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Faculté des Sciences

Département de Mathématiques

TITRE

AN INTRODUCTION TO MATHEMATICAL ENGLISH

(BASIC COURSES WITH ACTIVITIES)

Adressé aux étudiants niveau: Licence et Master

Domaine: Mathématique informatique

Filière: Mathématique

Spécialité: Mathématique

Etabli Par :

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الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي و البحث العلمي

Université Abou Bekr Belkaid
Tlemcen Algérie
جامعة أبي بكر بلقايد
تلمسان الجزائر

Faculty of Sciences كلية العلوم

Title of the Manual

An Introduction to Mathematical English

(Basic Courses with Activities)

Name of the author

Khadidja HAMMOUDI

Year of edition 2019

Field: **Mathematics**

Course: **Technical English**

Summary

Because English is nowadays the language of science and academic research, it becomes a necessity in undergraduate classes where students have to master not only the basics of the language as grammar, spelling and pronunciation, but also its use for more specific purposes. For this reason, this manual is developed for students of mathematics with its specialities or any reader who might need basics of maths. It proposes a dozen of courses which, in turn, end with some related exercises and solutions. In addition to courses on simple mathematical issues, we propose some courses on enhancing language basic skills as speaking, reading, and writing.

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Titre du polycopié: **Introduction à l'Anglais Technique**

Nom de l'auteur : **Khadidja HAMMOUDI**

L'année de l'édition : **2019**

- Domaine: **Mathématiques**
- Module: **Anglais Technique**

<u>Sommaire</u>

Cet ouvrage est un support de cours de la matière d'Anglais Technique. Il est principalement destiné aux étudiants de Mathématiques avec toutes ses spécialités. Il contient de différents cours pas seulement d'un Anglais général mais aussi des notions de base pour développer certaines compétences en Anglais Technique reliées aux domaines mathématiques. Chaque cours inclut des applications concrètes et des exercices afin d'aider les étudiants à mieux appréhender les notions et concepts présentés. A la fin de ce manuscrit, on propose une variété de cours de grammaire, expression orale et écrite qui ont pour but l'avancement des autres compétences que n'importe quel étudiant en a besoin.

Basic Mathematics

I. About the course

Lecture Class

Course Title: **Technical English**

Credit hours 1:30 hrs.

Level: Basic

Coefficient: 01

Credits: 01

UE: *Unité Méthodologie*

II. Course Description (Présentation du cours)

This course introduces the module of Mathematical English for undergraduate students (L2 & L3 classes of Maths and Computer Sciences). It also gives technical terms, definitions, basic expressions, concepts, symbols and many other aspects related to the field of studying mathematics in English. The primary aim of this course is to theoretically prelude students to reading maths and then make them able to practically conduct it and deal with it.

III. Objectives (Visées d'apprentissages)

This course aims to guide students at the Section of Mathematics in the Faculty of Sciences, University of Tlemcen, towards achieving competence and proficiency in the theory of and practice to the basics of Mathematical English. This course will help the students to:

- Know how to read mathematical symbols and notions in English.
- Get accustomed with the use of speaking maths in English instead of French.
- Develop a certain awareness with regard to the importance of the English language in studying scientific fields.
- Advance their competence in reading and speaking skills.

V. EVALUATION (Modalité d'évaluation)

Exam	✓ **50% of the final mark** ✓ Synthesis of the classes. ✓ At the end of each semester
Project	✓ **40% of the final mark of the module** ✓ Application of the information acquired. ✓ At the end of the semester
Oral presentation	✓ **10% of the final mark.** ✓ Students should present any topic related to Mathematical English/ e.g. solving equations in English using the learned details. ✓ During the semester
Participation	✓ In-class participation is appreciated and interaction is of great importance.

VI. Activités d'enseignement-apprentissage	Présentant les activités d'enseignement et d'apprentissage utilisées dans notre cours pour favoriser les apprentissages des étudiants afin d'atteindre le plus efficacement possible les objectifs visés. - Des **questions de compréhension** en classe - Des **quiz** occasionnels - L'**application** de chaque **procédure** en classe
VII. Modalités de fonctionnement	Assurons-nous que nos étudiants aient une idée claire de nos attentes quant à, par exemple : - Le **respect** doit être visible verbalement et dans le comportement des étudiants en classe. - Le **langage** d'enseignement, d'apprentissage et de communication doit être en Anglais académique.

Table of Contents

Preface to the Manual

This manual gives a detailed syllabus addressed to both teachers and students in the department of Mathematics. It aims at introducing mathematical English for students of Maths specialized in different fields including, for example, Biomathematics and Modelling, Partial Differential Equation and Applications, and Probabilities and Statistics or anyone who wants to deal with basic mathematical issues.

This manuscript consists of a dozen of courses designed to help students develop a “basic” competence with regard to the use of technical English. The courses cover basic concepts, symbols, to definitions, and texts. A number of exercises and applications are given to support each course so that students can build their capacity to express mathematics in English.

In addition to fundamental lectures which deal with mathematical English specifically, there are some sections devoted to general English where tips of writing and speaking are given to students. The section entitled “Needed Skills” focuses on and developing some skills that any language student needs. Courses on grammar, reading comprehension, writing and speaking are all given with some activities that can be implemented by students to ensure a good understanding of the fundamental concepts of mathematics in English.

Note that one course can take more than one session, i.e., the teacher should divide the lecture according to the competence, needs, as well as the achievements of the learners.

Special thanks go to Professor Ali MOUSSAOUI, Department of Mathematics, University of Tlemcen, who never hesitated to give help and assistance.

It is certain that this manuscript’s version is just a basic attempt and therefore is subject to modification as there must be some mistakes or data to add. For this, I invite all readers, teachers or students, to give their remarks or suggestions on my email address: doujamido1@gmail.com.

Course One

The Greek Alphabet

Objectives

After this course, students will be able to:

- Know the symbols mostly used in mathematics.
- Recognize the difference between the French and English pronunciations of these letters.

Letters mostly used in Mathematics

(The Greek Alphabet)

In this course, it is necessary to provide the learners of mathematics in English with the different letters that are frequently used in their domains. It is also compulsory to mention the distinction between the French and English pronunciations of those symbols, this is why the phonetic transcription is provided in the third column of the table below.

> NB. Students are expected to know all those letters and symbols in the French language; therefore, it is necessary to point where differences are.

The Greek alphabetical symbols have been used as a code to write the Greek language from about the late 9^{th}– early 8^{th} century B.C. It is, in fact, recognized as the first alphabetical script to decode both vowels and consonants pronounced in that language at that time. Twenty-four letters ordered from alpha to omega have become standardised, and therefore, the alphabet that the Greek language is written until nowadays. In addition to that, the symbols of the Greek alphabet serve as a source of technical symbols and labels in many fields of mathematics particularly and sciences globally.

Here are some examples where Greek alphabet is used in mathematics. Lower case epsilon (ε) is used as a symbolic representation for an arbitrary **positive** number. Lower case pi (π) is used to refer to the ratio of the circumference of a **circle** to its diameter. Whereas capitalized sigma ($\sum$) is the symbol for **summation**/ the sum, its lower case (σ) refers to standard **deviation**.

Letter	Name	Pronunciation
α	alpha	[a:lfæ]
β	beta	[beɪ'tæ]

γ	gamma	[ga:m’æ]
δ	delta	[de:ltæ]
ϵ, ε	epsilon	[‘epselən]
ζ	zeta	[zeɪ’tæ]
η	eta	[eɪ’tæ]
θ, ϑ	theta	[θeɪ’tæ]
ι	iota	[ɪ’jɔ’tæ]
λ	lambda	[‘lembdæ]
ν	nu	[nɪu:]
μ	mu	[mɪu:]
ξ	xi	[zaɪ/ksaɪ]
o	omicron	[omɪkrən]
ρ, ϱ	rho	[rəʊ]
σ	sigma	[si:gmæ]

τ	tau	[taʊ]
υ	upsilon	[j:psɪlən]
ϕ, φ	phi	[faɪ]
$\prod, \pi$	pi	[paɪ]
χ	chi	[kaɪ]
ψ	psi	[saɪ/ p'saɪ]
ω	omega	[ɔ:me'gæ]
κ	kappa	[ka:'pæ]

<u>Activity:</u> try to pronounce the mathematical symbols in English and find some concrete examples where they can be used in your field of study.

Examples:

$$e^{i\pi} = cos(\pi) + i\,sin\,(\pi)$$

$$e^{i\pi} = -1 + i0$$

$$e^{i\pi} = -1$$

$$e^{i\pi} + 1 = 0$$

$$
\begin{aligned}
\Gamma\left(\frac{1}{2}\right) &= \int_0^\infty x^{1/2-1}\exp(-x)dx \\
&= \int_0^\infty x^{-1/2}\exp(-x)dx \\
&= 2\int_0^\infty \exp\left(-t^2\right)dt \qquad\qquad \text{(change of variable: } t = x^{1/2}\text{)} \\
&= 2\left(\int_0^\infty \exp\left(-t^2\right)dt \int_0^\infty \exp\left(-t^2\right)dt\right)^{1/2} \\
&= 2\left(\int_0^\infty \exp\left(-t^2\right)dt \int_0^\infty \exp\left(-s^2\right)ds\right)^{1/2} \\
&= 2\left(\int_0^\infty \int_0^\infty \exp\left(-t^2 - s^2\right)dtds\right)^{1/2} \\
&= 2\left(\int_0^\infty \int_0^\infty \exp\left(-s^2u^2 - s^2\right)sduds\right)^{1/2} \qquad \text{(change of variable: } t = su\text{)} \\
&= 2\left(\int_0^\infty \int_0^\infty \exp\left(-\left(1+u^2\right)s^2\right)sdsdu\right)^{1/2} \\
&= 2\left(\int_0^\infty \left[-\frac{1}{2\left(1+u^2\right)}\exp\left(-\left(1+u^2\right)s^2\right)\right]_0^\infty du\right)^{1/2} \\
&= 2\left(\int_0^\infty \left[0 + \frac{1}{2\left(1+u^2\right)}\right]du\right)^{1/2} \\
&= 2^{1/2}\left(\int_0^\infty \frac{1}{1+u^2}du\right)^{1/2} \\
&= 2^{1/2}\left([\arctan(u)]_0^\infty\right)^{1/2} \\
&= 2^{1/2}\left(\arctan(\infty) - \arctan(0)\right)^{1/2} \\
&= 2^{1/2}\left(\frac{\pi}{2} - 0\right)^{1/2} \\
&= \pi^{1/2}
\end{aligned}
$$

Course Two

Basic Mathematical Symbols

Objectives

After this course, students will be able to:

- Know all the basic mathematical symbols and pronounce them correctly in English
- Employ them in concrete examples
- Repeat mathematical English loudly

Basic Mathematical Symbols

Symbol	Written/ spoken
+	plus
-	minus
x	Times/ multiplies
/ ÷	Divides/ divided by
=	equals
≠	Not equal
≡	identical
≢	Not identical
±	Plus or minus
∓	Minus or plus
≈	Approximately equal
~	Equivalent to
<	Less than
≮	Not less than
≤	Less than or equal to
≪	Much less than
>	Greater than
≥	Greater than or equal to

≯	Not greater than
≫	Much greater than
(	Open the (left) bracket
)	Close the (right) bracket
( )	Brackets/ parentheses
[	Open the (left) square bracket
]	Close the (right) square bracket
[ ]	Square brackets
{	Open the curly bracket
}	Close the curly bracket
{ }	Curly brackets
→	Approaches
→	Withdraws
↑	Upward
↓	Downward
$\lvert \boldsymbol{x} \rvert$	Absolute value of *x*
$\lvert \boldsymbol{z} \rvert$	Modulus/ modulo of *z*
$\lVert \boldsymbol{x} \rVert$	Norm of *x*
!	Factorial
.	Point
…	Dots/ ellipsis
:	Colon/ ratio

