

## **VEDIC MATHEMATICS, SCIENCE & TECHNOLOGY TEACHER COURSE**

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### **GANITA SUTRA 1 AND GANITA UPSUTRA 1**

This day the course focus is upon ‘Ganita Sutra 1 and Ganita Upsutra 1’. It four folds aspects being taken up are as follows:

- 69. Ganita Sutra 1 and Ganita Upsutra 1
- 70. Ganita Sutra 1 and Ganita Sutra 2
- 71. Ganita Sutra 2 and Ganita Upsutra 1
- 72. Ganita Sutra 3 and Ganita Sutra 4

The values being covered are to be taught as lessons numbers 69 to 72 to the students of 3-space Vedic Mathematics, Science & Technology.

### **LESSON-69**

#### **GANITA SUTRA 1 AND GANITA UPSUTRA 1**

1. Ganita Sutra ‘1’ means literally means ‘one more than before’. And, Ganita Upsutra ‘1’ literally means ‘to follow the form as it is’.
2. It leads to the rule of proportionately’. Also, it takes to the rule of ‘symmetry’.
3. As such, Ganita Sutra 1 and Ganita Upsutra 1, together focus upon ‘sequential order’.

4. In terms of such sequential ordering, one may beginning with the linear order of a line, at next step can reach at the spatial ordering of a plane.
5. And, a step ahead there would be a reach at ordering of solid format of 3-space bodies.
6. The sequential reach will continue ahead.
7. With it, the pure and applied value of working rules of Ganita Sutra 1 and Ganita Upsutra 1, individual and collectively makes a very rich mathematical domain.
8. Illustratively, beginning with number value '1', one may, a step by step, by the rule of Ganita Sutra 1 can reach at the set of counting numbers (1, 2, 3, 4 ...).
9. Also, by beginning with values  $1^1$ , one may reach at the power set ( $1^1, 1^2, 1^3 \dots$ ).
10. Also by beginning with (1x1), one may reach at (1x1, 1x2, 1x3, 1x4 ...).
11. Like that, a series of, different sequential values ranges, can be reach at an imaged by the working rule of Ganita Sutra 1 and Ganita Upsutra 1.
12. Still further, there can be reach at the sequence of (1-space, 2-space, 3-space, 4-space ...).
13. Corresponding reach can be at (interval, square, cube, and hyper cubes 4, 5, 6 ...).
14. Likewise, can be had a reach at (1, 1+2, 1+2+3, 1+2+3+4 ...).
15. Parallel to it, there would be a reach at the sequence of set [(1), (1, 2), (1, 2, 3), (1, 2, 3, 4), ...].
16. Likewise, can be had a reach at [(1, 2, 3, 4), (2, 3, 4, 5), (3, 4, 5, 6), (4, 5, 6, 7) ...].
17. Still further there would be a reach at single variable, double variables, triple variables, quadruples variables ...).

18. Also, can be had a reach at the sequence of first degree equation of single variable, second degree equation of single variable, third degree equation of single variable, fourth degree equation of single variable ...).
19. Polygons sequence, leads, dimensional frame, mile stone along a role, and the like there is going to be a very colorful spectrum of sequences, series and sequences of series, as well as series of equations whose chase can be managed by working rules of Ganita Sutra 1 and Ganita Upsutra 1.
20. The sequence of sequences settles mathematical system which inherently takes us from the format of organization of a linear order of a line to the format of the organization of the surface.
21. This as such, makes spatial format of a square, as the basic organization format.
22. One may have a pause here and take note that the text of Ganita Sutra and upsutras is having word formulation 'varga' as the basic formulation.
23. Out of the whole range of geometric format, the choice and option for the formulation 'varga' by the text of Ganita Sutra and upsutra, in itself settle the prominent role which format of varga is to plain in the Vedic mathematics systems.



## LESSON-70

### GANITA SUTRA 1 AND GANITA SUTRA 2

#### GANITA SUTRA-1

एकाधिकेन पूर्वेण

*Ekadhiken Purvena*

One More than One before.

