THE FUNDAMENTAL ROLE OF ALGEBRA IN DAILY LIFE

Jyoti*

Open Scholar, Department of Mathematics
Jind, Haryana, India

***Email ID**: jyotimorptr@gmail.com*

Accepted: 08.10.2022 **Published**: 01.11.2022

Keywords: Real-life applications, Algebra, Daily life, Mathematics.

Abstract

To gain insight into the practical applications of Algebra in real-world scenarios. The use of mathematics in everyday life necessitates a comprehensive examination of the principles and applications of Algebra. In this study, we conducted a partitioning of things within a bag throughout the purchasing process. The study of Basic Algebra represents the application of algebraic concepts within the context of pre-algebra. The concepts imparted in this course will be applicable in all subsequent mathematics courses. We will provide an introduction to engaging topics such as graphing and solving complex equations. During our academic tenure, we engage in the study of Algebra and Geometry. In contemporary times, there has been significant advancement in the realm of social media. We are unable to answer the aforementioned visual riddles, hence we can employ algebraic equations to solve them.

Paper Identification

**Corresponding Author*

Introduction

Definition Of Algebra

Algebra is a discipline within the field of mathematics that focuses on the study of relations, operations, and their constructions. It serves as a fundamental component of mathematics and exhibits a wide range of practical applications in our daily existence. In addition to its inherent importance as a fundamental discipline within mathematics, Algebra plays a crucial role in fostering a comprehensive comprehension of several advanced fields of mathematics, including but not limited to Calculus, Geometry, and Arithmetic, among others, for students and young learners. Algebra is a mathematical discipline that use alphabetic symbols to represent unknown numbers or members of designated sets of numbers, therefore generalizing arithmetical operations and connections. The field of mathematics that pertains to the study of abstract formal structures, such as sets, groups, and so forth.

Algebra: A More Complete Definition

Algebra, derived from the Arabic phrase "al-jebr" denoting the act of reuniting fragmented elements, constitutes a field within mathematics that focuses on the examination of principles governing operations and relationships. Additionally, algebra encompasses the exploration of various constructs and ideas that emerge from these principles, such as terms, polynomials, equations, and algebraic structures.

Algebra Basics

When engaging in the study of Algebra, one will encounter a variety of fundamental mathematical concepts and terminology. Prior to delving into the comprehensive examination of Algebra, it is advisable to acquaint oneself with certain fundamental Algebraic terminologies.

Basic Terms

There is only one word of user input, and that is EQUATION. An equation is a statement used to indicate the equality of two mathematical expressions through the use of symbols (variables), numbers (constants), and mathematical operators (addition, subtraction, multiplication, and division). To show that the two sentences are equivalent, we use the symbol =, which can be read as is equal to.

Variable

A variable is a symbolic representation of a quantity within an algebraic statement. The value in question has the potential to fluctuate over time and across different dimensions of the problem at hand.

Example: In the equation 3X + 7 = 16, X is the variable.

Also in the polynomial $X^2 + 5XY - 3Y^2$, both X and Y is variables.

One, Two & Three Variable Equation

An equation that exclusively involves a single variable is referred to as a one-variable equation..

Example:3X + 7 = 16

An equation that involves two variables is known as a Two Variable Equation.

Example: 2X + Y = 10 is a Two Variable Equation of where X and Y are variables.

Note: In this scenario, both X and Y possess an exponent of 1. Therefore, the above equation can be classified as a linear equation with a degree of 1. The degree of a polynomial is determined by the largest power of the variable(s) present in the expression.

$X^2 + 5XY - 3Y^2 = 25$ is also an example of a Two Variable Equation of degree 2.

A mathematical expression consisting of three variables or symbols is referred to as a Three Variable Equation.

Example: x + y – z = 1 ------------- (1)

8x + 3y - 6z = 1 ------------- (2)

4x - y + 3z = 1 ------------- (3)

The aforementioned set of three equations constitutes a system of three equations involving three variables, namely X, Y, and Z. Each of these equations represents a system of three variables with a degree of 1. Additionally, the aforementioned equations are referred to as linear equations in three variables.

Monomial

A monomial can be defined as the result of multiplying together several powers of variables. A monomial in a univariate context can be expressed as xn, where X represents a variable and n is a positive integer. Monomials can also exist in several variables. An illustrative instance of a monomial in two variables is represented as xmyn, where m and n denote positive integers. Monomials have the property of being multiplicatively compatible with nonzero constant values. The expression $24x^2+y^5+z^3$ can be classified as a monomial in three variables, namely x, y, and z, with respective exponents of 2, 5, and 3.

