## *Introduction :*

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**Vedic mathematics & FastMaths**

**"FastMaths" is a system of reasoning and mathematical working based on ancient Indian teachings called Veda. It is fast , efficient and easy to learn and use.**

**It is being taught in some of the most prestigious institutions in England and Europe. NASA scientists applied its principles in the area of artificial intelligence.**

**Vedic mathematics, which simplifies arithmetic and algebraic operations, has increasingly found acceptance the world over. Experts suggest that it could be a handy tool for those who need to solve mathematical problems faster by the day.**

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**In what way FastMaths Methods are different from Conventional Methods?**

**FastMaths provides answer in one line where as conventional method requires several steps.**

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**What is Vedic Mathematics?**

**It is an ancient technique, which simplifies multiplication, divisibility, complex numbers, squaring, cubing, square and cube roots. Even recurring decimals and auxiliary fractions can be handled by Vedic mathematics. Vedic Mathematics forms part of Jyotish Shastra which is one of the six parts of Vedangas. The Jyotish Shastra or Astronomy is made up of three parts called Skandas. A Skanda means the big branch of a tree shooting out of the trunk.**

---

**Who Brought Vedic Maths to limelight?**

**The subject was revived largely due to the efforts of Jagadguru Swami Bharathikrishna Tirthaji of Govardhan Peeth, Puri Jaganath (1884-1960). Having researched the subject for years, even his efforts would have gone in vain but for the enterprise of some disciples who took down notes during his last days.**

---

**What is the basis of Vedic Mathematics?**

**The basis of Vedic mathematics, are the 16 sutras, which attribute a set of qualities to a number or a group of numbers. The ancient Hindu scientists (Rishis) of Bharat in 16 Sutras (Phrases) and 120 words laid down simple steps for solving all mathematical problems in**

**easy to follow 2 or 3 steps.**

**Vedic Mental or one or two line methods can be used effectively for solving divisions, reciprocals, factorisation, HCF, squares and square roots, cubes and cube roots, algebraic equations, multiple simultaneous equations, quadratic equations, cubic equations, bi-quadratic equations, higher degree equations, differential calculus, Partial fractions, Integrations, Pythogorus theoram, Apollonius Theoram, Analytical Conics and so on.**

---

**What is the speciality of Vedic Mathematics?**

**Vedic scholars did not use figures for big numbers in their numerical notation. Instead, they preferred to use the Sanskrit alphabets, with each alphabet constituting a number. Several mantras, in fact, denote numbers; that includes the famed Gayatri mantra, which adds to 108 when decoded.**

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**How important is Speed?**

**How fast your can solve a problem is very important. There is a race against time in all the competitions. Only those people having fast calculation ability will be able to win the race. Time saved can be used to solve more problems or used for difficult problems.**

---

**Is it useful today?**

**Given the initial training in modern maths in today's schools, students will be able to comprehend the logic of Vedic mathematics after they have reached the 8th standard. It will be of interest to every one but more so to younger students keen to make their mark in competitive entrance exams.**
**India's past could well help them make it in today's world.**
**It is amazing how with the help of 16 Sutras and 16 sub-sutras, the Vedic seers were able to mentally calculate complex mathematical problems.**

---

## *Introduction :*

***Learn to calculate 10-15 times faster.***

---

**"FastMaths" is a system of reasoning and mathematical working based on ancient Indian teachings called Veda. It is fast , efficient and easy to learn and use.**

---

**Example 1 : Finding Square of a number ending with 5**

**To find the square of 75**

**Do the following**

**Multiply 5 by 5 and put 25 as your right part of answer.**
**Multiply 7 with the next higher digit ie (7+1)=8 gives**
**56 as the left part of the answer, Answer is 5625**

---

**Example 2 : Calculate 43 X 47**

**The answer is 2021 Same theory worked here too.**

**The above 'rule' works when you multiply 2 numbers with units digits add up to 10 and tenth place same**

---

**Example 3 : Find 52 X 58 ? Answer = 3016 How long this take ?**

---

**Example 4: Multiply 52 X 11**

**Answer is 572**

**Write down the number being multiplied and put the total of the digits between 2 digits**

**52 X 11 is [ 5 and 5+2=7 and 2 ] , answer is 572**

---

**Example 5: Can you find the following within less than a minute?**

**a) 1001/13 ?**

**b) 1/19 ?**

**Now you can learn Fastmaths techniques with ease at your home in your spare time**

# *Chapter 1 : Numbers*

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**1.1 Numbers**

---

**Numbers begins at 1. All other numbers come from one. There are only nine numbers and a zero.**

| **NUMBERS** | |
|---|---|
| **0 ? ZERO** | **5 ? FIVE** |
| **1 ? ONE** | **6 ? SIX** |
| **2 ? TWO** | **7 ? SEVEN** |
| **3 ? THREE** | **8 ? EIGHT** |
| **4 ? FOUR** | **9 ? NINE ?** |

**Starting from number 1 all whole numbers are generated using " By one more than one before".**

**2 is more than 1; 4 is more than 3; 6 is more than 5 and so on. ?**

| **Whole numbers are also called Natural Numbers** |
|---|

---

**Assignments**

---

**1. Which Number is 1 more than**

**a) 19**

**b) 40**

**c) 189**

**d) 23**

**e) 4589**

---

**2.Which number is 1 less than**

**a) 29**

**b) 48**

**c) 2339**

**d) 5**

**e) 65320**

---

**Assignments Answers**

---

**1. Which Number is 1 more than**

**a) 20** **b) 41**

**c) 190** **d) 24**

**e) 4590**

---

**2.Which number is 1 less than**

**a) 28** **b) 47**

**c) 2338** **d) 4**

**e) 65319**

# *Chapter 1 : Numbers*

## 1.2 Place Value

**Since there are only 9 numbers and a zero we count in groups of 10.**

- **Ten Units make a TEN,**
- **Ten Tens make a HUNDRED .**
- **Ten Hundreds make a THOUSAND.**

| PLACE VALUE | | | |
|---|---|---|---|
| X | X | X ????????X? | |
| Thousand | Hundred | Ten | Units |

**The first seven place values are UNITS, TENS, HUNDREDS, THOUSANDS,TEN-THOUSANDS,HUNDRED-THOUSANDS, and MILLIONS.**

**In any number the value of a digit depends upon its position**

- **The 4 in 41 stands for four Tens**
- **The two in 42 stands for two Units**
- **The value of the digit 5 in 452 is five Tens, because it is in the tens column.**

**The following Number can be written as**

**54321 = 54 X 1000 + 3 X 100 + 2 X 10 + 1 X 1**

**since**

- **The 54 in 54321 stands for 54 Thousands**
- **The 3 in 54321 stands for 3 Hundreds**
- **The 2 in 54321 stands for 2 Tens**
- **The 1 in 54321 stands for 1 Units**

**The number 54,321 says fifty four thousand, three hundred**

**and twenty one ?**

---

**Assignments**

---

**1.Find the value of 4 in the following**

**a) 430**
**b) 947**
**c) 14**
**d) 125004**

---

**2. Write the following numbers in Words**

**a) 57**
**b) 7002**
**c) 405**
**d) 9**

---

**3. Fill in the blanks**

**a) 243 = ____ X 100 + 4 X ____+ __X 3**
**b) 45 = 1000 X __ + 100 X __ + 10 X __+ 1 X __**
**c) 9 = 100 X __ + 10 X __+ 1 X __**

---

**4. Write the following numbers in Figures**

**a) Two hundred and thirty five**
**b) Nine thousand and twenty nine**
**c) Four million**
**d) Sixty-eight**
**e) Twenty four thousand**

---

**Assignments Answers**

---

**1.Find the value of 4 in the following**

**a) HUNDRED**
**b) TEN**
**c) UNITY**
**d) UNITY**

**2. Write the following numbers in Words**

**a) Fifty Seven**
**b) Seven thousand two**
**c) Four hundred Five**
**d) Nine**

**3. Fill in the blanks**

**a) 243 = 2 X 100 + 4 X 10+ 1 X 3**
**b) 45 = 1000 X 0 + 100 X0 + 10 X 4+ 1 X 5**
**c) 9 = 100 X 0 + 10 X 0+ 1 X 9**

**4. Write the following numbers in Figures**

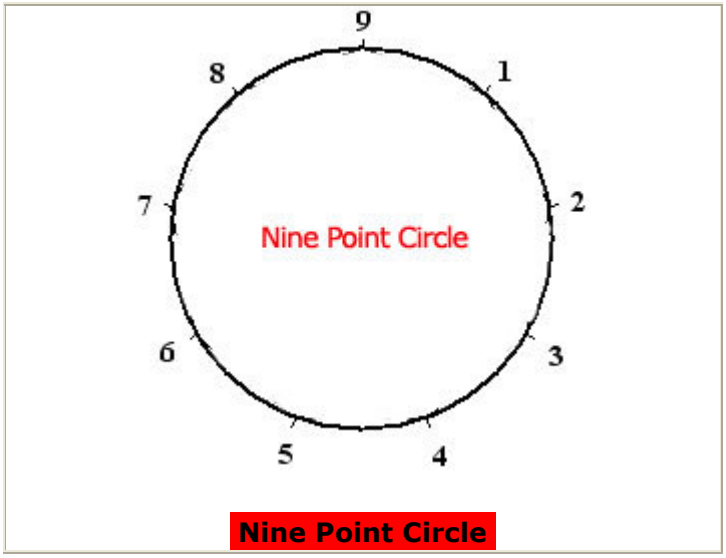
**a) 235**
**b) 9029**
**c) 4000000**
**d) 68**
**e) 24000**



# *Chapter 1 : Numbers*

## 1.3 9-Point Circle

**The basic numbers always remain one to nine.**




**Nine Point Circle**

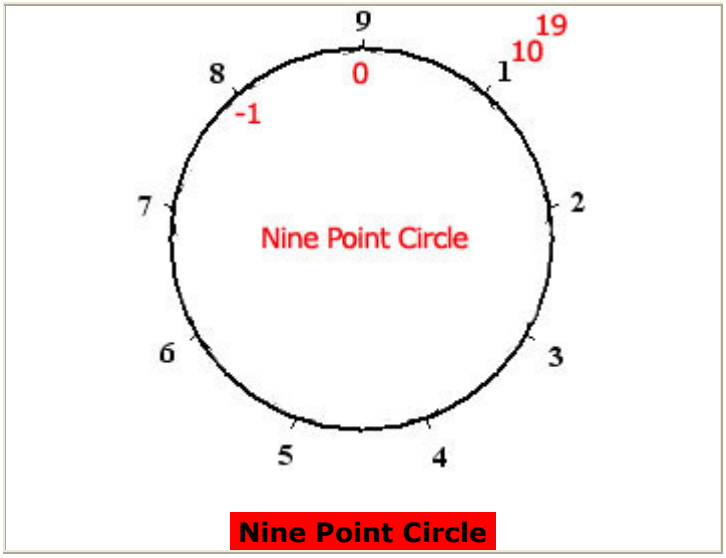
**We can represent 9 numbers as shown above. This circle is called a nine-point circle.**

**The number 1 is the absolute and is inside everything.**

**The number 1 is a factor of every number and every number is a factor to itself. ?**

**Where do we add 10 on a nine-point Circle?.**

**Now where do we add 0 ?**




**Nine Point Circle**

# *Chapter 1 : Numbers*

## 1.3.2 Product:

**When two numbers multiplied together the answer is called *product.***

**Example**

- **The product of 3 and 6 is 18??**
- **The product of 5 and 9 is 45? ?**

**Multiplying by 1 brings about no change**

**Any number when multiplied by 0 gives 0**

### Assignments

**Find the Product of**

**a) 5 X 4**

**b) 7 X 9**

**c) 6 X 2**

**d) 1 X 0**

**e) 12 X 1**

### Assignments Answers

**Find the Product of**

**a) 20** **b) 63**

**c) 12** **d) 0**

**e) 12**

---



# *Chapter 1 : Numbers*

---

## 1.3.3 Factors:

---

**Numbers, which multiplied together to give a product, are called *factors*.**

**3 and 8 are factors of 24, because 24= 3 X 8?**

**A number may also be seen as a factor of itself.?Some numbers have more than one pair as factors**

**All numbers have one and themselves as a factor.**

---

**Example 1: Find Factors of 36 ?**

**Factors of 36**

**36 can be expressed as 1 X 36 = 36, 2 X 18 = 36, 3 X 12 = 36, 4 X 9 = 36, 6 X 6 = 36**

**Factors of 36 are 1,2,3,4,6,9,12,18,36.**

**The number 1 is a factor of every number**

---

### 1.3.3.1 Factor pairs

---

**Number 18 has 6 factors; 1,2,3,6, 9,18**

**18 can be expressed as 1 X 18 = 18, 2 X 9 = 18, 3 X 6 =**

**18**

**Arrange Pair factors like (1X18),( 2X9), (3X6).?These pair of numbers is called *factor pairs*.**

***Factor pairs* of 18 are (1X18),( 2X9), ( 3X6)**

**If you know one factor of a number, you can get another using factor pairs.**

**If you know 44 can be divided by 4, than another factor of 44 must be 11 since 11X4 = 44**

---

**Assignments**

**List all factors and list factor pairs if any.**

**a) 64**
**b) 48**
**c) 128**
**d) 27**
**e) 37**

---

**Assignments Answers**

**List all factors and list factor pairs if any.**

**a) 64**

- **Factors 1,2,4,8,16,32,64**
- **Factor Pairs (1,64) (2,32) ( 4,16) (8,8)**

**b) 48**

- **Factors 1,2,3,4,6,8,12,16,24,48**
- **Factor Pairs (1,48) (2,24) (3,16) (4,12) (6,8)**

**c) 128**

- **Factors 1,2,4,8,16,32,64,128**
- **Factor Pairs (1,128) (2,64) (4,32) (8,16)**

**d) 27**

- **Factors 1,3,9,27**
- **Factor Pairs (1,27) (3,9)**

**e) 37**

- **Factors 1,37**
- **Factor Pairs (1,37)**

---



# *Chapter 1 : Numbers*

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### 1.3.3.2 Highest common factor (HCF)

---

**Suppose we have 2 numbers 70 and 99**

**70 = 2 X 5 X 7**
**99 = 3 X 3 X 11**

**Looking at the factors, there is no common factor except number 1. There is no factor of one number, which is also a factor of the other number, except for 1. Such pair of numbers is called *relatively prime*; they are prime in relation to each other.**

---

**Example 1: Check 18 and 30**

**18 = 2 X 3 X 3**
**30 = 2 X 3 X 5**

**So 18 and 30 are not relatively prime, they have factors in common**

**Both numbers can be divided by 2, 3 and 2 X 3 = 6**
**Of these three factor numbers the number 6 is the highest Common Factor (HCF)**

---

**Example 2: Check 48 and 72**

**48 = 2 X 2 X 2 X 2 X 3**
**72 = 2 X 2 X 2 X 3 X 3 ?**

**So 48 and 72 are not relatively prime, they have factors in common. Of these factor numbers the number 2 X 2 X 2 X 3 = 24 is the highest Common Factor (HCF)**

---

**Example 3: Check 140 and 27**

**140 = 2 X 2 X 5 X 7**
**27 = 3 X 3 X 3**

**So 140 and 27 are relatively prime. The highest Common Factor (HCF) = 1**

| **When numbers are close together the HCF will also be a factor of the sum and of the difference of the numbers ?** |
|---|

---

**Example 4: Find HCF of 411 and 417?**

**The above note means the HCF will divide into 411 and 417 also 411 + 417 = 828**

**417 ? 411= 6**

**This means that HCF is either 6 or a factor of 6 ( 6 or 3 or 2 or 1).**
**Since 6 is not a factor of 411 and 417 , test for 3 or 2**
**HCF(411,417)= 3**

---

**Example 5: Find HCF of 90 and 102**

**This means the HCF will divide into 102 and 90 also**

**102 + 90 = 192**
**102 ? 90 = 12**

**This means that HCF is either 12 or a factor of 12 (12, 6,4,3,2,1)**

**3 is a common factor of 90 and 102**
**And 2 also, but not 4 ,Therefore 2X3 = 6, HCF = 6**

**HCF(90,102)= 6**

---

## Assignments

---

**1. Find the following**

**a) HCF(80,20)=**
**b) HCF(68,24)=**
**c) HCF(88,38)=**
**d) HCF(88,82)=**
**e) HCF(63,18)=**

## Assignments Answers

---

**1. Find the following**

**a) HCF(80,20)=20**

**80 = 2 X 2 X 2 X 2 X 5**
**20 = 2 X 2 X 5 ?**

**So 80 and 20 are not relatively prime, they have factors in common. Of these factor numbers the number 2 X 2 X 5 = 20 is the highest Common Factor (HCF)**

**b) HCF(68,24)=4**

**68 = 2 X 2 X 17**
**24 = 2 X 2 X 6 ?**

**So 68 and 24 are not relatively prime, they have factors in common. Of these factor numbers the number 2 X 2 = 4 is the highest Common Factor (HCF)**

**c) HCF(88,38)= 2**

**88 = 2 X 2 X 2 X 11**
**38 = 2 X 19**

**So 88 and 38 are not relatively prime, they have factors in common. Of these factor numbers the number 2 is the highest Common Factor (HCF)**

**d) HCF(88,82)=2**

**88 = 2 X 2 X 2 X 11**
**82 = 2 X 41**

**So 88 and 82 are not relatively prime, they have factors in common. Of these factor numbers the number 2 is the highest Common Factor (HCF)**

**e) HCF(63,18)=9**

**63 = 3 X 3 X 7**
**18 = 2 X 3 X 3**

**So 63 and 18 are not relatively prime, they have factors in common. Of these factor numbers the number 3 X 3 = 9 is the highest Common Factor (HCF)**



# *Chapter 1 : Numbers*

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### 1.3.4 Divisibility

---

**The number 1 is not a product and cannot be divided. A number, which is a product, is divisible by any one of its factors.**

**10 is a product of 2 and 5 and so 2 and 5 are factors of 10.**

**10 can be divided by 2 or 5 without any reminders**

**10 /5 =2 or 10/2 = 5**

---

### 1.3.5 Prime Numbers

---

**Some numbers will have only one pair of factors**

**11 = 11 X 1 and there are no other numbers which multiply together to give 11.**

**Such numbers are called *prime numbers. ?***

**The first few prime numbers are 1, 3, 5, 7, 11, 13, 17, 19…….. ?**

---

**Assignments**

---

**Find Prime Number from the following**
**31, 49, 147, 97, 81**

---

**Assignments Answer**

---

**Find Prime Number from the following**
**31, 49,147,97, 81**
**Answer : 31, 97.**

**All other numbers have more than 1 factor. 49 can be written as 7X7 and 81 can be written as 3X 27 or 9X9**



# *Chapter 1 : Numbers*

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## 1.3.6 The number 2.

---

**The number two stands for 2 types of beings in the creation, good and evil. So the number two divides the creation into two types of beings. It also divides the number into two sorts, odd and even.**

---

### 1.3.6.1 Odd and Even Numbers ?

---

**Numbers which have 2 as a factor are called Even Numbers, which do not have 2 as a factor, are called Odd.**

**The even numbers are 2,4,6,8,10,12 14, and so on.**

**Any number which ends in a 2,4,6,8,or 0 is even.**

**The odd numbers are 1,3,5,7,9,11,13, and so on.**

**Any number, which ends in a 1,3,5,7 or 9, is an odd number. An odd number cannot be divided into two equal parts.**

---

## 1.3.6.2. Multiples

---

**Multiple means many. If we take number 1 many times, we arrive at 1,2,3,4,5…. Similarly if we take number two many times, we arrive at 2,4,6,8…. These are all multiples of two.**

**A multiple of a number is that number multiplied by any number ? ?**

---

## Assignments

---

**1. Find the Odd numbers from the following**

**3, 6, 7, 12, 15, 19, 21, 10,100**

---

**2. Find the Even numbers from the following**

**13, 26, 70, 12, 19, 39, 61, 102,150**

---

## Assignments Answers

---

**1. Find the Odd numbers from the following**

**3, 7,15, 19, 21**

---

**2. Find the Even numbers from the following**

**26, 70, 12, 102,150**

# *Chapter 1 : Numbers*

## 1.3.7. The Number 9

**In our number system number nine is the largest digit**

**The digital root of a number can be obtained by summing the digits of the number, for example, for 23, digital root is 2 + 3 = 5. ? We will learn more about digital roots in chapter 3.**

**The digit sum or Digital root of a number is unchanged if 9 is added to it or subtracted from it.**

**Table of 9**

- **9 X 1 ?= 9**
- **9 X 2 ?= 1 8**
- **9 X 3 = 2 7**
- **9 X 4 ?= 3 6**
- **9 X 5 ?= 4 5**
- **9 X 6 = 5 4**
- **9 X 7 ?= 6 3**
- **9 X 8 ?= 7 2**
- **9 X 9 = 8 1**

**If you read the answers as two columns the left column goes up by one more than one before (1,2,3,4,5....) and the right column goes down by one less than the one before ( 9,8,7,6,5...)**

### 1.3.7.1 By Addition and By Subtraction?

**When adding or subtracting numbers which end in 9 or 9's use the following method.**

**Example : Find 75 + 39**

**Add 40 to 75 and take 1 off. 75 + 39 = 75 + 30 - 1 = 114**

---

**Example : Find 122 -59**

**Subtract 60 from 122 and put 1 back. 122 - 60 + 1 = 63**

---

**Assignments**

---

**Find the following**

**a) 132 + 49 =**

**b) 34 + 29 =**

**c) 63 - 19 =**

**d) 56 - 9 =**

**e) 79 +19 =**

---

---

**Assignments Answers**

---

**Find the following**

**a) 132 + 49 = 181**

- **Add 50 to 132 and take 1 off.**
- **132 + 49 = 132 + 50 - 1 = 182 - 1 = 181**

**b) 34 + 29 = 63**

- **Add 30 to 34 and take 1 off.**
- **34 + 29 = 34 + 30 - 1 = 64 - 1 = 63**

**c) 63 - 19 = 44**

- **Subtract 20 to 63 and add 1.**
- **63 - 19 = 63 - 20 + 1 = 43 + 1 = 44**

**d) 56 - 9 =47**

- **Subtract 10 to 56 and add 1.**
- **56 - 9 = 56 - 10 + 1 = 46 + 1 = 47**

**e) 79 +19 = 98**

- **Add 20 to 79 and take 1 off.**
- **79 + 19 = 79 + 20 - 1 = 99 - 1 = 98**



# *Chapter 1 : Numbers*

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### 1.3.8. The Number 10

---

**The number ten is 1 with a zero next to it. So multiplying a number by ten the answer is the same but with a zero on the end.**

**Example 1 Find 84 X 10**

**84 X 10 = 840**

**Example 2: Find 77 X 10**

**77 X 10 = 770**

| |
|---|
| **The effect of multiplying a number by ten is to move every digit in that number one place to the left and a zero is added to the end.** |

**When multiplying decimal fraction by 10. Each number is moved into the next column to the left. The effect of this is to move the decimal point one place to the right.**

**Example 3. Find 0.4761 X 10**

**0.4761 X 10 = 4.761**

---

**Assignments**

---

**Find the following**

**a) 44 X 10 =** **b) 71 X 10 =**

**c) 0.123 X10 =** **d) 0.567 X10 =**

**e) 10.25 X 10 =**

---

**Assignments Answers**

---

**Find the following**

**a) 44 X 10 = 440** **b) 71 X 10 =710**

**c) 0.123 X10 = 1.23** **d) 5.67**

**e) 102.5**

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# *Chapter 1 : Numbers*

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**1.3.9 Square Numbers**

---

| | | | |
|---|---|---|---|
| | | | OOO |
| | | OO | OOO |
| | O | OO | OOO ? |
| | 1 | 2 | 3 |
| **Number of Squares** | 1 | 2 ???? | 3 |
| **Number of Counts** | 1 | 4 | 9 ??????? |

**The numbers 1,4,9,16...are called Square Numbers because you can arrange the number of counters to form a Square. The 4 Counters are in 2 rows of 2. The 9 counters are in 3 rows and 3 columns.**

**1 X 1 = 1**
**2 X 2 = 4**
**3 X 3 = 9**

**So if we square a number we multiply it by itself.**

**3 Squared is 3X3 = 9;**
**4 Squared is 4X 4 =16; ?**

| **Square numbers always have an odd number of factors. All other numbers have an even number of factors** |
|---|

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### 1.3.10 Triangular Numbers

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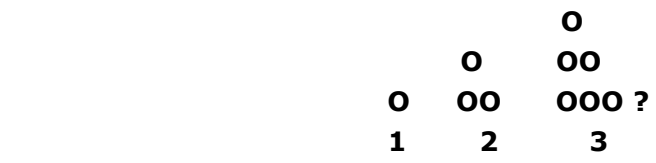



| | | | |
|---|---|---|---|
| **Number of Squares** | **1** | **2 ????** | **3** |
| **Number of Counts** | **1** | **3** | **6 ???????** |

**The numbers 1,3,6....are called Triangular Numbers because you can arrange the number of counters to form a Triangle.**

