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## ACTIVITIES IN THE HISTORY OF INDIAN MATHEMATICS IN ANCIENT TIMES

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### INTRODUCTION

In ancient times, man's connection with mathematics must have been very interesting. When human civilizations developed, they needed to count their things; initially humans used lines to count. And gradually this experiment started revealing the names and symbols of specific numbers. In this way, different types of number groups started emerging in different ancient civilizations. Their performance varied according to geographical area. During the medieval and modern times, when civilizations established contact with each other, they understood each other's calculation systems and felt each other's imprint in their calculation systems.

### 1. DEVELOPMENT OF MATHEMATICS IN INDUS VALLEY CIVILIZATION

The presence of humans on Earth is approximately 14 lakh years old. But knowledge of the subject of mathematics begins with the Indus Valley Civilization. The period of Indus Valley Civilization is considered to be from 2500 BC to 1750 BC. In the Indus Valley Civilization, proportions were used very precisely. In which binary and decimal systems like 1,2,4,8,16,32, 64 and 10,20, 40,160, 200,300 and 640 were used. Trade was highly developed in the Harappan civilization. The merchant class used weight and length accurately. The unit of measurement used at that time was very precise. Foreigners also used it. These people have an impurity of only 0.005 in their subdivision at a length of 1.32 inches. The people of the Indus Valley civilization used inches to measure length. The discovery of a bronze rod marked by them has revealed another scale.

## 2. DEVELOPMENT OF MATHEMATICS IN VEDIC PERIOD

The Vedic period lasted from 1500 BC to 1000 BC. In the Vedic period, mathematics was used along with religious rituals. The main occupation of the Vedic period was agriculture and animal husbandry. During this period, cows were used as currency. During this period the word twilight was used to measure time. The word Gavyatu was used to measure distance. Like other agricultural civilizations, in the Vedic period, mathematics and geometry were studied in secular activities. Arithmetic related operations like addition, subtraction, multiplication, division, square, cube and root etc. are described in Vishnu Purana. All these were developed by VedVyas around 1000 BC.

## 3. DEVELOPMENT OF MATHEMATICS IN THE LATER VEDIC PERIOD

In Indian history, the period in which Samaveda, Yajurveda, Atharvaveda, Brahmin texts and Upanishads were composed is called the later Vedic period. In this period, the word 'Shrestha' in 'Aitareya Brahmin' and 'Gana' and 'Ganapati' were used for business organization. Was done. The trade of this period was also based on the barter system; the currency system had not yet emerged. Sacrifices, tribute etc. were given to the king in the form of goods. During this period, Shataman, Krishnal, Pada etc. were used as measurements. Nishka was first used as a neck ornament, later it started being used as a weight of gold. Its fixed weight was equal to 320 ratti. Krishnal was equal to one ratti or 1.8 grains.

The use of geometry/line under arithmetic and algebra is found in the Shulvasutras of Baudhayana around 800 BC. The Greek mathematician Pythagoras was familiar with the Upanishads around 600 BC. He had learned the basic knowledge of geometry from the Shulva Sutras. And later he proved the Pythagorean Theorem, which is similar to the Baudhayana sutras. In this, information about rectangle is available, through this the solution of linear equations has been found. Only quadratic equations have been discussed in it. Details on the subject of square roots are found in the Baudhayana Sutra. Also the fasting section has been explained.

## 4. DEVELOPMENT OF MATHEMATICS IN RELIGIOUS MOVEMENTS

Religious movements and ideologies emerged in 600 BC. Their number is said to be 62 in Buddhist texts and 368 in Jain texts. Which existed in the society before the rise of Mahatma Buddha? Among the religious movements, Jainism and Buddhism remained more popular and stable.

Buddhist literature is also used towards indefinite and infinite numbers. Buddhist mathematics has been used in calculation or simple mathematics, higher mathematics. Buddhist texts recognize three types of numbers: the first number is said to be countable, the second number is said to be uncountable and the third number is said to be

infinite.

