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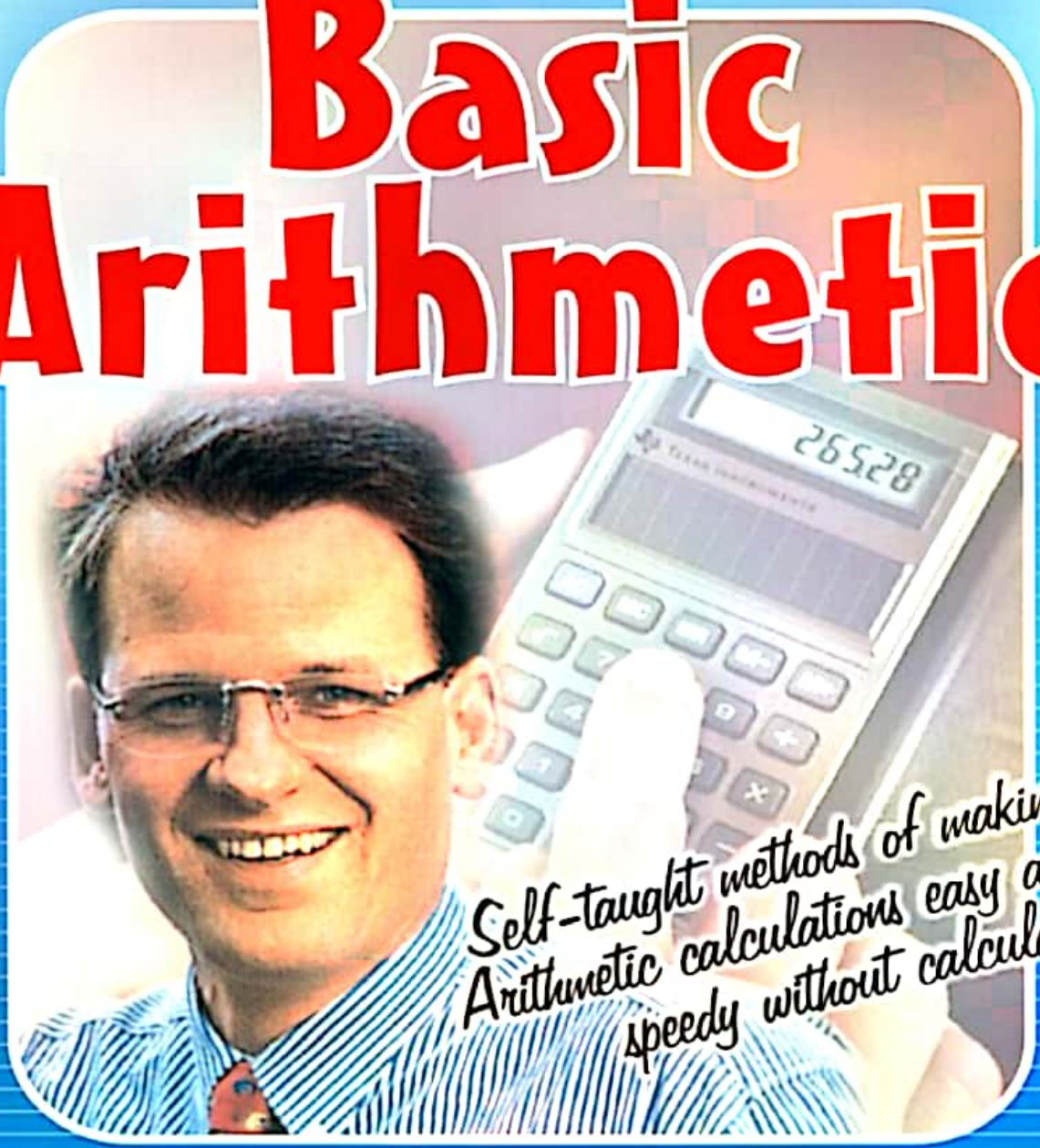
High Speed System of

Basic Arithmetic



Self-taught methods of making Arithmetic calculations easy and speedy without calculator

Dr. A. KUMAR

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UPKAR'S

High Speed System of Basic Arithmetic

Self-taught methods of making Arithmetic calculations easy and speedy without calculator

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High Speed System of Basic Arithmetic

Chapter 1
Multiplication—As Easy As Addition

Can multiplication is possible without memorizing multiplication tables ? Doesn't it sounds impossible ? Of course not, it is not only possible, but it is easy and as fast as addition of two numbers. Here, in this chapter we are going to show, how one can make multiplication from one to thirteen with any number, without the use of multiplication table or memorizing the multiplication table ?

Multiplication-made easy—First Step

Before making multiplication easy, let us first review some things you have learn at elementary level.

(i) A *digit* is a one figure number, *i.e.*, 5 or 6 or 9 or 0.

(ii) When two (or more) digits are added we get resultant in one figure or two figures (or more). Consider one figure resultant as two figure number by writing zero (0) before it.

i.e., $3 + 5 = 08$ (not 8); $1 + 2 + 3 = 06$ (not 6)

$2 + 5 + 1 = 08$ (not 8); $2 + 4 + 3 = 09$ (not 9)

(iii) The number by which we multiply we say it *multiplier* and the number to which we multiply we say it *multiplicand*.

e.g., *multiply* 122 by 6 or (122×6).

Here, 122 is multiplicand and 6 is multiplier

e.g., *multiply* 679 by 27 or (679×27).

Here, 679 is multiplicand and 27 is multiplier.

(iv) In multiplication we make computation with multiplicand from right to left.

e.g., multiply 123 by 6.

Here, 123 is multiplicand and 6 is multiplier.

In multiplicand we consider 3 first, then 2 and afterward 1, (from right digit 3 to left digit 1).

(v) **Carry-over principle :**

Of the resultant, the right most digit is written down and carry-over the rest.

e.g., *Add 6 and 8.*

Adding 6 and 8 gives 14; 6 + 8 = 14, in resultant 4 is writedown and one is carry-over.

e.g., *Multiply 6 by 9.*

Multiplying 6 by 9 gives 54; 6 × 9 = 54, 4 is writedown and 5 is carry-over.

Consider the following examples,

e.g., *Add 69 and 42.* 69 + 42

Adding 69 and 42.

■ We first add 9 and 2 which give 11;
9 + 2 = 11, in resultant 1 is writedown and 1 is carry-over.

```
  69
  42
 ---
   1
```

Next add 6 and 4 which give 10 plus carry 1;
(6 + 4) + 1 = 11 writedown 11.

```
  69
  42
 ---
 111
```

The answer is 111.

e.g., *Add 246 and 351.* 246 + 351

Adding 246 and 351

■ First we add 6 and 1; 6 + 1 = 07;
Write 7, carry-over 0.

```
 246
 351
 ---
   7
```

■ Add 4 and 5 plus carry 0
(4 + 5) + 0 = 09;
Write 9, carry-over 0

```
 246
 351
 ---
  97
```

■ Add 2 and 3 plus carry 0
(2 + 3) + 0 = 5.

```
 246
 351
 ---
 597
```

Multiplication by Thirteen

Method 1 :

Step 1 : Write zero before the given number.
Step 2 : Triple of each digit of the number is added to the right neighbour digit.

■ This method is similar as the working activity of multiplication of 12.

Example. Multiply 25637 by 13. 25637×13

Step 1 : *Write zero in front of the given number* 025637×13

Step 2 : *Tripple of each digit of the number is added to its right neighbour digit (plus carry).*

■ Triple of 7 is 21, since there is no digit right of 7, so add nothing.

So, 1 is writedown and 2 is carry-over $\frac{025637 \times 13}{1}$

■ Now, triple of 3 is 09 and 7 is right of 3.
So, 09 + 7 = 16 and 2 is carry.
So, 16 + 2 = 18.

Write 8 and 1 is carry-over $\frac{025637 \times 13}{81}$

■ Triple of 6 is 18 and 3 is right of 6. So,
18 + 3 = 21 and 1 is carry, so 21 + 1 = 22,

Write 2 and 2 is carry-over $\frac{025637 \times 13}{281}$

■ Triple of 5 is 15 and 6 is right of 5.
So, 15 + 6 = 21 and 2 is carry.
So, 21 + 2 = 23.

Write 3 and 2 is carry-over $\frac{025637 \times 13}{3281}$

■ Triple of 2 is 6 and 5 is right of 2.
So, 6 + 5 = 11 and 2 is carry.
So, 11 + 2 = 13.

Write 3 and 1 is carry-over $\frac{025637 \times 13}{33281}$

■ Triple of zero is 0 and 2 is right of zero.
So, 0 + 2 = 2 and 1 is carry.
So, 2 + 1 = 3.

Write 3 and no carry-over

$$\frac{025637 \times 13}{333281}$$

The answer is 333281

Example. Multiply 12532 by 13. 12532× 13

Step 1 : *Write zero in front of the given number* 012532 × 13

Step 2 : *Triple of each digit of the number is added to its right neighbour digit and plus carry.*

■ Triple of 2 is 6, since there is no digit at right of 2. So, nothing is to be added.

Write down 6 and no carry-over.

$$\frac{012532 \times 13}{6}$$

■ Triple of 3 is 9, add right neighbour 2

i.e., 9 + 2 = 11. Write 1 and 1 carry-over.

$$\frac{012532 \times 13}{16}$$

■ Triple of 5 is 15, right digit is 3.
So, 15 + 3 = 18 and 1 carry plus.

So, 18 + 1 = 19. Write 9 and 1 carry-over.

$$\frac{012532 \times 13}{916}$$

■ Triple of 2 is 6, right digit is 5.
So, 6 + 5 = 11 and 1 carry plus.

So, 11 + 1 = 12. Write 2 and 1 carry-over.

$$\frac{012532 \times 13}{2916}$$

■ Triple of 1 is 3, right digit is 2.
So, 3 + 2 = 5 and carry is 1.

So, 5 + 1 = 6. Write 6 and no carry.

$$\frac{012532 \times 13}{62916}$$

■ Triple of zero is zero and digit at right place is 1. So, 0 + 1 = 1 but no carry.

So, write 1.

$$\frac{012532 \times 13}{162916}$$

The answer is 162916

EXERCISE

1. Multiply 23456 by 13.
2. Multiply 25696 by 13.
3. Multiply 45321 by 13.
4. Multiply 32569 by 13.
5. Multiply 52969 by 13.
6. Find the area of rectangle of sides 22 and 13 cm.
7. Find area of square which side is of 13 cm each.
8. Find the product of 169 and 13.
9. Multiply 123 by 13.
10. Multiply 10101 by 13.

ANSWERS

1. 304928	2. 334048	3. 589173	4. 423397
5. 688597	6. 286	7. 169	8. 2197
9. 1599	10. 131313.		

Multiplication by Eleven

Method 1 :

> ***Step 1 : Write zero in front of given number.***
> ***Step 2 : Each (successive) digit of the number is added to its neighbour at right (plus carry).***

Example. Multiply 12345 by 11. 12345×11

Step 1 : *Write zero in front of given number* 012345×11

Step 2 : *Each (successive) digit of the number is added to its neighbour at right (plus carry).*

- 5 has no neighbour at right, so add nothing

$$\frac{012345 \times 11}{5}$$

- 4 has 5 as its right neighbour, add 4 and 5

  $4 + 5 = 09$; write 9, carry-over 0

$$\frac{012345 \times 11}{95}$$

- 3 has 4 as its right neighbour, add 3 and 4 plus carry 0

  $3 + 4 = 07$; write 7, carry-over 0

$$\frac{012345 \times 11}{795}$$

- 2 has 3 as its right neighbour, add 2 and 3 plus carry 0

  $2 + 3 = 05$; write 5, carry-over 0

$$\frac{012345 \times 11}{5795}$$

- 1 has 2 as its right neighbour, add 1 and 2 plus carry 0

  $1 + 2 = 03$; write 3, carry-over 0

$$\frac{012345 \times 11}{35795}$$

- 0 has 1 as its right neighbour, add 0 and 1 plus carry 0

  $0 + 1 = 01$

$$\frac{012345 \times 11}{0135795}$$

The answer is 135795

Example. Multiply 26789 by 11. 26789×11

Step 1 : *Write zero in front of given number* 026789×11

Step 2 : *Each (successive) digit of the number is added to its neighbour at right (plus carry-over)*

- 9 has no neighbour at right,

  so add nothing 026789×11 / 9

- 8 has 9 as its right neighbour, add 8 and 9

  $8 + 9 = 17$; write 7, carry-over 1 026789×11 / 79

- 7 has 8 as its right neighbour, add 7 and 8 plus carry 1

  $(7 + 8) + 1 = 16$; write 6, carry-over 1 026789×11 / 679

- 6 has 7 as its right neighbour, add 6 and 7 plus carry 1

  $(6 + 7) + 1 = 14$; write 4, carry-over 1 026789×11 / 4679

- 2 has 6 as its right neighbour, add 2 and 6 plus carry 1

  $(2 + 6) + 1 = 09$; write 9, carry-over 0 026789×11 / 094679

- 0 has 2 as its right neighbour, add 0 and 2 plus carry 0

  $(0 + 2) + 0 = 02$ 026789×11 / 0294679

The answer is 294679

EXERCISE

1. Multiply 123 by 11.
2. What is the product of 679432 and 11 ?
3. Multiply 964215 by 11.
4. Multiply 11111 by 11.
5. Multiply 101010 by 11.
6. What is the area of a rectangle if its sides are 89 and 11 cm ?
7. Find the area of a square room of side 11 mts.
8. What is the cost of 125679 pens, at the rate Rs. 11 each ?
9. Multiply 212121 by 11.
10. Multiply 99998 by 11.

ANSWERS

1. 1353	2. 7473752	3. 10606365	4. 122221
5. 1111110	6. 979 cm^2	7. 121 mts^2	8. Rs. 1382469
9. 2333331	10. 1099978		

Method 2 :

Step 1 : Write zero at the end of given number.
Step 2 : Add with original number.

