Simplification Techniques and Tricks

Simplification is one of the most important part of Quantitative Aptitude section of any competitive exam. Today I am sharing all the techniques to solve Simplification questions quickly.

Rules of Simplification
V → Vinculum
B → Remove Brackets - in the order ( ) , { }, [ ]
O → Of
D → Division
M → Multiplication
A → Addition
S → Subtraction

Important Parts of Simplification

- Number System
- HCF & LCM
- Square & Cube
- Fractions & Decimals
- Surds & Indices

Number System

- Classification
- Divisibility Test
- Division& Remainder Rules
- Sum Rules

Classification

Types	Description
Natural Numbers:	all counting numbers (1,2,3,4,5....∞)
Whole Numbers:	natural number + zero(0,1,2,3,4,5...∞)
Integers:	All whole numbers including Negative number + Positive number(∞.....-4,-3,-2,-1,0,1,2,3,4,5....∞)
Even & Odd Numbers :	All whole number divisible by 2 is Even (0,2,4,6,8,10,12.....∞) and which does not divide by 2 are Odd (1,3,5,7,9,11,13,15,17,19....∞)
Prime Numbers:	It can be positive or negative except 1, if the number is not divisible by any number except the number itself.(2,3,5,7,11,13,17,19,23,29,31,37,41,43,47,53,59,61....∞)

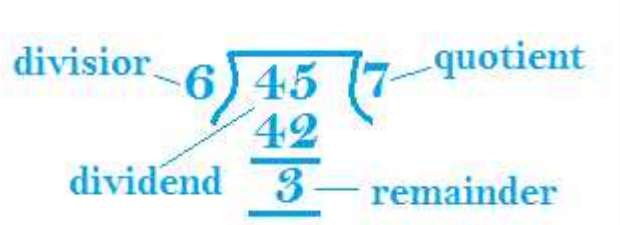
Composite Numbers:	Natural numbers which are not prime
Co-Prime:	Two natural number a and b are said to be co-prime if their HCF is 1.

Divisibility

Numbers	IF A Number	Examples
Divisible by 2	End with 0,2,4,6,8 are divisible by 2	254,326,3546,4718 all are divisible by 2
Divisible by 3	Sum of its digits is divisible by 3	375,4251,78123 all are divisible by 3. [549=5+4+9][5+4+9=18]18 is divisible by 3 hence 549 is divisible by 3.
Divisible by 4	Last two digit divisible by 4	5648 here last 2 digits are 48 which is divisible by 4 hence 5648 is also divisible by 4.
Divisible by 5	Ends with 0 or 5	225 or 330 here last digit digit is 0 or 5 that mean both the numbers are divisible by 5.
Divisible by 6	Divides by Both 2 & 3	4536 here last digit is 6 so it divisible by 2 & sum of its digit (like 4+5+3+6=18) is 18 which is divisible by 3.Hence 4536 is divisible by 6.
Divisible by 8	Last 3 digit divide by 8	746848 here last 3 digit 848 is divisible by 8 hence 746848 is also divisible by 8.
Divisible by 10	End with 0	220,450,1450,8450 all numbers has a last digit zero it means all are divisible by 10.
Divisible by 11	[Sum of its digit in odd places-Sum of its digits in even places]= 0 or multiple of 11	Consider the number 39798847 (Sum of its digits at odd places)-(Sum of its digits at even places)(7+8+9+9)-(4+8+7+3) (23-12) 23-12=11, which is divisible by 11. So 39798847 is divisible by 11.

Division & Remainder Rules

Suppose we divide 45 by 6



hence ,represent it as:

dividend = (divisor ✘ quotient) + remainder

or

divisior= [(dividend)-(remainder] / quotient

could be write it as

x = kq + r where (x = dividend,k = divisor,q = quotient,r = remainder)

Example:

On dividing a certain number by 342, we get 47 as remainder. If the same number is divided by 18, what will be the remainder ?

Number = 342k + 47

(18 ✘ 19k) + (18 ✘ 2) + 11

18 ✘ (19k + 2) +11.

Remainder = 11

Sum Rules

$(1+2+3+.....+n) = {}^1/_2\, n(n+1)$

$(1^2+2^2+3^2+.....+n^2) = {}^1/_6\, n\,(n+1)\,(2n+1)$

$(1^3+2^3+3^3+.....+n^3) = {}^1/4\, n^2\,(n+1)^2$

Arithmetic Progression (A.P.)

a, a + d, a + 2d, a + 3d, ...are said to be in A.P. in which first term = a and common difference = d.

Let the nth term be t_n and last term = l, then

a) nth term = a + (n - 1) d

b) Sum of n terms = ${}^n/_2$ [2a + (n-1)d]

c) Sum of n terms = ${}^n/_2$ (a+l) where l is the last term

Multiplication Tricks - Find solution within 20 seconds

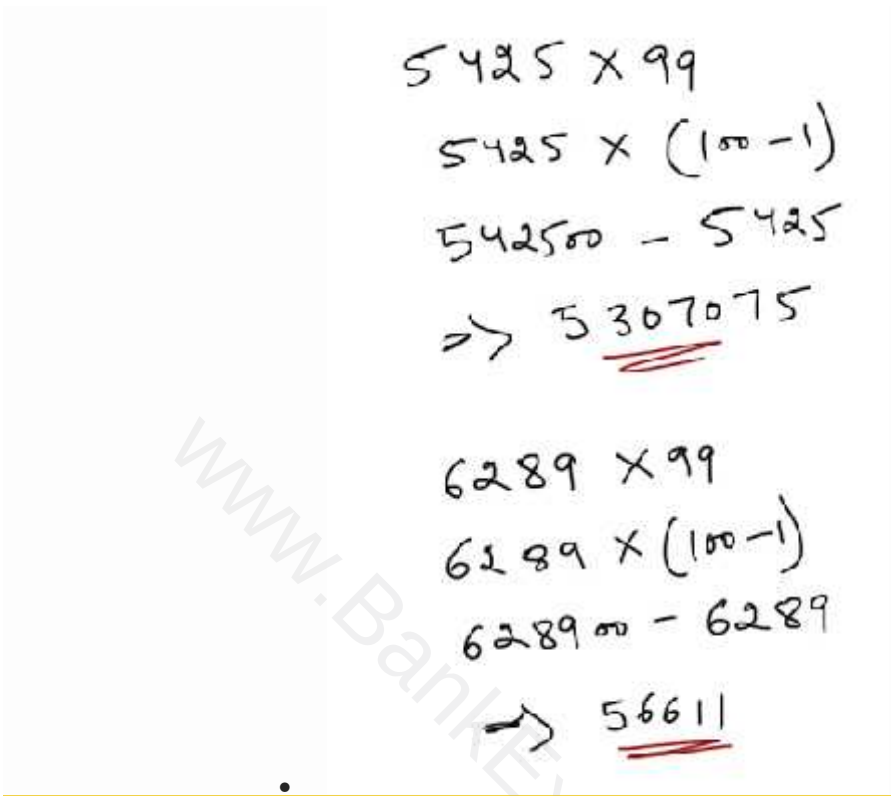
Today I am going to share quick multiplication tricks that will help you find the solution within 20 seconds. Must read - 10 Coolest Maths tricks

Multiply by 9,99,999,etc...

56*99=5544

Step 1:Place a zero at the end for each 9 :5600

Step 2 : Subtract the original number from Step 1 like this 5600-56=5544



Multiply by 125

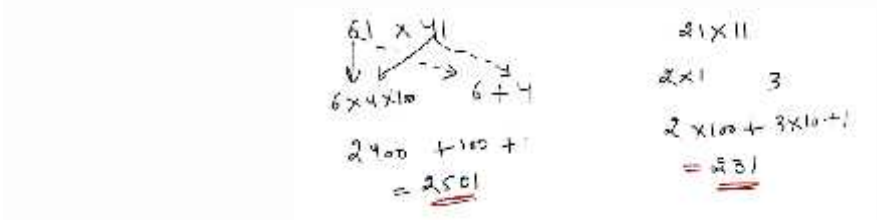
68*125=8500
Step 1 :Place three zeros at the end of the number :68000
Step 2: Divide the number from Step 1 by 8:68000/8=8500

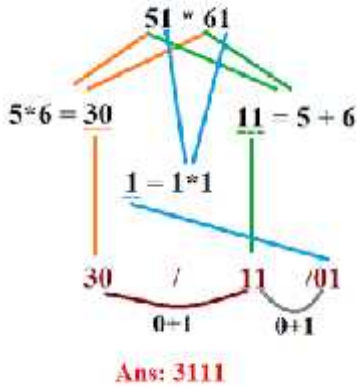
64*125 is the same as :
32*250 is the same as
16*500 is the same as
8*1000

64*125
Step 1. Each time you just need to pick 125 multiply it by 8 will get 1000
Step 2. Pick 64 and divide it by 8 will get 8
Step 3. Multiply the results with each other 8* 1000
Hence Solution is 8000
[Hint: Just remember 125*8=1000]

Multiply two digits numbers ending in 1

51*31=1581
Step 1: Multiply the left most digits : 5*3=15
Step 2: Add the left most digits:5+3=8
Step 3: Places the result from Step 2 next to the result from Step 1:158
Step 4 : Places 1 next to the result from Step 3 : 1581





Multiply numbers between 11 and 19

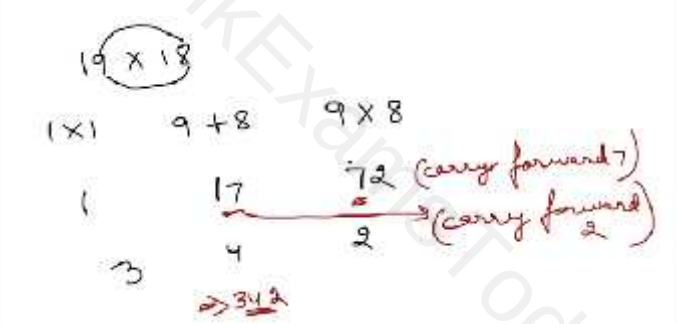
14*18=252

Step 1: Add the larger number to the right most digit of the other number:18+4=22

Step 2: Put a 0 at the end of the result from step 1:220

Step 3 :Multiply the right most digits of both original numbers : 8*4=32

Step 4:Add Step 2 and step 3 :220+32=252



Multiply two digit number by 11

53*11=583

Step 1: Add the both digts of the two digit number:5+3=8

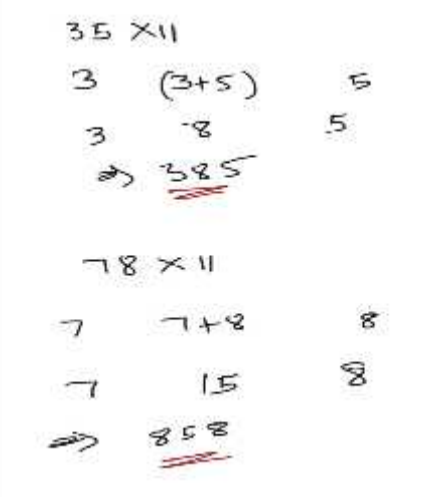
Step 2: Place the result in between both digits : 583

59*11=649

Step 1: 5+9=14

Step 2 : Carry the 1 when the result is greater than 9:5+1=6

Step 3: 649



Multiply by 5

1234 *5 =6170

Step 1 : Divide the number by 2 :1234/2=617

Step 2: Multiply the result from Step 1 by 10 : 617*10=6170

Multiply by 25

18*25=450

Step 1: Divide the number by 4:18/4

Step 2: Multiply the number from Step 1 by 100: 4.5 * 100 = 450

Multiply by 9

56*9=504

Step 1: Multiply the number by 10: 56*10=560

Step 2: Subtract the original number from Step 1: 560-56=504

Factorization

By Factoring number,you can break down problems into simpler multiplication tasks.Also,you may be able to apply some techniques you learned.