---

### 1.3.11 Cube Numbers

---

| | **1** | **2** | **3** |
|---|---|---|---|
| **Number of Cube** | **1** | **2 ????** | **3** |
| **Number of Counts** | **1** | **8** | **27 ???????** |

**Numbers 1, 8, 27 are called Cube numbers because you can arrange that many cubes to form a larger cube.**

**The length, breadth and height of cubes are always same.**

- **1 X 1 X 1 = 1**
- **2 X 2 X 2 = 8**
- **3 X 3 X 3 = 27**

**?**

| **If we cube a number we multiply it by itself twice?** |
|---|

**Examples:**

**3 cubed is 3X3X3 = 27;**

**4 Cubed is 4X4X4 =64; ??**



# *Chapter 1 : Numbers*

## 1.3.12.1 Doubling and Halving

**Multiply by 4**

**Since 4 = 2 X 2, we can multiply a number 4 by doubling it and doubling the answer ?**

> **Find 35 X 4 =?**
>
> **Simply double 35 to 70, then double 70 to 140.**
> **35 X 4 = 140**

**Multiply by 8**

**Since 8 = 2 X 2 X 2, we can multiply a number 8 by doubling it three times ?**

> **Find 26 X 8 =?**
>
> **Simply double 26 to 52, doubling 52 to 104, doubling 104 gives 208.**
> **26 X 8 = 208**

**Divide by 4 ?**

**Similarly if we halved a number and then halved again we would be dividing the number by 4.**

**Divide 72 by 4**

**We halve 72 twice; Half of 72 is 36, half of 36 is 18**

**Divide by 8**

**Similarly if we halved a number 3 times we would be dividing the number by 8**

**Divide 104 by 8**

**We halve 104 three times; Half of 104 is 52, Half of 52 is 26, half of 26 is 13**

**General**

**Find 14 X 18**
**Halving 14 and 18 gives 7 and 9. Since 7 X 9 = 63, we double this twice. We get 126 and 252**
**So 14 X 18 = 252**

**You will learn more techniques in next chapters.**

---

**Assignments**

---

**Find the following**

**a) 128 / 8 =**
**b) 28 X 4 =**
**c) 7 X 8 =**
**d) 64 / 4 =**

---

**Assignments Answers**

---

**Find the following**

**a) 128 / 8 = 16**
**b) 28 X 4 = 112**
**c) 7 X 8 = 56**
**d) 64 / 4 = 16**

# *Chapter 1 : Numbers*

**Assignment ? 1**

---

**1. Which Number is 1 more than**

**1) 199**

**2) 401**

---

**2.Which number is 1 less than**

**1) 20**

**2) 309**

---

**3.Find the value of 4 in the following**

**1) 430**

**2) 947**

**3) 14**

**4) 125004**

---

**4. Write the following numbers in Words**

**1) 57**

**2) 7002**

**3) 405**

**4) 9**

---

**5. Fill in the blanks**

**1) 243 = ____ X 100 + 4 X ____+ __X 3**

**2) 7002 = 1000 X __+ 100 X __ + 10 X __+ 1 X__**

**3) 45 = 1000 X __ + 100 X __ + 10 X __+ 1 X __**

**4) 9 = 100 X __ + 10 X __+ 1 X __**

---

**6. Write the following numbers in Figures**

**1) Two hundred and thirty five**

**2) Nine thousand and twenty nine**

**3) Four million**

**4) Sixty-eight**

**5) Twenty four thousand**

---

**7. Find the next member of the series**

**1) 2,4,6,8, ??**

**2) 8,16,24,32 , ?..**

**3) 27, 25, 23, 21,?..**

**4) 36,45,54,63,??..**

**5) 103, 110, 117, 124,?.**

---

**8. Addition and Subtraction**

**1) 6 ? 3 + 2 =**

**2) 67 ? 23 =**

**3) 24 + 5 ?2 =**

**4) 346 ?34 +23 =**

**5) 3 + 4 +5 +6 =**

---

**9. List all factors and list factor pairs if any.**

**1) 64**

**2) 48**

**3) 128**

**4) 27**

**5) 37**

---

**10. Find Prime Number from the following**
**31, 49,147, 97, 81**

---

**11. Find the following**

**1) HCF(80,20)=**

**2) HCF(68,24)=**

**3) HCF(88,38)=**

**4) HCF(88,82)=**

**5) HCF(63,18)=**

**6) HCF(66,64)=**

**7) HCF(57,33)=**

**8) HCF(40,4)=**

**9) HCF(60,26)=**

**10) HCF(74,52)=**

---

**12 Find the following**

**1) 128 / 8**

**2) 28 X 4**

**3) 7 X 8**

**4) 64 / 4**

---

**13. Write the following numbers in Ascending and Descending orders**

**1) 97, 63, 37, 39, 30**

**2) 11, 50, 5, 6, 0**

**3) 10, 57, 7, 38, 4**

**4) 60, 4, 66, 4, 23**

**5) 65, 37, 37, 22, 25**

---



## *Chapter 1 : Numbers*

**Answers**

**Assignment ? 1**

**1. Which Number is 1 more than**

- **Ans 200**
- **Ans 402**

**2.Which number is 1 less than**

- **20 Ans 19**
- **309 Ans 308**

**3.Find the value of 4 in the following**

- **430 Ans Hundred**
- **947 Ans Ten**
- **14 Ans Unity**
- **124002 Ans Thousand**

**4. Write the following numbers in Words**

- **57 Fifty Seven**
- **7002 Seven Thousand and two**
- **405 Four Hundred Five**
- **09 Nine**

**5. Fill in the blanks**

- **243 = 2 X 100 + 4 X 10 + 1 X 3**
- **7002 = 1000 X 7+ 100 X 0 + 10 X 0 + 1 X 2**
- **45 = 1000 X 0 + 100 X 0 + 10 X 4 + 1 X5**
- **9 = 100 X 0 + 10 X 0 + 1 X 9**

**6. Write the following numbers in Figures**

- **Two hundred and thirty five = 235**
- **Nine thousand and twenty nine = 925**

- **Four million = 4000000**
- **Sixty-eight = 68**
- **Twenty four thousand = 24000**

**7. Find the next member of the series**

- **2,4,6,8, ??  10**
- **8,16,24,32 , ?..  40**
- **27, 25, 23, 21,?..  19**
- **36,45,54,63,??.. 72**
- **103, 110, 117, 124,?..  131**

**8. Addition and Subtraction**

- **6 ? 3 + 2 = 5**
- **67 ? 23 = 44**
- **24 + 5 ?2 = 27**
- **346 ?34 +23 = 335**
- **3 + 4 +5 +6 = 18**

**9. List all factors and list factor pairs if any.**

- **64  Factors 1,2,4,8,16,32,64**

  **Factor Pairs  (1,64),(2,32),(4,16)(8,8)**

- **48  Factors 1,2,3,4,6,8,12,16,24,48**

  **Factor Pairs  (1,48),(2,24),(3,16),(4,12),(6,8)**

- **128  Factors 1,2,4,8,16,32,64,128**

  **Factor Pairs  (1,128),(2,64),(4,32),(8,16)**

- **27  Factors 1,3,9,27**

  **Factor Pairs  (1,27),(3,9)**

- **37  Factors 1,37**

  **Factor Pair  (1,37)**

**10. Find Prime Number from the following**

- **31  Prime Number**
- **49  Not a Prime Number**
- **147  Not a Prime Number**
- **97  Prime Number**
- **81  Not a Prime Number**

**11. Find the following**

- **HCF(80,20)= 20**
- **HCF(68,24)= 4**
- **HCF(88,38)= 2**
- **HCF(88,82)= 2**
- **HCF(63,18)= 9**
- **HCF(66,64)= 2**
- **HCF(57,33)= 3**
- **HCF(40,4)= 4**
- **HCF(60,26)= 2**
- HCF(74,52)= 2

**12 Find the following**

- **128 / 8 = First 128/ 2 gives 64. again divide by 2 gives 32 , again divide by 2 gives 31 since 8 = 2X2X2**
- **24 X 4 = First 24 X 2 gives 48 and again 48X2 gives 96 since 4 = 2X2**
- **7 X 8 = First 7 X 2 gives 14 and again 14X2 gives 28 , again 28X2 gives 56. since 8 = 2X2X2**
- **64 / 4 = 64 by 2 gives 32 and again 32 by 2 gives 16**

**13. Write the following numbers in Ascending and Descending orders**

**Ascending Order**

- **30, 37, 39, 63, 97**
- **0, 5, 6, 11, 50**
- **4, 7, 10, 38, 57**
- **4, 4, 23, 60, 66**
- **22, 25, 37, 37, 65**

**Descending Order**

- **97 , 63 , 39 , 37 , 30**
- **50 , 11 , 6 , 5 , 0**
- **57 , 38 , 10 , 7 , 4**
- **66 , 60 , 23 , 4 , 4**
- **65 , 37 , 37 , 25 , 22**

# *Chapter 3 : Digital roots or Digital Sum of Numbers*

## 3.1 Digital Roots or Digit Sums

**The word Digit means the single figure numbers; the numbers from 1 to 9 and zero**

**Digital Root or Digital Sum of a number : is the remainder when the number is divided by 9.**

**So for 23, the remainder is 5 because 23 ? 9 =2 remainder 5. The digital root is also 5.**

**The digital root can also be obtained by summing the digits of the number.**

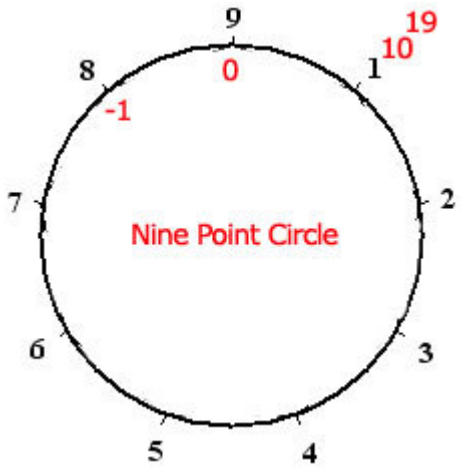
**For example,**

- **Digital sum of 23 is 2 + 3 = 5.**
- **Digital sum of 17 is 1 + 7 = 8**
- **Digital sum of 763 is 7 + 6 + 3 =16. And 16 is a 2-digit number and we add the figures in 16 to get 1 + 6 = 7. So digital root of 763 is 7**

**When the sum of digits is greater than 9, you keep adding. So for 2856, the digital root is 2 + 8 + 5 + 6 = 21, 2 + 1 = 3.**

**For example, with 18, 1 + 8 = 9, but 18 ? 9 = 2 remainder 0. Therefore we take a remainder of 0 as being identical with a digital root of 9.**

**Look at the 9-Point Circle below.**




**Adding 9 to a number does not affect its digit sum. So 1,10, 19, 28 all have a digit sum of 1**

**Digital sum of 39409 is 3 + 4 + 0 = 7, ignore all 9's**

**Looking again at the 9 point circle, if we count backwards round the circle we see that since 0 comes before 1 and it is logical to put zero at the same place as 9.**

**In terms of digit sums 9 and 0 are equivalent**

**Any group of digits in a number that add up to a 9 can also be removed.**

**Digit sum of 24701 is 5**

**We see that 2 and 7 which adds up to 9. We can remove 2 and 7 and add up only other digits 4 + 0 + 1 = 5**

---

**Assignments**

---

**Q1 Find the digit sum of 16, 27, 203 and 30103**

**Q2 The digit sum of a 2 digit number is 8 and the digits are same, What is the number?**

**Q3 The digit sum of a 2 digit number is 9 and the first digit is twice the second . What is the number?**

**Q4 Find the digit sum of 6437 , 3542 and 673982471**

## Assignments Answers

**Q1 Find the digit sum of 16, 27, 203 and 30103**

**Ans : Digit Sum of 16 is 1+6 =7**

**Digit Sum of 27 is 2+7 =9**

**Digit Sum of 203 is 2+0+3 =5**

**Digit Sum of 30103 is 3+0+1+0+3 =7**

**Q2 The digit sum of a 2 digit number is 8 and the digits are same, What is the number?**

**Ans : 44**

**Q3 The digit sum of a 2 digit number is 9 and the first digit is twice the second . What is the number?**

**Ans : 36**

**Q4 Find the digit sum of 6437 , 3542 and 673982471**

**Ans : Digit Sum of 6437 is 2**

**Digit Sum of 3542 is 5**

**Digit Sum of 673982471 is 2**

# *Chapter 3 : Digital roots or Digital Sum of Numbers*

## 3.1 Digital Roots or Digit Sums

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**So for 23, the remainder is 5 because 23 ? 9 =2 remainder 5. The digital root is also 5.**

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**When the sum of digits is greater than 9, you keep adding. So for 2856, the digital root is 2 + 8 + 5 + 6 = 21, 2 + 1 = 3.**

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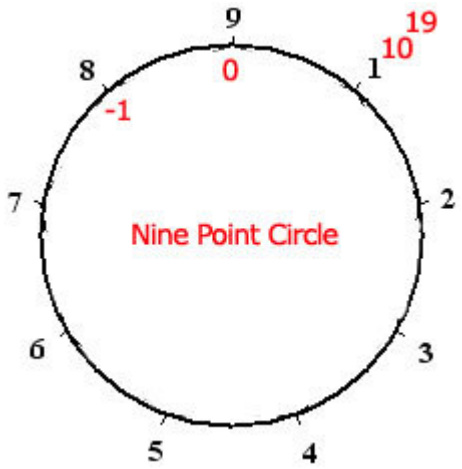


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**Looking again at the 9 point circle, if we count backwards round the circle we see that since 0 comes before 1 and it is logical to put zero at the same place as 9.**

**In terms of digit sums 9 and 0 are equivalent**

**Any group of digits in a number that add up to a 9 can also be removed.**

**Digit sum of 24701 is 5**

**We see that 2 and 7 which adds up to 9. We can remove 2 and 7 and add up only other digits 4 + 0 + 1 = 5**

---

**Assignments**

---

**Q1 Find the digit sum of 16, 27, 203 and 30103**

**Q2 The digit sum of a 2 digit number is 8 and the digits are same, What is the number?**

**Q3 The digit sum of a 2 digit number is 9 and the first digit is twice the second . What is the number?**

**Q4 Find the digit sum of 6437 , 3542 and 673982471**

**Assignments Answers**

**Q1 Find the digit sum of 16, 27, 203 and 30103**

**Ans : Digit Sum of 16 is 1+6 =7**

**Digit Sum of 27 is 2+7 =9**

**Digit Sum of 203 is 2+0+3 =5**

**Digit Sum of 30103 is 3+0+1+0+3 =7**

**Q2 The digit sum of a 2 digit number is 8 and the digits are same, What is the number?**

**Ans : 44**

**Q3 The digit sum of a 2 digit number is 9 and the first digit is twice the second . What is the number?**

**Ans : 36**

**Q4 Find the digit sum of 6437 , 3542 and 673982471**

**Ans : Digit Sum of 6437 is 2**

**Digit Sum of 3542 is 5**

**Digit Sum of 673982471 is 2**



# *Chapter 3 : Digital roots or Digital Sum of Numbers*

## 3.2 Divisibility rules for 9 and 3

**An easy test for 9 is to look at the sum of the digits.**

**Take any number like 243 and add the digits. If the sum is 9 then the number is divisible by 9.**

**Patterns within the 9? table shown below.**

**Table of 9**

**9 X 1 = 9 Digit Sum is 9**
**9 X 2 = 1 8 Digit Sum is 9**
**9 X 3 = 2 7 Digit Sum is 9**
**9 X 4 = 3 6 Digit Sum is 9**

**9 X 5 = 4 5 Digit Sum is 9**
**9 X 6 = 5 4 Digit Sum is 9**
**9 X 7 = 6 3 Digit Sum is 9**
**9 X 8 = 7 2 Digit Sum is 9**
**9 X 9 = 8 1 Digit Sum is 9**
**9 X10 = 9 0 Digit Sum is 9**

**When a number is divisible by 9 the digit sum is also 9**

**When a number is divisible by 3 the digit sum is 3,6 or 9**

---

**Assignments**

---

**Check the following numbers divisible by 3**

**Q1. 12** **Q2. 15**

**Q3. 20** **Q4. 36**

**Q5. 50**

---

**Check the following numbers divisible by 9**

**Q1. 18** **Q2. 45**

**Q3. 30** **Q4. 12825**

**Q5. 66273**

---

**Assignments Answers**

---

**Check the following numbers divisible by 3**

**Q1. 12 YES** **Q2. 15 YES**

**Q3. 20 NO** **Q4. 36 YES**

**Q5. 50 NO**

---

**Check the following numbers divisible by 9**

**Q1. 18 YES** **Q2. 45 YES**

**Q3. 30 NO** **Q4. 12825 YES**

**Q5. 66273 NO**

---



# *Chapter 4 : Digital roots or Digital Sum of Numbers*

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## 3.3 Digital roots applied to sequences

---

**Various symmetries can be discovered within sequences by plotting the digital roots on a circle of nine points.**

**Answers to the multiplication tables provide some easy examples as shown below.**

### 2X table and Digital Roots

| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 1 | 3 | 5 | 7 | 9 | 2 | 4 | 6 |

### 3X table and Digital Roots

| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 6 | 9 | 3 | 6 | 9 | 3 | 6 | 9 | 3 | 6 | 9 |

### 4X table and Digital Roots

| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 8 | 3 | 7 | 2 | 6 | 1 | 5 | 9 | 4 | 8 | 3 |

### 5X table and Digital Roots

| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 6 | 2 | 7 | 3 | 8 | 4 | 9 | 5 | 1 | 6 |

### 6X table and Digital Roots

| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3 | 9 | 6 | 3 | 9 | 6 | 3 | 9 | 6 | 3 | 9 |

### 7X table and Digital Roots

| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 5 | 3 | 1 | 8 | 6 | 4 | 2 | 9 | 7 | 5 | 3 |

**8X table and Digital Roots**

| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 9 | 8 | 7 | 6 |

**9X table and Digital Roots**

| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

**10X table and Digital Roots**

| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 | 2 | 3 |

**11X table and Digital Roots**

| 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 101 | 112 | 123 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 4 | 6 | 8 | 1 | 3 | 5 | 7 | 9 | 2 | 4 | 6 |

**12X table and Digital Roots**

| 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 148 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 6 | 9 | 3 | 6 | 9 | 3 | 6 | 9 | 3 | 6 | 9 |

| **The pattern for a number is the same as the pattern of its complement from 9.** |
|---|

**For example:**

**The pattern for 4 is the same as the pattern for 5 [ from 9, complement of 4 is 5 ] except one is the reverse of the other.**

| **Digital root patterns for two-digit multiplication tables are the same as those of the digital roots of those two-digit numbers.** |
|---|

**For example:**

**The pattern for 12 is the same as that for 1+2 = 3.**



# *Chapter 3 : Digital roots or Digital Sum of Numbers*

---

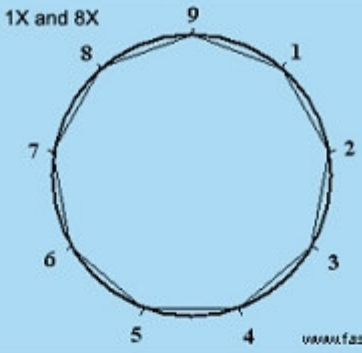
**3.3 Digital roots applied to sequences**

**Various symmetries can be discovered within sequences by plotting the digital roots on a circle of nine points.**

**Answers to the multiplication tables provide some easy examples.**

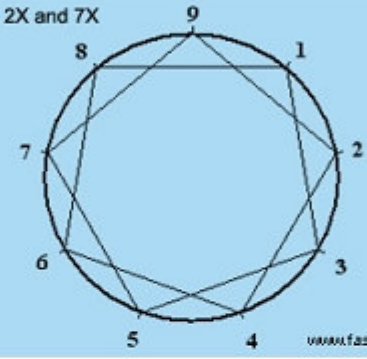
**The pattern are shown below**

PATTERN FOR 1X and 8X



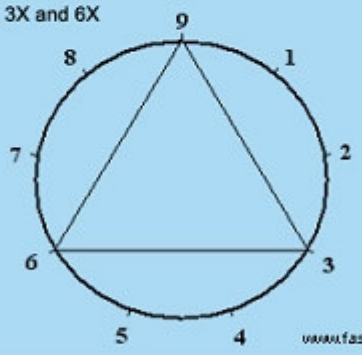

www.fastmaths.com

PATTERN FOR 2X and 7X




www.fastmaths.com

PATTERN FOR 3X and 6X

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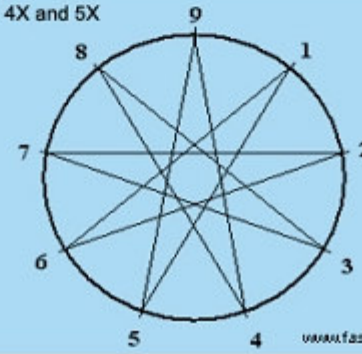
PATTERN FOR 4X and 5X

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# *Chapter 3 : Digital roots or Digital Sum of Numbers*

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**3.5 Useful application of Digital sums**

---

**Checking the answers to addition and subtraction sums**

**3.5.1 Addition: Digital Sum Check**
**3.5.1.1 Sum Involving No Carriers**

**Example 1: Find 4352 + 342 and check the answer using digit sum**

```
4 3 5 2 +
  3 4 2
--------------
4 6 9 4
```

**Line the numbers up with the units under units. There are no carriers so we simply add in each column**

**2 + 2 = 4, 5+4 = 9, 3 +3 = 6 and 4 +0 = 4**

**Digit sum of 4 3 5 2 is 4 + 3 + 5 + 2 = 14, again digit sum of 14 gives 1+4 = 5**

**Digit sum of 3 4 2 is 3 + 4 + 2 = 9**

**Sum of digital roots = 5 + 9 = 14 , again digit sum of 14 gives 1+4 = 5**

**The answer should have a digit sum of 5**

**Verifying the digit sum of the answer 4 + 6 + 9 + 4 = 23, Digit sum of 23 is 2+3 =5**

---

**Example 2. Find 32 + 12 and check the answer using digit sum**

```
3 2 +
1 2
--------------
4 4
```

**Digit sum of 32 is 3 + 2 = 5 and the digit sum of 12 is**

**1+2 = 3. The sum total of the digital sums is 5+3 = 8 . If the answer is correct the digit sum of the answer should be 8. i.e 4 + 4 = 8.**

---

### 3.5.1.2 Sum Involving Carriers

---

**Example 1. Find 76 + 18 and check the answer using digit sum**

```
7  6 +
1  8
--------------
8 14
```

**Carrying 1 over to the left gives 9 4**

**Add 8 + 6 = 14, so write down 4 in the unit's column and 'carry ' 1 to the next column. Add this carry 1 to 7+1 and write 9 in tens column.**

---

**Example 2: Add 375 and 108 and check the number**

```
3  7  5 +
2  0  8
--------------
5  8  3
```

**Digit sum of 375 is 3 + 7 + 5 = 15, again 1+ 5 = 6 and the digit sum of 208 is 2 + 0 + 8 = 10 or 1. The sum total of the digital sums is 6 + 1 = 7. If the answer is correct the digit sum of the answer should be 6. i.e 5+8+3 = 16, again 1+ 6 =7.**

---

### 3.5.2 Subtraction: Digital Sum Check

---

**Example 1: Find 57 - 22 and check the answer using digit sum**

```
5 7 -
2 2
--------
3 5
```

**Digit sum of 57 is 5 + 7 = 12, again1 + 2, the digit sum is 3. The digit sum of 22 is 2 + 2 = 4. The difference of the digital sums is 3 - 4 = 3 + 9 ? 4 = 8. If the answer is correct the digit sum of the answer should be 8. i.e 3 + 5 = 8.**

---

**Example 2: Find 518 - 211 and check the answer using digit sum**

```
5 1 8 +
2 1 1
--------------
3 0 7
```

**Digit sum of 518 is 5 + 1 + 8 = 14, again 1 + 4 = 5 and the digit sum of 211 is 2 + 1 + 1 = 4. The difference of the digital sums is 5 - 4 = 1. If the answer is correct the digit sum of the answer should be 1 , i.e 3 + 0 + 7 = 10, again 1 + 0 = 1.**



## *Chapter 4 : Digital roots or Digital Sum of Numbers*

---

**3. 6 Assignments**

---

**Q1. Add the following and check your answers using digital roots**

**1. 34 + 46**
**2. 54 + 27**
**3. 198 + 276**
**4. 555 +77**
**5. 4530 + 672**

---

**Q2. Subtract the following and check your answers using digital roots**

1. 62 - 27
2. 812 - 344
3. 503 - 274
4. 6005 - 2739
5. 9786 - 6879



## *Chapter 4 : Digital roots or Digital Sum of Numbers*

---

### 3. 6 Assignments Answers

---

**Q1. Add the following and check your answers using digital roots**

1. 34 + 46 = 80
2. 54 + 27 = 81
3. 198 + 276 = 474
4. 555 +77 = 632
5. 4530 + 672 = 5202

