

## **SAW Three-Month Workshop:**

### **Mathematical Practices in relation to the Astral Sciences**

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*Units to measure the arcs of orbits. Bhāskara's commentary on the Āryabhaṭīya*

**Abstract:** The Āryabhaṭīya by Āryabhaṭa (476-c.550 CE) includes some rules from which the circumference of orbits can be derived in units of yojanas, a measuring unit of length that was widely used in south Asia.

Āryabhaṭa and his commentator Bhāskara (7th century) state that 10 yojanas correspond to 1 arc minute on the moon's orbit in exactly the same way they explain that 60 minutes are 1 degree and that 30 degrees are 1 zodiacal sign. Measuring units of arcs and a measuring unit of distance is being blended in this case. It also raises the question whether the yojana was measured along a curved line, or whether a small segment of an arc was approximated as a straight line.

The circumference of every other planet can be obtained from the general rule that all planets traverse the same number of yojanas in a given time. The number of revolutions completed by each planet in one yuga (4,320,000 years) is stated earlier in the Āryabhaṭīya, and therefore their circumferences can be obtained by a Rule of Three. Bhāskara gives a series of Rules of Three which gives us a link to the longitude of planets and their daily motions in arc units. The number of yojanas traversed by any planet in one yuga is defined as "the orbit of space", which plays a central role in the Rules of Three and also draws our attention to the cosmology behind the explanation.