21*33

step 1 : 21*11*3

Step 2: 231*3

Step 3 :693

67*81

Step 1: 67*9*9

Step 2:603*9=5427

28*125=3500

Step 1: 28*125

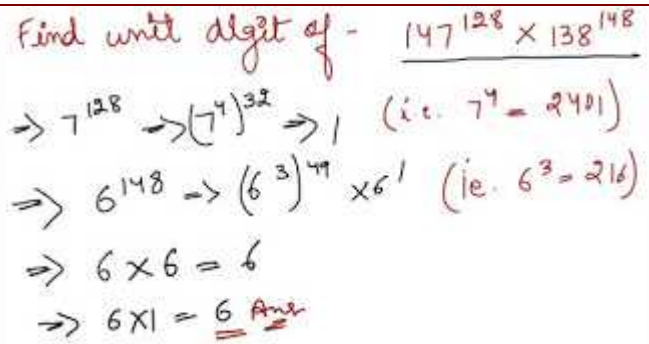
Step 2: 28*25*5

Step 3:28*(100/4)*5

Step 4:28/4*100*5

Step 5:7*500=3500

Find the unit digit of $147^{128} * 138^{148}$?



Unit Digit Shortcut - Find Last digit of any number

Suppose you have a series

P, Q, R, S ,T, P, Q, R, S ,T,P, Q, R, S ,T,P, Q, R, S ,T,P, Q, R, S , T,P, Q, R, S, T .....

And you have to find out the 16th term of the series. How would you do this?

One way to solve this is by counting the 16th term; you get your answer P.

The other way to solve: You can divide the 16 by 5 and get the remainder as 1. So now answer would be the 1st term that is P.

Why we have divided by 5 because the terms in the series are repeated after a cycle of 5.

Let us take another question.

Find out the 25th term of the above series. Following the same procedure you get

25/ 5 gives you the remainder zero (0)

In such case, your answer should be the last term of the cycle and the last term of the cycle is T

25th term is T.

Find out the unit digit in 268 × 453?

Now to solve this question, you are going to pick up the only last digits and in this case

__ __ 8× _ _ 3 which means 8×3 = 2 4

Unit digit

So the unit digit in the product 268 × 453 is 4.

Remember in such questions, in such questions, you are only going to get concerned about the unit digits

What is the unit digit in the product 753 × 43 × 1236 × 864?

Solution: let us pick up the unit digits and multiply them

3 in 753

3 in 43

6 in 1236

4 in 864

3 × 3 × 6 × 4 = ____ 6 **(concern only about unit digit in the product)**

So the unit digit in the product 753 × 43 × 1236 × 864 is 6.

Now let us observe the pattern in the cycle of different digit in other words after how many cycles the last digit repeats itself.

2	3	4	5	6	7	8	9
$2^1=2$	$3^1=3$	$4^1=4$	$5^1=5$	$6^1=6$	$7^1=7$	$8^1=8$	$9^1=9$
$2^2=4$	$3^2=9$	**$4^2=6$**	$5^2=5$	$6^2=6$	$7^2=9$	$8^2=4$	**$9^2=1$**
$2^3=8$	$3^3=7$	$4^3=4$	$5^3=5$	$6^3=6$	$7^3=3$	$8^3=2$	$9^3=9$
$2^4=6$	$3^4=1$	$4^4=6$	$5^4=5$	$6^4=6$	$7^4=1$	$8^4=6$	$9^4=1$
$2^5=2$	**$3^5=3$**	$4^5=4$	$5^5=5$	$6^5=6$	**$7^5=7$**	**$8^5=8$**	$9^5=9$
$2^6=4$	$3^6=9$	$4^6=6$	$5^6=5$	$6^6=6$	$7^6=9$	$8^6=4$	$9^6=1$
$2^7=8$	$3^7=7$	$4^7=4$	$5^7=5$	$6^7=6$	$7^7=3$	$8^7=8$	$9^7=9$

From above table we can see that

In case unit digit is 2 or 3 or 7 or 8, it repeats itself after 4 cycles

Now let us pick up some questions based on this observation

Find the unit digit in 2^{49}?

We know in case of 2, it repeats itself after a cycle of 4 . We will divide 49 by 4

49/4 remainder is 1

We write it as

$2^{49} = 2^1 = 2$

That means the unit digit in the 2^{49} is 2.

Find the unit digit in 3^{52}.

Solution: Now here the power is 52 and we know that in case of 3, it repeats itself after a cycle of 4 .

52/4 the remainder is 0.

In such cases, our answer should be the 4^{th} power

So answer is unit digit in $3^4$is 1.

Let us do some more complex examples

Find the last digit in the $7^{45304000}$

Solution: In this case we need to divide the power by 4

The power is 45304**00**

We know that a number is divisible by 4 if the number formed the last two digits is divisible by 4.

00/4 = 0 that means remainder is ZERO and we know that in case of 7 ,the cycle is 4 so we will find out the 4^{th} power of 7

7^4if you still find difficult, let us simplify it

$7^4 = 7^2 \times 7^2$

$= 9 \times 9$ (Unit digits)

= **81 Unit digit so the last digit in the $7^{45304000}$ is 1**

From the table we also observe that

in case of 4

If the power is odd, the unit digit is 4 and if the power is even, the unit digit is 6
And same is the case with 9

If the power is odd, the unit digit is 9 and if the power is even, the unit digit is 1

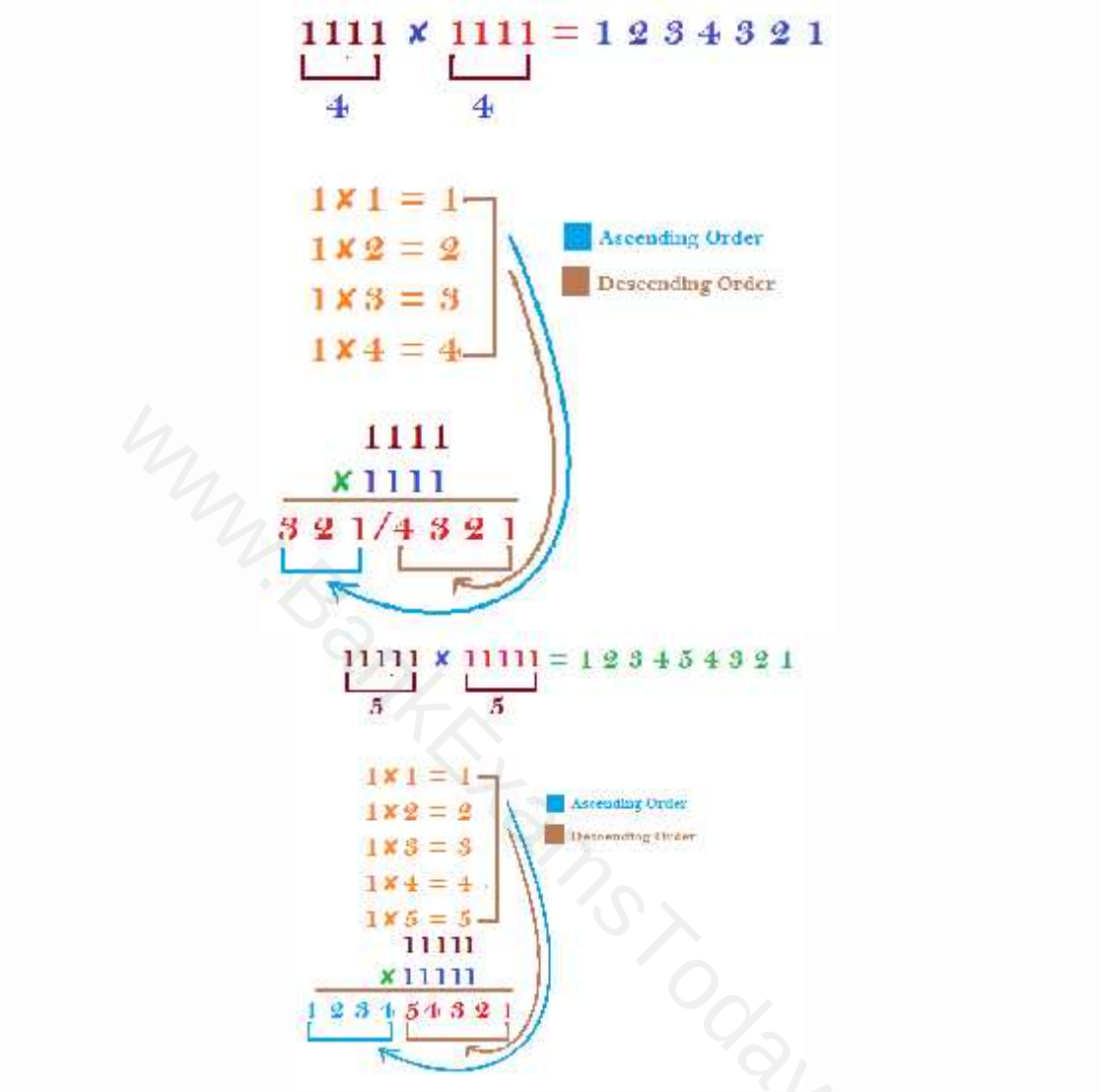
Let us do some of its applications

Find out the unit digit in $4^{39} \times 9^{78}$? In 4^{39} the unit digit is 4 (the power is odd)
In 9^{78} the unit digit is 1 (the power is even)