;	Semi-colon
∴	Therefore
∪	Union of …
∩	Intersection of …
∈	Belonging symbol
∃	There exists/ there is… in…
∄	There is no… in…
∝	Proportional to
∞	Infinity
+∞	Plus infinity
-∞	Minus infinity
∅	Empty
∏	Product
$\prod_{1}^{2} 3$	Product from 1 (bottom) to 2 (top) of 3 (next)
$\prod_1^2 3$	Product from 1 (bottom) to 2 (top) of 3 (next)
$\prod_{1=x} 2$ $\prod_{1=x} 2$	Product from 1 equals x (bottom) of 2 (next)
∑	Summation

$$\sum_{1}^{2} 3$$	Summation from 1 (bottom) to 2 (top) of 3 (next)
$\sum_{1=x}^{2} 3$	Summation from 1 equals *x* (bottom) to 2 (top) of 3 (next)
$$\sum_{1} 2$$ $\sum_{1=x} 2$	Summation 1 (bottom) of 2 (top) Summation from 1 equals x (bottom) of 2 (next)
$\int x$	Integral of *x*
$\iint$	Double integral
$\iiint$	Triple integral
$\int_{1=x}^{2} 3$	Integral from 1 equals x (bottom) to 2 (top) of 3 (next)
$$\int\limits_{1}^{2} 3$$	Integral from 1 (bottom) to 2 (top) of 3 (next)

Course Three

Numbers

Objectives

After this course, students will be able to:

- Differentiate between the French and English ways of pronouncing numbers
- Write numbers correctly in English
- Practice the reading of mixed numbers

On Numbers (Basic)

Numbers	Spoken/ Written
0	zero
1	one
2	two
3	three
4	four
5	five
6	six
7	seven
8	eight
9	nine

10	ten
11	eleven
12	twelve
13	thirteen
14	fourteen
15	fifteen
16	sixteen
17	seventeen
18	eighteen
19	nineteen

20	twenty
31	Thirty-one
42	Forty-two
53	Fifty-three
64	Sixty-four
75	Seventy-five
86	Eighty-six
97	Ninety-seven

200	two hundred
301	three hundred and one
402	four hundred and two
510	five hundred and ten
611	six hundred and eleven
753	seven hundred and fifty-three
826	eight hundred and twenty-six
999	Nine hundred and ninety-nine

1.000	One thousand/ two thousand…
10.000	Ten thousands/ twenty thousand…

100.000	One hundred thousand/ two hundred thousand…
1.000.000	One million/ two million
10.000.000	Ten million/ twenty million
100.000.000	One hundred million/ two hundred million
1.000.000.000	One billion
1.000.000.000.000	One trillion
1.000.000.000.000.000	One quadrillion
1.000.000.000.000.000.000	One quintillion

Activity One: write the following numbers in English

4 000 000 000

7 000 000 001

1 000 000 033 000

5 000 000 000 678

Solutions:

4 000 000 000 → four billion

7 000 000 001 → seven billion and one

1 000 000 033 000 → one trillion and thirty-three thousand

5 000 000 000 678 → five trillion and six hundred (and) seventy-eight

Activity Two: translate the following expressions into numbers

Two hundred and forty-five

Twenty-two thousand seven hundred and thirty-one

One million

Fifty-six million

Eleven

Solutions:

Two hundred and twenty-seven → 227

Twenty-two thousand seven hundred and thirty-one → 22 731

One million and forty-nine→ 1 000 049

Fifty-six million → 56 000 000

Eleven→ 11

Course Four

Sets of Numbers

Objectives

After this course, students will be able to:

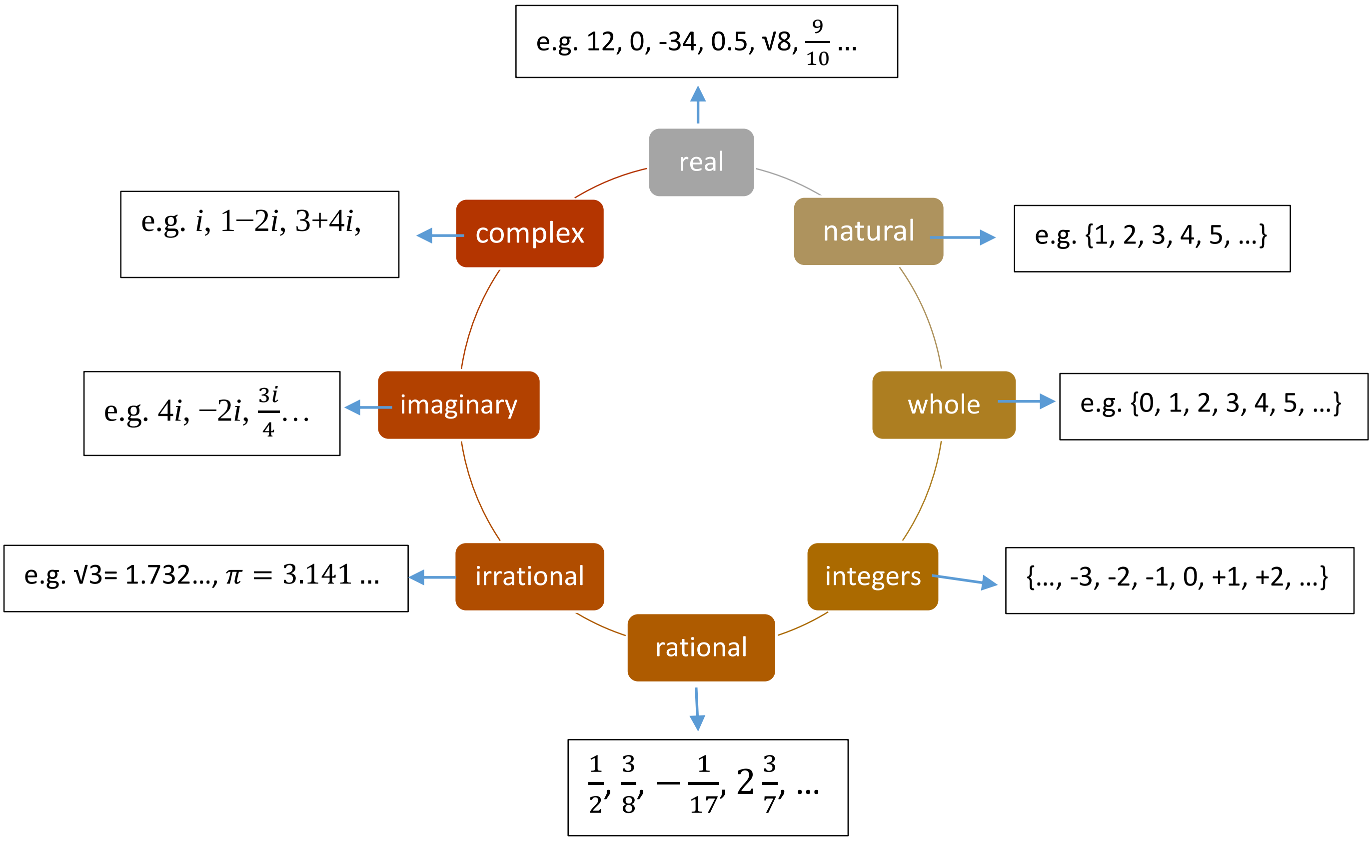
- Recognize the different sets of numbers
- Know what constitutes each set
- Prove to which set the solution of a given equation belongs to.

On Numbers (Advanced)

Types and Sets of Numbers

Types of Numbers

It seems for lay people that numbers are similar in expression though different in value. However, in mathematics, as a science, there exists a categorization of numbers which gives the following different types illustrated in the diagram.



The counting numbers {1, 2, 3 …} are commonly called **natural** numbers (IN); however, other definitions include zero, so that the **non-**negative **integers** {0, 1, 2, 3 …} are also called **natural** numbers. This set also includes **whole** numbers which are **greater** than zero, generally numbers that we can physically **count.** This group of numbers does not include **negative** values.

Positive and **negative** counting numbers, in addition to **zero** are called integers (*Z*). Examples include {1, 2, 3 …} which are **greater** than zero (**positive** integers) and {-3, -2, -1 …} which are **less** than zero (**negative** integers).

Numbers that can be expressed as **ratio** of an integer to **non**-zero integer are called **rational** numbers (*Q*). All integers are **rational**, but the **converse** is not true. They can be written as a **fraction** where both the top (**numerator**) and the bottom (**denominator**) are integers, e.g., $\frac{1}{3}$ $and\,\frac{23}{7}$ which are simple-unit **fractions**.

Numbers that can represent a distance along a line are called **real** numbers (IR). They can be **positive**, **negative**, or **zero**. All rational numbers are **real**, but the reverse is not true. This set can also be called **measuring** numbers or measurement numbers.

The set of real numbers which are **not** rational is called **irrational** numbers (II). They can't be written as **fractions**, e.g., $\sqrt{2} = 1.4142\ldots, \pi = 3.1415\ldots$ if we try to write these numbers as decimals, they go **infinite.**

The set of **complex** numbers (C) includes real numbers, **imaginary** numbers, i.e., numbers that equal the product of a real number and $\sqrt{-1}$, as well as sums and differences of those **numbers**.

Those numbers are classified into sets. Therefore, each group form a set with a particular sign that symbolizes each.

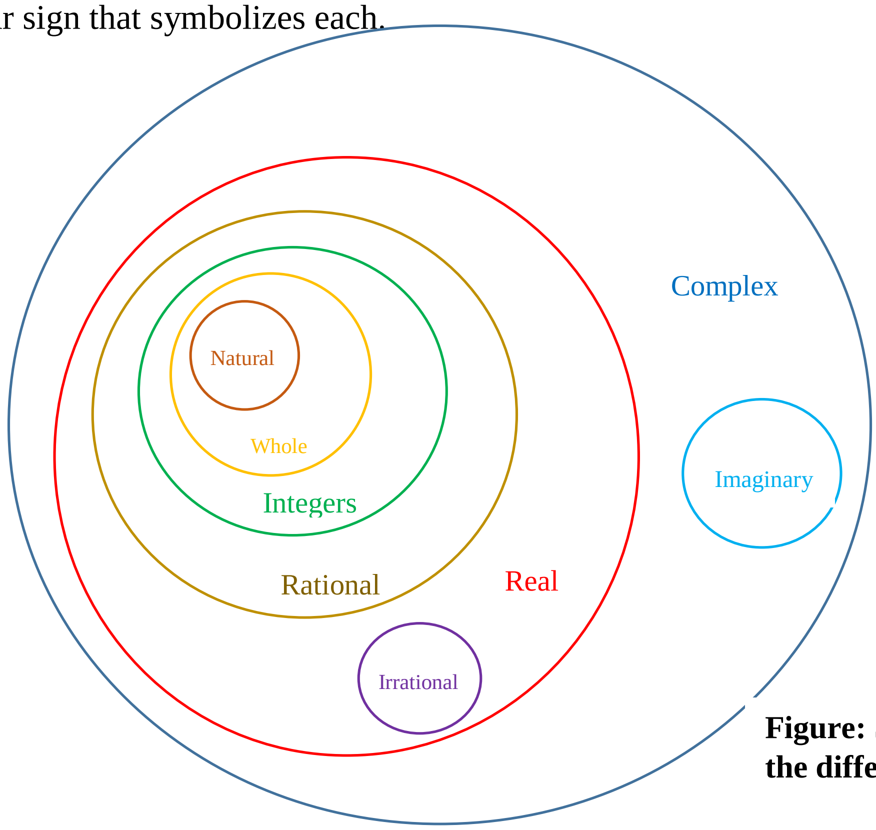


Figure: Schematic representation of the different sets of numbers

Activities:

<u>Activity One:</u> Determine the set that each of the following numbers belongs to

a) 5

b) 3.5

c) -2

d) $\frac{-1}{4}$

e) √18

f) √4

<u>Keys:</u>

a) 5 → natural	d) $\frac{-1}{4}$ → rational
b) 3.5 → rational	e) √18 → irrational
c) -2 → integer	f) √4 → natural, rational, real

<u>Activity Two:</u> Write the following mathematical expressions in English

(10+7*i*) – (6+3*i*)

(1+*i*) + (2*i*)

<u>Solution:</u>

1. Ten plus seven i the whole minus six plus three i.
2. One plus i the whole plus two i.

<u>Activity Three:</u> If *x*=36 and *y*=4, find if the following are <u>rational</u> numbers or not

$$\sqrt{x+y}, \sqrt{x-y}, \sqrt{x.y}, \sqrt{\frac{x}{y}}$$

<u>Solution:</u> We need to replace x by 36 and y by 4 and calculate the root of the result

$$\sqrt{x+y} \rightarrow \sqrt{36+4} = \sqrt{40}$$

$$\sqrt{x-y} \rightarrow \sqrt{36-4} = \sqrt{32}$$

$$\sqrt{x.y} \rightarrow \sqrt{36.4} = \sqrt{144}$$

$$\sqrt{\frac{x}{y}} \rightarrow \sqrt{\frac{36}{4}} = \sqrt{9}$$

Course Five

Indices & Powers

Objectives

After this course, students will be able to:

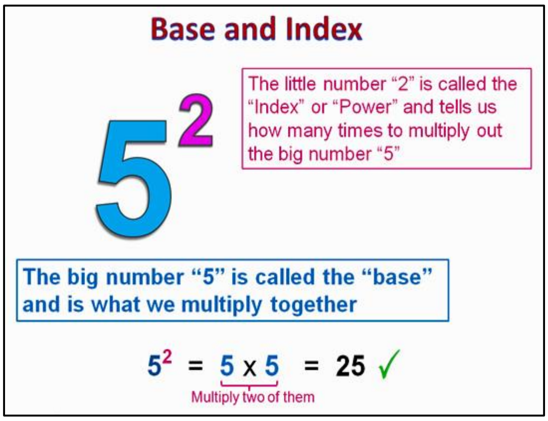
- Know what an index is.
- Learn the different rules of indices.
- Read the mathematical expressions in English.
- Simplify certain expressions containing indices.

Indices and Powers

(Situated where? Read how?)

What is an index?

An index (plural. Indices) is a mathematical form that explains how many times to use the number in a multiplication. In other words, it tells how many times you multiply the number by itself. For example, 3^4 means that you have to multiply 3 by itself four times, i.e., 3×3×3×3= 81. It is generally known as the power of a number that is written as a small number above the base number (in its right). Indices are important forms in the simplification of larger expressions of numbers. Indices can also be named as an exponent or power.



Laws of indices:

There is a set of crucial rules of indices that must be taken into account in learning basic mathematics (see the table bellow).

• $y^a \times y^b = y^{a+b}$ ***Examples*** $2^4 \times 2^8 = 2^{12}$ $5^4 \times 5^{-2} = 5^2$	**Rule 1.** *y* to the power of *a* times *y* to the *b* equals/ is equal to *y* to the power of *a+b*. To multiply expressions with the same base, copy the base and add the indices.
• $y^a \div y^b = y^{a-b}$ ***Examples***	**Rule 2.** *y* to the power of *a* divided by *y* to the *b* equals *y* to the power of *a-b*.

$3^9 \div 3^4 = 3^5$ $7^2 \div 7^5 = 7^{-3}$	To divide expressions with the same base, copy the base and subtract the indices.
• **$y^{-b} = 1/y^b$** ***Examples*** $2^{-3} = 1/2^3 = 1/8$ $3^{-1} = 1/3$	**Rule 3.** *y* to the power of *minus b* is equal to *one* over/ divided by *y* to the *b*th power.
• **$y^{m/n} = (^n\sqrt{y})^m$** ***Examples*** $16^{1/2} = \sqrt{16} = 4$ $8^{2/3} = (^3\sqrt{8})^2 = 4$	**Rule 4.** *y* to the power of *m* over/ by *n* equals *n* times the square root of *y*, the whole to the power of *m*.
• **$(y^n)^m = y^{nm}$** ***Example*** $2^5 + 8^4$ $= 2^5 + (2^3)^4$ $= 2^5 + 2^{12}$	**Rule 5.** *y* the *n*th power, the whole to the power of *m* equals *y* to the power of *n times m*. To raise an expression to the nth index, copy the base and multiply the indices.
• **$y^0 = 1$** ***Example*** $5^0 = 1$	**Rule 6.** *y* to the power of *zero* is equal to *one*. Regardless of the value of the base, any number, except 0, whose index is 0 is always equal to 1.

Activity: **Simplify the following expressions**

Form	Solutions
$5 \times 8^{2/3}$	$5 \times 8^{2/3}$ $= 5 \times (\sqrt[3]{8})^2$ *Using Rule* $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$ $= 5 \times 2^2$ *Get the value of* $\sqrt[3]{8}$ $= 5 \times 4$ *Get the value of* 2^2 $= 20$ *Get the product of 5 and 4*
$-2x^0$	$-2x^0 = -2(1)$ Using *Rule* $a^0 = 1$ $= -2$
$\frac{6(y^4)^5}{12y^4y^5}$	$\frac{6(y^4)^5}{12y^4y^5} = \frac{6y^{20}}{12y^9}$ Using Rule $(a^m)^n = a^{mn}$ for the numerator and *Rule* $a^m \times a^n = a^{m+n}$ *for the denominator.* $= \frac{y^{20}}{2y^9}$ Simplify $\frac{6}{12}$ $= \frac{y^{11}}{2}$ Using *Rule* $a^m \div a^n = a^{m-n}$
$(-243)^{-2/5}$	$(-243)^{-2/5} = \frac{1}{(-243)^{2/5}}$ Using *Rule* $a^{-m} = \frac{1}{a^m}$ $= \frac{1}{(\sqrt[5]{-243})^2}$ Using *Rule* $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$ $= \frac{1}{(-3)^2}$ Evaluate $\sqrt[5]{-243}$ $= \frac{1}{9}$ Take the square of -3

$5(8x^4 \div 2x^6)$	$5(8x^4 \div 2x^6)$ $= 5\ (8 \div 2)(x^4 \div x^6)$ $= 5\ (4)(x^{4-6})$ $= 20\ (x^{-2})$ $= \frac{20}{x^2}$	*Since* $a \div b = \frac{a}{b}$, *Split the equation to make it easier to solve* *Get the quotient of 8 and 2.* *Using Rule* $a^m \div a^n = a^{m-n}$ *Get the product of 5 and 4* *Using Rule* $a^{-m} = \frac{1}{a^m}$
$\left(\frac{5a}{b^2}\right)^2$	$\left(\frac{5a}{b^2}\right)^2 = \frac{5^2a^2}{b^{2\times2}}$ $= \frac{25a^2}{b^4}$	*Using Rule* $(a^m)^n = a^{mn}$ Evaluate 5^2
$(3a)^{-2}$	$(3a)^{-2} = \frac{1}{(3a)^2}$ $= \frac{1}{3^2a^2}$ $= \frac{1}{9a^2}$	*Using Rule* $a^{-m} = \frac{1}{a^m}$ *Using Rule* $(a^m)^n = a^{mn}$ Evaluate 3^2
$\left(\frac{2}{r^2}\right)^{-3}$	$\left(\frac{2}{r^2}\right)^{-3} = \frac{1}{\left(\frac{2}{r^2}\right)^3}$ $= \frac{1}{\frac{2^3}{r^{2\times3}}}$ $= \frac{1}{\frac{8}{r^6}}$ $= \frac{r^6}{8}$	*Using Rule* $a^{-m} = \frac{1}{a^m}$ *Using Rule* $(a^m)^n = a^{mn}$ Evaluate 2^3 Since $\frac{1}{\frac{a}{b}} = \frac{b}{a}$

References:

http://mathematics.laerd.com/maths/indices-intro.php (2019)

https://revisionmaths.com/advanced-level-maths-revision/pure-maths/algebra/indices (2019)

https://www.toppr.com/guides/business-mathematics-and-statistics/business-mathematics/laws-of-indices/ (2019)

Course Six

Mathematical Arguments

Objectives

After this course, students will be able to:

- How to move from one theorem to another using the appropriate arguments in English.
- Write an equation and solve it using some expressions/ arguments that have been learned.

Some Mathematical Arguments

While reading mathematical equations, the movement from one theorem to another needs a special type of arguments and expressions. In the following table, we will try to provide some of the necessary mathematical expressions to arrange equations. Those utterances are translated with their French counterparts since the students are supposed to know them in the French language.

It follows from . . . that . . .
Il résulte de… que…/ il s’ensuit que…
We deduce from . . . that . . .
On peut donc en déduire que …
Conversely, . . . implies that . . .
Inversement/ réciproquement, …cela implique que…
Equality (1) holds, by Proposition 2.
L’égalité (1) a…, par proposition 2.
By definition, . . . The following statements are equivalent.
Par définition, … les deux lignes ci-après sont équivalentes.
Thanks to . . . , the properties . . . and . . . of . . . are equivalent to each other.
Grace à…, les propriétés … et… de… sont équivalentes.
. . . has the following properties.
… a les critères/ propriétés suivantes
Theorem 1 holds unconditionally.
Le théorème 1 est toujours vrai lorsque…
This result is conditional on Axiom A.
Ce résultat est conditionnel/ dépendent de l’Axiome A.
. . . is an immediate consequence of Theorem 3.
…est une conséquence immédiate du théorème 3.
Note that . . . is well-defined, since . . .
Il est à noter que… est strictement définit, puisque…
As . . . satisfies . . . , formula (1) can be simplified as follows.

Comme… satisfait…, la formule (1) peut être simplifiée comme suit.
We conclude (the argument) by combining inequalities (2) and (3).
On conclut (l'argument) par combinaison des structures non-égales (2) et (3).
(Let us) denote by X the set of all . . .
Notons par X l'ensemble de tout…
Let X be the set of all . . .
X est l'ensemble de tout…
Recall that . . . , by assumption.
Rappelons que…, par hypothèse/ par supposition.
It is enough to show that . . .
C'est suffisant de montrer que…
We are reduced to proving that . . .
On est réduit/ limiter à prouver que…
The main idea is as follows.
L'idée principale est comme suit.
We argue by contradiction. Assume that . . . exists.
On argumente par contradiction… en assumant que… existe.
The formal argument proceeds in several steps.
L'argument précédent dans plusieurs étapes.
Consider first the special case when . . .
Il faut premièrement prendre en considération le cas spécial quant à…
The assumptions . . . and . . . are independent (of each other), since . . .
Les hypothèses/ suppositions… et… sont indépendantes, puisque…
. . . , which proves the required claim.
…, qui prouve la réclamation requise/ la preuve requise.
We use induction on *n* to show that . . .
On utilise insertion *n* pour montrer que…
On the other hand, . . .
D'autre part, …
. . . , which means that . . .

…, ça veut dire que…
In other words, . . .
Autrement dit, …

<u>Activity:</u> Write an equation (from your choice) and try to solve it using some expressions/ arguments that you have learned.

