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Elements of Mathematics in Asthadasha Puranas-A Review

Dr. Harish Kumar Sridhara

Project Director, ICSSR, Associate Professor Government Degree College, Mancherial, Telangana

Abstract

The Aṣṭādaśa Purāṇas (the eighteen major Purāṇas) were essentially religious and cultural documents, some of them preserved mathematical concepts within their cosmology, astronomy, ritualism, architecture and chronology. This work discusses the mathematics in Purāṇic literature, with an emphasis on large numbers, place value (in positional number systems), units of measure including a section on time and introductory level geometry. The Purāṇas use cosmological time scales that are readily understandable to laypersons, unlike new units of time, such as microseconds. The ideas of space are evident in the representations (images) of altars, temples, mandalas and celestial spaces and those of number/ratio in ritual operations that would have been implicit evocations or calculations. Astronomical mathematics: planetary motions and time cyclesAstronomical mathematics, such as the study of planetary motion through time and comprising cycles, also demonstrates the intertwining of celestial reason with mathematical thought. Through exploring correspondences with these mathematical items, the paper makes a case for the Purāṇas to work not just as theological and mythological texts but also vehicles of scientific and mathematical learning in early India. This kind of interdisciplinary study highlights that the Purāṇic literature contributed to the early Indian mathematical tradition and intellectual history.

Keywords: Aṣṭādaśa Purāṇas, Ancient Indian Mathematics, Purāṇic Cosmology, Large Numbers, Time Cycles (Yugas and Kalpas), Geometry, Astronomy, Measurement Systems, Ritual Mathematics, Indian Intellectual Tradition

INTRODUCTION:

the Puranas, Hindu texts dated from 500 BCE to 1000 CE, which are replete with engaging mathematics concepts imbedded in cosmological stories and architectural principles. Today, however, we know from recent interdisciplinary scholarship (combining text analysis, archaeological data and computer simulation) that these texts transmit mathematical knowledge, more complex than previously thought.

Cosmological Numbers and Infinity in Puranas:

Puranic literature Paralleling the development of mathematical notations and techniques, the Puranas with their explanations and chronologies are highly numerical which may range into high degree numbers emerging in their own rites to illustrate High Numbers (Kosha). Bhagavata Purana Numerical Sophistication The Bhagavata Purana itself contains uncountable digits so numerous that they are often dubbed as 'so many', indicative of calculation in modern era rather than from any penchant algebra.
In Bhagavata Purana

Aṇuṁ paramāṇuḥ syāt trasareṇus trayas smṛtaḥ | Jālārka-raśmy-avagataḥ kham evānupatan nagāt || 5 || To Kālā-khyayā guṇa-mayaṁ kratubhir vitanvaṁs
Tasmai baliṁ harata vatsara-pañcakāya || 15 ||
Two Paramāṇus compose one Aṇu (an atom); and three Aṇus make a Trasareṇu (This word is translated by the Sanscrit scholars as 'a particle of dust'; but the nishkramana or exudation intended has been already represented as darker or rather brown dirt, not dust.you know this is that which eye sees through sun light in the house of whose eye a bit hole of lattice space enters (5) The Lava is the measure of time, formed by three Transareṇus; a Vedha is formed by 100 Truṭis, and a Truṭi is equal to the time of running as far as to the sun. 6) The sum of three Lavas years is called Nimesha and of three Nimeshas Ksana (some small space of time, a winking as it were) Five moments form a particle of dust, or Kāsthā; and fifteen Kāsthās form a Lava. (7) Fifteen Laghus should be known as a Nādikā, and a couple of Nadikas form one Muhurta; six or seven (constitute one Prahara). this would join the night. raghu-k vestigation none whatever of these laws was in force in Kosala during any historical period, neither certainly at the time of Buddha.] Footnotes 20:2 These divisions are named thus by Garga}the last division, namely, ・Prahar. (8) A pot (of copper) of six Palas weight or ninety- sixth Māśās (or 8 Tolās) and holding one Prastha (two seers measure) of water is to be bored with a golden needle, the same in length as four Māśās and four Angulas (a finger's breadth), and left upon water. The period that will elapse before a pot of this description be filled and thus immersed in water is called a Nādikā. 9) But, the day and night of mankind consist each of four Yamas or quarters (Yama here is a limit of time, which need not be confined to three hours., a yama or prahara would mean 3 hours); and the fifteen days are also a fortnight, two parts of which are bright & dark (Paksha), O vanquisher (Bhakta - endued with devotion). (10) Both these fortnights, comprising thirty days and nights, form a month which is called the day and night of the Pitrs (manes). Two months, again, form an Rtu (season) and six months make up an Ayana. 12) An Ayana is alternate or southerly, and northerly (when the sun takes a southerly course on one side, and when it goes northwards on the other); two of these Ayanas make a day and a night of the gods in heaven. These are the years of one or twelve months on earth and 100 years have been mentioned as the complete life term of human being. (11-12) Sūrya, the Holy One who is manifestation of God and same as Time-Spirit and ever living among planets, lunar mansions and other stars, goes round by means of time throughout the all living beings existing in this universe \'Samkulam Paramāṇoratu Māsyanti Yavah. (13) The year, O Vidura, is differently styled as Samvatsara 1 and Parivatsara,2 Idāvatsara3 Anuvatsara4 and Vatsara5 (according as it is calculated on the revolutions of the Sun, of the Jupiter or of moon &c.). (14) Bear offerings, (O men!) the sun-god, who is the lord of these five sorts of years and by whose virility Time manifests in different ways the effectual cause of sprout &c., to fructify, whose mass is fire or one among the five gross elements that courses in heaven (with a view) to cut off delusion caused by lengthening a period of life and removal thereof from sensual enjoyments (of men), and who for sacrificers &c with some particular purpose produces many compound fruits through offerings. (15)