The answer is $4 \times 1 = 4$

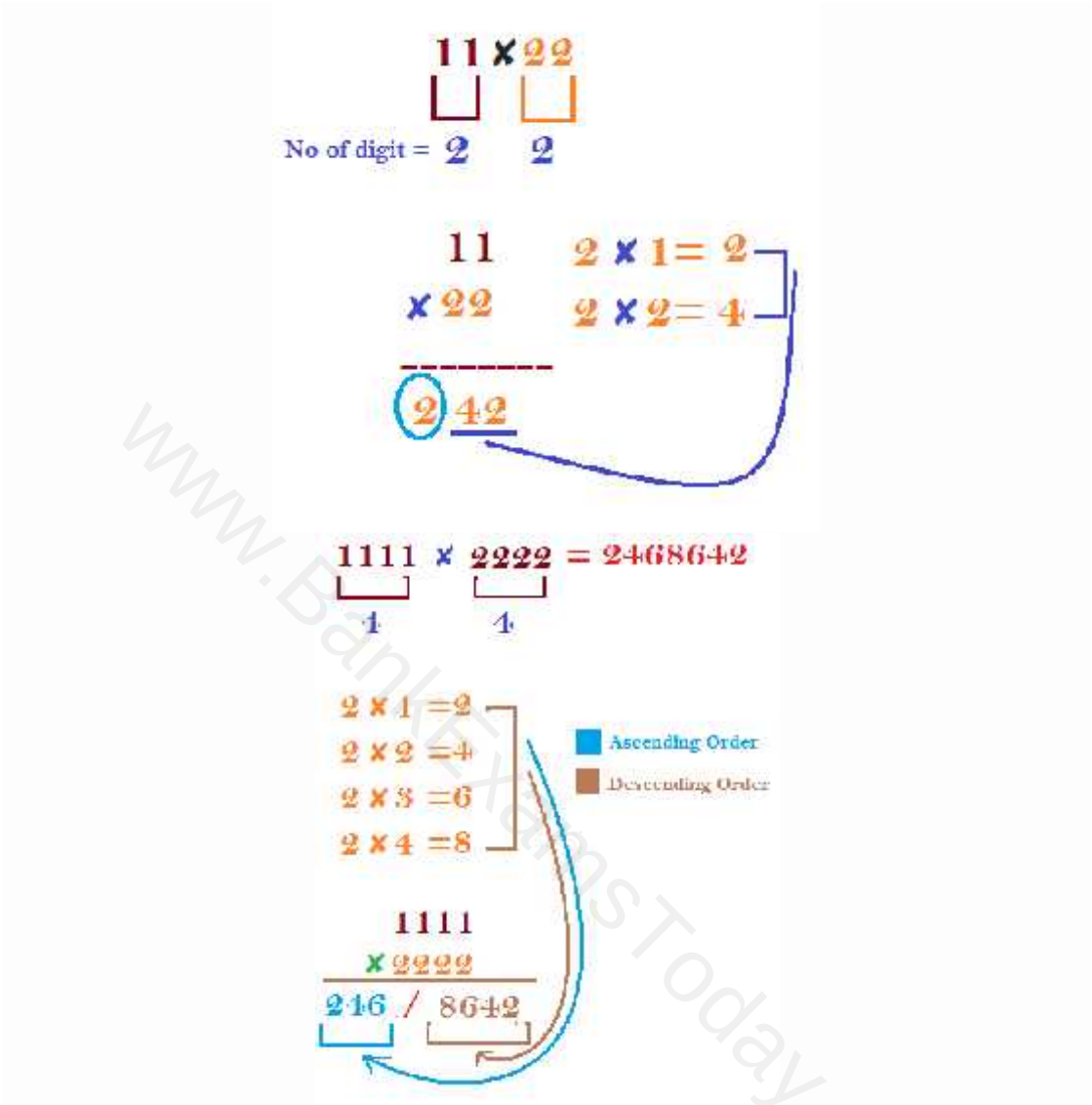
Multiply by 11,111,1111....so on

111111111 ✘ 111111111 = ?
Sol:
No of digits in multiplier = 9
Write in ascending order from left side like this:
987654321
and now 9-1=8
write it in descending order just after it
12345678
now you will get like this:
123456789 87654321
hence
111111111 ✘ 111111111 = 12345678987654321



1111111111 ✘ 1111111111 = ?

Sol:
No of digits in multiplier =10
Write in ascending order from left side like this:
10 9 8 7 6 5 4 3 2 1
and now 10-1=9
write it in descending order just after it
1 2 3 4 5 6 7 8 9
and after it just add **the carry**
1 2 3 4 5 6 7 8/ 9/ **10** 9 8 7 6 5 4 3 2 1
8+1/ 9+1 / 0
1 2 3 4 5 6 7 9 0 0 9 8 7 6 5 4 3 2 1
now you will get like this:
1234567900987654321
hence
1111111111 ✘ 1111111111 = 1234567900987654321

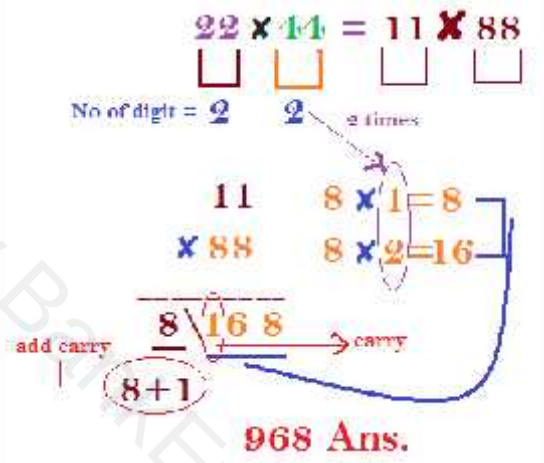


1111111 ✘ 2222222 = ?

Sol:
No of digit in the multiplier is 7 then let n=7;
Now Just multiply the digit 2 from 1 to 7 time & arrange them from extreme left to right in ascending order,you will get like this:
14 12 10 8 6 4 2
and now just subtract one from n.like this n=7,so n-1=6.
Multiply the digit 2 from 1 to 6 time & arrange them from just right after it,you will get like this:
2 4 6 8 10 12
Now placing both outcome like this & add the carry
2 4 6 8 **10 12 14 12 10** 8 6 4 2
8+1/0+1/2+1/4+1/2+1
You will get the answer:
2 4 6 9 1 3 5 3 0 8 6 4 2

1111111 ✘ 5555555 = ?
Sol:
No of digit = 7

Now Just multiply the digit 5 from 1 to 7 time & arrange them from extreme left to right in ascending order,you will get like this:
35 30 25 20 15 10 5
Just right after it perform same action but in descending order & till 6 times only.like this:
5 10 15 20 25 30
Now placing together ,just add the carry
5 10 15 20 25 30 35 30 25 20 15 10 5
6 1 7 2 8 3 8 2 7 1 6 0 5
1111111✘5555555=6172838271605



3 Step Multiplication Trick - A shortcut method

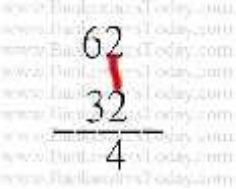
In the series of providing quantitative shortcuts and tricks, today I come up with multiplication trick.

While doing multiplication of a two digit number with another two digit number, we take at least 6 steps. Try yourself. Multiply 62 with 32.

Now let's do this with a trick

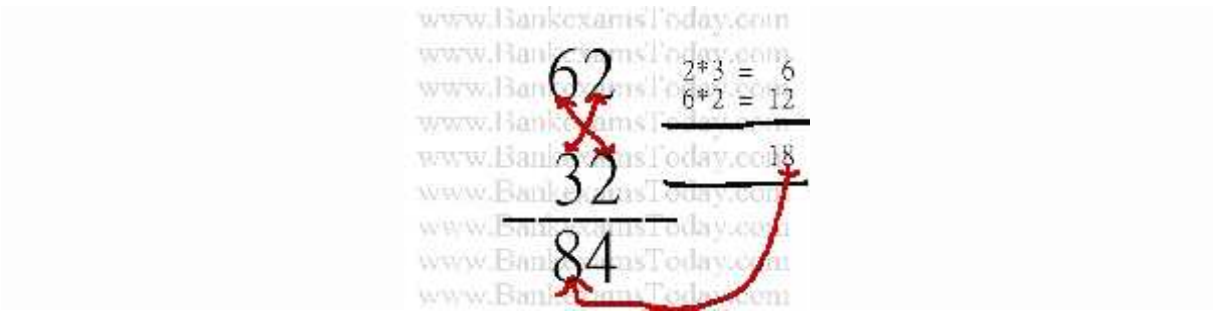
STEP 1

First step is same as conventional method, here we multiply 2 with 2.



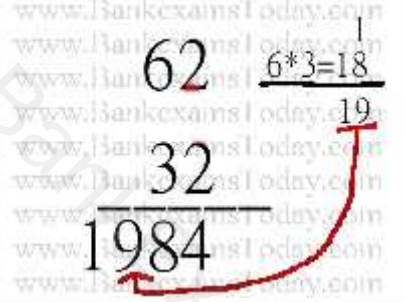
STEP 2

This is an interesting step. Now multiply last digit first value and first digit of second value and vice-versa. Then we add outcomes. But we need the last number that is 8 here.



STEP 3

This is the last step, in this step we do multiplication ten's digit of both value and add the remainder from previous calculation. That's it, we completed the calculation in 3 steps instead of six steps.



We can use this method for multiplication of three or even four digit numbers but time management is really important in IBPS exam and other recruitment exams so for longer calculations, estimation is the best trick. I will post an article about how to do long calculations using estimation and result is 95% accurate which is enough to arrive at answer.

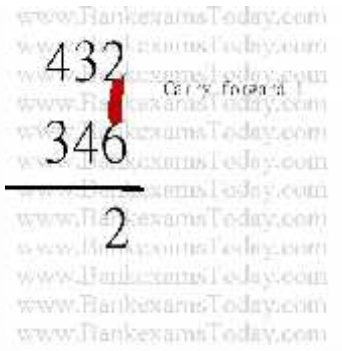
Update 06-09-2013

As two of the readers namely Rahul and Ansh have requested me to use this technique in longer calculations multiplications. I am updating this article.

MULTIPLICATION OF 3 DIGIT NUMBERS

In this example I will multiply 432 with 346. Now the 3 step multiplication method will become 5 step. This method can be used for 4 and even 5 digit numbers but as in bank exams there is lack of time available for calculations I recommend you to use approximation for long calculations.

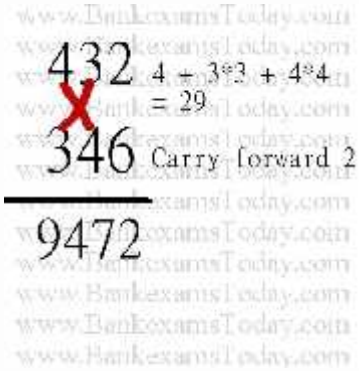
Step 1



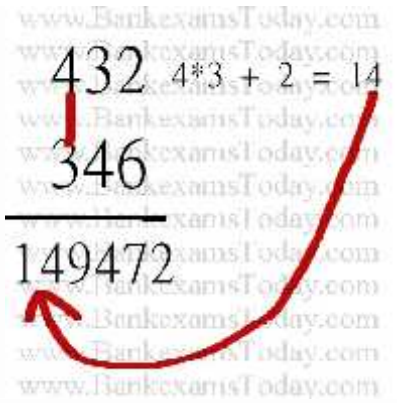
Step 2

Step 3

Step 4



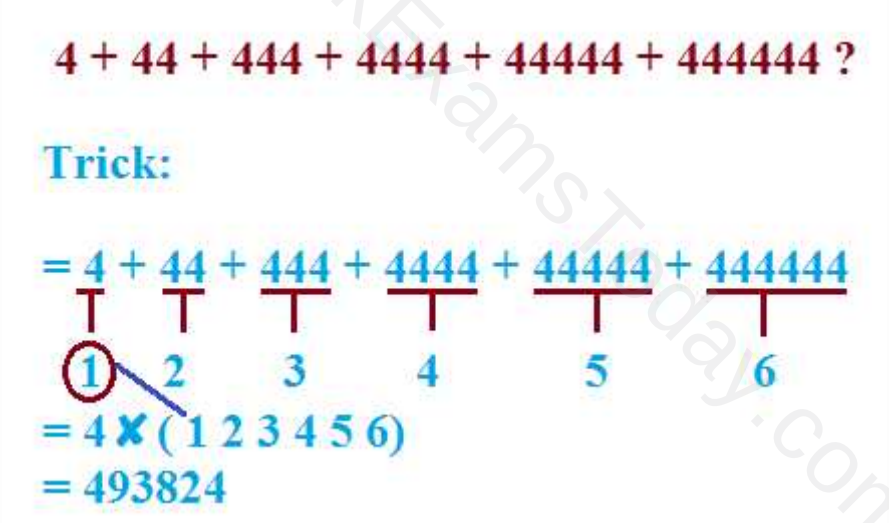
Step 5



In case you find any difficulty to understand the above multiplication method then ask your question in the comments. I will try to answer every query asap.