#### GANITA SUTRA-2

निखिलं नवतश्चरमं दशतः

*Nikhilam Navatascramam Dasatah.*

All from 9 and the last from ten

1. Working rule of Ganita Sutra 1: ‘one more than before’ structures construction of sequential range of number of count, as large, as may be desired.
2. Parallel to it, their results a construction of a line as big as would be desired.
3. This as such, leads to infinitely long line to accommodate whole range of counts range, of steps, as large in numbers, as may be desired.
4. Ganita Sutra 2 with its working rule: ‘all from 9 and last from 10’, leads to construction of ten place value system for chase of all the counts.
5. It is this attainment of transition from the mathematics of Ganita Sutra 1 to mathematics of Ganita Sutra 2 which deserves to be imbibed.

6. Basis base value of mathematics of Ganita Sutra 1 is the principle of sequential ordering of the objects / elements, and of steps of chase.
7. Basis base value of mathematics of Ganita Sutra 2 is the organization in terms of nine steps (numerals) of ten place value system.
8. Working rule of Ganita Sutra 1: 'one more than before', as such, will make a mathematics of single digit counts, and a step ahead will make mathematics of Ganita Sutra 2, as a mathematics of double digit counts. And a step ahead mathematics of Ganita Sutra 3 will become a mathematics of triple digit numbers.
9. Further, a working rule of Ganita Sutra 1 'one more than before' will sequentially begin with its first letter, namely a sixth vowel, and at the next step, it will reach at the second letter, namely the first Varga consonant (क्व).
10. Scriptures enlighten us as 'Ka Brahma'.
11. Brahma, is a four head lord.
12. With it, the first letter of the text of Ganita Sutra 1, namely sixth vowel gets associated with number six.
13. A step ahead, the second letter of the text of Ganita Sutra 1, gets associated with number four.
14. Accordingly first pair of letters of text of Ganita Sutra 1 get associated with a pair of numbers (6, 4).
15. The symmetry rule of Ganita Upsutra 1 will take us from the pair of numbers (6, 4) to a pair of numbers (N+2, N) for all values of N.
16. Now, nine numerals range of ten place value system, that way will take us to a pair of numbers (9+2, 9).
17. It would be blissful to take note that all digit numbers 01 to 99 of ten place value system, get accommodated by 9x11 grid / matrix as under:

01	02	03	04	05	06	07	08	09
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99

18. It would be blissful to take note that above organization format of double digit numbers of ten place value systems permits split into 2 parts, firstly as numbers of the upper part including the numbers of the numbers line (10, 20, 30, 40, 50, 60, 70, 80, 90).
19. The second part of above organization format consists of number below the numbers line (10, 20, 30, 40, 50, 60, 70, 80, 90).
20. It would further be blissful to take note that the upper part has numbers line 11, 22, 33, 44, as a mirror line.
21. Likewise the lower part as a mirror line 55, 66, 77, 88, 99.

22. It would further be blissful to take note, both the upper part and lower part, organize numbers as reflection pairs of numbers like (01, 10), (02, 20), (03, 30), ....
23. The mirror line of upper part (11, 22, 33, 44) as such makes these quadruple self reflecting artifices.
24. Further nine reflection pairs (01, 10), (02, 20), (03, 30), (04, 40), (05, 50), (06, 60), (07, 70), (08, 80), (09, 90) are availing 'zero', as a one of the digit.
25. The above quadruple self reflecting artifices / number namely (11, 22, 33, 44) together with above nine reflection pair availing zero as one of the digit, together make a set of  $4+9 = 13$  reflection pairs.
26. The remaining reflection pairs of upper part are 16.
27. It would be a blissful exercise to tabulate 16 reflection pair of the upper part of which 'zero is not marking its presence as one of the digits'.
28. It would be blissful to take note that there are 16 sutras and 13 upsutras.
29. It would further be blissful to take note that it artifice 29 is structurally very rich as that the transcendental code value of formulation Brahma is 29.
30. It would further be blissful to take note that the prime range of number range 1 to 29 is (2, 3, 5, 7, 11, 13, 17, 19, 23, 29).
31. It would be blissful to take note that the prime range of numbers 1 to 29 is of ten primes.
32. As such, the mathematics of Ganita Sutras is of the feature of mathematics of ten primes.
33. The ordinary mathematics is of ten numbers (1 to 10) while mathematics of Ganita Sutras is of ten primes (2, 3, 5, 7, 11, 13, 17, 19, 23, 29) which takes us uptill