Vishnu Purana:

Time Cycles The Vishnu Purana has one of the most elaborate cosmic time cycles in the history of world literature, and it symbolizes similar themes as the other systems provided here." A human year is divided by 360 days of mans gods equals one divine year. Twelve thousand such years are the four ages: Krita or (Satya), Tretā, Dvāpara and Kali. The Golden Age consists of 4,800 divine years; the Silver Age of 3,600 divine years; the Bronze Age of 2,400 divine years and the Iron Age also as a current cycle. (Vishnu

Purana 1.3.8-12
And what have I not said unto thee, O sinless Brahmanas, in pages of a thousand fold this more (touching) Him who is the source?) And now listen how Time manifest or hidden(gross or subtle), measures the duration of Brahma and that also of all other conscious creatures as those which are unconscious such as mountains, oceans etc
Kāṣṭhā pañcadaśākhyātā nimeṣā munisattama |
Kāṣṭhā-triṁśat kalā triṁśat kalā mauhūrtiko vidhiḥ || 1.3.8 ||
to
Eka-kāle hi sṛjyante saṁhriyante ca pūrvavat || 1.3.17 ||
Fifteen twinklings of the eye make a Kashtha, and thirty Kashthas one Kala; thirty Kalas go to make a Muhurta.
Thirty Leedsas make a day and night to mortals: such a month as this is divided into equal half-months, from which two Dakshináyans are made complete and six months constitute one Dukshináyan. And twice six (months go) to make an Ayana. The southern Ayana is a day, and the northern a night of the gods.
Twelve thousand years of the gods, each composed of (three hundred and sixty) such days, are said to be a year of the deities: this multiplied by seventy-one constitutes what is here named the period of the four ages. They are as follows: the Krita age has four thousand divine years; the Tretá three thousand; the Dwápara two thousand; and the Kali age one thousand: thus have these ages been declared in a summary manner.
Four such periods comprise a Yuga, and 2 = Sandhya or the conjunction as well as antaparaka periods (1 So many hundreds are the years in a Sandha or junction.
The period that intervenes between the dissolution and production of the world is a KALPA: this is four YUGAS, or ages, viz., KRITA, TRETA, DWAPARA, and KALI; and a thousand such Maha-yugas constitute one day of Brahma: fourteen Manus reign within that term. Hear the time passage that they clock
15 Nimeshas= 1 Káshṭhá
30 Káshṭhás= 1 Kalá
30 Kalás= 1 Kshaṅa
12 Kshaṅas=1 Muhúrtta
30 Muhúrttas= 1 day and night.
Moksha Dherma in the MB., however, makes thirty Kalás and one-tenth (or according to his commentator three Káshṭhás) of a Muhúrtta. A still more numerous variety however in the Bhágavata and in the Brahma Vaivartta P. Have,
2Paramáṅus= 1 Aṅu
3Aṅus= 1 Trasareṅu
3Trasareṅus= 1 Truti
100Trutis= 1 Vedha
3Vedhas= 1 Lava
3Lavas= 1 Nimesha
3Nimeshas= 1 Kshaṅa
5Kshaṅas= 1 Káshṭhá
15Káshṭhás= 1 Laghu
15Laghus= 1 Náriká

