VM006-Doc008

Vedic Mathematics, Science & Technology
Teacher Course

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CUBE SEQUENCE

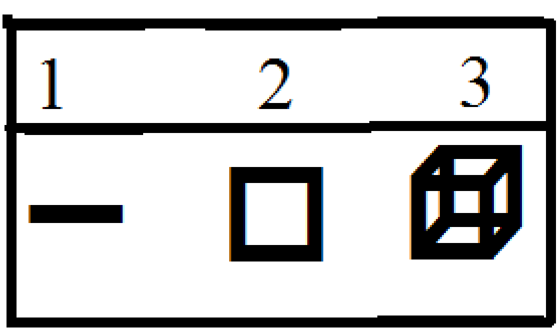
This day the course focus is upon 'Cube sequence'. It four folds aspects being taken up are as follows:

21. Interval, Square and cube formats.
22. Single, double and triple digits numbers
23. Cubes sequence (1^3, 2^3, 3^3, 4^3 …).
24. Synthesis of cubes as sub cubes.

The values being covered are to be taught as lessons numbers 21 to 24 to the students of 3-space Vedic Mathematics, Science & Technology.

LESSON-21

INTERVAL, SQUARE AND CUBE FORMATS



INTERVAL:-

1. Interval is hyper cube 1.
2. It is four folds manifestation layer (-1, 0, 1, 2).
3. Domain boundary ratio is $\mathbf{A^1:2A^0}$.
4. Interval (hyper cube 1) as 3 versions.
5. 3 version of interval permit organization as (-1, 0, 1) signature range.

SQUARE:-

6. Square is hyper cube 2.
7. It is four folds manifestation layer (0, 1, 2, 3).
8. Domain boundary ratio is $\mathbf{A^2:4A^1}$.
9. Square (hyper cube 2) as 5 versions.
10. 5 versions of square permit organization as (-2, -1, 0, 1, 2) signature range.

CUBE:-

11. Cube is hyper cube 3.
12. It is four folds manifestation layer (1, 2, 3, 4).
13. Domain boundary ratio is $\mathbf{A^3:6A^2}$.
14. Cube (hyper cube 3) as 7 versions.
15. 7 versions of cube permit organization as (-3,-2,-1, 0, 1, 2, 3) signature range.

SEQUENTIAL CHASE ALONG FORMAT OF MIDDLE SIGNATURE VERSION:-

INTERVAL:-

1. Value N for middle signature version will make three signature range as of values (N-1, N, N+1) of total value 3N.

2. As such, the sequential values of N = (2^2, 2^2, 2^3, 2^4 …) shall be leading to value as (2^1x3, 2^2x3, 2^3x3, 2^4x3 …).
3. One may have a pause here and take note that the middle signature version, maintains the sequential value for the summation value of whole range as above,
4. A step ahead, N = (3^1, 3^2, 3^3, 3^4 …) shall be leading to summation value sequence for the range as (3^1x3, 3^2x3, 3^3x3, 3^4x3 …)
5. Likewise, would follow the sequential values for N = (4^1, 4^2, 4^3, 4^4 …), and in general would follow for the values sequence for N = (N^1, N^2, N^3, N^4 …).

SQUARE:-

1. Value N for middle signature version will make five signature range as of values (N-2, N-1, N, N+1, N+2) of total value 5N.
2. As such, the sequential values of N = (2^2, 2^2, 2^3, 2^4 …) shall be leading to value as (2^1x5, 2^2x5, 2^3x5, 2^4x5 …).
3. One may have a pause here and take note that the middle signature version, maintains the sequential value for the summation value of whole range as above,
4. A step ahead, N = (3^1, 3^2, 3^3, 3^4 …) shall be leading to summation value sequence for the range as (3^1x5, 3^2x5, 3^3x5, 3^4x5 …).
5. Likewise, would follow the sequential values for N = (4^1, 4^2, 4^3, 4^4 …), and in general would follow for the values sequence for N = (N^1, N^2, N^3, N^4 …).

CUBE:-

1. Value N for middle signature version will make seven signature range as of values (N-3, N-2, N-1, N, N+1, N+2, N-3) of total value 7N.

