International Journal of Engineering Research & Management Technology

ISSN: 2348-4039

March-2014 Volume 1, Issue-2

Email: editor@ijermt.org www.ijermt.org

# HISTORY OF MATHEMATICS

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**ABSTRACT**

*A captivating voyage through the development of human thought can be had by studying the history of mathematics. From its humble beginnings in ancient civilizations such as Mesopotamia and Egypt, where mathematical concepts were primarily practical tools for commerce and construction, to the profound advancements of ancient Greece, where Euclid's geometry and Pythagoras' theorem laid the foundation for rigorous proofs and abstract thinking. From its humble beginnings in ancient civilizations such as Mesopotamia and Egypt, where mathematical concepts were primarily practical tools for commerce and construction, to the profound advancements of ancient Greece. During the Middle Ages, Islamic scholars were responsible for the preservation and transmission of mathematical knowledge. On the other hand, the Renaissance is credited with ushering in the resurgence of mathematical investigation in Europe. Calculus, which was developed by Newton and Leibniz in the 17th century, was a game-changer for both the scientific and technical communities. The 19th century was witness to the development of non-Euclidean geometries and the formalization of mathematical logic. The 20th century brought forth ground-breaking discoveries in fields such as set theory, topology, and the advent of computers, which transformed mathematics into an essential tool in a variety of scientific and technological disciplines. Today, mathematics is continuously developing, and it has deep linkages to physics, computer science, and other fields. These connections show the ever-present significance of mathematics in the process of forming our perception of the world.*

***Keywords:*** *Mathematics, history*

## INTRODUCTION

The language of mathematics has developed into a universal one, and it now has a specific structure that is based on logic. It consists of a set of knowledge concerning both numbers and space. It proposes a number of different avenues that can be taken in order to arrive at conclusions regarding the physical cosmos. To derive "proofs" and come to conclusions in this intellectual effort takes a combination of creative thinking and a strong intuitive sense. It frequently endows the creator with a great sense of aesthetic fulfillment, which is gratifying to them in various ways.

The history of mathematics contains examples of some of the most mind-boggling ideas that have ever been conceived across countless years. We find that mathematics is applicable to a variety of fields, including astronomy, agriculture, the military, and physics, among others. It has a much to teach us about the history of people, as well as about human nature, mathematics, and modern society. It is possible to acquire a sense of the intellectual growth of humanity by looking at the evolution of mathematical conceptions over the length of four millennia. This is because mathematical notions have been around for that long. At each point in time throughout history, an individual's capacity for mathematics and level of interest in the subject can tell us a great deal about the intellectual and technological climate of the era. In the eyes of future generations, the current man will be evaluated according to how well he understands mathematical concepts. Mathematics is a subject area that is always evolving, therefore previous mathematical ideas are being superseded by newer ones. One way to evaluate the significance of a new work is to consider how many conclusions drawn from earlier research it overturns. Mathematics focuses heavily on the study of the past, as well as the present and the future.

Instead of being studied as a chronological catalog of mathematical achievements, the history of mathematics is viewed as an expanding field. It did not merely appear in the form of a textbook all of a sudden; rather, it evolved over time, not always in a logical order, through a series of inspirations, mistakes, detours, and necessities from a practical standpoint. It is common practice to solve one problem by creating another before moving on to the next. It is possible that an argument that was accepted as valid in one century will no longer be valid in another century. Studying the history of mathematics can teach one a great deal about the evolution of mathematical concepts, the coherence of the field, and its place in the world. It is a fact that has been widely accepted that research into the history of mathematics has gotten a remarkably insufficient amount of attention. There hasn't been a lot of research done on this topic, and the research that has been done isn't particularly high quality. Numerous studies have been conducted on the subject, but none of them have even attempted to compile or analyze the essential findings.

Supposedly written by Descartes around 1640, the following can be found in his notebooks: "I am used to distinguishing two things in mathematics, the history and the science." I use the term "history" to refer to what has previously been discovered and recorded in written form. And by the competence to answer all questions, I mean scientific knowledge. According to him, the history of mathematics is contained within the entirety of mathematical literature, at least to the extent that it does not contain any instances of repetition. It would appear that the histories of mathematical literature and mathematical concepts are quite similar to one another.