---

**Q2. Subtract the following and check your answers using digital roots**

1. 62 - 27 = 35
2. 812 - 344 = 468
3. 503 - 274 = 229
4. 6005 - 2739 = 3266
5. 9786 - 6879 = 2907

# *Chapter 4 : Multiplication*

## 4.1 Multiplication:

**There is no change when any number is multiplied by 1.**

**When we multiply one number by another then it is increased and becomes further away from one. When 4 is multiplies by 5 it becomes 20 which is further away from 4 and 5.**

**Using our multiplication techniques, we relate each number very close to another number called base. The difference between the number and the base is termed as deviation.**

**Deviation may be positive or negative. Positive deviation is written without the positive sign and the negative deviation, is written using a bar or negative sign on the number.**

| Number | Base | Deviation |
|---|---|---|
| 15 | 10 | 15-10 = 5 |
| 9 | 10 | 9-10=-1 |
| 98 | 100 | 98-100=-2 |
| 112 | 100 | 112-100=12 |
| 994 | 1000 | 994-1000=-6 |
| 1013 | 1000 | 1013-1000=13 |

**Example 1: Find the deviation of 94 from base 100**

**Now deviation can be obtained by ?all from 9 and the last from 10? method i.e, the last digit 4 is subtracted from 10 gives 06 and remaining digit 9 is subtracted from9 gives 00.**

**Deviation of 94 from base 100 is 06**

**Example 2: Find the deviation of 86 from base 100**

**The last digit 6 is subtracted from 10 gives 04 and remaining digit 8 from 9 gives 1.**

**Deviation of 86 from base 100 is 14**

---

**Assignments**

---

**Q1. Write down the deviation from nearest base for the following**

**1. 88 from 100**
**2. 75 from 100**
**3. 8004 from 10000**
**4. 123870 from 1000000**
**5. 423 from 1000**
**6. 902 from 1000**
**7. 70503 from 100000**
**8. 9993 from 10000**

---

**Assignments Answers**

---

**Q1. Write down the deviation from nearest base for the following**

**1. 12**
**2. 25**
**3. 1996**
**4. 876130**
**5. 577**
**6. 098**
**7. 29497**
**8. 0007**



---

## *Chapter 1 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.1 Both the numbers are lower than the base.**

### 4.2.1.1 Multiplication using a base of 10

---

**Example 1: Multiply 7 by 8.**

**Consider the base number as 10 since it is near to both the numbers.**

**Step 1. Write the numbers one below the other.**

```
  7 X
  8
------
```

**Step 2. Take the deviations of both the numbers from the base and represent**

```
  7   -3      [ Base 10]
  8   -2
-----------
```

**Remainders 3 and 2 implies that the numbers to be multiplied are both less than 10**

**Step 3. The product or answer will have two parts, one on the left side and the other on the right. A vertical or a slant line i.e. a slash may be drawn for the demarcation of the two parts.**

```
  7   -3      [ Base 10]
  8   -2
-----------
    /
-----------
```

**Step4. The R.H.S. of the answer is the product of the deviations of the numbers. It contains the number of digits equal to number of zeroes in the base.**

```
  7   -3      [ Base 10]
  8   -2
-------------
    /  (3x2)
-------------
```

**Since base is 10, 3X2 = 6 can be taken as it is.**

**Step5. L.H.S of the answer is the sum of one number with**

**the deviation of the other. It can be arrived at in any one of the four ways.**

- **i) Cross-subtract deviation 2 on the second row from the original number 7 in the first row 7-2 = 5.**
- **ii) Cross?subtract deviation 3 on the first row from the original number8 in the second row 8 - 3 = 5**
- **iii) Subtract the base 10 from the sum of the given numbers. (7 + 8) ? 10 = 5**
- **iv) Subtract the sum of the two deviations from the base. 10 ? ( 3 + 2) = 5**

**Hence 5 is left hand side of the answer.**

```
  7   -3      [ Base 10]
  8   -2
-----------
  5 /  6
-----------
```

**Step 6 : If R.H.S. contains less number of digits than the number of zeros in the base, the remaining digits are filled up by giving zero or zeroes on the left side of the R.H.S. If the number of digits are more than the number of zeroes in the base, the excess digit or digits are to be added to L.H.S of the answer.**

---

**The general form of the multiplication**
**Let N1 and N2 be two numbers near to a given base in powers of 10, and D1 and D2 are their respective deviations from the base.**
**Then N1 X N2 can be represented as**

```
                N1   D1   [BASE]
                N2   D2
          ----------------------
(N1+D2) OR (N2+D1) / (D1xD2)
```

---

## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**
**4.2.1 Both the numbers are lower than the base.**
**4.2.1.2 Multiplication using a base of 100**

---

**Example. 1: Find 97 X 94.**

**Here base is 100**

**Deviation of 97 from 100 is -03**
**Deviation of 94 from 100 is -06**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**(97-06) or (94-03) / (3X6)**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**91 / 18**

**Answer is 9118**

---

**Example. 2: Find 98 X 97.**

**Deviation of 98 from 100 is -02**
**Deviation of 97 from 100 is -03**

**Here base is 100**

**98 -02 [ BASE 100]**
**97 -03**
**----------**
**(98-03) or (97-02) / (2X3)**

**98 -02 [ BASE 100]**

**97 -03**

**---**

**95 / 06**

**Answer is 9506**

---

**Example. 3: Find 75 X 95.**

**Here base is 100**

**Deviation of 75 from 100 is -25**
**Deviation of 95 from 100 is -05**

**75 -25 [ BASE 100]**
**95 -05**

**---**

**(75-05) or (95-25) / (25X5)**

**75 -25 [ BASE 100]**
**95 -05**

**---**

**70 / $_1$25**

**Since the base is 100, we write down 25 and carry 1 over to the left giving us 70 / $_1$25 = (70+1) / 25**

**Answer is 7125**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q1. 95 X 99** | **Q2. 93 X 98** |
| **Q3. 76 X 98** | **Q4. 96 X 98** |
| **Q5. 97 X 89** | **Q6. 98 X 91** |
| **Q7. 94 X 93** | **Q8. 92 X 97** |

---

**Assignments Answers**

---

**Find the following**

**Q1. 95 X 99 = 9405** **Q2. 93 X 98 = 9114**
**Q3. 76 X 98 = 7448** **Q4. 96 X 98 = 9408**
**Q5. 97 X 89 = 8633** **Q6. 98 X 91 = 8918**
**Q7. 94 X 93 = 8742** **Q8. 92 X 97 = 8924**

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## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**
**4.2.1 Both the numbers are lower than the base.**
**4.2.1.3 Multiplication using a base of 1000**

---

**Example 1: Find 786 X 998**

**Here base is 1000**

**Complement of 786 is 214.**
**7 from 9 is 2 and 8 from 9 is 1 and 6 from 10 is 4 .**

**Complement of 998 is 002**

**786 -214 [ BASE 1000]**
**998 -002**
**----------**
**(786-002) or (998-214) / (214X2)**

**786 -214 [ BASE 1000]**
**998 -002**
**----------**
**784 / 428**
**Answer is 784428**

---

**Example. 2: Find 994 X 988.**

**Here base is 1000**

**994 -006 [ BASE 1000]**
**988 -012**
**----------**
**(786-002) or (998-214) / (214X2)**

**994 -006 [ BASE 1000]**
**988 -012**
**----------**
**982 / 072**

**Answer is 982072**

---

**Example. 3: Find 750 X 995.**

**Here base is 1000**

**750 -250 [ BASE 1000]**
**995 -005**
**----------**
**(750-005) or (995-250) / (250X005)**

**750 -250 [ BASE 1000]**
**995 -005**
**----------**
**745 / $_1$250**

**Since the base is 1000, we write down 250 and carry 1 over to the left giving us 745 / $_1$250 = (745+1) / 250**

**Answer is 746250**

---

**Assignments**

---

**Find the following**

**Q1. 993 X 998** **Q2. 815 X 998**

**Q3. 987 X 994** **Q4. 985 X 998**
**Q5. 995 X 999** **Q6. 688 X 998**
**Q7. 999 X 999** **Q8. 872 X 998**

---

**Assignments Answers**

---

**Find the following**

**Q1. 993 X 998 =991014** **Q2. 815 X 998 =813370**
**Q3. 987 X 994 =981078** **Q4. 985 X 998 =983030**
**Q5. 995 X 999 =994005** **Q6. 688 X 998 =686624**
**Q7. 999 X 999 =998001** **Q8. 872 X 998 =870256**



## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.2 Both the numbers are higher than the base.**

---

**The method and rules : The only difference is the positive deviation. Instead of cross?subtract, we follow cross?add.**

---

**Example.1: Find 13X12.**

**Base is 10**

**13 3 [ BASE 10]**
**12 2**
**----------**

**(13 + 2) or (12 + 3) / (3 X 2)**

**13 3 [ BASE 10]**
**12 2**
**----------**
**15 / 6**

**Answer is 156**

---

**Example.2: Find 18X14.**

**Base is 10**

**18 8 [ BASE 10]**
**14 4**
**----------**
**(18 + 4) or (14 + 8) / (8 X 4)**

**18 8 [ BASE 10]**
**14 4**
**----------**
**22 / $_3$2**

**Since the base is 10, we write down 2 and carry 3 over to the left giving us 22 / $_3$2 = (22+3) / 2**

**Answer is 252**

---

**Example 3: Find 104 X 102**

**Here base is 100**

**104 04 [ BASE 100]**
**102 02**
**----------**
**(104 + 02) or (102 + 04) / (04 X 02)**

**104 04 [ BASE 100]**
**102 02**
**----------**
**106 / 08**

**Answer is 10608**

---

**Example. 4: Find 1275 X 1004.**

**Here base is 1000**

**1275 275 [ BASE 1000]**
**1004 004**
**----------**
**(1275 + 004) or (1004 + 275) / (275 X 004)**

**1275 275 [ BASE 1000]**
**1004 004**
**----------**
**1279 / $_1$100**

**Since the base is 1000, we write down 100 and carry 1 over to the left giving us 1279 / $_1$100 = (1279+1) / 100**

**Answer is 1280100**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q01. 11 X 14** | **Q02. 15 X 10** |
| **Q03. 12 X 13** | **Q04. 11 X 11** |
| **Q05. 101 X 104** | **Q06. 121 X 104** |
| **Q07. 107 X 103** | **Q08. 134 X 102** |
| **Q09. 1004 X 1009** | **Q10. 1115 X 1004** |
| **Q11. 1005 X 1003** | **Q12. 1035 X 1002** |

---

**Assignments Answers**

**Find the following**

| | |
|---|---|
| **Q01. 154** | **Q02. 150** |
| **Q03. 156** | **Q04. 121** |
| **Q05. 10504** | **Q06. 12584** |
| **Q07. 11021** | **Q08. 13668** |
| **Q09. 1013036** | **Q10. 1119460** |
| **Q11. 1008015** | **Q12. 1037070** |



# *Chapter 4 : Multiplication*

## 4.2 : Multiplication near to the base

### 4.2.3.1.1 Bar Numbers and application

**Look at the following Subtractions**

**9 = 10 ?1 = 11¯**

**8 = 10 ?2 = 12¯**

**7 = 10 ?3 = 13¯**

**6 = 10 ?4 = 14¯**

**5 = 10 ?5 = 15¯**

**4 = 10 ?3 = 16¯**

**9 is same as 10 - 1 , and this may be written as one ten in the ten?s column and take away 1 in the units column.**

**8 is same as 10 - 2 , and this may be written as one ten in the ten?s column and take away 2 in the units column.**

**More examples**

**¯**

**98 = 100 ? 2 = 102**

**196 = 200 ? 4 = 204** $\bar{}$

**32 = 30 ? 2 = 28** $\bar{}$

**145 = 140 ? 5 = 135** $\bar{}$

**A Viniculum Number OR Bar Number is a take away or minus number.**

**28 = 30 ? 2 = 32** $\bar{}$ **because 28 is 2 less than 30.**

**Thirty viniculum two is 28.**

---

**Example 1.**

**Bar number of 47 can be found by 47 = 50 ? 3 = 53** $\bar{}$
**One more than 4 is 5 and the complement of 7 is 3.**

**It is like telling the time when we say ?Five to six? instead of 5:55**

**To change a number back into its ordinary form, *write down the complement of the viniculum number and subtract 1 from the next digit to the left***

**To convert Viniculum 53** $\bar{}$

**Complement of 3 is 7 and 5 ? 1 is 4 give us the original number as 47.**

---

**Example 2**

**To convert 75** $\bar{}$

**Complement of 5 is 5 and 7-1 gives 6**
**The original number is 65**

**To change a tens column digit into a Viniculum we use same method. The digit is replaced by its complement and the digit to the left is increased by 1**

---

**Example 3**

**Convert Viniculum 17$\bar{4}$**

**The complement of 7 is 3 and 1+1 = 2**

**This is saying that one hundred seven tens and four units is the same as two hundreds minus three tens and 4 units.**

**Viniculum $1\overline{7}\overline{4}$ is 234**

**To change a tens column digit into a viniculum we use same method. The digit is replaced by its complement and the digit to the left is increased by 1**

---

**Example 4**

**Convert Viniculum $63\overline{2}$**

**The complement of 3 is 7 and 6 ? 1 = 5 . Answer is 572**

**Some Numbers may have more than one Viniculum number**

**$3\ 3\ 2\ 4\ 5\ 8\ \overline{2} = 2\ 7\ \overline{2}\ 4\ 4\ 2\ 2$**

---

**4.2.3.1.2 Adding and subtracting Viniculum numbers**

---

**Viniculum numbers are added or subtracted just like ordinary numbers.**

**$\overline{3} + \overline{2} = \overline{5}$**

**$\overline{5} - \overline{2} = \overline{3}$**

**$12 + 3\ \overline{} = 9$**

---

**Assignments**

---

**Find the following**

**Q1. Change units digit into viniculum number for 46**

**Q2. Change the following numbers back to ordinary**

**form**

**1. $1\bar{2}$ 2. $5\bar{1}$ 3. $4\bar{2}$ 4. $85\bar{}$**

**Q3. Change tens digit into viniculum number for 621**

**Q4. Change the following numbers back to ordinary form**

**1. $4\bar{1}3\bar{1}$ 2. $3\bar{3}3\bar{}$ 3. $71\bar{5}1\bar{}$ 4. $65\bar{3}2\bar{1}$**

**Q5. Find the following**

**1. $\bar{3} + 2\bar{}$ 2. $8\bar{} - 4\bar{}$ 3. $2\bar{} - 2\bar{}$ 4. $6 + \bar{2}$**

---

**Assignments Answers**

---

**Find the following**

**Q1. $5\bar{4}$**

**Q2. Change the following numbers back to ordinary form**

**1. 8 2. 49 3. 38 4. 75**

**Q3. $7\bar{8}1$**

**Q4. Change the following numbers back to ordinary form**

**1. 3929 2. 2727 3. 6949 4. 55281**

**Q5. Find the following**

**1. $\bar{5}$ 2. $\bar{4}$ 3. 0 4. $\bar{4}$**

---

# *Chapter 4 : Multiplication*

## 4.1 Multiplication:

**There is no change when any number is multiplied by 1.**

**When we multiply one number by another then it is increased and becomes further away from one. When 4 is multiplies by 5 it becomes 20 which is further away from 4 and 5.**

**Using our multiplication techniques, we relate each number very close to another number called base. The difference between the number and the base is termed as deviation.**

**Deviation may be positive or negative. Positive deviation is written without the positive sign and the negative deviation, is written using a bar or negative sign on the number.**

| Number | Base | Deviation |
|---|---|---|
| 15 | 10 | 15-10 = 5 |
| 9 | 10 | 9-10=-1 |
| 98 | 100 | 98-100=-2 |
| 112 | 100 | 112-100=12 |
| 994 | 1000 | 994-1000=-6 |
| 1013 | 1000 | 1013-1000=13 |

**Example 1: Find the deviation of 94 from base 100**

**Now deviation can be obtained by ?all from 9 and the last from 10? method i.e, the last digit 4 is subtracted from 10 gives 06 and remaining digit 9 is subtracted from9 gives 00.**

**Deviation of 94 from base 100 is 06**

**Example 2: Find the deviation of 86 from base 100**

**The last digit 6 is subtracted from 10 gives 04 and remaining digit 8 from 9 gives 1.**

**Deviation of 86 from base 100 is 14**

---

**Assignments**

---

**Q1. Write down the deviation from nearest base for the following**

**1. 88 from 100**
**2. 75 from 100**
**3. 8004 from 10000**
**4. 123870 from 1000000**
**5. 423 from 1000**
**6. 902 from 1000**
**7. 70503 from 100000**
**8. 9993 from 10000**

---

**Assignments Answers**

---

**Q1. Write down the deviation from nearest base for the following**

**1. 12**
**2. 25**
**3. 1996**
**4. 876130**
**5. 577**
**6. 098**
**7. 29497**
**8. 0007**



---

## *Chapter 1 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.1 Both the numbers are lower than the base.**

### 4.2.1.1 Multiplication using a base of 10

---

**Example 1: Multiply 7 by 8.**

**Consider the base number as 10 since it is near to both the numbers.**

**Step 1. Write the numbers one below the other.**

```
  7 X
  8
------
```

**Step 2. Take the deviations of both the numbers from the base and represent**

```
  7   -3      [ Base 10]
  8   -2
-----------
```

**Remainders 3 and 2 implies that the numbers to be multiplied are both less than 10**

**Step 3. The product or answer will have two parts, one on the left side and the other on the right. A vertical or a slant line i.e. a slash may be drawn for the demarcation of the two parts.**

```
  7   -3      [ Base 10]
  8   -2
-----------
    /
-----------
```

**Step4. The R.H.S. of the answer is the product of the deviations of the numbers. It contains the number of digits equal to number of zeroes in the base.**

```
  7   -3      [ Base 10]
  8   -2
-------------
    /  (3x2)
-------------
```

**Since base is 10, 3X2 = 6 can be taken as it is.**

**Step5. L.H.S of the answer is the sum of one number with**

**the deviation of the other. It can be arrived at in any one of the four ways.**

- **i) Cross-subtract deviation 2 on the second row from the original number 7 in the first row 7-2 = 5.**
- **ii) Cross?subtract deviation 3 on the first row from the original number8 in the second row 8 - 3 = 5**
- **iii) Subtract the base 10 from the sum of the given numbers. (7 + 8) ? 10 = 5**
- **iv) Subtract the sum of the two deviations from the base. 10 ? ( 3 + 2) = 5**

**Hence 5 is left hand side of the answer.**

```
  7   -3      [ Base 10]
  8   -2
-----------
  5 /  6
-----------
```

**Step 6 : If R.H.S. contains less number of digits than the number of zeros in the base, the remaining digits are filled up by giving zero or zeroes on the left side of the R.H.S. If the number of digits are more than the number of zeroes in the base, the excess digit or digits are to be added to L.H.S of the answer.**

---

**The general form of the multiplication**
**Let N1 and N2 be two numbers near to a given base in powers of 10, and D1 and D2 are their respective deviations from the base.**
**Then N1 X N2 can be represented as**

```
                N1   D1   [BASE]
                N2   D2
          ----------------------
(N1+D2) OR (N2+D1) / (D1xD2)
```

---

## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**
**4.2.1 Both the numbers are lower than the base.**
**4.2.1.2 Multiplication using a base of 100**

---

**Example. 1: Find 97 X 94.**

**Here base is 100**

**Deviation of 97 from 100 is -03**
**Deviation of 94 from 100 is -06**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**(97-06) or (94-03) / (3X6)**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**91 / 18**

**Answer is 9118**

---

**Example. 2: Find 98 X 97.**

**Deviation of 98 from 100 is -02**
**Deviation of 97 from 100 is -03**

**Here base is 100**

**98 -02 [ BASE 100]**
**97 -03**
**----------**
**(98-03) or (97-02) / (2X3)**

**98 -02 [ BASE 100]**

**97 -03**

**---**

**95 / 06**

**Answer is 9506**

---

**Example. 3: Find 75 X 95.**

**Here base is 100**

**Deviation of 75 from 100 is -25**
**Deviation of 95 from 100 is -05**

**75 -25 [ BASE 100]**
**95 -05**

**---**

**(75-05) or (95-25) / (25X5)**

**75 -25 [ BASE 100]**
**95 -05**

**---**

**70 / $_1$25**

**Since the base is 100, we write down 25 and carry 1 over to the left giving us 70 / $_1$25 = (70+1) / 25**

**Answer is 7125**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q1. 95 X 99** | **Q2. 93 X 98** |
| **Q3. 76 X 98** | **Q4. 96 X 98** |
| **Q5. 97 X 89** | **Q6. 98 X 91** |
| **Q7. 94 X 93** | **Q8. 92 X 97** |

---

**Assignments Answers**

---

**Find the following**

**Q1. 95 X 99 = 9405** **Q2. 93 X 98 = 9114**
**Q3. 76 X 98 = 7448** **Q4. 96 X 98 = 9408**
**Q5. 97 X 89 = 8633** **Q6. 98 X 91 = 8918**
**Q7. 94 X 93 = 8742** **Q8. 92 X 97 = 8924**



## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**
**4.2.1 Both the numbers are lower than the base.**
**4.2.1.2 Multiplication using a base of 100**

---

**Example. 1: Find 97 X 94.**

**Here base is 100**

**Deviation of 97 from 100 is -03**
**Deviation of 94 from 100 is -06**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**(97-06) or (94-03) / (3X6)**

**97 -03 [ BASE 100]**
**94 -06**
**----------**
**91 / 18**

**Answer is 9118**

---

**Example. 2: Find 98 X 97.**

**Deviation of 98 from 100 is -02**
**Deviation of 97 from 100 is -03**

**Here base is 100**

**98 -02 [ BASE 100]**
**97 -03**
**---**
**(98-03) or (97-02) / (2X3)**

**98 -02 [ BASE 100]**
**97 -03**
**---**
**95 / 06**

**Answer is 9506**

---

**Example. 3: Find 75 X 95.**

**Here base is 100**

**Deviation of 75 from 100 is -25**
**Deviation of 95 from 100 is -05**

**75 -25 [ BASE 100]**
**95 -05**
**---**
**(75-05) or (95-25) / (25X5)**

**75 -25 [ BASE 100]**
**95 -05**
**---**
**70 / $_1$25**

**Since the base is 100, we write down 25 and carry 1 over to the left giving us 70 / $_1$25 = (70+1) / 25**

**Answer is 7125**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q1. 95 X 99** | **Q2. 93 X 98** |
| **Q3. 76 X 98** | **Q4. 96 X 98** |
| **Q5. 97 X 89** | **Q6. 98 X 91** |
| **Q7. 94 X 93** | **Q8. 92 X 97** |

---

**Assignments Answers**

---

**Find the following**

| | |
|---|---|
| **Q1. 95 X 99 = 9405** | **Q2. 93 X 98 = 9114** |
| **Q3. 76 X 98 = 7448** | **Q4. 96 X 98 = 9408** |
| **Q5. 97 X 89 = 8633** | **Q6. 98 X 91 = 8918** |
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---

## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.1 Both the numbers are lower than the base.**

**4.2.1.3 Multiplication using a base of 1000**

---

**Example 1: Find 786 X 998**

**Here base is 1000**

**Complement of 786 is 214.**
**7 from 9 is 2 and 8 from 9 is 1 and 6 from 10 is 4 .**

**Complement of 998 is 002**

**786 -214 [ BASE 1000]**
**998 -002**
**----------**

**(786-002) or (998-214) / (214X2)**

**786 -214 [ BASE 1000]**
**998 -002**
**----------**
**784 / 428**

**Answer is 784428**

---

**Example. 2: Find 994 X 988.**

**Here base is 1000**

**994 -006 [ BASE 1000]**
**988 -012**
**----------**
**(786-002) or (998-214) / (214X2)**

**994 -006 [ BASE 1000]**
**988 -012**
**----------**
**982 / 072**

**Answer is 982072**

---

**Example. 3: Find 750 X 995.**

**Here base is 1000**

**750 -250 [ BASE 1000]**
**995 -005**
**----------**
**(750-005) or (995-250) / (250X005)**

**750 -250 [ BASE 1000]**
**995 -005**
**----------**
**745 / $_{1}$250**

**Since the base is 1000, we write down 250 and carry 1 over**

**to the left giving us 745 / $_1$250 = (745+1) / 250**

**Answer is 746250**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q1. 993 X 998** | **Q2. 815 X 998** |
| **Q3. 987 X 994** | **Q4. 985 X 998** |
| **Q5. 995 X 999** | **Q6. 688 X 998** |
| **Q7. 999 X 999** | **Q8. 872 X 998** |

---

**Assignments Answers**

---

**Find the following**

| | |
|---|---|
| **Q1. 993 X 998 =991014** | **Q2. 815 X 998 =813370** |
| **Q3. 987 X 994 =981078** | **Q4. 985 X 998 =983030** |
| **Q5. 995 X 999 =994005** | **Q6. 688 X 998 =686624** |
| **Q7. 999 X 999 =998001** | **Q8. 872 X 998 =870256** |



## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.2 Both the numbers are higher than the base.**

---

**The method and rules : The only difference is the positive deviation. Instead of cross?subtract, we follow cross?add.**

