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QUANT

VEDIC MATHS

eBook

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Chapter 1: Vedic Math

Squaring a number

Part – I:

While squaring a number, you need a base. All those numbers can be taken as bases, which have a 1 and the rest number of zeroes with them (i.e. the complete round numbers like 100, 1000, 10000 etc.). The square of a number will have two parts, the left part and the right part. There is no limit for the left side, but the right side must have as many digits as the number of zeroes in the base i.e. if 100 is taken as the base there should be 2 zeroes on the right side and if 1000 is taken as the base then the number of digits on RHS should be 3.

Now take a number 92. The nearest complete base is 100. The difference between the base and the number given is 8. The square of this difference is 64, which will become the right side. As it is already having two digits, so it would be simply placed on the right side. Now the difference of 8 is subtracted from the number given i.e. 92 – 8 = 84 and it will become the left side. Therefore the square of 92 is 8464.

Take another number say 94, which is 6 less than the base. While squaring 94, the right side will be $(6)^2$ i.e. 36. And the left side would be the number given – difference i.e. 94 – 6 = 88. So the square of 94 is 8836. *If the square* *of the difference is having lesser digits then required, then in order to have the needed number of digits on the right side, 0's can be put with the square*. e.g. if you square a number like 97, the difference is 3. The right side, in this case, would become 09 because 9 is a single digit number and you'll have to put a '0' before it to make it a two-digit right-hand side. The left side would be 97 – 3 = 94. The square is 9409.

In case, the number of digits is more than needed, then the extra digits are carried to the left side. e.g. take 86. The difference is 14 and the square of the difference is 196, which is a 3-digit number, so the 3rd extra digit 1 would be carried to the left side. The left side is 86 – 14 = 72 + 1 (carried over) = 73.

So the square of the number is

```
    7 2 - -
+   - 1 9 6
  ---------
   7  3 9 6
```

You can practice the following squares to get expertise on squaring.

85 _______ 79 _______ 91 _______ 87 _______ 97 _______ 77 _______

92 _______ 96 _______ 99 _______ 91 _______ 76 _______ 82 _______

81 _______ 88 _______ 89 _______

Part – II:

If the number to be squared is greater than the base, then there is only one difference in approach i.e. the difference between the number and the base is to be added in the number instead of subtracting. Take a number 107. The difference is 7. The right side will have square of difference i.e. $(7)^2$ = 49. And the left side will be 107 + 7 = 114. The number is greater than the base. So the square is 11449. Similarly even in this case, if the number of digits on the right side less than the required number, then you can write '0's with it to get the right side. The square of 103 would be : the difference is 3, its square is 9, which is a single digit number, so a 0 would be written with it i.e. 09. Then the left side is 103 + 3 = 106. The square becomes 10609.

In case the square of the difference is a 3-digit number, then the third digit would be carried to the left side. Consider one number say 118. The difference is 18 $\Rightarrow$ $(18)^2 \Rightarrow$ 324. Out of this 3-digit number the third digit 3 would be taken to the left side. The left side would become 118 + 18 + 3 (Carried) = 139 and the square would be

```
  1 3 6 - -
+ - - 3 2 4
-----------
  1 3 9 2 4
```

Square the following numbers:

112 ______ 108 ______ 109 _____ 121______

124 ______ 113 _______ 107 ______ 102______

123 _____ 105 ______ 101 ______ 114 _______

Chapter 2: Shortcuts in Multiplication & Division

1. To multiply by 9, 99, 999 etc.

To multiply a number α by 9, multiply a by 10 and subtract α from the result.

Algebraically, $\alpha \times 9 = \alpha \times (10 - 1) = 10\alpha - \alpha$.

Similarly, for 99, 999 etc multiply a by 100, 1,000 respectively.

e.g $745 \times 99 = 745 \times 100 - 745$

= 74,500 - 745 = 73,755.