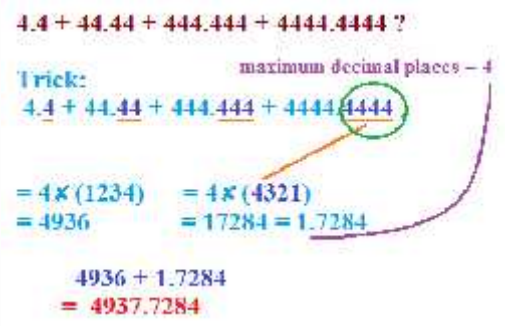
Tricks to Solve Simplification - Addition and Subtraction

Series/Addition/Subtraction



Q1 Find 8 + 888 + 8888 + 88888 ?

a) 97760 b) 98572 c) 98672 d) 97672 e) None of the above



Q2. Find 9.4 + 99.44 + 999.444 + 9999.4444 ?

a) 11207.728 b) 11107.728 c) 11106.728 d) 11111.728 e) None of these

$(15-6)=[(15)^2+15\times6+(6)^2]=?$

Trick:

$(a^3-b^3)=(a-b)(a^2+ab+b^2)$

$a=15, b=6;$

$(a)^3=625;$

$(b)^3=216;$

$[(a)^3-(b)^3]=109$

$(3-5)(3+5)[(3)^2-(5)^2]=?$

Trick:

$(a^4-b^4)=(a-b)(a+b)(a^2-b^2)$

$a=3, b=-5;$

$a=3;(a^4)=81$

$b=5;(b^4)=625$

$(a^4-b^4)=544$

Q3. (2.3 + 3.3) [(2.3)^2 - 2.3 ✘ 3.3 + (3.3)^2] = ?

a) 48.104 b) 47.104 c) 47.204 d) 48.204 e) None of these

Q4. (3-2) [(3)^4+((3)^3 ✘ 2)+(3)^2 ✘ (2)^2+(3 ✘ 2^3)+2^4] = ?

a) 311 b) 211 c) 201 c) 221 d) 301 e) None of these

Q5. (125.824+124.654)^2 + (125.824-124.54)^2 / ((125.824)^2+(124.54)^2)

a) 1.166 b) 1 b) 2 c) 625 d) 250.478 e) None of these

$2\div2\div2\div2\div2\div2=?$

$\frac{2}{2\times2\times2\times2\times2}=?$

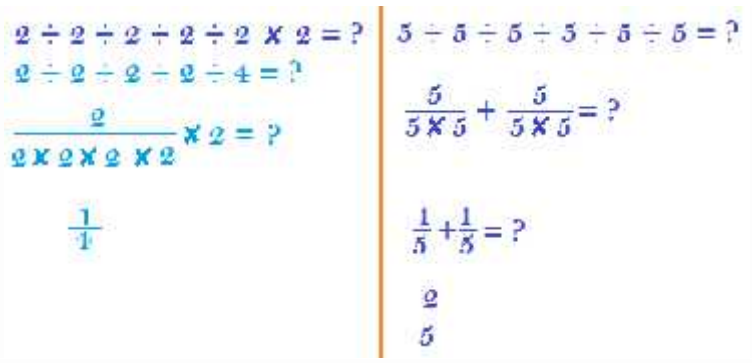
$=\frac{1}{16}$

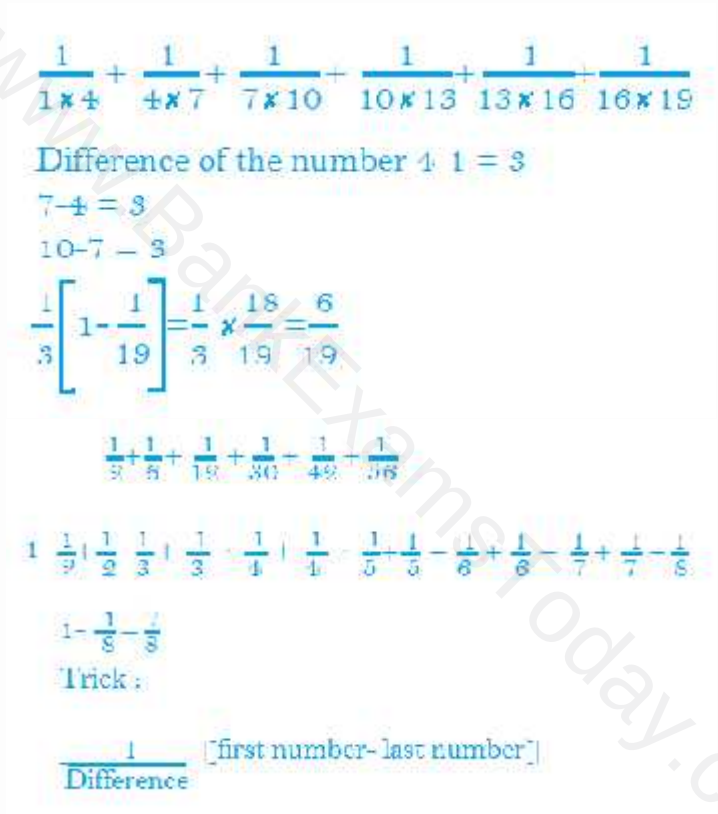
$2\div2\div2\div2\div2$ of $2=?$

$2\div2\div2-2\div4=?$

$\frac{2}{2\times2\times2\times4}=?$

$\frac{1}{16}$





Q6. Evaluate 1 + $^{1}/_{1*3}$ + $^{1}/_{1*3*9}$ + $^{1}/_{1*3*9*27}$ + $^{1}/_{1*3*9*27*81}$ up to three places of decimals ?

a)1.367 b) 1.370 c) 1.361 d) 1.267 e) None of these

Q7. 2 ÷ [2+ 2÷{2+2 ÷ 4)}]= x / 19. Find x.

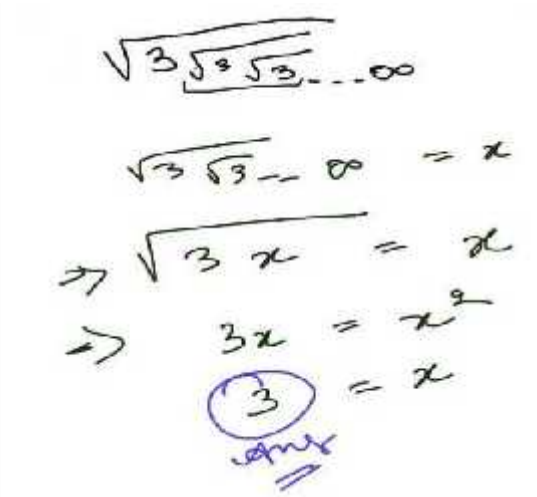
a) 3 b) 4 c) 5 d) 6 e) None of these

Q8. $\overline{4}.45 + 2.9\overline{27} + 0.\overline{6}$?

a) 0.67 b) 0.77 c) 0.87 d) 0.97 e) None of these

Q9) Find the sum of all even natural numbers less than 75.

a) 1416 b) 1426 c) 1396 d) 1406 e) None of these



$$\sqrt{3\sqrt{3\sqrt{3}\ldots\infty}}$$

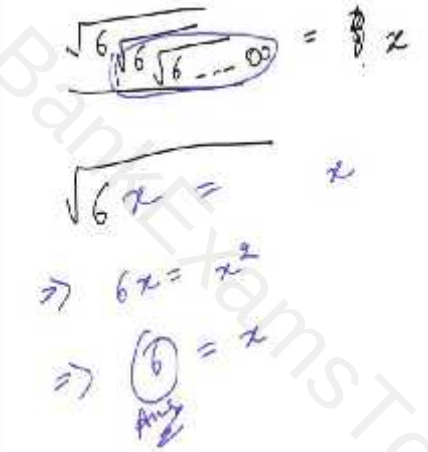
$$\sqrt{3\sqrt{3}\ldots\infty} = x$$

$$\Rightarrow \sqrt{3x} = x$$

$$\Rightarrow 3x = x^2$$

$$3 = x$$

Ans



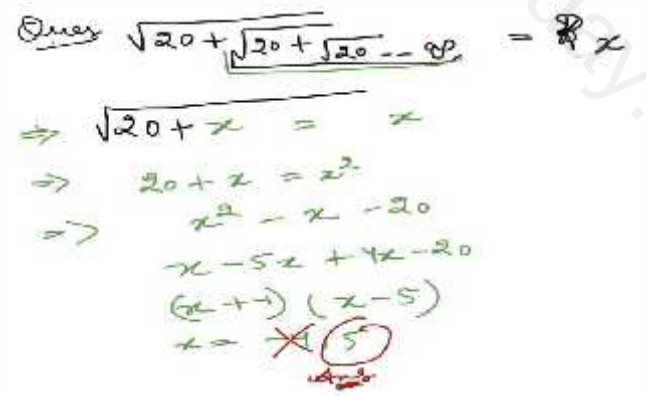
$$\sqrt{6\sqrt{6\sqrt{6}\ldots\infty}} = x$$

$$\sqrt{6x} = x$$

$$\Rightarrow 6x = x^2$$

$$\Rightarrow 6 = x$$

Ans



Ques $\sqrt{20+\sqrt{20+\sqrt{20}\ldots\infty}} = x$

$$\Rightarrow \sqrt{20+x} = x$$

$$\Rightarrow 20+x = x^2$$

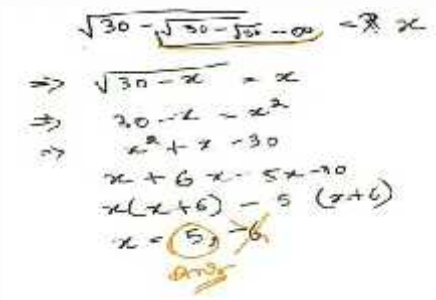
$$\Rightarrow x^2 - x - 20$$

$$x^2 - 5x + 4x - 20$$

$$(x+4)(x-5)$$

$$x = 5$$

Ans



$$\sqrt{30-\sqrt{30-\sqrt{30}\ldots\infty}} = x$$

$$\Rightarrow \sqrt{30-x} = x$$

$$\Rightarrow 30-x = x^2$$

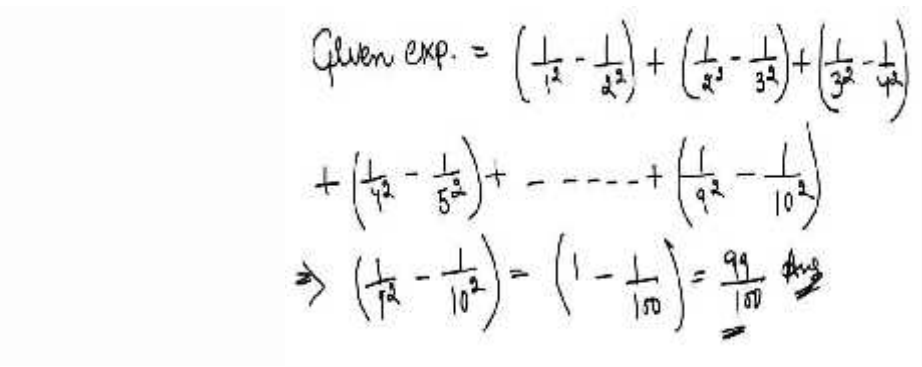
$$\Rightarrow x^2 + x - 30$$

$$x^2 + 6x - 5x - 30$$

$$x(x+6) - 5(x+6)$$

$$x = 5, -6$$

Ans



Solution:

(1)
Sol : Option (c)
8*(12345) - 88 = 98672

(2)
Sol: Option (b)
9✘(1234) = 11106
4✘(4321) = 17284
=1.7284
=11106+1.7284=11107.7284

(3)
Sol: Option (a)
$(a^3 + b^3)=(a+b)\ (a^2-ab+b^2)$
a = 2.3, b = 3.3;
$(a)^3 = 12.167$, $(b)^3 = 35.937$ $(a^3+b^3)=48.104$

(4)
Sol: option (b)
$(a^5-b^5)=(a-b)\ [a^4+a^3b+a^2b^2+ab^3+b^4]$ = ?
a = 3, b = 2; (3)5=243, (2)5 =32;
(a^5-b^5) = 243-32= 211

(5)
Sol: Option (b)
$(a+b)^2 + (a-b)^2=2((a)^2+(b)^2)$ Hence Answer is 2

(6)
Sol: Option (a)
1+0.33+0.0370 ... hence (a) is the answer no further addition is required.

(7)
Sol: option (e)
Using VODMAS method
Step 1. [2+ 2/4] = 5/2.
Step 2.(2 + 2 ÷5/2) = 2÷ 2✘2/5 =14/5
Step 3. [2+2÷14/5]=2+2*5/14=19/7
Step 4. L.H.S = 2÷19/7=14/19 = x/19 Hence x=19

(8)
Sol: Option (c)
= -4 + 0.45 + 2 + ⁹²⁷⁻⁹/₉₉₀ +6/9
= -4 + 0.45 + 2 + ⁹¹⁸/990 +3/2
= (- 4 + 2) + (0.45+1.5) + (⁵¹/55)
= -2 + 1.95 + 0.92 = 0.87

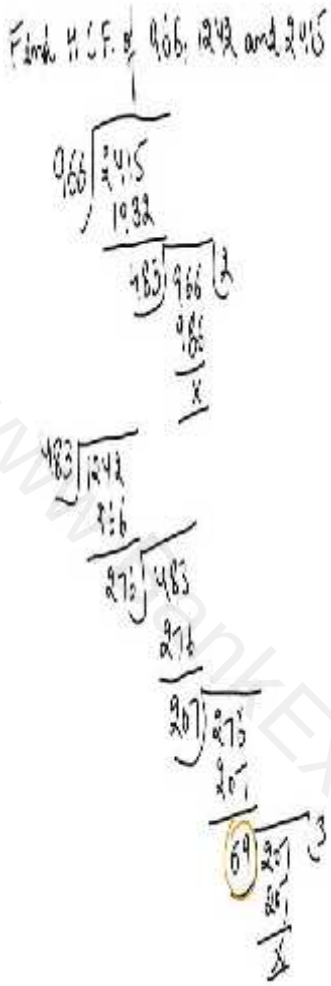
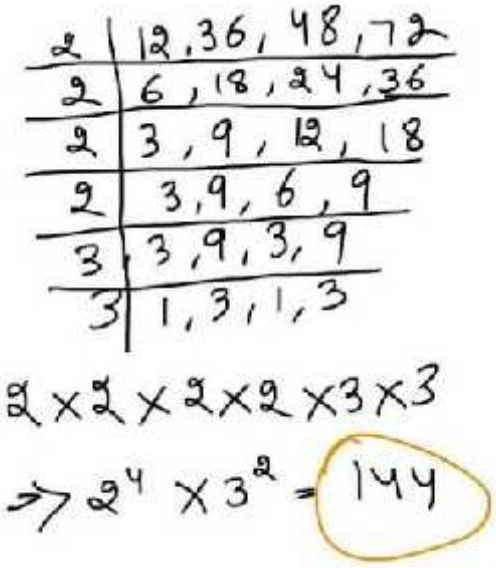
(9)
Sol: Option (d)
sum= 2 + 4 + 6 + ...+74 a=2 , d=(4-2)=2,l=74 n=37; sum= n/2 (a+l) 37/2 ✘ (2+74)=(37 ✘ 38)
=37 ✘ (40-2) =(37 ✘ 40)-(37 ✘ 2) =(1480-74)=1406

H.C.F. & L.C.M.

- Factorization & Division Method
- HCF & LCM of Fractions & Decimal Fractions

Methods

On Basis	H.C.F. or G.C.M	L.C.M.
Factorization Method	Write each number as the product of the prime factors. The product of least powers of common prime factors gives H.C.F. **Example:** Find the H.C.F. of 108, 288 and 360. $108 = 2^2 \times 3^3$, $288 = 2^5 \times 32$ and $360 = 23 \times 5 \times 32$ H.C.F. = $22 \times 32=36$	Write each numbers into a product of prime factors. Then, L.C.M is the product of highest powers of all the factors. **Examples:** Find the L.C.M. of 72, 108 and 2100. $72=23 \times 32$,$108=33 \times 22$, $2100=22 \times 52 \times 3 \times 7$. L.C.M.=$23 \times 33 \times 52 \times 7=37800$
Division Method	Let we have two numbers .Pick the smaller one and divide it by the larger one. After that divide the divisor with the remainder. This process of dividing the preceding number by the remainder will repeated until we got the zero as remainder.The last divisor is the required H.C.F. **Example:**	Let we have set of numbers. First of all find the number which divide at least two of the number in a given set of number.remainder and not divisible numbers will carry forward as it is. Repeat the process till at least two number is not divisible by any number except 1.The product of the divisor and the undivided numbers is the required L.C.M. **Example:** Find the L.C.M. of 12,36,48,72

	 H.C.F. of given numbers = 69	
H.C.F. & L.C.M. of Fractions	H.C.F. = H.C.F. of Numerator / L.C.M. of Denominators	L.C.M. = L.C.M. of Numerator / H.C.F. of Denominators
Product of H.C.F. & L.C.M.	H.C.F * L.C.M. = product of two numbers	
Decimal numbers	H.C.F. of Decimal numbers Step 1. Find the HCF of the given numbers without decimal. Step 2.Put the decimal point (in the HCF of Step 1) from right to left according to the MAXIMUM deciaml places among the given numbers.	L.C.M. of Decimal numbers Step 1. Find the LCM of the given numbers without decimal. Step 2.Put the decimal point (in the LCM of Step 1) from right to left according to the MINIMUM deciaml places among the given numbers.

HCF & LCM - Practice Set 1

- **Q1.** $12^2,12^4,12^{10},12^6$ Find the L.C.M.
- a) 12 b) 12^2 c)12^6 d)12^{10}
- **Q2.** $6^{-1},6^{-3},6^{-10},6^{-12}$ Find the H.C.F.
  a) 6^{-1} b) 1 c)6^{-12} d)6^{-11}

Q3. The L.C.M of the fraction of $^2/3,^4/9,^5/6,^7/12$ is:
- a) $^{35}/9$ b) $^1/36$ c) $^1/18$ d)$^{140}/3$

Q4. The ratio of two number is 5:6, if their H,C.F. is 9 and L.C.M. is 270. Find the numbers.
a) 72,63 b) 81,108 c) 45,54 d) 225,108

Q5. The multiplication of two numbers is 20,000 if their L.C.M is 800. Find the H.C.F.
a)400 b) 25 c) 2,000 d) 800

Q6. Find the least number which when divided by 4,6,7,8,9,12. leaves the same remainder 3 in each case.
a) 504 b) 501 c) 507 d) 506

Q7. The smallest number which is divisible by 12,15,20 and is a perfect square is:
a) 400 b) 900 c) 1600 d) 3600

Q8. The largest number which divided by 77, 147 and 252 to leave the same remainder in each case is:
a) 9 b) 15 c)35 d) 25

Q9. The H.C.F. of the fraction of $^{36}/25,^{48}/25,^{72}/75$
a)$^{12}/75$ b) $^4/25$ c) $^{36}/25$ d) ^{36}

Solution:

- **(1)**
  Sol: Option (d)
- $12^2,12^4,12^{10},12^6$ Find the L.C.M.
  L.C.M. = 12^{10}

(2)
Sol: Option(c)
- $6^{-1},6^{-3},6^{-10},6^{-12}$ Find the H.C.F.
- $^1/_6,^1/_6{}^3,^1/_6{}^{10},^1/_6{}^{12}$
- H.C.F.= $^{H.C.F.}/_{L.C.M.}$= $^1/_6{}^{12}$
  = 16^{-12}

(3)
Sol: Option (d)
- Fraction of L.C.M. = $^{L.C.M.}$/H.C.F. =$^{140}/3$

(4)
Sol: Option (c)
The ratio of numbers is 5:6
The number is 5✘9=45
=6✘9=54

(5)
Sol: Option (b)
L.C.M. ✘ H.C.F. = Ist No ✘ 2nd No.
800 ✘ H.C.F. = 20,000
H.C.F. = $^{20,000}/_{800}$ = 25

(6)
Sol: Option (c)
L.C.M. of the number 4,6,7,8,9,12
L.C.M. = 8 ✘ 9 ✘ 7 = 504
and Remainder = 3
So the number is L.C.M. + 3
504 + 3 = 507

(7)
Sol: Option (b)
L.C.M. = $(3 \times 5 \times 2^2)$
Required number = $(3^2 \times 5^2 \times 2^2)=900$

(8)
Sol: Option (c)
Required number = H.C.F. of (147-77)
(252-147) and (252-77)
= H.C.F. of 70,105 and 175
= 35
(70 = 2 ✘ 5 ✘ 7, 105 = 5 ✘ 3 ✘ 7 and 175=5 ✘ 5 ✘ 7)
H.C.F. =5 ✘ 7 = 35

(9)
Sol: Option (a)
= $^{\text{H.C.F. of numerator}}$/ L.C.M. of denominator
H.C.F.= $^{12}/_{75}$

HCF & LCM - Practice Set 2

Q1. 468 can be expressed as as a product of prime as :a) 2×2×13×7×2×3 b) 2×2×13×7 c) 2×2×13×3×3 d) 2×2×3×3 ×7 e) None of these

Q2. A number n is said to be perfect if the sum of all its divisor (excluding n itself) is equal to n. An example of perfect number is:
a) 27 b) 35 c) 21 d) 6 e) None of these

Q3. $^{70105}/_{21035}$ when expressed in simplest form is
a) $^{203}/_{601}$ b) $^{2003}/_{603}$ c) $^{2003}/_{601}$ d) $^{2001}/_{603}$ e) None of these

Q4. H.C.F. of $2^2\times3^3\times5^5$, $2^3\times3^2\times5^2\times7$ and $2^4\times3^4\times7^2\times5\times11$ is :
a)22×32×5
b)22×32×5×7×11
c)24×34×55
d)24×34×55×7×11
e) None of these