Example. Multiply 12345 by 11. 12345 × 11

Step 1 : *Write zero at the end of given number* 123450

Step 2 : *Add with original number*

123450
+ 12345
Ans. 135795

Example. Multiply 26789 by 11. 26789 × 11

Step 1 : *Write zero at the end of given number* 267890

Step 2 : *Add the number*

267890
+ 26789
Ans. 294679

Multiplication by Twelve

Step 1 : Write zero in front of given number.
Step 2 : Double each digit in term and add its neighbour at right. (Plus carry)

Example : Multiply 1234 by 12. 1234×12

Step 1 : *Write zero in front of given number* 01234×12

Step 2 : *Double each digit in turn and add its neighbour at right plus carry.*

- (double of 4 is) 8, but no neighbour at right $\frac{01234 \times 12}{8}$

- (double of 3 is) 6, add right neighbour 4

  $6 + 4 = 10$; write 0, carry-over 1 $\frac{01234 \times 12}{08}$

- (double of 2 is) 4, add right neighbour 3 plus carry 1

  $(4 + 3) + 1 = 08$; write 8, carry-over 0 $\frac{01234 \times 12}{808}$

- (double of 1 is) 2, add right neighbour 2 plus carry 0

  $(2 + 2) + 0 = 04$; write 4, carry-over 0 $\frac{01234 \times 12}{4808}$

- (double of 0 is) 0, add right neighbour 1 plus carry 0

  $(0 + 1) + 0 = 01$ $\frac{01234 \times 12}{014808}$

The answer is 14808

Example : Multiply 987 by 12. 987×12

Step 1 : *Write zero in front of given number* 0987×12

Step 2 : *Double each digit in turn and add its neighbour at right plus carry.*

- (double of 7 is) 14, but no neighbour at right
  write 4, carry-over 1 — $0987 \times 12 = 4$
- (double of 8 is) 16, add right neighbour 7 plus carry 1
  $(16 + 7) + 1 = 24$; write 4, carry-over 2 — $0987 \times 12 = 44$
- (double of 9 is) 18; add right neighbour 8 plus carry 2
  $(18 + 8) + 2 = 28$; write 8, carry-over 2 — $0987 \times 12 = 844$
- (double of 0 is) 0; add right neighbour 9 plus carry 2.
  $(0 + 9) + 2 = 11$ — $0987 \times 12 = 11844$

The answer is 11844

EXERCISE

1. Multiply 12345 by 12.
2. Multiply 64942 by 12.
3. Multiply 11111 by 12.
4. Multiply 101010 by 12.
5. Multiply 987654 by 12.
6. What is the area of rectangle of sides 11 and 12 cm ?
7. Find the area of square of sides 12 cm.
8. Find the product of 11 and 12.
9. Multiply 123987 by 12.

ANSWERS

1. 148140	2. 779304	3. 133332	4. 1212120
5. 11851848	6. 132	7. 144	8. 132
9. 1487844			

Multiplication by Six

Step 1 : ***Write zero in front of given number.***
Step 2 : ***To each successive digit***
→ **For even, add half the right neighbour (plus carry)**
→ **For odd, add half of the right neighbour plus 5 (plus carry)**

First consider example with even digits.

Example : Multiply 8246 by 6. 8246 × 6

Step 1 : *Write zero in front of given number* 08246 × 6

Step 2 : *To each successive digit*

→ *For even, add half the neighbour (plus carry)*

■ 6 (is even) has no right neighbour,

so add nothing 08246 × 6 / 6

■ 4 (is even) add (half of right neighbour 6) 3

4 + 3 = 07; write 7, carry-over 0 08246 × 6 / 76

■ 2 (is even) add (half of right neighbour 4) 2 plus carry 0

(2 + 2) + 0 = 04; write 4, carry-over 0 08246 × 6 / 476

■ 8 (is even) add (half of right neighbour 2) 1 plus carry 0

(8 + 1) + 0 = 09; write 9, carry-over 0 08246 × 6 / 9476

■ 0 (is even) add (half of right neighbour 8) 4 plus carry 0

(0 + 4) + 0 = 04; write 4, carry-over 0 08246 × 6 / 049476

The answer is 49476

When all digits are odd.

Example : Multiply 135 by 6. 135×6

Step 1 : *Write zero in front of given number* 0135×6

Step 2 : *To each successive digit*

→ *For odd, add half the right neighbour plus 5 (plus carry)*

■ 5 (is odd), but has no right neighbour,
so add 5 only

$5 + 5 = 10$; write 0, carry-over 1 $\quad \begin{array}{r} 0135 \times 6 \\ \hline 0 \end{array}$

■ 3 (is odd), add (half of right neighbour 5),
2 plus 5 plus carry 1

$(3 + 2) + 5 + 1 = 11$; write 1, carry-over 1 $\quad \begin{array}{r} 0135 \times 6 \\ \hline 10 \end{array}$

■ 1 (is odd), add (half of right neighbour 3) 1
plus 5 plus carry 1

$(1 + 1) + 5 + 1 = 08$; write 8, carry-over 0 $\quad \begin{array}{r} 0135 \times 6 \\ \hline 810 \end{array}$

■ 0 (is even), odd (half of right neighbour)
0 plus carry 0

$(0 + 0) + 0 = 00$. $\quad \begin{array}{r} 0135 \times 6 \\ \hline 00810 \end{array}$

The answer is 810

When some are even and some are odd.

Example : Multiply 8537 by 6. 8537 × 6

Step 1 : *Write zero in front of given number* 08537 × 6

Step 2 : *To each successive digit*

→ *For even, add half the neighbour (plus carry)*

→ *For odd, add half the right neighbour plus 5 (plus carry)*

■ 7 (is odd), but has no neighbour, plus 5 only

7 + 5 = 12; write 2, carry-over 1 — 08537 × 6 / 2

■ 3 (is odd), add (half of right neighbour 7) 3 plus 5 plus carry 1

(3 + 3) + 5 + 1 = 12; write 2, carry-over 1 — 08537 × 6 / 22

■ 5 (is odd), add (half of right neighbour 3) 1 plus 5 plus carry 1

(5 + 1) + 5 + 1 = 12; write 2, carry-over 1 — 08537 × 6 / 222

■ 8 (is even), add (half of right neighbour 5) 2 plus carry-over 1

(8 + 2) + 1 = 11; write 1, carry-over 1 — 08537 × 6 / 1222

■ 0 (is even), add (half of right neighbour 8) 4 plus carry-over 1

(0 + 4) + 1 = 05 — 08537 × 6 / 051222

The answer is 51222

EXERCISE

1. Multiply 464321 by 6.
2. Multiply 12345 by 6.
3. Multiply 64321 by 6.
4. 1256 × 6 is .....
5. 6942 × 6 is .....
6. The square of 6 is .....
7. The area of strip of sides 6 and 12579 cm is .....
8. What is the total length of 868491 logs, each of 6 mts long ?
9. Compute the number of bottles that can be washed in 67894 hours by a machine having a capacity of 6 bottles an hour.
10. If a ton of soft coal occupies 6 square feet, what space is occupied by 99362 tons ?

ANSWERS

1. 2785926	2. 74070	3. 385926	4. 7536
5. 41652	6. 36	7. 75474	8. 5210946 mts
9. 407364	10. 596172 sq. feet.		

Multiplication by Seven

Step 1 : ***Write zero in front of given number.***

Step 2 : ***Double each successive digit and***

- → **For even, add half the right neighbour (plus carry)**
- → **For odd, add half of the right neighbour plus 5 (plus carry)**

Example : Multiply 12345 by 7. 12345 × 7

Step 1 : *Write zero in front of given number* 012345 × 7

Step 2 : *Double each successive digit*

→ *For even, add half the right neighbour*

→ *For odd, add half the right neighbour plus 5*

■ (double of 5) 10 add (since no right neighbour) 0 plus (since 5 is odd) 5

(10 + 0) + 5 = 15; write 5, carry-over 1 — 012345 × 7 / 5

■ (double of 4) 8 add (half of neighbour 5) 2 plus carry 1

(8 + 2) + 1 = 11, write 1, carry-over 1 — 012345 × 7 / 15

■ (double of 3) 6 add (half of neighbour 4) 2 plus (since 3 is odd) 5 plus carry 1,

(6 + 2) + 5 + 1 = 14; write 4, carry-over 1 — 012345 × 7 / 415

■ (double of 2) 4 add (half of neighbour 3) 1 plus carry 1

(4 + 1) + 1 = 06; write 6, carry-over 0 — 012345 × 7 / 6415

■ (double of 1) 2 add (half of neighbour 2) 1
plus (since 1 is odd) 5

$(2 + 1) + 5 = 08$; write 8, carry-over 0

$$\begin{array}{r} 012345 \times 7 \\ \hline 86415 \end{array}$$

■ (double of 0) 0 add (half of neighbour 1) 0
plus carry 0

$0 + 0 = 00$

$$\begin{array}{r} 012345 \times 7 \\ \hline 0086415 \end{array}$$

The answer is 086415

EXERCISE

1. $125642 \times 7 = ?$
2. $22222 \times 7 = ?$
3. $101010 \times 7 = ?$
4. $11111 \times 7 = ?$
5. $11110101 \times 7 = ?$
6. What is the cost of 46671 pens, if each pen set is Rs. 7 ?
7. Multiply 66666 by 7.
8. Multiply 77777 by 7.
9. Multiply 212121 by 7.
10. Multiply 223355 by 7.

ANSWERS

1. 879494	2. 155554	3. 707070	4. 77777
5. 77770707	6. 326697	7. 466662	8. 544439
9. 1484847	10. 1563485		

Multiplication by Five

Method 1 :

> ***Step 1 : Write zero in front of given number.***
> ***Step 2 : To each successive digit***
> → **For even, half the neighbour at right (plus carry)**
> → **For odd, half the neighbour at right plus 5 (plus carry)**

Example : Multiply 12345 by 5. 12345 × 5

Step 1 : *Write zero in front of given number* 012345 × 5

Step 2 : *To each successive digit*

→ *For even, half the neighbour (plus carry)*

→ *For odd, half the right neighbour plus 5 (plus carry)*

■ 5 is odd, but no right neighbour plus 5

(0 + 5) = 05; write 5, carry-over 0 — 012345 × 5 / 5

■ 4 is even so (half of right neighbour 5) 2 plus carry 0

(2 + 0) = 02; — 012345 × 5 / 25

■ 3 is odd so (half of neighbour 4) 2 plus 5 plus carry 0

(2 + 5) + 0 = 07 — 012345 × 5 / 725

■ 2 is even so (half of neighbour 3) 1 plus carry 0

(1 + 0) = 01 — 012345 × 5 / 1725

■ 1 is odd so (half of neighbour 2) 1 plus 5 plus carry 0

$(1 + 5) + 0 = 06$

012345 × 5
61725

■ 0 is even so (half of neighbour 1) 0 plus carry 0

$(0 + 0) = 00$

012345 × 5
0061725

The answer is 61725

Example : Multiply 986 by 5.

986 × 5

Step 1 : *Write zero in front of given number.*

0986 × 5

Step 2 : *To each successive digit*

→ *For even, half the neighbour (plus carry)*

→ *For odd, half the right neighbour plus 5 (plus carry)*

■ 6 is even, no right neighbour, 00

0986 × 5
0

■ 8 is even, (half of right neighbour 6) 3 plus carry 0

$3 + 0 = 03$

0986 × 5
30

■ 9 is odd, (half of right neighbour 8) 4 plus 5 plus carry 0

$4 + 5 + 0 = 09$

0986 × 5
930

■ 0 is even, (half of right neighbour 9) 4 plus carry 0

$4 + 0 = 04$

0986 × 5
04930

The answer is 4930

EXERCISE

1. Multiply 236151 by 5.
2. Multiply 123456 by 5.
3. 64321 × 5 .....
4. 129876 × 5 .....
5. 112233 × 5 .....
6. 998877 × 5 .....
7. 997755 × 5 .....
8. 886644 × 5 .....
9. 332211 × 5 .....

ANSWERS

1. 1180755	2. 617280	3. 321605	4. 649380
5. 561165	6. 4994385	7. 4988775	8. 4433220
9. 1661055			

Method 2 :

Step 1 : Write zero at the end of given number.
Step 2 : Half the new number. (Divide new number by 2)

Example : Multiply 12345 by 5. 12345 × 5

Step 1 : *Write zero at the end of given number* 123450

Step 2 : *Half the new number (Divide new number by 2).*

$$123450 \times \frac{1}{2} = 61725$$

The answer is 61725

Multiplication by Nine

Method 1 :

Step 1	***:***	***Add zero in front of given number.***
Step 2	***:***	***Subtract right most digit of number from 10.***
Step 3	***:***	***Middle digit : After right most digit, each successive digit (till last digit zero is reached) is subtracted from 9 and added to right neighbour (plus carry).***
Step 4	***:***	***To left most digit (that is zero) add right neighbour and subtract 1.***

Example : Multiply 845678 by 9. 845678×9

Step 1 : *Add zero in front of given number* 0845678×9

Step 2 : *Subtract the right most digit 8 from 10*

$10 - 8 = 02$ $\quad 0845678 \times 9 = 2$

Step 3 : *After the right most digit, each successive digit is sub-tracted from 9 and add to the right neighbour till left most digit zero is reached.*

- Subtract 7 from 9 and add (to right neighbour) 8

  $(9 - 7) + 8 = 10$; write 0, carry-over 1 $\quad 0845678 \times 9 = 02$

- Subtract 6 from 9 and add (to right neighbour) 7 plus carry 1

  $(9 - 6) + 7 + 1 = 11$; write 1, carry-over 1 $\quad 0845678 \times 9 = 102$

- Subtract 5 from 9, and add (to right neighbour) 6 plus carry 1

  $(9 - 5) + 6 + 1 = 11$; write 1, carry-over 1 $\quad 0845678 \times 9 = 1102$

- Subtract 4 from 9 and add (to right neighbour) 5 plus carry 1

  $(9 - 4) + 5 + 1 = 11$; write 1, carry-over 1 $\quad 0845678 \times 9 = 11102$

■ Subtract 8 from 9 and add (to right neighbour) 4 plus carry 1

$(9 - 8) + 4 + 1 = 06$; write 6, carry-over 0

$$\begin{array}{r} 0845678 \times 9 \\ \hline 611102 \end{array}$$

Step 4 : To 0 add (right neighbour) 8 and subtract 1 plus carry 0

$0 + 8 - 1 + 0 = 07$

$$\begin{array}{r} 0845678 \times 9 \\ \hline 07611102 \end{array}$$

The answer is 7611102

EXERCISE

1. Multiply 123456 by 9.
2. Multiply 564321 by 9.
3. Multiply 423621 by 9.
4. Multiply 121212 by 9.
5. Multiply 102030 by 9.
6. Multiply 123321 by 9.
7. What is the product of 864321 and 9 ?
8. 164321 times 9 is .....
9. 643643 times 9 is .....
10. Multiply 99999 by 9.