2. To multiply by 5 or powers of 5

a. To multiply by 5, multiply by 10 and divide by 2.

e.g. 137 $\times$ 5 = $\frac{1,370}{2}$ = 685

b. To multiply by 25, multiply by 100 and divide by 4.

e.g. 24 $\times$ 25 = 24 $\times$ $\frac{100}{4}$ = $\frac{2,400}{4}$ = 600

c. To multiply by 125, multiply by 1,000 and then divide by 8

e.g. 48 $\times$ 125 = 48 $\times$ $\frac{1,000}{8}$ = $\frac{48,000}{8}$ = 6,000

d. To multiply by 625, multiply by 10,000 & then divide by 16

e.g. 64 $\times$ 625 = 64 $\times$ $\frac{10,000}{16}$ = 40,000

3. To multiply a and b (any two numbers) close to a power of 10

a. Take as the base for the calculations that power of 10 which is nearest to the numbers to be multiplied.

b. Put *a* and *b (the two numbers)* above and below on the left-hand side.

c. Subtract each of them from the base (nearest power of 10) and write down the remainders r_1 and r_2 on the right-hand side either with a connecting minus sign between *a* & r_1 and *b* & r_2 if the numbers *a* and *b* are less than the closest power of 10. Otherwise, use a connecting plus sign between the numbers and the remainders.

d. The final answer will have two parts. With one on the left-hand side and the other on the right-hand side. The right-hand side is the multiplication of the two remainders and the left-hand side is either the difference of a and r_2 or b and r_1 if the numbers are less than the closest power of 10. Otherwise, it is the sum of a and r_2 or b and r_1.

Taking few examples, which make the procedure clear, are:

e.g. Multiplication of 9 and 7

The closest base to the two numbers, in this case, is 10

9 – 1 (The remainder after subtracting the number from10)

7 – 3 (The remainder after subtracting the number from 10)

The right-hand side of the answer will be 1 × 3 = 3.

The left-hand side can be computed either by subtracting 3 from 9 or 1 from 7 which is 6. Therefore, the answer is 63.

e.g. A more difficult Multiplication is that of 94 and 87

The closest base to the two numbers, in this case, is 100

Therefore 87 – 13

94 – 6

81, 78 $\Rightarrow$ 8178

Here, 6 in the first row is the difference 100 and 94 and the 13 in the second row is the difference between 100 and 87. The right-hand side of the answer is obtained by the multiplication of 6 and 13 which is 78 and the left-hand side is obtained by the difference between either 87 and 6 or 94 and 13, both of which give the answer 81.

e.g. Taking numbers which are greater than the closest power of 10

Find the product of 108 and 112.

The closest base is 100 in this case as well.

Therefore, 108 + 8

$\times$

112 + 12

120, 96

The procedure is the same with only difference being that instead of subtracting the remainder of one number from the other number, we add in this case as the numbers were marginally larger than the nearest power of 10.

e.g. When the number of digits of the product of the remainders is greater than the power of 10 closest to the two numbers - Product 84 and 92

$$\begin{array}{c} 84 - 16 \\ \times \\ \underline{92 - 8} \\ 76, 28 \end{array}$$

$\Rightarrow$ (76 +1), 28 $\Rightarrow$ 7728

As the product of 16 and 8 is 128, which is a three-digit number as against 2 being the power of 10 in 100, we carry forward the digits on the left more than 2 digits (in this case) and add to 76, the left-hand side of the answer.

e.g. When one of the numbers is lesser than the closest power of 10 and the other greater than the closest power of 10 – the product of 88 and 108.

$$\begin{array}{c} 88 - 12 \\ \times \\ \underline{108 + 8} \\ 96, 96 \end{array}$$

$\Rightarrow$ 95, (100 - 96) $\Rightarrow$ 95,04

The operation is similar, except that as the right-hand side of the answer is obtained by the multiplication of a positive and a negative number, the answer has to be subtracted from 100 by reducing the left-hand side number by 1.