Example 1: Solve √(x/2) = 3

Start with: √(x/2) = 3

Square both sides: $x/2 = 3^2$

Calculate $3^2 = 9$: x/2 = 9

Multiply both sides by 2: x = 18

Example 2: Solve for x:

2x/ **(x – 3)** + 3 = *6/* **(x – 3)** (x≠3)

We have said x≠3 to avoid a division by zero.

Let's multiply through by (x − 3): 2x + 3(x−3) = 6

Bring the 6 to the left: 2x + 3(x−3) − 6 = 0

Expand and solve: 2x + 3x − 9 − 6 = 0
5x − 15 = 0
5(x − 3) = 0

x − 3 = 0

That can be solved by having x=3

Let us check:

(2 × 3)/ (**3 – 3)** + 3 = *6/ (* **3 – 3)**

That means Dividing by Zero!

And anyway, we said at the top that x≠3, so ... x = 3 does not actually work, and so:

There is **No** Solution!

Solve: 5x + 2 = -8 3y - 7 = 26 (x + 2)(2x -1) = 0 (7 - 2y)(5 + y) = 0

Course Seven

Types of Equations

Objectives

At the end of this course, students will be able to:

- Know some basic types of mathematical equations
- Solve some practical cases (calculate, write and read maths in English)

Types of Equations

In mathematical operations, one can come across a number of mathematical structures. In this lecture, some types of equations are introduced.

Polynomial equations: exist in the form P(x)= 0, where P (x) is a polynomial.

Basic Types:

Linear equations: are equations of the type: ax+ b= 0,where a is different from zero, i.e., $a \neq 0$. It can also be any other equation in which the terms can be operated and simplified into an equation of the same form. Here is a concrete example:

$(x + 1)^2 = x^2 - 2$

$x^2 + 2x + 1 = x^2 - 2$

$2x + 1 = -2$

$2x + 3 = 0$

Quadratic equations: as its name implies, (2) is the highest power. These equations are always of the type $ax^2 + bx + c = 0$, where a is not equal to zero, that is $a \neq 0$

Cubic equations: is a kind of polynomial equations in which the highest sum of exponents of the variables is equal to three (3). It is of the type $ax^3 + bx^2 + cx + d = 0$, with $a \neq 0$

Quartic equations: are equations of the fourth degree. Its form is of the type $ax^4 + bx^3 + cx^2 + dx + e = 0$

Some pieces of research indicate the existence of more than four types and claim that there exists about 26 types of equations. Some examples include:

Quintic equation: is also a polynomial equation where the highest power of a given variable is five (5) e.g., $ax^5 + bx^4 + cx^3 + dx^2 + ex + f = 0$

Exponential equations: involve variables instead of exponents for example 4*x* = 0 (where 4 is considered as a base and *x* is the exponent).

Activity: Say which type of equation are the following mathematical forms

$12x - 10 = 0$	$-2xy = 0$	$2x^2 - 5x - 12 = 0$
$12x + 10y - 10 = 0$	$12x^2 + 4y^2 = 0$	$x^{1/2} + 14 = 0$
$12x + 10y - 3z - 10 = 0$	$10xy + 23y - 2x = 0$	$x/4 = (x+12)/12$

Solution

Formula	Type
$12x - 10 = 0$	Linear Equation with one Variable
$-2xy = 0$	Monomial Equations: The polynomial equations which has only one term is called as monomial equations.
$2x^2 - 5x - 12 = 0$	Quadratic Equation
$12x + 10y - 10 = 0$	Linear Equation with two Variables
$12x^2 + 4y^2 = 0$	Binomial Equations: The polynomial equations which has two terms is called as binomial equations
$x^{1/2} + 14 = 0$	Radical equation
$12x + 10y - 3z - 10 = 0$	Linear Equation with three Variables
$10xy + 23y - 2x = 0$	Trinomial Equation: a polynomial equation which has three terms is called as trinomial equations
$x/4 = (x+12)/12$	Rational Equation

Course Eight

Translation Game

Translation is a crucial step in acquiring and learning a new language. In order to facilitate this operation for the students of English for Specific purposes, a translation game is proposed. By the end of this practical, self-developed course, students will be able to know the terminological equivalent of certain mathematical concepts that are often used while reading maths.

On Translation

This course is introduced in the form of an exercise. Certain necessary expressions (mostly used in mathematical operations/ classes) are given either in English or in French. Students have to guess the counterpart of each word, term, or expression in the other language.

NB. Two tables are given in this course. The first one can be printed for the practice; whereas the second presents the keys.

Français	English	Symbol/ Example
Additionner	………………………………..	………………………………..
Algorithme	………………………………..	………………………………..
………………………………..	Left bracket	………………………………..
………………………………..	Right braket	………………………………..
………………………………..	Curly braket	………………………………..
Différence	………………………………..	………………………………..
Diviser	………………………………..	………………………………..
………………………………..	Divisor	………………………………..
………………………………..	Greatest common divisor (gcd)	………………………………..
………………………………..	Least common multiple (lcm)	………………………………..
Nombre pair	………………………………..	………………………………..
Nombre impair	………………………………..	………………………………..
………………………………..	Pair	………………………………..
Deux à deux	………………………………..	………………………………..
Premier entre eux	………………………………..	………………………………..
………………………………..	Remainder	………………………………..
………………………………..	Index	………………………………..
………………………………..	Multi-index	………………………………..

Racine simple	………………………………..	………………………………..
Racine double	………………………………..	………………………………..
Racine triple	………………………………..	………………………………..
Racine multiple	………………………………..	………………………………..
Racine de multiplicité m	………………………………..	………………………………..
………………………………..	Left hand side (L.H.S)	………………………………..
………………………………..	Right hand side (R.H.S)	………………………………..
Solution	………………………………..	………………………………..
Résoudre	………………………………..	………………………………..
Coefficient	………………………………..	………………………………..
………………………………..	Belong to	………………………………..
………………………………..	Provided that	………………………………..
………………………………..	Disjoint from	………………………………..
Application	………………………………..	………………………………..
Application bijective	………………………………..	………………………………..
Application injective	………………………………..	………………………………..
Application surjective	………………………………..	………………………………..
………………………………..	Argument	………………………………..
………………………………..	Assumption	………………………………..
………………………………..	Concept	………………………………..
Conclusion	………………………………..	………………………………..
Condition	………………………………..	………………………………..
Une condition nécessaire et suffisante	………………………………..	………………………………..
………………………………..	Boundary condition	………………………………..
………………………………..	Initial condition	………………………………..
………………………………..	The complex conjugate of….	………………………………..

Keys: ☐ **Each student should give his/her own examples (differ from one to another)**

Français	English	Symbol/ Example
Additionner	add	(+) plus
Algorithme	algorithm	Sequence of operations
Parenthèse à gauche	Left bracket	(
Parenthèse à droite	Right braket	)
Accolade	Curly braket	{
Différence	difference	x-y= z (z is the difference)
Diviser	divide	/
Diviseur	Divisor	
Plus grand commun diviseur	Greatest common divisor (gcd)	
Plus petit commun multiple	Least common multiple (lcm)	
Nombre pair	Even number	If it is divided by 2
Nombre impair	Odd number	If it is not
Couple	Pair	
Deux à deux	Pairwise (comparison par pair)	
Premier entre eux	Relatively prime	
Reste	Remainder	
Indice	Index	
Multi-indice	Multi-index	
Racine simple	Simple root	K= 1: r
Racine double	Double root	K= 2: r
Racine triple	Tripple root	K= 3: r
Racine multiple	Multiple root	K> 1: r
Racine de multiplicité m	Root of multiplicity m	
Terme de gauche	Left hand side (L.H.S)	
Terme de droite	Right hand side (R.H.S)	
Solution	Solution	
Résoudre	Solve	
Coefficient	Coefficient	
Appartenir à	Belong to	
À condition que	Provided that	
Disjoint de	Disjoint from	
Application	Map/ mapping	
Application bijective	Bijective map	
Application injective	Injective map	
Application surjective	Surjective map	
Argument	Argument	
Hypothèse	Assumption	
Notion	Concept	
Conclusion	Conclusion	
Condition	Condition	
Une condition nécessaire et suffisante	A necessary and sufficient condition	
Condition au bord	Boundary condition	
Condition initiale	Initial condition	
Le conjuguer…	The complex conjugate of….	$\overline{1-2\iota}$

Needed Skills

The coming courses are meant to develop skills for English students in general. They include:

- **Grammar**
- **Written production**
- **Reading comprehension**
- **Oral expression**

Course Nine

Needed (1)

Grammar

Objectives

This course aims at:

1. Understanding basic sentence structure by knowing its components

2. Getting to know the different types and tenses of verbs in English

Needed (1)

Grammar

Part One: Sentence Elements

A sentence is a group of words that are generally known as units or elements. They are mainly: Subject (S), Verb (V), Object (O), Complement (C), and Adverbial (A).

e.g. I/ study/ mathematics/ everyday. She/ is/ a mathematician.
S V O A S V C

The subject is the doer of the action. It can be one word or many. It can refer to a person (name or pronoun) or a thing.

The verb refers to the action or the state itself. It can be one word or a phrase (stem+ preposition). It reflects what subjects do and what happen to them.

The object is (structurally) the word and (pragmatically) the thing on which the action has happened. It can be a word or a phrase which serves to complete the meaning and the structure of the sentence. Objects are generally known as receivers of actions; and there are two types of objects in English:

- Direct object (O^D) e.g. We/ are solving/ an equation.
  S V Od
- Indirect object (O^I) e.g. she/ gave/ the teacher/ a solution.
  S V Oi Od

The difference between the two is that the direct object is the first receiver of the action; however, the indirect object is the second receiver of the same action expressed by the verb of the sentence.

The complement is a word that comes after a linking verb/ becoming verb and provides additional information about either the subject or the object. Therefore, there arise two types of complements:

-Subject complement: when it gives information about the subject.

e.g. the mathematician/ is/ a scientist
S V Cs

-Object complement: when it gives illustrations to the object.
e.g. mathematics/ makes/ students/ intelligent thinkers.
S V Od Co

The adverbial is a word or words containing an adverb of either place, time or manner.

e.g. They work everyday (time); They work in the laboratory (place); They work slowly (manner).

Activity One: Reorder each of the following word groups to form meaningful sentences then label the elements

1- her- her- made- daughters- their- have- model

2- you- before- have- there- been

3- can- all- their- they- tomorrow- work- perfectly- perform

4- increasingly- economics- course- has- at- an- become- university- popular

Solution:

1. Her daughters have made her their modal
2. Have you been there before?
3. They can perform their work perfectly tomorrow.
4. Economics has become an increasingly popular course at university.

Activity Two: Identify the function of the underlined words in the following sentences

1. Worrying is pretty inefficient, most of the time. ……………
2. Mary is a pretty girl. ……………
3. Pretty girls often do not care too much about being complemented. …………..
4. Let the pretty girl living inside you, be confident. …………
5. Smiling makes you look prettier. ……………
6. Remaining positive gives the person a pretty feeling of happiness. …………

Keys:

1.A 2.. C S 3. S. 4.DO 5. CO 6. DO

<u>Activity Three:</u> Divide the following sentences into their constituent parts and label each part.

1-Alice was getting tired.

2-The students over there are studying English.

3-President Roosevelt ordered the evacuation.

4-After many years of study, both of my daughters became professionals.

5-John offered Sarah an expensive ring.

<u>Keys:</u>

1. S/ V/ O 2.. S/ A/ V/ O 3. S/ V/ O 4. A/ V/ Cs 5. S/ V/ Oi/ Od.

Part Two: Verbs

In English, there are two classes of verbs including auxiliaries and lexical/ main verbs.