ANSWERS			
1. 1111104	2. 5078889	3. 3812589	4. 1090908
5. 918270	6. 1109889	7. 7778889	8. 1478889
9. 5792787	10. 899991		

Method 2 :

Step 1 : Write zero at the end of given number.
Step 2 : Subtract the number.

Example : Multiply 845678 by 9.

$$\begin{array}{r} 845678 \times 9 \end{array}$$

Step 1 : *Write zero at the end of given number*

$$\begin{array}{r} 8456780 \end{array}$$

Step 2 : *Subtract the number*

$$\begin{array}{r} 8456780 \\ -\ 845678 \\ \hline 7611102 \end{array}$$

The answer is 7611102

Multiplication by Eight

Step 1 :	***Add zero in front of given number.***
Step 2 :	***Subtract the right most digit of the given number from 10 and double.***
Step 3 :	***Middle digit : After the right most digit, each successive digit is subtracted from 9, double it and add the right neighbour (plus carry), till last digit (zero) is reached.***
Step 4 :	***To left most digit that is zero add the right neighbour and subtract 2 (plus carry).***

Example : Multiply 845679 by 8. 845679×8

Step 1 : *Add zero in front of given number* 0845679×8

Step 2 : *Subtract the right most digit, 9 from 10, and double it*

$10 - 9 = 1; 1 \times 2 = 2$ $\quad 0845679 \times 8 = 2$

Step 3 : *Middle term after the right most digit, each successive digit is subtracted from 9, double it and add the right neighbour plus carry, till last digit zero is reached.*

- 7 is subtracted from 9; double it;
  add right neighbour 9
  $9 - 7 = 2; 2 \times 2 = 4; 4 + 9 = 13;$
  write 3, carry 1 $\quad 0845679 \times 8 = 32$
- 6 is subtracted from 9; double it;
  add right neighbour 7 (plus carry 1)
  $9 - 6 = 3; 3 \times 2 = 6; 6 + 7 + 1 = 14;$
  write 4, 1 carry $\quad 0845679 \times 8 = 432$
- 5 is subtracted from 9; double it;
  add right neighbour 6 (plus carry 1)
  $9 - 5 = 4; 4 \times 2 = 8; 8 + 6 + 1 = 15;$
  write 5, 1 carry-over $\quad 0845679 \times 8 = 5432$

■ 4 is subtracted from 9; double it;
add right neighbour 5 (plus carry 1)
$9 - 4 = 5$; $5 \times 2 = 10$; $10 + 5 + 1 = 16$;
write 6, 1 carry-over

0845679 × 8
65432

■ 8 is subtracted from 9; double it,
add right neighbour 4 (plus carry 1)
$9 - 8 = 1$; $1 \times 2 = 2$; $2 + 4 + 1 = 07$;
write 7, carry-over 0

0845679 × 8
765432

Step 4 : To zero add right neighbour 8 subtract 2 (plus carry 0)

$0 + 8 - 2 + 0 = 06$

0845679 × 8
06765432

The answer is 6765432

EXERCISE

1. Multiply 689421 by 8.
2. Multiply 124567 by 8.
3. Multiply 464646 by 8.
4. Multiply 454545 by 8.
5. Multiply 565656 by 8.
6. Multiply 22222 by 8.
7. Multiply 55555 by 8.

ANSWERS

1. 5515368	2. 996536	3. 3717168	4. 3636360
5. 4525248	6. 177776	7. 444440.	

Multiplication by Four

Step 1 : ***Add zero in front of given number.***

Step 2 : ***To the right most digit.***

- **If even, subtract it from 10 (plus carry)**
- **If odd, subtract it from 10 and add 5 (plus carry)**

Step 3 : ***Middle digits : After the right most digit, to each successive digit, till zero is reached.***

- **If even, is subtracted from 9 plus half the right neighbour (plus carry)**
- **If odd, is subtracted from 9, plus half the right neighbour and add 5 (plus carry)**

Step 4 : ***To the left most digit (that is zero) add half of the right neighbour subtract 1 (plus carry).***

Example : Multiply 234567 by 4. 234567 × 4

Step 1 : *Add zero in front of given number.* 0234567 × 4

Step 2 : *Right most digit 7 is odd,*
So, subtract it from 10, and add 5
(10 – 7) + 5 = 08

write 8, carry 0

0234567 × 4
8

Step 3 : *Middle digits*

- 6 is even, subtract it from 9,
plus (half the right neighbour 7) 3
(9 – 6) + 3 = 06

write 6, carry 0

0234567 × 4
68

- 5 is odd, subtract it from 9, plus
(half the right neighbour 6) 3 add 5,
(9 – 5) + 3 + 5 = 12;

write 2, carry-over 1

0234567 × 4
268

- 4 is even, subtract it from 9,
  plus (half the right neighbour 5) 2
  (plus carry 1)
  $(9 - 4) + 2 + 1 = 08$

  write 8, carry 0

  0234567 × 4

  8268

- 3 is odd, subtract it from 9, plus (half of right neighbour 4) 2 plus 5
  $(9 - 3) + 2 + 5 = 13$;

  write 3 carry-over 1

  0234567 × 4

  38268

- 2 is even, subtract it from 9, plus
  (half of right neighbour 3) 1
  (plus carry 1)
  $(9 - 2) + 1 + 1 = 09$

  write 9, carry 0

  0234567 × 4

  938268

Step 4 : To zero, add (half the right neighbour 2) 1
subtract 1 (plus carry 0)
$0 + 1 - 1 + 0 = 00$

write 00

0234567 × 4

00938268

The answer is 938268

EXERCISE

1. Multiply 121212 by 4.
2. Multiply 242424 by 4.
3. Multiply 353535 by 4.
4. Multiply 55555 by 4.
5. Multiply 44444 by 4.
6. Multiply 77777 by 4.

ANSWERS

1. 484848	2. 969696	3. 1414140	4. 222220
5. 177776	6. 311108.		

Multiplication by Three

Step 1 :	***Write zero in front of given number.***
Step 2 :	***Right most digit***
	→ **If even, subtract it from ten and double.**
	→ **If odd, subtract from 10 and double, add 5, (plus carry)**
Step 3 :	***Middle digits :***
	→ **If even, subtract from 9 and double and add half the right neighbour (plus carry)**
	→ **If odd, subtract from 9 and double and add half the right neighbour plus 5 (plus carry)**
Step 4 :	***To left most digit, (that is zero), half the neighbour and subtract 2 (plus carry).***

Example : Multiply 2536 by 3. 2536 × 3

Step 1 : *Add zero in front of given number* 02536 × 3

Step 2 : *Right most digit 6* (is even)

Subtract from 10 and double

10 – 6 = 4; 4 × 2 = 08;

write 8, carry-over 0

02536 × 3
8

Step 3 : *Middle digit* :

- 3 (is odd), subtract from 9 and double, add (half the right neighbour 6) 3, plus 5, (plus carry 0)

  9 – 3 = 6; 6 × 2 = 12; 12 + 3 + 5 = 20;

  write 0, carry-over 2

  02536 × 3
  08

- 5 (is odd), subtract from 9 and double, add (half the right neighbour 3) 1, plus 5, (plus carry 2)

  9 – 5 = 4; 4 × 2 = 8; 8 + 1 + 5 + 2 = 16;

  write 6, carry-over 1

  02536 × 3
  608

■ 2 (is even), subtract from 9 and double,
add (half the right neighbour 5) 2,
(plus carry 1)
$9 - 2 = 7$; $7 \times 2 = 14$; $14 + 2 + 1 = 17$;

write 7, carry-over 1

$$\begin{array}{r} 02536 \times 3 \\ \hline 7608 \end{array}$$

Step 4 : (half of neighbour 2) 1,
subtract 2 (plus carry 1)
$1 - 2 + 1 = 00$

write 00

$$\begin{array}{r} 02536 \times 3 \\ \hline 007608 \end{array}$$

The answer is 7608

EXERCISE

1. Multiply 121212 by 3.
2. 121235×3 .....
3. 424242×3 .....
4. 525252×3 .....
5. 554455×3 .....
6. 445544×3 .....
7. 336633×3 .....

ANSWERS

1. 363636	2. 363705	3. 1272726	4. 1575756
5. 1663365	6. 1336632	7. 1009899.	

Multiplication by Two

Step 1 : Double each successive digit (plus carry).

Example : Multiply 345 by 2. 345×2

Step 1. Double each successive digit (plus carry-over)

- double of 5 is 10;

  write 0 carry-over 1

$$\begin{array}{r} 345 \times 2 \\ \hline 0 \end{array}$$

- double of 4 is 08 (plus carry 1);
  $8 + 1 = 09$

  write 9 carry-over 0

$$\begin{array}{r} 345 \times 2 \\ \hline 90 \end{array}$$

- double of 3 is 06 (plus carry 0);
  $6 + 0 = 06$

  write 06

$$\begin{array}{r} 345 \times 2 \\ \hline 0690 \end{array}$$

The answer is 0690

EXERCISE

1. 9×2 ..... 2. 8×2 ..... 3. 7×2 .....
4. 6×2 ..... 5. 5×2 ..... 6. 3×2 .....

ANSWERS

1. 18 2. 16 3. 14 4. 12 5. 10 6. 06

Multiplication by One

The number itself.

Example : Multiply 123456 by 1. 123456×1

The number itself

$$\begin{array}{r} 123456 \times 1 \\ \hline 123456 \end{array}$$

The answer is 123456

Multiplication by Zero

The resultant is zero.

Example : Multiply 123456 by 0. 123456×0

The resultant is zero

$$\begin{array}{r} 123456 \times 0 \\ \hline 0 \end{array}$$

Multiplication—As Easy As Addition
(A Review)

Step 1 : To multiply any number from 1 to 12, write zero in front of that number.	
To multiply by	**Step 2 :** and onwards
11	■ Add the neighbour at right.
12	■ Double the digit and add the neighbour at right.
6	■ If even add half the neighbour at right. ■ If odd add 5 too.
7	■ If even double the digit, add half the neighbour at right. ■ If odd add 5 too.
5	■ If even half the neighbour at right. ■ If odd add 5 too.
9	■ *Right most digit* : Subtract it from 10. ■ *Middle digit* : Subtract it from 9, and add the neighbour. ■ *Left most digit* : Subtract 1 from neighbour.
8	■ *Right most digit* : Subtract it from 10 and double. ■ *Middle digit* : Subtract it from 9, double it and add the neighbour. ■ *Left most digit* : From neighbour, subtract 2.
4	■ *Right most digit* : Subtract it from 10, → If odd, add 5 too. ■ *Middle digit* : Subtract it from 9, plus half the neighbour, → If odd add 5 too. ■ *Left most digit* : Half the neighbour and subtract 1.
3	■ *Right most digit* : Subtract from 10 and double, → If odd add 5 too. ■ *Middle digit* : Subtract it from 9, and double add half the neighbour, → If odd add 5 too. ■ *Left most digit* : Half the neighbour and subtract 2.
2	■ Double each digit.
1	■ Copy down the multiplicand.
0	■ Write Zero.

Note—The Left most digit is always 0.

Chapter 2
Rapid Multiplication

In the previous chapter one saw how basic multiplication can be made more rapidly without memorizing the multiplication tables. In this chapter we will go one step further and find ourselves more confidence in our ability to perform rapid multiplication of any number by any other number. No matter who long the multiplicand and multiplier are, one can make multiplication more rapidly than regular method.

Rapid Multiplication-made easy—First Step

Before making rapid multiplication, let us go with the following :

(i) A digit is a one figure number, *i.e.*, 5 or 6 or 7 or 1.

(ii) When two (or more) digits are multiplied together (or square), we get resultant in one figure or two figure (or more).

Consider one figure resultant as two figure number by writing zero (0) in front of it.

e.g., $2 \times 3 = 06$ (not 6)

$4 \times 2 \times 1 = 08$ (not 8)

(iii) **Carry-over principle :** *Of the resultant, the right most digit is write down and carry-over the rest.*

e.g., multiply 6 by 9.

Multiplying 6 by 9 gives 54; $6 \times 9 = 54$, here 4 is written down, 5 is carry-over.

(iv) **Inside-Outside principle :**

Consider the multiplicand and multiplier with same number of digits.

- ***Multiply each successive right hand digit of multiplicand by each successive left hand digit of multiplier.***
- ***Add the products.***

Example : Apply inside-outside principle on 45 and 67.

- Multiply 5 of the multiplicand by 6 of multiplier;

  5×6 $\overset{\frown}{45 \times 67}$

- Multiply 4 of the multiplicand by 7 of multiplier;

  4×7 45×67

- Add the products;

  $(5 \times 6) + (4 \times 7) = 30 + 28 = 58$.

  The resultant is 58. 45×67

Example : Apply inside-outside principle on 567 and 432.

- Multiply 7 of multiplicand by 4 of multiplier;

  7×4 $\overset{\frown}{567 \times 432}$

- Multiply 6 of multiplicand by 3 of multiplier;

  6×3 567×432

- Multiply 5 of multiplicand by 2 of multiplier;

  5×2 567×432

- Add the products;

  $(7 \times 4) + (6 \times 3) + (5 \times 2) = 28 + 18 + 10 = 56$ 567×432

  The resultant is 56.