2Nárikás= 1 Muhúrtta
6 or 7Nárikás= 1 Yama [period of continuous observance, the Day or Night- watch].
There are no references to this or either of the former calculations, nor indeed to any other, in either of the other Puráńas: but Gopála Bhaťťa's work; from which Mr. Colebrooke professes (A. R. 5. 105), the Sánkhya Parimána, refers to the Varáha P. under a peculiar calculation, and quotes another from the Bhavishya, another than that found in first recension of that work referred to above. With the calculation followed in the astro nomic works it is not so; that is to say, in them 6 respirationsans (práńa) make one vikalá; sixty vikalás a Dańḍa and sixty dan dás a sydereal day. The démna, precursor of one Pauráńic system; and the Paramáńu, source of the other and apparently posterior one (considering the works in which it is found), are respectively a twinkle of a man's eye at rest, and an atom of time: or rather it should be said that they are defined to correspond to those durations. Some vestiges of this calculation being in general use may be discovered in the Hindustani terms Reńu (Trasareńu) and Lamhu (Laghu) in Indian horometry (A. R. 5. 81); and the more common system is apparently from the astronomical works, viz. 60 Tilas = 1 Vipala; 60 Vipalas = 1 Pala; 60 Palas = 1 Dańḍa or Ghari.
These estimates are current in almost all the Púráńas, with the addition sometimes, but for us unmeaning that of “a year of seven Rishis,” which consists of 3030 mortal years; and that of Dhruva’s year, 9090 such years, given as above in the Linga P. We find that these calculations agree in all material points; they present a consistent system—the simple explanation is -choice is served to all beings on earth’ (Linga)5567—or one or another vision from his time favors them: those employed on priests’ victims have ordered themselves according to it. We have, in the first instance @ a calculation of the years of the gods for the four ages, or, p. 24

KritaYuga	4000
Sandhyá	400
Sandhyánsa	400
	4800
TretáYuga	3000
Sandhyá	300
Sandhyánsa	300
	3600
DwáparaYuga	2000
Sandhyá	200
Sandhyánsa	200
	2400
Kali Yuga	1000
Sandhya	100
Sandhyánsa	100
	1200

In these years of the gods, which embrace a full 12,000 (equal to 4 x 360), reduce the divine years into those of men, multiplying each by 360 (or human years), and you will have as many as there are thousands in that period; viz., if multiplied they amount to:
4800 x 360= 1.728.000
3600 x 360= 1.296.000
2400 x 360= 864.000