The history of mathematics informs us that mythical demigods did not invent mathematics; rather, it was mankind who invented mathematics. Euclid, Diophantus, Aryabha!a, Bhaskara-II, Newton, Euler, and Gauss, amongst others, created their ideas as a reaction to problems they faced and the mathematics they were already familiar with at the time. They made significant contributions, as well as blunders, which were afterwards accurately duplicated by other mathematicians.

Algebra is a branch of mathematics that focuses on solving problems that have one or more unanswered questions. Whether we are conscious of it or not, we are confronted with algebraic challenges on a regular basis in our lives. When translated with the help of the unknowns, all of these problems can be simplified down to equations or inequalities involving the unknowns. Algebra is fraught with difficulty due to the fact that solving some problems requires not only x but also x 2, x 3, and even higher powers. Quadratics are present whenever there is a need to solve problems involving areas of two dimensions. Cubes originated as a solution to the volumetric challenges presented by three dimensions. Equations of quadratic and higher degree need to be used in order to answer problems that include complex scientific issues.

The word "algebra" derives from the Arabic word al-jabr, which can be translated as "restoring." AI-Khwarizmi is credited with writing the book AI-jabr wa-Imuqabala (Science of Restoring and Opposition) in the year 825 AD. This book is considered to be the first book to introduce mathematics. An effort is being made to solve the equations. In this situation, "restoring" meant giving both sides equal terms, and "opposition" meant making the two sides equal to one another. The AI-Khwarizmi algebra was only able to solve problems involving quadratic expressions. The Babylonians had a firm hold on it, and Euclid offered a geometrical interpretation of what they had discovered. It was Brahmagupta (628) who first distilled the solution into a formula. In a number of areas, including notation and the adoption of negative numbers, the work of Brahmagupta was more advanced than that of AI-Khwarizmi.

The study of algebra is closely related to number theory and fundamental arithmetic in Indian mathematics. In ancient Greek mathematics, algebra was hidden behind geometry. Other potential sources of algebra, such as Egypt, Babylon, and China, were either eradicated or cut off from the Western world before it was too late for them to have an impact on the development of algebra. The idea of algebra provided the foundation upon which the science of polynomial equations was built. The field of algebra did not venture outside of the sphere of equation theory until the eighteenth century. At this point in time, the vast majority of mathematical subfields had outgrown the surroundings in which they were initially developed.

The emergence of numerals and the gradual refinement of the concept of place value were necessary preconditions for the development of methodologies for mathematical computation. However, when contrasted to the development of algebra, it was a simple process. In light of the circumstances, it was necessary to have both a system for expressing quantities whose exact value was uncertain and a method for indicating distinct operations. The goal of the algebraist was to make his theorems as general as was practically possible, therefore he came up with the idea of negative, irrational, and imaginary numbers to accomplish this. These discoveries build upon one another to create a stronger picture. Symbols were used to indicate newly developed processes, and these newly developed processes needed the development of new symbolism.

The Babylonians were responsible for the development of the ideas that were later utilized by Islamic mathematicians. They created an entirely new algebra by combining it with the classical geometry of Greek, which they went on to develop further. By the time the 19th century was coming to a close, the mathematical classics of ancient Greece had garnered a significant amount of respect throughout the Islamic world. Islamic mathematicians investigated them and offered their thoughts on them as a result of their findings. Through their research into Greek works, they were able to unearth a number of important ideas, the most important of which was the concept of the evidence. They ingrained the idea that a mathematical problem could not be considered solved unless it could be demonstrated that the answer was correct, and until then, the problem could not be considered solved. As a consequence of this, Islamic mathematicians assigned themselves the task of utilizing geometry to validate algebraic rules, regardless of whether these rules originated in ancient Babylonia or were newly discovered by Islamic mathematicians.

**Ancient Polynomial Equation (Up To 3rd Century)**

**800 Bc**

It is generally agreed that the Assyrians, the Egyptians, the Babylonians, and the Phoenicians were the most influential ancient civilizations in terms of their contributions to the development of science. Only the Egyptians and the Babylonians had made significant contributions to the expansion of mathematical knowledge at that point in time.

**Egypt**

The Rhind Mathematical Papyrus and the Moscow Mathematical Papyrus are two papyri that are the key resources for a significant portion of what we know about the mathematics of ancient Egypt. Both papyri contain collections of mathematical questions and the solutions to those problems. A.H. Rhind, a Scotsman, purchased the Rhind Mathematical Papyrus in Luxor in the year 1858. In his honor, the papyrus was later given its current name. The Moscow Mathematical Papyrus was initially purchased by V.S. Golenishchev in the year 1893. Subsequently, the Moscow Museum of Fine Arts was in possession of it. The previous papyrus was a copy of an earlier original that was more than 200 years old and was made by the scribe Ahmes in the year 1650 Be. The later papyrus was created about the same time as the first. The Rhind Papyrus contains a total of 85 issues, while the Moscow Papyrus only contains 25 issues.