EXERCISE

Apply inside-outside principle on the following pairs :

1. (56) and (17)
2. (83) and (92)
3. (87) and (56)
4. (35) and (46)
5. (15) and (24)

ANSWERS

1. 41	2. 43	3. 83	4. 38
5. 14			

Apply inside-outside principle on the following triplets :

1. (321) and (654)
2. (703) and (654)
3. (870) and (654)
4. (021) and (543)
5. (987) and (654)

ANSWERS				
1. 28	2. 46	3. 67	4. 13	5. 118

Apply inside-outside principle on the following quadruplet :

1. (7021) and (6543)
2. (8702) and (6543)
3. (6543) and (9870)

ANSWERS		
1. 37	2. 64	3. 94

Multiplication of Two Digit Multiplicand by Two Digit Multiplier

Method I :

Step 1 : The right hand digit of multiplicand is multiplied by right hand digit of multiplier.
Step 2 : Apply inside-outside principle (plus carry).
Step 3 : The left hand digit of multiplicand is multiplied by left hand digit of multiplier (plus carry).

Example : Multiply 56 by 17.

56 × 17

Step 1 : Right hand digit 6 of multiplicand 56 is multiplied by right hand digit 7 of multiplier 17

$6 \times 7 = 42$; write 2, carry-over 4

56 × 17
2

Step 2 : Apply inside-outside principle
$[(6 \times 1) + (5 \times 7)] = 6 + 35 = 41$
Plus carry 4;

$41 + 4 = 45$; write 5, carry-over 4

56 × 17
52

Step 3 : Left hand digit 5 of multiplicand 56 is multiplied by left hand digit 1 of multiplier 17.

$5 \times 1 = 05$
Plus carry 4;

$05 + 4 = 09$; write 09

56 × 17
0952

The answer is 952

Method II :

Multiply 56 by 17.

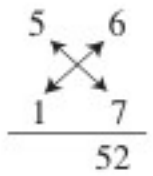
Step 1 : Multiply the units places digits of multiplicand and multiplex $6 \times 7 = 42$

write 2 and carry-over 4.

5 6
↕
1 7
2

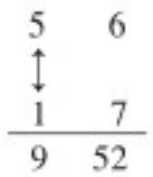
Step 2 : Apply cross multiple as $5 \times 7 = 35$ and $6 \times 1 = 6$. Add these with carry. As,

$35 + 6 + 4 = 45$ write 5 and carry-over 4.



Step 3 : Multiply the tens digits of multiplicand and multiplier as $5 \times 1 = 5$ and plus with

carry 4, as $5 + 4 = 9$, then write 9.



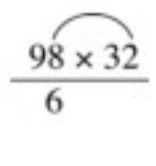
The answer is 952.

Example : Multiply 98 by 32. 98 × 32

Method I :

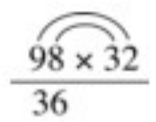
Step 1 : Right hand digit 8, of multiplicand 98 is multiplied by right hand digit 2 of multiplier 32.

$8 \times 2 = 16$; write 6, carry-over 1



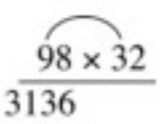
Step 2 : Apply inside-outside principle
$[(8 \times 3) + (9 \times 2)] = 24 + 18 = 42$
Plus carry 1;

$42 + 1 = 43$; write 3 carry-over 4



Step 3 : Left hand digit 9 of multiplicand is multiplied by left hand digit 3 of multiplier
$9 \times 3 = 27$;
Plus carry 4;

$27 + 4 = 31$; write 31.



Method II :

Multiply 98 by 32.

Step 1 : Multiply the units digits of multiplicand and multiplier. As, $8 \times 2 = 16$.

Write 6 and carry-over 1.

$$\begin{array}{cc} 9 & 8 \\ & \updownarrow \\ 3 & 2 \\ \hline & 6 \end{array}$$

Step 2 : Apply cross multiple rule. As, $(9 \times 2) + (8 \times 3)$ $= 18 + 24 = 42$ and add will carry 1.
As, $42 + 1 = 43$

Write 3 and carry-over 4.

$$\begin{array}{cc} 9 & 8 \\ \times & \times \\ 3 & 2 \\ \hline & 36 \end{array}$$

Step 3 : Multiply the tens digits of multiplicand and multiplier. As, $9 \times 3 = 27$ carry 4.

As, $27 + 4 = 31$. Write 31.

$$\begin{array}{cc} 9 & 8 \\ \updownarrow & \\ 3 & 2 \\ \hline 31 & 36 \end{array}$$

The answer is 3136.

EXERCISE

1. Multiply 89 by 63.
2. Multiply 69 by 42.
3. Multiply 87 by 78.
4. What is the area of rectangle of sides 49 cm and 89 cm ?
5. What is the cost of 29 pens, if the rate is Rs. 96 each pen ?
6. If an elephant drinks 48 litres of water daily, how much water it requires in 56 days ?
7. There are 99 packets and each packet contains 79 bullets. Find the total number of bullets ?
8. Multiply 67 by 76.
9. Find the cost of 77 metre pipe at the rate of Rs. 29 per metre.

ANSWERS

1. 5607	2. 2898	3. 6786	4. 4361 sq. cm
5. Rs. 2784	6. 2688 litre	7. 7821 bullets	8. 5092
9. Rs. 2233			

Multiplication by Two Digit Multiplier

Step 1 : The right most digit of multiplicand is multiplied by right most digit of multiplier.

Step 2 : For each successive pair of digits of multiplicand and multiplier apply inside-outside principle (plus carry).

Step 3 : The left most digit of multiplicand is multiplied by left most digit of multiplier (plus carry).

Method I :

Example : Multiply 987432 by 56. $\underline{987432 \times 56}$

Step 1 : Right most digit 2 of multiplicand is multiplied by right most digit 6 of multiplier

$2 \times 6 = 12$; write 2, carry-over 1 $\dfrac{987432 \times 56}{2}$

Step 2 :

- For pair 32 and multiplier 56, apply inside-outside principle (plus carry 6)
  $[(2 \times 5) + (3 \times 6)] + 1$
  $= 10 + 18 + 1 = 29$;

  write 9, carry-over 2 $\dfrac{987432 \times 56}{92}$

- For pair 43 and multiplier 56
  apply inside-outside principle (plus carry 2)
  $[(3 \times 5) + (4 \times 6)] + 2$
  $= 15 + 24 + 2 = 41$;

  write 1, carry-over 4 $\dfrac{987432 \times 56}{192}$

- For pair 74 and multiplier 56
  apply inside-outside principle + (carry 4)
  $[(4 \times 5) + (7 \times 6)] + 4$
  $= 20 + 42 + 4 = 66$;

  write 6, carry-over 6 $\dfrac{987432 \times 56}{6192}$

■ For pair 87 and multiplier 56
$[(7 \times 5) + (8 \times 6)] + 6$ (carry)
$= 35 + 48 + 6 = 89$;

write 9, carry-over 8

$$\overset{\frown}{987432 \times 56}$$
$$96192$$

■ For pair 98 and multiplier 56
$[(8 \times 5) + (9 \times 6)] + 8$ (carry)
$= 40 + 54 + 8 = 102$;

write 2, carry-over 10

$$\overset{\frown}{987432 \times 56}$$
$$296192$$

Step 3 : The left most digit 9 of multiplicand is multiplied by left most digit 5 of multiplier (plus carry 10)
$(9 \times 5) + 10 = 45 + 10 = 55$;

write 55

$$\overset{\frown}{987432 \times 56}$$
$$55296192$$

The answer is 55296192

Method II :

Example : Multiply 987432 by 56.

Step 1 : Multiply unit digits as $2 \times 6 = 12$.

Write 2, carry-over 1.

$$\begin{array}{r} 9874\ 32 \\ \updownarrow \\ 56 \\ \hline 2 \end{array}$$

Step 2 : Apply cross multiple in 32 and 56. As $3 \times 6 + 2 \times 5 = 28$ add carry as $28 + 1 = 29$.

Write 9, carry-over 2.

$$\begin{array}{r} 9874\ 32 \\ \times \\ 56 \\ \hline 92 \end{array}$$

Step 3 : Now leaving right digit 2 apply cross multiple in 43 and 56 and $4 \times 6 + 3 \times 5 = 39$ add carry. As $39 + 2 = 41$.

Write 1 and carry-over 4.

```
9874  32
        \/
        56
-------------
   1  92
```

Step 4 : Now leaving two digits from right end, apply cross multiple in 74 and 56. As $7 \times 6 + 4 \times 5 = 62$. Plus carry, as $62 + 4 = 66$.

Write 6 and carry-over 6.

```
9874  32
       \/
        56
-------------
  61  92
```

Step 5 : Now leaving three digits from right end apply cross multiple in 87 and 56.
As $8 \times 6 + 7 \times 5 = 83$. Plus carry, as $83 + 6 = 89$.

Write 9 and carry-over 8.

```
9874  32
      \/
        56
-------------
 961  92
```

Step 6 : Now leaving four digits from right end apply cross multiple in 98 and 56.
As $9 \times 6 + 8 \times 5 = 94$. Plus carry, as $94 + 8 = 102$.

Write 2 and carry-over 10.

```
9874  32
     \/
        56
-------------
2961  92
```

Step 7 : Multiply the left hand digits as, $9 \times 5 = 45$ and plus carry as $45 + 10 = 55$.

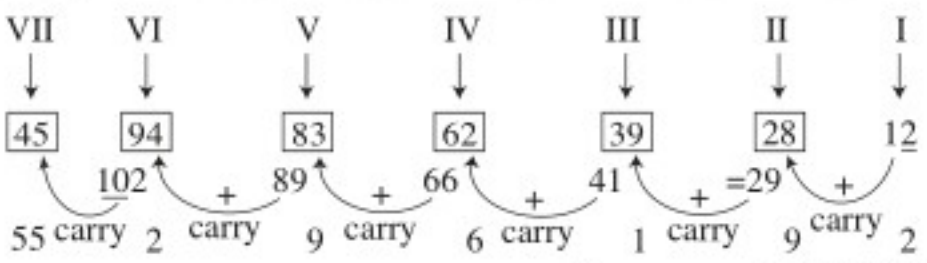
Write 55.

```
9874  32
     \
        56
-------------
552961  92
```

∴ The answer is 55296192.

■ In the given example all the steps are written down all together as.

$$\begin{array}{r} 9874\ 32 \\ \hline 9\times5/9\times6+8\times5/6\times8+7\times5/6\times7+5\times4/6\times4+3\times5/6\times3+2\times5/2\times6 \end{array}$$



∴ The answer is 55296192

■ **Again —**

$$\begin{array}{r} 9\,8\,7\,4\,3\,2 \\ \hline 5\,6 \\ \hline 5\,5_{10}2_{8}9_{6}6_{4}1_{2}9_{1}2 \end{array}$$

(The multiplication in single line.)

∴ The answer is 55296192

EXERCISE

1. Multiply 998641 by 76.
2. Multiply 110011 by 33.
3. Multiply 666666 by 77.
4. What is the area of rectangular field of sides 7779 mts and 68 mts ?
5. If the cost of a car is Rs. 297640 then what will be the cost of 95 cars ?
6. Multiply 9999 by 99.
7. Multiply 101010 by 66.
8. Multiply 987654 by 17.
9. Multiply 123456 by 13.
10. Multiply 694356 by 75.

ANSWERS			
1. 75896716	2. 3630363	3. 51333282	4. 528972 mts^2
5. Rs. 28275800	6. 989901	7. 6666660	8. 16790118
9. 1604928	10. 52076700		

Multiplication by Three Digit Multiplier

Step 1 :	***The right most digit of multiplicand is multiplied by right most digit of multiplier.***
Step 2 :	***For the right most pair of multiplicand and right most pair of multiplier apply inside-outside principle (plus carry).***
Step 3 :	***For each successive triplet of multiplican and multiplier apply inside-outside principle (plus carry).***
Step 4 :	***For the left most pair of multiplicand and left most pair of multiplicand apply inside-outside principle (plus carry).***
Step 5 :	***The left most digit of multiplicand is multiplied by left most digit of multiplier (plus carry).***

Method I :

Example : Multiply 9870321 by 654.

9870321 × 654

Step 1 : Multiply 1 by 4;

$1 \times 4 = 4$;

write 4

9870321 × 654
4

Step 2 : For pair 21 and pair 54 apply inside-outside principle;

$[(1 \times 5) + (2 \times 4)] = 5 + 8 = 13$;

write 3, carry-over 1

9870321 × 654
34

Step 3 :

- For triplet (321) and multiplies (654) apply inside-outside principle (+ carry 1)

$[(1 \times 6) + (2 \times 5) + (3 \times 4)] + 1$
$= 6 + 10 + 12 + 1 = 29$;

write 9, carry-over 2

9870321 × 654
934

- For triplet (032) and multiplier (654)
  $[(2 \times 6) + (3 \times 5) + (0 \times 4)] + 2$ (carry)
  $= 12 + 15 + 0 + 2 = 29$;

  write 9, carry-over 2

  9870321 × 654
  9934

- For triplet (703) and multiplier 654
  $[(3 \times 6) + (0 \times 5) + (7 \times 4)] + 2$ (carry)
  $= 18 + 0 + 28 + 2 = 48$;

  write 8, carry-over 4

  9870321 × 654
  89934

- For triplet (870) and multiplier 654
  $[(0 \times 6) + (7 \times 5) + (8 \times 4)] + 4$ (carry)
  $= 0 + 35 + 32 + 4 = 71$;

  write 1, carry-over 7

  9870321 × 654
  189934

- For triplet (987) and multiplier 654
  $[(7 \times 6) + (8 \times 5) + (9 \times 4)] + 7$ (carry)
  $= 42 + 40 + 36 + 7 = 125$;

  write 5, carry-over 12

  9870321 × 654
  5189934

Step 4 : For pair (98) and pair (65)
$[(8 \times 6) + (9 \times 5)] + 12$ (carry)
$= 48 + 45 + 12 = 105$;

write 5, carry-over 10.

9870321 × 654
55189934

Step 5 : Multiply 9 by 6 (plus carry 10)
$(9 \times 6) + 10 = 54 + 10 = 64$;

write 64

9870321 × 654
6455189934

The answer is 6455189934

Method II :

Example : Multiply 9870321 by 654.

