

APPENDIX

GREEK ALPHABET

Letter	Name	Pronoun.	Letter	Name	Pronoun.
A α	Alpha	['ælfə]	N ν	Nu	['nju:], US ['nu:]
B β	Beta	['bi:tə], US ['beɪtə]	Ξ ξ	Xi	['zaɪ], ['ksaɪ]
Γ γ	Gamma	['gæmə]	Ο ο	Omicron	['oʊmaɪkrən], ['omikrən]
Δ δ	Delta	['deltə]	Π π	Pi	['paɪ]
E ε	Epsilon	['ɛpsɪlən], UK also [ɛp'saɪlən]	Ρ ρ	Rho	['rou]
Z ζ	Zeta	['zi:tə], US ['zeɪtə]	Σ ζ	Sigma	['sɪgmə]
H η	Eta	['i:tə], US ['eɪtə]	Τ τ	Tau	['taʊ], ['tə:]
Θ θ	Theta	['θi:tə], US ['θeɪtə]	Υ υ	Upsilon	[ju:p'saɪlən], ['upsɪlən], US ['ʌpsɪlən]
Ι ι	Iota	[aɪ'outə]	Φ φ	Phi	['faɪ]
K κ	Kappa	['kæpə]	Χ χ	Chi	['kaɪ]
Λ λ	Lambda	['læmdə]	Ψ ψ	Psi	['saɪ], ['psaɪ]
M μ	Mu	['mju:]	Ω ω	Omega	['oʊmɪgə], US [ou'meɪgə]

SOME COMMON ABBREVIATIONS AND PHRASES

- **i.e.** (id est) means “that is” or “in other words”. (It is used to paraphrase a statement that was just made)
- **e.g.** (exempli gratia) means “for example”. (It is usually used to give an example of a statement that was just made)
- **viz.** (videlicet) means “namely” or “more specifically”. (It is used to clarify a statement that was just made by providing more information and is never followed by a comma.)
- **etc.** (et cetera) means “and so forth” or “and so on”. (It is used to suggest that the reader should infer further examples from a list has been started and is usually not followed by a comma.)
- **abbr.** means abbreviate; abbreviation

MATHEMATICAL ABBREVIATIONS

Abbreviated names of mathematical functions, function-like operators and other mathematical terminology can also be met in mathematical texts. The capitalization of some of these abbreviations is not standardized – different authors use different capitalizations. Some examples follow.

- Fig. – figure
- Tab. – table
- a.e. – almost everywhere
- a.s. – almost surely
- Card – cardinality of a set
- dom – domain of a function
- gcd – greatest common divisor of two numbers
- alt – altitude
- iff – if and only if
- lcm – lowest common multiple of two numbers
- LHS – left-hand side of an equation
- RHS – right-hand side of an equation
- Eq.(pl. Eqs) – equation
- pf – proof
- f. (pl. ff) – function
- resp – respectively

- RTP – required to prove
- lim – limit of a sequence, or of a function
- RTP – required to proof
- p.a /pa/per an. (per annum) – yearly
- mx – matrix
- log – logarithm
- WTP – want to prove

TABLE OF COMMON SIGNS AND SYMBOLS

FUNDAMENTAL SYMBOLS			
Sign	Name	Example	Reading
+	addition	$2 + 7$	two plus seven
–	subtraction	$a - b$	a minus b
$\cdot$ $\times$	multiplication	$a \times b$	a (multiplied (by)) b , or: a times b
$:$ $\div$ $/$	division	$82 : 2$	eighty-two divided by two
$\pm$	plus-minus	$1\,000 \pm 5$	one thousand plus-minus five
=	equality	$p = q$	p is equal to q or: p equals q
$\neq$	inequality	$a \neq b$	a is not equal to b or: a does not equal q
$\equiv$	identity, congruence	$f(x) \equiv 0$	f of x is identical with zero or: f of x is always equal to zero
<	inequality	$a < 6$	a is less than six
>	inequality	$a > 11$	a is greater than eleven
$\leq$	inequality	$x \leq 1$	x is less than or equal to one
$\geq$	inequality	$x \geq 0$	x is greater than or equal to zero
$\approx$	approximately equal	$c \approx 3$	c is approximately equal to three
()	parentheses	$(a - b)$	a minus b in parentheses
[]	(square) brackets	$[a + c]$	a plus c in brackets
{ }	braces	$\{a + x\}$	a plus x in braces
	absolute value	$ a $	absolute value of a
[]	hybrid brackets		
1. 2. 3. 37. ...	ellipsis	1, 2, 3, ..., 25 1, 2, 3, ...	firstly or: in the first place secondly or: in the second place thirdly or: in the third place in the thirty-seventh place one, two, three, and so on to twenty-five one, two, three, and so on to infinity
∞	infinity		
x_1, x_2	subscript		x one, x sub one; x two, x sub two
a'			a prime, a dash, a dashed,
a''			a second prime, a two dash, a double dash, a double prime
$\sim$	tilde	$\tilde{a}/\sim p$	a tilde /not p
–	bar	$\bar{x}$	x bar/ x overbar
!	factorial	$n!$	n factorial
Σ	summation	$\sum_{i=1}^n a_i$	the sum/summation from i equals 1 to n of a_i ; the sum as i runs from 1 to n of the a_i
	absolute value		
$\binom{n}{m}$	combinatorial number		n choose m
%	percent / per cent	20 %	twenty percent (per cent)