4. **Multiplication of numbers, which are not close to the nearest power of 10**
   Let us take the case of multiplication of 41 by 43. Going by the earlier method we have the nearest power of 10 as 100 or 10. In the former case, the remainders are 59 and 57, multiplication of which will be as tedious as the multiplication of these two numbers. Or in the latter case, the remainders will be 31 and 33, which will be equally difficult. Therefore, we need to look at an alternative method.
   In this case, we can take 50, which is a sub multiple of 100 or a multiple of 10 and proceed

$$\begin{array}{c} 41 - 9 \\ \times \\ \underline{43 - 7} \\ 34, 63 \end{array}$$

   Since 50 = 100/2, we divide the left-hand side number also by 2 while retaining the right-hand side.
   Therefore, the answer will be 1763.

5. Multiplication of numbers whose unit digits add up to 10 and have the same 10th place

Let us take an example - 47×43

Multiply the unit's digits = $7 \times 3 = 21$

Then multiply 4, which is the tenth's digit with 5 which 1 + 4 = 20

Therefore, the answer is 2021

The corollary would be finding the squares of numbers ending with 5

e.g. $35^2 \Rightarrow (3 \times 4), 25 = 1225$

6. Division by 5 and higher powers of 5

To divide by 5, 25, 125, 625 etc. multiply the number by 2, 4, 8, and 16 and cut off from the right 1, 2, 3, 4 digits respectively to get the quotient. To get the remainder, divide the cut off figure by 2, 4, 8, 16 respectively.

e.g. $3458 \div 25 = 3458 \times 4 / 100 = 138.32$

Therefore, the quotient is 138 & the remainder is $32 \div 4 = 8$.

7. Finding the remainder when a number is divided by 9

Add up the digits of the number rejecting 9s. Add up the digits of the resulting answer and continue this process till you get a single digit number, which will be remainder.

e.g. $3684799 \Rightarrow 3 + 6 + 8 + 4 + 7 \Rightarrow 28 \Rightarrow 2 + 8 \Rightarrow 1$

Therefore, the remainder is 1.

Chapter 3: Multiplying numbers

When a 2-digit number is to be multiplied by a two-digit number the following process would be applied. If there were two numbers AB and CD then their product would be calculated as under.

$$\begin{array}{l} AB \\ \underline{CD\quad\quad} \end{array}$$

***Step 1*:** BD (Write only the unit's digit and carry the rest to the next step).

***Step 2*:** AD + BC + Carryover (Cross multiply and Add, write a single digit and carry the rest to the next step).

***Step 3*:** AC + Carryover (Write the complete number because this is the last step).

$$\begin{array}{l} 29 \\ \underline{53\quad\quad} \end{array}$$

***Step 1*:** $9 \times 3 = 27$ (Write 7 and 2 are carried over to the next step).

***Step 2*:** $2 \times 3 + 9 \times 5 + 2$ (Carried Over) = 53 (Write 3 and 5 is carried over to the next step)

Step 3: 2 × 5 + 5 (Carried Over) = 15 (Write 15 because this is the last step)
Therefore 1537 is the answer

37
73

Step 1: 7 × 3 = 21 (Write 1 and 2 is carried over to the next step)

Step 2: 3 × 3 + 7 × 7 + 2 (Carried Over) = 60 (Write 0 and 6 is carried over to the next step)

Step 3: 3 × 7 + 6 (Carried Over) = 27 (Write 27 because this is the last step)
Therefore 2701 is the answer.

Try Multiplying 23 and 32 and see if the answer is 736.
Try Multiplying 28 and 82 and see if the answer is 2296.
Now we will try multiplying a three-digit number by a three-digit number. Because there are six digits, the total number of steps would be 5.

