

**Vedic Mathematics, Science & Technology
Teacher Course**

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VERTICAL AND CROSSWISE FORMAT

This day the course focus is upon 'vertical and crosswise format'. It four folds aspects being taken up are as follows:

81. Vertical and crosswise format
82. Split of square values
83. To reach at prime
84. Learning for teaching and learning while teaching

The values being covered are to be taught as lessons numbers 81 to 84 to the students of 3-space Vedic Mathematics, Science & Technology.

LESSON-81

VERTICAL AND CROSSWISE FORMAT

1. Ganita Sutra 3 with its working rule of 'vertical and crosswise format', in case of pair of numbers of single digits (a, b) with their double digit format (0a, 0b) lead to multiplicand of three parts:
 - (i) First part value (0x0)
 - (ii) Second part value (0xb+0xa) = (0)
 - (iii) Third part value ab
 - (iv) Resultant multiplicand value = (0+0+ab) = ab.

2. The general rule expression of above vertically and crosswise format for multiplication of a pair of double digit numbers comes to be:
 - (i) First part = second digit of first number $\times$ second digit of second number.
 - (ii) Second part = second digit of first number multiplied by first digit of second number + first digit of first number $\times$ second digit of second number.
 - (iii) Third part = first digit of first number $\times$ first digit of second number.
3. Pictorially above steps format can be depicted as under:
 - (i) Vertical line connecting second digits of both numbers.
 - (ii) Pair of digit of both numbers to be coordinated crosswise.
 - (iii) First digits of both numbers to be coordinated by a vertical line.
 - (iv) A step ahead, pair of numbers of three digit each, to accepts pictorial representation as under:
 - (v) The above pictorial representation of five parts:
 - (a) First part is a single vertical line coordination.
 - (b) Second part is a cross of a pair of lines.
 - (c) Third part is a cross separated by a middle vertical line.
 - (d) Fourth part is a cross of a pair of lines.
 - (e) Fifth part is a single vertical line.
4. The symmetry of above format, brings to focus that the end result of multiplication along above format can be reached by progressing left to right, as well as from right to left.

5. The above format, when availed for square of, say a triple digit number '321', it shall be the result of summation of values of five duplexes, namely:
 - (a) (3)
 - (b) (3, 2)
 - (c) (3, 2, 1)
 - (d) (2, 1) and
 - (e) (1)
6. The values of above five duplexes come to be $(3^2, 2 \times 3 \times 2, 2 \times 3 \times 1 + 2^2, 2 \times 2 \times 1, 1^2)$.
7. This range of five values (9, 12, 10, 4, 1) on carry forward of the second digit of above pair of digit values, namely (12, 10), as such shall be leading to the value (103041), which is the value of square of triple digit number 321.
8. Likewise, one may reach at square of numbers of any number of digits.
9. The above formats, will simultaneously help square any polynomial of any degree of a single variable.
10. It will make a very blissful exercise to reach at squares of single, double, triple and quadruple digits numbers.
11. It will further make a very blissful exercise to square polynomial of single variable of first, second, third and quadruple degree.



LESSON-82

SPLIT OF SQUARE VALUES

1. One way to split square value N^2 is to sequentially progress as (1, 2, 3, 4, ..., N) and thereafter to

sequentially increase as $(N+1, N+2, N+3, \dots, 3, 2, 1)$ and to have a split for N^2 square value as a range of above values.

2. This split organization also can be viewed as that for N^2 values, one shall begin with value n and to have decreasing along its both sides and to have reach at value '1' on both ends.
3. The other way to split square values is to reach at
 - (i) $1^2 = 1$, the first odd number.
 - (ii) $2^2 = 4, 1+3$, summation of first pair of odd numbers.
 - (iii) $3^2 = 9 = 1+3+5$, summation value of first triple odd numbers.
 - (iv) $4^2 = 16 = (1+3+5+7)$, summation value of first quadruple odd numbers.
 - (v) And like that one can have a reach up-till N^2 as a summation value of first N odd numbers.
4. The above first split of square is of the format of a two folds flow from the middle of its reach on either side in sequential steps at the end value '1' on both sides.
5. The above second split format is parallel to sequential manifestation along the (dimension, domain format as that 1-space as dimension manifests 3-space domain, which at next step as 3-space dimension manifests 5-space, and the same at next step as 5-space manifests 7-space domain and so on.
6. This manifestation process as such, sequentially become the format value being square of one spatial unit, square of four spatial units, square of 9 spatial units, square of 16 spatial units and so on.
7. The above pair of square split format, when viewed together the same shall be bringing us face to face with

transcendence and ascendance feature at the centre of the square and making a vertical line of equal length along both phases of the surface.