$\mathbb{R}$ or $\mathbb{R}$	real numbers $(-\infty, +\infty)$	
$\mathbb{R}^+$	positive real numbers $(0, +\infty)$	
$\mathbb{C}$ or $\mathbb{C}$	complex numbers $\{x + iy : x, y \in \mathbb{R}\}$	(i is the imaginary unit, $i^2 = -1$)

MATHEMATICAL LOGIC			
Sign	Name	Example	Reading
$\therefore$	three dots		therefore
$\because$			because / since
$\Rightarrow$	implication, if - then	$X \Rightarrow Y$	X implies Y X follows from Y
$\Leftrightarrow$	biimplication, if-and only if	$X \Leftrightarrow Y$	if X holds then Y also holds X is equivalent to Y X holds if and only if Y holds
$\exists$	the existential quantifier	$\exists n \in \mathbb{N}, n \geq 7$	there exists
$\forall$	the universal quantifier	$\forall n \in \mathbb{N}, n \geq 0$	for all
$\wedge$	logical conjunction - and	$X \wedge Y$	X and Y (conjunction of statements X and Y)
$\vee$	logical (inclusive) disjunction – or	$X \vee Y$	X or Y (alternative of statements X and Y)
$\neg$	negation, not		

GEOMETRY			
Sign	Name	Example	Reading
$\angle$	angle symbol	$\angle ABC$ is 45°	The angle formed by ABC is 45 degrees.
Δ	triangle	ΔABC has 3 equal sides	Triangle ABC has three equal sides
$\perp$	right angle	$\alpha = 90^\circ$	
$\perp$	perpendicular	$AB \perp CD$	The line AB is perpendicular to line CD
$\parallel$	parallel lines	$EF \parallel GH$	The line EF is parallel to line GH
$\overleftrightarrow{AB}$	line "AB"		infinite line
$\overrightarrow{AB}$	ray "AB"		line that start from point A
$\overline{AB}$	line segment		line from point A to point B
$\cong$	congruent	$\Delta ABC \cong \Delta DEF$	Triangle ABC is congruent to triangle DEF
$\sim$	similarity	$\Delta ABC \sim \Delta XYZ$	Triangle ABC is similar to triangle XYZ

CALCULUS			
Expression	Reading	Expression	Reading
(a, b)	open interval $a b$	e^x	e to the x / the exponential function
$[a, b]$	closed interval $a b$	$\ln x$	natural logarithm of x
$(a, b]$	half-open interval $a b$, open on the left and closed on the right	$\log_a x$	log base a of x / log x base a
$\sin x$	sine x / sine of x	$\cos x$	cosine x / cosine of x
$\tan x$	tangent x / tangent of x	$\cot x$	cotangent x / cotangent of x
$\arcsin x$	inverse sine of x ; arc sine of x	D_f	the definition domain of (the function) f

R_f	the range of (the function) f	$f : S \rightarrow T$	function f from S to T
$f(A) ; f(X)$	the image of A ; the image of the domain	$f : x \mapsto y$	f maps x to y
$f(x)$	$f x$ / f of x / the function f of x	f'	f prime / f dash / the derivative of f
$f'(x)$	f prime (of) x / f dash (of) x / the derivative of f with respect to x / the first derivative of f with respect to x	f''	f double-prime / f double-dash / the second derivative of f
$f^{(n)}(x)$	f n (of) x / the n th derivative of f with respect to x	$\frac{df}{dx}$	$d f d x$
$\lim_{x \rightarrow c} f(x)$	limit as x tends to c of $f x$ / limit as x approaches c of $f x$	$\frac{\partial f}{\partial x_1}$	the (first) partial derivative of f with respect to x_1
$\lim_{x \rightarrow \infty} f(x)$	limit as x tends to infinity of $f x$ / limit as x goes to infinity of $f x$	$\int_a^b f(x) dx$	the definite integral of $f x d x$ from a to b
$\int f(x) dx$	the indefinite integral of $f x d x$ / the antiderivative of $f x$		

MATRICES AND DETERMINANTS	
Expression	Reading
$A_{m,n}$	m by n matrix
A^T	the transpose of a matrix A
$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$	a two-by-two matrix, the first row is a,b , the second is c,d
$A = \begin{pmatrix} a & b & c \\ d & e & f \end{pmatrix}$	two-by-three matrix
$A = \begin{pmatrix} 1 & 4 & 100 \\ 0 & 3 & 4 \\ 0 & 0 & 1 \end{pmatrix}$	upper-triangular three-by-three matrix
$A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 8 & 0 \\ 4 & 9 & 7 \end{pmatrix}$	lower-triangular three-by-three matrix
$ A = 1$	the determinant of A equals 1

<http://www.statisticshowto.com/how-to-read-symbols-and-equations-in-calculus/>

http://www.rapidtables.com/math/symbols/Geometry_Symbols.htm

<http://byjus.com/maths/math-symbols/>

<http://www.batmath.it/eng/say/say3.htm>