BHASKARA'S CALCULATIONS OF THE GNOMON'S SHADOW

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The following problems, proposed and solved by Bhaskara in his Siddhantajyotish, are characteristic of his work.

(i) To find the gnomon's shadow in a given direction on any day in a place of known latitude.

Bhaskara's formula runs as follows:

that is, assuming Rs/sin a to be the equinoctial shadow where s is the original equinoctial shadow, R the radian measured in minutes and equal to 3438 and a the azimuth of the moment, compute the sine of the corresponding latitude, say sin L; then compute sin D from the formula sin D = sin d sin L/sin φ where d is the sun's declination and φ the latitude of the place. Then L ± D gives us the zenith-distance wherefrom the shadow can be derived.

The equinoctial shadow is that cast by the gnomon on an equinoctial day at noon. Thus s/12 = tan φ, the gnomon's length being 12 units. Hence the Hindu sine of the latitude of the place, in terms of the equinoctial shadow would be \( \frac{Rs}{\sqrt{12^2 + s^2}} \) where the Hindu sine is the modern sine multiplied by R.

The formula may be proved as follows according to modern methods.

Let TRQ be the equator, Z the zenith, P the pole and S the Sun's position. ZS, the zenith-distance of the Sun, is equal to ZT ± ST according as the Sun is in the South or North of the Equator. ZT
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