---

**Example.1: Find 13X12.**

**Base is 10**

**13  3  [ BASE 10]**
**12  2**
**----------**
**(13 + 2) or (12 + 3) / (3 X 2)**

**13  3  [ BASE 10]**
**12  2**
**----------**
**15 /  6**

**Answer is 156**

---

**Example.2:  Find 18X14.**

**Base is 10**

**18  8  [ BASE 10]**
**14  4**
**----------**
**(18 + 4) or (14 + 8) / (8 X 4)**

**18  8  [ BASE 10]**
**14  4**
**----------**
**22 / $_3$2**

**Since the base is 10, we write down 2 and carry 3 over to the left giving us 22 / $_3$2  = (22+3) / 2**

**Answer is 252**

---

**Example 3: Find 104 X 102**

**Here base is 100**

**104 04 [ BASE 100]**
**102 02**
**----------**
**(104 + 02) or (102 + 04) / (04 X 02)**

**104 04 [ BASE 100]**
**102 02**
**----------**
**106 / 08**

**Answer is 10608**

---

**Example. 4: Find 1275 X 1004.**

**Here base is 1000**

**1275 275 [ BASE 1000]**
**1004 004**
**----------**
**(1275 + 004) or (1004 + 275) / (275 X 004)**

**1275 275 [ BASE 1000]**
**1004 004**
**----------**
**1279 / $_1$100**

**Since the base is 1000, we write down 100 and carry 1 over to the left giving us 1279 / $_1$100 = (1279+1) / 100**

**Answer is 1280100**

---

**Assignments**

---

**Find the following**

**Q01. 11 X 14** **Q02. 15 X 10**
**Q03. 12 X 13** **Q04. 11 X 11**

**Q05. 101 X 104** **Q06. 121 X 104**
**Q07. 107 X 103** **Q08. 134 X 102**
**Q09. 1004 X 1009** **Q10. 1115 X 1004**
**Q11. 1005 X 1003** **Q12. 1035 X 1002**

---

**Assignments Answers**

---

**Find the following**

**Q01. 154** **Q02. 150**
**Q03. 156** **Q04. 121**
**Q05. 10504** **Q06. 12584**
**Q07. 11021** **Q08. 13668**
**Q09. 1013036** **Q10. 1119460**
**Q11. 1008015** **Q12. 1037070**



# *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**
**4.2.3.1.1 Bar Numbers and application**

---

**Look at the following Subtractions**

**$9 = 10 - 1 = 1\bar{1}$**

**$8 = 10 - 2 = 1\bar{2}$**

**$7 = 10 - 3 = 1\bar{3}$**

**$6 = 10 - 4 = 1\bar{4}$**

**$\bar{}$**

**5 = 10 ?5 = 15**

**4 = 10 ?3 = 16**
**9 is same as 10 - 1 , and this may be written as one ten in the ten?s column and take away 1 in the units column.**

**8 is same as 10 - 2 , and this may be written as one ten in the ten?s column and take away 2 in the units column.**

**More examples**

**98 = 100 ? 2 = 102**

**196 = 200 ? 4 = 204**

**32 = 30 ? 2 = 28**

**145 = 140 ? 5 = 135**

**A Viniculum Number OR Bar Number is a take away or minus number.**

**28 = 30 ? 2 = 32 because 28 is 2 less than 30.**

**Thirty viniculum two is 28.**

---

**Example 1.**

**Bar number of 47 can be found by 47 = 50 ? 3 = 53**
**One more than 4 is 5 and the complement of 7 is 3.**

**It is like telling the time when we say ?Five to six? instead of 5:55**

**To change a number back into its ordinary form, *write down the complement of the viniculum number and subtract 1 from the next digit to the left***

**To convert Viniculum 53**

**Complement of 3 is 7 and 5 ? 1 is 4 give us the original number as 47.**

---

**Example 2**

**To convert 75**

**Complement of 5 is 5 and 7-1 gives 6**
**The original number is 65**

**To change a tens column digit into a Viniculum we use same method. The digit is replaced by its complement and the digit to the left is increased by 1**

---

**Example 3**

**Convert Viniculum $17\overline{4}$**

**The complement of 7 is 3 and 1+1 = 2**

**This is saying that one hundred seven tens and four units is the same as two hundreds minus three tens and 4 units.**

**Viniculum $17\overline{4}$ is 234**

| **To change a tens column digit into a viniculum we use same method. The digit is replaced by its complement and the digit to the left is increased by 1** |
|---|

---

**Example 4**

**Convert Viniculum $632\overline{}$**

**The complement of 3 is 7 and 6 ? 1 = 5 . Answer is 572**

**Some Numbers may have more than one Viniculum number**

**$3\ 3\ 2\ 4\ 5\ 8\ \overline{2} = 2\ 7\ \overline{2}\ 4\ 4\ 2\ 2$**

---

## 4.2.3.1.2 Adding and subtracting Viniculum numbers

---

**Viniculum numbers are added or subtracted just like ordinary numbers.**

$$\overline{3} + \overline{2} = \overline{5}$$

$$\overline{5} - \overline{2} = \overline{3}$$

**$12 + 3\bar{=} 9$**

---

## Assignments

---

**Find the following**

**Q1. Change units digit into viniculum number for 46**

**Q2. Change the following numbers back to ordinary form**

**1. $1\bar{2}$ 2. $5\bar{1}$ 3. $4\bar{2}$ 4. $85\bar{}$**

**Q3. Change tens digit into viniculum number for 621**

**Q4. Change the following numbers back to ordinary form**

**1. $4\bar{1}3\bar{1}$ 2. $3\bar{3}3\bar{}$ 3. $7\bar{1}5\bar{1}\bar{}$ 4. $6\bar{5}\bar{3}21$**

**Q5. Find the following**

**1. $\bar{3} + 2\bar{}$ 2. $8\bar{} - 4\bar{}$ 3. $2\bar{} - 2\bar{}$ 4. $6\bar{} + 2$**

---

## Assignments Answers

---

**Find the following**

**Q1. $5\bar{4}$**

**Q2. Change the following numbers back to ordinary form**

**1. 8 2. 49 3. 38 4. 75**

**Q3. $7\bar{8}1$**

**Q4. Change the following numbers back to ordinary form**

**1. 3929 2. 2727 3. 6949 4. 55281**

**Q5. Find the following**

**1. $\bar{5}$ 2. $\bar{4}$ 3. 0 4. $\bar{4}$**

---

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---

## *Chapter 4 : Multiplication*

---

**4.2 : Multiplication near to the base**

**4.2.3.1.1 Bar Numbers and application**

---

**Example.1: Find 13 X 7.**

**Base is 10**

**13 3 [ BASE 10 ]**
**7 -3**
**----------**
**10 / $\bar{9}$**

**One deviation is positive and the other is negative. So the product of deviations becomes negative. So the right hand side of the answer obtained will therefore have to be subtracted.**

**Using ?To change a tens column digit into a Viniculum we use same method. The digit is replaced by its complement and the digit to the left is decreased by 1?**

**Complement of 9 is 1 and 10 is decreased by 1**

**13  3  [ BASE 10 ]**
**7  -3**
**----------**
**(10-1) / Complement of 9 = 91**

**Answer is 91**

---

**Example.2: Find 108 X 94.**

**Base is 100**

**108  08  [ BASE 100 ]**
**94  -06**
**----------**
**102 / $\overline{48}$**

**Complement of 48 is 52 and 102 is decreased by 1**
**(102-1) / Complement of 48 = 10152**

**Answer is 10152**

---

**Example.3: Find 998 X 1025.**

**Base is 1000**

**998  -002  [ BASE 1000 ]**
**1025  025**
**----------**
**1023 / $\overline{050}$**

**Complement of 50 is 950 and 1023 is decreased by 1**
**(1023-1) / Complement of 50 = 1022950**

**Answer is 1022950**

---

**Assignments**

---

**Find the following**

**Q1. 9 X 13** **Q2. 8 X 17**

**Q3. 97 X 106** **Q4. 88 X 102**

**Q5. 997 X 1006** **Q6. 989 X 1028**

---

**Assignments Answers**

---

**Find the following**

**Q1. 9 X 13 = 117** **Q2. 8 X 17 = 136**

**Q3. 97 X 106 =10282** **Q4. 88 X 102 = 789888**

**Q5. 997 X 1006 = 1002982** **Q6. 989 X 1028 = 1016692**

---



---

## *Ch4 : Multiplication*

---

### 4.3 Squaring numbers that ends in 5

---

**Example 1 : Find $75^2$**

```
    7  5  X
    7  5
 -------------
 8X7 / 5X5   =>  5625
 ------------
```

**Simply multiply 7 the number before 5 by the next number up 8 . This gives 7 X 8 = 56 as the first part of the answer and the last part is 5 X 5 =25 so the answer is 5625**

**Example 2 : Find $305^2$**

```
      30  5
      30  5
   ------------
30X31 / 5X5   => 93025
   ------------
```

**Simply multiply 30 the number before 5 by the next number up 31 . This gives 30 X 31 = 930 as the first part of the answer and the last part is 5 X 5 =25 so the answer is 93025**

**Assignments**

**Find the following**

**Q1. $35^2$** **Q2. $45^2$**

**Q3. $105^2$** **Q4. $95^2$**

**Assignments Answers**

**Find the following**

**Q1. 1225** **Q2. 2025**

**Q3. 11025** **Q4. 7225**



## *Ch4 : Multiplication*

**4.4 Multiplying numbers whose first figures are the same and whose last figures add up to 10, 100 etc**

**Example.1 : Find 43 X 47**

**Check for R.H.S : 3 + 7 = 10, L.H.S. portion remains the same i.e.,, 4.**

```
    4  3  X
    4  7
  ---------------
  4X5 / 3X7   =>  2021
   --------------
```

**Multiply 4 ( the same figure in both the numbers ) by the next number up 5. This gives 4 X 5 = 20 as the first part of the answer and the last part is 3 X 7 = 21 so the answer is 2021**

---

**Example.2 : Find 31 X 39**

**Check for R.H.S : 9 +1 = 10, L.H.S. portion remains the same i.e.,, 3.**

```
    3  1 X
    3  9
  ---------------
  3X4 / 1X9   =>  1209
   --------------
```

**Multiply 3 ( the same figure in both the numbers ) by 4. This gives 3 X 4 = 12 as the first part of the answer and the last part is 1X 9 = 09 so the answer is 1209**

---

**Example.3 : Find 127 X 123**
**Check for : 7 + 3 = 10, L.H.S. portion remains the same i.e.,, 12.**

```
     12  7 X
     12  3
  ---------------
 12X13 / 7X3   =>  15621
   --------------
```

**Answer is 15621**

---

**Example.4 : Find 395 X 395**

**Check for : 5 + 5 = 10, L.H.S. portion remains the same i.e.,, 39.**

```
      39  5  X
      39  5
  ---------------
 39X40 / 5X5   =>  156025
   --------------
```

**Answer is 156025**

---

**Assignments**

---

**Find the following**

| | |
|---|---|
| **Q1. 23 X 27** | **Q2. 34 X 36** |
| **Q3. 62 X 68** | **Q4. 136 X 134** |

---

**Assignments Answers**

---

**Find the following**

| | |
|---|---|
| **Q1. 621** | **Q2. 1224** |
| **Q3. 4216** | **Q4. 18224** |

---



## *Ch4 : Multiplication*

---

**4.5 Numbers of which the last 2 0r 3 0r 4 digits added up give 100,1000,10000**

**The same rule works when the sum of the last 2, last 3, last 4 digits added respectively equal to 100, 1000, 10000 .**

**Example.1 : Find 292 X 208**

**Here 92 + 08 = 100, L.H.S portion is same i.e. 2**

**2 92 X**
**2 08**
**---**
**2X3 / 92X08 => 60/736**
**---**
**60 / 736 ( for 100 raise the L.H.S. product by 0 i.e 6X10 )**

**Answer is 60736.**

---

**Example.2 : Find 848 X 852**

**Here 48 + 52 = 100, L.H.S portion is same i.e. 8**

**8 48 X**
**8 52**
**---**
**8X9 / 48X52**
**---**
**We can use our fastmaths technique to find the product of 48X52**

**48 -2 [ BASE 50 ]**
**52 2**
**---**
**Half of ( 50) / complement of 04 => (25-1)/ 96 => 2496**
**---**
**and write 848 x 852 = 8 x 9 / 48 x 52**

**= 720 / $_2$496 ( for 100 raise the L.H.S. product by 0 i.e 72X10)**
**=(720+2)/496 = 722496**

**Since L.H.S product is to be multiplied by 10 and 2 to be carried over as the base is 100**

**Answer is 722496**

---

**Example.3 : Find 693 X 607**

**Check for : 93 + 07 = 100, L.H.S. portion remains the same i.e., 6**

```
      6  93  X
      6  07
  ---------------
  6X7 / 93X07    =>  2021
   ------------
```

**Now R.H.S product 93 X 07 can be obtained mentally.**

**693 x 607 = 6 x 7 / 93 x 07**
**= 420 / 651 (for 100 raise the L.H.S. product by 0 i.e. 42X10)**
**= 420651.**

**Answer is 420651.**

---

**Assignments**

---

**Find the Following**

**Q1. 393 X 307**
**Q2. 696 X 604**
**Q3. 873 X 827**
**Q4. 188 X 112**
**Q5. 454 X 446**

---

**Assignments Assignments**

---

**Find the Following**

**Q1. 393 X 307 = 120/651 = 120651**
**Q2. 696 X 604 = 420384 = 420/384 = 420384**
**Q3. 873 X 827 = 720/$_1$971 = 721971**
**Q4. 188 X 112 = 20/$_1$056 = 21056**

**Q5. 454 X 446 = 200/$_2$484 =202484**

---



## *Ch4 : Multiplication*

---

**4.5 Numbers of which the last 2 0r 3 0r 4 digits added up give 100,1000,10000**

---

**The same rule works when the sum of the last 2, last 3, last 4 digits added respectively equal to 100, 1000, 10000 .**

**Example.1 : Find 292 X 208**

**Here 92 + 08 = 100, L.H.S portion is same i.e. 2**

```
     2  92 X
     2  08
  ---------------
  2X3 / 92X08   =>  60/736
   ------------
  60 / 736 ( for 100 raise the L.H.S. product by 0 i.e 6X10 )
```

**Answer is 60736.**

---

**Example.2 : Find 848 X 852**

**Here 48 + 52 = 100, L.H.S portion is same i.e. 8**

```
     8  48 X
     8  52
  ---------------
  8X9 / 48X52
   ------------
```

**We can use our fastmaths technique to find the product of 48X52**

**48 -2 [ BASE 50 ]**
**52 2**
**----------**
**Half of ( 50) / complement of 04 => (25-1)/ 96 => 2496**
**----------**
**and write 848 x 852 = 8 x 9 / 48 x 52**

**= 720 / $_2$496 ( for 100 raise the L.H.S. product by 0 i.e 72X10)**
**=(720+2)/496 = 722496**

**Since L.H.S product is to be multiplied by 10 and 2 to be carried over as the base is 100**

**Answer is 722496**

---

**Example.3 : Find 693 X 607**

**Check for : 93 + 07 = 100, L.H.S. portion remains the same i.e., 6**

**6 93 X**
**6 07**
**----------**
**6X7 / 93X07 => 2021**
**----------**

**Now R.H.S product 93 X 07 can be obtained mentally.**

**693 x 607 = 6 x 7 / 93 x 07**
**= 420 / 651 (for 100 raise the L.H.S. product by 0 i.e. 42X10)**
**= 420651.**

**Answer is 420651.**

---

**Assignments**

---

**Find the Following**
**Q1. 393 X 307**
**Q2. 696 X 604**

**Q3. 873 X 827**
**Q4. 188 X 112**
**Q5. 454 X 446**

---

**Assignments Assignments**

---

**Find the Following**

**Q1. 393 X 307 = 120/651 = 120651**
**Q2. 696 X 604 = 420384 = 420/384 = 420384**
**Q3. 873 X 827 = 720/$_1$971 = 721971**
**Q4. 188 X 112 = 20/$_1$056 = 21056**
**Q5. 454 X 446 = 200/$_2$484 =202484**

---



# *Ch4 : Multiplication*

---

**4.6 Multiplication using other bases**

---

**Example.1 : Find 568 X 998**

**Base is 1000**

**Complement of 568 is 432**
**Complement of 998 is 002.**

```
    568  -432   [ BASE 1000 ]
    998  -002
  ____________________
  568 - 2 / 864   =>  566 / 864
  ____________________
```

**Answer is 566864**

---

**Example.2 : Find 213 X 203**

**Base is 200**

**Complement of 213 is 13**
**Complement of 203 is 03.**

**213 13 [ BASE 200 ]**
**203 03**

**213+3 / 39 => 216 x 2 / 39**

**since the base is 200 i e 2X100**

**The numbers are close to 200 which is 100X 2 we multiply only the left hand part of the answer by 2 to get 43239**

**Answer is 43239**

---

**Example.3 : Find 29 X 28**

**Base is 30**

**Complement of 29 is -1**
**Complement of 28 is -2.**

**29 -1 [ BASE 30 ]**
**28 -2**

**29 -2 / 2 => 27 x 3 / 2 since the base is 30 i.e 3X 10**

**The numbers are close to 30 which is 10X 3 we multiply only the left hand part of the answer by 3 to get 812**

**Answer is 812**

---

**Example.4 : Find 43 X 44**

**Base is 40**

**Complement of 43 is 3**
**Complement of 44 is 4.**

**43 3 [ BASE 40 ]**
**44 4**

**43 + 4 / $_1$2 => 47 x 4 / $_1$2 since the base is 40 i.e 4X 10**

**The numbers are close to 40 which is 10X 4 we multiply only the left hand part of the answer by 4 (before carrying 1 over to the left) to get 188/$_1$2 = (188+1)/2**

**Answer is 1892**

---

**Example.5 : Find 83 X49**

**Same as ?(83 X 98)**

**83 -17 [ BASE 100 ]**
**98 -02**

**83 -02 / 17X2 => 81 /34 = 8134**

**Answer = ?(8134) = 4067**

**Answer is 4067**

---

**Example.6 : Find 9998 X 94**

**Numbers are close to different bases 10,000 and 100**

**9998 -2 [ BASE 10000 ]**
**94 -6 [ BASE 100 ]**

**9398 / 12 => 939812**

**Note that 6 is not subtracted from 8, but from the 9 above the 4 in 94**
**Second column from left. So 9998 becomes 9398**

**Answer is 939812**

---

**Example.7: Find 10007 X 1003**

**Numbers are close to different bases 10,000 and 100**

```
  10007   007    [ BASE 10000 ]
  1000    003    [ BASE 100 ]
 _____________________
10037 / 021    =>  10037021
 _____________________
```

**Note that 3 is not added to 7, but to the third column from left.**

**Answer = 10037021**

---

**Assignments**

---

**Find the Following**

**Q1. 314 X 304**
**Q2. 1014 X 998**
**Q3. 74 X 73**
**Q4. 93X 49**
**Q5. 9998 X 96**

---

**Assignments Answers**

---

**Find the Following**

**Q1. 314 X 304 = 95456**
**Q2. 1014 X 998 =1011972**
**Q3. 74 X 73 = 5402**
**Q4. 93 X 49 =4557**
**Q5. 9998 X 96 =959808**

---

# *Ch4 : Multiplication*

## 4.7 Multiplication by 5, 50 and 25

**Example 1: Find 44 X 5**

**Multiply by 2 and divide by 2 gives**

**44 X (5 X 2) / 2 = 44 X10/2**

**Find 44 X 10 and divide by 2**

**440/2 = 220**

**Answer = 220**

---

**Example 2: Find 27 X 50**

**Multiply by 2 and divide by 2 gives**

**27 X (50 X 2) / 2 = 27 X100/2**

**Find 27 X 100 and divide by 2**

**2700/2 = 1350**

**Answer = 1350**

---

**Example.3: Find 82 X 25**

**Multiply by 4 and divide by 4 gives**

**82 X (25 X 4) / 4 = 82 X100 /4**

**Find 82 X 100 and divide by 4**

**8200/4 = 2050**

**Answer = 2050**

---

**Assignments**

---

**Find the following**

**Q1. 55 X 5**
**Q2. 55 X 25**
**Q3. 55 X 50**
**Q4. 98 X 50**
**Q5. 98 X 25**

---

**Assignments Answers**

---

**Find the following**

**Q1. 55 X 5 = 275**
**Q2. 55 X 25 = 1375**
**Q3. 55 X 50 = 2750**
**Q4. 98 X 50 = 4900**
**Q5. 98 X 25 = 2450**

---



# *Ch4 : Multiplication*

---

**4.8 Multiplication by 9**

---

**Method:**

- **Step 1. The left hand side digit is obtained by deduction 1 from the left side digit. To find 7 x 9; LHS. digit is 7 - 1 = 6**
- **Step 2. The right hand side digit is the complement or difference between the multiplier and the left hand side digit. i.e. To find 7 X 9, RHS is 9 - 6 = 3.**

- **Step 3. The two numbers give the answer; i.e. 7 X 9 = 63.**

---

**Example 1: Find 8 x 9**

- **Step 1: 8 - 1 = 7 (LHS. Digit)**
- **Step 2: 9 - 7 = 2 (RHS. Digit)**
- **Step 3: The answer is 72**

---

**Example 2: Find 15 x 99**

- **Step 1: 15 - 1 = 14**
- **Step 2: 99 - 14 = 85 (or Complement of 15 , 100 - 15)**
- **Step 3: 15 x 99 = Answer is 1485**

---

**Example 3: Find 24 x 99**

- **Step 1: 24 - 1 = 23**
- **Step 2: 99 - 23 = 76 (or complement of 24, 100 - 24)**
- **Step 3: 24 x 99 = Answer is 2376**

---

**Example 4: Find 356 x 999**

- **Step 1: 356 - 1 = 355**
- **Step 2: 999 - 355 = 644 (or Complement of 356 , 1000 - 356)**
- **Step 3: 356 x 999 = Answer is 355644**

---

**Example 5: Find 878 x 9999**

- **Step 1: 878 - 1 = 877**
- **Step 2: 9999 - 877 = 9122 (or Complement of 878 , 10000 - 878)**
- **Step 3: 878 x 9999 = Answer is 8779122**

**The multiplicand has to be reduced by 1 to obtain the LHS and the right side is obtained by the subtraction of the LHS from the multiplier.**

**Assignments**

**Find the products**

- **Q1. 64 x 99**
- **Q2. 723 x 999**
- **Q3. 3251 x 9999**
- **Q4. 443 x 999**
- **Q5. 256 x 9999**
- **Q6. 1857 x 99999**

**Assignments Answers**

**Find the products**

- **Q1. 6336**
- **Q2. 722277**
- **Q3. 32506749**
- **Q4. 442557**
- **Q5. 2559744**
- **Q6. 185698143**

**We have dealt the cases**

**a) When the multiplicand and multiplier both have the same number of digits**

**b) When the multiplier has more number of digits than the multiplicand.**

**In both the cases the same rule applies. But what happens when the multiplier has lesser digits?**

**i.e. for problems like 42 X 9, 124 X 9, 26325 X 99 etc**

**Multiplication table when both multiplicand and multiplier are of 2 digits.**

**m n**

**11 x 99 = 10 89 = (11-1) / 99 - (11-1) = 1089**
**12 x 99 = 11 88 = (12-1) / 99 - (12-1) = 1188**
**13 x 99 = 12 87 = (13-1) / 99 - (13-1) = 1287**

**18 x 99 = 17 82**

**19 x 99 = 18 81**
**20 x 99 = 19 80 = (20-1) / 99 - (20-1) = 1980**

**The rule mentioned in the case of above table also holds good here. Further we can state that the rule applies to all cases, where the multiplicand and the multiplier have the same number of digits.**

**Consider the following Tables.**

**Table A**

| | m | n |
|---|---|---|
| 11 x 9 = | 9 | 9 |
| 12 x 9 = | 10 | 8 |
| 13 x 9 = | 11 | 7 |
| --- | | |
| 18 x 9 = | 16 | 2 |
| 19 x 9 = | 17 | 1 |
| 20 x 9 = | 18 | 0 |

**Table B**

| | | |
|---|---|---|
| 21 x 9 = | 18 | 9 |
| 22 x 9 = | 19 | 8 |
| 23 x 9 = | 20 | 7 |
| --- | | |
| 28 x 9 = | 25 | 2 |
| 29 x 9 = | 26 | 1 |
| 30 x 9 = | 27 | 0 |

**Table C**

**35 x 9 = 31 5**
**46 x 9 = 41 4**
**53 x 9 = 47 7**
**67 x 9 = 60 3**
**---------- and so on.**

**From the above tables the following points can be observed:**

**1) Table A has the multiplicands with 1 as first digit except the last one. Here LHS of products are uniformly 2 less than the multiplicands. So also with 20 x 9**

**2) Table B has the same pattern. Here LHS of products are uniformly 3 less than the multiplicands.**

**3) Table C is of mixed example and yet the same result. If 3 is first digit of the multiplicand then LHS of product is 4 less than the multiplicand; if 4 is first digit of the**