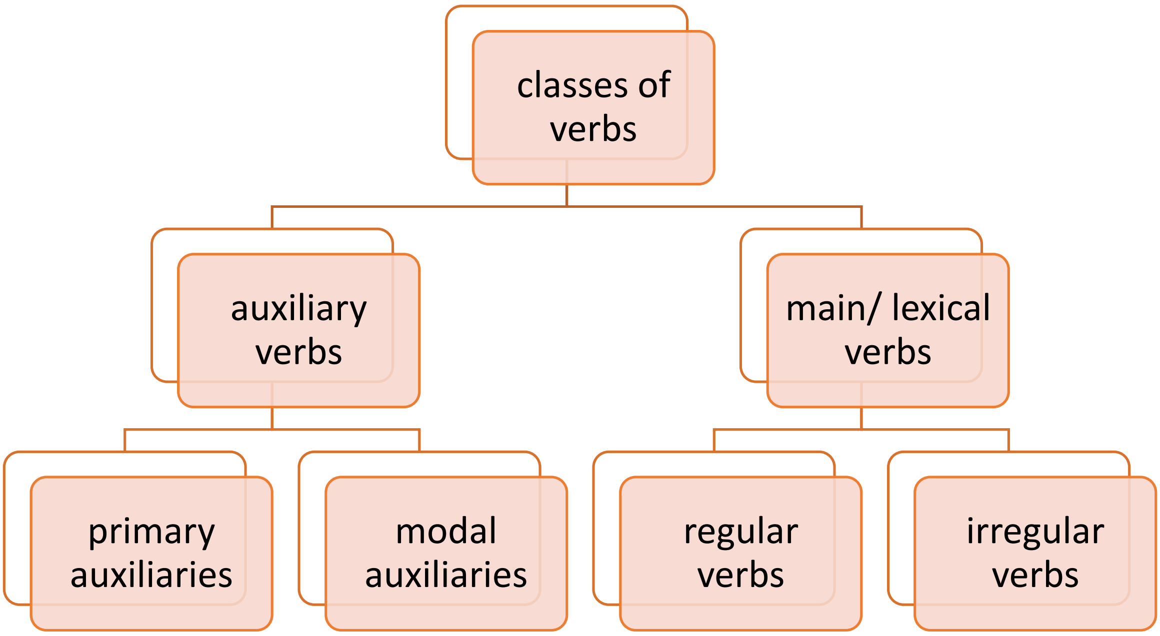


Figure: Diagram representing classes of verbs

Auxiliary verbs are mainly divided into two categories:

Primary auxiliaries: be, have, do

Modal auxiliaries: can, could, may, might, must, shall, should, ought to, will, would, need, dare, used to.

Lexical verbs are the main verbs other than auxiliaries, e.g. to count, to solve, to calculate. They are divided into two groups including regular and irregular classes. Whereas the first category refers to verbs that do not change when conjugated, the latter involves the verbs that show some/ radical changes when put in the past or participle.

<table>
<tr><th>Subject</th><th>Present simple</th><th>Past simple</th><th>Future simple</th></tr>
<tr><td>I</td><td rowspan="4">stem</td><td rowspan="5">Stem+ ed</td><td rowspan="5">Will+ verb</td></tr>
<tr><td>You</td></tr>
<tr><td>We</td></tr>
<tr><td>They</td></tr>
<tr><td>He/ she/ it</td><td>Stem+ s</td></tr>
</table>

Verb form	Infinitive	Past simple	Past participle	Present participle	's' form in the present
Regular	calculate	calculated	calculated	calculating	calculates
Irregular	write	wrote	written	writing	writes

Subject	Present participle	Present continuous (to be in present+ v+ing)	Past continuous (to be in past + v+ing)
I	V+ ing	am+ v+ing	was+ v+ing
you		are+ v+ing	were+ v+ing
we		are+ v+ing	were+ v+ing
they		are+ v+ing	were+ v+ing
He/ she/ it		is+ v+ing	was+ v+ing

Subject	Past participle	Present perfect (have in present+ v+ed)	Past perfect (have in past + v+ed)
I	V+ ed	have+ v+ed	had+ v+ed
you		have+ v+ed	had + v+ed
we		have+ v+ed	had + v+ed
they		have+ v+ed	had + v+ed
He/ she/ it		has+ v+ed	had + v+ed

Activity: Conjugate some verbs of your choice and put them in different tenses and then in different sentences.

Here are some examples

Verb	Present simple	Past simple	Present perfect	Past perfect	Present continuous	Past continuous
To dance	**Dance/ s/he/it +s**	**danced**	**Have/has danced**	**Had danced**	**Am/ is/ are dancing**	**Was/ were dancing**
To eat	**Eat/ eats s/he/it +s**	**ate**	**Have/has eaten**	**Had eaten**	**Am/is/are eating**	**Was/were eating**
To walk	**Walk/ walks**	**walked**	**Have/has walked**	**Had walked**	**Am/is/are walking**	**Was/were walking**
To write	**Write/ writes**	**wrote**	**Have/has written**	**Had written**	**Am/is/are writing**	**Was/were writing**

Course Ten

Needed (2)

Written Production

Objectives

This course aims at developing the students' writing skill in addition to:

1. Knowing the structure of a paragraph

2. Knowing the structure of an essay

3. Transform the theoretical information into practice and writing one's own coherent paragraphs and essays

Needed (2)

Written Production

How to write a paragraph?

One of the most important skills in learning a foreign language is writing. Actually, writing does not only entail knowing vocabulary, but also how to bring those lexical items into more coherent syntactic structures. Then, after managing a correct grammatical sentence, one will be able to construct a longer block which is generally known as a paragraph.

Conventionally speaking, a paragraph is a set of sentences linked to advocate one single idea. In other words, any paragraph should deal “only” with one main topic. Structurally, paragraphs are generally formed by a topic sentence, supporting sentences, and a concluding sentence.

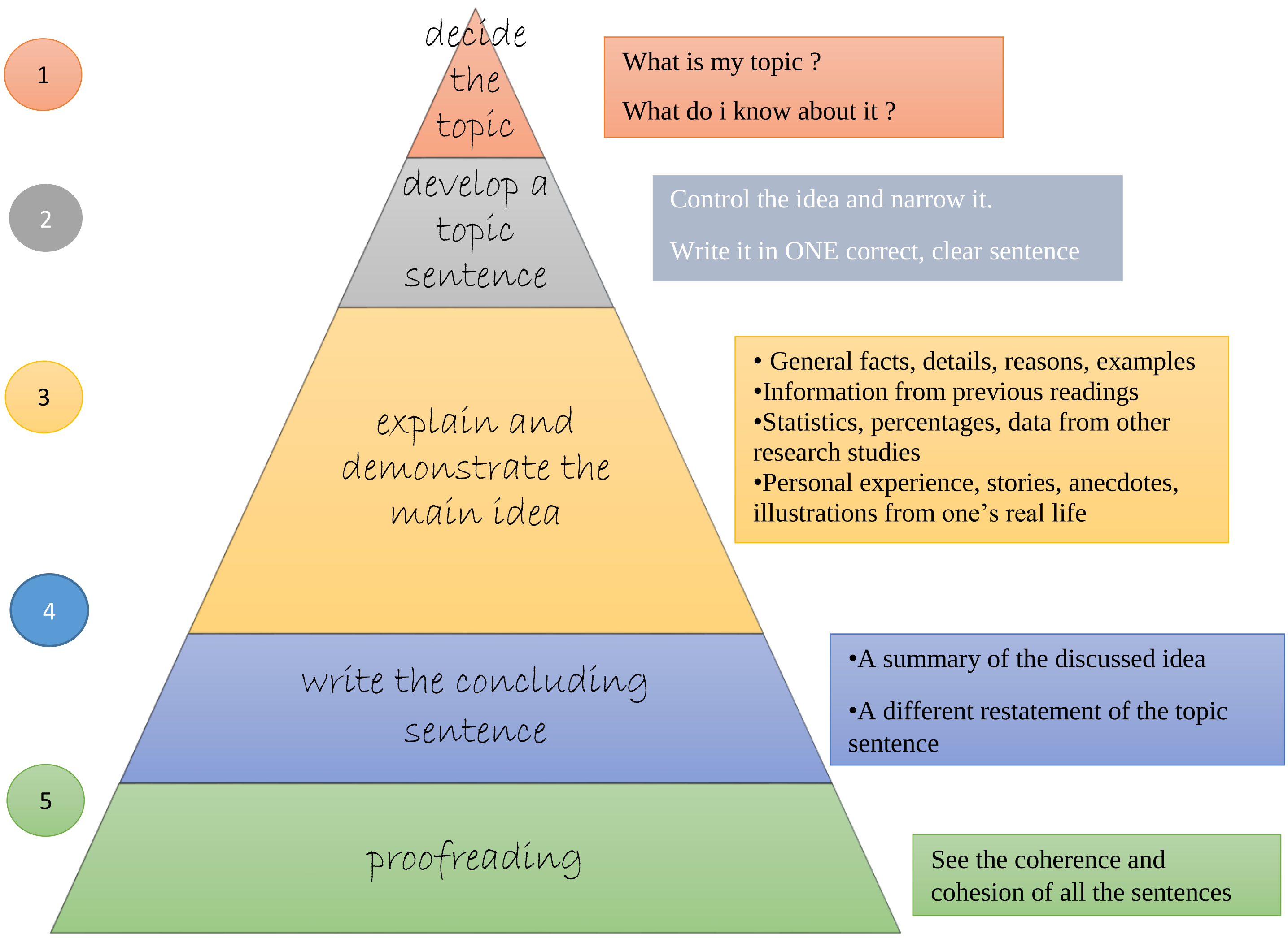
The topic sentence is always the first sentence in the paragraph. It tells the reader about what the subject matter of this block is about. For example, if one wants to talk about how they spent their summer holidays in a paragraph, their first sentence must something like *“During this summer, I have chosen to travel with my family”* or *“In these holidays, I preferred to stay home for my thesis preparation”*, etc. Interestingly, we notice that these two examples of sentences work as an opening of the paragraph and tell us about its main topic which is summer holidays (in this example).

The supporting sentences are the sentences that come after the topic sentence of the paragraph. They come in a sequence that gives more details about the main topic. Those details can be explanations, illustrations, examples, and related information that support the topic treated. For example, if we want to carry on talking about the first idea (1^{st} topic sentence), certain expressions can be used as *“My family and I have decided to which country to go first… we have chosen Tunisia as a former destination… we prepared ourselves to go to many places there and enjoy our time together…”* As we notice, those sentences came as a sequence of ideas that explain and support the topic sentence. To make the paragraph more cohesive, some words can be used to link those sentences as: in fact, additionally, moreover, for example, however, in addition to that… Numeration can also be helpful in the organisation of ideas like first, second, third, etc.

The concluding sentence is the last sentence of the paragraph. It functions as a closing to all what has been explained in the supporting sentences. It is, most of the time, equivalent to the topic sentence as it reminds the reader about the main topic, but different words must be used. For example, a possible concluding sentence to the first example can be *"It was a great summer/ I loved Tunisia very much."* Some linking words can be used to indicate that this is the last sentence such as: finally, so, to conclude, to sum up, etc.

Activity: Select a topic and write a coherent paragraph about it

Keys:



How to write an essay?

What is an essay?

The essay is a group of paragraphs that talk about one main topic. It is composed of many sections, and each has a specific role. Its important parts are mainly the introduction, the body, and the conclusion.

I. Introduction

The introduction is the first paragraph of any essay. This part works as a prelude to the topic. It starts from general to specific in order to attract the reader's attention. Sometimes, the writer can start with some background information about the topic in three to five sentences. Those information need to become gradually more specific leading to the main idea of the essay which is expressed in the introduction's last sentence.