- number range 1 to 29, and as number 30 is a composite number, as such the coverage range extends as 1 to 30.
34. It would further be blissful to take note that the volume of the cube is sustained by a structural set up of 29 components of cube, namely (8 corner points, 12 edges, 6 surface, 3 axes, 1 origin).
35. One shall sit comfortably and to permit the mind to fully comprehend the above features and values of Ganita Sutras mathematics.
36. One shall fully imbibe the above features and values to have its complete appreciation for proper insight and appropriate enlightenment about the mathematics of Ganita Sutras.
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## LESSON-71

### GANITA SUTRA 2 & GANITA UPSUTRA 1

#### GANITA SUTRA-2

निखिलं नवतश्चरमं दशतः

*Nikhilam Navatascramam Dasatab.*

All from 9 and the last from ten

#### GANITA UPSUTRA – 1

आनुरूप्येण

Anurupyena.

Proportionately

1. Ganita Sutra 2 with its working rule: ‘All from nine and last from ten’. And Ganita Upsutra 1, with its working

rule: 'Proportionately / symmetrical / follow the form as it is framed', make a mathematics of '**All Place Value System**'.

2. The organization format features of place value system, as such come to be as that double digit numbers of ten place value system get accommodated by the  $N \times (N+2)$  grid / matrix.
3. Illustratively, double digit numbers of six place value system will be accommodated by  $5 \times 7$  grid, as under:-

01	02	03	04	05
10	11	12	13	14
15	20	21	22	23
24	25	30	31	32
33	34	35	40	41
42	43	44	45	50
51	52	53	54	55

4. It would be blissful exercise to chase split of above organization format into upper part including number line 10, 20, 30, 40, 50) and the lower part below this numbers.
5. It would further be blissful to chase reflection pairing of numbers of the upper part along the mirror line (11, 22) still further,
6. It would also be blissful to chase reflection pairing of number of the lower part along the mirror line (33, 44, 55).

7. Working rules of Ganita Sutra 1, Ganita Upsutra 1 and Ganita Sutra 2, together help us reach at the common polynomial format for chase of numbers along place value systems, as under  
 $AX^0 + BX^1 + CX^2 + \dots$ .
8. For  $X = 10$  and numerals range (1, 2, 3, 4, 5, 6, 7, 8, 9) will help work out numbers along ten place value system on the above polynomial format.
9. Likewise  $X = 6$  and numerals range (1, 2, 3, 4, 5) will help us chase numbers along six place value system on the above polynomial format
10. Likewise all others place value system can be worked out values of number all above polynomial format.
11. It will make a blissful exercise to convert value of number of ten place value system into six place value system, and also the other way around likewise one may reach from a given place value system into another require place value system.

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## LESSON-72

### GANITA SUTRA 3 AND GANITA SUTRA 4

#### GANITA SUTRA-3

ऊर्ध्वतिर्यग्याम्

*Urdhva tiryagbhyam.*

Vertically and crosswise

SN	1	2	3	4	5	6	7	8	9	10
Letter	ऊ	घ	र्	व्	अ	त्	इ	र्	य्	अ
TCV	6	7	2	7	1	4	2	2	1	1
SN	11	12	13	14	15					
Letter	ग्	भ्	य्	टा	म्					
TCV	3	8	1	2	9					

## GANITA SUTRA 4

परावर्त्य योजयेत्

*Paravartya Yojayet.*

Transpose and Apply

SN	1	2	3	4	5	6	7	8	9	10
Letter	प्	ट	र्	टा	व्	ट	र्	त्	य्	ट
TCV	5	1	3	2	7	1	3	4	1	1
SN	11	12	13	14	15	16	17			
Letter	य्	ओ	ज्	अ	य्	ए	त्			
TCV	1	7	4	1	1	6	4			