**multiplicand then, LHS of the product is 5 less than the multiplicand and so on.**

**4) The right hand side of the product is obtained by subtracting the RHS part of the multiplicand from 10.**

**Keeping these points in view we solve following problems:**

---

**Example1: Find 42 X 9**

**Step 1) Divide the multiplicand (42) of by a line '/' into a right hand portion consisting of as many digits as the multiplier.**

**i.e. 42 has to be written as 4/2**

**Step 2) Subtract from the multiplicand one more than the whole excess portion on the left. Left portion of multiplicand is 4.**

**one more than it 4 + 1 = 5.**

**We have to subtract this from multiplicand**
**i.e. write it as**

```
4 / 2
  /-5
_______
3 / 7
```

**This gives the LHS part of the product.**

**Step 3) Subtract the RHS part of the multiplicand. RHS of multiplicand is 2. Its complement is 8.**
**It gives the RHS of the product**

**i.e. answer is 3 / 7 / 8 = 378.**

**Thus 42 X 9 can be represented as**

```
  4 / 2
    /-5 / 8
-----------------
  3 / 7 / 8 = 378.
```

---

**Example 2: Find 124 X 9**

**Step 1) Here Multiplier has one digit only. We**

**write 12 / 4**

**Step 2) 12 + 1 = 13**

**i.e. 12 / 4**
**-1 / 3**
**----------**

**Step 3 ) RHS of multiplicand is 4. Its complement is 6**

**124 X 9 is 12 / 4**
**-1 / 3 / 6**
**----------**
**11 / 1 / 6 = 1116**

**The process can also be represented as**
**124 x 9 = [ 124 - ( 12 + 1 ) ] / ( 10 - 4 ) = ( 124 - 13 ) / 6 = 1116**

---

**Example 3: Find 15639 x 99**

**Since the multiplier has 2 digits, the answer is**

**[15639 - (156 + 1)] / (100 - 39) = (15639 - 157) / 61 = 1548261**

---

**Assignments**

---

**Find the products in the following cases.**

- **Q1. 58 x 9**
- **Q2. 62 x 9**
- **Q3. 427 x 99**
- **Q4. 832 x 9**
- **Q5. 24821 x 999**
- **Q6. 111011 x 99**

---

**Assignments Answers**

---

**Find the products in the following cases.**

- **Q1. 522**
- **Q2. 558**

- **Q3. 42273**
- **Q4. 7488**
- **Q5. 24796179**
- **Q6. 10990089**

---



## *Ch4 : Multiplication*

---

### 4.8 Multiplication by 11

---

**11 Multiplication table is easy to remember**

**11 X 1 = 11**
**11 X 2 = 22**
**11 X 3 = 33**
**11 X 4 = 44**
**11 X 5 = 55**
**11 X 6 = 66**
**11 X 7 = 77**
**11 X 8 = 88**
**11 X 9 = 99**

**Multiplying larger number by 11 is also easy.**

---

**Example 1. Find 52 X 11**

**52 X 11 is 5 72**

**Write down the number being multiplied and put the total of the digits between 2 digits**

**52 X 11 is [5 and 5+2=7 and 2], answer is 572**

---

**Example 2. Find 57 X 11**

**57 X 11 is [5 and 12 and 7], equals 627**

**5 / $_1$2 / 7 = 627**

**The 1 in 12 is carried over to 5 to give 6**

---

**Example 3. Find 234 X 11**

**234 X 11 is [2 and 2+3 and 3+4 and 4] equals 2 5 7 4**

---

**Example 4. Find 777 X 11**

**777 X 11 is [7 and 7+7 and 7+7 and 7] simplifies to [ 7 and 14 and 14 and 7 ]**

**7 /$_1$4 / $_1$4 / 7 = 8 5 4 7**

**Answer is 8547. We simply carry the 1's over**

---

**Example 5. Find 13423 X 11**

**13423 X 11 is [1 and 3+1 and 3+4 and 4+2 and 2+3 and 3] simplifies to [1 and 4 and 7 and 6 and 5 and 3]**

**Answer is 147653**

---

**Assignments**

---

**Find the Following**

**Q1. 37 X 11**
**Q2. 137 X 11**
**Q3. 12337 X 11**
**Q4. 567 X 11**
**Q5. 98 X 11**

---

**Assignments Answers**

---

**Find the Following**

**Q1. 407**
**Q2. 1507**

**Q3. 135707**
**Q4. 6237**
**Q5. 1078**

---



# *Ch4 : Multiplication*

---

## 4.9 Multiplication by 12

---

**Multiplication table of 12 is easy to remember**

**12 X 1 = 12**
**12 X 2 = 24**
**12 X 3 = 36**
**12 X 4 = 48**
**12 X 5 = 60**
**12 X 6 = 72**
**12 X 7 = 84**
**12 X 8 = 96**
**12 X 9 = 108**

**Multiplication of large numbers with 12 is also easy. Just double the digit to the left before adding**

---

**Example 1. Find 52 X 12**

**52 X 12 is**

**Add 0 to the left and right as shown below**

**0 5 2 0**
**0 5 $_1$2 4 [2X0 + 5, 2X5 + 2, 2X2+0]**

**Answer is 624**

---

**Example 2. Find 234 X 12**

**234 X 12 is**

**Add 0 to the left and right as shown below**

**0 2 3 4 0**
**0 2 7 $_1$0 8 [2X0 + 2, 2X2 + 3, 2X3+4, 2X4+0]**

**Answer is 2808**

---

**Example 3. Find 65214 X 12**

**65214 X 12 is**

**Add 0 to the left and right as shown below**

**0 6 5 2 1 4 0**
**0 6 $_1$7 $_1$2 5 6 8 [2X0+6, 2X6 +5, 2X5+2, 2X2+1, 2X1+4, 2X4+0]**

**Answer is 782568**

---

**Assignments**

---

**Find the Following**

**Q1. 98 X 12**
**Q2. 56 X 12**
**Q3. 134 X 12**
**Q4. 564 X 12**
**Q5. 123498 X 12**

---

---

**Assignments Answers**

---

**Find the Following**

**Q1. 1176**
**Q2. 672**
**Q3. 1608**
**Q4. 6768**
**Q5. 1481976**

---

# *Ch4 : Multiplication*

## 4.10 Multiplication by vertically and Crosswire

**We have seen all the multiplication sums had at least one of the numbers to be multiplied close to a particular base of 10,100 , 1000 etc. We learn a more general formula which can be used for all cases of multiplication.**

**Multiplying 2 two-digit Numbers**

**Remember the following diagram. Each dot represents a digit in the number and the lines joining the dots stand for digits to be multiplies**

**Step 1** **Step 2** **Step 3**



**Example 1: Multiply 42 by 13**

**Step 1. Starting from left, multiply the two left handed most digits vertically. 4 X 1 = 4 and set the answer down underneath as the left most part of the answer.**

**4 2 X**
**1 3**
**---------**
**4**

**Step 2. Multiply 4 by 3 and 2 by 1, cross multiplying and add these two answers**

**together 4 X 3 + 2 X 1 = 14. Set down 4 as the next answer digit and carry the 1 to the left.**

```
4   2 X
1   3
---------
4 14
```

**Step 3. Multiply 2 by 3 vertically and set down the answer 6 as the right most answer digit.**

```
4   2 X
1   3
----------
4 14  6
```

**Step 4. Add to the carry digit to give the answer 546**

**This method can be started either from the right or from the left.**

---

**Example 2 Find 23 X 72**

**Step 1. Starting from right, multiply the two right-handed most digits vertically. 3 X 2 = 6 and set the answer down underneath as the right most part of the answer.**

```
2   3 X
7   2
---------
    6
```

**Step 2. Multiply 2 by 2 and 3 by 7, cross multiplying and add these two answers together 2 X 2 + 3 X 7 = 4 + 21 = 25. Set down 5 as the next answer digit and carry the 2 to the left.**

```
 2   3 X
 7   2
---------
25   6
```

**Step 3. Multiply 2 by 7 vertically and set down the answer 14 as the left most answer digit.**

```
     2   3 X
     7   2
-------------
```

**$_1$4 $_2$5 6**
**----------**
**1 6 5 6**

---

**Assignments**

---

**Find the Following**

**Q1. 23 X 12**
**Q2. 87 X 24**
**Q3. 63 X 42**
**Q4. 28 X 98**
**Q5. 45 X 67**

---

**Assignments Answers**

---

**Find the Following**

**Q1. 276**
**Q2. 2088**
**Q3. 2646**
**Q4. 2744**
**Q5. 3015**



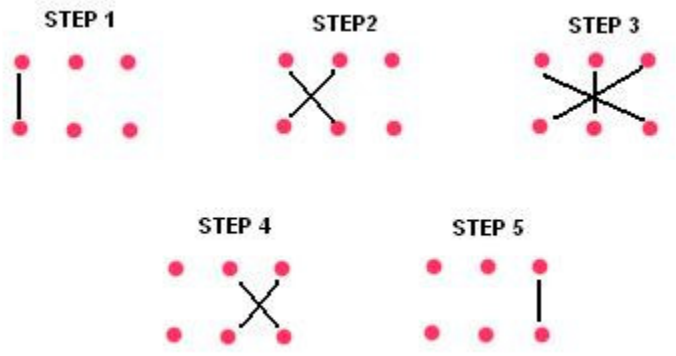
# *Ch4 : Multiplication*

---

**4.11 Multiplying larger numbers**

---

**Each dot represents a digit in the number and the lines joining the dots stand for digits to be multiplied.**




---

**Example 1: Find 362 X 134**

**Step 1. Starting from left, multiply the two left handed most digits vertically. 3 X 1 = 3 and set the answer down underneath as the left most part of the answer.**

**3 6 2 X**
**1 3 4**
**--------**
**3**

**Step 2. Multiply 3 by 3 and 6 by 1, cross multiplying and add these two answers together 3 X 3 + 6 X 1 = 15. Set down 5 as the next answer digit and carry the 1 to the left.**

**3 6 2 X**
**1 3 4**
**---------**
**3 $_1$5**

**Step 3. Middle step is to add the cross product of all six digits as shown below**

**3 X 4 + 2 X 1 + 6 X 3 = 32**

**3 6 2 X**
**1 3 4**
**---------**
**3 $_1$5 $_3$2**

**Step 4. Sum of the products of the four right hand most digits give**

**3 X 2 + 6 X 4 = 30**

**3 6 2 X**

**1 3 4**
**----------**
**3 $_{1}$5 $_{3}$2 $_{3}$0**

**Step 5. The final step is the product of the two right hand most digits 2 X 4 =8**

**3 6 2 X**
**1 3 4**
**----------**
**3 $_{1}$5 $_{3}$2 $_{3}$0 8**

**Step 6. After adding up the carry digits the answer is 48508**

---

**Example 2 Find 498 X 289**

**Step 1. Starting from left, multiply the two left handed most digits vertically. 4 X 2 = 8 and set the answer down underneath as the left most part of the answer.**

**4 9 8 X**
**2 8 9**
**----------**
**8**

**Step 2. Multiply 4 by 8 and 9 by 2, cross multiplying and add these two answers together 4 X 8 + 9 X 2 = 50. Set down 0 as the next answer digit and carry the 5 to the left.**

**4 9 8 X**
**2 8 9**
**----------**
**8 $_{5}$0**

**Step 3. Middle step is to add the cross product of all six digits as shown below**

**4 X 9 + 8 X 2 + 9 X 8 = 36+16+72=124 . Set down 4 as the next answer digit and carry the 12 to the left.**

**4 9 8 X**
**2 8 9**
**----------**
**8 $_{5}$0 $_{12}$4**

**Step 4. Sum of the products of the four right hand most digits give**

**9 X 9 + 8 X 8 = 81 + 64= 145  Set down 5 as the next answer digit and carry the 14 to the left.**

**4  9  8  X**
**2  8  9**
**----------**
**8 $_{5}$0 $_{12}$4 $_{14}$5**

**Step 5. The final step is the product of the two right hand most digits 8 X 9 =72**

**4  9  8  X**
**2  8  9**
**----------**
**8 $_{5}$0 $_{12}$4 $_{14}$5 $_{7}$2**

**Step 6. After adding up the carry digits**

**$_{1}$3 $_{1}$2 $_{1}$8 $_{1}$2 2**

**Step 7. After adding up the carry digits the answer is 143922**

---

**Assignments**

---

**Find the Following**

**Q1.  147 X 477**
**Q2.  270 X 131**
**Q3.  427 X 47**
**Q4.  353 X 566**
**Q5.  777 X 220**

---

**Assignments Answers**

---

**Find the Following**

**Q1.  70119**
**Q2.  35370**
**Q3.  20069**
**Q4.  199798**
**Q5.  170940**

---

# *Chapter 4 : Multiplication*

## 4.12 Multiplication using Average

**Consider the following example**

**Example 1 : Find 29 X 31**

**Since the average of 29 and 31 is 30**
**Find $30^2$ and subtract the square of the difference of either number from the average. 900 - 1 = 899**

> **Square the average and subtract the square of the difference of either number from the average.**

**Example 2 : Find 26 X 34**

**Since the average of 26 and 34 is 30**
**Find $30^2$ and subtract the square of the difference of either number from the average. 900 - $4^2$ = 884**

## Assignments

**Q1. Find 58 X 62 ?**
**Q2. Find 67 X 69 ?**
**Q3. Find 98 X 102 ?**
**Q4. Find 49 X 51 ?**
**Q5. Find 73 X 93 ?**

## Assignments Answers

**Q1. Find 58 X 62 ?**

**Since the average of 58 and 62 is 60**
**Find $60^2$ and subtract the square of the difference of either number from the average. 3600 - $2^2$ = 3596**

---

**Q2. Find 67 X 69 ?**

**Since the average of 67 and 69 is 68**
**Find $68^2$ and subtract the square of the difference of either number from the average. 4624 - $1^2$ = 4623**

---

**Q3. Find 98 X 102 ?**

**Since the average of 98 and 102 is 100**
**Find $100^2$ and subtract the square of the difference of either number from the average. 10000 - $2^2$ = 9996**

---

**Q4. Find 49 X 51 ?**

**Since the average of 49 and 51 is 50**
**Find $50^2$ and subtract the square of the difference of either number from the average. 2500 - $1^2$ = 2499**

---

**Q5. Find 73 X 93 ?**

**Since the average of 73 and 93 is 83**
**Find $83^2$ and subtract the square of the difference of either number from the average. 6889 - $10^2$ = 6789**

---

# *Chapter 5 : Division*

---

**5.1 Division:**

---

**Using one, there is no division. When one is divided into four, the answer four shows that four has not been divided at all. Division always start at two.**

**5.2.1. Simple Division**

**Find 1648 /4**

- **4 Into 1 does not go, 4 into 16 = 4**
- **4 into 4 = 1**
- **4 into 8 =2**
- **The answer is 412**

---

**5.2.1.Division with reminders**

---

**A division sum has 4 parts called Divisor, Divident, Quotient and Remainder.**

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

**In the conventional procedure for division, the process is of the following form.**

```
                Quotient
               ________
Divisor ) Dividend     OR    Divisor ) Dividend ( Quotient
            --------                    ---------
            --------                    ---------
           ___________                  __________
            Remainder                    Remainder
```

**Find 2862/4**

- **4 Into 2 goes 0 remainder 2**
- **4 goes into 28 = 7**
- **4 into 6 goes 1 remainder 2**
- **4 into 22 goes 5 remainder 2**

**Above example**

```
      715
    _____
4 ) 2862
    28
   ----
     6
     4
    ----
     22
     20
    ----
      2
```

**Divisor = 4**
**Divided = 2862**
**Quotient = 715**
**Remainder = 2**

**But in the FastMaths Division process, the format is**

```
Divisor ) Dividend
          --------
         --------
_____________________
Quotient / Remainder
```

**The conventional method is always the same irrespective of the divisor. But FastMaths methods are different depending on the nature of the divisor.**



## *Chapter 5 : Division*

---

**5.3 Divisibility Tests**

---

**5.3.1 Divisibility by 2,5,10**

---

**Look at the following Series 2,4,6,8,10,12,14,16,???**

**All numbers ending in even numbers or zero must have 2 as a factor. We say the number is divisible by 2. Any number ending in an even number or zero is a multiple of 2.**

**Given number 36**

**2 is a factor of 36**
**36 is a multiple of 2**
**36 is divisible by 2**

**Look at the following Series 5,10,15,20,25 ,???**
**All numbers ending in 5 or zero are divisible by 5.**

**Look at the following Series 10,20,30,40,?..**
**All numbers ending in 0 are divisible by 10**

| |
|---|
| **All numbers ending in even numbers or zero are divisible by 2**<br><br>**All numbers ending in 5 or zero are divisible by 5.**<br><br>**All numbers ending in 0 are divisible by 10** |



# *Chapter 5 : Division*

## 5.3 Divisibility Tests

### 5.3.2 Divisibility by 3 and 9

**Look at the following Series 9,18,27,36??.**
**Digital root or digit sum of the series 9,9,9,9?..**

**All numbers whose digit sum is 9 are divisible by 9**

**All numbers with a digit sum is 9 are divisible by 9**

**Look at the following Series 3, 6, 9, 12, 15, 18,?..?.**
**Digital root or digit sum of the series 3, 6, 9, 3, 6 ,9 ???..**
**All numbers with a digit sum of 3,6 or 9 are divisible by 3**

**All numbers with a digit sum of 3,6 or 9 are divisible by 3**



## *Chapter 5 : Division*

### 5.3 Divisibility Tests

### 5.3.3 Divisibility by 4

**Look at the following Series 4,8,12,16,20,24,28,32??.**
**If 4 divides into last 2 digits of a number then 4 divides into the whole number**

**If 4 divides into last 2 digits of a number then 4 divides into the whole number**

### 5.3.4 Divisibility by 6

**Any number which is divisible by 6 must also divisible by 2 and by 3. So the test for divisibility by 6 ; it must pass the test for both 2 and 3**

**78 is divisible by 2, but also by 3 (as its digit sum is 6) so 78 is divisible by 6. All numbers divisible by both 2 and 3 are divisible by 6**

**All numbers divisible by both 2 and 3 are divisible by 6**

### 5.3.4 Divisibility by 8

**A 3 digit number is divisible by 8 if the ultimate plus 2 times the penultimate plus 4 times the pen-penultimate is divisible by 8.**

**Is 134 is divisible by 8 ?**

**Find we can divide 4 + 2 X 3 + 8 X 1 by 8 :**

**4 + 6 + 8 = 18**

**18/8 gives 2 and remainder 2 ,**

**8 does not divide exactly 134 so 134 is not divisible by 8**

**A 3 digit number is divisible by 8 if the ultimate plus 2 times the penultimate plus 4 times the pen-penultimate is divisible by 8.**

**If a number is divisible by 8 it must also be divisible by 2 and 4.**



## *Chapter 5 : Division*

### 5.3 Divisibility Tests

### 5.3.5 Divisibility by 11

**Add all the digits in the ODD position and all digits in the EVEN position and subtract the smaller result from the larger result. If we get 0 or 11 or any multiples of 11 , then the number is divisible by 11**

**Example : 7282231**

**Sum of odd digits : 7+8+2+1 = 18**

**Sum of Even digits : 2 +2+3 = 7**

**18-7 = 11. the number 7282231 is divisible by 11**

**Add all the digits in the ODD position and all digits in the EVEN position and subtract the smaller result from the larger result. If we get 0 or 11 or any multiples of 11 , then the number is divisible by 11**



## *Chapter 5 : Division*

---

**5.3 Divisibility Tests**

---

**5.3.5 Divisibility by 15**

---

**Any number which is divisible by 15 must also divisible by 5 and by 3. So the test for divisibility by 15 ; it must pass the test for both 5 and 3**

**All numbers divisible by both 5 and 3 are divisible by 15**

**345 is divisible by 5, but also by 3 (as its digit sum is 3) so 345 is divisible by 15**

| |
|---|
| **All numbers divisible by both 5 and 3 are divisible by 15** |



# *Chapter 5 : Division*

## 5.3 Divisibility Tests

### 5.3.6 Summary

| Divisibility Tests: Summary | |
|---|---|
| **Number tested** | **Test** |
| **0,2** | **Is the last digit 0 or even?** |
| | |
| **3,6,9** | **Is the digit Sum 3, 6 or 9?** |
| | |
| **4** | **Is the 2 digit number on the end is divisible by 4?** |
| | |
| **5** | **Is the last digit is 0 or 5?** |
| | |
| **6** | **Is the number divisible by both 2 and 3?** |
| | |
| **8** | **If the ultimate plus 2 times penultimate plus four times the pen-penultimate is divisible by 8** |
| | |
| **9** | **Is the digit sum 9?** |
| | |
| **10** | **Is the last digit 0?** |
| | |
| **15** | **Is the number divisible by both 3 and 5?** |

**Assignments**

**Q1. Is 4662 divisible by 18 ?**

**Q2. Is 1848 divisible by 24 ?**

**Q3. Is 3444 Divisible by 12 ?**

**Q4. Is 2772 Divisible by 36 ?**

**Q5. Is 7341 Divisible by 52?**

**Assignments Answers**

**Q1. Is 4662 divisible by 18 ?**

**Since 18 = 2 X 9 , a number will be divisible by 18 if it is divisible by both 2 and 9**

**4662 can be easily divisible by 2**

**4662 digit sum is 9 , so divisible by 9 also**

**4662 is divisible by 18**

**Q2. Is 1848 divisible by 24 ?**

**Since 24 = 6 X 4 , Do not use 6 and 4 since they are not relatively prime.**

**24 = 3 X 8 , use 3 and 8 and verify 1848 can be divided by both 3 and 8.**

**1848 can be easily divisible by 8 since ultimate plus 2 times penultimate plus four times the pen-penultimate is 8 + 2 X 4 + 4 X 8 = 48 is divisible by 8**

**1848 digit sum is 3 , so divisible by 3 also**

**1848 is divisible by 24**

**Q3. Is 3444 Divisible by 12 ?**

**Since 12 = 3 X 4 , verify 3444 can be divided by both 3 and 4.**

**3444 can be easily divisible by 3 since the digit sum is 6**

**3444 can be divided by 4 since the last 2 digit sum 44 can be divided by 4**

**3444 is divisible by 12**

---

**Q4. Is 2772 Divisible by 36 ?**

**Since 36 = 6 X 6 , verify 2772 can be divided by 6, ie divisible by 2 and 3**

**2772 can be easily divisible by 3 since the digit sum is 9**

**2772 can be divided by 2**

**2772 is divisible by 36**

---

**Q5. Is 7341 Divisible by 52?**

**7341 is an odd number cannot be divided by an even number 52**

---



---

## *Chapter 5 : Division*

---

### 5.4. Division techniques

---

#### 5.4.1. Dividing by 9

---

**Consider some two digit numbers (dividends) and same divisor 9.**

**Observe the following example.**

**i) 15 ? 9 The quotient (Q) is 1, Remainder (R)**

**is 6.**

**since 9 ) 15 ( 1**
**9**
**———**
**6**

**ii) 34 ? 9, Q is 3, R is 7.**

**iii) 60 ? 9, Q is 6, R is 6.**

**iv) 80 ? 9, Q is 8, R is 8.**

**Each number to be divided has been separated into two parts by a diagonal stroke. The left-hand part gives the first part of the answer and right-hand side gives the reminder.**

**Steps**

**1) Separate off the last digit of the dividend with a diagonal stroke.**

**2) Put the first digit of the dividend as it is under the horizontal line. Put the same digit under the right hand part for the remainder, add the two and place the sum i.e.,, sum of the digits of the numbers as the remainder.**

---

**Example 1: Find 13/9 , 34/9 and 80/9**

**1 / 3 3 / 4 8 / 0**
**1 3 8**
**——— , ——— , ———**
**1 / 4 3 / 7 8 / 8**

**13 ? 9 gives Q = 1, R = 4**

**34 ? 9 gives Q = 3, R = 7**

**80 ? 9 gives Q = 8, R = 8**

---

**Example 2: Find 21 ? 9**

**9) 2 / 1**

**2 / 3**

**i.e Q=2, R=3**

**Example 3: Find 43 ? 9**

**9) 4 / 3**

**4 / 7**

**i.e Q = 4, R = 7.**

**In the division of two digit numbers by 9, we can take the first digit down for the quotient-column and by adding the quotient to the second digit, we get the remainder.**

**Consider the following examples**

**1) Find 104 /9**

```
9 ) 104 ( 11          9 ) 10 / 4
    99                      1 / 1
??????       as       ???????
     5                     11 / 5
```

**2) Find 212 / 9**

```
9 ) 212 ( 23          9 ) 21 / 2
   207                     2 / 3
  ?????        as     ???????
    5                    23 / 5
```

**3) Find 401 / 9**

```
9 ) 401 ( 44          9 ) 40 / 1
   396                     4 / 4
  ?????        as     ???????
     5                   44 / 5
```

**Note that the remainder is the sum of the digits of the dividend. The first digit of the dividend from left is added to the second digit of the dividend to obtain the second digit of the quotient. This digit added to the third digit sets the remainder. The first digit of the dividend remains as the first digit of the quotient.**

**Division by 9 rules:**

- **The remainder is the sum of the digits of**

the dividend.

