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HOW TO CALCULATE THE LAGNA.

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THE term **lagna** means the point of the ecliptic upon the eastern horizon at a given time.[1] And there are **two problems** connected with the *lagna*. We may be called upon to find out, for a particular date and place, either (1) **the time of the day** at which a given point of the ecliptic was or will be *lagna*; or (2) **the point of the ecliptic** which, at a given time of a stated day, was or will be *lagna*, *i. e.*, was or will be on the eastern horizon.

For the solution of either problem, we must first ascertain **the true longitude of the sun** at the date under consideration. This can be done, with a very high degree of accuracy, by the method explained in my paper, *Ep. Ind.* Vol. I. p. 431, § 51. For ordinary cases, however, it will be sufficient to use the long. ☉ as given in table VIII., *ibid.* This table furnishes us with the *sidereal* longitude of the sun for all days of the *solar* year.[2] The *sid.* long. can be expressed in *râśis* by using table V., *ibid.*; *e. g.*, *sid.* long. ☉ = 35° means that the sun was in the 5th degree of Vṛishabha (Taurus). In the calculations now to be described, both *sidereal* and *tropical* longitude is used. *Sidereal* longitude is counted from the initial point of the Hindû ecliptic, or 0 Mêsha; *tropical* longitude, from the vernal equinox. The latter is derived from the former by adding the amount of precession, or *ayanâṁśas*, for the year under consideration, from table XXVIII. or XXIX., *Ep. Ind.* Vol. II. p. 498. For instance, on the 6th solar Jyaishṭha, Kaliyuga 4000, the *sid.* long. ☉ = 35° (table VIII.), the *ayanâṁśas* = 6° (table XXVIII.), and so the *trop.* long. ☉ = 35° + 6° = 41°. And we take this date as an example in our further calculations.

To arrive at **a first approximation of the lagna,** we suppose the ecliptic to coincide with the heavenly equator; in other words, that the sun moves, and the *lagna* is a point, on the equator.[3]

I. — First Problem. — How many *ghaṭikâs* and *vinâḍîs* after sunrise was, at the given date, some given point, *e. g.*, the 15th degree of Kanyâ (Virgo), on the eastern horizon, *i. e.*, was the *lagna?* On the day of our example, the sid. long. ☉ was 35°; (the *lagna*) Kanyâ 15° is equal to 5 signs 15 degrees, or 165° *sidereal* longitude; therefore, the distance between the sun and the given *lagna* was 165° — 35° = 130°. This distance is equal to 21 *gh.* 40 *v.*; for, 6 degrees take one *ghaṭikâ* in rising, and 6 minutes take one *vinâḍî*. Accordingly the given *lagna* occurred 21 *gh.* 40 *v.* after sunrise.

II. — Second Problem. — What point of the ecliptic was the *lagna* at a igven time of the day under consideration, *e. g.*, 20 *ghaṭikâs* after sunrise? This problem is obviously the inversion of the first. Multiplying the *ghaṭikâs* by 6, we find the distance of the sun and the *lagna* in degrees 6 × 20 = 120°; and adding to the result the *sid.* long. ☉ (35°), we find the *sid.* long. of the *lagna* = 155°, or 5 signs 5 degrees. Therefore the *lagna* was (counting from 0 Mêsha-Aries as initial point) five degrees of Kanyâ (Virgo).

We now proceed **to correct the approximate result thus arrived at.** Since the ecliptic and the equator do not, as we had assumed, coincide, a point on the ecliptic does not rise at the same time with the corresponding point on the equator; but at a place of northern latitude (as is the case with all places in India) it rises *earlier*, when the heavenly point in question is between 0° and 180° *tropical* longitude; and it rises *later*, when it is between 180° and 360°. The exact value of this difference, which depends on the *tropical* longitude of the point on the ecliptic and on the terrestrial latitude of the place in question, is given in table XXVII., *Ep. Ind.* Vol. II. p. 492 ff. We take from this table the corrections which must be applied (1) to

[1] In the astrology of the Ancients: ἀνατολή, *ortus*; see *Firmicus Maternus*, Math. ii. 15, 1.