5. $5^2 \times 3 \times 2^4 \times 2^2 \times 3^2 \times 7$ Find the L.C.M.
a) 12300 b) 12600 c) 24600 d) 25200

Q6. H.C.F. of $4 \times 27 \times 3125$, $8 \times 9 \times 25 \times 27$ & $16 \times 81 \times 5 \times 11 \times 49$ is:
a) 180 b) 360 c) 540 d) 1260 e) None of these

Q7. The greatest 5-digit number that is exactly divisible by 100 is:
a) 99899 b) 99800 c) 99900 d) 99889 e) None of these

Q8. What will be the remainder when $(29)^{36}$ is divided by 28 ?
a) 0 b) 1 c) 29 d) 5 e) Cannot be determined

Q9. A number when divided by 627 leaves a remainder 43. By dividing the same number by 19, the remainder will be
a)19 b) 24 c) 43 d) 5 e) 13

Q10. The numbers 1, 3, 5 ... 25 are multiplied together. The number of zeroes at the right end of the product is :
a) 22 b) 8 c) 13 d) 6 e) 0

Q11. When a certain number is multiplied by 21, the product consist oof only fours. The smallest such number is:
a) 21164 b) 4444 c) 444444 d) 444 e) None of these

Q12. In a question, divisor is 2/3 of the dividend and twice the remainder. If the remainder is 5, then the dividend is
a) 85 b) 145 c) 225 d) 65 e) None of these

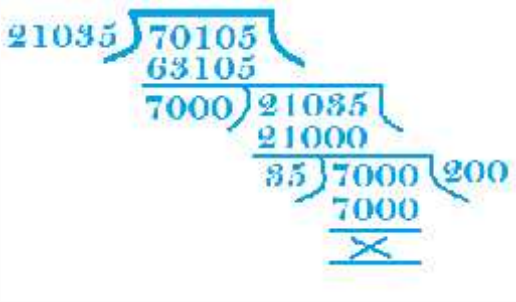
Solution

(1)
Sol : Option (c)
2 ✘ 2 ✘ 13 ✘ 3 ✘ 3 = 468

(2)
Sol : Option (d)

n	Divisors excluding n	Sum of divisor
27	3 ✘ 9 ✘ 1	13
35	5 ✘ 7 ✘ 1	13
21	3 ✘ 7 ✘ 1	11
6	3 ✘ 2 ✘ 1	6

(3)
Sol : Option (c)



(4)
Sol: Option (a)

(5)
Sol:Option (d)
50+75+150+250+350
=875

(6)
Sol: Option (a)
$4 \times 27 \times 3125 = 2^3 \times 3^3 \times 5^5$
$8 \times 9 \times 25 \times 7 = 2^3 \times 3^2 \times 5^{2 \times 7}$
$16 \times 81 \times 5 \times 11 * 49 = 2^4 \times 3^4 \times 7^2 \times 5 \times 11$
H.C.F. $= 2^2 \times 3^2 \times 7 = 180$

(7)
Sol: Option (c)

(8)
Sol: Option (b)

(9)
Sol: Option (d)

(10)
Sol: Option (e)

(11)
Sol: Option (a)

(12)
Sol: Option (e)

Square & Cube

- Square & Cube
- Square Root & Cube Root
- Factorization Method

Perfect Square	Non-Perfect Square
last digit is 1, 4, 9, 6, 5	last digit is 2, 3, 7, 8

Chart of Perfect Squares 1 to 30

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

1	4	9	16	25	36	49	64	81	100
121	144	169	196	225	256	289	324	361	400
441	484	529	576	625	676	729	784	841	900
961	1024	1089	1156	1225	1296	1369	1444	1521	1600
1681	1764	1849	1936	2025	2116	2209	2304	2401	2500
2601	2704	2809	2916	3025	3136	3249	3364	3481	3600
3721	3844	3969	4096	4225	4356	4489	4624	4761	4900
5041	5184	5329	5476	5625	5776	5929	6084	6241	6400
6561	6724	6889	7056	7225	7396	7569	7744	7921	8100
8281	8464	8649	8836	9025	9216	9409	9604	9801	10000

Square Root & Cube Root

$\sqrt{1} = 1$ since $1^2 = 1$

$\sqrt{4} = 2$ since $2^2 = 4$

$\sqrt{9} = 3$ since $3^2 = 9$

$\sqrt{16} = 4$ since $4^2 = 16$

$\sqrt{25} = 5$ since $5^2 = 25$

$\sqrt{36} = 6$ since $6^2 = 36$

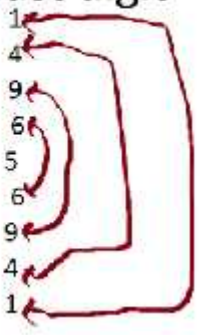
$\sqrt{49} = 7$ since $7^2 = 49$

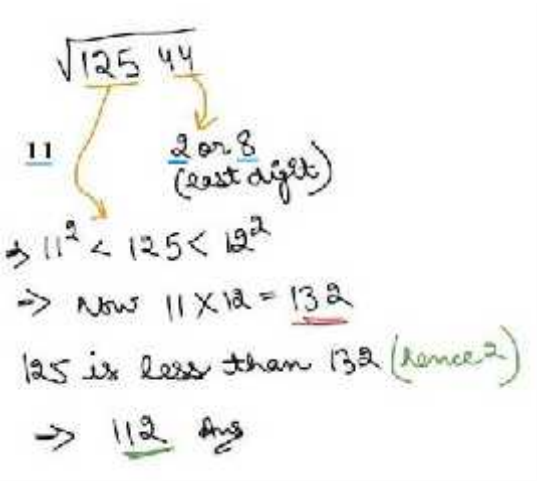
$\sqrt{64} = 8$ since $8^2 = 64$

$\sqrt{81} = 9$ since $9^2 = 81$

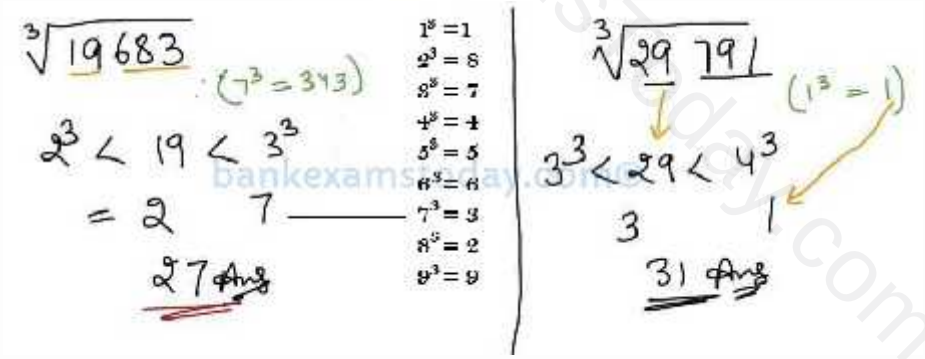
$\sqrt{100} = 10$ since $10^2 = 100$

numbers	squares	last digit
1	1	1
2	4	4
3	9	9
4	16	6
5	25	5
6	36	6
7	49	9
8	64	4
9	81	1





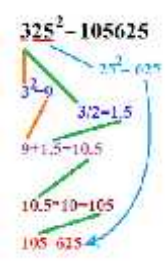
No.	Cube	Unit digit of cube
1	1	1
2	8	8
3	27	7
4	64	4
5	125	5
6	216	6
7	343	3
8	512	2
9	729	9
10	1000	0



Find Square of any number within 10 seconds

Today i am going to share an interesting vedicmaths trick. At first you will find it difficult but with practice, you will be able to find square of any number within 10 seconds.

Square numbers ending in 25



$325^2 = 105625$

Step 1. 325 = 3_25 => 3

Step 2. Square the number from Step 1: $3^2 = 9$

Step 3. Divide the number from Step 1 by 2: 3/2 =1.5

Step 4. Add Step 2 and Step 3 : 9 + 1.5 = 10.5

Step 5. Multiply the number from Step 4 by 10: 10.5 * 10 =105

Step 6. Write the number 625 next to the result from Step 5: 105_625 = 105625

Square numbers between 80 and 130

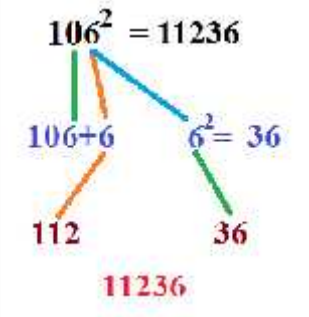
Above 100

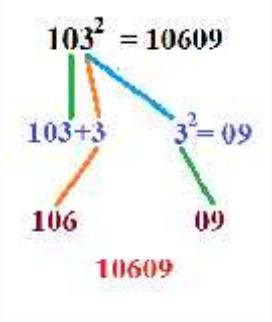
$103^2 = 10609$

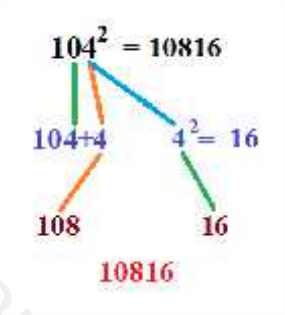
Step 1. Add the number to the ones digit:
103 + 3 = 106

Step 2. Square the ones digit number (if the result is a single digit put a 0 in front of it):
$3^2 = 09$

Step 3. Place the result from Step 2 next to the result from Step 1 : 10609







Below 100

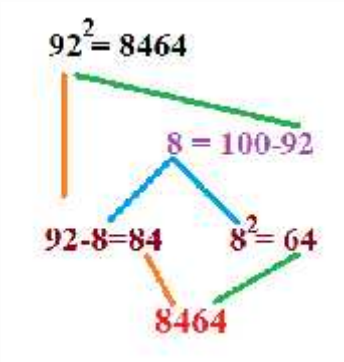
97^2 = 9409

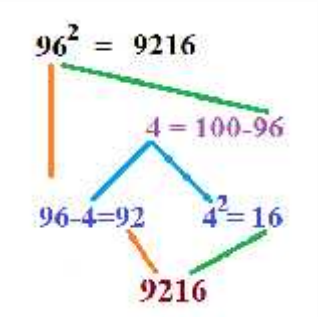
Step 1. Subtract the number from 100: 100- 97 = 3

Step 2. Subtract the number (from Step 1) from original number : 97-3 =94

Step 3. Square the result from Step 1 (if the result is a single digit put a 0 in front of it) : 3^2 = 09

Step 4. Place the result from Step 3 next to the result from Step 2: 9409





Square numbers between 30 and 80

Below 50

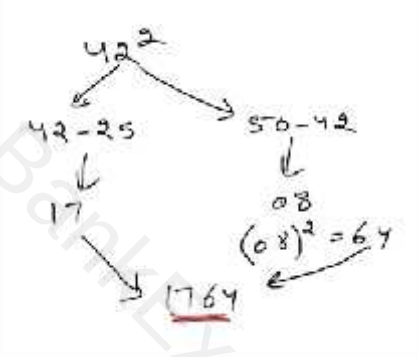
$48^2 = 2304$

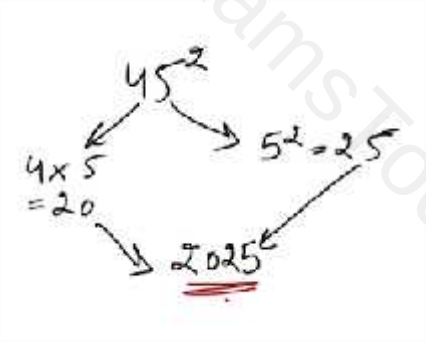
Step 1 . Subtract the number from 50: 50-48=2