- The first digit of the dividend from left is added to the second digit of the dividend to obtain the second digit of the quotient.
- This digit is added to the third digit set the remainder.
- The first digit of the dividend remains as the first digit of the quotient.

---

**Example 4: Find 511 / 9**

**Add the first digit 5 to second digit 1 getting 5 + 1 = 6. Hence Quotient is 56. Now second digit of 56 i.e.,, 6 is added to third digit 1 of dividend to get the remainder i.e.,, 1 + 6 = 7**

**9 ) 51 / 1**

**56 / 7**

**Q is 56, R is 7.**

---

**Example 5: Find 1204 / 9**

**The first digit 1 is set down as the first answer digit . Take this 1 and add the next digit 2. This gives 3 as the next digit. Working this way 3+0 =3, and the remainder is 3+4 =7**

**9 ) 120 / 4**
**133 / 7**

**Q = 133, R = 7**

---

**Example 6: Find 13210 / 9**

**The first digit 1 is set down as the first answer digit . Take this 1 and add the next digit 3. This gives 4 as the next digit. Working this way 4+2 =6, 6+1 =7 and the remainder is 7+0 =7**

**9 ) 1321 / 0**

**1467 / 7**

**Q = 1467, R = 7**

**Assignments**

**Q1. Find 235471 / 9**

**Q2 Find 42111 / 9**

**Q3. Find 214091 / 9**

**Q4. Find 112 / 9**

**Q5. Find 1022/ 9**

**Assignments Answers**

**Q1. Find 234571 / 9**

**The first digit 2 is set down as the first answer digit . Take this 2 and add the next digit 3. This gives 5 as the next digit. Working this way 5+4 =9, 9+5 =14 , 14+7 =21 and the remainder is 21+1 =22**

**9 ) 234 5 7 / 1**
**259 $_1$4 $_2$1/ 22**

**26061 / 22**

**The remainder 22 is larger than 9 , the divisor and so divide by 9 giving 2 and remainder 4. This 2 is carried over to the left giving answer are 26063/4**

**Q= 26063, R = 4**

**Q2. Find 42111 / 9**

**The first digit 4 is set down as the first answer digit . Take this 4 and add the next digit 2. This gives 6 as the next digit. Working this way 6+1 =7, 7+1 =8, and the remainder is 8+1 =9**

**9 ) 4211 / 1**
**4678 / 9**

**4678 / 9**

**The remainder 9 is equal to 9 , the divisor and so divide by 9 giving 1 and remainder 0. This 1 is carried over to the left**

**giving answer are 4679/0**

**Q= 4679, R = 0**

---

**Q3. Find 214091/9**

**9 ) 2140 9 / 1**
**2377 16/ 17**

**23786 / 17**

**The remainder 17 is larger than 9 , the divisor and so divide by 9 giving 1 and remainder 8. This 1 is carried over to the left giving answer are 23787/8**

**Q= 23787, R = 8**

---

**Q4. Find 112/9**

**9 ) 11 / 2**
**12 / 4**

**12 / 4**

**Q= 12, R = 4**

---

**Q5. Find 1022/9**

**9 ) 102 / 2**
**113 / 5**

**113 / 5**

**Q= 113, R = 5**

---



---

## *Chapter 5 : Division*

## 5.4. Division techniques

### 5.4.2 Dividing by 5, 50 and 25

**Example 1: Find 85 / 5**

**Find double of 85 and divide by 10**

**85X2 / 5X2**

**170/10 = 17**

**Answer = 17**

**Example 2: Find 750 / 50**

**Find double of 750 and divide by 100**

**750X2 / 50X2**

**1500 / 100 =15**

**Answer = 15**

**Example 3: Find 82 / 25**

**Double 82 twice and divide by 100**

**82X4 / 25X4**

**82X2X2 / 100**

**Double 82 gives 164 and doubling this gives 328**

**Answer = 328/100 = 3.28**

**Assignments**

**Q1. Find 250 /5**

**Q2. Find 343 / 25**

**Q3. Find 765 / 50**

---

**Assignments Answers**

---

**Q1. Find 250 /5**

**Can be written as 250 X 2 / 10**

**Find double of 250 and divide by 10**

**250X2 / 10 = 500/10 = 50**

**Answer = 50**

---

**Q2. Find 343 / 25**

**Can be written as 343 X 4 / 100**

**Double 343 gives 686 and doubling this gives 1372**

**1372 / 100 = 13.72**

**Answer = 13.72**

---

**Q3. Find 765 / 50**

**Can be written as 765 X 2 / 100**

**Double 765 gives 1530**

**1530 / 100 = 15.3**

**Answer = 15.3**

---

# *Chapter 5 : Division*

---

**5.4.3 Division Techniques**

---

**5.4.3 Division with any base**

---

**Example 1: Consider the division 1235 ? 89.**

**Conventional method:**

```
89 ) 1235 ( 13
       89
     _____

       345
       267
     _____
        78
```

**Thus Q = 13 and R = 78.**

**FastMaths method:**

**This method is useful when the divisor is nearer and less than the base. Since for 89, the base is 100 we can apply the method.**

**Step (i): Write the dividend and divisor as in the conventional method. Obtain the modified divisor (M.D.) applying the complement formula. Write M.D. just below the actual divisor. Thus for the divisor 89, the M.D. obtained by using complement is 11 in the last from 10 and the rest from 9. Now Step 1 gives**

**89 ) 1235**

**11**

**Step (ii): Bifurcate the dividend by by a slash so that RHS of dividend contains the number of digits equal to that of M.D. Here M.D. contains 2 digits hence**

**89 ) 12 / 35**

**11**

**Step (iii): Multiply the M.D. with first column digit of the dividend. Here it is 1. i.e. 11 x 1 = 11. Write this product place wise under the 2nd and 3rd columns of the dividend.**

**89 ) 12/3 5**
**11 1 1**
**_____**
**1**

**Step (iv): Add the digits in the 2nd column and multiply the M.D. with that result i.e. 2+1=3 and 11x3=33. Write the digits of this result column wise as shown below, under 3rd and 4th columns. i.e.**

**89 ) 12/3 5**
**11 1 1**
**3 3**
**_____**
**13 /**

**Step (v): Add the digits in the 3rd column 3 +1 +3=7. Add the digits in the 4th column 5 +3 =8 .**

**89 ) 12 /3 5**
**11 1 1**
**3 3**
**_____**
**13/7 8**

**Now the division process is complete, giving Q = 13 and R = 78.**

---

**Example 2: Find Q and R for 121134 ? 8988.**

**Steps (1+2):**

**8988 ) 12 / 1134**

**1012**

**Step (3):**

**8988 ) 12 / 1134**
**1012 1 012**

**_____**
**1**

**Step (4):**

**8988 ) 1 2 / 1134**
**1012 1 012**
**3036 [ 2 + 1 = 3 and 3x1012 = 3036 ]**

**_____**
**1 3 /**

**Now final Step**

**8988 ) 1 2 / 1134**
**1012 1 012**
**3036 (Column wise addition)**

**_____**
**13 / 4290**

**Thus 121134 / 8988 gives Q = 13 and R = 4290.**

**In all the cases mentioned above, the remainder is less than the divisor.**

**What about the case when the remainder is equal or greater than the divisor?**

---

**Example 3.**

**9 ) 3 / 6 9) 24 / 6**
**3 2 / 6**
**?????? or ????????**
**3 / 9 (equal) 26 / 12 (greater).**

**We proceed by re-dividing the remainder by 9, carrying over this Quotient to the quotient side and retaining the final remainder in the remainder side.**

**9 ) 3 / 6 9 ) 24 / 6**
**/ 3 2 / 6**
**??????? ????????**
**3 / 9 26 / 12**
**??????? ????????**
**4 / 0 27 / 3**

**Q = 4, R = 0 Q = 27, R = 3.**

**Example 4. Find 113/89**

**Get the complement of 89 as 11. Set off the 2 digits from the right as the remainder consists of 2 digits. Further while carrying the added numbers to the place below the next digit, we have to multiply by this 11.**

**89 ) 1 / 13**

**11 / 11**
**????????**
**1 / 24**

**Q = 1, R = 24.**

---

**Example 5. Find 10015 / 89**

**Get the complement of 89 as 11. Set off the 2 digits from the right as the remainder consists of 2 digits. Further while carrying the added numbers to the place below the next digit, we have to multiply by this 11.**

**89 ) 100 / 15**
**11 11 / first digit 1 x 11**
**1 / 1 total second is 0+1=1, 1x11**
**/22 total of 3rd digit is 0+1+1=2, 2x11=22**
**_____**
**112 / 47**
**Q = 112, R = 47.**

---

**Example 6 : What is 10015 ? 98 ?**

**Get the complement as 100 - 98 = 02. Set off the 2 digits from the right as the remainder consists of 2 digits. While carrying the added numbers to the place below the next digit, multiply by 02.**

**Thus**

**98 ) 100 / 15**
**02 02 / i.e., 10015 ? 98 gives**
**0 / 0 Q = 102, R = 19**
**/ 04**
**??????????**

**102 / 19**

---

**Example 7: Find 11422 ? 897 ?**

**Complement of 897 is 103**

**897 ) 11 / 422**
**103 1 / 03**
**/ 206**
**?????????**
**12 / 658 Answer is Q = 12, R=658.**

---

---

**Example 8: Find 1374 / 878 = ?**

**Step1. Separate off the last 3 digit of the dividend 1374 with a diagonal stroke**

**Step2. Write the complement of 878 ie 122 underneath 878.**

**878 ) 1 / 374**
**122**

**Step3. Bring down the first digit.**

**878 ) 1 / 374**
**122**
**1**

**Step4. Multiply this 1 by the complement 122 and write 1 X 122 = 122 underneath the next dividend digit**

**878 ) 1 / 374**
**122 122**
**1**

**Step5. Add up the second column. 374 +122 = 496 and this is the next quotient digit.**

**878 )  1 / 374**
**122  122**
**1 / 496**

**The answer is 1 remainder 496**

---

## Assignments

---

**Find The following**

**Q1) 3116 ? 98**

**Q2) 120012 ? 9**

**Q3) 1135 ? 97**

**Q4) 113401 ? 997**

**Q5) 11199171 ? 99979**

---

## Assignments Answers

---

**Q1 Find 3116 ? 88**

**Step1. Separate off the last 2 digit of the dividend 3116 with a diagonal stroke**

**Step2. Write the complement of 88 ie 12 underneath 98.**

**88 )  31 / 16**
**12**

**Step3. Bring down the first digit.**

**88)  31 / 16**
**12**
**3**

**Step4. Multiply this 3 by the complement 12 and write 3 X 12 = 36 underneath the next dividend digit**

**88 )  3 1 / 1 6**

**12 3 / 6**
**3**

**Step5. Add up the second column. 3 +1 = 4 and this is the next quotient digit.**

**88 ) 3 1 / 1 6**
**12 3 / 6**
**3 4**

**Step6. Multiply this 4 by the complement 12 and write 4 X 12 = 48 underneath the next dividend digit**

**88 ) 3 1 / 1 6**
**12 3 / 6**
**4 8**

**3 4 / 124**

**Remainder is 124 and it is greater than 88. Divide 124 by 88 gives 1 and remainder 36. Carry over 1 to left and gives 35/36**

**The answer is 35 remainder 36.**

**Q2) 120012 ? 9 = 13334 and remainder 6**

**Q3) 1135 ? 97 = 11 and remainder 68**

**Q4) 113401 ? 997 = 113 and remainder 740**

**Q5) 11199171 ? 99979 = 112 and remainder 11623**



## *Chapter 5 : Division*

---

**5.4.3 Division Techniques**

---

**5.4.4 Vulgar fractions whose denominators are numbers ending in 9 :**

---

**Consider examples of 1 / a9, where a = 1, 2, -----, 9. In the**

**conversion of such vulgar fractions into recurring decimals**

**Example.1: Division Method: Find the value of 1 / 19.**

**The numbers of decimal places before repetition is the difference of numerator and denominator, i.e.,, 19-1=18 places.**

**For the denominator 19, the previous is 1.**

**Hence one more than the previous is 1 + 1 = 2.**

**The method of division is as follows:**

**Step.1: Divide numerator 1 by 20.**
**1 / 20 = 0.1 / 2 = .$_1$0 (0 times, 1 remainder)**

**Step.2: Divide 10 by 2**
**0.0$_0$5(5 times, 0 remainder)**

**Step.3: Divide 5 by 2**
**0.05$_1$2 (2 times, 1 remainder)**

**Step.4: Divide 12 by 2**
**0.0526 (6 times, No remainder)**

**Step.5: Divide 6 by 2**
**0.05263 (3 times, No remainder)**

**Step. 6: Divide 3 by 2**
**0.05263$_1$1(1 time, 1 remainder)**

**Step.7: Divide $_1$1 i.e.,, 11 by 2**
**0.052631$_1$5 (5 times, 1 remainder)**

**Step.8: Divide $_1$5 i.e.,, 15 by 2**
**0.0526315$_1$7 ( 7 times, 1 remainder)**

**Step.9: Divide $_1$7 i.e.,, 17 by 2**
**0.05263157$_1$8 (8 times, 1 remainder)**

**Step.10: Divide $_1$8 i.e.,, 18 by 2**
**0.0526315789 (9 times, No remainder)**

**Step.11: Divide 9 by 2**
**0.0526315789$_1$4 (4 times, 1 remainder)**

**Step.12: Divide $_1$4 i.e.,, 14 by 2**

**0.052631578947 (7 times, No remainder)**

**Step.13: Divide 7 by 2**
**$0.052631578947_1$3 (3 times, 1 remainder)**

**Step. 14: Divide $_1$3 i.e.,, 13 by 2**
**$0.0526315789473_1$6 (6 times, 1 remainder)**

**Step.15: Divide $_1$6 i.e.,, 16 by 2**
**0.052631578947368 (8 times, No remainder)**

**Step.16: Divide 8 by 2**
**0.0526315789473684 (4 times, No remainder)**

**Step.17: Divide 4 by 2**
**0.05263157894736842 (2 times, No remainder)**

**Step.18: Divide 2 by 2**
**0.052631578947368421 (1 time, No remainder)**

**Now from Step 19, i.e.,, dividing 1 by 2, Step 2 to Step 18 repeats thus giving**

**1 / 19 = 0.052631578947368421**

**Note that we have completed the process of division only by using ?2?. Nowhere the division by 19 occurs.**



## *Chapter 5 : Division*

### 5.4.3 Division Techniques

### 5.4.4 Multiplication Method: Find the value of 1 / 19

**As we recognize the right most digit of the repeating block of decimals for the type 1 / a9. For any fraction of the form**

**i.e.,, in whose denominator 9 is the digit in is 1, we continue in the case of 1 / 19 as follows :**

**For 1/19, ?previous? of 19 is 1 and one more than of it is 1 + 1 = 2. In the case of 1/29 we work with 2 +1 =3 , In the case of 1/49 we work with 4+1 = 5**

**Therefore 2 is the multiplier for the conversion. In all cases of multiplication, we write the right most digit in the block as 1 and follow steps leftwards. When there is more than one digit in that product, we set the last of those digits down there and carry the rest of it over to the next immediately preceding digit towards left.**

**Step. 1 : 1**

**Step. 2 : 21 (multiply 1 by 2, put to left)**

**Step. 3 : 421 (multiply 2 by 2, put to left)**

**Step. 4 : 8421 (multiply 4 by 2, put to left)**

**Step. 5 : $_1$68421 (multiply 8 by 2 =16, 1 carried over, 6 put to left)**

**Step. 6 : $_1$368421 ( 6 X 2 =12,+1 [carry over] = 13, 1 carried over, 3 put to left )**

**Step. 7 : 7368421 ( 3 X 2, = 6 +1 [Carryover] = 7, put to left)**

**Step. 8 : $_1$47368421 (as in the same process)**

**Step. 9 : 947368421 ( continue to step 18)**

**Step. 10 : $_1$8947368421**

**Step. 11 : $_1$78947368421**

**Step. 12 : $_1$578947368421**

**Step. 13 : $_1$1578947368421**

**Step. 14 : 31578947368421**

**Step. 15 : 631578947368421**

**Step. 16 : $_1$2631578947368421**

**Step. 17 : 52631578947368421**

**Step. 18 : 1052631578947368421**

**Now from step 18 onwards the same numbers and order towards left continue.**

**Thus 1 / 19 = 0.052631578947368421**

**It is interesting to note that we have**

**i) Not at all used division process**
**ii) Instead of dividing 1 by 19 continuously, just multiplied 1 by 2 and continued to multiply the resultant successively by 2.**

**Observations:**

**a) For any fraction of the form 1/a9 i.e., in whose denominator 9 is the digit in the units place and ?a? is the set of remaining digits, the value of the fraction is in recurring decimal form and the repeating block?s right most digit is 1.**

**b) Whatever may be a9, and the numerator, it is enough to follow the said process with (a+1) either in division or in multiplication.**

**c) Starting from right most digit and counting from the right, we see (in the given example 1 / 19)**

**1 / 19 = 0 . 0 5 2 6 3 1 5 7 8 9 4 7 3 6 8 4 2 1**

**Sum of 1st digit + 10th digit = 1 + 8 = 9**
**Sum of 2nd digit + 11th digit = 2 + 7 = 9**
**Sum of 3rd digit + 12th digit = 4 + 5 = 9**
**- - - - - - - - -- - - - - - - - - - - - - - - - - - -**
**Sum of 9th digit + 18th digit = 9+ 0 = 9**

**From the above observations, we conclude that if we find first 9 digits, further digits can be derived as complements of 9.**

**i) Thus at the step 8 in division process we have 0.052631517 and next step. 9 gives 0.052631578**

**Now the complements of the numbers**
**0, 5, 2, 6, 3, 1, 5, 7, 8 from 9**
**9, 4, 7, 3, 6, 8, 4, 2, 1 follow the right order**

**i.e.,, 0.052631578947368421**

**Now taking the multiplication process we have**
**Step. 8 : 147368421**
**Step. 9 : 947368421**

**Now the complements of 1, 2, 4, 8, 6, 3, 7, 4, 9 from 9**

**i.e.,, 8, 7, 5, 1, 3, 6, 2, 5, 0 precede in successive steps, giving the answer. 0.052631578947368421.**

**d) When we get (Denominator ? Numerator) as the product in the multiplication process, half the work is done. We stop the multiplication there and write the remaining half of the answer by merely taking down complements from 9.**

**e) Either division or multiplication process of giving the answer can be put in a single line form.**



## *Chapter 5 : Division*

---

**5.4.3 Division Techniques**

---

**Find the value of 1 / 49**

---

**Here ?previous? is 4. ?One more than the previous? is 4 + 1 = 5. Now by division right ward from the left by ?5?.**

**1/49 = $._1$0 ---- (divide 1 by 50)**
**= .02 - - - - - - -(divide 2 by 5, 0 times, 2 remainder)**
**= .02$_2$0 - - - - -(divide 20 by 5, 4 times)**

**= .0204 - - - -- (divide 4 by 5, 0 times, 4 remainder)**
**= .0204$_4$0 -- -- (divide 40 by 5, 8 times)**
**= .020408 - - - (divide 8 by 5, 1 time, 3 remainder)**
**= .020408$_3$1 - -(divide 31 by 5, 6 times, 1 remainder)**
**= .0204081$_1$ 6 - - - - - - - continue**
**= .02040816$_1$3$_3$2$_2$6$_1$5306$_1$1$_1$2$_2$2$_2$4$_4$4$_4$8 - -- - - - -**

**On completing 21 digits, we get 48 [ Denominator - Numerator = 49 ? 1 = 48] standing up before us. Half of the process stops here. The remaining half can be obtained as complements from 9.**

**Thus 1 / 49 = 0.020408163265306122448 979591836734693877551**

**Now finding 1 / 49 by process of multiplication left ward from right by 5, we get**

**1 / 49 =----------1**
**=----------51**
**= ----------$_2$551**
**= ----------$_2$7551**
**= ----------$_3$77551**
**$_4$8$_3$9$_4$7$_2$9$_4$59$_4$1$_1$8$_3$3$_3$6$_1$7$_2$3$_3$4$_4$69$_4$3$_3$8$_3$7$_2$7551**

**Denominator ? Numerator = 49 ? 1 = 48**

**When we get 45 + 3 = 48 half of the process is over. The remaining half is automatically obtained as complements of 9.**

**Thus 1 / 49 = ----------979591836734693877551**

**= 0.020408163265306122448979591836734693877551**

---

**Example 2: Find 1/39**

---

**Now by multiplication method, 3 + 1 = 4**

**1/39 = ----------1**
**= ----------41**
**= ----------$_1$641**
**= ----------$_2$5641**
**= ----------$_2$25641**
**= ----------$_1$025641**
**Here the repeating block happens to be block of 6 digits. Now the rule predicting the completion of half of the computation does not hold. The complete block has to be computed.**

**Now continue and obtain the result.**

**1/39 = 0.025641025641025641025641...**

---

**Assignments**

---

**Find the recurring decimal form of the fractions**

**Q1. 1 / 29**

**Q2. 1 / 59**

**Q3. 1 / 69**

**Q4. 1 / 79**

**Q5. 1 / 89**

---

**Assignments Answers**

---

**Find the recurring decimal form of the fractions**

**Q1. 1 / 29 = 0.034482758620689655172413793103448....**

**Q2. 1 / 59 = 0.016949152542372881355932203389831...**

**Q3. 1 / 69 = 0.014492753623188405797 1.....**

**Q4. 1 / 79 = 0.0126582278481.....**

**Q5. 1 / 89 = 0.011235955056179775280898876404494**



## *Chapter 5 : Division*

---

## 5.4.3 Division Techniques

---

**General Method: Straight division**

---

**Example 4: 43852 ? 54.**

**Step1:**

**Put down the first digit (5) of the divisor (54) in the divisor column as operator and the other digit (4) as flag digit. Separate the dividend into two parts where the right part has one digit. This is because the flag digit is single digit.**

**The representation is as follows.**

```
4 : 4 3 8 5 : 2
5
```

**Step2:**

**i) Divide 43 by the operator 5. Now Q= 8 and R = 3. Write this Q=8 as the 1st Quotient - digit and prefix R=3, before the next digit i.e. 8 of the dividend, as shown below. Now 38 becomes the gross-dividend ( G.D. ) for the next step.**

```
4 : 4 3 8 5 : 2
5 :    3
_____________
  :  8
```

**ii) Subtract the product of flag digit (4) and first quotient digit (8) from the G.D. (38) i.e. 38-(4X8)=38-32=6. This is the net - dividend (N.D) for the next step.**

**Step3:**

**Now N.D Operator gives Q and R as follows. 6 ? 5, Q = 1, R = 1. So Q = 1, the second quotient-digit and R = 1, the prefix for the next digit (5) of the dividend.**

**4 : 4 3 8 5 : 2**
**5 : 3 1**
**_____**
**: 8 1**

**Step4:**

**Now G.D = 15; product of flag-digit (4) and 2nd quotient - digit (1) is 4X1=4 Hence N.D=15-4=11 divide N.D by 5 to get 11 ? 5, Q = 2, R= 1. The representation is**

**4 : 4 3 8 5 : 2**
**5 : 3 1 :1**
**_____**
**: 8 1 2 :**

**Step5:**

**Now the RHS part has to be considered. The final remainder is obtained by subtracting the product of flag-digit (4)and third quotient digit (2) form 12.**
**Final remainder = 12 - (4 X 2) = 12 - 8 = 4.**
**Thus the division ends into**

**4 : 4 3 8 5 : 2**
**5 : 3 1 : 1**
**_____**
**: 8 1 2 : 4**

**Thus 43852 ? 54 gives Q = 812 and R = 4.**

---

**Example 5: Divide 237963 ? 524**

**Step1:**

**We take the divisor 524 as 5, the operator and 24, the flag-digit and proceed as in the above example. We now separate the dividend into two parts where the RHS part contains two digits for Remainder.**

**24 : 2 3 7 9 : 63**
**5**

**Step2:**

**i) 23?5 gives Q = 4 and R = 3, G.D = 37.**
**ii) N.D is obtained as**

**= 37 ? ( 4 x 2 + 4 x 0)**
**= 29.**

**Representation**
**24 : 2 3 7 9 : 63**
**5 3**
**_____**
**: 4**

**Step3:**

**i) N.D ? Operator = 29 ? 5 gives Q = 5, R = 4 and G.D = 49.**
**ii) N.D is obtained as**

**= 49 ? (10 + 16)**
**= 49 ? 26**
**= 23.**

**i.e.,**
**24 : 2 3 7 9 : 63**
**5 : 3 4 :**
**_____**
**: 4 5 :**

**Step 4:**

**i) N.D ? Operator = 23 ? 5 gives Q = 4, R = 3 and G.D = 363.**
**Note that we have reached the remainder part, thus 363 is total sub?remainder.**

**24 : 2 3 7 9 : 63**
**5 : 3 4 : 3**
**_____**
**: 4 5 4 :**

**Step 5:**

**We find the final remainder as follows.**
**Subtract the cross-product of the two, flag-digits [2,4] and two last quotient-digits [5,4] and then vertical product of last flag-digit with last quotient-digit from the total sub-remainder.**
**Note that 2, 4 are two flag digits: 5, 4 are two last quotient digits:**