In the first portion of the papyrus, Ahmes addresses unit fractions; in modern parlance, these fractions will have the form of 2/2n+1, where n is any odd number between 5 and 49.

For example, the number 2/29 can also be written as $\frac{1}{24}+\frac{1}{58}+\frac{1}{174}+\frac{1}{132}$. Note how near the scribe was to the action. Ahmes is simply responsible for logging the result. It's possible that earlier mathematicians, each of whom worked in their own way or through a series of trials, were the ones to figure things out. It is difficult to identify the specific steps that led to the discovery of these results.

The vast bulk of the early works in mathematics are centered on the process of applying various mathematical techniques to problems in order to find solutions. To begin, we will investigate the many different methods available for solving linear equations. In many literature, the solution to a single linear equation is assumed as a given and is not questioned. When a problem of this magnitude and complexity is being tackled, the solution to such an equation is never actually delivered; rather, it is just stated. However, similar equations are discussed in detail in the papyri that were discovered in Egypt.

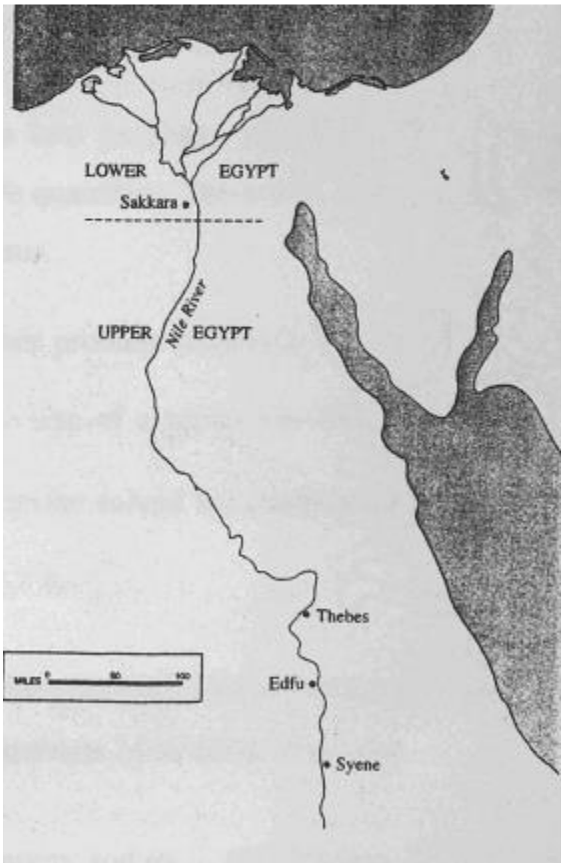


**Figure 1: Pharaonic Egypt**

For example, the method that is considered to be typical nowadays is used in the Moscow Papyrus. It illustrates that the quantity is such that if it is employed, it will have the desired effect. $1\frac{1}{2}$ times, an additional four, and the sum comes to ten. terms applicable to the equation that are current today $1\frac{1}{2}x+4=10$. The author proceeds in the same manner that we are doing right now. First, he takes away 4 from 10, which leaves him with 6. After that, multiply the result by 2/3, which is the reciprocal of 6 $1\frac{1}{2}$) to get to the bottom of the question 4. One of the requirements of a Rhind Papyrus problem is to locate a number so that the sum of the product of that number, its 2/3, its 1/2, and its 1/7 equals 33. In order to find "x" in such a way that, to put it in more contemporary terms $x+\frac{2}{3}x+\frac{1}{2}x+\frac{1}{7}x=33$

The scribe was successful in finding a solution to the problems by dividing 33 by $1+\frac{2}{3}+\frac{1}{2}+\frac{1}{7}$

His reaction, expressed in terms of current notation, is $14\frac{28}{97}$.

The scribe demonstrated that his approach is applicable to all division problems, despite the fact that these two questions are posed in a manner that is wholly conceptual and does not involve any references to actual quantities.