1. Ganita Sutra 3 is the third sutra.

2. Sequentially Ganita Sutra 1, 2 and 3 will accept sequential value triple (1, 2, 3).
3. Ganita Sutras 1, 2, 3 will also have sequential association of values of mathematics of single, double and triple digit respectively.
4. This will further take us to sequential progression of sequential triples, like:
  - (i) (1, 2, 3)
  - (ii) (single axis, double axis, triple axis)
  - (iii) (first axis, second axis, third axis)
5. The availability of symmetry rule of Ganita Upsutra 1, will help us have a reach from the sequential arrangement along a line to that of an arrangement along the circumference of a circle, where by the sequential triple (1, 2, 3) will help us have an arrangement of progression as (2, 3, 1), as well.
6. The sequential reach for the formats of Ganita Sutra 1, 2, and 3 will also bring us face to face with a single point fixation of a line, double points fixation of a line and triple points fixation of a line.
7. It will also further bring us face to face with the triple point fixation of a line with first step being the first end point as a starting point and, second point being the reach at the second end point, and finally the third point to take us the middle point.
8. These features, as such, will bring us face to face with the sequential mathematical reach, in the order of Ganita Sutra 1, 2, 3.
9. The first letter of the text of Ganita Sutra 1 being the sixth vowel has an association of number value six. The letter of the text of Ganita Sutra 1 namely in the first consonant has first association of number value four.

And a step ahead, the third letter of the text of Ganita Sutra 1, being the elongated first vowel, the same as an association of number value 2.

10. Let us have a pause here and take note that the emerging values sequence (6, 4, 2), as such, bring us face to face with many features, like:
  - (i) (6, 4, 2) is of opposite orientation of value triples (2, 4, 6).
  - (ii) Value triples (2, 4, 6) is parallel to value triple (1, 2, 3).
  - (iii) Further the difference value (6, 4) is equal to the difference value (4-2).
  - (iv) Still further, the above differences values, in their generality, is of the format  $[(N+2)-(N)]$ .
  - (v) It is parallel to 1-space as dimension (axis) of 3-space (domain).
  - (vi) The triple (1, 3, 5) will take us firstly from 1-space as dimension to 3-space as domain, and secondly from 3-space as dimension to 5-space as domain.
11. Let us have a fresh look at the set up of half open interval, as a set up of a point and a line.
12. The close interval is of a set up of (point, line, point).
13. Further triple point fixation of a line will lead us to (point, line, point, line, point).
14. This set up will help us have an organization of:
  - (i) Half close interval and of
  - (ii) Half open interval
15. Let us have a fresh visit to the above features and we can comprehend as that at first step we are having a set up of an half open interval. At second step the reach is at closed interval. And third step, the reach is at a synthetic set up of a close interval and of a half open interval.

16. The above synthetic set up, with it split, will also help us reach at the organization has of a square, as a dynamic state format of a closed interval, which shall be making the middle point to pass through the centre of the square, and the third axis through the centre of the square will make a set up of half cube above the first phase of the square surface and second half of the cube, being towards the other phase of the square surface.
17. The sequential step also will take us, at the first steps as horizontal line progression, and the same at the second step leading to horizontal plane set up, and finally at the third step there can be reach as a vertical plane set up.
18. Still further, the triple steps progression may be at the first step being '1 as 1', and at second step being '2 as 1 and 1 as 2', leading to  $\frac{1}{2}$  as a working unit. And next there can be reach at  $\frac{1}{4}$  as a working unit.
19. One may have a pause here and take note that the vertical plane with its first part above the first phase of the square surface base, when splits into two parts, the same shall be making quarter square format for the working organization, and the same is available for the working rule of Ganita Sutra 3: 'vertically and crosswise'.
20. It would be blissful to glimpse and imbibe the above features and values of the organization and format of Ganita Sutra 3.
21. It would also be blissful to glimpse and imbibe the transition values for a reach at the organization format of Ganita Sutra 4 'transpose and apply to unite', by having a reach from the format of half part of the half square of Ganita Sutra 3 to reach at the second half of the half square.

22. One shall sit comfortably and to permit the mind to fully comprehend and to completely imbibe the above features and values of organization format of the working rule of Ganita Sutras 1, 2, 3 and 4.