**363 - [ ( 8 + 20 ) / $_1$6 ] = 363 - [ 28 / $_1$6 ]**
**= 363 - 296 = 67**

**Thus the division 237963 ? 524 gives Q = 454 and R = 67.**

---

**Assignment**

---

**Q1. Find 2465 / 98**

**Q2 . Find 1313 / 867**

**Q3 . Find 111 / 76**

**Q4 . Find  12034 / 8877**

**Q4. Find 166 / 82**

---

**Assignment Answers**

---

**Q1. Find 2465 / 98**

**Step1:**

**Put down the first digit (9) of the divisor (98) in the divisor column as operator and the other digit (8) as flag digit. Separate the dividend into two parts where the right part has one digit. This is because the flag digit is single digit.**

**The representation is as follows.**

**8 : 2 4 6 : 5**
**9**

**Step2:**

**i) Divide 24 by the operator 9. Now Q= 2 and R = 6.  Write this Q=2 as the 1st Quotient - digit and prefix R=6, before the next digit i.e. 1 of the dividend, as shown below. Now 61 becomes the gross-dividend ( G.D. ) for the next step.**

**8 : 2 4 6 : 5**
**9 :  6**
**_____**

**: 2**

**ii) Subtract the product of flag digit (8) and first quotient digit (2) from the G.D. (66) i.e. 66-(2X8)=66-16=50. This is the net - dividend (N.D) for the next step.**

**Step3:**

**Now N.D Operator gives Q and R as follows. 50 ? 9, Q = 5, R = 5. So Q = 5, the second quotient-digit and R = 5, the prefix for the next digit (5) of the dividend.**

**8 : 2 4 6 : 5**
**9 : 6 5**
**_____**
**: 2 5 :**

**Step4:**

**Now G.D = 55; product of flag-digit (8) and 2nd quotient - digit (5) is 8X5=40 Hence N.D=55-40=15**

**8 : 2 4 6 : 5**
**9 : 6 5**
**_____**
**: 2 5 : 15**

**Thus 2465 ? 98 gives Q = 25 and R = 15.**

---

**Q2 . Find 1313 / 867**

**Step1:**

**We take the divisor 867 as 8, the operator and 67, the flag-digit and proceed as in the above example. We now separate the dividend into two parts where the RHS part contains two digits for Remainder.**

**67 : 13 : 13**
**8**

**Step2:**

**i) 13?8 gives Q = 1 and R = 5**

**Representation**
**67 : 1 3 : 1 3**
**8 5**
**_____**
**: 1**

**Step 3: We find the final remainder as follows. Subtract the cross-product from 513 - 67 = 446**

**67 : 1 3 : 1 3**
**8 5**
**_____**
**: 1 : 446**

**Thus the division 1313 ? 867 gives Q = 1 and R = 446.**

---

**Q3 . Find 111 / 76**

**Step1:**

**We take the divisor 76 as 7, the operator and 6, the flag-digit and proceed as in the above example. We now separate the dividend into two parts where the RHS part contains one digit for Remainder.**

**6 : 11 : 1**
**7**

**Step2:**

**i) 11?7 gives Q = 1 and R = 4**

**Representation**
**6 : 1 1 : 1**
**7 4**
**_____**
**: 1**

**Step 3: G.D = 41. N.D is obtained as**

**= 41 ? ( 6 x 1 )**

**= 35.**

**6 : 1 1 : 1**
**7 4**
**_____**
**: 1 : 35**

**Thus the division 111 ? 67 gives Q = 1 and R = 35.**

---

**Q4 . Find 12034 / 8877**

**Step1:**

**We take the divisor 8877 as 88, the operator and 77, the flag-digit and proceed as in the above example. We now separate the dividend into two parts where the RHS part contains two digits for Remainder.**

**77 : 120 : 34**
**88**

**Step2:**

**i) 120?88 gives Q = 1 and R = 32**

**Representation**
**77 : 1 2 0 : 3 4**
**88 32**
**_____**
**: 1**

**Step 3:**

**We find the final remainder as follows. Subtract the cross-product from 3234 - 77 = 3157**

**G.D = 3234. N.D is obtained as**

**= 3234 ? ( 77X1)**
**= 3234 - 77 = 3157**

**77 : 1 2 0 : 3 4**
**88 32**
**_____**

**: 1 : 3157**

**Thus the division 12034 ? 8877 gives Q = 1 and R = 3157**

---

**Q4. Find 166 / 82**

**Step1:**

**We take the divisor 82 as 8, the operator and 2, the flag-digit and proceed as in the above example. We now separate the dividend into two parts where the RHS part contains one digit for Remainder.**

**2 : 16 : 6**
**8**

**Step2:**

**i) 16?8 gives Q = 2 and R = 0, G.D = 6.**

**2 : 1 6 : 6**
**8 0**
**_____**
**: 2 :**

**Remainder is calculated as 6 - 2X2= 2**

**2 : 1 6 : 6**
**8 0**
**_____**
**: 2 : 2**

**Thus the division 166 ? 82 gives Q = 2 and R = 0.**

---

# *Chapter 5 : Division*

## 5.4. Divisibility Test for 7,13,19,39

### 5.4.1 Divisibility by 7

**Is 33803 divisible by 7?**

**1/7 is same as 7/49 .**

**The test for 49 uses 5 (5 being one more than the 4 of 49). 5 is the called the Osculator, P = 5. The process employed is called Osculation**

> **Multiply units place by Osculator 3 X 5 = 15.**
> **Add the next digit, 15 + 0 = 15**
>
> **Casting out 7's leaves 15 - 2X7 = 1 Repeat this process for other digits**
>
> **1 X 5 = 5, 5 + 8 = 13. Casting out 7?s leaves 6.**
>
> **6 X 5 = 30, 30 + 3 = 33. Casting out 7?s leaves 5.**
>
> **5 X 5 = 25, 25 + 3 = 28**
>
> **28 is divisible by 7 and therefore 33803 is divisible by 7.**

## Assignments

**Check The following numbers are divisible by 7**

> **Q1. 4523**
>
> **Q2. 87339**
>
> **Q3. 12349**
>
> **Q4. 987**

**Assignments Answers**

**Check The following numbers are divisible by 7**

**Q1. 4527 is not divisible by 7**

**Q2. 87345 is divisible by 7**

**Q3. 12349 is not divisible by 7**

**Q4. 987 is divisible by 7**



# *Chapter 5 : Division*

## 5.4. Divisibility Test for 7,13,19, 29 etc

### 5.4.2 Divisibility by 13

**Is 42705 divisible by 13?**

**1/13 is same as 3/39 . So we use Osculator as 4**

**5 X 4 = 20, 20 + 0 = 20. Casting out 13?s leaves 7.**

**7 X 4 = 28, 28 + 7 = 35. Casting out 13?s leaves 9.**

**9 X 4 = 36, 36 + 2 = 38. Casting out 13?s leaves 12.**

**12 X 4 = 48, 48 + 4 = 52**

**52 is divisible by 13 and therefore 42705 is divisible by 13.**

**Assignments**

**Check the following numbers are divisible by 13**

**Q1. 2908**

**Q2. 8723**

**Q3. 123567**

**Q4. 78351**

**Assignments Answers**

**Check the following numbers are divisible by 13**

**Q1. 2908 is not divisible by 13**

**Q2. 8723 is divisible by 13**

**Q3. 123567 is not divisible by 13**

**Q4. 78351 is not divisible by 13**



# *Chapter 5 : Division*

## 5.4. Divisibility Test for 7,13,19, 29 etc

### 5.4.3 Divisibility by 19

**The test for 19 uses 2 (2 being one more than the 1 of 19). 2 is the called the Osculator, P = 2. The process employed is called Osculation**

**Is 548 divisible by 19?**

**Osculator is 1+1 = 2**

**Multiply units place by Osculator 8 X 2 = 16. Add the next digit, 16 + 4 = 20, and multiply by 2, 20 X 2 = 40. Add the next digit, 40 + 5 = 45.**

| | | |
|---|---|---|
| 5 | 4 | 8 |
| 90 | 45 | 20 |

**90 is not divisible by 19 and therefore 548 is also not divisible by 19.**

**Is 1015968 divisible by 19?**

**Osculator is 1+1 = 2**

**Starting at the right-hand end, 8 X 2 = 16. Add the next digit, 16 + 6 = 22. Cast out 19?s, 22 ? 19 = 3.**

**3 X 2 = 6. Add the next digit, 6 + 9 = 15.**

**15 X 2 = 30. Cast out 19?s = 11, add the 5 = 16.**

**16 X 2 = 32, cast out 19 leaving 13 and add 1 = 14.**

**14 X 2 = 28, cast out, = 9, and add 0, = 9.**

**9 X 2 = 18, add 1 = 19.**

**19 is divisible by 19 and therefore 1015968 is divisible by 19.**

---

**Assignments**

---

**Check the following numbers are divisible by 19**

**Q1. 204567**

**Q2. 7866**

**Q3. 1234943**

**Q4. 987**

**Assignments Answers**

**Check the following numbers are divisible by 19**

**Q1. 204567 is not divisible by 19**

**Q2. 7866 is divisible by 19**

**Q3. 1234943 is divisible by 19**

**Q4. 987 is not divisible by 19**



# *Chapter 5 : Division*

## 5.4. Divisibility Test for 7,13,19,39

### 5.4.4 Divisibility Test for 39

**Is 161928 divisible by 39?**

**Osculator is 3+1 = 4**

**Starting at the right-hand end, 8 X 4 = 32. Add the next digit, 32 + 2 = 34.**

**34 X 4 = 136. Add the next digit,136 + 9 = 145. Cast out 39's from 145, giving 145 - 3 X39 = 28.**

**28 X 4 = 112. Add the next digit,112 +1 =113. Cast out 39?s = 35.**

**35 X 4 = 140, Add the next digit 6 , 140+6 =146. cast out 39 leaving 29**

**29 X 4 = 116 , and add 1, = 117.**

**117 is divisible by 39 and therefore 161928 is divisible by**

**39.**

---

**Assignments**

---

**Check the following numbers are divisible by 39**

**Q1. 34567**

**Q2. 976**

**Q3. 1287**

**Q4. 9876516**

---

**Assignments Answers**

---

**Check the following numbers are divisible by 39**

**Q1. 34567 is not divisible by 39**

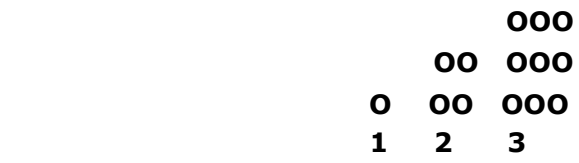
**Q2. 976 is not divisible by 39**

**Q3. 1287 is divisible by 39**

**Q4. 9876516 is divisible by 39**

# *Chapter 6 : Squaring Techniques*

## 6.0 Square Numbers



| | | | | |
|---|---|---|---|---|
| **Number of Squares** | **1** | **2** | **3** | **4** |
| **Number of counts** | **1** | **4** | **9** | **16** |

**The numbers 1,4,9,16....are called Square Numbers because you can arrange the number of counters to form a Square. The 4 Counters are in 2 rows of 2. The 9 counters are in 3 rows and 3 columns.**

**1 X 1 = 1**
**2 X 2 = 4**
**3 X 3 =9**

**So if we square a number we multiply it by itself. 3 Squared is $3^2$=3X3 = 9 ; 4 Squared is $4^2$=4X 4 =16;**

**Square numbers always have an odd number of factors. All other numbers have an even number of factors**



# *Chapter 6 : Squaring Techniques*

## 6.1 Squaring Techniques : Squares of numbers ending in 5 :

**Consider the example $25^2$.**

**We have to find out the square of the number 25. For the number 25, the last digit is 5 and the "previous" is 2.**

**Hence 'one more than' previous is 2+1=3. The method is 'to multiply the previous digit 2 by one more than itself, by 3'. It becomes the LHS of the result, 2 X 3 = 6. The RHS of the result is $5^2$, i.e., 25.**

**Thus $25^2$ = (2 X 3) / 25 = 625.**

**In the same way,**

**$35^2$= 3 X (3+1) /25 = 3 X 4 / 25 = 1225;**
**$65^2$= 6 X 7 / 25 = 4225;**
**$105^2$= 10 X 11/25 = 11025;**
**$135^2$= 13 X 14/25 = 18225.**

---

**Assignments**

---

**Find the Squares of the following**

**Q1. 15**

**Q2. 125**

**Q3. 635**

**Q4. 1105**

**Q5. 2545.**

---

**Assignments Answers**

---

**Find the Squares of the following**

**Q1. $15^2$ = 225**

**Q2. $125^2$ = 15635**

**Q3. $635^2 = 403225$**

**Q4. $1105^2 = 1221025$**

**Q5. $2545^2 = 6477025$**



## *Chapter 6 : Squaring Techniques*

---

### 6.2 Squares of numbers close to bases of powers of 10.

---

**The Method is "what ever the deficiency subtract that deficit from the number and write along side the square of that deficit". This method can be applicable to obtain squares of numbers close to bases of powers of 10.**

---

**Method-1 : Numbers near and less than the bases of powers of 10.**

---

**Example 1: Find $9^2$**

**Here base is 10. The answer is separated in to two parts by a '/'**

**Note that deficit is 10 - 9 = 1**

**Multiply the deficit by itself or square it**

**$1^2 = 1$. As the deficiency is 1, subtract it from the number i.e., 9-1 = 8.**

**Now put 8 on the left and 1 on the right side of the vertical line or slash i.e., 8/1. Hence 81 is answer.**

---

**Example. 2: Find $96^2$**

**Here base is 100. Since deficit is 100-96=4 and square of it is 16.**
**The deficiency subtracted from the number 96 gives 96-4 = 92, we get the answer 92 / 16 Thus $96^2 = 9216$.**

---

**Example 3: Find $994^2$**

**Here base is 1000. Deficit is 1000 - 994 = 6.**
**Square of 6 is 36. Deficiency subtracted from 994 gives 994 - 6 = 988 Answer is 988 / 036 [036 since base 1000 has 3 zero's]**

**Answer = 988036**

---

**Example 4: Find $9988^2$**

**Base is 10,000. Deficit = 10000 - 9988 = 12.**
**Square of deficit = $12^2 = 144$.**

**Deficiency subtracted from number = 9988 - 12 = 9976.**

**Answer is 9976 / 0144 [0144 since base 10,000 has 4 zero's ].**

**Answer = 99760144**

---

**Example 5: Find $88^2$**

**Base is 100. Deficit = 100 - 88 = 12.**
**Square of deficit = $12^2 = 144$.**

**Deficiency subtracted from number = 88 - 12 = 76.**

**Now answer is 76 / $_1$44 [since base is 100, keep 44 and carry over 1 to left]**
**Answer = (76+1)/44 = 7744**

---

**Assignments**

---

**Find the Squares of the following**

**1) 7** **2) 98**

**3) 987** **4) 14**

**5) 116** **6) 1012**

**7) 19** **8) 475**

**9) 796** **10) 108**

**11) 9988** **12) 6014**

---

**Assignments Answers**

---

**Find the Squares of the following**

**1) 49** **2) 9604**

**3) 974169** **4) 196**

**5) 13456** **6) 1024144**

**7) 361** **8) 225625**

**9) 633616** **10) 11664**

**11) 99760144** **12) 36168196**

---



## *Chapter 6 : Squaring Techniques*

---

**Method-2 : Numbers near and greater than the bases of powers of 10.**

---

**Example: Find $13^2$ .**

**Instead of subtracting the deficiency from the number we add and proceed as in Method-1.**

**For $13^2$ , base is 10, surplus is 3.**

**Surplus added to the number = 13 + 3 = 16.**

**Square of surplus = $3^2$ = 9**

**Answer is 16 / 9 = 169.**

---

**Example: Find $112^2$ .**

**Base = 100, Surplus = 12,**

**Square of surplus = $12^2$ = 144**

**Add surplus to number = 112 + 12 = 124.**

**Answer is 124 / $_1$44 = (124+1)/44= 12544**

---

**Example 3: Find $10025^2$**

**Base = 10000, Surplus = 25,**

**Square of surplus = $25^2$ = 625**

**Add surplus to number = 10025 +25 = 10050.**

**Answer is 10050 / 0625 [ since base is 10,000 ]**

**= 100500625.**

---

**Assignments**

---

**Find the Squares of the following**

**1) 7** **2) 98**

**3) 987** **4) 116**

**5) 1012** **6) 9988**

---

**Assignments Answers**

---

**Find the Squares of the following**

**1) 49** **2) 9604**

**3) 974169** **4) 13456**

**5) 1024144** **6) 99760144**



## *Chapter 6 : Squaring Techniques*

---

**Method 3 This is applicable to numbers which are near to multiples of 10, 100, 1000 .... etc.**

---

**Example 1: Find $388^2$**

**Nearest base = 400.**
**400 = 4 x 100. As the number is less than the base we proceed as follows**

**Number 388, deficit = 400 - 388 = 12**

**Since it is less than base, deduct the deficit i.e. 388 - 12 = 376.**

**Multiply this result by 4 since base is 4 X 100 = 400.**

**376 x 4 = 1504**

**Square of deficit = $12^2$ = 144.**

**Hence answer is 1504 / $_1$44 = 150544 [ Since we have taken multiples of 100, write down 44 and carry 1 over to the left ].**

---

**Example 2: Find $485^2$**

**Nearest base = 500.**

**Treat 500 as 5 x 100 and proceed**

**Number 485, deficit = 500 - 485 = 15**

**Since it is less than base, deduct the deficit i.e. 485 - 15 = 470.**

**Multiply this result by 5 since base is 5 X 100 = 500.**

**470 x 5 = 2350**

**Square of deficit = $15^2$ = 225.**

**Hence answer is 2350 / $_2$55 [since we have taken multiples of 100].**

**Answer = 235255**

---

**Example 3: Find $67^2$**

**Nearest base = 70**

**Number 67, deficit = 70 - 67 = 3**

**Since it is less than base, deduct the deficit i.e. 67 - 03 = 64.**

**Multiply this result by 7 since base is 7 X 10 = 70.**

**64 x 7 = 448**

**Square of deficit = $3^2$ = 9.**

**Hence answer is 448 /9 [since we have taken multiples of 10].**

**Answer = 4489**

---

**Example 4: Find $416^2$**

**Nearest base = 400**

**Here surplus = 16 and 400 = 4 x 100**

**Number 416, deficit = 416 - 400 = 16**

**Since it is more than base, add the deficit i.e. 416 + 16 = 432.**

**Multiply this result by 4 since base is 4 X 100 = 400.**

**432 x 4 = 1728**

**Square of deficit = $16^2$ = 256**

**Hence answer is 1728 /$_2$56 = 173056 [since we have taken multiples of 100].**

---

**Example 5: $5012^2$**

**Nearest base is 5000**
**Here surplus = 12 and 5000 = 5 x 1000**

**Number 5012, surplus = 5012 - 5000 = 12**

**Since it is more than base, add the deficit 5012 + 12 = 5024.**

**Multiply this result by 5 since base is 5 X 1000 = 5000.**

**5024 x 5 = 25120**

**Square of deficit = $12^2$ = 144**

**Hence answer is 25120 /144 = 25120144 [since we have taken multiples of 1000, write down 144 as it is].**

---

**Assignments**

---

**Find the Squares of thefollowing**

**1) 7** **2) 98**

**3) 14** **4) 116**

**5) 1012** **6) 475**

**7) 118** **8) 6014**

**Assignments**

**Find the Squares of the following**

**1) 49** **2) 9604**

**3) 196** **4) 13456**

**5) 1024144** **6) 225625**

**7) 13924** **8) 36168196**



# *Chapter 6 : Squaring Techniques*

## 6.3 Straight Squaring:

**We have already noticed methods useful to find out squares of numbers. But the methods are useful under some situations and conditions only. Now we go to a more general formula.**

**The Duplex combination process is used in two different meanings.**

**They are a) by squaring**

**b) by cross-multiplying.**

**We use both the meanings of Duplex combination in the context of finding squares of numbers as follows:**

**We denote the Duplex of a number by the symbol D. We define**

- **for a single digit 'a', D =$a^2$.**
- **for a two digit number of the form 'ab', D =2( a x b ).**
- **for a 3 digit number like 'abc', D =2( a x c ) + $b^2$.**

- **for a 4 digit number 'abcd', D = 2( a x d ) + 2( b x c ) and so on.**

**If the digit is single central digit, D represents 'square'.**

**Consider the examples:**

| Number | Duplex D |
|---|---|
| 3 | $3^2 = 9$ |
| 6 | $6^2 = 36$ |
| 23 | 2 (2 x 3) = 12 |
| 64 | 2 (6 x 4) = 48 |
| 128 | $2 (1 \times 8) + 2^2 = 16 + 4 = 20$ |
| 305 | $2 (3 \times 5) + 0^2 = 30 + 0 = 30$ |
| 4231 | 2 (4 x 1) + 2 (2 x 3) = 8 + 12 = 20 |
| 7346 | 2 (7 x 6) + 2 (3 x 4) = 84 + 24 = 108 |

**For a n- digit number, the square of the number contains 2n or 2n-1 digits.**

**Thus in this process, we take extra Zeros to the left one less than the number of digits in the given numbers.**

---

**Examples:1 Find $62^2$**

**Since number of digits = 2, we take one extra ZERO to the left. Thus**

**062**

**For 2, D = $2^2$ = 4, Write down 4 as the right most digit**

**4**

**For 62, D = 2 ( 6 x 2) = 24 , write down 4 and carry over 2 to the left**

**$_2$44**

**For 062, D = 2 (0 x 2) + $6^2$ = 36**

**$_3$6$_2$44**

**Finally answer = 3844**

**$62^2 = 3844$.**

---

**Examples:2 Find $234^2$**

**Number of digits = 3.**

**Extra ZEROS added to the left =Number of digits -1 = 2 Thus**

**00234**

**For 4, D = $4^2$ = 16, Write down 6 as the right most digit and carry 1 over to left**

**$_1$6**

**For 34, D = 2 ( 3 x 4) = 24 , write down 4 and carry over 2 to the left**

**$_2$4$_1$6**

**For 234, D = 2 (2 x 4) + $3^2$ = 16 + 9 =25, write down 5 and carry over 2 to the left**

**$_2$5$_2$4$_1$6**

**For 0234, D = 2 (0 x 4) + 2 (2 x 3) = 0 + 12 =12, write down 2 and carry over 1 to the left**

**$_1$2$_2$5$_2$4$_1$6**

**For 00234, D = 2 (0 x 4) + 2 (0 x 3) + $2^2$ = 0 + 0 + 4 =4, write down 4 as it is**

**4$_1$2$_2$5$_2$4$_1$6**

**Finally answer = 54756**

**$234^2 = 54756$.**

---

**Examples:3 $1426^2$.**

**Number of digits = 4**

**Extra ZEROS =Number of digits -1 = 3 Thus**

**0001426**

**For 6, D = $6^2$ = 36, Write down 6 as the right most digit and carry 3 over to left**

**$_3$6**

**For 26, D = 2 ( 2 x 6) = 24 , write down 4 and carry over 2 to the left**

**$_2$4$_3$6**

**For 426, D = 2 (6 x 4) + $2^2$ = 48 + 4 =52, write down 2 and carry over 5 to the left**

**$_5$2$_2$4$_3$6**

**For 1426, D = 2 (1 x 6) + 2 (2 x 4) = 12 + 16 =28, write down 8 and carry over 2 to the left**

**$_2$8$_5$2$_2$4$_3$6**

**For 01426, D = 2 (0 x 6) + 2 (1 x 2) + $4^2$ = 0 + 4 + 16 =20, write down 0 and carry over 2 to the left**

**$_2$0$_2$8$_5$2$_2$4$_3$6**

**For 001426, D = 2 (0 x 6) + 2 (0 x 2) +2 (1 x 4) = 0 + 0 + 8 =8, write down 8 as it is**

**8$_2$0$_2$8$_5$2$_2$4$_3$6**

**For 0001426, D = 2 (0 x 6) + 2 (0 x 2) +2 (0 x 4) +$1^2$ = 0 + 0 + 0 + 1 =1, write down 8 as it is**

**18$_2$0$_2$8$_5$2$_2$4$_3$6**

**Finally answer = 2033476**

**$1426^2$ = 2033476**

---

**Assignments**

---

**Find the Squares of the following**

**Q1. 54** **Q2. 123**

**Q3. 2051** **Q4. 3146**

---

**Assignments Answers**

---

**Find the Squares of the following**

**Q1. 2916** **Q2. 15129**

**Q3. 4206601** **Q4. 9897316**

# *Chapter 7 : Cubing Techniques*

## 7.0 Cube Numbers

## 7.1 Cubing Technique : Find Cube of a two digit number

**Example 1 : Find Cube of a two digit number : 14.**

**i) Find the ratio of the two digits i.e. 1:4**

**ii) Now write the cube of the first digit of the number i.e. $1^3$**

**iii) Now write numbers in a row of 4 terms in such a way that the first one is the cube of the first digit and remaining three are obtained in a geometric progression with common ratio as the ratio of the original two digits (i.e. 1:4) i.e. the row is**