Polynomial

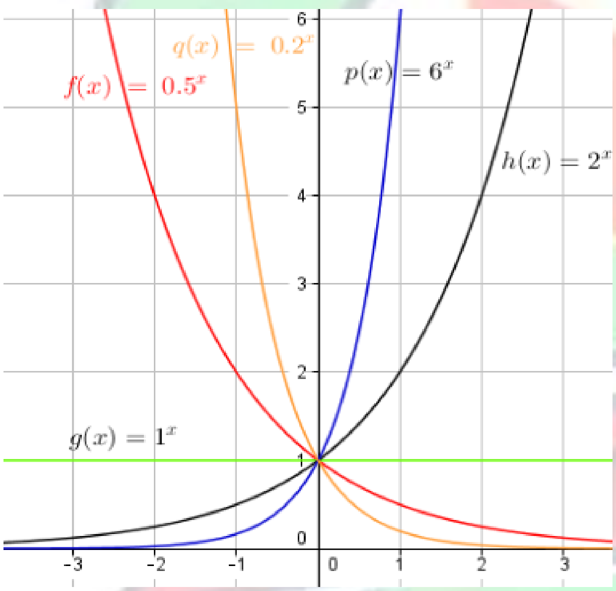
A polynomial is constructed from a finite collection of monomials that are interconnected by the operations of addition and subtraction. The rank of a polynomial is determined by the greatest degree monomial contained within the mathematical expression. The expression $2x^3 + 4x^2 + 3x - 7$ can be classified as a polynomial of degree 3 in a single variable. Polynomials can also be defined in several variables. The expression $x^3 + 4x^2y + xy^5 + y^2 - 2$ can be classified as a polynomial in the variables x and y.

Exponent

Exponentiation is a fundamental mathematical operation denoted as a^n, where a represents the base and n denotes the power, index, or exponent. It is important to note that n is a positive number. In the context of exponentiation, it can be stated that a numerical value is iteratively multiplied by itself, with the exponent serving as a representation of the quantity of multiplications performed.

- In a^3, a is multiplied with itself 3 times i.e. a x a x a.
- a^5 translates to a x a x a x a x a (a multiplied with itself 5 times).

The graph presented below illustrates the process of exponentiation over various values of bases denoted as 'a'.



Upon analyzing the graph, it can be inferred that the values smaller than one tend to converge towards zero as the exponent increases. Conversely, as the exponentiation index increases for numbers bigger than 1, the values of exponentiation go towards infinity. Thus far, all of the equations encountered exhibit a linear form. The primary distinction between the two categories of equations can be summarized as follows.

Types of equation

linear equations

- A basic linear equation can be expressed in the following format: y = mx + c.
- A linear equation exhibits a linear relationship and is visually represented as a straight line on a graph.
- The variable exhibits a consistent and unchanging rate of change.
- The degree of a linear equation is invariably 1.
- The principle of superposition can be used to a system that is characterized by a linear equation.
- The output of a linear system exhibits a direct proportionality to its input.

Non-Linear Equations

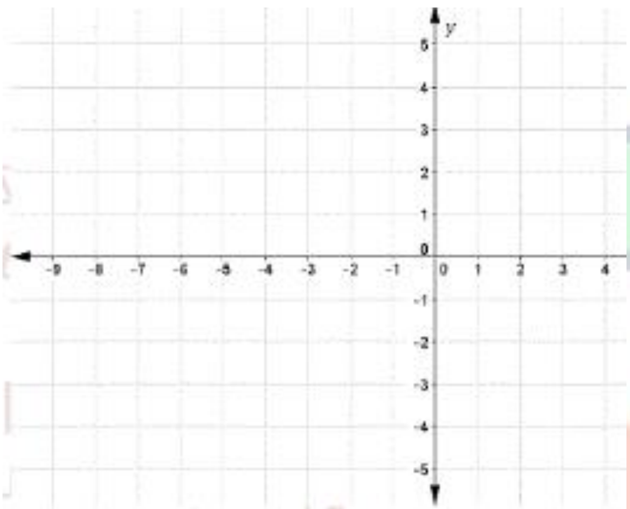
- A basic non-linear equation can be expressed in the following format: $ax^2 + by^2 = c$.
- When a non-linear equation is graphed, it takes the form of a curve.
- The slope value exhibits variability.
- The degree of a non-linear equation is typically equal to or greater than 2, as it represents the highest exponent of the variable(s) involved. As the degree of the equation grows, the curvature of the graph also increases. The application of the superposition principle is not valid for systems that are described by non-linear equations.
- The relationship between the input and output of a non-linear system is not directly correlated.