∴ 9870321
× 654

Step 1 : Multiply unit digits. As $1 \times 4 = 4$

Write 4, no carry-over.

9870321
↕
654
4

Step 2 : Apply cross multiple. As, $2 \times 4 + 1 \times 5 = 13$.

Write 3, carry-over 1.

9870321
⤫
654
34

Step 3 : Apply cross multiple. As, $3 \times 4 + 2 \times 5 + 1 \times 6 = 28$. Add carry as $28 + 1 = 29$.

Write 9 and carry-over 2.

9870321
⤫
654
934

Step 4 : Now leaving right digit 1 apply cross multiple between 032 and 654.
As $0 \times 4 + 3 \times 5 + 2 \times 6 = 27$.
Add carry as $27 + 2 = 29$.

Write 9 and carry-over 2.

9870321
⤫
654
9934

Step 5 : Now leaving two right digit 2 and 1.
Apply cross multiple between 703 and 654.
As, $7 \times 4 + 0 + 5 + 3 \times 6 = 46$.
Add carry as, $46 + 2 = 48$.

Write 8, carry-over 4.

9870321
⤫
654
89934

Step 6 : Now leaving three digits 3, 2 and 1.
Apply cross-multiple between 870 and 654.
As $8 \times 4 + 5 \times 7 + 0 \times 6 = 67$.
Add carry as $67 + 4 = 71$.

Write 1, carry-over 7.

9870321
654
189934

Step 7 : Now leaving four right digits 0, 3, 2 and 1.
Apply cross-multiple between 987 and 654.
As $9 \times 4 + 8 \times 5 + 7 \times 6 = 118$.
Add carry as $118 + 7 = 125$.

Write 5 and carry-over 12.

9870321
654
5189934

Step 8 : Now leaving five right digits from multiplicand and one right digit from multiplies.
Apply cross multiple between 98 and 65.
As $9 \times 5 + 8 \times 6 = 93$.
Add carry as $93 + 12 = 105$.

Write 5, carry-over 10.

9870321
654
55189934

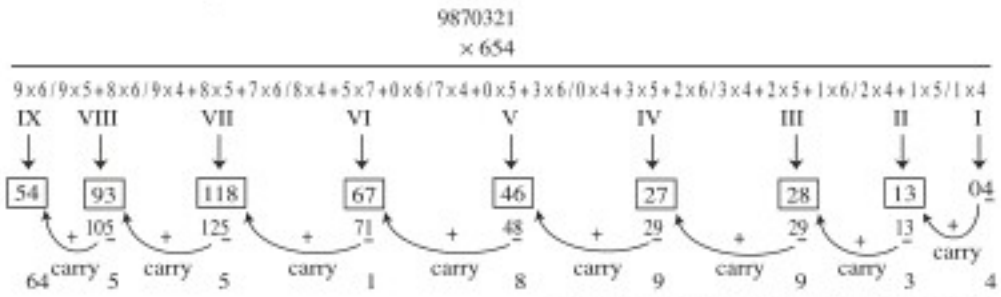
Step 9 : Now leaving six right digits from multiplicand and two digits from multiplier apply cross-multiple between 9 and 6. As $9 \times 6 = 54$.
Add carry as $54 + 10 = 64$.

Write 64.

9870321
654
6455189934

∴ The answer is 6455189934.

■ In the given example all the steps are written down all together as,



∴ The answer is 6455189934.

■ **Again—**

$$\begin{array}{r} 9\,8\,7\,0\,3\,2\,1 \\ \times\, 6\,5\,4 \\ \hline 6\,4\,5\,5\,1\,8\,9\,9\,3\,4 \\ {\scriptstyle 10\,12\;7\;4\;2\;2\;1\;0} \end{array}$$

(Multiplication in single line.)

(At the base the carry are shown.)

■ Carry may be shown on the top of the digits of multiplicand, as

$$\begin{array}{r} {\scriptstyle 10\;12\;\;7\;\;4\;\;2\;\;2\;\;1\;\;0 \leftarrow \text{carry}} \\ 9\,8\,7\,0\,3\,2\,1 \\ \times\, 6\,5\,4 \\ \hline 6\,4\,5\,5\,1\,8\,9\,9\,3\,4 \end{array}$$

EXERCISE

1. Multiply 23987 by 999.
2. Multiply 23987 by 989.
3. Multiply 23987 by 787.
4. Multiply 23987 by 676.
5. Multiply 23987 by 566.
6. Multiply 17123 by 432.
7. Multiply 17123 by 321.
8. Multiply 17123 by 234.
9. Multiply 17123 by 421.
10. Multiply 17123 by 212.

ANSWERS

1. 23963013	2. 23723143	3. 18877769	4. 16215212
5. 13576642	6. 7397136	7. 5496483	8. 4006782
9. 7208783	10. 3630076		

Multiplication by Four Digit Multiplier

Step 1 : *The right most digit of multiplicand is multiplied by right most digit of multiplier.*

Step 2 : *For the right most pair of multiplicand and right most pair of multiplier apply inside-outside principle (plus carry).*

Step 3 : *For the right most triplet of multiplicand and right most triplet of multiplier apply inside-outside principle (plus carry).*

Step 4 : *For each successive quadruple and multiplies apply inside-outside principle (plus carry).*

Step 5 : *For the left most triplet of multiplicand and left most triplet of multiplier apply inside-outside principle (plus carry).*

Step 6 : *For the left most pair of multiplicand and left most pair of multiplier apply-inside-outside principle (plus carry).*

Step 7 : *For left most digit of multiplicand is multiplied by left most digit of multiplier (plus carry).*

Method I :

Example : Multiply 987021 by 6543.

987021 × 6543

Step 1 : Multiply 1 by 3;
$1 \times 3 = 03$;

write 3

$\overline{987021 \times 6543}$
$\overline{3}$

Step 2 : For pair (21) and (43);
$[(1 \times 4) + (2 \times 3)]$
$= 4 + 6 = 10$;

write 0, carry-over 1

$\overline{987021 \times 6543}$
$\overline{03}$

Step 3 : For triplet (0 2 1) and (543), plus carry 1
$[(1 \times 5) + (2 \times 4) + (0 \times 3)] + 1$
$= 5 + 8 + 0 + 1 = 14$

write 4, carry-over 1

$\overline{987021 \times 6543}$
$\overline{403}$

Step 4 :

■ Quadruple (7021) and multiplier (6543) + 1 (carry);

$[(1 \times 6) + (2 \times 5) + (0 \times 4) + (7 \times 3)] + 1$

$= 6 + 10 + 0 + 21 + 1 = 38;$

write 8, carry-over 3

$$\overline{\overline{\overline{\overline{987021} \times 6543}}}$$
$$8403$$

■ Quadruple (8702) and multiplier (6543) + 3 (carry);

$[(2 \times 6) + (0 \times 5) + (7 \times 4) + (8 \times 3)] + 3$

$= 12 + 0 + 28 + 24 + 3 = 67;$

write 7, carry-over 6

$$\overline{\overline{\overline{\overline{987021} \times 6543}}}$$
$$78403$$

■ Quadruple (9870) and multiplier (6543) + 6 (carry);

$[(0 \times 6) + (7 \times 5) + (8 \times 4) + (9 \times 3)] + 6$

$= 0 + 35 + 32 + 27 + 6 = 100;$

write 0, carry-over 10

$$\overline{\overline{\overline{\overline{987021} \times 6543}}}$$
$$078403$$

Step 5 : Triplet (987) and (654) + 10 (carry);

$[(7 \times 6) + (8 \times 5) + (9 \times 4)] + 10$

$= 42 + 40 + 36 + 10 = 128;$

write 8, carry-over 12

$$\overline{\overline{\overline{987021} \times 6543}}$$
$$8078403$$

Step 6 : Pair (98) and (65) + 12 (carry);

$[(8 \times 6) + (9 \times 5)] + 12$

$= 48 + 45 + 12 = 105;$

write 5, carry-over 10

$$\overline{\overline{987021} \times 6543}$$
$$58078403$$

Step 7 : Multiply 9 by 6;

$9 \times 6 = 54 + 10$ (carry) $= 64$;

write 64

$\overline{987021 \times 6543}$

6458078403

The answer is 6458078403

Method II :

Example : Multiply 987021 by 6543.

$\therefore$ 987021

× 6543

Step 1 : Multiply unit digits. As, $1 \times 3 = 3$

987021

↕

6543

Write 3. No carry-over.

3

Step 2 : Apply cross multiple. As $2 \times 3 + 1 \times 4 = 10$.

987021

6543

Write 0, 1 carry-over.

03

Step 3 : Apply cross multiple.

As, $0 \times 3 + 2 \times 4 + 1 \times 5 = 13$.

Add carry as, $13 + 1 = 14$

987021

6543

Write 4, carry-over 1.

403

Step 4 : Apply cross multiple again.

As $7 \times 3 + 0 \times 4 + 2 \times 5 + 1 \times 6 = 37$.

Add carry as, $37 + 1 = 38$.

987021

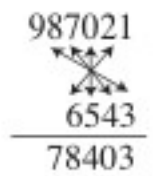
6543

Write 1 and carry-over 3.

8403

Step 5 : Now leaving right digit 1. Apply cross multiple between 8702 and 6543.
As, $8 \times 3 + 7 \times 4 + 0 \times 5 + 2 \times 6 = 64$.
Add carry as $64 + 3 = 67$.

Write 7 and carry-over 6.



Step 6 : Now leaving two right digits 2 and 1.
Apply cross multiple between 9870 and 6543.
As, $9 \times 3 + 8 \times 4 + 7 \times 5 + 0 \times 6 = 94$.
Add carry as $94 + 6 = 100$.

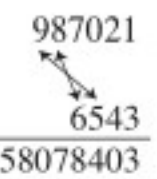
Write 0 and carry-over 10.

Step 7 : Now leaving 3 digits from multiplicand from right end. As 0, 2 and 1 and leaving one digit from multiplier from right end as 3.
Apply cross multiple between 987 and 654.
As, $9 \times 4 + 8 \times 5 + 7 \times 6 = 118$.
Add carry as $118 + 10 = 128$.

Write 8 and carry-over 12.

Step 8 : Now leaving four digit from multiplicand and two digits from multiplier.
Apply cross multiple between 98 and 65.
As, $9 \times 5 + 8 \times 6 = 93$.
Add carry as $93 + 12 = 105$.

Write 5 and carry-over 10.



Step 9 : Now apply multiple of left end digits.

As $9 \times 6 = 54$.

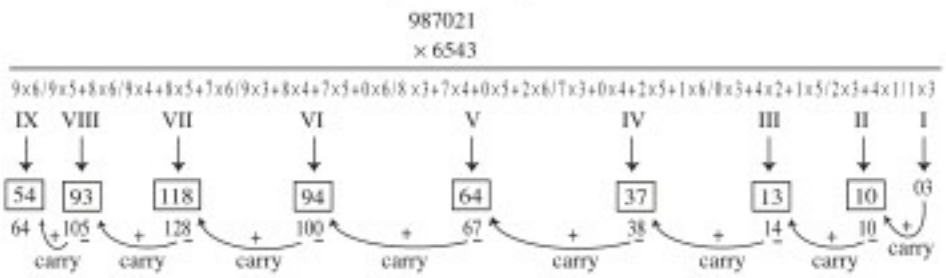
Add carry as $54 + 10 = 64$.

Write 64. Now.

$$\begin{array}{r} 987021 \\ \times\ 6543 \\ \hline 6458078403 \end{array}$$

∴ The answer is 6458078403.

■ In the given example all the steps are written down all together as,



■ Again, **Multiplication in a single line.**

$$\begin{array}{r} 987021 \\ \times\ 6543 \\ \hline 6458078403 \\ {\scriptstyle 10\ 12\ 10\ 6\ 3\ 1\ 1\ 0} \end{array}$$

(carry are shown at the base.)

■ Carry may be shown on the top of the digits of multiplicand. As,

$$\begin{array}{r} {\scriptstyle 10\ 12\ 10\ 6\ 3\ 1\ 1\ 0\ \leftarrow \text{carry}} \\ 987021 \\ \times\ 6543 \\ \hline 6458078403 \end{array}$$

The answer is 6458078403.

EXERCISE (A)

1. Multiply 121210 by 9999.
2. Multiply 1234567 by 8888.
3. Multiply 246879 by 7777.
4. Multiply 164321 by 6666.
5. Multiply 1642316 by 5555.
6. Multiply 224466 by 4444.

7. Multiply 5544779 by 3333.
8. Multiply 22336677 by 2222.
9. Multiply 121212 by 9876.

ANSWERS		
1. 1211978790	2. 10972831496	3. 1919977983
4. 1095363786	5. 9123065380	6. 997526904
7. 18480748407	8. 49632096294	9. 1197089712.

EXERCISE (B)

1. In the multiplication of 7806259 to 691, what digit will come at the ten thousandth place in the result ?
2. Multiply 1342352 by 3214 and find what digit will come at the lakhth. Place in the result ?
3. Multiply 720320172 by 10101 and find what digit will come at the sixth place from right end in the result ?
4. Multiply 6893421 by 321 and find what digit will come at the left hand ?
5. Multiply 621345 by 224 and find what digit will come at the fourth place from right end in result ?

ANSWERS				
1. 6	2. 3	3. 0	4. 2	5. 1

Rapid Multiplication
(A Review)

Inside-outside principle

Consider the multiplicand and multiplier with same number of digits.

- Multiply successive right hand digit of multiplicand by successive left hand digit of multiplier.
- Add the product.

