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Literary Works of Aryabhata

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Abstract: India has a very rich culture mathematical history. Many great legends since ancient period enriched our mathematical literature with their incomparable work. To list a few include Katyayana, Bharata Muni, Baudhayana, Yajnavlkya, Aryabhata, Brahmagupta, Bhaskaracharya, Shridharacharya, Lilavati, Bharati Krishna Tirtha, Brahmadeva, Shakuntala Devi, Srinivasa Ramanuja and many m Aryabhata or Aryabhata I was the first of the major mathematician-astronomers from the classical age of Indian mathematics and Indian astronomy. His works include the Āryabhaṭīya (which mentions that in 3600 Kali Yuga, 499 CE, he was 23 years old) and the Arya-Siddhanta. Much of the research included subjects in astronomy, mathematics, physics, biology, medicine, and other fields. Aryabhatiya, a compendium of mathematics and astronomy, was referred to in the Indian mathematical literature and has survived to modern times. The mathematical part of the Aryabhatiya covers arithmetic, algebra, plane trigonometry, and spherical trigonometry. It also contains continued fractions, quadratic equations, sums-of-power series, and a table of sines.

Keywords: Here are some keywords related to the literary works of Aryabhata- Aryabhatiya, Khagol-Shastra, Arya Siddhanta, Sutra, Ardha-Jya, Dasageethika, Ganitapada, Kalakriya and Gola.

I. INTRODUCTION

Aryabhata (476–550), also known as the father of Indian Mathematics was a renowned astronomer and mathematician of the ancient times of India. He was an Indian astronomer and mathematician who wrote several works on mathematics and astronomy, including Aryabhatiya and Arya-Siddhanta:

Aryabhatiya: A Sanskrit book that summarizes astronomy and mathematics. It's still used in modern Indian mathematical research. The book is written in the form of a sutra, which is a collection of aphorisms. The mathematical part of the book covers arithmetic, algebra, trigonometry, fractions, quadratic equations, and more. The astronomy part of the book is known as Khagol-Shastra. This is Aryabhatta's most well-known work, written in Sanskrit and divided into four sections. It covers a wide range of topics, including:

i. ***Mathematics*****:** Arithmetic, algebra, plane and spherical trigonometry, fractions, quadratic equations, and a table of sines

ii. ***Astronomy:*** The location of the sun and planets, planetary longitude corrections, and spherical astronomy

iii. ***Cosmology:*** The planetary revolutions in a Maha Yuga, which are said to last up to 4.32 million years

Arya-Siddhanta: This work deals with astronomical calculations and describes several astronomical instruments, including a gnomon, shadow instrument, angle-measuring devices, a cylindrical stick, and an umbrella-shaped device. This work is based on the older Surya Siddhanta.

He discovered zero by using it in the decimal system. He made the concept of zero and used it in large numbers. Aryabhata made many more discoveries in mathematics such as trigonometric equations, the value of pi, equations on mathematical progression, and quadratic equations. His work was well-received in the Islamic world, particularly his astronomical findings. His work influenced the development of mathematics in India and early European mathematics.

Aryabhatta Award*:* An annual award, instituted by the Astronautically Society of India. The award is presented to individuals with notable lifetime contributions in the field of astronautics and aerospace technology in India.

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India's first satellite Aryabhata and the lunar crater Aryabhata were named to honor this great Indian scientist.

II. PARAGRAPH OF MAJOR CHAPTERS-15

Aryabhatta was born =in the 4th century in Kusumpura, Kulpa Bihar India. He is one of India's most acknowledged mathematicians and astronomers. His contributions and discoveries have left an indelible mark on Indian astrological traditions.

Aryabhatta is one of India's earliest mathematicians who flourished under the Gupta dynasty in ancient India. Under this empire, Aryabhatta composed two exceptional accounts- Aryabhatiya and Aryabhatasiddhanta. His books are a testament to his critical thinking and immense mathematical knowledge.

He has been credited with the discovery of trigonometric functions, the value of Pi, and algebraic identities. Furthermore, he is most popularly known for inventing Zero and finding its place in the number system. In addition to Mathematics, Aryabhatta has made ample contributions to the field of Astronomy. He was the one who propagated the 'Heliocentric Theory'. According to this theory, planets revolve around the sun and it is not the other way around. Also, he explained the science behind solar and lunar eclipses.

For his explicit mention of the relativity of motion, he also qualifies as a major early physics. He revolutionized the Vedic method of solving mathematical problems. Also, he studied and evolved key Mathematical fields like plane and spherical trigonometry, arithmetic, and algebra. Owing to his astounding knowledge of Algebra, he is regarded as the 'Father of Algebra'.

Aryabhatta contributed significant work in science and mathematics and concluded theories of earth rotation on its axis, approximation of pie (π) place value system of zero, trigonometry, and trigonometry, and many others. He approximated the value of 'pi' as 3.14. He made use of null coefficients while being cautious about the risks associated with using zero. In contrast to Brahmi numbers, he followed the Sanskrit tradition, which primarily used letters and alphabets for notation.

Furthermore, Aryabhatta's accurate insight was that the Earth rotates daily on its axis around the sun, causing the apparent movement of stars and concluded theories of earth rotation on its axis. This contradicted the prevalent belief of his time, which held that the sky itself rotated. Heliocentrism which is defined as the astronomical model that places the sun at the center of the universe, with the Earth and other planets revolving around it, The celestial body's axial rotation' supported by the mathematical evidence.

