Bhaskara Encyclopedia Article

Bhaskara

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Bhaskara

1114-1185

Indian Mathematician and Astronomer

Bhaskara, one of the greatest medieval Indian scholars, pioneered learning in a number of areas, most notably in his approximations of π. Director of the astronomical observatory at Ujjain, he was at the center of scientific activities in the India of his time, and his work in number systems and equations represented a level of understanding far beyond that of contemporary Europeans.

Bhaskara is known variously as Bhaskara II, Atscharja Bhaskara, Bhaskaracharya, and Bhaskara the Learned. His role in Ujjain is significant, because that city—located in the central part of the subcontinent—was a focal point of learning for Hindu India. During this time, Muslim forces occupied what is now western India, Pakistan, and Afghanistan, but they were unable to penetrate deeper into India, and thus the scientists at Ujjain were able to continue their studies largely undisturbed.

Not only did Bhaskara know and understand the uses of the numeral 0, his demonstration that there are two solutions to the equation $x^2 = 9$ shows an understanding of negative numbers. He worked on what later came to be known as Pell's equation, or $x^2 = 1 + py^2$, solving the latter for $p = 8$, 11, 32, 61, and 67. This resulted in some very large numbers; thus where $p = 61$, $x = 1{,}776{,}319{,}049$, and $y = 22{,}615{,}390$.

Bhaskara's best-known work is the *Siddhanta Siromani,* (Head Jewel of Accuracy), a series of books on mathematics and astronomy. The first two books, *Lilavati* (The beautiful) and *Bijaganita* Seed counting) deal largely with arithmetic and algebra. Although some of their content builds on the work of earlier mathematicians, Bhaskara also demonstrates the first consistent use of the decimal system, and began the practice of using letters to represent variables, a technique used to this day. He also presented several approximations for π and solved quadratic equations.

In addition to the last two books of the *Siddhantasiromani,* which deal with the heavens, Bhaskara also wrote *Karanakutuhala* (Calculation of astronomical wonders), a significant text on the motions of the planets and the numerical techniques used to study them. Not content merely with the ethereal realms of numbers and stars, in about 1150 Bhaskara also made one of the first descriptions of a machine for perpetual motion.