## **5. DEVELOPMENT OF MATHEMATICS IN MAGADHA EMPIRE**

The tenure of the Magadha Empire is believed to be from 545 BC to 322 BC. During this period, there is evidence of considerable progress in science and mathematics. Especially his development in the medical field was remarkable. Under Greek influence, Indians acquired the art of Satraps system and currency system from the Greeks. The currency creation of the Greeks had an impact on the Indian currency creation.

## **6. DEVELOPMENT OF MATHEMATICS DURING THE MAURYA EMPIRE**

The reign of the Maurya period was from 323 BC to 184 BC. During the Maurya period, the members of the Council of Ministers got an annual salary of Rs 12000. Samhati was the chief officer of the revenue department who prepared the annual budget. His salary was Rs 24000. During the Maurya period, even in the absence of banking facilities, rupees were lent at 15% interest, but if someone borrowed rupees for a sea voyage, he had to pay 60% interest. Mathematics developed during the Maurya period, under this, percentage system, ratio system, measurement system etc. were developed.

## **6. DEVELOPMENT OF MATHEMATICS IN BRAHMIN KINGDOM**

The Brahmin kingdom lasted from 185 BC to 240 BC. There were trading classes within cities. 18 categories were mentioned in the JatakKathaen. Coin was the main medium of exchange for doing business. On the basis of Manusmriti, officers were provided land in lieu of salary. The banking system was developed in the Brahmin kingdom. In which traders were given money on interest for doing business.

## **7. DEVELOPMENT OF MATHEMATICS DUE TO FOREIGN INVASION OF INDIA**

India was invaded and ruled by Hindu Greeks, Doubt, Pahlavas and Kushan respectively. In India, we got the opportunity to learn science, astrology and mathematics from the Greeks. According to Mr. Tarn, Indians learned from the Greeks the method of calculating time, the use of calendars, the method of dividing the week into seven days and the names of different planets. Indians learned the art of making coins from the Greeks and the art of writing inscriptions on coins from the Sikhs.

Ashwaghosh treatise Sariputra Episode is a play in nine acts. There lived a scientist named Nagarjun in the court of Kanishka, who is called the Einstein of India. He has presented the theory of relativity in his book madhyamik sutra. Charak lived in Kanishkas court who composed Charak Samhita.

## 8. DEVELOPMENT OF MATHEMATICS IN GUPTA PERIOD

The Gupta period reign lasted from 319 AD to 550 AD. Smith has compared the Gupta period with the Elizabethan and Stuart periods of British history. Made important contributions to the development of astronomy, mathematics and medicine during the Gupta period.

Aryabhata was the greatest mathematician of his time, he wrote a book named commentary on Aryabhatiya. Decimal system could be developed by them. Aryabhata was the first constellation scientist of India, he also created the Surya theory.

Bhaskara I wrote the first commentary on Aryabhata's theory. Bhaskara composed important texts named Mahabhaskariya, Laghubhaskariya and Brahmgupta explained in Brahma Siddhanta that the earth attracts all things towards itself.

Aryabhata calculated the value of  $\pi$  accurately and he was the first to tell that the Earth rotates on its axis. Aryabhata had said that the area of a triangle is equal to the product of half of the triangle with the perpendicular.