ABC
DEF

***Step 1*:** CF (Write only the unit's digit and carry the rest to the next step)

***Step 2*:** BF + CE + Carried Over (Write only the unit's digit and carry the rest to the next step)

***Step 3*:** AF + CD + BE + Carried Over (Write only the unit's digit and carry the rest to the next step)

***Step 4*:** AE + BD + Carried Over (Write only the unit's digit and carry the rest to the next step)

***Step 5*:** AD + Carried Over
(Write the complete number because this is the last step)

$$\begin{array}{r} 123 \\ 456 \\ \hline \end{array}$$

***Step 1*:** $3 \times 6 = 18$ (Write 8 and 1 is carried over to the next step)

***Step 2*:** $2 \times 6 + 3 \times 5 + 1$ (Carried Over) = 28 (Write 8 and 2 is carried over to the next step)

***Step 3*:** $1 \times 6 + 3 \times 4 + 2 \times 5 + 2$ (Carried Over) = 30 (Write 0 and 3 is carried over to the next step)

***Step 4*:** 1 × 5 + 2 × 4 + 3 (Carried Over) = 16 (Write 6 and 1 is carried over to the next step)

***Step 5*:** 1 × 4 + 1 (Carried Over) = 5 (Write 5 because this is the last step). Therefore 56088 is the answer.

$$\begin{array}{l} 243 \\ \underline{172\quad\quad} \end{array}$$

***Step 1*:** 3 × 2 = 6 (Write 6 which is the single digit number)

***Step 2*:** 4 × 2 + 7 × 3 = 29 (Write 9 and 2 is carried over to the next step)

***Step 3*:** 2 × 2 + 1 × 3 + 4 × 7 + 2 (Carried Over) = 37 (Write 7 and 3 is carried over to the next step)

***Step 4*:** 2 × 7 + 4 × 1 + 3 (Carried Over) = 21 (Write 1 and 2 is carried over to the next step)

***Step 5*:** 2 × 1 + 2 (Carried Over) = 4 (Write 4 as this is the last step). Therefore 41796 is the answer.

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Here are some problems for practice.

112 171	128 325	237 525	378 978
276 923	399 546	657 763	876 453
497 129	179 598	929 135	868 963

Chapter 4: Tables, Squares and Cubes to be remembered

As you have decided to improve your quantitative skills, but keep in mind you cannot be good at Math unless you are good at calculations. Take this as the starting point and make it the most important part of your preparation.

Tables:

Learn all these tables by heart and see how you improve your calculation speed.

T×1	T×2	T×3	T×4	T×5	T×6	T×7	T×8	T×9	T×10
12	24	36	48	60	72	84	96	108	120
13	26	39	52	65	78	91	104	117	130
14	28	42	56	70	84	98	112	126	140
15	30	45	60	75	90	105	120	135	150
16	32	48	64	80	96	112	128	144	160
17	34	51	68	85	102	119	136	153	170
18	36	54	72	90	108	126	144	162	180
19	38	57	76	95	114	133	152	171	190
21	42	63	84	105	126	147	168	189	210
23	46	69	92	115	138	161	184	207	230
24	48	72	96	120	144	168	192	216	240
27	54	81	108	135	162	189	216	243	270
29	58	87	116	145	174	203	232	261	290
37	74	111	148	185	222	259	296	333	370

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Squares:

Learn these squares by heart.

Z	1	2	3	4	5	6	7	8	9	10
Z^2	1	4	9	16	25	36	49	64	81	100
Z	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Z^2	121	144	169	196	225	256	289	324	361	400
Z	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Z^2	441	484	529	576	625	676	729	784	841	900
Z	**31**	**32**	**33**	**34**	**35**					
Z^2	961	1024	1089	1156	1225					

Cubes:

Learn these cubes by heart

Z	Z^3
1	1
2	8
3	27
4	64
5	125
6	216

7	343
8	512
9	729
10	1000
11	1331
12	1728
13	2197
14	2744
15	3375
16	4096
17	4913
18	5832
19	6859
20	8000