Mathematical Symbols and Abbreviations

mccp-matthews-symbols-001

This leaflet provides information on symbols and notation commonly used in mathematics. It is designed to enable further information to be found from resources in **math**centre (www.mathcentre.ac.uk). In the table below, the symbol or notation is given in column one. It is not always obvious how the combination of characters used in mathematical notation is said, so where appropriate this information is given in column two. Column three explains the use of the symbol and an example may be given for further explanation in column four. The last column contains a phrase to be entered as a search topic in **math**centre if further details are required.

Care should be taken as context is important. Identical mathematical symbols and notation are used in different circumstances to convey very different ideas.

Symbol	Say	Means	Example	mathcentre Search Topic
$\sum$	sigma	Represents summation		"Sigma notation"
$\|\|$	Parallel	In the same direction as		"The gradient of a straight line segment"
$\|\|$ (vertical lines, either side of a number or variable)	Modulus, absolute value	The size of a number, ignoring the sign	$\|3\|= 3$, $\|-3\|= 3$	Modulus
$\|A\|$	Determinant of matrix A	Determinant of matrix A		Determinants
det (A)	Determinant of matrix A	Determinant of matrix A		Determinants

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Mathematical Symbols and Abbreviations (continued)

Symbol	Say	Means	Example	mathcentre Search Topic
()	brackets	Used in many different contexts e.g. to show multiplication, to define points, to define functions		"Expanding or removing brackets", "Removing brackets"
%	Percent, Percentage	Represents a fraction with the denominator of 100	$\frac{25}{100} = 25\ \%$	Percentages
$\pm$	Plus or minus, positive or negative	Represents two numbers, one positive and one negative	± 5 indicates $+5$ and -5	"Mathematical language"
$\pm$	Plus or minus, positive or negative	Used to indicate a range	10 ± 2 indicates the range starting from $10 - 2$ to $10 + 2$ i.e. $8, 9, 10, 11, 12$	"Mathematical language"
π	pi	Represents the ratio of the circumference of a circle to its diameter. $\pi = \frac{\text{circumference}}{\text{diameter}}$	π is equal to $3.14159....$	"Substitution & Formulae"
e		The exponential constant	e is approximately equal to 2.718	"The exponential constant e"
∞	Infinity	Used to represent infinity		

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Mathematical Symbols and Abbreviations (continued)

Symbol	Say	Means	Example	mathcentre Search Topic
x		Commonly used as a variable		
θ	theta	Commonly used as a variable to indicate an angle		See Greek alphabet in "Mathematical language" "Facts & Formulae Leaflet"
(x, y)	Point xy	A point with co-ordinates x and y		"x-y plots"
P(x, y)	Point xy labeled P	A point P with co-ordinates x and y		"x-y plots"
m		Gradient or slope of a curve		"Equation of a straight line"
c		y-axis intercept or a constant of unknown value e.g. the constant of integration		"Equation of a straight line" "Integration as the reverse of differentiation"
$\dot{}$ (dot above a digit)	Recurring	Indicates a digit continues to recur	$0.\dot{3} = 0.3333...$	Decimals
$\dot{x}$ (dot above variable x)	x dot	Differentiate function x with respect to t (time)		
Superscript	To the power of	A digit or letter placed above and slightly to the right of another digit or letter. Used to indicate multiplications of the same number	$2^3 = 2 \times 2 \times 2$	"Mathematical language", "Indices or powers"
Subscript		A digit or letter placed below and slightly to the right of a letter. Used to distinguish between variables	$x_1, x_2, x_3, ..., x_m, x_n$	"Mathematical language"

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Mathematical Symbols and Abbreviations (continued)

Symbol	Say	Means	Example	mathcentre Search Topic
$\propto$	Proportional to	Proportional to	$y \propto x$ means $y = \mathrm{k}x$ where k is a constant	
$<$	Less than	Value on the left is less than value on the right		Inequalities
$\leq$	Less than or equal to	Value on the left is less than or equal to value on the right		Inequalities
$>$	Greater than	Value on the left is greater than value on the right		Inequalities
$\geq$	Greater than or equal to	Value on the left is greater than or equal to value on the right		Inequalities
$=$	Equal to	Equal to		
$\neq$	Not equal to	Not equal to		Mathematical language
$\approx$	Approximately equal to	Approximately equal to		Mathematical language
$\equiv$	Equivalent to	Equivalent for all values	$2x + x \equiv 3x$, equivalent for all values of x	
$\Rightarrow$	Implies	Calculations on left of symbol imply those on the right		
$\Leftrightarrow$	Implies	Calculations on either side of symbol imply those on the other		

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Mathematical Symbols and Abbreviations (continued)

Symbol	Say	Means	Example	mathcentre Search Topic
$\therefore$	Therefore	Therefore		
$\perp$	right angle to, perpendicular to	At 90° to, perpendicular to, normal to		"The gradient of a straight line segment"
!	Factorial	Used to indicate the multiplication of consecutive whole numbers	$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$	Factorials
$\log$, $\log_b x$	Log to the base b of x	Logarithm	$\log_2 8 = 3$	Logarithms
$\ln$	lin	Natural logarithm defined as $\log_e$ i.e. logarithm to the base e		Logarithms
δ	delta	Represents a small change	δx is a small change in the variable x	"Differentiation from first principles"
Δ	delta	Represents a small change	Δx is a small change in the variable x	
$f(x)$	f of x	function f of variable x		"What is a function?"
$f^{-1}(x)$	f to the minus 1 of x	Inverse of function $f(x)$		"Inverse functions"