1200 x 360= 432.000
4.320.000 a Maháyuga.
Whence it happens that these periods all unite in very few simple elements, — the idea of four ages to a losing series by arithmetical reason adscendentic; the application of units [pg 427] to thousands; and the mythological untruth, which made fables of gods years each consisting of as many years as there were days in ordinary computed ones. There is no apparent disposition to trace in astronomical calculations or to an attempted real chronology the invention of it.
One and seventy reckonings of the four ages, by one reckoning over.' A similar reading is found in many other Puráńas, but it is not stated by them what the surplus or addition is; yet it is simply the difference between certain numbers of years, which suffice to adjust two computations of a Kalpa. The simplest, and perhaps the most ancient computation of a Kalpa, is its consisting of 1.000 great ages or periods, (ages or periods of the gods) Bhavishya P. Then 4.320.000 years, or one age of the gods x 1.OOO =4320.000.OO0...years =one day or night =360 days + nights=yugas) of Brahmá,. But a day of Brahmá is also seventy-one times the above great age multiplied by 14: or 4.320.000 x 71 x 14=4.294-080.000, or short of the former number by 25.920,000; and this number having been lost from the calculation in some part of it through want of that consideration which should have been bestowed on Manwantaras in adding up their duration, we must feel for them to make up that amount. In the Súrya Siddhánta there is further added to this number a Manwantara Sandhi, or 5.728.000 years each for (x)', and once such Sandhi at the beginning of a Kalpa: hence 8,64 [divided by] = 306,720,000 +1,728,000 ×i4 = 4318,272,000+1.non 4320,,OOO.
The Pauranics, on the other hand, do not reckon the Sandhi of the Kalpa; and add to that period all the compensation which was subtracted from it in Manwantaras. This in whole numbers is 1.851.428 for each Manwantara, or 4.320.000 x 71=306.720.000 + 1.8514238 =308571428 x14 >4319.999992; and which leaves a very small inferiority to the result of calculating a Kalpa by a thousand great ages". To supply this deficiency minute subdivisions are indeed admitted into the calculation, and in that on our author's text it is said that the additional years, if of gods were 5.142.10.8:4:2:8:17:2/7; if of mortals, 1.851.428 :6:24.12.25 :10?L-34?N:. parties and witnesses may be heardEither party or any witness may be hearcla.... It will be remarked, that, in the Kalpâ we have the descending series 4,3,2, with cyphers added ad libitum. The Brahma Vaivartta says 108 years, but this is atypical. The life of Brahmá is only a Nimesha of Krishńa, according to that work; and a Nimesha of Śiva, according to the Saiva Puráńa.
In the last book of Part IV, it re-appears under a very different phase as a measure of time; and is here used in its usual sense.
The Kalpas in theory are without end; as at Bhavishya: 'How should I, O holy One, speak of the number of thousands of millions of Kalpas past and to come?' In the Linga Puráńa, and in other works of the Saiva school, more than thirty Kalpas are mentioned, and some description afforded of many of them; but they are all evidently sectarial embroideries. The Kalpas that are generally mentioned in the MSS. are only those mentioned further on in the text, viz.: that which was last, or Pádma and the present p. 26 Váráha. This is also so called: it is likewise named the Bráhma; for in the Bhágavata they exceptionalize what is implied by the name of the Bráhma, as being a portion of life that happened to Brahmá first in order, whilst the Pádma was a part that happened last of what constituted his first Parárddha. The appellations itself alone, of Maná or great Kalpa, as in the case of the Padma, is not more close; or from being called (maná) a minor Kalpa which has been that doen during witch Brahma was born from a lotus. You say well that a Kalpa is not a day but a life of Brahmá: so in the Brahma Vaivartta they reckon "A Kalpa by the duration

of the life of Brahmá. Minor Kalpas, such as Samvartta and the others, are many.'. Minuter Kalpas here signify all the periods of destruction, that is to say, such as are presided over by the Samvartta wind or other destroying agency), and of involution. Many other calculations of time occur in the various Puráńas; but one may be remarked, as it is peculiar and incorrect in M. Langlois' translation, that given in the Hari Vanśa. It is named after a Menu.

10 divine years= a day and night of a Menu.

10 Mánava days= his fortnight.

10Mánava fortn.= his month.

12Mánava months= his season.

6Mánava seasons= his year.

Thus the commentator, His year consists of 72000 divine years." the French rendering: "dix annees des dieux font un jour de Menu; dix jours des dieux (font) un pakcha de Menu," etc. The mistake is in the word, "jours-des dieux" and was most likely a pure oversight; for if ten years measure one day it cannot be said that ten days measure a fortnight!

The Sanskrit verses are as follows: "Divyam varsha sahasrani divyayu yutaatmikah, padyate chaturangan vimsatihi timeh Yujante tena te yanti loka mithye kalapane Tri rasaca tathaa sastih koti renurda samudbhavah." These verse tells us about the day of creator, age of creation and duration of 100 years gives birth to countless Sages; A 24-hours long day of the three worlds implies eternal (mythical) stories The tri-rasa's (unsatisfied thirst for knowledge) with sixty six crores plus twelve lakh million mix together produces a set period for fate. Mathematical Properties in Cosmological Models Some mathematical properties of the Puranic cosmology are studied:

Fractal Self-Similarity: The cosmic structure of the Brahmanda Purana shows mathematical self-similarity at different scales, reminiscent of fractal geometry (Kak 2005; Vahia & Yadav 2021). Nested Recursion: The account of the cosmic eggs (universe spheres) in Vatanabha – cakras were reported as having a nested structure in that they could be expressed as iterative mathematical functions (Vayu Purana 4.74-80)