The last sentence of the introduction is called **the thesis statement.** This sentence states the main idea of the essay and which main points are going to be further discussed in the coming paragraphs. It tells how we are going to proceed within the body, i.e., whether it is a comparison, an analysis, a narration, etc. Sometimes, we can deduce the number of paragraphs (of the body) just through the thesis statement.

II. Body

This part consists of a set of paragraphs; each dealing with a subpart of the main idea of the whole essay. In other words, the first sub-idea has to be discussed in one paragraph; the second in another, and so forth. For example, if one wants to talk about the countries of North Africa, they have to dedicate one paragraph for Morocco, one for Algeria, another for Tunisia, Egypt and so forth. If a writer wants to discuss the different sets of numbers, s/he has to mention each set in a separate paragraph.

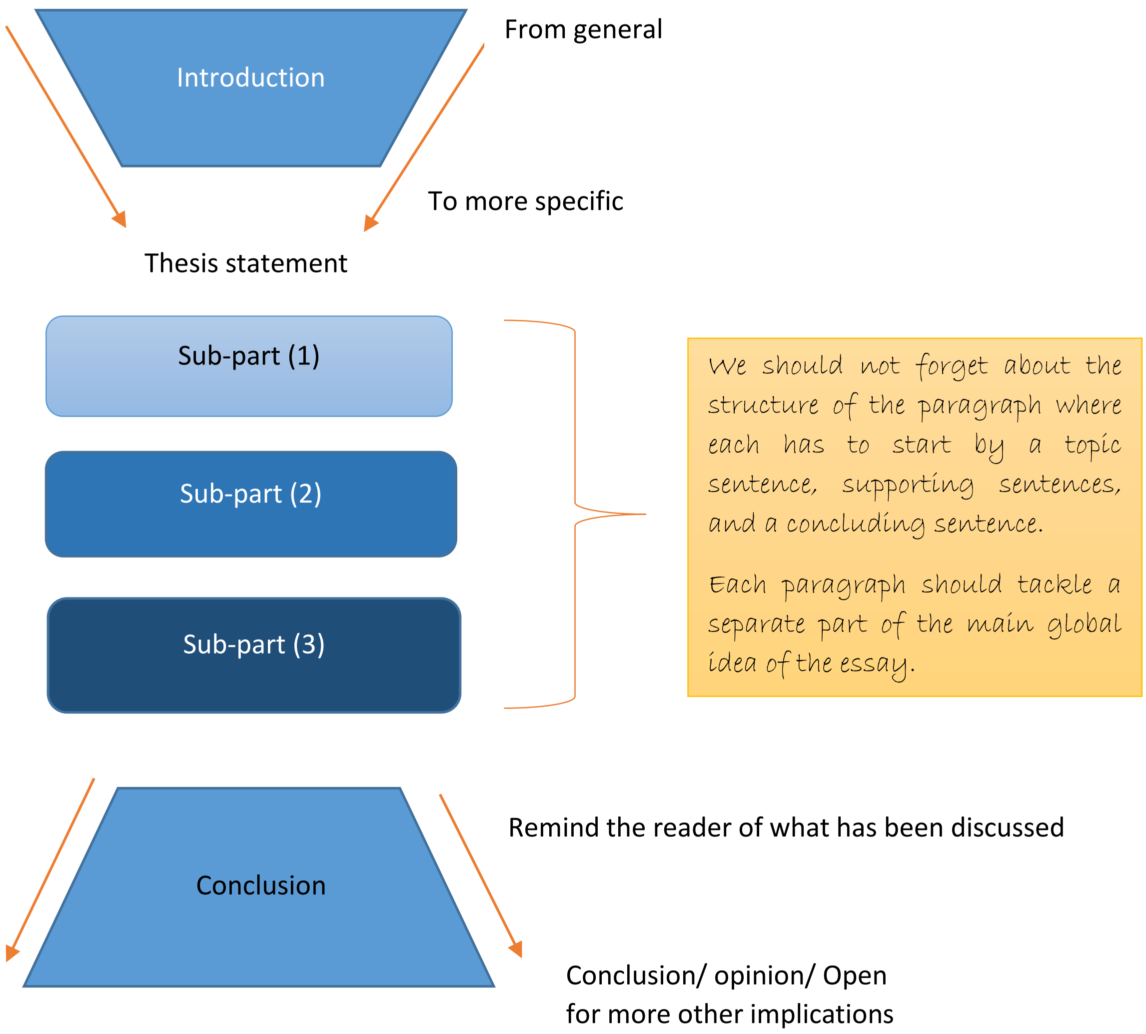
The structure of these paragraphs differs from one writer to another as we can start by a definition and carry on with explanations and details through examples and explanations. The paragraphs should have a link first in meaning by not bringing irrelevant situations or illustrations, and second in structure where the last sentence has to be a transition from a paragraph to the next one.

III. Conclusion

The last paragraph in an essay is the conclusion. It functions as the closing door of all what has been discussed in the body. Most of time, the conclusion refers to the thesis statement in addition to summarizing the main points. It can also be a solution, an opinion or an implication. New ideas are preferably not to be mentioned here. Expressions like: finally, to sum up, as a conclusion, in a nutshell, etc. can be used at the beginning of the conclusion in order to show that this is the end of the essay.

Activity: Select a topic and write an essay on it

Keys: The following diagram can be helpful in the construction of an essay



Course Eleven

Needed (3)

Reading Comprehension

Objectives

This course aims at developing the reading skill in addition to:

1. Building fluency in reading texts in English.

2. Analysing and understanding general ideas of the texts.

3. Answering comprehension questions related to the studied texts.

Needed (3)

Reading Comprehension

Some Mathematical Methods

(Liaqat Ali Khan, 2015 “What is Mathematics- an Overview” -*revised*)

Mathematics is not only concerned with everyday problems, but also with using imagination, intuition and reasoning to find new ideas and to solve puzzling problems. One method used by mathematicians in discovering new ideas is to perform experiments. This is called the "experimental method" or "inductive reasoning". When a scientist takes a large number of careful observations and from them infers some probable results or when he repeats an experiment many times and from these data arrives at some probable conclusion, he is using inductive reasoning. That is to say, from a large number of specific cases he obtains a single general inference.

The other method is based on reasoning rather than on experiments or observations. This is called "deductive reasoning". When a mathematician begins with a set of acceptable conditions, called the hypothesis and by a series of logical implications reaches a valid conclusion, he employs deductive reasoning. The major difference in the two methods is implied in the two words: “probable” with respect to inductive reasoning and `valid' relative to deductive reasoning. For example, if we perform an experiment successfully say a thousand times, then another twenty successful trails would lend credence to the result, but we have no assurance whatever that the experiment will not fall on the very next trail. On the other hand, in a deductive system, once we accept the hypothesis, the validity of our conclusion is inevitable provided each implication in the reasoning process is a logical consequence of what which proceeds it. Here "consistency" of a logical system means that no theorem of the system contradicts another and "validity" means that the system's rules of proof never allow a false inference from true premises.

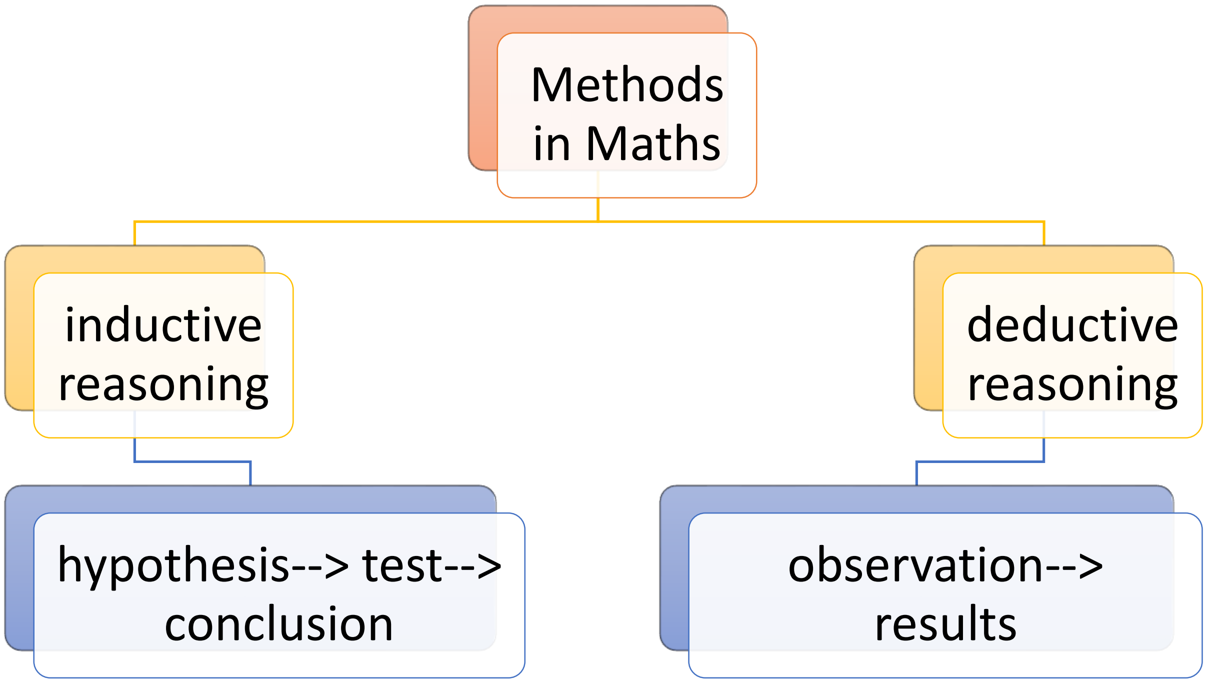
Reading Comprehension Questions:

1. What is the general idea of the text? Justify your answer by examples.
2. Give the sub-ideas of each paragraph.
3. Draw the difference between the two discussed methods.
4. Can you give concrete examples for each method of reasoning in mathematics?

Keys:

After <u>reading</u> the passage many times, it is necessary to deal with each sentence and see <u>vocabulary challenges</u> faced by the learners.

1. The text speaks about the different methods of reasoning in mathematics, i.e., how to arrive to certain conclusions.
2. The first paragraph deals with "inductive reasoning"/ the experimental method, whereas the second paragraph deals with "deductive reasoning".
3. An illustrative diagram of the text



4. Some examples:

Example of induction:

If: A=B (apple= fruit)

And, C=A (granny smith= apple)

Then, C=B (granny smith= fruit)

The result is based on the pre-supposed logical assumption. Therefore, it is certain.

Example of deduction:

If one algerian talks about football, and another Algerian talks about football, we can assume that Algerians love talking about football. (which is just a temporary/ situational result).

The result is not certain since it is changeable from one environment to another. (It is only based on observation of certain circumstances).

The Fibonacci Sequence

(Nicolas Bacaër, 2011-*revised*)

Leonardo Pisa, named later as Fibonacci, was born in 1170 in the Republic of Pisa. At the age of twenty, he joined his father to learn trade for the sake of becoming a merchant. With time, Leonardo was so interested in mathematical issues as calculations, number systems and so forth. By 1202, he finished writing his book *"Liber abaci"* (Book of Calculation) in which he explains a lot of laws in number system especially with regard to accounting, currency exchange, weight, etc.

In this book, Fibonacci discussed what is today known as the population dynamics problem illustrating it with the example of rabbits. He started by asking the question:

> A certain man had one pair of rabbits together in a certain enclosed place. One wishes to know how many are created from the pair in one year when it is the nature of them in a single month to bear another pair and in the second month those born to bear also.