One-Variable Linear Equation Graphing

The process of graphing an equation necessitates the utilization of a coordinate plane. The object under consideration is comprised of two linear segments, one oriented horizontally and the other oriented vertically.

The horizontal line is commonly denoted as the x-axis, whereas
the vertical line is known as the y-axis. The location at where the two lines intersect is sometimes referred to as the origin.

A simple coordinate plane has been shown below



The coordinate plane is comprised of an unlimited number of points. A singular point can be denoted by a pair of coordinates, x and y, and is expressed as an ordered pair (x, y). The variables x and y have a domain that includes all real numbers.

To visually represent a linear equation in one variable, we utilize a coordinate plane. We will illustrate this concept by providing an example.

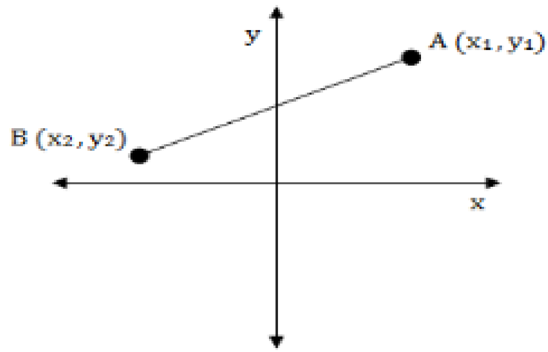
Distance Formula

The Distance Formula, as its name implies, is employed to calculate the most direct (linear) distance between two places.

Pythagorean Theorem

The formula can be derived in a straightforward manner by applying the aforementioned renowned theorem. As per the theorem being referenced, the length of the hypotenuse of a right-angled triangle can be determined using the equation $h^2 = x^2 + y^2$.

In the context of the distance formula, the value of x can be determined by subtracting x_1 from x_2. In a similar manner, the value of y can be determined by subtracting y_1 from y_2, as illustrated in the accompanying diagram.



$$d = \sqrt{(x2 - x1)2 + (y2 - y1)2}$$

The formula for calculating the straight line distance, denoted as d, between two points (x_1, y_1) and (x_2, y_2) is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

eventually determined as follows:

Mid Point Formula

The midpoint formula is employed to get the coordinates of a point that lies precisely between two other points within a two-dimensional plane. The formula demonstrates significant utility within the field of geometry.

The coordinates of the point (x, y) that is precisely at the midpoint between the two points (x_1, y_1) can be

$$x = x_1 + x_2, y = y_1 + y_2$$

determined as follows:

In a similar vein, when seeking to ascertain the midpoint of a segment within three-dimensional space, one can employ the following method to calculate said midpoint:

$$x = x_1 + x_2, y = y_1 + y_2, z = z_1 + z_2$$

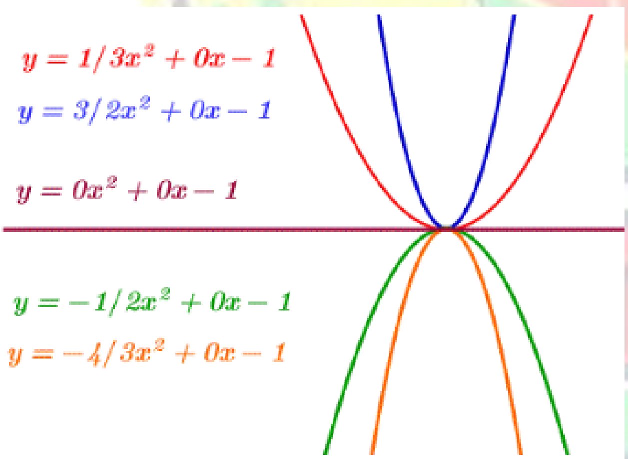
The median formula is depicted in the following graphic.

In the context of one variable, a quadratic equation is a polynomial of degree two. This is written as

$$ax^2+bx+c=0$$

In the above equation, a,b,c are constants where a!=0.

The diagram presented below illustrates the graphical representation of a quadratic equation in the form of $y=ax^2+bx+c$. The values of each of the three coefficients are systematically altered individually. While variable an exhibits variation, variables b and c remain constant. Based on the above illustration, it can be inferred that the graph of a quadratic equation exhibits the characteristic shape of a parabola. Furthermore, alterations in the values of the three coefficients of the equation result in a displacement of this parabola along the coordinate axis.



