (Indefinite integral)	`$\displaystyle \int f(x)\,\mathrm{d}x$`	$\int \ln x\,\mathrm{d}x = x\ln x - x$
f_x (Partial derivative)	`$f_x$`	If $f(x,y) = x^2y^3$, then $f_x(x,y) = 2xy^3$.

5 Relational Symbols

5.1 Equality-based Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$x = y$ (Equal)	`$x = y$`	$3x - x = 2x$
$x \neq y$ (Non-equal)	`$x \ne y$`	$2 \neq 3$
$x \approx y$ (Approximately equal)	`$x \approx y$`	$\pi \approx 3.1416$
$x \sim y$, xRy (Related to)	`$x \sim y$`, `$xRy$`	xRy if and only if $\|x\| = \|y\|$
$x \equiv y$ (Equivalent to)	`$x \equiv y$`	$2 \equiv 101$ in mod 33
$f(x) \propto g(x)$ (Proportional to)	`$f(x) \propto g(x)$`	$V \propto r^3$

5.2 Comparison-based Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$x < y$ (Less than)	`$x < y$`	$\sin x < 3$
$x > y$ (Greater than)	`$x > y$`	$\pi > e$
$x \leq y$ (Less than or equal to)	`$x \le y$`	$n! \leq n^n$

$x \geq y$ (Greater than or equal to)	`$x \ge y$`	$x^2 \geq 0$

5.3 Number-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$m \mid n$ (Divisibility)	`$m \mid n$`	$101 \mid 1111$
$m \perp n$ (Coprime integers)	`$m \perp n$`	$31 \perp 97$

5.4 Geometry-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$\ell_1 \parallel \ell_2$ (Parallel)	`$\ell_1 \parallel \ell_2$`	$\overline{PQ} \parallel \overline{RS}$
$\ell_1 \perp \ell_2$ (Perpendicular)	`$\ell_1 \perp \ell_2$`	$\overrightarrow{AB} \perp \overrightarrow{BC}$
$F \sim F'$ (Similar figures)	`$F \sim F'$`	$\triangle ABC \sim \triangle DEF$
$F \cong F'$ (Congruent figures)	`$F \cong F'$`	$\square ABCD \cong \square PQRS$

5.5 Set-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example

$a \in A$ (Member of)	`$a \in A$`	$\frac{2}{3} \in \mathbb{R}$
$a \notin A$ (Not a member of)	`$a \notin A$`	$\pi \notin \mathbb{Q}$
$A \subseteq B$ (Subset of)	`$A \subseteq B$`	$A \cap B \subseteq A$
$A = B$ (Equal Sets)	`$A = B$`	If $A = B$, then $A \subseteq B$.

5.6 Logic-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$P \implies Q$ (Implies)	`$P \implies Q$`	x is even $\implies$ 2 divides x
$P \impliedby Q$ (Implied by)	`$P \impliedby Q$`	$x = 3 \impliedby 3x + 2 = 11$
$P \iff Q$, $P \equiv Q$ (If and only if)	`$P \iff Q$`, `$P \equiv Q$`	$x \neq y \iff (x - y)^2 > 0$
$P \therefore Q$ (Therefore)	`$P \therefore Q$`	$i \in \mathbb{C} \therefore \exists z \, (z \in \mathbb{C})$
$P \because Q$ (Because)	`$P \because Q$`	$x = \frac{\pi}{2} \because$ $\sin x = 1$ and $\cos x = 0$

5.7 Probability-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$A \perp B$ (Independent events)	`$A \perp B$`	If $A \perp B$, then $P(A \cap B) = P(A) \cap P(B)$.

