



Mathematicians in India & Their Contribution to Development of Mathematics

Pushkar Amrutrao Taro

NKSPT Institute of Engineering and Technology,
Badnapur, Dist. Jalna

Introduction:

Mathematics is the science of numbers, patterns, structures, and reasoning, often called the language of the universe because of its universal application. Ancient India made pioneering contributions, most notably the concept of zero or *śūnya*. Aryabhata in the 5th century developed rules for arithmetic, algebra, and astronomy, while Brahmagupta in the 7th century gave systematic rules for zero and negative numbers. Bhaskaracharya in the 12th century wrote *Lilavati* and *Bijaganita*, which became famous works of mathematics. Indian scholars also developed early ideas of calculus much before it appeared in Europe. The Kerala mathematician Madhava is credited with the discovery of infinite series for trigonometric functions. These contributions influenced later mathematical traditions across the world. Thus, Indian mathematics laid a strong foundation for modern science and technology and continues to inspire research even today.

Indian Mathematicians:

1. Aryabhata (476–550 CE)

Aryabhata was one of the earliest Indian mathematicians and astronomers. He introduced the concept of place value and used zero in calculations. His famous work *Aryabhatiya* covers arithmetic, algebra, trigonometry, and astronomy. He gave an approximate value of π and explained the motion of planets. His ideas greatly influenced later scholars in India and abroad.

2. Brahmagupta (598–668 CE)

Brahmagupta wrote the classic text *Brahmasphutasiddhanta*. He systematically defined zero as a number and formulated rules for operations with negative numbers. He also introduced methods for solving quadratic equations. His interpolation formulas were used



in astronomy and trigonometry. His works were later translated into Arabic and influenced Islamic and European mathematics.

3. Bhaskaracharya (1114–1185 CE)

Also called Bhaskara II, he was a great mathematician and astronomer of medieval India. His book *Lilavati* explained arithmetic through practical problems, while *Bijaganita* discussed algebra in detail. He developed early concepts of calculus and the idea of derivatives. His astronomical work *Siddhanta Shiromani* described planetary motion. He is regarded as one of the greatest minds in Indian science.

4. Madhava of Sangamagrama (c. 1340–1425 CE)

Madhava was the founder of the Kerala School of Mathematics. He discovered infinite series expansions for sine, cosine, and arctangent functions. His work was an early form of calculus centuries before Newton and Leibniz. He gave an accurate value of π using infinite series. His ideas influenced later Kerala scholars like Nilakantha and Jyesthadeva.

5. Srinivasa Ramanujan (1887–1920)

Ramanujan was a self-taught genius who made extraordinary contributions to mathematics. He worked on number theory, infinite series, modular functions, and partitions. His collaboration with G.H. Hardy at Cambridge University brought him international fame. He developed highly original formulas, many of which are still being researched today. Despite his short life, he left behind over 3,000 theorems.

6. Harish-Chandra (1923–1983)

Harish-Chandra was a mathematician and physicist who specialized in representation theory. He worked on harmonic analysis on semisimple Lie groups, which has wide applications in modern mathematics. His contributions helped establish a new branch of mathematics. He held academic positions at prestigious institutions like Princeton and Columbia University. He is regarded as one of the leading figures in 20th-century mathematics.

7. C.R. Rao (1920–2023)

Calyampudi Radhakrishna Rao was a legendary statistician from India. His *Cramér–Rao inequality* and *Rao–Blackwell theorem* are fundamental in statistics. His work transformed modern statistical theory and its applications in genetics, econometrics, and artificial intelligence. He taught and guided students across the world, leaving a global impact. He received the US National Medal of Science and many international honors.

**8. D.R. Kaprekar (1905–1986)**

Dattatreya Ramchandra Kaprekar was a schoolteacher with a deep love for recreational mathematics. He discovered many interesting properties of numbers, including the Kaprekar constant (6174). His work included magic squares, self-numbers, and Kaprekar numbers. Though not formally trained, his contributions gained recognition in number theory. He inspired many to explore mathematics as a creative art.