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Mathematical Symbols and Abbreviations (continued)

Symbol	Say	Means	Example	mathcentre Search Topic
$\frac{dy}{dx}$	dee y dee x	Differentiate function y with respect to x		"Differentiation from first principles"
$\frac{d^2y}{dx^2}$	dee 2 y dee x squared	Double differentiate function y with respect to x, second derivative of function y		
$f'(x)$	f dash of x	Differentiate function $f(x)$ with respect to x, equivalent to $\frac{dy}{dx}$ if $y = f(x)$		"Differentiation from first principles"
y'	y dash	Differentiate function y, equivalent to $\frac{dy}{dx}$ if $y = f(x)$		"Differentiation from first principles"
$f''(x)$	f double dash of x	Differentiate function $f(x)$ with respect to x twice, Second derivative of function $f(x)$		
$f'''(x)$	f triple dash of x	Differentiate function $f(x)$ with respect to x three times, Third derivative of function $f(x)$		
$\int f(x)dx$	Integrate f of x dee x	Find the indefinite integral of function $f(x)$ with respect to x		"Integration as summation" "Integration as the reverse of differentiation"

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Mathematical Symbols and Abbreviations (continued)

$\int_a^b f(x)dx$	Integrate f of x dee x between the limits a and b	Find the definite integral of function $f(x)$ with respect to x		"Evaluating definite integrals" "Integration as summation"
$\overline{AB}, \overrightarrow{AB}$	Vector AB	Vector with direction from point A to point B		"Introduction to vectors"
$\mathbf{a}$	Vector a	Vector a		"Introduction to vectors"
$\overline{a}$	a bar, vector a	Vector a		"Introduction to vectors"
$\underline{a}$	a underline, vector a	Vector a		"Introduction to vectors"
$\hat{\mathbf{a}}$	a hat	Unit vector in the direction of vector a		"Introduction to vectors"
z^*	Complex conjugate of z	Complex conjugate of complex number z, used in the division of complex numbers		"The complex conjugate"
$\sqrt{}$	Square root	Indicates a square root - a number that may be multiplied by itself to achieve the value shown inside the square root symbol	$\sqrt{9} = \pm 3$ as $3 \times 3 = 9$ and $-3 \times -3 = 9$	Surds and roots
$\sqrt[3]{}$	Cube root	Indicates a cube root - a number that may be multiplied by itself three times to achieve the value shown inside the symbol	$\sqrt[3]{8} = 2$ as $2 \times 2 \times 2 = 8$	Surds and roots

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Mathematical Symbols and Abbreviations (continued)

i		Represents $\sqrt{-1}$ (square root of minus 1) and used interchangeably with j		"Motivating the study of complex numbers"
$\underline{i}$ or $\mathbf{i}$		Unit vector in the direction of the positive x-axis		Vectors
j		Represents $\sqrt{-1}$ (square root of minus 1) and used interchangeably with i, usually by engineers		"Motivating the study of complex numbers"
$\underline{j}$ or $\mathbf{j}$		Unit vector in the direction of the positive y-axis		Vectors
$\underline{k}$ or $\mathbf{k}$		Unit vector in the direction of the positive z-axis		Vectors
$\sin(\theta)$	sine theta	The trigonometric function sine abbreviated as sin		"Trigonometric functions"
$\cos(\theta)$	cos theta cosine theta	The trigonometric function cosine abbreviated as cos		"Trigonometric functions"
$\tan(\theta)$	tan theta	The trigonometric function tangent abbreviated as tan		"Trigonometric functions"

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Mathematical Symbols and Abbreviations (continued)

$\text{cosec}(\theta)$	cosec theta	The trigonometric function cosecant abbreviated as cosec and defined as $\frac{1}{\sin(\theta)}$		Cosecant
$\sec(\theta)$	sec theta	The trigonometric function secant abbreviated as sec and defined as $\frac{1}{\cos(\theta)}$		Secant
$\cot(\theta)$	cot theta	The trigonometric function cotangent abbreviated as cot and defined as $\frac{1}{\tan(\theta)}$		Cotangent
$\sin^{-1}(x)$	sine to the minus 1 of x	$\theta = \sin^{-1}(x)$is the inverse of function $x = \sin(\theta)$		"Trigonometric functions"
$\cos^{-1}(x)$	cos to the minus 1 of x	$\theta = \cos^{-1}(x)$ is the inverse of function $x = \cos(\theta)$		"Trigonometric functions"
$\tan^{-1}(x)$	tan to the minus 1 of x	$\theta = \tan^{-1}(x)$ is the inverse of function $x = \tan(\theta)$		"Trigonometric functions"
d.p	Decimal places	Indicates the number of decimal places after the decimal point to which a number should be rounded	$12.357 = 12.36$ (2d.p)	Decimals
s.f	Significant figures	Indicates how a number should be displayed by stating the number of non-zero digits that should be shown counting from the left	$0.05653 = 0.06$ (1s.f) $0.05653 = 0.0565$ (3s.f)	Decimals

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