$X \sim F$ (X follows distribution F)	`$X \sim F$`	$Y \sim \text{Bin}(30, 0.4)$

5.8 Calculus-related Relational Symbols

Symbols (Explanation)	LaTeX Code	Example
$f(x) \sim g(x)$ (Asymptotically equal)	`$f(x) \sim g(x)$`	$\pi(x) \sim \frac{x}{\ln x}$
$f(x) \in O(g(x))$ (In the big-O of)	`$f(x) \in O(g(x))$`	$2x^2 + 3x + 3 \in O(x^2)$

6 Notational Symbols

6.1 Common Notational Symbols

Symbols (Explanation)	LaTeX Code	Example
$\ldots$, $\cdots$ (Horizontal ellipsis)	`$\ldots$, $\cdots$`	$1^2 + 2^2 + \cdots + n^2$
$\vdots$, $\ddots$ (Vertical ellipsis)	`$\vdots$, $\ddots$`	$\begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{pmatrix}$
$f : A \to B$, $A \xrightarrow{f} B$ (Function's domain/codomain specifier)	`$f : A \to B$, $A \overset{f}{\to} B$`	A function $g : \mathbb{N} \to \mathbb{R}$ can be thought of as a sequence.

$x \mapsto f(x)$ (Function mapping rule)	`$x \mapsto f(x)$`	The function $x \mapsto x^2$ is increasing in the interval $[0, \infty)$.
$Q.E.D.$, ■, □ (End-of-the-proof symbols)	`$Q. E. D.$`, `$\blacksquare$`, `$\square$`	Thus the result is established as desired. ■
$Q.E.A.$, $\bot$ (Contradiction symbols)	`$Q. E. A.$`, `$\bot$`	Multiplying both sides of the equation yields that $1 = 2$. $\bot$

6.2 Notational Symbols in Geometry and Trigonometry

Symbols (Explanation)	LaTeX Code	Example
$^\circ$ (Degree)	`$^{\circ}$`	$\cos(90^\circ) = 0$
$'$ (Arcminute)	`$'$`	$35' = \left(\frac{35}{60}\right)^\circ$
$''$ (Arcsecond)	`$''$`	$20'' = \left(\frac{20}{60}\right)'$
rad (Radian)	`$\mathrm{rad}$`	$\pi\,\mathrm{rad} = 180^\circ$
grad (Gradian)	`$\mathrm{grad}$`	$100\,\mathrm{grad} = 90^\circ$

6.3 Notational Symbols in Calculus

Symbols (Explanation)	LaTeX Code	Example
$+\infty$ (Positive infinity)	`$+\infty$`	$\frac{n^2+1}{n} \to +\infty$

$-\infty$ (Negative infinity)	`$-\infty$`	$\lim_{x \to -\infty} e^x = 0$
Δx (Change in variable)	`$\Delta x$`	$m = \dfrac{\Delta y}{\Delta x}$
$\mathrm{d}x$ (Differential)	`$\mathrm{d} x$`	$\mathrm{d}y = f'(x)\,\mathrm{d}x$
∂x (Partial differential)	`$\partial x$`	$\dfrac{\partial f}{\partial x}\,\mathrm{d}x$
$\mathrm{d}f$ (Total differential)	`$\mathrm{d} f$`	$\mathrm{d}g(x,y) = \dfrac{\partial g}{\partial x}\,\mathrm{d}x + \dfrac{\partial g}{\partial y}\,\mathrm{d}y$

6.4 Notational Symbols in Probability and Statistics

Symbols (Explanation)	LaTeX Code	Example
i.i.d. (Independent and identically distributed)	`i.i.d.`	Given n i.i.d. random variables $X_1, \ldots, X_n$, $V(X_1 + \cdots + X_n) = V(X_1) + \cdots + V(X_n)$.
H_0 (Null hypothesis)	`$H_0$`	$H_0 : \mu = 23$
H_a (Alternative hypothesis)	`$H_a$`	$H_a : \sigma_1^2 \neq \sigma_2^2$

7 Additional Resources

- **Ultimate LaTeX Reference Guide**: A definitive reference guide on the LaTeX language, with the commands, environments and

packages most LaTeX users will ever need

- **Definitive Guide to Learning Higher Mathematics**: A standalone 10-principle framework for tackling higher mathematical learning, thinking and problem solving
- **10 Commandments of Higher Mathematical Learning**: An illustrated web guide on 10 scalable rules for learning higher mathematics
- **Definitive Glossary of Higher Mathematical Jargon**: A tour around higher mathematics in 100 terms

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