**1 4 16 64**

**iv) Write twice the values of 2nd and 3rd terms under the terms respectively in second row.**

**1 4 16 64**
**8 32 ( 2 x 4 = 8, 2 x 16 = 32)**

**v) Add the numbers column wise and follow carry over process.**

**First Column from Left: Bring down 4 and carry over 6**

**1 4 16 64**
**8 32**
**_____**
**$_6$4**

**Second Column from Left: 16 + 32 + 6 = 54 . Bring down 4 and carry over 5**

**1 4 16 64**
**8 32**
**_____**
**$_5$4 4**

**Third Column from Left: 4 + 8 + 5 = 17 . Bring down 7 and carry over 1**

**1 4 16 64**
**8 32**
**_____**
**$_1$7 4 4**

**Fourth Column from Left: 1+1 =2. Write down 2**

**1 4 16 64**
**8 32**
**_____**
**2 7 4 4**

**This 2744 is the cube of the number 14**

# *Chapter 7 : Cubing Techniques*

## 7.1 Cubing Technique : Find Cube of a two digit number

**Example 2 : Find Cube of a two digit number : 18.**

**i) Find the ratio of the two digits i.e. 1:8**

**ii) Now write the cube of the first digit of the number i.e. $1^3$**

**iii) Now write numbers in a row of 4 terms in such a way that the first one is the cube of the first digit and remaining three are obtained in a geometric progression with common ratio as the ratio of the original two digits (i.e. 1:8) i.e. the row is**

**1 8 64 512.**

**iv) Write twice the values of 2nd and 3rd terms under the terms respectively in second row.**

**1 8 64 512**
**16 128 ( 2 x8 = 16, 2 x 64 = 128)**

**v) Add the numbers column wise and follow carry over process.**

**First Column from Left: Bring down 2 and carry over 51**

**1 8 64 512**
**16 128**
**_____**
**$_{51}$2**

**Second Column from Left: 64+128+51 = 243 wrote down 3 and carry over 24**

**1 8 64 512**
**16 128**
**_____**
**$_{24}$3 2**

**Third Column from Left: 8+ 16 +24 = 48 write down 8 and carry over 3**

**1 8 64 512**
**16 128**
**_____**
**$_{4}$8 $_{24}$3 2**

**Fourth Column from Left: 4 +1 = 5, write down 5**

**1 8 64 $_{51}$2**
**16 128**
**_____**
**5 8 3 2**

**This 5832 is the cube of the number 18**

## *Chapter 7 : Cubing Techniques*

---

**7.1 Cubing Technique : Find Cube of a two digit number**

---

**Example 3 : Find Cube of a two digit number : 33.**

**i) Find the ratio of the two digits 3:3 gives 1:1**

**ii) Now write the cube of the first digit of the number i.e. $3^3$**

**iii) Now write numbers in a row of 4 terms in such a way that the first one is the cube of the first digit and remaining three are obtained in a geometric progression with common ratio as the ratio of the original two digits (i.e. 1:1) i.e. the row is**

**27 27 27 27**

**iv) Write twice the values of 2nd and 3rd terms under the terms respectively in second row.**

**27 27 27 27**
**54 54 ( 2 x27 = 54)**

**v) Add the numbers column wise and follow carry over process.**

**First Column from left : Bring down 7 as it is and carry over 2**

**27 27 27 27**
**54 54**
**_____**
**$_{2}$7**

**Second Column from left: 27+54+2 = 83 write down 3 and carry over 8.**

**27 27 27 27**
**54 54**
**_____**
**$_{8}$3 7**

**Third Column from left: 27 + 54 + 8 = 89 write down 9 and carry over 8**

**27 27 27 27**
**54 54**
**_____**
**$_{8}$9 3 7**

**Fourth Column from left: 27 +8 = 35, write down 35**

**27 27 27 27**
**54 54**
**_____**
**35 9 3 7**

**This 35937 is the cube of the number 33**

---

**Assignments**

---

**Find the cube of the following**

**Q1. 15** **Q2. 18**

**Q3. 24** **Q4. 36**

**Q5. 48**

---

**Assignments Answers**

---

**Find the cube of the following**

**Q1. 3375** **Q2. 5832**

**Q3. 13824** **Q4. 46656**

**Q5. 110592**

# *Chapter 7 : Cubing Techniques*

---

## 7.2 Cubing Technique : Find Cube of a 2 , 3 or 4 digit number

---

**Example 1 : Find Cube of a 3 digit number : 106.**

**To find $106^3$.**

**i) The base is 100 and excess is 6. In this context we double the excess and then add.**
**i.e. 106 + 12 = 118. ( 2 X 6 =12 )**

**This becomes the left - hand - most portion of the cube.**
**i.e. $106^3$ = 118 / - - - -**

**ii) Multiply the new excess by the initial excess**

**i.e. 18 x 6 = 108 (excess of 118 is 18)**

**Now this forms the middle portion of the product, of course 1 is carried over, 08 in the middle.**

**i.e. 1063 = 118 / $_1$ 08 / - - - - -**

**iii) The last portion of the product is cube of the initial excess.**
**i.e. $6^3 = 216$.**

**16 in the last portion and 2 carried over.**

**i.e. $106^3$ = 118 / $_1$08 / $_2$ 16 = 1191016**

---

**Example 2: Find $1002^3$.**

**To Find $1002^3$.**

**i) Base = 1000. Excess = 2. Left-hand-most portion of the cube becomes 1002+(2x2)=1006.**

**ii) New excess X initial excess = 6 x 2 = 12.**

**Thus 012 forms the middle portion of the cube since the base is 1000.**

**iii) Cube of initial excess = $2^3 = 8$.**

**So the last portion is 008, since the base has 3 zero digits.**

**Thus 10023 = 1006 / 012 / 008 = 1006012008.**

---

**Example 3: Find $94^3$.**

**To Find $94^3$.**

**i) Base = 100, deficit = - 6. Left-hand-most portion of the cube becomes 94 + ( 2 X-6) =94-12 =82.**

**ii) New deficit X initial deficit = -(100-82)x(-6)=-18x-6=108**

**Thus middle potion of the cube = 08 and 1 is carried over.**

**iii) Cube of initial deficit = $(-6)^3$ = -216**

**Now $94^3$ = 82 / $_1$08 / $_2$16 = 83 / 06 / 16**
**(since the carry 2 is subtracted from 8 to get 6)**

**Removing bar Number**
**= 83 / 05 / (100 - 16)**
**= 830584.**

---

**Example 4: Find $998^3$.**

**$998^3$ Base = 1000; initial deficit = - 2.**

**$998^3$ = (998 - [2 x 2]) / (- 6 x - 2) / $(- 2)^3$**

**= 994 / 012 / 008**

**Removing the bar number**
**= 994 / 011 / (1000 - 008)**

**= 994 / 011 / 992**

**= 994011992.**

---

**Assignments**

---

**Find the cube of the following**

**Q1. 92** **Q2. 112**

**Q3. 998** **Q4. 1003**

**Q5. 10007** **Q6. 9992**

---

**Assignments Answers**

---

**Find the cube of the following**

**Q1. 778688** **Q2. 1404928**

**Q3. 994011992** **Q4. 1009027027**

**Q5. 1002101470343** **Q6. 997601919488**

# *Chapter 8 : Square Roots*

## 8.0 Square Roots

## 8.1 Using straight Division

**Basic Rules for extraction of Square Root**

**The given number is first arranged in two-digit groups from right to left; and a single digit if any left over at the left hand ed is counted as a simple group itself**

**The number of digits in the square root will be the same as the number of digit-groups in the given number itself.**

- **25 will count as one group**
- **144 will count as 2 groups**
- **1024 as two groups**

**If the square root contains 'n' digits then square must contain 2n or 2n-1 digits**

**If the given number has 'n' digits then square root will have n/2 or (n+1)/2 digits**

**The squares of the first nine natural numbers are 1, 4,9,16,25,36,49,64,91 This means**

**An exact square cannot end in 2 ,3,7, or 8**

- **That a complete square ending in 1 must have either 1 or 9 [ mutual complements from 10] as the last digit of its square root.**
- **That a square can end in 4 , only if the square root ends in 2 or 8**
- **That ending of a square in 5 or 0 means that its square root ends in 5 or 0 respectively**
- **That a square can end in 6, only if the square root ends in 4 or 6**
- **That a square can end in 9, only if the square root ends in 3 or 7**

| **We can see that** |
|---|

- **1,5,6 and 0 at the end of a number reproduce themselves as the last digits in the square.**
- **The squares of complements from ten have the same last digit . i.e $1^2$ and $9^2$ , $2^2$ and $8^2$, $3^2$ and $7^2$, $4^2$ and $6^2$ , $5^2$ and $5^2$, $0^2$ and $10^2$ have the same ending.**
- **2,3,7 and 8 cannot be a final digit of a perfect square.**

**Start with previous knowledge of the number of digits in the square root (N) and the first digit(F).**

- **74562814 N=8 Digits in the square root is 8/2=4 and the first digit will be 8**
- **963106713 N=9 Digits in the square root is (9+1)/2=5 and the first digit will be 3**
- **Sqrt(0.16) = 0.4**

# *Chapter 8 : Square Roots*

## 8.1 Using straight Division

**Basic Rules for extraction of Square Root**

**We use both the meanings of Duplex combination in the context of finding squares of numbers.**

**We denote the Duplex of a number by the symbol D.**

**We define**

- **for a single digit 'a', D =$a^2$.**
- **for a two digit number of the form 'ab', D =2( a x b ).**
- **for a 3 digit number like 'abc', D =2( a x c ) + $b^2$.**
- **for a 4 digit number 'abcd', D = 2( a x d ) + 2( b x c ) and so on. i.e.**

**If the digit is single central digit, D represents 'square'**

**Consider the examples:**

| Number | Duplex D |
|---|---|
| 3 | $3^2 = 9$ |
| 6 | $6^2 = 36$ |
| 23 | 2 (2 x 3) = 12 |
| 64 | 2 (6 x 4) = 48 |
| 128 | 2 (1 x 8) + 2 x 2 = 16 + 4 = 20 |
| 305 | 2 (3 x 5) + 0 x 2 = 30 + 0 = 30 |
| 4231 | 2 (4 x 1) + 2 (2 x 3) = 8 + 12 = 20 |
| 7346 | 2 (7 x 6) + 2 (3 x 4) = 84 + 24 = 108 |

---

**Example 1: Find the square root of 119716**

**Step 1 : Arrange the number as follows groups of 2 digits starting from right.**

```
    1 1  :  9 7   1 6
  :      :
  :  3
```

**Step 2: Find the perfect square less that the first group 11 . i.e 9 and its square root is 3. Write down this 3 and the reminder 2 as shown below**

```
    1 1  :  9 7   1 6
6 :      : 2
  :  3
```

**New divisor is the exact double of the first digit of the quotient 3 X 2 = 6**

**Step 3 : Next gross dividend-unit is 29. Without subtracting anything from it, we divide 29 by the divisor 6 and put down the second Quotient digit 4 and the second reminder in their proper place .**

```
    1 1  :  9 7   1 6
6 :      : 2 5
  :  3   : 4
```

**Step 4 : Third gross dividend-unit is 57. From 57 subtract 16 [ Duplex value of the second quotient digit, D(4) = 16 ] , get 41 as the actual dividend. , divide it by 6 and set the**

**Quotient 6 and reminder 5 in their proper places**

```
    1 1 :  9 7   1 6
6 :     : 2 5   5
  :  3  : 4 6
```

**Step 5 : Fourth gross dividend-unit is 51. From 51 subtract Duplex D(46) = 48 [ because for 46 Duplex is 2(4 X 6) = 48 ] obtain 3 , divide this 3 by 6 and put down Quotient as 0 and reminder 3 in their proper places**

```
    1 1 :  9 7   1 6
6 :     : 2 5   5 3
  :  3  : 4 6 . 0
```

**Step 6 : Fifth gross dividend-unit is 36. From 36 subtract Duplex(6) = 36 [ because for 6 Duplex is $6^2 = 36$ ] obtain 0 , This means the work is completed.**

```
    1 1 :  9 7   1 6
6 :     : 2 5   5 3
  :  3  : 4 6 . 00
```

**The given number is a perfect Square and 346 is the square root**

**A number cannot be an exact square when**

- **it ends in 2, 3,7 or 8**
- **it terminates in an odd number of zeros**
- **its last digit is 6 but its penultimate digit is even**
- **its last digit is not 6 but its penultimate digit is odd**
- **its last 2 digits are not divisible by 4**

# *Chapter 9 : Cube Roots*

## 9.0 Cube Roots

**Basic Rules for extraction of Cube Roots**

**The given number is first arranged in three-digit groups from right to left. A single digit if any left over at the left hand is counted as a simple group itself**

**The number of digits in the cube root will be the same as the number of digit-groups in the given number itself.**

- **125 will count as one group**
- **1000 will count as 2 groups**
- **15625 as two groups**

**If the cube root contains 'n' digits , the cube must contain 3n or 3n-1 digits**

**If the given number has 'n' digits the cube root will have n/3 or (n+1)/3 digits**

**The first digit of the Cube root will always be obvious from the first group in the cube .**

**For example a cube number with first group as 226 , the first digit of the cube root will be 6 since $6^3$ is 216 which is a perfect cube closer to 226.**

**The Cubes of the first nine natural numbers are**

**$1^3 = 1$**
**$2^3 = 8$**
**$3^3 = 27$**
**$4^3 = 64$**

**$5^3 = 125$**
**$6^3 = 216$**
**$7^3 = 343$**
**$8^3 = 512$**
**$9^3 = 729$**

**This means, the last digit of the cube root of an exact cube is**

- **Cube ends in 1 , the Cube Root ends in 1**
- **Cube ends in 2 , the Cube Root ends in 8**
- **Cube ends in 3 , the Cube Root ends in 7**
- **Cube ends in 4 , the Cube Root ends in 4**
- **Cube ends in 5 , the Cube Root ends in 5**
- **Cube ends in 6 , the Cube Root ends in 6**
- **Cube ends in 7 , the Cube Root ends in 3**
- **Cube ends in 8 , the Cube Root ends in 2**
- **Cube ends in 9 , the Cube Root ends in 9**

**We can see that**

- **1,4,5,6,9,0 repeat themselves in the cube ending**
- **2,3,7 and 8 have their complements from 10, in the cube ending**

**Start with previous knowledge of the number of digits (N), first digit (F) and last digit (L) , in the cube root**

---

**Example 1: For 226981 , Find F, L and N**

**Write 226981 as 226, 981 , the number of 3 digit groups , N =2**
**Last digit of the cube is 1, the cube root also ends in 1, so L=1**

**The first group is 226 , the closest minimum exact cube to 226 is 216 which is nothing but $6^3$**

**The fist digit of the Cube root is 6. F=6**

---

**Example 2 For 1728 : Find F, L and N**

**Write 1278 as 1,278 , the number of 3 digit groups , N =2**

**Last digit of the cube is 8, the cube root ends in 2, so L=2**

**The first group is 1 , the closest minimum exact cube to 1 is 1 which is nothing but $1^3$**

**The fist digit of the CR is 1, F=1**

---

**Example 3: For 83453453 : Find F, L and N**

**Write 83453453 as 83,453, 453 the number of 3 digit groups , N =3**

**Last digit of the cube is 3, the cube root ends in 7, so L=7**

**The first group is 83 , the closest minimum exact cube to 83 is 64 which is nothing but $4^3$**

**The fist digit of the CR is 4, F=4**

---

**Assignments**

---

**Find F, L and N of the following**
**Q1. 1548816893**

**Q2. 4251528**

**Q3. 33076161**

**Q4. 1728**

**Q5. 6699961286208**

---

**Assignments Answers**

---

**Find F, L and N of the following**
**Q1. F = 1 , L =7 , N = 4**

**Q2. F = 1 , L =2 , N = 3**

**Q3. F = 3 , L =1 , N = 3**

**Q4. F = 1 , L =2 , N = 2**

**Q5. F = 1 , L =2 , N = 5**

# *Chapter 9 : Cube Roots*

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## 9.0 Cube Roots

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**Basic Rules for extraction of Cube Roots**

**The given number is first arranged in three-digit groups from right to left. A single digit if any left over at the left hand is counted as a simple group itself**

**The number of digits in the cube root will be the same as the number of digit-groups in the given number itself.**

- **125 will count as one group**
- **1000 will count as 2 groups**
- **15625 as two groups**

**If the cube root contains 'n' digits , the cube must contain 3n or 3n-1 digits**

**If the given number has 'n' digits the cube root will have n/3 or (n+1)/3 digits**

**The first digit of the Cube root will always be obvious from the first group in the cube .**

**For example a cube number with first group as 226 , the first digit of the cube root will be 6 since $6^3$ is 216 which is a perfect cube closer to 226.**

**The Cubes of the first nine natural numbers are**

**$1^3 = 1$**
**$2^3 = 8$**
**$3^3 = 27$**
**$4^3 = 64$**
**$5^3 = 125$**
**$6^3 = 216$**
**$7^3 = 343$**
**$8^3 = 512$**
**$9^3 = 729$**

**This means, the last digit of the cube root of an exact cube is**

- **Cube ends in 1 , the Cube Root ends in 1**
- **Cube ends in 2 , the Cube Root ends in 8**
- **Cube ends in 3 , the Cube Root ends in 7**
- **Cube ends in 4 , the Cube Root ends in 4**
- **Cube ends in 5 , the Cube Root ends in 5**
- **Cube ends in 6 , the Cube Root ends in 6**
- **Cube ends in 7 , the Cube Root ends in 3**
- **Cube ends in 8 , the Cube Root ends in 2**
- **Cube ends in 9 , the Cube Root ends in 9**

**We can see that**

- **1,4,5,6,9,0 repeat themselves in the cube ending**
- **2,3,7 and 8 have their complements from 10, in the cube ending**

**Start with previous knowledge of the number of digits (N), first digit (F) and last digit (L) , in the cube root**

---

**Example 1: For 226981 , Find F, L and N**

**Write 226981 as 226, 981 , the number of 3 digit groups , N =2**

**Last digit of the cube is 1, the cube root also ends in 1, so L=1**

**The first group is 226 , the closest minimum exact cube to 226 is 216 which is nothing but $6^3$**

**The fist digit of the Cube root is 6. F=6**

---

**Example 2 For 1728 : Find F, L and N**

**Write 1278 as 1,278 , the number of 3 digit groups , N =2**

**Last digit of the cube is 8, the cube root ends in 2, so L=2**

**The first group is 1 , the closest minimum exact cube to 1 is 1 which is nothing but $1^3$**

**The fist digit of the CR is 1, F=1**

---

**Example 3: For 83453453 : Find F, L and N**

**Write 83453453 as 83,453, 453 the number of 3 digit groups , N =3**

**Last digit of the cube is 3, the cube root ends in 7, so L=7**

**The first group is 83 , the closest minimum exact cube to 83 is 64 which is nothing but $4^3$**

**The fist digit of the CR is 4, F=4**

---

**Assignments**

---

**Find F, L and N of the following**

**Q1. 1548816893**

**Q2. 4251528**

**Q3. 33076161**

**Q4. 1728**

**Q5. 6699961286208**

**Assignments Answers**

**Find F, L and N of the following**

**Q1. F = 1 , L =7 , N = 4**

**Q2. F = 1 , L =2 , N = 3**

**Q3. F = 3 , L =1 , N = 3**

**Q4. F = 1 , L =2 , N = 2**

**Q5. F = 1 , L =2 , N = 5**



# *Chapter 9 : Cube Roots*

**9.0 Cube Roots**

**General Method**

**Example 2: Find the cube root of 417 to 3 decimal places**

**Arrange the number as follows groups of 3 digits starting from right.**

**Step 1**

**417 : 0 0 0**

**By inspection write down 7 and 74 as the first Q and R . Since 343 is the perfect cube close to 417 and the reminder from 417 is 74**

**Step 2**

**417 : 0 0 0 0**

**147 : : 74**

**: 7 :**

**The dividend is found by multiplying the Quotient Squared by 3 , $7^2$ X 3 = 147**

**Step 3**

| | | | | | |
|---|---|---|---|---|---|
| | 417 | : | 0 | 0 | 0 | 0 |
| 147 | : | : | 74 | 152 | | |
| | : | 7 | : | 4 | | |

**The second gross dividend is 740 , Do not subtract anything from this, divide it by 147 and put down 4 as Quotient and 152 as Remainder.**

**Step 4**

| | | | | | | |
|---|---|---|---|---|---|---|
| | 417 | : | 0 | 0 | 0 | 0 |
| 147 | : | : | 74 | 152 | 155 | |
| | : | 7 | : | 4 | 7 | |

**The third gross dividend is 1520 , subtract $3ab^2$ , 3 x 7 x $4^2$ = 336 .**

**The third actual working Dividend is 1520 - 336 = 1184 .**

**Divide 1184 by 147 and put down 7 as Quotient and 155 as Remainder.**

**Step 5**

| | | | | | | |
|---|---|---|---|---|---|---|
| | 417 | : | 0 | 0 | 0 | 0 |
| 147 | : | : | 74 | 152 | 155 | 163 |
| | : | 7 | : | 4 | 7 | 1 |

**The $4^{th}$ gross dividend is 1550 , subtract $6abc + b^3$ , 6 x 7 x 4 x 7 + $4^3$ = 1176 + 64 = 1240.**

**The $4^{th}$ actual working Dividend is 1550 - 1240 = 310.**

**Divide 310 by 147 and put down 1 as Quotient and 163 as Remainder.**

**Step 6**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 417 | : | 0 | 0 | 0 | 0 | |
| 147 | : | : | 74 | 152 | 155 | 163 | 118 |
| | : | 7 | : | 4 | 7 | 1 | 1 |

**The 5th gross dividend is 1630 , subtract $3ac^2 + 3b^2c$ , 3 x 7 x $1^2$ + 3 x $4^2$ x 7 = 1029 + 336 = 1365.**

**The 5th actual working Dividend is 1630 - 1365 = 265.**

**Divide 265 by 147 and put down 1 as Quotient and 118 as Remainder.**

**The number of digits in the cube root will be 1 , so the cube root is 7.4711**

---

**Assignments**

---

**Find the cube root of the following up to 3 decimals**

**Q1. 250** **Q2. 1500**

**Q3. 1728** **Q4. 13824**

**Q5. 33076161** **Q6. 30124**

**Q7. 83525660** **Q8. 105820461**

---

**Assignments Answers**

---

**Find the cube root of the following up to 3 decimals**

**Q1. 6.2996** **Q2. 11.4471**

**Q3. 12.000** **Q4. 24.000**

**Q5. 321.000** **Q6. 31.115**

**Q7. 437.126** **Q8. 472.995**



## *Chapter 9 : Cube Roots*

## 9.0 Cube Roots

**General Method**

**The divisor should not be too small. The smallness will give rise to big quotients with several digits. This will lead to complications.**

**Another method is to multiply the given number by another small number cubed and find the cube root. Final answer is calculated by dividing the result by small number**

**Example 4: Find the cube root of 2**

**We multiply 2 by $5^3$**

**The new Number becomes 2 x 125 = 250**

**Find the cube root of 250 and divide the answer by 5 [ since we multiplied the original number by $5^3$ ]**

**Step 1**

```
          250   :  0     0    0
```

**By inspection write down 6 and 34 as the first Q and R . Since 216 is the perfect cube close to 250 and the reminder from 250 is 34.**

**Step 2**

```
          250 :     0   0   0
    108 :       :   34
          :  6  :
```

**The dividend is found by multiplying the Quotient Squared by 3 , $6^2$ X 3 = 108**

**Step 3**

```
          250  :     0     0   0
    108 :      :   34  124
          :  6 :    2
```

**The second gross dividend is 340 , Do not subtract anything from this, divide it by 108 and put down 2 as Quotient and**

**124 as Remainder.**

**Step 4**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 250 | : | 0 | 0 | 0 |
| 108 | : | | : | 34 | 124 | 196 |
| | : | 6 | : | 2 | 9 | |

**The third gross dividend is 1240 , subtract $3ab^2$ , 3 x 6 x $2^2$ = 72.**

**The third actual working Dividend is 1240 - 72 = 1168.**

**Divide 1168 by 108 and put down 9 as Quotient and 196 as Remainder.**

**Step 5**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 250 | : | 0 | 0 | 0 | |
| 108 | : | | : | 34 | 124 | 196 | 332 |
| | : | 6 | : | 2 | 9 | 9 | |

**The $4^{th}$ gross dividend is 1960 , subtract $6abc + b^3$ , 6 x 6 x 2 x 9 + $2^3$ = 648 + 8 = 656.**

**The $4^{th}$ actual working Dividend is 1960 - 656 = 1304.**

**Divide 1304 by 108 and put down 9 as Quotient and 332 as Remainder.**

**Step 6**

**The number of digits in the cube root will be 1 , so the cube root of 250 is 6.299**

**Cube root of 2 can be found by dividing 6.2999 by 5**

**The cube root of 2 is 1.259**