How many rabbits can one have at the end of the year? Given the idea that we have a newly born pair of rabbits at the beginning of the month, there is a fact that these rabbits will be able to give birth to others until after the second month. For this we have:

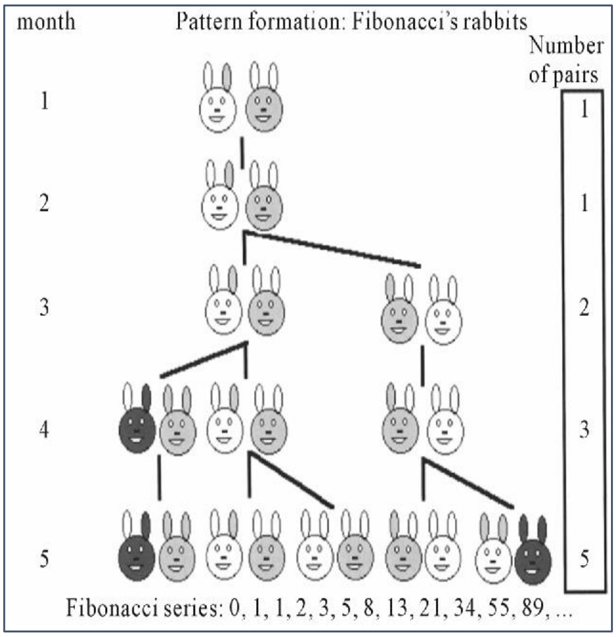
1) Pn be the number of pairs of rabbits at the beginning of month n.

2) The number of pairs of rabbits $Pn+1$ in month $n+1$ is the sum of the number Pn of pairs in month n and of the number of newborn pairs in month $n+1$.

3) However, only the pairs of rabbits that are at least two months old give birth to new pairs of rabbits in month $n+1$. These are the pairs that were already there in month $n-1$ and their number is $Pn-1$.

$$\Rightarrow Pn+1 = Pn+Pn-1.$$

This is a recurrence relation: it gives the population in month $n+1$ as a function of the population in the previous months. Hence Fibonacci could easily build the following diagram, where 1+1 = 2, 1+2 = 3, 2+3 = 5, 3+5 = 8, etc.



This book, and others, have not been published until after Leonardo's death. Many authors have found the same mathematical results in models on population dynamics. However, many questions have to be asked with regard to the application of this hypothesis in biology especially with issues of illness, death, separation of sexes, etc.

Reading Comprehension Questions:

1. What is the general idea of the text?
2. What did you know about Fibonacci? Illustrate from the text.
3. In your own words, give a simple definition of the discussed hypothesis.
4. Give an attempt and calculate the number of rabbits at the end of the year.
5. Draw the results on a table.

Keys:

1. The text talks about the famous Fibonacci Sequence.
2. I knew new information such as: his real name, date and place of birth, academic works etc.
3. The Fibonacci sequence is a mathematical hypothesis that was introduced by Leonardo Pisa in his Book of Calculation. It was mainly taken from the issue of population dynamics where he took the rabbits as an example.
4. Calculating the possible number of rabbits by the application of the Fibonacci sequence:

January: **1** pair (not mature)
February: (getting fertile) still **1**
March: (giving birth) 1+1 = **2** (one plus one equals two)
April: 1+2 = **3** (one plus two equals three)
May: 2+3 = **5** (two plus three equals five)
June: 3+5 = **8** (three plus five equals eight)
July: 5+8= **13** (five plus eight equals thirteen)
August: 8+13= **21** (eight plus thirteen equals twenty one)
September: 13+21= **34** (thirteen plus twenty one equals thirty four)
October: 21+34= **55** (twenty one plus thirty four is equal to fifty five)
November: 34+ 55= **89** (thirty four plus fifty five is equal to eighty nine)
December: 55+89= **144** (fifty five plus eighty nine equals one hundred forty four)

5. Number of rabbits at the end of the year can be illustrated as follows:

n	1	2	3	4	5	6	7	8	9	10	11	12	13
Pn	1	1	2	3	5	8	13	21	34	55	89	144	233

n refers to the number of month

Pn refers to the numbers of rabbits per the indicated month

Course Twelve

Needed (4)

Oral Expression

Objectives

This course aims at:

1. **Pushing students to express themselves in English**
2. **Knowing how to make a good presentation in public**

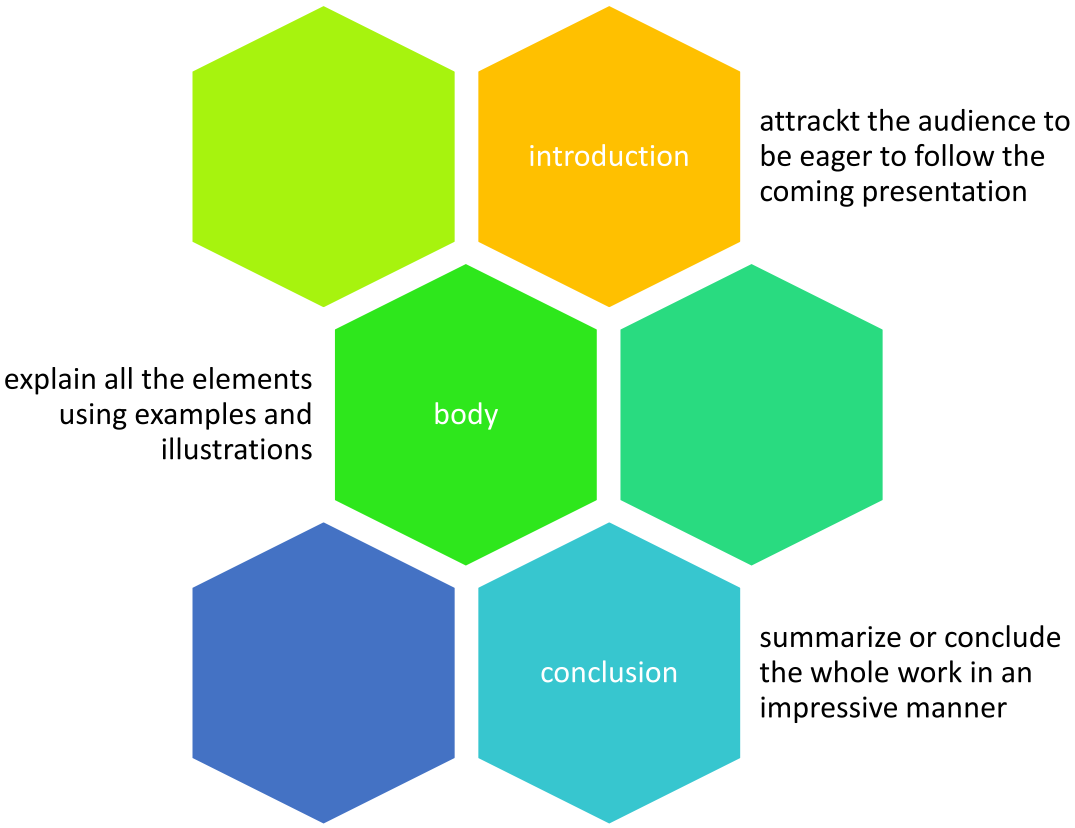
Needed (4)

Course: Oral Expression

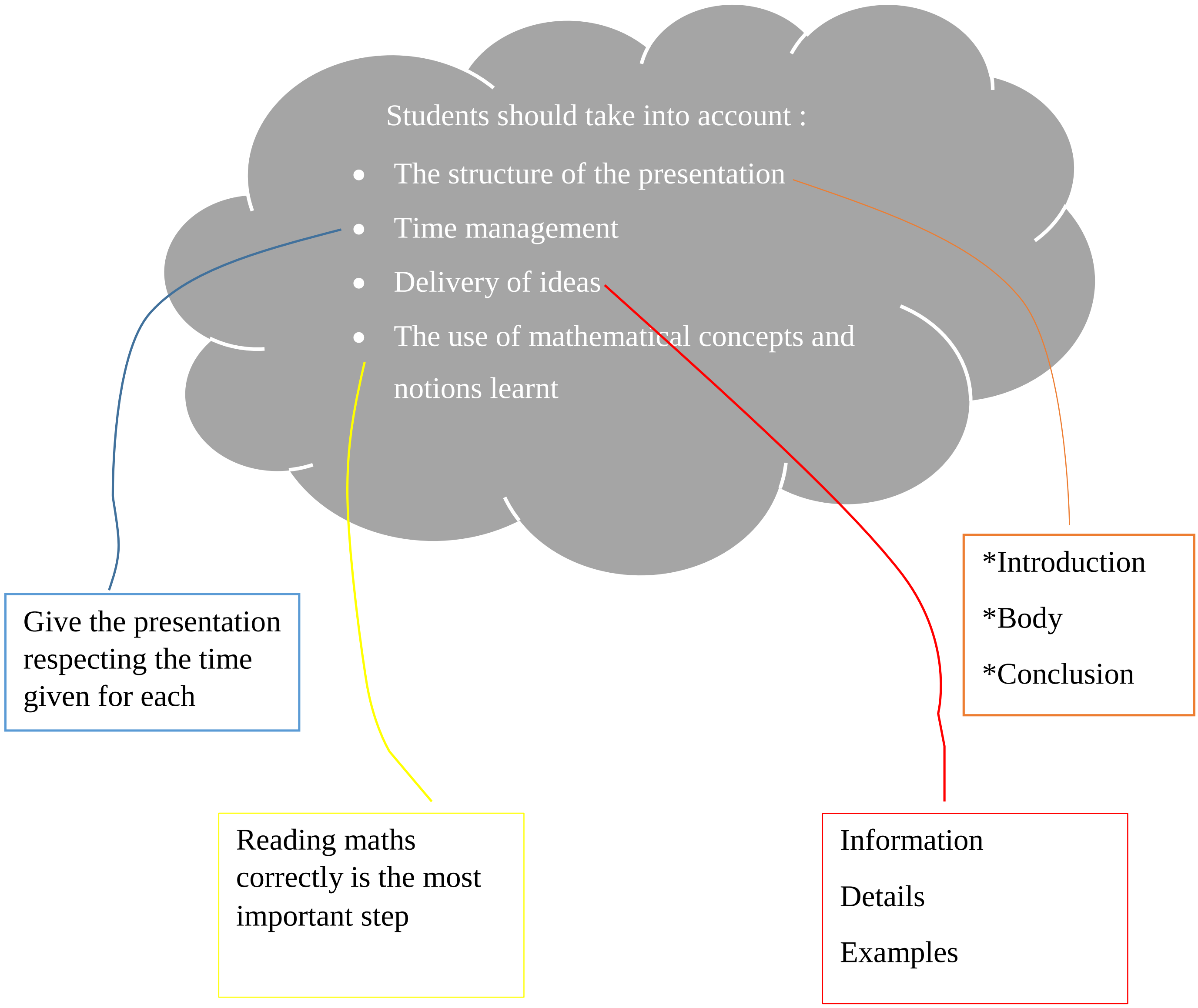
Facing the audience and talking in a foreign language is one of the most difficult operations that a student may encounter. However, it is a compulsory activity in both the process of learning as well as enriching and developing one's career. For these reasons, oral expression is a must in foreign language learning in general and learning English for specific purposes in particular. In the period devoted to this activity, students are asked to express themselves in English and ONLY ENGLISH.

How to make a good presentation?

As seen in the lecture of *'essay writing'*, making a presentation relies on a similar procedure. In other words, there must be a structure in one's presentation which is based on: introducing the topic, developing the ideas, and a final conclusion. Although the structure is almost always the same, students/ presenters may vary in their oral delivery especially with regard to how to enter and proceed into the topic.