Quadratic formula

For a general quadratic equation of the form

$$x= (-b\pm\sqrt{(b^2-4*a*c)})/2*a$$

According to this solution, there are two **roots** of the quadratic equation. And they are given as:

$$x= (-b+\sqrt{(b^2-4*a*c)})/2*a$$

$$x= (-b-\sqrt{(b^2-4*a*c)})/2*a$$

i.e. one with the positive sign, while the other has a negative sign.

$ax^2+bx+c=0$

where a,b,c are constants (can be -ve) and where a!=0, the quadratic formula is given by

Operations With Polynomials

Polynomials

In mathematics, a polynomial is an expression that uses just the arithmetic operations of addition, subtraction, and multiplication to produce a set of variables and constants. The exponents of the variable are members of the set of positive integers, while the coefficients of the polynomials are members of the set of real numbers.

Degree, Coefficients &Variables of Polynomial

The degree of a polynomial refers to the largest exponent of the variable that appears in the polynomial expression.

The coefficients of a polynomial refer to the constant values that are associated with its terms. The coefficients employed in the aforementioned polynomial are 1, 5, and -3.

Variables in mathematics are typically represented by alphabets such as a, b, c, x, y, and z. These symbols are commonly employed within the context of polynomials. The term "variables" is used to describe entities that have the ability to assume any value within a certain range, hence the name "variables". In the aforementioned illustration, the variable x is denoted. Additionally, there are polynomials that involve many variables.

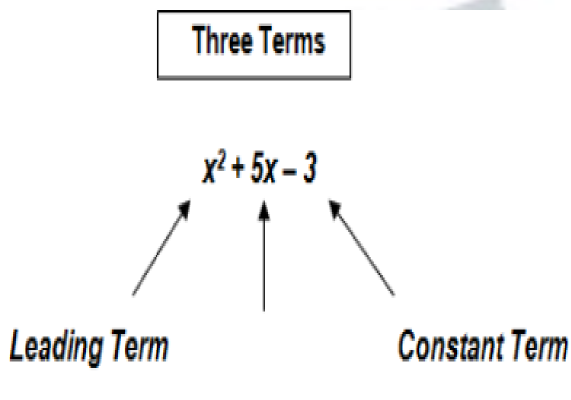
Example $x^2+5xy-3y^2$ is a polynomial of degree 2 in two variable x and y.

When is a number not a polynomial?

Exponents cannot be negative in a polynomial.

There can't be a variable within the radical sign in (4x-2) as an example.

The "term" refers to the individual components of the polynomial that make up the sum or difference. Thus, there are three terms in the polynomial.



Polynomial Addition Algorithm

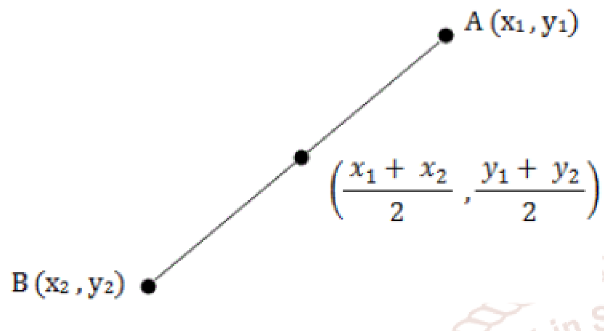
The process of adding two polynomials entails the consolidation of similar terms that are found inside the two polynomials. The term "like terms" refers to terms that possess both the same variable and the same exponent.

As an illustration, consider the following:

- The same variable is used for both terms.
- Power of the variable is the same in both terms.

Subtracting Polynomials Calculator

The process of subtracting polynomials bears a strong resemblance to the process of adding polynomials. It can be said that the process of subtracting one polynomial from another involves adding the second polynomial to the first polynomial while inverting the signs of all terms in the first polynomial.



Explanation

When determining the midpoint of a line segment defined by two sets of coordinates, let us assume that point A is represented by the coordinates (x_1, y_1) and point B is represented by the coordinates (x_2, y_2). The midpoint formula provided above allows for the determination of the average of the x and y coordinates, resulting in the determination of the midpoint between Point A and Point B. The formula provided enables the determination of the midpoint for line segments that are either vertical, horizontal, or diagonal.

