MM101 Introduction to Calculus: Some Useful Terminology for Writing Mathematics

The Greek Alphabet

Name	Lower case	Upper case
alpha	α	A
beta	β	B
gamma	γ	Γ
delta	δ	Δ
epsilon	ϵ	E
zeta	ζ	Z
eta	η	H
theta	θ, ϑ	Θ
iota	ι	I
kappa	κ	K
lambda	λ	Λ
mu	μ	M
nu	ν	N
xi	ξ	Ξ
omicron	o	O
pi	π	Π
rho	ρ	P
sigma	σ, ς	Σ
tau	τ	T
upsilon	υ	Υ
phi	ϕ, φ	Φ
chi	χ	X
psi	ψ	Ψ
omega	ω	Ω

Some useful notation

$\sum_{k=1}^{n} T(k)$ the sum $T(1) + T(2) + \ldots + T(n)$

$\prod_{k=1}^{n} T(k)$ the product $T(1) \cdot T(2) \cdot \ldots \cdot T(n)$

$\begin{pmatrix} n \\ r \end{pmatrix}$ or ${}^{n}C_{r}$ the binomial coefficient (n choose r)

$\lim_{x \to a} T(x)$ the limit of $T(x)$ as x tends to a

Some useful mathematical symbols

$\in$	is an element of
$\notin$	is not an element of
$\{x_1, x_2, ...\}$	the set with elements $x_1, x_2, ...$
$\emptyset$ or $\{\}$	the empty set
$\{x : statement\}$	the set of all x for which *statement* holds
$\mathbb{N}$	the set of natural numbers $\{1, 2, 3, 4, \ldots\}$
$\mathbb{Z}$	the set of integers $\{\ldots, -2, -1, 0, 1, 2, \ldots\}$
$\mathbb{Q}$	the set of rational numbers $\{a/b : a, b \in \mathbb{Z} \text{ and } b \neq 0\}$
$\mathbb{R}$	the set of real numbers
$\mathbb{C}$	the set of complex numbers
$\subset$	is a subset of
$\cup$	union
$\cap$	intersection
$p \implies q$	p implies q (if p then q)
$p \impliedby q$	p is implied by q (if q then p)
$p \iff q$	p implies q and is implied by q (p if and only if q)
$\exists$	there exists
$\forall$	for all
$[a, b]$	the *closed* interval $\{x \in \mathbb{R} : a \leq x \leq b\}$
(a, b)	the *open* interval $\{x \in \mathbb{R} : a < x < b\}$
$\wedge$	and
$\vee$	or
$\cdot$	multiplies
$=$	is equal to
$\neq$	is not equal to
$:=$	is equal by definition to
$\equiv$	is identically equal to
$<$	is less than
$>$	is greater than
$\leq$	is less than or equal to
$\geq$	is greater than or equal to
$a \mid n$	n divides a (n is a factor of a)
$a \equiv b \pmod{n}$	a is congruent to b modulo n (n divides $a - b$)
$\lvert x \rvert$	the modulus of x (the absolute value of x)
∞	infinity
$\neg$	not ($\neg p$ is the negation of statement p)
!	factorial $\left(n! = \prod_{k=1}^{n} k = 1 \cdot 2 \cdot \ldots \cdot n \right)$

Some useful words and their meanings

1. Nouns

Algorithm
A set of instructions used to solve a problem or obtain a desired result. For example, the "shampoo algorithm" explains how to wash one's hair: wet hair, lather, rinse, repeat.

Axiom
A statement accepted as true without proof.

Conjecture
An educated guess.

Constant
A term with a well-defined meaning that remains unchanged during its use.

Corollary
A proposition that can be easily deduced, usually from a theorem that is considered to be more important or fundamental than the corollary.

Definition
A statement of the exact meaning of a variable, function or other mathematical concept.

Digit
Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 used to write numbers. For example, the digits in the number 361 are 3, 6, and 1.

Divisor
An integer that divides into another integer without a remainder. Thus 4 is a divisor of 12.

e.g.
From Latin *exempli gratia*, meaning *for example*. (Note: this is **not** the same as **i.e.**).