2. As such, the sequential values of N = (2^2, 2^2, 2^3, 2^4 …) shall be leading to value as (2^1x7, 2^2x7, 2^3x7, 2^4x7 …).
3. One may have a pause here and take note that the middle signature version, maintains the sequential value for the summation value of whole range as above.
4. A step ahead, N = (3^1, 3^2, 3^3, 3^4 …) shall be leading to summation value sequence for the range as (3^1x7, 3^2x7, 3^3x7, 3^4x7 …).
5. Likewise, would follow the sequential values for N = (4^1, 4^2, 4^3, 4^4 …), and in general would follow for the values sequence for N = (N^1, N^2, N^3, N^4 …).

HYPER CUBE 4, HYPER CUBE 5 AND HYPER CUBE 6:-

1. Hyper cube 4, 5 and 6 are 9, 11 and 13 versions respectively.
2. As such, these version would be signature ranges:
   (N-4, N-3, N-2, N-1, N, N+1, N+2, N+3, N+4)
   (N-5, N-4, N-3, N-2, N-1, N, N+1, N+2, N+3, N+4, N+5)
   (N-6, N-5, N-4, N-3, N-2, N-1, N, N+1, N+2, N+3, N+4, N+5, N+6)

3. It would be blissful exercise to chase along above format for N = (2^1, 2^2, 2^3 …), (3^1, 3^2, 3^3, 3^4 …), (4^1, 4^2, 4^3, 4^4 …), (M^1, M^2, M^3, M^4 …).

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LESSON-22

SINGLE, DOUBLE AND TRIPLE DIGITS NUMBERS

1. Single digit number of ten place value system are (1, 2, 3, 4, 5, 6, 7, 8, 9).
2. Double digit number of ten place value system are:

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

3. Triple digit numbers are 001 to 999. These are of the organization 99+900. Further it is of organization 9x11+9x100. This as such, makes ten blocks of which one block is of 99 numbers while remaining 9 blocks are of 100 numbers in each of the range 100 to 999.
4. It would be blissful to reach at single, double and triple digit number of 6 place value system.
5. Single digit number of 6 place value system are

   (1, 2, 3, 4, 5)

6. Double digit number of 6 place systems are:

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

7. Triple digit number of 6 place value systems are:

R-1	001	002	003	004	005
R-2	010	011	012	013	014
R-3	015	020	021	022	023
R-4	024	025	030	031	032
R-5	033	034	035	040	041
R-6	042	043	044	045	050
R-7	051	052	053	054	055
R-8	100	101	102	103	104
R-9	105	110	111	112	113
R-10	114	115	120	121	122
R-11	123	124	125	130	131
R-12	132	133	134	135	140
R-13	141	142	143	144	145
R-14	150	151	152	153	154
R-15	155	200	201	202	203
R-16	204	205	210	211	212
R-17	213	214	215	220	221
R-18	222	223	224	225	230
R-19	231	232	233	234	235
R-20	240	241	242	243	244
R-21	245	250	251	252	253

R-22	254	255	300	301	302
R-23	303	304	305	310	311
R-24	312	313	314	315	320
R-25	321	322	323	324	325
R-26	330	331	332	333	334
R-27	335	340	341	342	343
R-28	344	345	350	351	352
R-29	353	354	355	400	401
R-30	402	403	404	405	410
R-31	411	412	413	414	415
R-32	420	421	422	423	424
R-33	425	430	431	432	433
R-34	434	435	440	441	442
R-35	443	444	445	450	451
R-36	452	453	454	455	500
R-37	501	502	503	504	505
R-38	510	511	512	513	514
R-39	515	520	521	522	523
R-40	524	525	530	531	532
R-41	533	534	535	540	541
R-42	542	543	544	545	550
R-43	551	552	553	554	555

1000

8. It would be blissful to take note that Braham sutra is a scripture of 55 Shalokas.
9. It would further be blissful to take note that Surya Ank is '6'.
10. Par Braham is a step ahead of Nav Braham and as such Braham Ank is 10.