[2] The *solar* date, as entered in table VIII., is directly found, together with the lunar date, by calculating the latter with the help of my General Tables, *loc. cit.* § 26; or, if the Julian date be known, it may be converted into the solar date used in the tables according to the rules in § 19, *ibid.*

[3] Or what comes to the same, that we may use recta ascensio for longitude.

the rising of the sun and (2) to that of the point of the ecliptic, which is to be the *lagna*. In demonstrating how our previous results are to be corrected, we will suppose, for example's sake, that the place from which the document is dated, lies on the 20th parallel northern latitude.

I(A). — (First Problem). — We had found above, that the given *lagna* occurred 21 *gh.* 40 *v.* after sunrise. The *sid.* long. ☉ on the day in question was 35°, the *ayanámśas* of the year in question were 6°, and accordingly the *trop.* long. ☉ was 35° + 6° = 41°. Now we learn from table XXVII., part B., that for a place of 20° northern lat. the 41st degree of the ecliptic rises earlier than the same degree of the equator by 1 *gh.* 18 *v.* This amount must be added to the interval between sunrise and the *lagna* as found above, *viz.*, 21 *gh.* 40 *v.* + 1 *gh.* + 18 *v.* = 22 *gh.* 58 *v.* The *sid.* longitude of the given *lagna* is 165°. Adding 6° for the *ayanámśas*, we get the *trop.* long. of the *lagna* = 171°. From the same table, part F., we learn, that 171° on the ecliptic rises earlier, by 6 *vinádís*, than the same point on the equator, for the assumed place 20° north. lat. Therefore we must subtract 6 *v.* from the result once corrected, 22 *gh.* 58 *v.* — 6 *v.* = 22 *gh.* 52 *v.* By this much, *viz.*, 22 *gh.* 52 *v.*, the given *lagna* occurred after true sunrise at a place 20° north. lat. on the 6th solar Jyaishṭha, Kaliyuga 4000.

II(A). — (Second Problem). — By approximation we have found, in II., that 20 *gh.* after sunrise the 155th degree was on the eastern horizon, or was then the *lagna*. We now calculate, according to the method explained in I. (A)., the *true* interval between true sunrise and the rising of the 155th degree *sid.* long. We have found, above, that true sunrise occurred 1 *gh.* 18 *v.* before the moment previously assumed ; and this added to the interval stated above, *viz.* 20 *gh.*, makes 21 *gh.* 18 *v.* Adding the *ayanámśas*, = 6°, to the *sidereal* longitude of the calculated *lagna* = 155°, we arrive at the *tropical* long. of the same point, *viz.* 161°. Table XXVII., part F., shows that the 161th degree of the ecliptic rises earlier, by 14 *vinádís*, than the corresponding point of the equator, always of course at 20° northern latitude. This reduces the once corrected interval (21 *gh.* 18 *v.*) to 21 *gh.* 4 *v.* We want, however, to know what was the *lagna* at 20 *gh.* after sunrise, not at 21 *gh.* 4 *v.* The sought *lagna* was a point of the ecliptic which rose 1 *gh.* 4 *v.* before the calculated *lagna* (161° trop. long.). In the same table XXVII., part F., at the head of the column for 20° lat., which has just been used, is entered the time in *vinádís*, *viz.* 10·72, which one degree (or 60′) takes in rising. Now we have the proportion 10·72 *v.* : 60′ = 64 *v.* : X. ; and so, X. = 358′ = 5° 58′. Accordingly the *lagna* at 20 *gh.* after true sunrise on the 6th solar Jyaishṭha Kaliyuga 4000 at 20° north. lat., was, not 155° *sid.* long., but 155° — 5° 58′ = 149° 2′, = 4 *signs* 29° 2′, or Karkaṭa (Cancer) 29° 2′. This result can be tested, if wanted, by calculating, according to the above rules in I. and I. (A)., the interval between this point, *viz. sid.* long. 149°, and sunrise.