Vedic Mathematics

(*Basic Arithmetic*)

of

Bharati Krshna Tirthaji Maharaj,

(*Shankaracarya of Puri Govardhana Mutt, Puri*)

by

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Bharati Krshna Tirthaji Maharaj,
Shankaracarya of Puri Govardhana Mutt, Puri,
Propounder of *Vedic Mathematics - A profile*.

Mathematics is considered the most difficult subject, not only by the ordinary people but by students and the learned as well. At the same time, everyone thinks it is an essential subject to be learnt by all. Many have tried to make it attractive and interesting but their efforts did not have much impact. But there was one divine personality who could make mathematics the simplest, easiest and most attractive of all subjects. Bharati Krshna Tirthaji, who was the Shankaracarya of Puri Govardhana Mutt for 35 long years till his Mahasamadhi in 1960, says that he reconstructed 16 mathematical sutras from materials scattered here and there in the Atharva Veda during 8 years of research and hard work. He wrote 16 volumes and named Vedic Math. But unfortunately, all of them were lost. Despite his failing health and weak eyesight the Swamiji began to rewrite them, but he could complete only one volume, which is presently available. Research work is going on in foreign countries as well as in India to rediscover what was lost in the 16 volumes.

The Swamiji was such a genius that he took M.A. with the highest honours in 8 different subjects from the American College of Science, Rochester, New York at the age of just 20. He contributed learned articles on religion, philosophy, sociology, history, politics, literature *etc.,* while he was a student. In fact, study of the latest researches and discoveries in modern sciences were his hobby till his very last days. At the age of 16, the Madras Sanskrit Association awarded him the title 'Saraswati' for his extraordinary proficiency in Sanskrit.

Bharati Krshna Tirthaji worked with Gopala Krishna Gokhale from 1905 in connection with the National Education Movement and the South African issue. He was chosen the first Principal of the National College at Rajamahendri founded in 1908 by the Nationalists for the propaganda of education based on Indian culture and heritage heritage catering to the needs of an Indian to attain all round development, as distinct from the system introduced by the British. He left that post in 1911 to practice Brahma Sadhana at Sringeri. He was initiated to samnyasa at Benares by the Shankaracarya Sri Trivikrama Thirthaji of Saradapeeth and became Swami Bharathi Krishna Thirthaji. In 1921, he became the Shankaracarya of Saradapeeth. In 1925, he became the Shankaracarya of Puri Govardhana Math. He toured all over India and abroad to propagate Dharma which he defined as "*the sum total of the means necessary for speedily making and permanently keeping all the people, individually as well as collectively superlatively comfortable, prosperous, happy and joyous in all aspects (including the physical, mental, intellectual, educational, economical, social, political, psychic,spiritual etc., ad infinitum).* He founded Sri Viswa Punarnirmana Sangha at Nagpur in 1953 for the all-round reconstruction of India and through it of the world.

Mathematicians all over the world say that Vedic Mathematics is applicable to all the branches of mathematics and sciences. To propagate Vedic Sciences, the National Institute of Vedic Sciences under the guidance of of Founder and Chief Patron His Holiness Sri Sri Vijnananidhi theertha Swamiji is organizing lectures, symposiums and workshops for teachers, pupils and public along with publications.

Introduction

Ten digits used in the International place-value system of numerals for numbers are 1, 2, 3, 4, 5, 6, 7, 8, 9 and 0 and therefore International place-value system of numerals is called base ten system or denary system of place value.The digits from 1 to 9 are named *significant digits/ figurates*. Place-value of each digit in the numeral of a number increases in multiples of 10 from right to left (as we look at it) starting with 1.

For example, the numeral of a number *twenty thousand sixty-five* is 20,065, because its expansion is;

20,065 = 2x10000 + 0x1000 + 0x100 + 6x10 + 5x1.

Place-values of digits in the numeral 20,065 is increasing in multiples of 10 from right to left (as you look at it). Digit 0 is a special kind of digit. It occupies all the places of place-values where *no figurate/ significant digit* is spelt in a number.

Place-value of *figurate/ significant* digit 5 in 20,065 is 1.

Place-value of *figurate/ significant* digit 6 in 20,065 is 10.

Place-value of the significant digit 2 in 20,065 is 10000.

Since no *figurate/ significant digit* has occupied the place-values of 100 and 1000, their place-values spelt. But numeral of the number *twenty thousand sixty-five* is 20065, but 0 has occupied these place-values (which are not spelt) and for this reason 0 *is called the null figurae* or *null.*

The place-value of each digit in the numeral of a number moves (*increases*) *towards left* (*in multiples of ten* frm the right extreme).

This fact is stated as अङ्कानाम् वामतोगतिः ।

Give the value of 7 in the following.

(i) 837, (ii) 72 (iii) 8796 (iv) 73006 (v) 170008

Chapter I

I. Rule : निखिलम् नवतश्चरमम् दशतः ।

(All from nine and last (significant digit) from ten)

1(a). The Rule 1 is helpful to find deviation or complement of a given number from its base.

Base of a single-digit number is 10. Base of numbers from 1 to 9 is 10

Base of a two-digit number is 100. Base of numbers from 10 to 99 is 100.

Base of a three-digit number is 1000. Base of numbers from 100 to 999 is 1000, and so on.

Deviation of a single digit number 7 (from its base) is 3. 3 is the complement of number 7 to its base 10.

Similarly, complement/ deviation of number 857 is 143 (from its base 1000).

The Rule : निखिलम् नवतश्चरमम् दशतः । (All from nine and last (significant digit) from ten) is useful to find the deviation of a number from its base.

To find the complement / deviation of 857 from its base 1000, subtract 8 and 5 from 9, and the last 7 from 10.