11. It would be a blissful exercise to chase number value 555 along ten place value system, as well as along 6place value systems.
12. Triple digit value number 555 along 6 place value system is of value 215 along ten place value systems.
13. The difference value (555-215) = 340 = 34x10 = (7+8+9+10) x (1+2+3+4) bring us face to face with the set up of hyper cube 9 and hyper cube 3.

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LESSON-23

CUBES SEQUENCE (1^3, 2^3, 3^3, 4^3 …).

1. Cube is a set up within a three dimensional frame.
2. It permits a sequential chase as steps of (i) Single axis (ii) Pair of axes, and (iii) All the triple axes.
3. These three sequential steps are of the format of (i) Interval (ii) Square and (iii) Cube.
4. Interval is of a pair of orientation.
5. This pair of orientation permit expression (+1, -1), parallel to '+1 space' and '-1 space'.
6. One may have a pause here and take note that '+1 space' accepts '-1 space as dimension'.
7. Further as that, (+1, -1) = 0 is parallel to zero is playing the role of dimension of 2-space.
8. One may further have a pause here and take note that 2-space plays the role of origin of 1-space.
9. With it, we are face to face with the organization (-1, 0, +1) for the set up of an interval, in reference to it middle point.
10. It would be blissful to take note that, this leads us to a flow of a pair of stream of values along the formats of a

pair of halves of an interval of opposite orientation placement.

11. This, as such, sequentially leads us to the organization for square values sequence are as follows:
    (o) $0^2 = (-1+0+1)$, a set up of 3 values (-1, 0, 1) with 0 at middle placement.
    (i) $1^2 = (0+1+0)$, a set up of values (0, 1, 0) with 1 at middle placement, and this middle placement being approach from both sides in equal steps.
    (ii) $2^2 = (0+1+2+1+0)$, a set up of values (0, 1, 2, 1, 0) with 2 at middle placement, and this middle placement being approach from both sides in equal steps.
    (iii) $3^2 = (0+1+2+3+2+1+0)$, a set up of values (0, 1, 2, 3, 2, 1, 0) with 3 at middle placement, and this middle placement being approach from both sides in equal steps.
    (iv) And in general, $N^2 = (0+1+2+3+\ldots(n-1)+n+n+1, n-2, 3+2+1+0\ )$ with n at its middle placement permit approach from both sides in equal steps.
12. One may have a pause here and take note that the above organization of value N^2 is of $(2N+1)$ steps.
13. It would further be blissful to take note that, this is parallel to hyper cube n accepting 2n+1 version.
14. Still further, it would be blissful to take note that the square value (N^2) permits organization along the format of a interval, which permit fixation in terms of triple points, namely, the pair of end points and middle point of the intervals.
15. One shall sit comfortably and to permit the mind to glimpse the above organization format, features of intervals accommodating square value(s).

16. It is this feature of the interval accommodating square value, which deserves to be comprehended well for its through appreciation and its complete imbibing.
17. With interval accommodating square value, the same at next steps will lead us to and will bring us face to face the cube value getting accommodating along the square format as N^3 permit re-organization as N^2 x N
18. One shall sit comfortably and the mind to glimpse and imbibe the above feature of formats of interval and square, sequentially accommodating square value and cube value respectively.
19. Further, one may comprehend that the chase of cubes as geometric bodies sequence of values (1^3, 2^3, 3^3, 4^3 …) can be sequentially approach for their internal structural set up of cube 1^3 as a single cube of structural component 27 = 3^3 with value 3 being parallel to 3 versions of hyper cube 1.
20. Further, one may comprehend that cube 2^3 as 8 cubes of structural component 125 = 5^3 with value 5 being parallel to 5 versions of hyper cube 2.
21. Still further, one may comprehend that cube 3^3 as 27 cubes of structural component 343 = 7^3 with value 7 being parallel to 7 versions of hyper cube 3.
22. And in general, cube (N^3) is a structural set up of $(2N+1)^3$ with hyper cube n being of (2N+1) versions.
23. It would be a blissful exercise to chase and to tabulate the above features of cubes (4^3, 5^3, 6^3) being of structural components of (9^3, 11^3, 13^3) value respectively parallel to (9, 11, 13) versions of (hyper cube 4, hyper cube 5, and hyper cube 6).