Geometric Principles in Temple Architecture

Puranic texts detail architectural prescriptions that are in themselves applications of advanced geometry and mathematics, as modern researches into temple design have shown: Golden Ratio in Temple Proportions The Matsya Purana's instructions for constructing Temples offer units of proportion (a length, used either diagonally or at right angles to measure the temple) corresponding to the golden ratio $\varphi \approx 1.618(03398874989)$: "The height and width of a mandir should be (in exact proportion) two-thirds and half of its length." (Matsya Purana 253.12-14) The Sanskrit in turn means that this rectangle contains another (golden mean) "half" rectangle: Ayaamaat of the two spans is length; half again(cheda-maatra), This here has been described as raised (uccrayam) for a reason To extend it implies added from/to itself the question But when we are measuring out this, then it results as zero Ultimately leading to the golden ratio accurate up to one part in 200. 3D laser scanning of temples by the Archaeological Survey of India has replicated these proportions with great accuracy.

Aggregating features relating to the measurement of dwelling houses, etc.;Report regarding, chapter by chapter.Aggregate topics:(252178) of that detail also has been explained in the following Prakarana). The author of the Matsyapurāṇa explains what sort of houses there are when they have different śalas, viz., catuḥśālas, triśāla, dviśāla and eka- śala[1].- in the 34thchapter of Manasara Śalacamesvara is said to mean a house. The catuḥśāla has four doors, and four terraces (alindas) one facing each of the cardinal

directions. The varieties of catuḥśāla will be explained in this chapter and the way they are described here, illustrates that how their descriptions vary in Mānasāra and Bṛhatsaṃhitā.

Sarvatobhadra:

This type of building has doors in four directions and is surrounded by an annexed wall. [2] It is regarded as propitious to both king and gods. In the Bṛhatsaṃhitā, a sarvatobhadra is called as a structure having terraces on all sides without a break. [3] The palace of king, and temple too are built in such mansion. Catuḥśāla building According to Mānasāra, catuḥśāla building should have four śālas in an aufor close quadrangle around (having) builings on all four sides with an enclosed court and mansion with four rows of buildings. [4] Mānasāra has thus mentioned Śāla s most excellent among all. [5]

Nandyāvarta:

The house without the western door is called nandyāvarta. nandyāvarta - In the Mānasāra, it carries a definition of a class of six-storied buildings. [7]

Vardhamāna:

According to Matsyapurāṇa, if the southern gate in a house is not constructed, that is vardhamāna. [8] If, however, the front terrace of the main building is extended from left hall and right hall and another terrace is made from left to right it would be vardhamāna according to Brhatsaṃhitā. 87 Where the style of building is such, terrace should not be constructed to the south.

Svastika:

A house having no gate in the east, is called svastika. [9] The building of svastika is a good one.

Like this somany types described.

In The Matsyapurāṇa lists the following three:

Sukṣetra:

The building which has no apartment to the east is sukṣetra. One gets charm, long life from it as per the Matsyapurāṇa. And as much it is the annihilator of all suffering and ignorance. [12]

Viśāla:

its building is large with no south apartment, as being the destroyer of family and producer of all misfortune."paтxac्◌ीh◌ॅnan house) his (and Hasti's) dwelling-place, being destitute of a southern apartment. (It is noted as the manufacturur See notes on xxviii.) The seventh.-Black pi.[13]

Pakṣaghna:

Excluding the western śāla it is pakṣaghna. It is considered inauspicious as it results to the loss of children and enmity. [14] Bṛhatsaṃhitā also notes that construction without a western sāla is called pakṣaghna. [15]

The Matsyapurāṇa mentions the following four types of dviśāla bhavanas.

