Bhaskara I :- The Pioneer Of Indian Mathematics And Astronomy

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Abstract:-

Bhaskara I, a brilliant mathematician and astronomer of 7th-century of ancient India. He stands as a towering figure in the history of mathematics. His profound insights and innovative contributions have left an indelible mark on the field, shaping the course of mathematical thought for centuries to come. This article delves into the life, works, and enduring legacy of this remarkable scholar. Bhaskara I. The 7th Century Indian Mathematician and Astronomer Bhaskara I, also known as Bhaskara charya or Bhaskara the First, was a brilliant Indian mathematician and astronomer. He is considered one of the most influential mathematicians of his time and a pioneer in the field of mathematics and astronomy.

Key Words:- Brilliant , Innovation, Contribution, Indelible, Remarkable.

Introduction :-

Bhaskara I referred to as Bhaskara I in order to differentiate from the 12th-century mathematician Bhaskara. Bhaskara I is considered to be one of the three pearls of Indian Astronomy and Mathematics along with Brahmagupta and Madhava Samgramagrama.

Bhaskaracharya was a famous mathematician but not much is known about his early life except what has been inferred from his writings. Many believe that he must have been working in a school of mathematicians in Asmaka which was probably in the Nizamabad District of Andhra Pradesh. There are other references to places in India in Bhaskara's writings. There are some allusions to Valabhi the capital of the Maitraka dynasty in the 7th century, and Sivarajapura, which were both in Saurashtra, which today is the state of Gujarat. There is yet another school of thought which believes that he was born in Bori, in Parbhani district of Maharashtra. By and large, it is believed that Bhaskara was born in Saurashtra and later moved to Asmaka. He was tutored in astronomy by his father. It is believed his father taught him astronomy. Bhaskara i is considered to be a follower of Aryabhata. He is considered to be the most important scholar of Aryabhata's astronomical school.

Bhaskara I is famous for the following works:

1. Zero, positional arithmetic, the approximation of sine.

2. The three treatises he wrote on the works of Aryabhata (476-550 CE)

3.The Mahabhaskariya ("Great Book of Bhaskara")

4.The Laghubhaskariya ("Small Book of Bhaskara")

5.The Aryabhatiyabhashya (629)

One of the most important mathematical contributions is related to the representation of numbers in a positional system. The first positional representations were known to Indian astronomers about 500 years ago before Bhaskaracharya, but the numbers were not written in figures, but in words, symbols or pictorial representations. For example, the number 1 was given as the moon, since there is only one moon. The number 2 was represented anything in pairs; the number 5 could relate to the five senses and so on.....

He explains a number given in this system, using the formula ankair api, ("in figures, this reads") by repeating it written with the first nine Brahmi numerals, using a small circle for the zero. Brahmi numerals system, dating from 3rd century B.C is an ancient system for writing numerals and are the direct graphic ancestors of the modern Indian and Hindu-Arabic numerals. Since 629, the decimal system has been known to the Indian scientists. Though Bhaskara did not invent it, he was the first to use the Brahmi numerals in a scientific contribution in Sanskrit.

Bhaskara I sine approximation formula:-

Bhaskara I knew the approximation to the sine functions that yields close to 99% accuracy, using a function that is simply a ratio of two quadratic functions.

The formula is given in verses 17-19, Chapter VII, Mahabhaskariya of Bhaskara I. He stated the formula in stylised verse.

According to his formula:

If o≤ x ≤ 180 then sin x deg is approximately equal to $\frac{4x(180-x)}{(40500-x)(180-x)}$

Sina = 4a(180-a)/(40500-a(180-a)

Below is briefly stated the rule for finding the bhujaphala. The result obtained by multiplying the R sine of the koṭi due to the planet's kendra by the tabulated epicycle and dividing the product by 80 without making use of the R sine-differences 225, etc.

Subtract the degrees of a bhuja from the degrees of a half-circle (that is, 180 degrees). Then multiply the remainder by the degrees of the bhuja or koti and put down the result at two places. At one place subtract the result from 40500. By one-fourth of the remainder divide the result at the other place as multiplied by the "anthyaphala. Thus is obtained the entire bahuphala for the sun, moon or the star-planets. So also are obtained the direct and inverse R sine .

It is not known how Bhaskara I arrived at his approximation formula though many historians of mathematics have marveled at the accuracy of the formula. The formula is simple and enables one to compute reasonably accurate values of trigonometric sines without using any geometry whatsoever.

Great Book of Bhaskara I "The Mahabhaskariya " :-

The Mahabhaskariya is a work on Indian mathematical astronomy consisting of eight chapters dealing with mathematical astronomy. The book deals with topics such as the longitudes of the planets; association of the planets with each other, conjunctions among the plant and the stars; the lunar crescent; solar and lunar eclipses; and rising and setting of the planets. As referred to earlier, this treatise also includes chapters which illustrate the sine approximation formula. Both the treatises, "Mahabhaskariya" and Laghubhaskariya", are

astronomical works in verse. It is interesting to note that Parts of Mahabhaskariya were later translated into Arabic.

Aryabhatiyabhasiya (629):-

The Aryabhatiyabhashya is Bhaskara I's commentary on the Aryabhatiya. The Aryabhatiya is a treatise on astronomy written in Sanskrit. It is said to be the only known surviving work of the 5th-century Indian mathematician Aryabhata. It is estimated that the book was written around 510 B.C.

Bhaskara I wrote the Aryabhatiyabhasya in 629:-

Bhaskara I's comments revolve around the 33 verses in Aryabhatiya which is about mathematical astronomy. He also expounds on the problems of indeterminate equations and trigonometric formulas. While discussing Aryabhatiya, he discussed cyclic quadrilaterals. He was the first mathematician to discuss quadrilaterals whose four sides are not equal with none of the opposite sides parallel. Bhaskara I explains in detail Aryabhata's method of solving linear equations with illustrative examples.

Countribution:-

Here is a more detailed look at some of Bhaskara I's key contributions to mathematics:

***Arithmetic:** Bhaskara I developed several new methods for solving linear and quadratic equations, including the use of the "rule of false position." He also made important contributions to the study of fractions and decimals.

***Algebra:** Bhaskara I was one of the first mathematicians to use negative numbers in his work. He also developed a number of new algebraic techniques, such as the method of elimination.

Trigonometry: Bhaskara I developed a new sine approximation formula that was more accurate than the one used by Aryabhata. He also made important contributions to the study of the sine function and its properties.

Astronomy: Bhaskara I made significant contributions to the study of planetary motion, eclipses, and other astronomical phenomena. He also developed a new method for calculating the position of the planets and eclipses.

Legacy and Influence :-

Bhaskara I's contributions to mathematics and astronomy have had a lasting impact on the intellectual landscape of India and beyond. His work was studied and admired by later Indian mathematicians, and his ideas were transmitted to other parts of the world through various channels.

Bhaskara I's emphasis on the decimal number system and his innovative trigonometric approximations played a crucial role in the development of modern mathematics. His work on algebra and astronomy also laid the foundation for further advancements in these fields.

Conclusion:-

Bhaskara I was a brilliant mathematician and astronomer who made significant contributions to the development of these fields. He was a pioneer in his time, and his work continues to be studied and appreciated today. Bhaskara I's legacy is a testament to his brilliance and his lasting impact on the world of mathematics and astronomy.

Bhaskara I stands as a towering figure in the history of Indian mathematics. His profound insights, innovative contributions, and unwavering dedication to the pursuit of knowledge have left an enduring legacy. His work continues to inspire and inform mathematicians and astronomers today, reminding us of the brilliance and ingenuity of ancient Indian scholars.

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