9. Shakuntala Devi (1929–2013)

Known as the “Human Computer,” Shakuntala Devi was a prodigy in mental calculations. She amazed audiences worldwide with her speed and accuracy in solving complex problems. In 1982, she entered the *Guinness Book of World Records* for multiplying two 13-digit numbers in seconds. She also wrote books on mathematics and astrology. Her work popularized mathematics among the masses.

10. Manjul Bhargava (1974–)

Manjul Bhargava is a modern Indian-American mathematician who won the Fields Medal in 2014. His research focuses on number theory and algebraic structures. He extended Gauss’s composition law to higher-degree forms. Bhargava has contributed significantly to modern algebra and inspired young mathematicians worldwide. He currently teaches at Princeton University.

Contributions of Indian Mathematicians in the Development of Mathematics:

Indian mathematicians made pioneering contributions to world knowledge, especially through the invention of zero and the decimal place-value system, which revolutionized arithmetic and became the foundation of modern mathematics. They developed advanced ideas in algebra, geometry, and trigonometry, with Aryabhata introducing sine functions and Brahmagupta formulating rules for zero, negative numbers, and quadratic equations. Bhaskara II expanded mathematical thought with early concepts of calculus and derivatives, while Madhava of the Kerala School anticipated infinite series expansions centuries before Newton and Leibniz. These discoveries not only shaped theoretical mathematics but also supported astronomy, navigation, architecture, and engineering in ancient and medieval times. In the modern age, Ramanujan contributed extraordinary insights in number theory and infinite series, influencing contemporary research worldwide. Statisticians like C.R. Rao transformed statistical science with tools fundamental to data analysis, genetics, and artificial intelligence. Recreational



mathematicians such as D.R. Kaprekar highlighted the beauty of numbers, while Shakuntala Devi popularized mathematics among common people through her mental calculation feats. Manjul Bhargava's modern research in number theory continues this legacy, showing the enduring global impact of Indian scholarship. Thus, from the invention of zero to cutting-edge research in algebra and statistics, Indian mathematicians have shaped not only mathematics as a discipline but also contributed to the progress of science, technology, and society at large.

Current Scenario:

In the present scenario, India continues to contribute significantly to mathematics through both pure and applied research. Institutions like the Indian Statistical Institute, IITs, and TIFR have become global centers for mathematical studies. Indian-origin scholars such as Manjul Bhargava, a Fields Medalist, and Akshay Venkatesh, also a Fields Medalist with Indian roots, have brought international recognition. In fields like number theory, algebraic geometry, and statistics, Indian mathematicians remain active and influential. Apart from pure mathematics, India plays a vital role in applied mathematics, data science, artificial intelligence, and computational research, linking ancient traditions with modern technological needs. Government initiatives, mathematical Olympiads, and programs like INSPIRE are encouraging young students to pursue careers in mathematics. Women mathematicians and educators are also increasingly contributing, breaking barriers and inspiring future generations. Globally, Indian mathematicians are part of leading universities and research centers, shaping the discipline's future. Thus, the legacy of India's mathematical past continues in the modern era, where Indian talent is recognized as central to both theoretical advancement and practical innovation.

Conclusions:

The history of mathematics in India is a testimony to the country's intellectual depth and creativity. From the invention of zero and the decimal system to advanced concepts in algebra and trigonometry, Indian thinkers laid the foundation of global mathematics. Aryabhata, Brahmagupta, Bhaskara, and Madhava opened new horizons in theory and application. Their works influenced not only India but also the Arab world and Europe, shaping the Renaissance. In the modern era, Ramanujan's genius took Indian mathematics to international heights. Popular figures like Shakuntala Devi brought mathematics closer



to ordinary people. Today, India continues this legacy through research in pure and applied mathematics. Institutions and scholars are producing world-class contributions in number theory, statistics, and data science. Young talents are encouraged through Olympiads, fellowships, and global collaborations. The journey of Indian mathematics reflects both continuity of tradition and adaptation to modern needs. In conclusion, Indian mathematicians have not only enriched the discipline but also contributed to humanity's scientific progress.

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