Direct details of Aryabhata's work are known only from the Aryabhatiya. The name "Aryabhatiya" is due to later commentators. Aryabhata himself may not have given it a name. His disciple Bhaskara I calls it Ashmakatantra (or the treatise from the Ashmaka). It is also occasionally referred to as Arya-shatas-aShTa (literally, Aryabhata's 108), because there are 108 verses in the text. It is written in the very terse style typical of sutra literature, in which each line is an aid to memory for a complex system. Thus, the explication of meaning is due to commentators. The text consists of the 108 verses and 13 introductory verses, and is divided into four Pādas or chapters:

Gitikapada: (13 verses): large units of time—kalpa, manvantra, and Yuga—which present a cosmology different from earlier texts such as Lagadha's Vedanga Jyotisha (c. 1st century BCE). There is also a table of sines (Jya), given in a single verse. The duration of the planetary revolutions during a mahayuga is given as 4.32 million years.

Ganitapada (33 verses): covering mensuration (kṣetra vyāvahāra), arithmetic and geometric progressions, gnomon / shadows (shanku-chhAyA), simple, quadratic, simultaneous, and indeterminate equations (kuṭṭaka).

Kalakriyapada (25 verses): different units of time and a method for determining the positions of planets for a given day, calculations concerning the intercalary month (adhikamAsa), kShaya-tithis, and a seven-day week with names for the days of week.

Golapada (50 verses): Geometric/trigonometric aspects of the celestial sphere, features of the ecliptic, celestial equator, node, shape of the earth, cause of day and night, rising of zodiacal signs on horizon, etc. In

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addition, some versions cite a few colophons added at the end, extolling the virtues of the work, etc.

The Aryabhatiya presented a number of innovations in mathematics and astronomy in verse form, which were influential for many centuries. The extreme brevity of the text was elaborated in commentaries by his disciple Bhaskara I (Bhashya, c. 600 CE) and by Nilakantha Somayaji in his Aryabhatiya Bhasya (1465 CE).

Aryabhatiya is also well-known for his description of relativity of motion. He expressed this relativity thus: "Just as a man in a boat moving forward sees the stationary objects (on the shore) as moving backward, just so are the stationary stars seen by the people on earth as moving exactly towards the west."

In later years, Aryabhatta's research, inquiries, and computations were translated into numerous languages to assist astronomers from different cultures. The most notable translations occurred during the Islamic Golden Age, with influential Arabian mathematicians like Al-Khawarizmi and Al-Biruni, who also believed in the Earth's axial rotation, drawing upon some of Aryabhatta's discoveries.

In the realm of scientific knowledge and global impact, Aryabhatta played a pivotal role in putting India on the map. He challenged and contradicted many prevailing beliefs of his era, providing compelling evidence through his calculations to support his assertions. His work has stood the test of time, remaining remarkably precise. Aryabhatta was one of the few scientists who dedicated their entire lives to an extraordinary and enduring legacy of achievement. His contributions are celebrated and acknowledged throughout India.

Therefore, it is ideal to say that Aryabhatta was an excellent scientist with immense knowledge and an exceptional understanding of his surroundings.

III. FUTURE RESEARCH FOR RESEARCHERS

Aryabhata is noted for his unparalleled knowledge in the domains of astronomy and mathematics, having written treaties in both. Many of Aryabhata's works have been lost to time's tidal wave, but some are still available, and modern scholars hold them reverently because of their tremendous credibility. Therefore, we must be aware of Aryabhata's notable discoveries, which have given India so much pride.

If researchers want to comprehend who Aryabhata is, then researcher has to dig a little deeper and know more about his legacies and inventions. But, before researcher know about his discoveries, researcher have to know about his life or as much information as can be found about his life.

IV. RESEARCH ON WHO IS ARYABHATA?

If researcher want to comprehend who Aryabhata is, then researcher have to dig a little deeper and know more about his legacies and inventions. But, before researcher know about his discoveries, researcher have to know about his life or as much information as can be found about his life.

Research on what are the Notable Inventions/ main contributions of Aryabhatta?

Research on Aryabhata's Notable Inventions: Aryabhata had remarkable achievements that are relevant to this day as he had the most excellent visionary approach. Though most of his works are lost in time, his most significant works are Arya-Siddhanta and Aryabhatiya. In both texts, Aryabhata explores astronomy and mathematics and the correlation between the two. He also discussed how the equations of mathematics could help figure out the world's workings via astronomy.

Research on Aryabhata's Mathematical series, quadratic equations, compound interest (involving a quadratic equation), proportions (ratios), and the solution of various linear equations among the arithmetic and algebraic topics included.

If researcher want to explore on Aryabhatiya, further researcher is helpful to authenticate on the texts mathematical portion has 33 verses that give researcher 66 rules. The text is divided into four chapters Ganitapada (33 verses), Golapada (50 verses), Gitikapada (13 verses), and Kalakriyapada (25 verses).

Research is needed on the Arya-Siddhanta, a lost work on astronomical computations, is known through the writings of Aryabhata's contemporary Varahamihira, as

well as through later mathematicians and commentators including Brahmagupta and Bhaskara I. This work appears to be based on the older Surya Siddhanta, and uses the midnight-day-reckoning, as opposed to sunrise in Aryabhatiya. This also contained a description of several astronomical instruments, the gnomon a shadow instrument ,possibly angle-measuring devices, semi-circle and circle shaped (dhanur-yantra / chakra-Yantra), a cylindrical stick yasti-yantra, an umbrella-shaped device called chhatra-yantra, and water clocks of at least two types, bow-shaped and cylindrical.

Further research is helpful on the Concept of Zero, Calculation of Pi, Contributions to Algebra and Trigonometry and Solar System and also 121 verses where he explains astronomical treatises.

Research on the "Legacy of Aryabhatta" is helpful on **the** calendrical calculations introduced by Aryabhata and his followers have been in continuous use in India for the practical purposes of preparing the **Panchangam** (Hindu calendar).

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