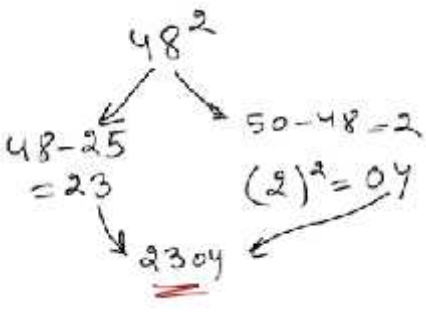
Step 2 . Subtract the result (from Step 1) from 25: 25-2 =23

Step 3 . Square the result from Step 1 (if the result is a single digit put a 0 in front of it) : $2^2 = 04$

Step 4 . Place the result from Step 3 next to the result from Step 2 : 2304







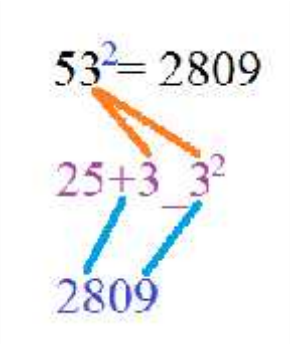
Above 50

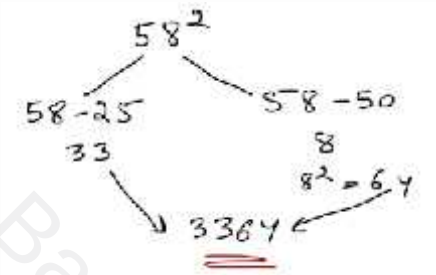
$53^2 = 2809$

Step 1. Add 25 to the ones digit: 25 + 3 = 28

Step 2. Square the ones digit number (if the result is a single digit put a 0 in front of it) : $3^2 = 09$

Step 3. Place the result from Step 2 next to the result from Step 1 : 2809



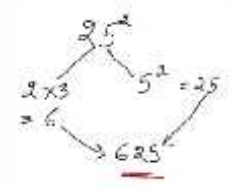


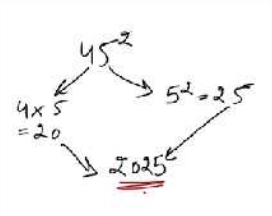
SQUARE NUMBERS ENDING IN 5

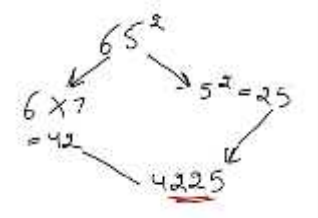
$35^2 = 1225$

Step 1. Multiply the first digit by the first digit plus one: 3 * (3 + 1) = 12

Step 2. Write the numbers 25 next to the result from Step 1 : 1225







Updated On 29th June 2015

Square numbers between 10 and 19

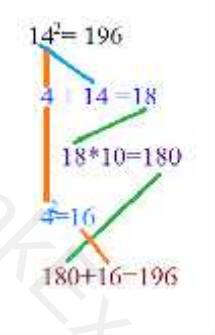
$14^2 = 196$

Step 1: Add the number to the ones digit : 14 + 4 = 18

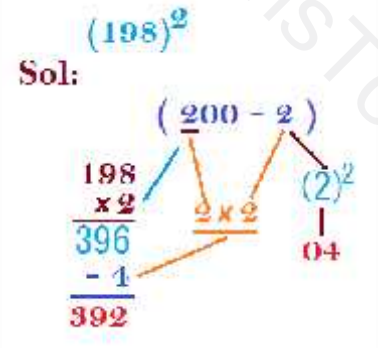
Step 2: Multiply the number from Step 1 by 10: 18 *10 = 180

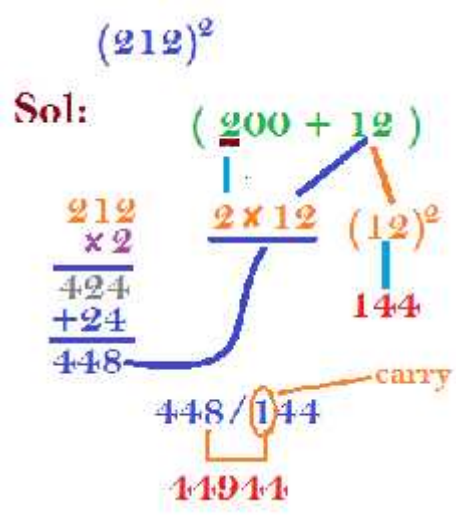
Step 3: Square the ones digit number $4^2 = 16$

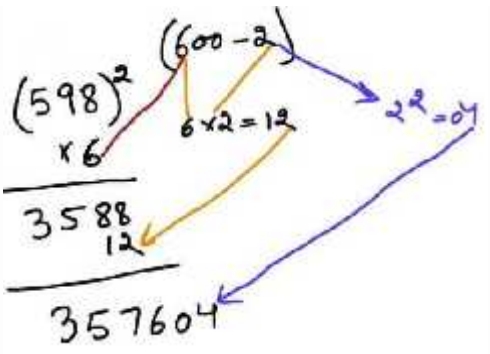
Step 4: Add Step 2 and Step 3 : 180 + 16 = 196

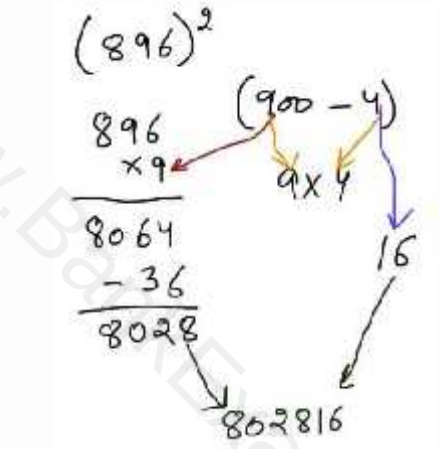


Square of Nearest value of 100,200,300...so on



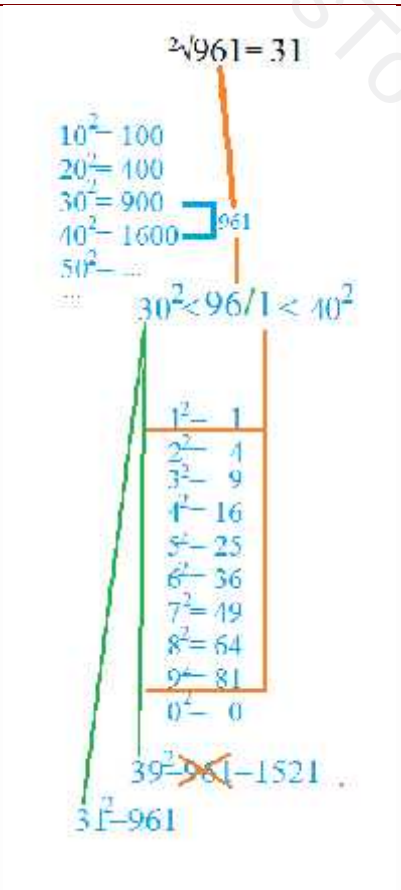


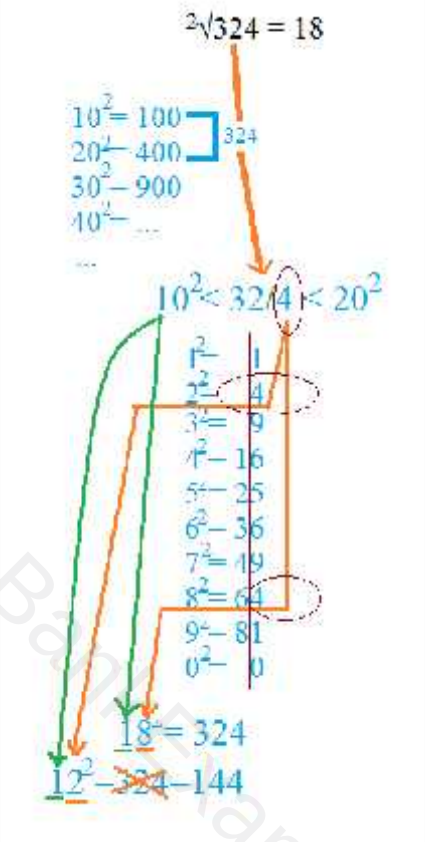




#nth root

Square root





Squaring Technique - Find Square of any number under 10 seconds

Simple technique to find square of a two digit or three digit number under 10 seconds.

Here we are going to use simple algebric formula that it

$[a+b]^2 = a^2 + 2ab + b^2$

By applying this formula, let's do some examples:-

Find 43^2
$\Rightarrow [43]^2$
$\Rightarrow [4|3]^2$
$\Rightarrow [4^2 \mid 2 \times 4 \times 3 \mid 3^2]$
$\Rightarrow [16 \mid 24 \mid 9]$
1849

More shortcut techniques

Find 114^2
$\Rightarrow [11|\ 4]^2$
$\Rightarrow [11^2 \mid 2 \times 11 \times 4 \mid 4^2]$

⇒ [121 | 88 | 16]
⇒[121| 88 + 1 | 6]
⇒ [121 | 89 | 6]
⇒ [129 | 9 | 6]
12996

Find 253^2
⇒[25|3]²
⇒[25² | 2 × 25 × 3 | 3²]
⇒[625 | 150 | 9]
64009

TECHNIQUE

In case of two digit number deduct last digit and add it to another number and then add square of same.

In this technique we simplify the squaring method by making one unit's digit zero. It is far easy to multiply 50*24 than 54*24. So I used this technique. Try practice more to become expert in this technique.

LET'S TAKE SOME EXAMPLES

Find square of 53.
=(53*53)
= (53+3) * (53-3) + (3*3)
=(56*50) + 9
= (560*5) + 9
= 2800 + 9 = 2809

Let's take another example
Find square of 69
= (69*69)
= (69+1) * (69-1) + (1*1)
= (70*68) + 1
= (680*7) + 1
= 4761

Let's take one more example
Find square of 45
= (45*45)
= (45-5)*(45+5) + (5*5)
= (40*50) + 25
= 2000+25
= 2025

Tricks to find Square Root and Cube Roots

$$\sqrt{16} = \sqrt{4 \times 4} = 4$$

$$\sqrt[3]{4} = \sqrt[3]{4 \times 4 \times 4} = 4$$

Division Method

- **Step 1**. Make Pair of digits of given number from left to right
- **Step 2.** Pick first pair, like here 6 find the square which is equals to 6 or less than it.Like 2
- **Step 3.** So Place it to in the section of Quotient as well as in the divisor.
- **Step 4:** then subtract from square of no which is equals to 6 or less than it with 6
- **Step 5.** Now comes to second pair bring it down like here 40,double the quotient like 2 = 4 and write the result on the left of 240 .It is just like division.Now repeat From Step 2 until you got the remainder zero.

