

Mr. G's Handbook of Mathematics

Mathematical Symbols and Definitions

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Symbol	Description
$\in$	<i>is an element of</i>
$\notin$	<i>is not an element of</i>
$\{x_1, x_2, \dots\}$	<i>the set with elements $x_1, x_2, \dots$</i>
$\{x : \dots\}$	<i>the set of all x such that ...</i>
$\{x \mid \dots\}$	<i>the set of all x such that ...</i>
$n(A)$	<i>the number of elements in set A</i>
$\emptyset$	<i>the empty set</i>
U or ξ	<i>the universal set</i>
A'	<i>the complement of set A</i>
N	<i>set of natural numbers, $\{0, 1, 2, 3, \dots\}$</i>
Z	<i>set of integers, $\{0, \pm 1, \pm 2, \pm 3, \dots\}$</i>
$\mathbf{Z}^+$	<i>set of positive integers, $\{1, 2, 3, \dots\}$</i>
$\mathbf{Z}_n$	<i>set of integers modulo n, $\{1, 2, 3, \dots, n-1\}$</i>
Q	<i>set of rational numbers $\{p/q : p \in \mathbf{Z}, q \in \mathbf{Z}^+\}$</i>
$\mathbf{Q}^+$	<i>set of positive rational numbers, $\{x \in \mathbf{Q} : x > 0\}$</i>
$\mathbf{Q}_0^+$	<i>set of +ve rational numbers and zero, $\{x \in \mathbf{Q} : x \geq 0\}$</i>
$\mathbf{R} \equiv \mathbf{R}_0$	<i>set of real numbers (and note 0 is a real number)</i>
$\mathbf{R}^+$	<i>set of positive real numbers, $\{x \in \mathbf{R} : x > 0\}$</i>
C	<i>set of complex numbers</i>
(x, y)	<i>the ordered pair x, y</i>
$A(x, y)$	<i>the point A in the plane with Cartesian coordinates x and y</i>
$[AB]$	<i>the line segment with end points A and B</i>
AB	<i>the length of $[AB]$</i>
(AB)	<i>the line containing points A and B</i>
$\hat{CAB}$	<i>the angle between $[CA]$ and $[AB]$</i>
$\triangle CAB$	<i>the triangle whose vertices are A, B and C</i>
$A \times B$	<i>the cartesian product of sets A cross $B = \{(a,b) : a \in A, b \in B\}$</i>
$\subseteq$	<i>is a subset of</i>
$\subset$	<i>is a proper subset of</i>

$\cup$	union
$\cap$	intersection
$P(A)$	the probability of event A
$P(A)'$	the probability of event "not A "
$P(A B)$	the probability of event A given B
$x_1, x_2, \dots$	observations of a variable
$f_1, f_2, \dots$	frequencies with which the observations $x_1, x_2, x_3 \dots$ occur
$\bar{x}$	sample mean
μ	population mean
s_n	standard deviation of the sample
σ	standard deviation of the population
r	Pearson's product-moment correlation coefficient
χ^2	chi-squared
$[a, b]$	the closed interval, $\{x \in \mathbb{R} : a \leq x \leq b\}$
$[a, b)$	the interval $\{x \in \mathbb{R} : a \leq x < b\}$
$(a, b]$	the interval $\{x \in \mathbb{R} : a < x \leq b\}$
(a, b)	the open interval $\{x \in \mathbb{R} : a < x < b\}$
$]a, b[$	the open interval $\{x \in \mathbb{R} : a < x < b\}$
u_n	the n^{th} term of a sequence or series
d	the common difference of an arithmetic sequence
r	the common ratio of a geometric sequence
S_n	the sum of the first n terms of a sequence $u_1 + u_2 + \dots + u_n$
$x \mapsto$	maps to eg $x \mapsto x + 1$ ($\mapsto$ called a maplet)
$y R x$	y is related to x by the relation R
$y \sim x$	y is equivalent to x , in the context of some equivalence relation
$\neq$	is not equal to
$\equiv$	is identical to <u>or</u> is congruent (equivalent) to
$\sim$	is approximately equal to (preferable to $\approx$ or $\nearrow$)
$\cong$	is isomorphic to (there exists a one-to-one mapping)
$\propto$	is proportional to

$< / >$	is less than / is greater than
$\leq$	is less than or equal to, is not greater than
$\geq$	is greater than or equal to, is not less than
$\square$	is not less than
$\square$	is not greater than
∞	infinity
$p \wedge q$	p AND q (conjunction)
$p \vee q$	p OR q (or both) (disjunction)
$p \underline{\vee} q$	p XOR q (not both) (exclusive disjunction)
$\neg p$	NOT p (preferable to $\sim p$ or p')
$\Rightarrow / \Leftarrow$	p implies q (if p then q) / p is implied by q (if q then p)
$\Leftrightarrow$	p implies and is implied by q (p is equivalent to q)
$\exists$	there exists
$\forall$	for all
$\sum a_i$	$a_1 + a_2 + \dots + a_n$
$\prod a_i$	$a_1 \times a_2 \times \dots \times a_n$
$\sqrt[n]{a}$	a to the power of $1/n$, n^{th} root of a
$\sqrt{a}$	the positive square root of a
$ a $	the modulus of a
$n!$	n factorial
$\binom{n}{r}$	the binomial coefficient
$f(x)$	the value of the function f at x / image of x under function f
$f: A \rightarrow B$	f is a function under which each element set A has image in set B
$f: x \alpha y$	the function f maps the element x to the element y
f^{-1}	the inverse function of the function f
$g \circ f, gf$	composite function f and g defined by $(g \circ f)(x)$ or $gf(x)=g(f(x))$
$\lim_{x \rightarrow a} f(x)$	the limit of $f(x)$ as x tends to a
$\Delta x, \delta x$	an increment of x
$\frac{dy}{dx}$	the derivative of y with respect to x