Another problem that arises with the Rhind Papyrus is one of a more practical kind. This needs determining the size of the scoop, which in turn requires $3\frac{1}{3}$ travels are required to fill one hekat measure. The equation, which is currently denoted as, was ultimately completed by the scribe $3\frac{1}{3}x=1$ by dividing 1 by $3\frac{1}{3}$.

The Rhind Papyrus, problem 24, demonstrates how to solve a linear equation by taking an alternative approach to the problem.

A numerical value and its $\frac{1}{7}$ proportion became 19 in size. What is the level of the volume? In the Egyptian method regula falsi, also known as the "Method of False Position," the solution to this dilemma is to assume a workable but unreliable solution and then change it in the appropriate way. This method is also known as the "Method of False Position." The response from the scribe can be found down below.

Let's say the answer is seven; the seventh portion would be one in this case.

It comes out to a total of 8 overall. It is very clear that this is not the appropriate reaction. When the presumed response of 7 is multiplied by the same number of times as 8, the result is 19.

That is $8.\frac{19}{8}=19$ and $7.\frac{19}{8}=16\frac{5}{8}$

In modern terms, $x+\frac{x}{7}=19$

$$x=7.\frac{19}{8}=16\frac{5}{8}$$

**Figure 2: Apage from the Rhind Papyrus (kept at the British Museum)**

**OBJECTIVES**

1. To study history of mathematics
2. To study polynomial equation

**MEDIEVAL POLYNIMAL EQUATION**

**301 - 800 AD**

**India-Bakhshali Manuscript**

In the year 1881, an unimpressive mathematical manuscript that came to be known as the Bakhshall document was discovered in the village of Bakhshall, which is located in North Western India, close to Peshwar. This site is currently in Pakistan at the moment. The Gatha language, written in the Sharada script, is used to create this document. It is comprised of seventy birch bark leaves in total. It is not known where it originated, and possible dates span from the third to the twelfth century after the common era. A number of scholars date the event to the third or fourth century after the common era. According to the information that has been gathered so far, the Bakhshall Manuscript is a commentary on an earlier piece of work.

The Bakhshall Manuscript is a guidebook of rules that includes illustrations in the form of examples as well as the answers to those problems. The core areas of focus are mathematics and algebra, with only a few questions devoted to geometry and measurement. The arithmetic examples go through a wide range of topics, including square roots, fractions, profit and loss, interest, and the Rule of Three. The algebraic problems include a variety of different types of equations, including simple equations, simultaneous linear equations, quadratic equations, arithmetic progressions, and geometric progressions.

In the Bakhshall Manuscript, the subject matter is laid out in the following format: sutra groups followed by individual sutras. A rule is described, and then an applicable example is provided, which is initially described vocally and is afterwards described symbolically. The solution is presented after that, followed by the demonstration or "proof" at the conclusion. This manner of presenting is utilized in Indian mathematics only very infrequently.

There is some debate on how old the Bakhshall Manuscript actually is. H. Hoemle, G. R. Kaye, and Datta were all paying attention to what was going on. They took a look at the manuscript from a variety of perspectives. However, scientists were not able to arrive at a conclusion that satisfied them regarding its age. According to Hoernle, the manuscript was most likely a later copy of a text that was produced during one of the early decades of the Christian era. This information is based on the fact that Hoernle was able to date the document. He thought that it was from the third or fourth century after the common era. The plausibility of this assertion has been acknowledged by a large number of math historians, such as Moritz Cantor, Buhler Cajori, B. Datta, S.N. Sen, A.K. Bag, and R.C. Gupta, among others. Hoemle dated the work based on a variety of factors, including the mathematical content, the monetary units that were used in some examples, the use of the symbol "+" for the negative sign, and the absence of references to certain subjects, particularly the solution of indeterminate equations, which appeared in works that were known to have been written later. Hoemle used these and other factors to determine the age of the work. G. R. Kaye, on the other hand, places it in the 12th century after Christ and even casts doubt on its Indian ancestry. Datta was of the opinion that the mathematical principles, symbols, and vocabulary that were used in this study would make for more effective guidelines. Datta came to the realization that the work dated back to the third or fourth century after the common era (AD).

According to the information provided by the specialists, the book in question is almost certainly a later copy of a work that was initially penned around the year 400 AD. The conclusion that the manuscript is a copy of an original that dates back to approximately 400 AD is supported by the lack of any evidence to the contrary.

