

# Matrix Representation of Multiplication

Atul N. Desai, Tejpal H. Goda

**Abstract:-** Multiplication is the basic process of mathematical operations. In the vedic mathematics for this lengthy process, a simple process is used with the help of urdhva tiryakbhyam sutra. It helps to avoid small work in calculator which can be manually done easily. If a person starts using this method without sufficient practice, many a times one can make mistakes in long calculations during cross and vertical multiplication and addition at a time. To avoid these mistakes a simple matrix form representation of the multiplication can help this technique without long calculation of multiplication and addition at a time.

**Keywords-** Matrix, Multiplication

## I. INTRODUCTION

Suppose we have to multiply  $(Ax + B)$  with  $(Cx + D)$ , the product is  $acx^2 + x(ad+bc) + bd$ . In other words, the first term, i.e the coefficient of  $x^2$  is got by vertical multiplication of a and c; the middle term, i.e. the coefficient of x is obtained by the cross-wise multiplication of a and d and of b and c and addition of the two products; and the independent term is arrived at by vertical multiplication of the absolute terms. And, as all arithmetical numbers too. Now, if our multiplicand and multiplier be of 3 digits each, it merely means that we are multiplying thus pattern of multiplication observed is:

$$(ax^2+bx+c) \text{ by } (dx^2+ex+f) \text{ (where } x= 10\text{):}$$

$$ax^2+bx+c$$

$$dx^2+ex+fadx^4 + x^3(ae+bd) + x^2(af+be+cd) + x(bf+ce) + cf$$

Step 1 $\begin{array}{r} 252 \\ \times 846 \\ \hline 162 \\ 2100 \\ 19200 \\ \hline 213192 \end{array}$ result = 12 pre carry = 0	Step 2 $\begin{array}{r} 252 \\ \times 846 \\ \hline 162 \\ 2100 \\ 19200 \\ \hline 392000 \\ 213192 \end{array}$ result = 38 pre carry = 1
Step 3 $\begin{array}{r} 252 \\ \times 846 \\ \hline 162 \\ 2100 \\ 19200 \\ \hline 510000 \\ 213192 \end{array}$ result = 48 pre carry = 3	Step 4 $\begin{array}{r} 252 \\ \times 846 \\ \hline 162 \\ 2100 \\ 19200 \\ \hline 530000 \\ 213192 \end{array}$ result = 48 pre carry = 5
Step 1 $\begin{array}{r} 252 \\ \times 846 \\ \hline 162 \\ 2100 \\ 19200 \\ \hline 213192 \end{array}$ result = 16 pre carry = 5	

## II. MATRIX REPRESENTATION OF THE SAME CAN BE DONE AS UNDER

The matrix is represented by various numbers as  $A_{11}, A_{12}, A_{13}, A_{21}, A_{22}, A_{23}$  etc.

Here attempt is made to represent multiplication in the matrix form.  $A_{11}$  means multiplication of first digit of the multiplicand and multiplier and so on. Hence the entire multiplication can be represented as under.

	8	4	6
2	16	8	12
5	40	20	30
2	16	8	12

Finally adding the results of multiplied numbers and arranging them in proper format the result can be obtained as under.

	16	40 + 8 = 48	12 + 20 + 16 = 48	30 + 8 = 38	12
1	6	8	8	8	2
(+1)	4	4	3	1	
2	1	3	1	9	2

### Example 1:

#### Vedic Method:

#### 2583\*41

Step 1 $\begin{array}{r} 2583 \\ \times 41 \\ \hline 2583 \\ 10332 \\ \hline 105903 \end{array}$ result = 3 pre carry = 0	Step 2 $\begin{array}{r} 2583 \\ \times 41 \\ \hline 2583 \\ 10332 \\ \hline 103320 \\ 105903 \end{array}$ result = 20 pre carry = 0
Step 3 $\begin{array}{r} 2583 \\ \times 41 \\ \hline 2583 \\ 10332 \\ \hline 103320 \\ 105903 \end{array}$ result = 37 pre carry = 2	Step 4 $\begin{array}{r} 2583 \\ \times 41 \\ \hline 2583 \\ 10332 \\ \hline 103320 \\ 105903 \end{array}$ result = 22 pre carry = 3
Step 1 $\begin{array}{r} 2583 \\ \times 41 \\ \hline 2583 \\ 10332 \\ \hline 105903 \end{array}$ result = 8 pre carry = 2	

#### Alternate Matrix representation

	2583	
	X 41	
	4	1
2	2*4=8	2*1=2
5	5*4=20	5*1=5
8	8*4=32	8*1=8
3	3*4=12	3*1=3

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Prof. A.N.Desai, Structure Department, Birla Vishvakarma Mahavidyala, VV nagar, Anand, Gujarat, India.

Tejpal H. Goda, B.E Civil, M.E. Structure (pursuing), Birla Vishwakarma Mahavidyala Engg. College VV nagar, Anand, Gujarat, India.



## Matrix Representation of Multiplication

	8		2
	20		5
	32		8
	12		3

Summing all intermediate answers to get final answer, such that **first digit of number goes down to previous on**

	8	20+2=22	32+5=37	12+8=20	3
	8	2	7	0	3
(+1)	2	3	2		
<b>1</b>	<b>0</b>	<b>5</b>	<b>9</b>	<b>0</b>	<b>3</b>

OR

	2	5	8	3
4	8	20	32	12
1	2	5	8	3

8	20+2= 22	32+5=37	12+8=20	3
			0	
8	2	7	0	3
2	3	2		
<b>10</b>	<b>5</b>	<b>9</b>	<b>0</b>	<b>3</b>

### Example 2:

#### Vedic Method:

**987\*123**

Step 1 $\begin{array}{r} 9\ 8\ 7 \\ \times 1\ 2\ 3 \\ \hline 27 \\ 180 \\ 987 \\ \hline 121401 \end{array}$ result = 21 pre carry = 0	Step 2 $\begin{array}{r} 9\ 8\ 7 \\ \times 1\ 2\ 3 \\ \hline 27 \\ 180 \\ 987 \\ \hline 0140 \end{array}$ result = 38 pre carry = 2
Step 3 $\begin{array}{r} 9\ 8\ 7 \\ \times 1\ 2\ 3 \\ \hline 27 \\ 180 \\ 987 \\ \hline 40154 \end{array}$ result = 50 pre carry = 4	Step 4 $\begin{array}{r} 9\ 8\ 7 \\ \times 1\ 2\ 3 \\ \hline 27 \\ 180 \\ 987 \\ \hline 140131 \end{array}$ result = 26 pre carry = 5
Step 1 $\begin{array}{r} 9\ 8\ 7 \\ \times 1\ 2\ 3 \\ \hline 27 \\ 180 \\ 987 \\ \hline 121401 \end{array}$ result = 9 pre carry = 3	

#### Alternate Matrix representation

	9	8	7
1	9	8	7
2	18	16	14
3	27	24	21

	9	18+8=26	27+16+7=50	14+24=38	21
	9	6	0	8	1
(+1)	2(+1)	5	3(+1)	2	
<b>1</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>0</b>	<b>1</b>

#### REFERENCE

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**Prof. A. N. Desai** (Associate professor) Structure Department. Birla Vishvakarma Mahavidyala Engineering college VV nagar, Anand, Gujarat, India



**Tejpal H. Goda** B.E civil, M.E. Structure(pursuing)BVM engg. College, (Under G. T. U) VV nagar, Anand, Gujarat, India