Multiplication	Steps
Of two digit multiplicand by two digit multiplier	■ Right hand digit of multiplicand is multiplied by right hand digit of multiplier. ■ Apply inside-outside principle (plus carry). ■ Left hand digit of multiplicand is multiplied by left hand digit of multiplier (plus carry).
Multiplication	**Steps**
With two digit multiplier	■ Right most digit of multiplicand is multiplied by right hand digit of multiplier. ■ Successive pair of digits of multiplicand and multiplier apply inside-outside principle (plus carry). ■ Left hand digit of multiplicand is multiplied by left hand digit of multiplier (plus carry).
Multiplication	**Steps**
With three digit multiplier	■ Right most digit of multiplicand is multiplied by right hand digit of multiplier. ■ Right most pairs of multiplicand and right most pair of multiplier-apply inside-outside principle (+ carry). ■ Successive triplets of multiplicand and multiplier apply inside-outside principle (+ carry). ■ Left most pair of multiplicand and left most pair of multiplier apply inside-outside principle (+ carry). ■ Left hand digit of multiplicand is multiplied by left hand digit of multiplier (+ carry).

Multiplication	Steps
With four digit multiplier	■ Right most digit of multiplicand is multiplied by right hand digit of multiplier. ■ Right most pairs of multiplicand and right most pairs of multiplier-apply inside-outside principle (+ carry). ■ Right most triplet of multiplicand and right most triplet of multiplier-apply inside-outside principle (+ carry). ■ Successive quadruplet of multiplicand and multiplier-apply inside-outside principle (+ carry). ■ Left most triplet of multiplicand and left most triplet of multiplier-apply inside-outside principle (+ carry). ■ Left most pairs of multiplicand and left most pair of multiplier-apply inside-outside principle (+ carry). ■ Left hand digit of multiplicand is multiplied by left hand digit of multiplier (+ carry).

Some Special Easy Methods of Multiplication

1. Product of two such numbers whose units digit sum is 10 and tense digits are equal.

> ***Step 1 :*** *Write, two lefthand digits as the product of tense and (tense + 1).*
>
> ***Step 2 :*** *Write, two right hand digits as the products of unit digit.*

Example : Multiply 33 by 37.

Here sum of unit digits is 3 + 7 = 10.

Step 1 : Left hand digits 3 × (3 + 1) = 12.

$$\frac{33 \times 37}{12}$$

Step 2: Right hand digits 3 × 7 = 21.

$$\frac{33 \times 37}{12 \quad 21}$$

Example : Multiply 24 by 26.

Step 1 : 2 × (2 + 1) = 6.

$$\frac{24 \times 26}{6}$$

Step 2 : 4 × 6 = 24.

$$\frac{24 \times 26}{6 \quad 24}$$

Example : Multiply 35 by 35.

Step 1 : 3 × (3 + 1) = 3 × 4 = 12.

$$\frac{35 \times 35}{12}$$

Step 2 : 5 × 5 = 25.

$$\frac{35 \times 35}{12 \quad 25}$$

Example : Multiply 43 by 47.

Step 1 : 4 × (4 + 1) = 4 × 5 = 20.

$$\frac{43 \times 47}{20}$$

Step 2 : 3 × 7 = 21.

$$\frac{43 \times 47}{20 \quad 21}$$

Example : Multiply 55 by 55.

Step 1 : 5 × (5 + 1) = 5 × 6 = 30.

$$\frac{55 \times 55}{30}$$

Step 2 : 5 × 5 = 25.

$$\frac{55 \times 55}{30 \quad 25}$$

Example : Multiply 73 by 77.

Step 1 : 7 × (7 + 1) = 7 × 8 = 56.

$$\frac{73 \times 77}{56}$$

Step 2 : $3 \times 7 = 21$.

$$\begin{array}{r} 73 \times 77 \\ \hline 56 \quad 21 \end{array}$$

Example : Multiply 83 by 87.

Step 1 : $8 \times (8 + 1) = 8 \times 9 = 72$.

$$\begin{array}{r} 83 \times 87 \\ \hline 72 \end{array}$$

Step 2 : $3 \times 7 = 21$.

$$\begin{array}{r} 83 \times 87 \\ \hline 72 \quad 21 \end{array}$$

Example : Multiply 91 by 99.

Step 1 : $9 \times (9 + 1) = 9 \times 10 = 90$.

$$\begin{array}{r} 91 \times 99 \\ \hline 90 \end{array}$$

Step 2 : $1 \times 9 = 09$.

$$\begin{array}{r} 91 \times 99 \\ \hline 90 \quad 09 \end{array}$$

Note : If the product of unit digits is less than 10, then we put zero in front the result.

EXERCISE

1. Multiply 31 by 39.
2. Multiply 33 by 37.
3. Multiply 35 by 35.
4. Multiply 44 by 46.
5. Multiply 55 by 55.
6. Multiply 56 by 54.
7. Multiply 67 by 63.
8. Multiply 64 by 64.
9. Multiply 72 by 78.
10. Multiply 93 by 97.

ANSWERS

1. 1209	2. 1221	3. 1225	4. 2024
5. 3025	6. 3024	7. 4221	8. 4216
9. 5616	10. 9021		

2. Product of two such numbers whose difference is 10.

Step 1 : Square the right most digit (units digit).
Step 2 : Add the tense digits and multiply the sum by units digit. (Plus carry).
Step 3 : Multiply the tense digits (Plus carry).

Example : Multiply 86 by 96.

Here, the difference of numbers is 10.

Step 1 : Square the right hand digit. As, $6^2 = 36$.

Write 6 and carry-over 3. $\frac{86 \times 96}{6}$

Step 2 : Add the tens digits as $8 + 9 = 17$ and multiply to it by unit digit as $17 \times 6 = 102 + 3$ (carry)

Write 2 and carry-over 10. $\frac{86 \times 96}{56}$

Step 3 : Multiply the tens digits as $8 \times 9 = 72$

and add carry as, $72 + 10 = 82$. $\frac{86 \times 96}{8256}$

In a single line it can be shown as :

$$\frac{86 \times 96}{8 \times 9 + \underline{1}0 = 82 \,/\, (8+9) \times 6 + \underline{3} = \underline{10}5 \,/\, 6^2 = \underline{3}6}$$

$\therefore 86 \times 96 = 8256.$

Example : Multiply 43 by 53.

Here the difference of numbers is 10.

Step 1 : Square the right hand digit as $3^2 = 9$.

Write 9 and no carry-over. $\frac{43 \times 53}{9}$

Step 2 : Add the tens digits as $4 + 5 = 9$ and multiply to it by 3 as $9 \times 3 = 27$

Write 7 and carry-over 2. $\frac{43 \times 53}{79}$

Step 3 : Multiply the tens digits as $4 \times 5 = 20$ and add carry as $20 + 2 = 22$.

Write 22. $\frac{43 \times 53}{2279}$

It can be shown in a single line as :

$$\frac{43 \times 53}{(4 \times 5) + \underline{2} = 22 \,/\, (4+5) \times 3 = \underline{2}7 \,/\, 3^2 = 9}$$

$\therefore 43 \times 53 = 2279.$

Example : Multiply 67 by 57.

Here, the difference of numbers is 10.

Step 1 : $7^2 = 49$ → 9 $\qquad \frac{67 \times 57}{}$

Step 2 : $(6 + 5) \times 7 + 4 = 81$ → 19 $\qquad \frac{67 \times 57}{}$

Step 3 : $(6 \times 5) + 8 = 38$ → 3819 $\qquad \frac{67 \times 57}{}$

Example : Multiply 89 by 99.

Here, the difference between no. is 10.

Step 1 : $9^2 = 81$ → 1 $\qquad \frac{89 \times 99}{}$

Step 2 : $(8 + 9) \times 9 + 8 = 161$ → 11 $\qquad \frac{89 \times 99}{}$

Step 3 : $(8 \times 9) + 16 = 88$ → 8811 $\qquad \frac{89 \times 99}{}$

Example : Multiply 13 by 23.

Step 1 : $3^2 = 9$ $\qquad \frac{13 \times 23}{9}$

Step 2 : $(1 + 2) \times 3 = 9$ $\qquad \frac{13 \times 23}{99}$

Step 3 : $1 \times 2 = 2$ $\qquad \frac{13 \times 23}{299}$

EXERCISE

1. Multiply 23 by 33.
2. Multiply 44 by 54.
3. What is the area of a rectangular plot of sides 69 m and 79 m.
4. If the cost of lamp is Rs. 59 then what will be the cost of such 49 cars.
5. Multiply 78 by 88.
6. Multiply 67 by 57.

7. If a car runs 37 km in an hour. How will the car run in 47 hours.
8. Multiply 29 by 39.
9. Multiply 43 by 53.
10. Multiply 67 by 77.

ANSWERS

1. 759	2. 2376	3. 5451	4. 2891
5. 6864	6. 3819	7. 1739	8. 1131
9. 2279	10. 5159.		

3. Product of two such two digits numbers whose units digit are same.

Step 1 : Square the right most digit (units digit).
Step 2 : Add the tens digits and multiply the sum by unit digit and plus carry.
Step 3 : Multiply the tens digits and add carry.

Note : This method belongs to the product of two such numbers whose difference is 10.

Example : Multiply 43 by 63.

Here, the unit digits *i.e.*, 3 are same.

Step 1 : Square the right hand digit *i.e.*, unit digits

as $3 \times 3 = 9$ or $3^2 = 9$.

$$\frac{43 \times 63}{9}$$

Step 2 : Add the tens digits as $4 + 6 = 10$ and multiply to it by unit digit as $10 \times 3 = 30$.

Write 0 and carry-over 3.

$$\frac{43 \times 63}{09}$$

Step 3 : Multiply the tens digit as $4 \times 6 = 24$ and add

carry as $24 + 3 = 27$

$$\frac{43 \times 63}{2709}$$

Example : Multiply 47 by 97.

Here, the unit digits are same.

Step 1 : Square the unit digit as $7^2 = 49$.

Write 9 and carry-over 4.

$$\frac{47 \times 97}{9}$$

Step 2 : Add the tense digits as $4 + 9 = 13$ and multiply to it by unit digit as $13 \times 7 = 91$ and add carry as $91 + 4 = 95$.

Write 5, carry-over 9.

$$\frac{47 \times 97}{59}$$

Step 3 : Multiple tens digit as $4 \times 9 = 36$ add carry as

$36 + 9 = 45$.

$$\frac{47 \times 97}{4559}$$

It can be shown in a single line :

$$\frac{47 \times 97}{4 \times 9 = 36 \,/\, (4+9) \times 7 = 91 \,/\, 7^2}$$

$= 45$ (+ carry) $= 95$ (+ carry) $= 49$

$\therefore\ 47 \times 97 = 4559.$

Example : Multiply 27 by 77.
Here the unit digits are same.

Step 1 : Square the unit digit as $7^2 = 49$.

Write 9 and carry-over 4. $\frac{27 \times 77}{9}$

Step 2 : Add the tens digits as $2 + 7 = 9$ and multiply to it by unit digit as $9 \times 7 = 63$ and plus carry as $63 + 4 = 67$.

Write 7 and carry-over 6. $\frac{27 \times 77}{79}$

Step 3 : Multiply the tens digits as $2 \times 7 = 14$ and plus

carry as $14 + 6 = 20$. $\frac{27 \times 77}{2079}$

It can be shown in a single line as :

$$\frac{27 \times 77}{2 \times 7 = 14 \,/\, (2+7) \times 7 = 63 \,/\, 7^2}$$

$= 20$ (+ carry) $= 67$ (+ carry) $= 49$

$\therefore 27 \times 77 = 2079$.

Note : A little practice of this method will give you a hard step to go ahead speedly. So, you should take a hard decision to reach your goal.

EXERCISE

1. Multiply 34 by 64.
2. Multiply 48 by 78.
3. Multiply 23 by 63.
4. The length of a plot is 73 m and breadth of the plot is 43, what is the area of the plot ?
5. Multiply 26 by 86.
6. Multiply 83 by 93.
7. Multiply 27 by 67.
8. Multiply 35 by 75.
9. The area of a plot is measured as length x breadth. If the length and breadth of the plot is 96 and 56 m. Find the area.
10. Multiply 79 by 69.

ANSWERS

1. 2176	2. 3744	3. 1449	4. 3139
5. 2236	6. 7719	7. 1809	8. 2625
9. 5376	10. 5451.		

Chapter 3
Division

Dealing with multiplication of fairly considerable length, we now move to division. Division, in comparison to multiplication is considered tough, yet the truth is that division is as simple as multiplication and faster.

Naming the Parts of a Division

A division has four parts which are called **divisor, dividend, quotient** and **remainder.** The following rhyme will help you to remember the parts of division :

"The divisor is the number that divides the dividend, the answer is the quotient, the remainder's at the end."

The parts of division may be shown by the basic property.

Divisor) Dividend (Quotient
.....
.....
.....
.....
Remainder

$\therefore$ Dividend = (Divisor × Quotient) + Remainder

Example : Divide 2862 by 4.

$$2862 \div 4 = 715 + 2$$

In the example the divisor is 4, because it divides the dividend 2862. The quotient is 715 (which is the result of division) and the remainder is 2 (because it is that which remains).

Consider this also.

*The **divisor** is the number that divides.*

*The **dividend** is the number that is being divided.*

*The **quotient** is the result of division.*

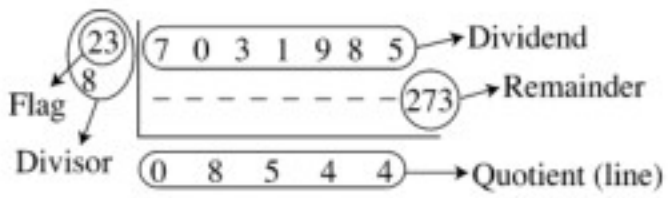
*The **remainder** is that remains after division.*

and also.

Example : Divide 7031985 by 823.

Here 7031985 is dividend and 823 is divisor. On dividing 7031985 (dividend) by 823 (divisor) one get 8544 as quotient and 273 as remainder. This can be written as

7031985 ÷ 823 = 8544 + remainder 273



Above we have written divisor 823 as 8^{23} where 23 is called a flag. We will see later in this chapter the use of flag.

Inside-Outside Principle

Same as the inside-outside principle we have used in Rapid multiplication, we will use this principle in Division too. Let us review it.

Inside-Outside principle :

Consider the multiplicand and multiplier with same number of digits.