- **Assignment One:** prepare a topic of your choice to present in five (5) minutes.
- **Assignment Two:** develop your previous presentation by adding more examples and illustrations; then explain it in the board (around 15 minutes).
- **Assignment Three:** by giving reference to books and articles, give a presentation on a scientific topic (related to mathematics as a discipline) and talk about it in 30 minutes (technological devices, such as the data-show, are allowed).



Exam sample

Exercise One (5 pts): Put a tick (√) in the right answer

1	$e^{\pi i} = -1$ **is read as:**
	e to the power of *pi i* equals minus one.
	e power *pi* to the *i*-th power equals minus one.
	e powers *pi i* equal the minus first.
2	$\overline{1-2i} = 1+2i$ **is read as:**
	One minus two *i* the complex conjugated equals one plus two *i*.
	One minus two *i*-s powers the complex conjugated equals one plus two times *i*.
	The complex conjugate of one minus two *i* equals one plus two *i*.
3	$x^n + y^n = z^n$ **is read as:**
	xn plus *yn* equalling *zn*.
	x to the *n* plus *y* to the *n* equals *z* to the *n*.
	x to the *n*-th plus *y* to the *n*-th equals the *z* times *n*.
4	$\sum_{i=0}^{n} 0^{aix^{i}}$ **is read as:**
	Summation *i* to *n* equals zero to the *ai xi*.
	Sum of *i* ranging from zero to *n* of *ai* times *xi*.
	Sum of over *i* ranging from zero to *n* of *ai* time *x* to the *i*.
5	**3/5= 0.6 is read as:**
	Three divides the five equals zero point six.
	Three divided by five equals zero point six.
	Three divide five is equal to six.
6	$A \cap B = \emptyset$ **is read as:**
	The intersection of A plus B is empty.
	A and B running to empty set.
	The empty set is not of belonging to the A and to the B.
7	***L'application surjective*** **is translated as:**
	Surjective map.
	Subjective map.
	Surjective application.
8	***A necessary and sufficient condition*** **is translated as:**
	Une conclusion nécessaire et suffisante.
	Une condition nécessaire et suffisante.
	Un argument nécessaire et suffisant.
9	***Satisfy property P*** **is translated as:**
	Satisfaire la propriété *P*.
	Satisfaction *P*.
	Vérifier la propriété *P*.
10	***Appartenir à*** **is translated as:**
	Belang to.
	Bilong to.
	Belong to.

Exercise Two (5 pts): Say whether these statements are *true* or *false*. *Correct* the wrong ones.

1- Two integers *a*,*b* are congruent modulo a positive integer *m* if they have a different remainder when divided by *m*.

………

2- *gcd* refers to the greatest common difference.

………

3- An integer $n>1$ is a prime number if it cannot be written as a product of two integers $a,b>1$.

………

4- The multiples of a positive integer a are the numbers $-a$, $-2a$, $-3a$, $-4a$,…

………

5- If b is a multiple of a, we say that b divides a.

………

Exercise Three (4 pts): Solve the following mathematical problematic and write the English translation in front of each mathematical sentence in the solution.

Problematic: $\boldsymbol{y = 7x^3 - 14}$ → y equals seven times …………… ………………………………

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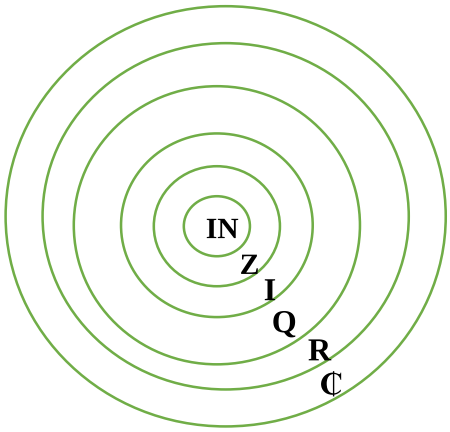
Exercise Four (6 pts): In a coherent paragraph, comment on the following diagram after giving it a title.

Title: ……………………………………………………………………



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Level: -----

Groups: Bio-maths, Proba, EDP

EXAM CORRECTION

Exercise One (5 pts): Put a tick (√) in the right answer

1	$e^{\pi i} = -1$ **is read as:**	**0.5 pts**
√	*e* to the power of *pi i* equals minus one.	
	e power *pi* to the *i*-th power equals minus one.	
	e powers *pi i* equal the minus first.	
2	$\overline{1-2i} = 1+2i$ **is read as:**	**0.5 pts**
	One minus two *i* the complex conjugated equals one plus two *i*.	
	One minus two *i*-s powers the complex conjugated equals one plus two times *i*.	
√	The complex conjugate of one minus two *i* equals one plus two *i*.	
3	$x^n + y^n = z^n$ **is read as:**	**0.5 pts**
	xn plus *yn* equalling *zn*.	
√	*x* to the *n* plus *y* to the *n* equals *z* to the *n*.	
	x to the *n*-th plus *y* to the *n*-th equals the *z* times *n*.	
4	$\sum_{i=0}^{n} 0^{aix^i}$ **is read as:**	**0.5 pts**
	Summation *i* to *n* equals zero to the *ai xi*.	
	Sum of *i* ranging from zero to *n* of *ai* times *xi*.	
√	Sum of over *i* ranging from zero to *n* of *ai* time *x* to the *i*.	
5	**3/5= 0.6 is read as:**	**0.5 pts**
	Three divides the five equals zero point six.	
√	Three divided by five equals zero point six.	
	Three divide five is equal to six.	
6	$A \cap B = \emptyset$ **is read as:**	**0.5 pts**
√	The intersection of A plus B is empty.	
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	Une conclusion nécessaire et suffisante.	
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	Satisfaire la propriété *P*.	
	Satisfaction *P*.	
√	Vérifier la propriété *P*.	
10	***Appartenir à*** **is translated as:**	**0.5 pts**
	Belang to.	
	Bilong to.	
√	Belong to.	

Exercise Two (5 pts): Say whether these statements are *true* or *false*. *Correct* the wrong ones.

1-Two integers *a,b* are congruent modulo a positive integer *m* if they have a different remainder when divided by *m*.

- **FALSE** → Two integers *a,b* are congruent modulo a positive integer *m* if they have the same remainder when divided by *m*. **1 pts**

2- *gcd* refers to the greatest common difference.

- **FALSE** → gcd refers to the greatest common diviser. **1 pts**

3- An integer *n*>1 is a prime number if it cannot be written as a product of two integers *a,b*>1.

- **TRUE** **1 pts**

4- The multiples of a positive integer *a* are the numbers -*a*, -2*a*, -3*a*, -4*a*,…

- **FALSE** → The multiples of a positive integer *a* are the numbers *a, 2a, 3a, 4a,…* **1 pts**

5- If *b* is a multiple of *a*, we say that *b* divides *a*.

- **FALSE** → If *b* is a multiple of *a*, we say that *a* divides *b* **1 pts**

Exercise Three (4 pts): Solve the following mathematical problematic and write the English translation in front of each mathematical sentence in the solution.

Problematic: $y = 7x^3 - 14$ → y equals seven times x cubed minus fourteen **1 pts**

Rearranging Equations

► Suppose you are given the equation: $y = 7x^3 - 14$ and you are asked to solve for x.

To solve for x, you need to isolate x on one side of the equation. To do so, you need to perform the order of operations in reverse (i.e., as opposed to BEDMAS, it becomes SAMDEB). In addition, you need to apply the inverse operations to eliminate other variables and/or constants.

	$y = 7x^3 - 14$	add 14 to both sides
0.25 pts	$y + 14 = 7x^3 - 14 + 14$	simplify
	$y + 14 = 7x^3$	divide by 7 on both sides
0.25 pts	$(y + 14) / 7 = 7x^3 / 7$	simplify
0.25 pts	$(y + 14) / 7 = x^3$	take the cube root of both sides
	cube root $[(y + 14) / 7]$ = cube root $[x^3]$	simplify
0.25 pts	cube root $[(y + 14) / 7] = x$	

0.5 pts On each reading

<u>Keys:</u>

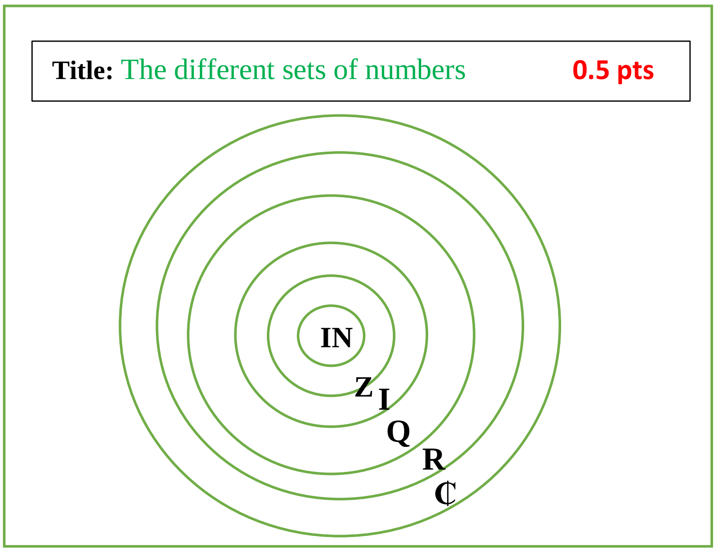
Minus/ plus fourteen

Cubic *x* vs. *x* cubed vs. *x* to the 3d power

The whole over seven

Solution (equals *x* or *x* equals …)

Exercise Four (6 pts): In a coherent paragraph, comment on the following diagram after giving it a title.



Answer

1. **Naming the sets:**

N = The set of Natural numbers 0.25 pts

C = The set of Complex numbers 0.25 pts

Z = The set of Integers 0.25 pts

R = The set of Real numbers 0.25 pts

I = The set of Irrational numbers 0.25 pts

Q = The set of Rational numbers 0.25 pts

2. Techniques of paragraph writing

0.5 pts → topic sentence of the paragraph

0.5 pts → concluding sentence of the paragraph

1 pts → grammar

2 pts → information & meaning

References

1. Chang L. A. (1983). Handbook for Spoken Mathematics (Larry's Speakeasy). University of California.
2. Hall P. (2002). Reading Mathematics.
3. Liaqat A. K. (2015). What is Mathematics- an Overview: International Journal of Mathematics and Computational Science. Vol. 1, No. 3, 2015, pp. 98-101
4. Nekovàr J. (2011). Mathematical English (a brief summary). University of Paris 6: Paris.
5. Nicolas B. (2011). A Short History of Mathematical Population Dynamics. Springer: London.
6. No. author (2009). Useful Mathematical Symbols. International Journal of Mathematical Science Education. Vol. 2, No. 1, pp. 32- 36.
7. Oancea A., Maillot S., Mitschi C. (2007). Reading Mathematical Expressions. University of Louis Pasteur: Srasbourg I.
8. Sigler, L.E.: *Fibonacci's Liber Abaci*. Springer, New York (2002) books.google.com
9. http://mathematics.laerd.com/maths/indices-intro.php (January, 2019)
10. https://revisionmaths.com/advanced-level-maths-revision/pure-maths/algebra/indices (January, 2019)
11. https://www.toppr.com/guides/business-mathematics-and-statistics/business-mathematics/laws-of-indices/ (January, 2019)
12. https://www.mathsisfun.com/algebra/equations-solving.html (December, 2018)

About the author

Ms. Khadidja HAMMOUDI is an assistant teacher at the University of Tlemcen. She is interested in English for specific purposes and what can help students of scientific domains to develop their competence in the English language. She is actually undertaking research on Technical English methods of teaching at university.

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