

SAW Three-Month Workshop:

Mathematical Practices in relation to the Astral Sciences

Abstract

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Unveiling the Layers of Āmarāja's commentary on Brahmagupta's sines

Abstract: In his commentary to Brahmagupta's *Khaṇḍakhādya*, twelfth century scholar Āmarāja devotes a large part of his exposition to providing the background relations and computations to the versified tabulated sines Brahmagupta presents (Chapter 3, verse 7). His technical exegesis is notably layered, in that it involves several distinct approaches to the reasoning behind the verse; the layers stand in relation to one another in both a complementary yet nuanced way. We carefully read the verse of Brahmagupta and its accompanying commentary. We noted the use of the phrase *bhujīkṛta* (lit: make into a *bhuja*) which means reduce the arc to one between 0 and 90 degrees. We observed that Brahmagupta gives a small number (150) for his radius and a small number of data points which is typical for a *karanā*, and that in fact he gives the first differences (*khaṇḍas*). This latter point suggests that Brahmagupta had in mind the operation of interpolation. We also explored the use of the term *bhukta* and *bhogyā* to describe the interpolation procedure for non-tabulated values and remarked that the interpolation operation expressed in the verse was concerned with manipulating the tabulated data that preceded it. In Āmarāja's commentary, we observed the various layers of reasoning at work: the *vāsanā* or rationale with the diagram that was constructed and the reasoning that took place using it; the two distinct *utpatti* or productions, where Āmarāja derives and computes each of the versified sine values, the first numerically, and the second geometrically. We used the diagram and Āmarāja's guidance to reconstruct each of the sine values, spotting the appropriate triangles and pondered the interplay between *bhuja* and *ko.ti* and the ways in which they emphasized the arc or chord in question that was being sought. We reflected more generally on these operations and the terms which were invoked to describe and carry them out, all of which took on new meaning outside of their more familiar *gaṇita* context.