$\sqrt{64009} = ?$

2	6 40 09	253 = Quotient
+2	4	
45	2 40	
+5	2 25	(since 45 × 5 225)
503	15 09	(since 503 × 3 1509)
	15 09	

$\sqrt{64009} = 253$ (i.e. Quotient)

Prime Factor Method

$\sqrt{11025} = ?$

3	11025
3	3675
5	1225
5	245
7	49
	7

$\sqrt{11025} = 3 \times 5 \times 7 = 105$

$$\sqrt{\frac{529}{900}} = ?$$

$$529 = 23^2$$
$$900 = 30^2$$

$$\sqrt{\frac{529}{900}} - \frac{23}{30}$$

Square Root of a Decimal Fraction

- Step 1. Make the pair of integer part first.
- Step 2. Now find whether the decimal part is odd or even if it is odd then make it odd by placing at the end of it zero.
- Now just find the square root by the division method as discussed above and don't forget to put the decimal point in the square root as the integer part is over.

$\sqrt{387.09126} = ?$

1	$3\overline{87}.\overline{09}\,\overline{12}\,\overline{60}$	19.674
+ 1	1	
29	$2\overline{87}$	
+ 9	261 (integer part is over)	since $29 \times 9 = 261$
386	$26\overline{09}$	
6	23 16	since $386 \times 6 = 2316$
3927	$293\overline{12}$	
7	27489	since $3927 \times 7 = 27489$
39344	$1823\overline{60}$	
	157376	since $39344 \times 4 = 157376$

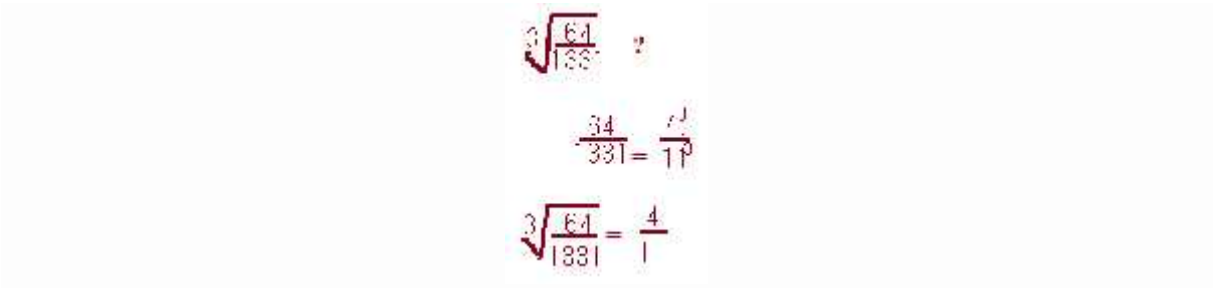
Method of Finding Cube Root of Perfect Cube

$\sqrt[3]{2744} = ?$

2	2744
2	1372
2	686
7	343
7	49
	7

$$\sqrt[3]{2744} - 2^3 \times 7^3$$

$$\sqrt[3]{2744} = 2 \times 7 = 14$$



Fractions & Decimals

On Basis	Explanation
Decimal Fractions	A number with a denominator of power of 10 is a decimal fractions. $^{1}/_{10}$= 1 tenth; $^{1}/_{100}$= 0.1;$^{38}/_{100}$=0.38
Vulgar Fractions	Conversion of 0.64(decimal number) into a Vulgar Fraction.First of all write the numeric digit 1 in the denominator of a number (like here 0.64) and add as many numeric zeros as the digit in the number after decimal point.After that removes the decimal point from the given number.At last step just reduce the fraction to its lowest terms. So, 0.64 = $^{64}/_{100}$=$^{16}/_{25}$;25.025 = $^{25025}/_{1000}$ = $^{1001}/_{4}$
Operations	**Addition & Subtraction** To perform the addition and subtraction of a decimal fraction could be done through placing them right under each other that the decimal points lie in one column. 3.424+3.28+.4036+6.2+.8+4 3. 424 3. 28 . 4036 6. 2 . 8 +4 18. 1076 **Multiplication of a Decimal Fraction** To find the multiplication of decimal fraction , first of all you need to remove the decimal point from the given numbers and then perform the multiplication after that assign the decimal point as many places after the number as the sum of the number of the decimal places in the given number. Step 1. 0.06*0.3*0.40 Step 2. 6*3*40=720 Step 3. 0.00720 Multiplication of a decimal fraction by power of 10 A multiplication of a decimal fraction by a power of 10 can be perform through shifting the decimal point towards right as many places as is the power of 10. like 45.6288*100=45628.8, 0.00452*100=0.452 **Division**

	$\frac{0.0204}{17} = \frac{204}{17} = 12$ $= 0.0012$ $\frac{0.00066}{0.11} = \frac{0.00066 \times 100}{0.11 \times 100} = \frac{0.066}{11} = .0066$
Comparison of Fractions	To compare the set of fractions numbers,first of all you need to convert each fraction number or value into a equal decimal value and then it will be became easy for you to assign them (the numbers or value) in a particular way(ascending or descending order). $^3/5, ^4/7, ^8/9$ and $^9/11$ Arranging in Ascending Order $^3/5$= 0.6, $^4/7$ = 0.571, $^8/9$ = 0.88, $^9/11$ = 0.818. Now, 0.88 > 0.818 > 0.6 > 0.571 $^8/9 > ^9/11 > ^3/5 > ^4/7$
Recurring Decimal	**Recurring Decimal** A decimal number in which after a decimal point a number or set of number are repeated again and again are called recurring decimal numbers.It can be written in shorten form by placing a bar or line above the numbers which has repeated. $\frac{8}{3} = 2.666..... = 2.\bar{6}$ $\frac{1}{7} = 0.\ 142857142857142857$ $= 0.\overline{142857}$ **Pure Recurring Decimal** A decimal number in which all digits are repeated after a decimal point. $0.5 = \frac{5}{9};\ 0.\overline{53} = \frac{53}{99};\ 0.\overline{067} = \frac{67}{999}$ **Mixed Recurring Decimal** A decimal number in which certain digits are repeated only.

	$0.17333..... = 0.17\overline{3}$ $0.16 = \frac{16-1}{90} = \frac{15}{90} = \frac{1}{6}$ $0.22\overline{73} = \frac{2273-22}{9900} = \frac{2251}{9900}$

Fraction - Techniques with Practice Questions

Types

- Proper
- Improper
- Mixed Fraction

I. Proper Fraction: [when numerator < denominator]

Eg. $^{4}/_{5}$, $^{6}/_{8}$, $^{9}/_{7}$

II. Improper Fraction : [when numerator > denominator]

Eg. $^{4}/_{2}$, $^{5}/_{3}$, $^{6}/_{2}$

III. Mixed Fraction :

- Mixed with Proper Fraction
- Mixed with Improper fraction

a) Mixed with Proper Fraction: When a proper fraction is mixed with a whole number known as mixed with proper fraction.

Eg. $5^{2}/_{3}$, $6^{3}/_{4}$, $7^{1}/_{4}$

b) Mixed with Improper Fraction: When a proper fraction is mixed with a whole number known as mixed with Improper fraction.

Eg. $2^{3}/_{2}$, $4^{4}/_{1}$, $6^{6}/_{1}$

Rules

I. $4 + {}^{3}/_{8} = 4\ {}^{3}/_{8}$

II. $4+{}^{8}/_{3} = 4 + 2^{2}/_{3}$
$= 6^{2}/_{3}$
III. $4-{}^{3}/_{8} = 3+(1-{}^{3}/_{8}) = 3+{}^{5}/_{8} = 3^{5}/_{8}$

Q1. Arrange the fractions $a={}^{3}/_{5}$, $b={}^{4}/_{7}$, $c={}^{8}/_{9}$ and $d={}^{9}/_{11}$ in their descending order.
a) a,b,c,d
b)c,d,a,c
b) a,d,c,a,b
d) c,d,a,b
e) None of these

Q2.[0.00625 of 23/5], when expressed as a vulgar, fraction, equals:
a)23/80 b) 23/8000 c) 23/800 d) 125/23 e) None of these

Q3. Simplify : $\dfrac{1\frac{1}{2}}{1+\frac{1}{1+\frac{1}{4}}}$

a)5/6 b) 5/9 c) 15/18 d) 3/18 e) None of these

Q4.If 47.2506 = 4A +7/B+2C +5/D+6E, then the value of 5A + 3B + 6C + D + 3E is:

a) 153.6003 b)53.6003 c) 53.603 d) None of these e) 213.0003

Q5.4/15 of 5/7 of a number is greater than 4/9 of 2/5 of the same number by 8.What is half of that number?

a)215 b) 315 c) 305 d) 325 e)None of these

Q6. Find the value of $1/2 \times 3 + 1/3 \times 4 + 1/4 \times 5 + 1/5 \times 6 + \ldots\ldots\ldots + 1/9 \times 10$

a)$4/10$ b) $2/10$ c) $2/5$ d) $4/5$ e) None of these

Solution

(1)
Sol: Option d
Clearly $3/5=0.6$, $4/7 = 0.571$, $8/9 = 0.88$, $9/11= 0.818$
Now, $0.88 > 0.818 > 0.6 > 0.571$

(2)
Sol: Option c
$[0.000625 \text{ of } 23/5]=[625/100000 * 23/5]=23/800$

(3)
Sol: Option (a)

$$\frac{\frac{3}{2}}{1+\frac{1}{\frac{5}{4}}} = \frac{\frac{3}{2}}{\frac{9}{5}}$$

(4)
Sol: Option (a)
$4A + {}^{7}/_{B} + 2C + {}^{5}/_{D} + 6E = 47.2506$
$4A + {}^{7}/_{B} + {}^{2}/_{C} + {}^{5}/_{D} + 6E = 40+7+0.2+0.05+0.0006$
Comparing the terms on both sides, we get
$4A=40$, ${}^{7}/_{B}=7$, $2C = 0.2$, ${}^{5}/_{D}=0.05$, $6E=0.0006$
or
a=10, B=1, C=0.1, D = 100, E = 0.0001
5A+3B+6C+D+3E
=(5810)+(3*1)+(6*0.1)+100+(3*0.0001)
=50+3+0.6+100+0.0003=153.6003

(5)
Sol: Option B
Let the number be x. Then,
${}^{4}/_{15}$ of ${}^{5}/_{7}$ of x - ${}^{4}/_{9}$ of ${}^{2}/_{5}$ of x = 8
${}^{4}/_{21}x - {}^{8}/_{45}x = 8$
$[{}^{4}/_{21} - {}^{8}/_{45}]x = 8$
$[{}^{60-56}/_{315}]x = 8$
${}^{4}/_{315}x = 8$
$x = [{}^{8*315}/_{4}] = 630$
${}^{1}/_{2}\ x = 315$

(6)
Sol: Option C
Given expression $[{}^{1}/_{2} - {}^{1}/_{3}] + [{}^{1}/3 - {}^{1}/4] + [{}^{1}/4 - {}^{1}/5] + [{}^{1}/5 - {}^{1}/6] + \ldots\ldots\ldots\ldots\ldots + [{}^{1}/9 - {}^{1}/10]$
$= [{}^{1}/2 - {}^{1}/10]$
=4/10
=2/5

Surds & Indices

- Some Rules of Indices
- Some Rules of Surds