Aryabhata had proved interesting results of squares and cubes. Aryabhata developed the place value system. According to the French mathematician Georgesifrah, the knowledge of zero as a place holder for the power of 10 through the empty coefficient is contained in Aryabhata's place value system

Brahmgupta was a famous mathematician of India. Zero was mentioned as a separate number by the Brahm as fruit theory. In this book, 12 chapters of mathematics, arithmetic series and geometry are illustrated. In this book, the rules of negative numbers and zero have been mentioned. Brahmgupta could not give the correct principle of dividing any number by zero. He told that  $0/0$  is equal to zero. He derived the solution of linear equations and also gave the principle of solving quadratic equations, by which the area of the fast was calculated. He had determined the circumference of the Earth which is close to the modern value. He has given the value of  $\pi$  as 3.14149265. Through this the exact formula for the area of a cyclic quadrilateral has been derived. Varāhamihira is one of the great mathematicians of India. Varāhamihira discovered trigonometric formulas. Varāhamihira defined the sine table propounded by Aryabhata more precisely. Number theory was created by Varahamihira. He tried to calculate the permutation accumulation hypothesis. Bhaskar I was a great mathematician of the seventh century of India. He has written a commentary named Aryabhatiya Bhagya in the year 629. Mahabhaskariya has eight chapters. In the seventh chapter of this book, a formula to calculate the approximate value of  $\text{Sin}x$  is given in chapters 17, 18 and 19.

## DEVELOPMENTS BY OTHER MATHEMATICIANS OF ANCIENT INDIA

### 1 Govind Swami

Govind Swami was an Indian mathematician from 800 AD to 860 AD. He had composed a Bhagya based on the book Mahabhaskariya of Bhaskar I. Many examples of local values have been presented through his fate. The method for constructing sine table has been given by him. A book named Govindkriti has been written by him, which is currently unavailable.

### 2 Veersen

Acharya Veersen was a great mathematician of the eighth century. These have helped in calculating the volume of the frustum. He said that any number divided by 2 ultimately becomes 1. He discovered the logarithmic factor. He has given a formula to find the circumference of a fast by using its diameter.

### 3 Mahavir

Mahavir was a famous mathematician of the ninth century. He did his work on permutation accumulation, and provided formulas related to it. He lived in the place of Amoghavarsha I of the Rashtrakuta Empire. He has solved equations of degree  $n$ . Many properties of cyclic quadrilateral have been explained by him. He told that square root of negative numbers cannot be found. The sum of  $n$  terms of the arithmetic progression has been calculated by him. How to find the perimeter of an ellipse is explained by. A new nomenclature of large numbers has been presented by him.

### 4 Jaidev

He was a great mathematician of the ninth century of India. Chakrawal method has been further advanced by him. The complete solution of the following equation is given by them.

### 5 Aryabhata (II)

Aryabhata II was a scholar of mathematics and astrology, he has written the book Mahasiddhanta Astrology.

### 6 Bateshwar

He was one of the great mathematicians of the tenth century. He created the Bateshwar theory. Trigonometric identities have been created by him. Practical mathematics has also been composed by him.

### 7 Brahmadev

He made significant contributions in the field of mathematics during his tenure in ancient India from 1060 to 1130. Bhagya has been written by him on the works of Aryabhata, this Bhagya is named Prakash, in which trigonometry and astrology have been discussed by him

### 8 shripati

He has made impressive contributions in the field of mathematics from 1019 to 1066. He has explained about solar eclipse and lunar eclipse.

## CONCLUSION

The mathematical history of man in ancient times must have been very interesting. But gradually man continued to struggle with his mathematical problems. It took thousands of years for us to solve these elementary mathematical problems. Just as ancient humans developed the number system through the names and symbols of their specific numbers. Thereafter decimal and binary numbers emerged in India. In the Vedic period, man used the cow as a currency, and before the Vedic period, the necessary numbers were known. During this period mathematical operations emerged. There was further improvement in the field of mathematics during the Maurya period. Revolutionary steps in the field of mathematics emerged in the Gupta period. The Gupta period is considered an important era for mathematics. During this period, Aryabhata, Brahmgupta and Varāhamihira made important contributions in the field of mathematics. In ancient times, India had become self-reliant in the mathematical field, and was capable of solving its everyday problems. The practical contribution of mathematics which completely fulfilled the mathematical needs of the society of that time. By being mathematically competent, better and necessary work has been completed for the society.

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