Parentheses Rules Definition

In Algebraic/Mathematical expressions, parentheses serve the primary purpose of altering the standard order of operations. Hence, within an algebraic equation containing parenthesis, the terms included within the parentheses () are prioritized for evaluation.

$$a+(-b)=a-b$$
$$a-(-b)=a+b$$
$$a\cdot(-b)=-ab$$
$$(-a)(-b)=ab$$

In this presentation, we provide illustrative instances pertaining to the use of Parentheses Rules, aiming to enhance comprehension of its relevance and usage.

Polynomial Multiplication Tool

Polynomial multiplication is a frequently encountered operation in the field of Algebra and Mathematics as a whole. The three qualities that are commonly utilized throughout the process of multiplying polynomials are routinely employed.

It is important to note that what remains are the rules of exponents. Firstly, we will provide an explanation of these rules, and subsequently, we will go to the topic of polynomial multiplication.

Exponentiation Rules

Consider a real number, denoted as "a," and let "m" and "n" be positive integers. It follows that the product of a raised to the power of m and a raised to the power of n, denoted as am an, is equal to a raised to the power of m plus n, denoted as am + n.

For every real number a, and positive integers m and n, the expression (am)n is equivalent to amn.

Consider two real numbers, denoted as a and b, and a positive integer denoted as n. In this context, it is desired to investigate the expression (ab)n and its relationship to the expressions a and bn.

These qualities exhibit a high level of simplicity and may be readily verified. It is essential to commit them to memory before to proceeding with the multiplication of polynomials.

When applied in the actual world, how does algebra help?

Algebra is a branch of mathematics. Typically, the initial exposure to this subject is commonly encountered by students in high school or primary levels. The prevailing consensus among individuals is that this particular subject is widely regarded as one of the most challenging and intricate fields of study. Various aspects of Mathematics can potentially be interconnected.

Upon hearing the word "Algebra," many typically associate it with numbers and equations, which quickly come to mind. What is commonly unknown to many individuals is the origin, key figures, and historical development of Algebra. This article aims to provide a concise overview of the historical development of Algebra, shedding light on the origins, motivations, and key figures involved in its inception.

Although the ancient Babylonians are sometimes credited with the invention of algebra, it was the Greeks of the third century who first presented the concept. The Babylonians are credited with creating equations and formulas that are still used in modern approaches to solving problems. Diophantus was ultimately bestowed with the title of the Father of Algebra. During the 16th century, René Descartes gained prominence for his renowned publication named "La Géométrie." The actions he undertook were characterized by a greater degree of modernity and continue to be employed and instructed in contemporary times.

Having acquired a sufficient understanding of the historical background of Algebra, do you currently hold the belief that it possesses a significant degree of importance? One can continue to assert and question the practical applications of Algebra in real-world contexts. Is it capable of being used? Does it provide assistance in daily life? Is it truly necessary to possess knowledge of Algebra in order to lead a fulfilling life? The aforementioned inquiries could perhaps find resolution within the contents of this scholarly work.

Regardless of personal preferences, it is essential to acknowledge that Algebra holds practical significance in various aspects of daily life. Numbers and equations are widely utilized in various contexts across the globe.

Consider, for instance, the scenario in which one is engaged in the activity of procuring food. Acquiring proficiency in the skills of adding and subtracting products from one's cart would likely prove advantageous in the realm of computing and financial management. However, in this particular scenario, there remains a cashier who could potentially assist you in resolving this predicament. What are the appropriate actions to take when one finds oneself in a solitary circumstance, such as at a gas station? The process entails self-service refueling, wherein individuals are responsible for replenishing their own fuel tanks, returning the nozzle to its original position, and afterwards making a payment transaction by swiping their credit card on the designated machine. Following these steps, the refueling process is successfully completed. The daily fluctuation of gasoline prices exhibits significant variability and rapid fluctuations. In order to address the quandary of determining the quantity of gallons one can get under a given budgetary constraint, it is imperative to acquire proficiency in the discipline of Algebra.

The current state of the economy is experiencing significant challenges. Financial constraints are a perennial issue, prompting individuals to meticulously allocate funds for every conceivable expense. Individuals often engage in multiple forms of employment in order to meet their financial obligations and provide a consistent provision for their basic needs. In the context of financial transactions and discussions pertaining to the economy, numerical values invariably emerge. Undoubtedly, Algebra may serve as the sole tool to navigate the challenges posed by the subtraction of accumulated debts and loans in one's daily life.