Element
A member of a set or an entry in a matrix.

Equation
A mathematical statement built by connecting terms with one or more equal signs.

Factor
Any integer or polynomial that divides another integer or polynomial without remainder.

Formula
An expression used to calculate a desired result, such as a formula to find a volume or a formula to count combinations. Formulas can also be equations involving numbers and variables, such as Euler's formula.

Function
A relation between two sets with the property that each element of the first set is associated with an element of the second set.

Identity
An equation that is true regardless of the values of any variables involved.

i.e.
From Latin *id est*, meaning *that is* or *in other words*. (Note: this is **not** the same as **e.g.**).

Inequality
A mathematical statement including one or more of the symbols $<, >, \leq$ or $\geq$.

Lemma
A helpful proposition which is of interest mainly as a stepping stone towards the proof of a theorem.

Parameter
A constant in an equation that can be varied to give other equations of the same general form.

Prime
A natural number greater than 1 that has no divisors other than 1 and itself.

Proof
A demonstration that a proposition is true, using definitions, axioms and other propositions which have already been proved.

Proposition
A statement that can be true or false.

Quotient
The result of dividing two numbers or expressions. For example, 40 divided by 5 has a quotient of 8. Note: 43 divided by 5 has a quotient of 8 and a remainder of 3.

Reciprocal
The reciprocal of a number a is the number that, when multiplied by a, gives 1.

Term
A single number, variable, or other mathematical symbol, or a combination of such entities.

Theorem
A proposition of some importance. A theorem is proved using axioms, definitions and other, already established theorems.

Variable
Usually a single letter, not meaningful by itself, acting as a placeholder for something else, for example, a number.

2. Verbs

Calculate/Compute

To figure out or evaluate. For example, "compute $2 + 3$" means to figure out that the answer is 5.

Define

To state the exact meaning of a variable, function or other mathematical concept.

Denote

To stand as a name or a symbol for something.

Evaluate

To calculate the value of an expression. For example, "evaluate f at 7" means calculate the value of the function f when its argument is equal to 7.

Imply

For a statement, to have as a consequence the truth of another statement.

Satisfy

A quantity satisfies an equation if it makes it true.

Simplify

To use the rules of arithmetic and algebra to rewrite an expression in a more compact or pleasing form.

Suppose

To assume that something is the case without formal proof for the sake of working out its consequences. Often used in proof by contradiction.

Verify

To make sure a solution is correct by making sure it satisfies all equations and inequalities in a problem. To establish the truth of a statement or equation. It is a synonym for check.

3. Connecting Words and Phrases

Introducing a new variable/concept:

Let ... be
Suppose (that) ... is/are
We define ... to be

Connecting similar ideas:

...apples **and** pears...
...**both** apples and pears...
...apples, and **also** pears, ...
...apples, **as well as** pears, ...
... **not only** apples, **but also** pears...
Apart from apples, pears...
In addition to apples, pears...
... apples. **Moreover,** pears...
... apples. **Furthermore,** pears...

Adding contradictory ideas or restrictions:

Alternatively, ...
Although ...
... , though ...
..., but ...
..., whereas ...
In contrast, ...
In comparison, ...
Except for ...
However, ...
On the other hand, ...
On the contrary, ...
Nevertheless, ...
Despite ...
Despite the fact that ...
In spite of ...
... instead of ...
... rather than ...

Stating conditions:
If ...
Unless ...
Whether or not ...
Provided that ...

Adding implications or explanations:
If ... then
as/because/since
due to
in view of / owing to / on account of
consequently/therefore/thus/so/hence

Emphasising:
Indeed, ...
... actually ...
... clearly ...
... certainly ...

Adding an example:
For example, ...
For instance, ...

Expressing a result:
Accordingly, ...
As a result, ...
As a consequence, ...
It is easy to see/show that ...
From ... we have ...
By substituting ... into ... we obtain ...
Without loss of generality ...
Given ... it follows that ...