- ***Multiply each successive right hand digit of multiplicand by each successive left hand digit of multiplier.***
- ***Add the products.***

Example : Apply inside-outside principle on 45 and 67.

- Multiply 5 of the multiplicand by 6 of multiplier;

  5×6 $\qquad\qquad$ $\overset{\frown}{45 \times 67}$

- Multiply 4 of the multiplicand by 7 of multiplier;

  4×7 $\qquad\qquad$ $\overset{\frown}{45 \times 67}$

- Add the products;

  $(5 \times 6) + (4 \times 7) = 30 + 28 = 58$.

  The resultant is 58. $\overset{\frown}{45 \times 67}$

Example : Apply inside outside principle on 567 and 432.

- Multiply 7 of multiplicand by 4 of multiplier;

  7×4 $\overset{\frown}{567 \times 432}$

- Multiply 6 of multiplicand by 3 of multiplier;

  6×3 $\overset{\frown}{567 \times 432}$

- Multiply 5 of multiplicand by 2 of multiplier;

  5×2 $\overset{\frown}{567 \times 432}$

- Add the products;

  $(7 \times 4) + (6 \times 3) + (5 \times 2) = 28 + 18 + 10 = 56$ $\overset{\frown}{567 \times 432}$

  The resultant is 56.

Example : Applying inside-outside principle on (23 and 36) gives

$(3 \times 3) + (2 \times 6) = 9 + 12 = 21$.

Applying inside-outside principle on (123 and 567) gives

$(3 \times 5) + (2 \times 6) + (1 \times 7) = 15 + 12 + 7 = 34$.

In respective of multiplication in division we make computations dividend from left to right.

In division we make computation with dividend from left to right.

e.g., in dividing 123 by 6.

Here 123 is dividend and 6 is divisor.

In dividend we consider 1 first, then 2 and afterward 3 (from left digit 1 to right digit 3).

Division by Single Digit Divisor

Divide remainder and successive digit (from left to right) by divisor

Example : Divide 8396 by 6.

$$6 \overline{)\,8\;3\;9\;6}$$

Divide remainder and successive digit (from left to right) by divisor.

- Since there is no remainder, divide 8 by divisor 6;
  $8 \div 6 = 1$ remainder 2.

$$6 \overline{)\,8\;(3)\;9\;6}\quad (2)\quad 1$$

- Divide 23 (remainder 2, successive digit 3) by divisor 6;
  $23 \div 6 = 3$ remainder 5.

$$6 \overline{)\,8\;3\;(9)\;6}\quad (2\;5)\quad 1\;3$$

- Divide 59 (remainder 5, successive digit 9) by divisor 6;
  $59 \div 6 = 9$ remainder 5.

$$6 \overline{)\,8\;3\;9\;(6)}\quad (2\;5\;5)\quad 1\;3\;9$$

- Divide 56 (remainder 5, successive digit 6) by divisor 6;
  $56 \div 6 = 9$ remainder 2.

$$6 \overline{)\,8\;3\;9\;6}\quad (2\;5\;5\;2)\quad 1\;3\;9\;9$$

The answer is 1 3 9 9 remainder 2.

EXERCISE

Divide, leaving whole number remainders.

1. Divide 454 by 3
2. Divide 4112 by 3
3. Divide 6599 by 6
4. Divide 7455 by 6

ANSWERS

1. 151 rem. 1 2. 1370 rem. 2 3. 1099 rem. 5 4. 1242 rem. 3

Division by Two Digit Divisor

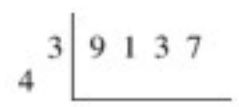
Step 1 : Divide first digit of dividend by first digit of divisor.

Step 2 : ■ ***(Remainder and successive digit of dividend) — (Flag × quotient)***

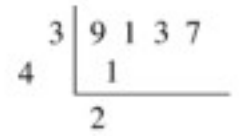
■ ***Divide it by first digit of divisor.***

Step 3 : (Remainder and last digit of dividend) — (Flag × quotient) = Remainder of division

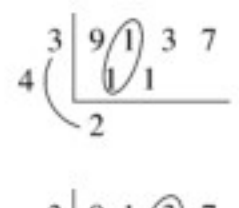
Example : Divide 9137 by 43



Step 1 : 9 ÷ 4 = 2 remainder 1.



Step 2 : ■ 11 – (3 × 2) = 11 – 6 = 5;
5 ÷ 4 = 1 remainder 1.

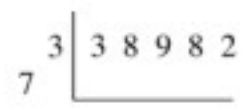


■ 13 – (3 × 1) = 13 – 3 = 10;
10 ÷ 4 = 2 remainder 2.

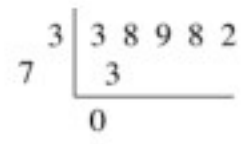
Step 3 : ■ 27 – (3 × 2) = 27 – 6 = 21.

The answer is 212 remainder 21.

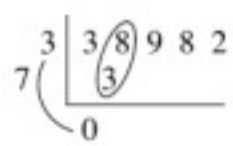
Example : Divide 38982 by 73.



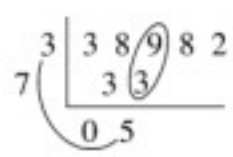
Step 1 : 3 ÷ 7 = 0 remainder 3.



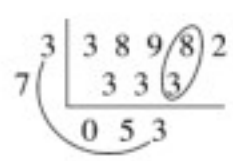
Step 2 : ■ $38 - (3 \times 0) = 38 - 0 = 38$;
$38 \div 7 = 5$ remainder 3.



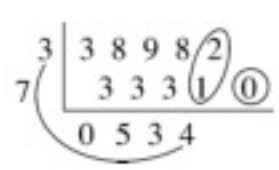
■ $39 - (3 \times 5) = 39 - 15 = 24$;
$24 \div 7 = 3$ remainder 3.



■ $38 - (3 \times 3) = 38 - 9 = 29$;
$29 \div 7 = 4$ remainder 1.



Step 3 : $12 - (3 \times 4) = 12 - 12 = 0$



The answer is 534 remainder 0.

EXERCISE

1. Divide 7343 by 33
2. Divide 9534 by 56
3. Divide 2188 by 64
4. Divide 4564 by 61
5. Divide 8696 by 36
6. Divide 3276 by 75
7. Divide 1874 by 92
8. Divide 5353 by 24
9. Divide 4585 by 35
10. Divide 7332 by 64

ANSWERS

1. 222 rem. 17	2. 170 rem. 14	3. 34 rem. 12	4. 74 rem. 50
5. 241 rem. 20	6. 43 rem. 51	7. 20 rem. 34	8. 223 rem. 1
9. 131 rem. 0	10. 114 rem. 36		

Division by Three Digit Divisor

Step 1 : *Divide first digit of dividend by first digit of divisor.*

Step 2 : ■ *(Remainder and second digit of dividend)—(First digit of flag × quotient)*

■ *Divide by first digit of divisor.*

Step 3 : ■ *(Remainder and successive digit of dividend)—(Apply inside-outside principle on flag and successive quotient pair).*

■ *Divide by first digit of divisor.*

Step 4 : *(Remainder and last digit of dividend)—(Apply inside-outside principle on flag and last quotient pair).*

Example : Divide 7031985 by 823.

```
 23 | 7 0 3 1 9 8 5
8   |
```

Step 1 : 7 ÷ 8 = 0 remainder 7.

```
 23 | 7 0 3 1 9 8 5
8   |   7
    |
    |   0
```

Step 2 : ■ [70 – (2 × 0)]
= 70 – 0 = 70;
70 ÷ 8 = 8 remainder 6.

```
 23 | 7 0 3 1 9 8 5
8   |   7 6
    |  0 8
```

Step 3 : ■ [63 – (23 ⌢ 08)]
= [63 – (0 + 16)]
= 63 – 16 = 47;
47 ÷ 8 = 5 remainder 7.

```
 23 | 7 0 3 1 9 8 5
8   |   7 6 7
    |  0 8 5
```

■ [71 – (23 ⌢ 85)]
= [71 – (24 + 10)]
= 71 – 34 = 37;
37 ÷ 8 = 4 remainder 5.

```
 23 | 7 0 3 1 9 8 5
8   |   7 6 7 5
    |  0 8 5 4
```

■ $[59 - \overset{\frown}{(23\ 54)}]$
$= [59 - (15 + 8)]$
$= [59 - 23] = 36;$
$36 \div 8 = 4$ remainder 4.

$$8\overline{)\underline{23}\ 7\ 0\ 3\ 1\ 9\ 8\ 5}$$
$$\quad\ \ 7\ 6\ 7\ 5\ 4$$
$$\quad\ \ 0\ 8\ \underline{5\ 4}\ 4$$

■ $[48 - \overset{\frown}{(23\ 44)}]$
$= [48 - (12 + 8)]$
$= 48 - 20 = 28;$
$28 \div 8 = 3$ remainder 4.

$$8\overline{)\underline{23}\ 7\ 0\ 3\ 1\ 9\ 8\ 5}$$
$$\quad\ \ 7\ 6\ 7\ 5\ 4\ 4$$
$$\quad\ \ 0\ 8\ 5\ \underline{4\ 4}\ 3$$

Step 4 : $[45 - \overset{\frown}{(23\ 43)}]$
$= [45 - (12 + 06)]$
$= 45 - 18 = 27.$

$$8\overline{)\underline{23}\ 7\ 0\ 3\ 1\ 9\ 8\ 5}$$
$$\quad\ \ 7\ 6\ 7\ 5\ 4\ 4\ (27)$$
$$\quad\ \ 0\ 8\ 5\ 4\ \underline{4\ 3}$$

The answer is 8544 remainder 273.

EXERCISE

1. Divide 2458 by 111
2. Divide 1236 by 112
3. Divide 2384 by 113
4. Divide 1486 by 112
5. Divide 1278 by 111

ANSWERS

1. 22 rem. 16 2. 11 rem. 04 3. 21 rem. 11 4. 13 rem. 30
5. 11 rem. 57

Chapter 4
Squares

What is a square ? The square of a number is multiplying a number by itself. In the previous chapters we have gone by rapid multiplication. Now here we make multiplying a number by itself–squaring of number–by more faster and easier method than rapid multiplication.

Square of Single Digit Number

We are all familiar with the square of single digit number. Let us review them as the square of single digit number is often used in the squaring of two and three digit numbers.

Number	*Square of the number*
0	00
1	01
2	04
3	09
4	16
5	25
6	36
7	49
8	64
9	81

Here point is to be noted that *always write square of 0, 1, 2 and 3 as 00, 01, 04, 09 respectively in two digits*.

EXERCISE

Do it mentally

1. The square of 9 is .....
2. The square of 8 is .....
3. The square of 6 is .....
4. The square of 5 is .....

5. The square of 7 is .....
6. The square of 4 is .....
7. The square of 0 is .....
8. The square of 2 is .....
9. The square of 1 is .....
10. The square of 3 is .....

ANSWERS

1. 81	2. 64	3. 36	4. 25	5. 49
6. 16	7. 00	8. 04	9. 01	10. 09

Square of Two Digit Number

In squaring two digit number, we consider any number in one of the following types :

(a) Number that ends in 5, *i.e.*, 15, 25, 35,....., 85, 95.

(b) Number that begins with 5, *i.e.*, 50, 51,....., 58, 59.

(c) Number in general, a number without begin or end in 5, *i.e.*, 11, 12, 13, 14,....., 19, 20,..... 98, 99.

First let us consider the number of type (a) and (b).

Square of number ends in 5 :

Step 1 : Write 25 with room front of it.

Step 2 : Multiply the first digit by the next large (successive) digit to it.

Example : Find the square of 45. $(45)^2$

Step 1 : Write 25 with room front of it. $(45)^2$

$--25$

Step 2 : Multiply the first digit 4

by the next large digit to it 5. $(45)^2$

$4 \times 5 = 20$ $20\ 25$

The answer is 2025.

Example : Find the square of 15. $(15)^2$

Step 1 : Write 25 with room in front of it. $(15)^2$

$--25$

Step 2 : Multiply the first digit 1

by next large digit to it 2. $(15)^2$

$1 \times 2 = 02$ 0225

The answer is 0225

EXERCISE

Do it mentally

1. Find the square of 95
2. Find the square of 65
3. Find the square of 55
4. Find the square of 35
5. Find the square of 25
6. Find the square of 75
7. Find the square of 45
8. Find the square of 85
9. Find the square of 15
10. Find the square of 05

ANSWERS

1. 9025	2. 4225	3. 3025	4. 1225	5. 0625
6. 5625	7. 2025	8. 7225	9. 0225	10. 0025

Square of number begins with 5 :

Step 1 : Write the square of last digit with room in front of it.

Step 2 : Add 25 to the last digit and write it.

Write the square of 0, 1, 2, 3 in two digits as 00, 01, 04, 09 respectively.

Example : Find the square of 51. $(51)^2$

Step 1 : Write the square of the last digit 1. $(51)^2$

$1^2 = 01$ $--01$

Step 2 : Add 25 to the last digit 1 and write it. $(51)^2$

$1 + 25 = 26$ 2601

The answer is 2601

Example : Find the square of 59. $(59)^2$

Step 1 : Write the square of last digit 9. $(59)^2$

$9^2 = 81$ $--81$

Step 2 : Add 25 to the last digit 9 and write it $(59)^2$

$9 + 25 = 34$ 3481

The answer is 3481

EXERCISE

1. The square of 58
2. The square of 56
3. The square of 57
4. The square of 55
5. The square of 52
6. The square of 53
7. The square of 51
8. The square of 50
9. The square of 59
10. The square of 54

ANSWERS

1. 3364	2. 3136	3. 3249	4. 3025	5. 2704
6. 2809	7. 2601	8. 2500	9. 3481	10. 2916

Squaring two digit number (in general)

Step 1 : Square the last digit.