Professionals also require proficiency in arithmetic operations such as addition, subtraction, and equation computation. Even if individuals are not responsible for managing household expenses such as budgeting for housing payments, utility bills, or grocery purchases, it is still essential for them to possess numerical literacy skills. Bank tellers must consistently exercise vigilance and discernment in determining which transactions to authorize and which to deny, leaving no room for hesitation or doubt. What about those engaged in the real estate industry, stock exchange participants, or proprietors of small-scale grocery stores? In order to achieve success, individuals must possess the requisite aptitude for acquiring knowledge and navigating numerical concepts.

Algebra In Geometry

The depiction of two-dimensional figures can be accomplished by employing a coordinate system. The representation of a point with the coordinates (4,2) indicates that the point is attained by moving four units horizontally and two units vertically, starting from the intersection of the x-axis and y-axis.

Algebraic representation allows for the generalization of a point in a two-dimensional Cartesian coordinate system as a pair of coordinates (x, y). It is possible that you have previously acquired knowledge regarding the representation of a straight line through an equation in the form of $y = mx + b$, where m and b are constants. There exist equations that exhibit similarities in describing both circles and more intricate curves. By utilizing algebraic equations, a multitude of calculations can be performed without the need for visual representation of the shapes. For instance, it is possible to determine the intersection points between a circle and a straight line, as well as ascertain whether one circle is contained within another. Please refer to the article on geometry in order to gain insights into its various applications.

Algebra In Computer Programming

As evidenced, algebra involves the identification and comprehension of overarching patterns. Instead of perceiving the equations 3x+1=5 and 6x+2=3 as distinct entities, Algebra recognizes them as instances of a common equation form, namely ax+b=c. Numerical values have been substituted by symbols.

Computer programming languages such as C++ or Java operate in a similar manner. Within the confines of a computer system, a character shown in a computer game can be understood as a sequence of symbolic representations. Proficiency in character representation is an essential skill for programmers. In addition, the user possesses a restricted set of instructions to communicate to the computer regarding the manipulation of this particular string. Computer programming is the representation of a particular situation, such as a game, through the use of abstract symbols.

Conclusion

Mathematics plays a fundamental role in the problem-solving, investigation, testing, design, and analytical activities conducted by the Australian Bureau of Statistics. The utilization of this technology enables the creation of a comprehensive database of information in a cost-effective manner. The utilization of data allows for the extraction of value by means of analyzing patterns within the data and making informed estimations regarding the reliability of the inferences made. One intriguing characteristic of the utilization of mathematics in industry is that, within the pragmatic setting, it appears that no specific answer is readily applicable. Instead, it is imperative to comprehend the underlying principles of previous research in order to derive further solutions, thereby facilitating the advancement and refinement of new theoretical frameworks that align with real-world circumstances. In order to effectively use and expand existing theories in practical settings, it is imperative to have researchers and graduate practitioners who possess a comprehensive comprehension of the underlying concepts and developmental foundations of those theories.

References

1. Stieltjes, T.J. (1882). Oeuvres Complètes, Vol. 1, publiées par les soins de la Société Mathématique d' Amsterdam, Groningen 1914–1918.
2. Tall, D. (1992). The transition to advanced mathematical thinking: Functions, limits, infinity and proof. In D.A. Grouws (Ed.), Handbook of Research on Mathematics Teaching and Learning (pp. 495–511). New York: Macmillan.
3. Tall, D. (1993). Real mathematics, rational computers and complex people. Proceedings of the Fifth Annual International Conference on Technology in College Mathematics Teaching (pp. 243–258)
4. Brown, D.P., Porta, H. and Uhl, J. (1991). Calculus & Mathematica. Reading, MA: Addison-Wesley Publishing Company. Cauchy, Sonin, Vol.1. NewYork: Chelsea Publishing Company.
5. Cornu, B. (1981). Apprentissage de la notion de limite: Modèles spontanés et modèlespropres. Proceedings of the 5th International Conference for the Psychology of Mathematics Education (pp. 322–329).
6. Grenoble, France. Cornu, B. (1991). Limits. In D. Tall (Ed.), Advanced Mathematical Thinking (pp. 153–166).
7. Dordrecht: Kluwer Academic Publishers. Cottrill, J. and Dubinsky, E. (1996). Understanding the limit concept: Beginning with acoordinated scheme. The Journal of Mathematical Behavior 15: 167–192.
8. Courant, R. and Robbins, H. (1941). Revised by Stewart, I. 1996. What is Mathematics? Oxford: Oxford University Press.