The Bakhshall Manuscript is an attempt to bridge the vast knowledge gap that exists between the Sulbasutras of the Vedic Period (800–200 BC) and the classical mathematics that was practiced between the years 400 AD and 1200 AD.

In the Bakhshall Manuscript, integers are represented by fractions with a denominator of 1, as this was the only available option. When writing mixed expressions, the integral component goes above the fraction in the expression.

$$\text{Thus } 1\frac{1}{3} = \begin{matrix}1\\1\\3\end{matrix}$$

They replaced our'=' with the word phalam, which they reduced to pha for short. Yu is an abbreviated form of the Chinese character for addition. yuta In many cases, the combinable numerals were enclosed in rectangles or sandwiched between lines.

**Modern Polynomials Equation and Algebraic Concepts**

**The Eighteenth Century**

The evolution of analysis and its applications in a wide variety of fields was a central focus of the history of mathematics during the eighteenth century. There was also significant progress being made in a number of other areas.

During the course of the century, a number of significant algebraic works, including works by Maclaurin and Euler, were made available to the public. The information contained in these books is arranged in a specific fashion. Maclaurin's research contributed to the development of an innovative method for solving linear equation systems. Cramer's Rule is the name that most people give to these guidelines. The book written by Euler contained some information on a variety of methods pertaining to number theory. The primary purpose of algebra was to broaden the applicability of the methods developed by Cardano and Ferrari (1522–1565) for solving equations to polynomial equations of degrees five and higher. No one was successful in making this happen. Around the turn of the century, Lagrange penned a comprehensive study that examined the methods that may be used to solve cubic and quartic equations. He developed ideas that would prove to be essential in the solution of equations of a higher degree.

**Issac Newton (1642-1727)**

Isaac Newton was born on Christmas Day in 1642, the same year that Galileo passed away. 1642 was the year that Galileo died. The Principia, the "Method of Fluxions," the Opticks, and the Arithmetica universalis are the four books authored by Newton that are considered to be among the most influential in their respective fields. The most recent work was written between the years 1673 and 1683, and it was made available to the public for the first time in 1707. This treatise provides the formulas for the sums of the powers of the roots of a polynomial equation, which are generally referred to as "Newton's Identities."

**Figure 3 : Issac Newton**

Cardano was aware that the total of the roots of was equal to $x^n + a_1x^{n-1} + \ldots\ldots\ldots + a_{n-1}x + a_n = 0$ is $-a_1$ Viete was responsible for determining the connections that existed between the roots and the coefficients. In the year 1629, Girard presented his method for computing the sum of the cubes, squares of the roots, and fourth powers.

It is said that Newton expanded the scope of this investigation to embrace all abilities.

If $k \leq n$, the relationships

$$S_k + a_1S_{k-1} + \ldots + a_kk = 0$$

$$S_k + a_1S_{k-1} + \ \ldots\ + a_kS_0 + a_{k+1}S_{-1} + \ \ldots\ + a_nS_{k-n} = 0$$, both hold.

If $k > n$, the relationship

$S_k + a_1S_{k-1} + \ \ldots + a_{n-1}S_{k-n+1} + a_nS_{k-n} = 0$ holds, where $S_i$ is the sum of the powers possessed by the i-th root.

Recursively applying these relationships and calculating the sums of the powers of the roots for every integral power is a simple and straightforward calculation. In addition to that, he was the inventor of the literal indices system, which $a^m$ and $a^n$

Another theorem that generalizes the "Descartes Rule of Signs" may be found in the Arithmetica universalis, and it can be used to determine the number of fictitious roots that are associated with a polynomial. In addition to that, it provides a recommendation for a maximum acceptable number of positive roots.

## CONCLUSION

The "History of Mathematics" is going to be the main topic of discussion throughout this study. This study was conducted with the intention of shedding some light on the history of algebra, and more specifically on the development of linear and quadratic equations. In order to portray the historical foundation of algebra, which spans over a period of more than three thousand years (1650 BC - the Modern period [from 1701 AD until the present]), ancient polynomial equations, medieval polynomial equations, early modern, and modern polynomial equations, as well as algebraic concepts of Egyptians, Babylonians, Indians, Grecians, Chinese, Arabs, and Europeans, among others, were examined and significant aspects were presented. What is being offered here are accounts that have been gathered, collated, and analyzed from secondary sources. By reading them, one can obtain a sense of how numerous ideas connected to mathematics have developed over the course of time.

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