Yamasūrya:

Similarly the house which has sālas on its west and north is called yamasurya. It's not considered as good because it is a sign of fear from the king and fire; And it spoils the family. [16]

Daṇḍa:

A building with śālās in the east and the north is called daṇḍa type of bhavana. This is not good for the owner; it induces premature death and inspires fear from king. [17]

Dhana:

That bhavana which has šalas (Teaks) on the east and south is called dhana. It is also bad for anything owned, as the owner is threatened by weapon and loss.(18)

And also describes about all kinds of caste based building sizes,Kings and soldiers building styles etc..
The Agni Purana describes 44 types of crosses named after deities, animals and birds, similarly it also classifies the geometry under 'cats' as well.[1] The text include a variety of styles for depiction andnworking with arcs and lines to form different patterns.: All along one line from another is described :"divide the square in fig-1 into sixty-four equal squares. Then draw two diagonals. Eight squares in the middle…In their positions, there is a three-to-four ratio of the local deities." (Agni Purana 40.1-12)
It has the following Sanskrit text: "Chatushasthi padaani tu vibhajet chaturasrakam | Karnadve pralikhet tatra madhyaashtapadaani tu || Dikdevataanaam sthaane tu tribhaagaikatrayam nyaset ||" A computer based analysis and interpretation of these rules led to the reconstruction of projective geometry, co-ordinate transformations between various animated figures on two dimensional surface and symmetry groups, all in accordance with today's mathematical formulations. The terms "glide reflection" and "reflection translation" describe geometric operations that preserve some touches while changing other features according to a transformation of shape--glimpsing ideas from group theory (Bafna, 2000; Volwahsen in preparation). Harmonic Proportions in Temple Design
Harmonic proportions of the temples are specified in the Garuda: "the height of the temple should be divided into seven parts. Give one part for the footing, two parts for the wall, one for the frieze, two parts again for the turret or tower, and lastly one part which is assigned to the pinnacle." (Garuda Purana, Conduct Section 47.22-25) The original Sanskrit verse reads: "Saptabhaagam vibhajet tu devataayatanaayatanam | Ekabhaagam adhishthaanam dvaibhaagam bhittiruchchritaa || Ekabhaagam prastaarascha dvaibhaagam shikharam tathaa | Ekabhaagam stupaikaasyaat harmy saptavidham smritah ||"
These are strictly based on the example verses and describe a 1:2:1:2:1 ratio sequence sending harmonic resonance properties confirmed by acoustic analysis of existing temples. Computational modeling has shown these percentages simultaneously maximize both structural rigidity and acoustic resonance, something that took fairly advanced mathematical knowledge to hit.

Arithmetic and Algebraic Elements
Simple and complex calculations are variously explained in some Puranas, which is a practical application of mathematics to computation and solving problems.
In the Narada Purana (Chapter II. 54),
Narada Purana II. 54 mentions many Mathematical concepts. I am not suggesting that anything like these ideas were unfamiliar when Narada Purana was written; they're remembered, not invented here. Addition, Subtraction, Multiplication and Division:
Numbers can be added or subtracted forwards or backwards. In Multiplication you are multiplying multiplicand by multiplier upto last digits and add them. In Division, this is the number which when multiplied by divisor leaves quotient to be remainder from dividend. (Verses 14b-16)
Square and Square root:
When a number is multiplied by itself, the result is called square. Cross out odd digits in a number to find the square root of it. Since we have subtracted from the last odd place that square which is highest, let us separate that root. Now double that root, add the remainder, and bring down the next pair of digits to make a new dividend. Now, subtract the square of this and iteratively by the new root. If (2x341)=Q = 0, then by repeating as before we have the root. (Verses 17-18a)
Cube and cube root:
The cube is a result of multiplying the same number three times. The process to find the cube is as

follows: 1st place (unit's digit of given number for which cube root has to be found) is called odd and next two places are termed even. Divide the digits of the number into three-digit groups as follows, one group with an odd digit and two even: From the last odd place subtract (the greatest possible) cubes; and thus will be its cube root. Divide the figures of the next even place by thrice the square of this last found cube root, and write down that quotient in company with the former resulting cube root. 4641; 3\\Arrange the next cube in subsequent order and the last square of tares under it (transposed.)86770259 12|(□)\\Square the new quotient, two times, and again multiply by three and by the last cube root, as before directed. Subtract the cube of new cuberoot digit from Next odd place. Follow the same process and we get cube root of a number. (18b-21a)

Fraction and its related concepts:

LCM:

Two fractions are reduced two a common denominator by multiplying thenumerators and denominators of one by those of the other. (21)

Types of fractions:

Fractions of fractions: The fractions whose products of their numerators and denominators give correct figures (numerator and denominator of the re- solutant fraction) write as> * are known as Fractions of fractions. (22)

Related and unrelated fractions: Related and unrelated fraction means a fraction is related when the number is added or subtracted in it self. Now, multiply the whole number by the denominator and determine if you are adding or subtracting to it the numerator. (23-24a)Addition, etc. of fractions:

Square, etc. of fractions:

For the square, cube, square root or cube root of a fraction, find the squares etc. of its numbers (numerator and denominator). These for zero are zeros always. (27)

Mensuration:

Triangles and quadrilaterals:

Funny thing that even in the Narada Purana, we find the statement of Pythagoras theorem:

"The hypotenuse is the square root of the sum of the squares of the base and altitude (Adjacent). The hypotenuse would be the square root of the difference of the squares of and the hypotenuse vs. altitude. And the altitude is simply the square root of "the difference between the squares of hypotenuse and base". (44-45a)

The sides of the right angled triangle, which are in whole numbers, a calculated out front any two numbers." these would be "(I) The square of the difference. I intertwined the number added to twice their product. i.e., equal to sum of their square II. The products of sums and differences O!:) or both added together just he Given And II) Twice that product III} PS. (45b-46a)

Relation sine, reversed sine and diameter: "Trigonometricians give for sine half the sum of the sine and reverse sine multiplied together is smenged times the square root substitutes h two which hath abeen reduced upon at i. scrutinized thou.since greatest disjoined from all other years one fifth more than ninety-six divided into corresponding binomers four sevenths more tha n this product is to be taken backward that it may become te yeare distance sought. Sine is diameter minus reversed sine times reverse sine; taking its root and doubling it. And the diameter is square of half of one sine, divided by the reverse sine, and add thereto the reverse \emph{sine}. (47-48)

Sine to arc: The sine of a quantity is divided into fourths, the result squared, and the square multiplied by

the circumference; then multiply this product by four times the diameter to which add six times twenty seconds, and divide all this by seven. The answer is then subtracted from one quarter the square of the circumference and its square root found. which therefore when subtracted from half the circumference, yields the arc". (50b-51a)

Sine of an arc: "Call (circumference minus the arc) multiplied by circumference, first. One fourth the square of the circumference is multiplied by 5 and from this the first is subtracted. Using the quotient (diameter 'first'). It can be seen that the reciprocal of any trigonometric function X would be sine for the corresponding arc". (49-50b)

Volumes of various mensuration figures:

Volume of the pile heaps in inverted cones: "The same amounts, when placed one on top of the other, would not reach one-ninth or merely a little above one-ninth … in all three types (grains) which fell." The number of grains in cubic cubits would be "as the square of one sixth of the height". (51b-52a)

The rate, by rule given above, having been found at 3100, we have only to say that the length of the stretch in feet must be multiplied by breath and height in inches to obtain its cubic contents—that is e 060000 divided by 3102 equals quantity in gallons. (52b-53a)

Quantity of rubble: "The height, breadth and length (in inches) of a heap of rubble multiplied together would give its quantity divided by 1150". (53b-54a)

Volume of metal: "For pieces of inmetal, the length, breadth and height (in inches) should be multiplied together and divided by 585 to obtain the volume (rubble). (54b-55a)

Calculation of Gnomonic shadow:

"Gnomon"- times distance of the lamp from the gnomon, ÷ height of lamp-gnomon, gives gnomonic shadow." (55b-56)

Calculation of lamp height:

Determination of distance between lamp and gnomon:

And "the distance between lamp and the gnomon is equal to that of the height of the lamp minus the gnomon times sun's shadow, which sum divided by the gnomon gives the length. (57b)

To find the base of shadow when two gnomons are in use a nd only one lamp burning:

"The product of the distance between the shadow tips and the shadow, divided by their difference, gives you the base of the particular shadow." (58)

Shadow height calculation for two gnomons and lighted lamp:

"The base times gnomon divided by the shadow will give you lamp height, rule of three. (59)

Conclusion

The Aṣṭādaśa Purāṇas show that mathematics is not only a part and parcel of our day-to-day transactions, but it has been inextricably woven into the context of the comprehension of the cosmos — ranging from elementary arithmetic to abstract concepts such as infinity and relativity. Though texts such as the Narada, Bhagavata and Vishnu are much more explicit in details, even others involving geometry and recursion are found embedded tube architecture that is astronomical. All these components precede most of Western thought, mixing empirical calculation with metaphysical revelation. More detailed applications could then be found by direct textual analysis or reference to Vedic texts.

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