Therefore complement / deviation of 857 (from its base) is (1000 - 857) = 143.

Complement/ deviation of 807 is 193.

Complement / Deviation of 8950200 is 1049800. Because, the digits 8, 9, 5 and 0 are subtracted from 9 and the last significant digit 2 is subtracted from 10, and then 2 is followed by zeroes.

Exercise I. 1 (a): - Write the complements/ deviation of the following.

(i) 68 (ii) 502 (iii) 9405 (iv) 89699 (v) 2950 (vi) 990

(vii) 38730 (viii) 1111 (ix)5099000 (x) 8888880000

I. 1(b) Product of two single-digit numbers less than the base 10 applying निखिलम् नवतश्चरमम् दशतः **: -**

Example 1: - Find 6 x 8 base = 10

In numbers 6 and 8, digits 6 and 8 are the last digits also.

Therefore, Deviation of 6 to base 10 = 6 - 10 = - 4

and deviation of 8 to base 10 = 8 - 10 = -2

Write numbers in LHS and their deviations from the base in RHS.

LHS (*number*)	RHS (*deviation*)
6	-4
8	-2
4	8

Write (6 - 2) = (8 - 4) = 4 in LHS taking numbers crosswise.

Write (-4) x (-2) = 8 in RHS as shown.

Then, 6 x 8 = 48

Example 2: - Find 7 x 9 base = 10

In numbers 7 and 9, digits 7 and 9 are the last digits also.

Therefore, Deviation of 7 to base 10 = 7 - 10 = -3

and deviation of 9 to base 10 = 9 - 10 = -1

Write numbers in LHS and their deviations from the base in RHS.

LHS (*number*)	RHS (*deviation*)
7	-3
9	-1
6	3

Write (7 - 1) = (9 - 3) = 6 in LHS taking numbers crosswise.

Write (-3) x (-1) = 3 in RHS as shown.

Then, 7 x 9 = 63

Exercise I. 1(b): - Find the product of the following using the method shown above: - (i) 8 x 6 (ii) 8 x 9 (iii) 5 x 9 (iv) 9 x 9

(v) 9 x 6 (vi) 8 x 8 (vii) 7 x 7 (viii) 9 x 3 (ix) 6 x 8 (x) 4 x 9

I. 1 (c) Product of two two-digit numbers nearer to base 100 निखिलम् नवतश्चरमम् दशतः **: -**

Example 1: - Find 98 x 97 base = 100

Deviation of 98 to base 100 = 98 - 100 = -02 and

deviation of 97 to base 100 = 97 - 100 = -3

Write numbers in LHS and their deviations from the base in RHS.

LHS (*number*)	RHS (*deviation*)
98	-02
97	-03
95	06

Write (98 - 3) = (98 - 2)= 95 in LHS taking numbers cross-wise. Write (-3) x (-2) = 6 in RHS as shown.

Then, 98 x 97 = 9506

Example 2: - Multiply 95 and 85 base = 100

Deviation of 95 to base 100 = 95 - 100 = -05 and

deviation of 85 to base 100 = 85 - 100 = -15

Write numbers in LHS and their deviations from the base in RHS.

LHS (*number*)	RHS (*deviation*)
95	-05
85	-15
80	75

Write (95 - 15) =(85 - 5) = 80 in LHS taking numbers cross-wise. Write (-05) x (-15) = 75 in RHS as shown.

Then, 95 x 85 = 8075

Exercise I. 1 (c): - Find the product of the following using the method shown above; (i) 94 x 96 (ii) 96 x 87 (iii) 85 x 75

I. 1(d) Product of three two-digit numbers nearer to base 1000: -

Example 1: - Find 998 x 987 base = 1000

Deviation of 998 to base 1000 = 998 - 1000 = -002 and deviation of 987 to base 1000 = 987 - 1000 = -013

Write numbers in LHS and their deviations from the base in RHS.

L H S (*number*)	R H S (*deviation*)
998	-002
987	-013
985	026

Write (998 - 013) = (987-002)= 985 in LHS taking numbers crosswise. Write (-002) x (-013) = 026 in RHS as shown.

Then, 998 x 987 = 985026

Example 2: - Find 986 x 988 base = 1000

Deviation of 986 to base 1000 = 986 - 1000 = -014 and deviation of 988 to base 1000 = 988 - 1000 = -012

Write numbers in LHS and their deviations from the base in RHS.

LHS Number	RHS Deviation
986	- 014
988	- 012
974	168

LHS: (986 – 012) *or* (988 – 014) = 974

RHS: (-014) (-012) = 168

Exercise I. 1(d): - Find the product of the following using the method shown above.

(i) 994 x 996 (ii) 986 x 990 (iii) 995 x 975 (iv) 982 x 988 (v) 991 x 979 (vi) 983 x 998

I. 1(e) Miscellanius problems and justification: -

Example 1: - Multiplying 99988 and 99984 base = 1,00,000

L H S		R H S
99,988		- 00,012
99,984		- 00,016
12	/	00,192

99988 x 99984 = 1200192

because;

Real value of the answer = L H S x base + R H S

99988 x 99984 = 12 x 1,00,000 + 00,192

= 1200192

Example 2: - A challenging Problem

Multiplying 99,99,998 and 984 base = 1,00,00,000

L H S		R H S
99,99,998		- 00,00,002
00,00,984		- 99,99,016
982	/	$_1$99,98,032

99,99,998 x 984 = = 982$_1$99,98,032 = 9,83,99,98,032

because;

Real value of the answer = L H S x base + R H S

99,99,998 x 984 = 982 x 1,00,00,000 + 1,99,98,032

= 9,82,00,00,000 + 1,99,98.032

= 9,83,99,98,032

Exercise I. 1(e): - Find the product of the following using the method shown above.