8. It is this feature which deserves to be comprehend well for its complete appreciation to have full imbibing their off for proper insight and appropriate phenomenon about this mathematical value.
9. It would be blissful to re-glimpse square as hyper cube 2, a representative regular body of 2-space with 3-space as origin.
10. One shall revisit centre of the square as a seat of 3-space origin.
11. 3-space is a linear order space, as such this order, with availability of spatial base, will manifests third axis as a vertical line for the horizontal plane.
12. Further, because of it, the horizontal plane shall be manifesting a pair of phases.
13. Accordingly the vertical axis split into a pair of half axis, the first half of which will be making a third axis along the first phase of the axis and the second half of vertical axis make third axis for the second phase of the axis.
14. One shall sit comfortably and to permit the transcending mind to comprehend well the above feature of the square split phenomenon and to completely appreciate the same to have its full imbibing.



LESSON-83

TO REACH AT PRIMES

1. Square format helps us sequentially reach at primes.

2. For it, given square N^2 , the other split for it $M^2 = MS$ will make either M to be less than N or S to be less than N .
3. As such $N = B$ prime will help us short out all composite up-till P^2 by striking out the multiplies of all the primes up-till prime P .
4. With $P = 2$, as prime and by striking out all multiplies up-till 2^2 , we will left with number '3' and same will become another prime having being reached at in the process.
5. Now $P = 3$, together with previous prime 2 will help us reach at primes up-till 3^2 by striking out the multiplies of 2 and 3 from the range of numbers 1 to 9.
6. Accordingly we will have a reach at primes (2, 3, 5, 7).
7. Now with the help of $P = 7$ we can reach at prime up-till $7^2 = 49$ by striking out multiplies of (2, 3, 5 & 7) from the range of number 1 to 49.
8. It will be a reach at primes (2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47).
9. With availability of above range of prime, with 47 as the biggest prime of this range, the same will help us reach at prime of the reach at the number of 1 to 47^2 .
10. One may have a pause here and take note that for a reach for prime up-till number N^2 , there would be a lead of availability of prime only up-till number value N .
11. As such, the prime up-till number value 10 can be worked out with the help of prime up-till '3'.
12. Further, the prime up-till 100 can be worked out with the prime up-till 10, a step ahead, prime up-till 10000 can be worked out with the help of prime up-till 100 only.
13. And, the prime up-till 1000 can be worked out with prime up-till 31.

14. Now as the prime up-till 31 are (2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31), as such by striking multiples of these primes we can reach at prime up-till 1000.
15. It will be very blissful to work out primes up-till 1000.
16. As for as, the prime '31' is concerned, it would be required to strike out the number 31 to 31.
17. However, 29 is to be availed for striking out (29×29 and 29×31).
18. Prime 23 is to be availed for striking out 23×23 for striking out (23×23 , 23×29 and 23×31).
19. Number 19 is to be availed for striking out (19×19 , 19×23 , 19×29 and 19×31).
20. Proceeding other way round, prime 2 will strike out all even number bigger than 2.
21. Prime 3 will strike out all multiples of three, may be even or odd, but as even numbers already stand strike out by prime 2, there for only odd numbers lead be taken up for striking out of multiples of 3.
22. Prime 5 as number value 5 will help strike out all multiple of five, bigger than '5' itself. However as, the multiples of 2 and 3 having being already applied for their multiples of 2 and 3, there for it is only, out of the remaining number that multiples of five would be required to be strike out.
23. Likewise, chase can be from prime 7 onwards.
24. This way one shall reach at tabulation for the primes of numbers range 1 to 1000. ■

LESSON-84

LEARNING FOR TEACHING AND LEARNING WHILE TEACHING

1. Learning approach shall be of dual values, firstly as that, one shall learn for teaching, and secondly to continue learning while teaching.
2. Students of this year course of basis base 3-space mathematics for 3-space Vedic Mathematics, Science & Technology shall imbibe above two folds value during this course.
3. One shall aim to learn 3-space mathematics within aim to teach the same to other and also to continue learning while teaching 3-space mathematics.
4. One shall draw one's own sequence of teaching steps of 3-space mathematics. Naturally, one's sequence of teaching steps would be the way one feel that one should have been taught the subject the way they are successful to comprehend and imbibe the values of 3-space mathematics.
5. The difficulties, which one may have released by learning, would naturally get blungted in one's own sequence of teaching steps of 3-space mathematics.
6. Further, while one would be teaching, one shall be more intimately releasing the aspects of values of 3-space mathematics. It is this intimate confrontation of the values of 3-space mathematics which will be en-reaching one's comprehension and imbibing of values of 3-space mathematics, with more intimate interaction of learning 'facility of one's mind, with itself.
7. It is this self interacting virtue of mind which gets activity, while one is teaching the values having already being learnt, and as a result one continues learning more and more by teaching the value already learn.