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LESSON-24
SYNTHESIS OF CUBES AS SUB CUBES

1. A cube is a structural set up of 8 corner points, 12 edges, 6 surfaces and 1 volume, together making it a set up of 27 structural components.
2. When 2 cubes of 27 structural components each are synthesized together with one of the surface plate being the common separating surface for both the cubes, it shall be dispensing with the structural components of one of the surface plate.
3. One surface plate is (a square) is a set up of 9 structural components namely 4 corner points, 4 edges and 1 surface area.
4. Therefore, a pair of cubes of 27 structural components each, together making a set of 27+27 = 54 structural components, on their synthesis will get reduced to a synthetic set up of a pair of cubes being of 27+27-9 = 45 structural components only.
5. It may be taken as that the first cube contributes its all the 27 structural components while the second cube to contribute only 27-9 = 18 components only.
6. This synthetic set up of a pair of cubes, as of 45 structural components will be of following classification for these structural components:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Total:	12	20	11	2	45

7. Now when third cube is synthesized with the above set up of a pair of cubes, there would be a further contribution of 18 structural components by the third cube.
8. One may note that while third cube will be synthesizing itself with the above synthetic set up of a pair of cubes, the structural component of one of the surface plate will get dispensed with.
9. The resultant structural component of synthetic set up of 3 cubes would be as of 27+18+18 = 63 structural components accepting classification as under:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Total:	16	28	16	3	63

10. Now when one more cube, namely fourth cube would be synthesized with the above synthetic set up of 3 cubes, the contribution because of the fourth cube would be only of 12 structural components, as in this situation 2 of the surface plates will get dispensed with.
11. As a result, the synthetic set up of 4 cubes will make a set up of 75 structural components accepting following classification:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Fourth	2	5	4	1	12
Total:	18	33	20	4	75

12. A step ahead, when fifth cube would be synthesized with the above synthetic set up of 4 cubes, it shall be contributing only 18 structural components and thereby making synthetic set up of 5 cubes being of 75+18 = 93 structural components accepting following classification:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Fourth	2	5	4	1	12
Fifth	4	8	5	1	18
Total:	22	41	25	5	93

13. A step ahead, synthetic set up of 6 cubes is going to be a structural set up of 105 structural components of following classification:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Fourth	2	5	4	1	12
Fifth	4	8	5	1	18
Sixth	2	5	4	1	12
Total:	24	46	29	6	105

14. . A step ahead, synthetic set up of 7 cubes is going to be a structural set up of 117 structural components of following classification:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Fourth	2	5	4	1	12

Fifth	4	8	5	1	18
Sixth	2	5	4	1	12
Seventh	2	5	4	1	12
Total:	26	51	33	7	117

15. Finally the synthetic set up of 8 cubes/sub cubes, as a cube shall be becoming a structural set up of 125 structural components accepting following classification:

Cube	Corner points	Edges	Surfaces	Volume	Total
First	8	12	6	1	27
Second	4	8	5	1	18
Third	4	8	5	1	18
Fourth	2	5	4	1	12
Fifth	4	8	5	1	18
Sixth	2	5	4	1	12
Seventh	2	5	4	1	12
Eighth	1	3	3	1	8
Total:	27	54	36	8	125

16. It would be blissful to take note that $8 = 2^3$ number of cubes synthesize a structural set up of $125 = 5^3$ number of structural components.
17. One may have a pause here that square as 2 space body as linear boundary of 4 components and this makes 5 versions of square parallel to presence of boundary components of (4, 3, 2, 1, 0) in number and it will help us acquire insight as to the feature of 2^3 number of cubes synthesizing a structural set up of 5^3 structural components.
18. It would be a blissful exercise to chase further as that $3^3 = 27$ cubes shall be synthesizing a structural set up of $7^3 = 343$ structural components.
19. Here it would be blissful to take note that cube; the representative regular body of 3-space accepts 7 versions.
20. A step ahead, 4^3 numbers of cubes synthesize a structural set up of 9^3 structural components and that 4 space body as 9 versions.
21. In general N^3 cubes synthesize a structural set up of $(2N+1)^3$ structural components. ■