$d^n y/dx^n$	the n^{th} derivative of y with respect to x
$f'(x), f''(x), \dots f^{(n)}(x)$	first, second ... n^{th} derivatives of $f(x)$ with respect to x
$\int y \, dx$	the indefinite integral of y with respect to x
$\int_a^b y \, dx$	the definite integral of y with respect to x
$\partial V / \partial x$	the partial derivative of V with respect to x
e	base of natural logarithms ($e \cong 2.71828\dots$)
$e^x, \exp x$	exponential function of x
$\log x$	logarithm to the base 10 of x
$\log_a x$	logarithm to the base a of x
$\ln x$	natural logarithm of x (preferable to $\log_e x$)
$\sin, \cos, \tan, \operatorname{cosec}, \sec, \cot$	the circular functions
$\sin^{-1}, \cos^{-1}, \tan^{-1}$ etc.	inverse circular functions
$\sinh, \cosh, \tanh$ etc.	the hyperbolic functions
$\sinh^{-1}, \cosh^{-1}, \tanh^{-1}$ etc.	inverse hyperbolic functions
z	a complex number, $z = x + iy$
$\mathcal{R}(z)$	the real part of z , $\mathcal{R}(z) = x$
$\mathcal{I}(z)$	the imaginary part of z , $\mathcal{I}(z) = y$
$ z $	$\sqrt{a^2 + b^2}$ termed r the modulus or absolute value
$\arg z$	the argument of z , $\arg z = \tan^{-1} y/x$
M	a matrix M
M^{-1}	the inverse of the matrix M
M^T	the transpose of the matrix M
$\det M, M $	the determinant of the square matrix M
$\underline{a}$	vector $\underline{a}$
$\hat{a}$	a unit vector in the direction of $\underline{a}$
$\underline{i}, \underline{j}, \underline{k}$	unit vectors in direction of the cartesian coordinate axes
$ \underline{a} , a$	the magnitude of $\underline{a}$
$\underline{a} \cdot \underline{b}$	the scalar product of $\underline{a}$ & $\underline{b}$ viz. $\sum_{i=1}^n a_i b_i = a_1 b_1 + a_2 b_2 + \dots$
$\underline{a} \times \underline{b}$	the vector product of $\underline{a}$ & $\underline{b}$ viz. $ \underline{a} \underline{b} \sin \theta$

Greek Alphabet				Principle/Simplest Use	English	Type
alpha	A	not used	α	first root of quadratic	a	a
beta	B	Beta function	β	second root of quadratic	b	b
gamma	Γ	Gamma function	γ	Euler's constant	g	g
delta	Δ	Difference operator	δ	small increment	d	d
epsilon	E	not used	ε	error	short e	e
zeta	Z	not used	ζ	Riemann zeta function	z	z
eta	H	not used	η	efficiency	long e	h
theta	Θ	asympt. tight bound	θ	angle	th	q
iota	I	not used	ι	imaginary unit	i	i
kappa	K	not used	κ	curvature	k	k
lambda	Λ	diag. matrix eigen-values	λ	failure rate	l	l
mu	M	not used	μ	population mean	m	m
nu	N	not used	ν	poisson ratio	n	n
xi	Ξ	grand canonical ensemble	ξ	damping coefficient	x	x
omicron	O	limiting behaviour function	$\circ$	generally not used	short o	o
pi	Π	Product operator	π	ratio $\frac{C}{d}$ / circle	p	p
rho	P	not used	ρ	correlation coefficient	r	r
sigma	Σ	summation	σ	standard deviation	s	s
tau	T	not used	τ	mean lifetime	t	t
upsilon	Y	Bessel function	υ	generally not used	u	u
phi	Φ	cumulative function	ϕ	golden ratio	ph	f
phi (alt.)	ϑ	not used	φ	normal function scalar potential	ph	j
chi	X	probability function	χ^2	chi-squared prob.function	ch	c
psi	Ψ	not used	ψ	wave function	ps	y
omega	Ω	mathematical constant	ω	angular frequency	long o	w
stigma	ς					v
pomega			ϖ	angular velocity		v

Counting

No.	Greek	Latin
1	mono	uni
2	duo	bi
3	tri	tri
4	tetra	quad
5	penta	quin
6	hexa	sex
7	hepta	sept
8	octo	oct
9	nona	non
10	deca	dec

The "Handbook of Mathematics" has been written and produced by Robert Goodhand

Although the formulae and expressions given have been individually derived and checked errors do creep in. Sections of the Handbook are continuously updated.

If you would like the latest issue, just email me at robert.goodhand@gmail.com