Step 2 : ■ ***Multiply both digit; double it; write one zero after it.***

■ ***Square the first digit; write two zero after it.***

■ ***Add them.***

Example : Find the square of 26. $(26)^2$

Step 1 : ■ Square of last digit 6;

$6^2 = 36$ $(26)^2$

36

Step 2 : ■ Multiply both digit ($2 \times 6 = 12$);

double 24; $(26)^2$

36

Write one zero after it 240

■ Square first digit 2; $2^2 = 04$;

write two zero after it. 0400

■ Add them 0676

The answer is 676

Example : Find the square of 75. $(75)^2$

Step 1 : ■ Square of 5; $(75)^2$

$(5)^2 = 25$ 25

■ Multiply 7 and 5, double it;

$7 \times 5 = 35$; $35 \times 2 = 70$

Write one zero after it. 700

■ Square of 7; write two zero after it

$(7)^2 = 49$; 4900

■ Add them. 5625

The answer of 5625

EXERCISE

1. The square of 99
2. The square of 87
3. The square of 65
4. The square of 32
5. The square of 46
6. The square of 79
7. The square of 67
8. The square of 42
9. The square of 36
10. The square of 91

ANSWERS

1. 9801	2. 7569	3. 4225	4. 1024	5. 2116
6. 6241	7. 4489	8. 1764	9. 1296	10. 8281

Some Important Methods

Square of numbers end in 1 :

Step 1 : Write 1 at unit place.

Step 2 : Double the tens place digit and put it in tens place.

Step 3 : Square the tens place digit (add carry if you have) and put it at left end.

Example : Find the square of 41. $\frac{(41)^2}{}$

Step 1 : Write 1 at the unit place *i.e.*, at right place $\frac{(41)^2}{1}$

Step 2 : Double tens place digit $\frac{(41)^2}{81}$

Step 3 : Square tens place digit $\frac{(41)^2}{1681}$

The answer is 1681

This may be shown as

$$\frac{(41)^2}{(4)^2 \,/\, (2 \times 4) \,/\, 1}$$

$$16 \,/\, 8 \,/\, 1$$

$\therefore \quad (41)^2 = 1681$

Example : Find the square of 61. $\frac{(61)^2}{}$

Step 1 : Write 1 at the unit place $\frac{(61)^2}{1}$

Step 2 : Double the tens digit write 2 and one carry-over $\frac{(61)^2}{21}$

Step 3 : Square the tens digit and add carry $\frac{(61)^2}{3721}$

It may be shown in following manner.

$(61)^2$

$(6)^2$	2×6	1
$= 36$	$= 12$	
37	2	1

$\therefore \quad (61)^2 = 3721$

EXERCISE

1. The square of 31
2. The square of 41
3. The square of 91
4. The square of 71
5. The square of 11
6. The square of 21
7. The square of 51
8. The square of 81
9. The square of 61
10. The square of 21

ANSWERS

1. 961	2. 1681	3. 8281	4. 5041	5. 121
6. 441	7. 2601	8. 6561	9. 3721	10. 14641

Square of any Two Digit Number

Method I :

Step 1 : Square the last digit and put it at the unit place.

Step 2 : Double the multiplication of both digits and put it at tens place.

Step 3 : Square the left end digit and add carry if you have and put it at left end.

For Example :

$(ab)^2$

a^2	$2 \times a \times b$	b^2
carry	carry	

Example : Find the square of 63.

$(63)^2$

Step 1 : Square the right digit

$(63)^2$

9

Step 2 : Double the multiplication of both digit as

$$2(6 \times 3) = 36$$

Write 6 and carry-over 3.

$(63)^2$

69

Step 3 : Square the left digit and add carry as

$$(6)^2 + 3 = 39$$

$(63)^2$

3969

The above example can be shown in a single line as :

$(63)^2$

6^2	$2 \times 6 \times 3$	3^2
$= 36$	$= 36$	$= 9$
39	6	9

$\therefore \quad (63)^2 = 3969$

Example : Find the square of 82. $(82)^2$

Step 1 : Square the last digit as $(2)^2 = 4$ and put it at the unit place $\underline{(82)^2}\ 4$

Step 2 : Double the multiplication of both the digits as $2(8 \times 2) = 32$.

Write 2 and carry-over 3 $\underline{(82)^2}\ 24$

Step 3 : Square the left hand digit and add carry as, $8^2 + 3 = 67$ $\underline{(82)^2}\ 6724$

This solution can be done in single line as :

$(82)^2$

8^2	$2 \times 8 \times 2$	$(2)^2$
64	$= 32$	$= 4$
67	2	4

$\therefore$ $(82)^2 = 6724$

EXERCISE

Find the square of :

1. 43	2. 56	3. 38	4. 24
5. 58	6. 64	7. 77	8. 86
9. 84	10. 97.		

ANSWERS

1. 1849	2. 3136	3. 1444	4. 576	5. 3364
6. 4096	7. 5929	8. 7396	9. 7056	10. 9409

Square any Two Digit Number

Method II :

Step 1 : Round the number to the nearest ten.

Step 2 : Square the rounded number.

Step 3 : Double the rounded number, then

(i) If the base number was rounded down multiply the difference between the rounded and base number afterward, then add this result.

(ii) If the base number was rounded up multiply the difference between the rounded and base number afterward then subtract this result.

Step 4 : Add the square of the difference between the base number and the rounded number.

Example : Find the square of 23. $(23)^2$

Step 1 : Round the number to the nearest ten. 20

Step 2 : The square of 20 is $(20)^2 = 400$

Step 3 : Double of 20 = 40

Multiply by difference as, 40 × 3 = 120

add it to 400 (since the number is rounded

down) as 400 + 120 = 520 $400 + 120 = 520$

Step 4 : Add the square of difference to 520

as $(3)^2 + 520 = 529$ $520 + (3)^2 = 529$

Example : Find the square of 27. $(27)^2$

Step 1 : Round the number to the nearest ten, as 30

Step 2 : Square of 30, as $(30)^2 = 900$

Step 3 : Double of 30, as $2 \times 30 = 60$

multiply it by difference as $60 \times 3 = 180$

Subtract it (180) from 900 as $900 - 180 = 720$

Step 4 : Add the square of difference to 720, as $720 + 9 = 729$

The answer is 729

Example : Find the square of 46. $(46)^2$

Step 1 : Rounded it to 50. 50

Step 2 : $(50)^2$ 2500

Step 3 : 2 × rounded number × difference as

$2 \times 50 \times 4 = 400$ 400

subtract it from 2500 2100

Step 4 : Add the square of difference

$2100 + (4)^2 = 2116$ 2116

The answer is 2116

Example : Find the square of 78. $(78)^2$

Step 1 : Rounded it to 80. Difference is 2 (80)

Step 2 : Square it as $(80)^2$ $(80)^2 = 6400$

Step 3 : $2 \times 80 \times 2 = 320$ 320

and $6400 - 320 = 6080$ 6080

Step 4 : Add the square of difference as

$6080 + (2)^2 = 6084$ 6084

∴ The answer is 6084

EXERCISE

1. Square of 43
2. Square of 48
3. Square of 57
4. Square of 62
5. Square of 63
6. Square of 72
7. Square of 83
8. Square of 92
9. Square of 88
10. Square of 43.

ANSWERS

1. 1849	2. 2304	3. 3249	4. 3844	5. 3969
6. 5184	7. 6889	8. 8464	9. 7744	10. 1849

Square of Three Digit Number

Step 1 : Write square of last two digits.

Step 2 :
- ***Multiply first and last digit; double it; write two zero after it.***
- ***Multiply first and second digit; double it; write three zero after it.***
- ***Square first digit; write four zero after it.***
- ***Add them.***

Example : Find the square of 987 $(987)^2$

Step 1 : The square of 87

$(87)^2$

49

1120

6400

7569 ; $(87)^2 = 7569$

Step 2 :
- Multiply 9 and 7; double it; write two zero after it

  $9 \times 7 = 63$; $63 \times 2 = 126$

- Multiply 9 and 8; double it; write three zero after it

  $9 \times 8 = 72$; $72 \times 2 = 144$

- Square first digit; write four zero after it

  $9^2 = 81$

$(987)^2$
7569
12600
144000
810000
974169

The answer is 974169

Example : Find the square of 857 $(857)^2$

Step 1 : The square of 57

$(57)^2$

49

700

2500

3249 ; $(57)^2 = 3249$

$(857)^2$

3249

Step 2 :

- Multiply 8 by 7; double it; write two zero after it

  $8 \times 7 = 56$; $56 \times 2 = 112$ 11200

- Multiply 8 by 5; double it; write three zero after it

  $8 \times 5 = 40$; $40 \times 2 = 80$ 80000

- Square first digit; write four zero after it

  $8^2 = 640000$ 640000

734449

The answer is 734449

EXERCISE

1. The square of 123
2. The square of 234
3. The square of 345
4. The square of 456
5. The square of 567
6. The square of 678
7. The square of 789
8. The square of 890
9. The square of 901
10. The square of 012

ANSWERS

1. 15129	2. 54756	3. 119025	4. 207936
5. 321489	6. 459684	7. 622521	8. 792100
9. 811801	10. 144		

Square of Four Digit Number

Step 1 : Write the square of last three digits.

Step 2 :
- ***Multiply first and last digit; double it; write three zero after it.***
- ***Multiply first and third last digit; double it; write four zero after it.***
- ***Multiply first and second digit; double it; write five zero after it.***
- ***Square first digit; write six zero after it.***
- ***Add them.***

Example : Find the square of 3987 $(3987)^2$

Step 1 : Write the square of 987 $(3987)^2$

$987^2 = 974169$ 974169

Step 2 : $(3987)^2$

974169

$3 \times 7 = 21; 21 \times 2 = 42$ 42000

$3 \times 8 = 24; 24 \times 2 = 48$ 480000

$3 \times 9 = 27; 27 \times 2 = 54$ 5400000

$3^2 = 09$ 09000000

15896169

The answer is 15896169

Example : Find the square of 2857 $(2857)^2$

Step 1 : The square of 57 $(2857)^2$

$(857)^2 = 734449$ 734449

Step 2 :

$(2857)^2$

	734449
$2 \times 7 = 14; 14 \times 2 = 28$	28000
$2 \times 5 = 10; 10 \times 2 = 20$	200000
$2 \times 8 = 16; 16 \times 2 = 32$	3200000
$2^2 = 04$	04000000
	8162449

The answer is 8162449

EXERCISE

1. The square of 2222
2. The square of 6565
3. The square of 7562
4. The square of 3679
5. The square of 7962
6. The square of 3689
7. The square of 9797
8. The square of 6792
9. The square of 9999
10. The square of 3636

ANSWERS

1. 4937284	2. 43099225	3. 57183844	4. 13535041
5. 63393444	6. 13608721	7. 95981209	8. 46131264
9. 99980001	10. 13220496		

Squaring—A Review

Number of digits	Squaring
Two digits	**Step 1 :** ■ Square last digit. **Step 2 :** ■ Multiply both digit; double it; write one zero after it. ■ Square first digit; write two zero after it. ■ Add them.
Number of digits	**Squaring**
Three digits	**Step 1 :** ■ Square last two digits. **Step 2 :** ■ Multiply first and last digit; double it; write two zero after it. ■ Multiply first and second digit; double it; write three zero after it. ■ Square first digit; write four zero after it. ■ Add them.
Number of digits	**Squaring**
Four digits	**Step 1 :** ■ Square the last three digits. **Step 2 :** ■ Multiply first and last digit; double it; write three zero after it. ■ Multiply first and second last digit; double it; write four zero after it. ■ Multiply first and second digit; double it; write five zero after it. ■ Square first digit; write six zero after it. ■ Add them.

Chapter 5
Cubes

If 'a' is any number, then *cube of a* is $a^3 = a \times a \times a$

Cubing–Single Digit Number

We all are familiar with the cube of single digit. Let us review as they are often used in cubing two or three digit numbers.

Number	*Cube of the number*
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729

EXERCISE

Do it mentally

1. The cube of 9 is.....
2. The cube of 8 is.....
3. The cube of 7 is.....
4. The cube of 6 is.....
5. The cube of 5 is.....
6. The cube of 4 is.....
7. The cube of 3 is.....
8. The cube of 2 is.....
9. The cube of 1 is.....

ANSWERS

1. 729	2. 512	3. 343	4. 216	5. 125
6. 64	7. 27	8. 8	9. 1	

Cubing Two Digit Number

Step 1 : ***Cube the last digit.***

Step 2 :
- ***Square the last digit × First digit; double it and add; write one zero after it.***
- ***Square the first digit × Last digit; double it and add; write two zero after it.***
- ***Cube the first digit; write three zero after it.***

Example : Find the cube of 17 $(17)^3$

Step 1 : Cube the last digit 7 $(17)^3$

$7^3 = 343$ 343

Step 2 :
- Square last digit × first digit; $(17)^3$

$7^2 \times 1 = 49 \times 1 = 49$ 343

Double it; $49 \times 2 = 98$

Add and write 1 zero 147×10 1470
- Square first digit × last digit;

$1^2 \times 7 = 1 \times 7 = 07$

Double it; $07 \times 2 = 14$

Add and write 2 zero $= 21 \times 100$ 2100
- Cube the first digit write 3 zero.

$1^3 = 1 \times 1000$ 1000
- Add them all. 4913

The answer is 4913

Example : Find cube of 32.

Step 1 : $2^3 = 8$ $(32)^3$

8

Step 2 :
- $2^2 = 4; 4 \times 3 = 12$

$12 \times 2 = 24$

Add and write 1 zero $(12 + 24) \times 10 = 36 \times 10$ 360
- $3^2 = 9; 9 \times 2 = 18;$

$18 \times 2 = 36$

Add write 2 zero $(18 + 36) \times 100 = 54 \times 100$ 5400

- $3^3 = 27 \times 1000$ — 27000

  Cube write 3 zero. — 32768
- Add them all.

The answer is 32768

EXERCISE

1. Find the cube of 67
2. Find the cube of 86
3. Find the cube of 47
4. Find the cube of 39
5. Find the cube of 46
6. Find the cube of 97
7. Find the cube of 92
8. Find the cube of 43
9. Find the cube of 29
10. Find the cube of 77

ANSWERS

1. 300763	2. 636056	3. 103823	4. 59319
5. 97336	6. 912673	7. 778688	8. 79507
9. 24389	10. 456533		

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