RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

A case study on Planning & Importance of Mathematical Tricks in Competitive Exams in India: The Challenges and Opportunities

Upendra Kumar
Assistant professor Department of Mathematics Government Post Graduate College Obra, Sonbhadra, Uttar Pradesh, India – 231219.

Abstract:

While preparing for a competitive exam it is common to feel panicked about the mathematical section which is a complex one to crack. For all competitive exams time is the most important factor to achieve the targets. The main purpose of adding the category of Quantitative Aptitude to a competitive exam is to test ability to solve basic mathematical problems logically. For this, a good grasp of quantitative concepts with sufficient practice is needed.

Mathematical Tricks, tips and shortcut plays a very important role in every competitive exam. These quick shortcut tricks help the students to solve math & reasoning problems easily, quickly and efficiently in competitive exams. Most importantly, this also improve techniques and skills to solve mathematical problems in less time. In fact, these mathematical tricks for competitive exams can be mastered not just for exam purposes but also to become efficient in solving problems. Imagine how mathematics would be easy and interesting when we have the ability to calculate the problems in a matter of seconds using some mathematical tricks. There are different kinds of arithmetic operations like addition, subtraction, division, multiplication, squaring, roots, powers, logarithms, divisions, etc. In this paper we have discussed some of the best tricks, which will help students to perform arithmetic calculations easily. In this paper, we elaborate some tricks to solve long square root series in seconds that generally ask in competitive exams. Also discussed some tricks of fast calculation of multiplication, square and division tricks.

Key Words: Mathematical Tricks, competitive Exam

Introduction:

Mathematics is a wonderful, elegant, and exceedingly useful language. It has its own vocabulary and syntax, its own verbs, nouns, and modifiers, and its own dialects and patois. It is used brilliantly by some, poorly by others. Some of us fear to pursue its more esoteric uses, while a few of us wield it like a sword to attack and conquer income tax forms or masses of data that resist the less courageous.

Math is the language of science, or the language of Nature is mathematics. The more we understand the universe, the more we discover its mathematical connections. Flowers have spirals that line up with a special sequence of numbers (called Fibonacci numbers) that you can understand and generate yourself. Seashells form in perfect mathematical curves (logarithmic spirals) that come from a chemical balance. Star clusters tug on one another in a mathematical dance that we can observe and understand from millions and even billions of kilometres away. We have spent centuries discovering the mathematical nature of Nature. With each discovery, someone had to go through the math and make sure the numbers were right. Almost everyone has ten fingers, so our system of mathematics started with 1 and went to 10. In fact, we call both our numbers and our fingers “digits.” Coincidence? Hardly. Pretty soon, though, our ancestors ran out of fingers. The same thing has probably happened to you. But we can’t just ignore those big numbers. We need numbers—they’re part of our lives every day, and in ways we typically don’t even notice. Think about a conversation you had with a friend. To call, you needed a phone number, and the time you spent on the phone was measured in numbers of hours and minutes. Every date in history, including an important one like your birthday, is reckoned with numbers. We even use numbers to represent ideas that have nothing to do with counting. People describe one another in numbers representing height and weight. And, of course, we all like to know how much money we have or how much something costs in numbers: dollars, pesos, yuan, rupees, krona, euros, or yen. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills.

Mathematics is not easy for some students. It is a subject that many kids tend to struggle with it. It is not uncommon to see kids eventually lose interest in developing their numerical literacy, which can make coping with math increasingly difficult as they advance to middle and high school. Even in competitive exams students struggle to attempt mathematical and reasoning part due to lack of mathematics knowledge. Here the mathematics tricks play important role. The Mathematical tricks are not only helpful for school-going kids but also support to manage time in final exams as well as in the competitive exam and solve the Mathematical questions with accuracy. Mathematical tricks can be helpful for kids in several ways. They can help them reduce the number of steps that they need to take to tackle a problem and arrive at the right solution. They can also offer kids a range of ways to approach and solve the same problem. Getting a grasp of math tricks can ultimately make math more interesting and less daunting for kids. So why not give them a whirl? Here in this paper are some math tricks with answers and examples to help the students to catch on fast.

Research Methodology:

The research paper has been developed from Primary and descriptive secondary data. The secondary information is collected from books about tricks on mathematics, Vedic mathematics, research journals, web links, related research papers etc.

Objective:

The objective of the research paper is to highlight on **some** mathematical tricks to solve long square root series in seconds that generally ask in competitive exams. Also discussed some tricks of fast calculation of multiplication, square and division tricks.

Tips to Improve Mathematics for Competitive Exams:

The key tips that can follow for preparation for the section of Mathematics for Competitive Exams.

- **Use short mathematical tricks instead of long method.**
- **Always Keep a List of Important Formulas on Your Desk** Mathematics without formulas is like Pizza without cheese. Instead of cramming up the formulas at the last moment, it is better to go through them as many times as you can. Also, try to memorize only few important formulas and not the entire list.
- **Master Important Topics First** Study smart, not hard. Almost all the topics in Mathematics for competitive exams are important but there are a few concepts that are commonly asked. Identify those areas and practice them thoroughly.
- **Memorize the Right Stuff** Remember multiplication tables at least up to 20 and learn the square as well as cube roots for numbers till 30. These hacks can help you save time from difficult calculations.
- **Follow the Mantra of Practice** When you take competitive tests that are set in a specific time frame, it improves your speed and helps you identify the areas where you still lag. So, keep practicing the key concepts until you feel confident enough to crack them.

Mathematical Tricks:

A. Multiplying by 6

If you multiply 6 by an even number, the answer will end with the same digit. The number in the ten's place will be half of the number in the one's place.

Example: i) 6 x 8 = 48.

ii) 6 X 24 =

We write down 4 from the number 24 in the unit place & take 2 as carry so unit place digit … 4

We write down at ten's place --- Half of 26 = 13 + 2(carry) =15 …15

Final Answer is 6 X 24 = **154**

B. Finger Multiplication Table:

A simple way to do the "9" multiplication table is to place both hands in front of you with fingers and thumbs extended. To multiply 9 by a number, fold down that number finger, counting from the left.

Examples: i) To multiply 9 by 4, fold down the fourth finger from the left. Count fingers on either side of the "fold" to get the answer. In this case, the answer is 36.

ii) To multiply 9 times 8, fold down the eighth finger, giving an answer of 72.

C. Square a number ending with 5:

Example: i) square of 35

Step 1. Find square of 5; 5^2= 25 (put it on right side of answer)
Step 2. Multiply the number other than 5 in the given number by its next higher digit (i.e. 3 X 4)
We get 12 (put it on left side of answer)
So, result is 35 X 35 = **1225**
ii) Square of 115
Step 1. Square of 5 = 25 (put it on right side of answer)
Step 2. 11 X 12 = 132 (put it on left side of answer)
So, result is 125 X 125 = **13225**
iii) Square of 7.5
Step 1. Square of 5 = 25 (put it on right side of (decimal) answer)
Step 2. 7 X 8 = 56 (put it on left side of (decimal) answer)
So, result is 125 X 125 = **56.25**

D. Two-digit numbers with the same first digit, and Sum of second digits is 10:

We can use a similar trick when multiplying two-digit numbers with the same first digit, and second digits that sum to 10. The answer begins the same way that it did before (the first digit multiplied by the next higher digit), followed by the product of the second digits.

Example i) 83 X 87. (Both numbers begin with 8, and the last digits sum to 3+ 7 =10.)
Since 8 X 9 =72, and 3 X 7 = 21, the answer is **7221**.

ii) 46 X 44 (Both numbers begin with 4, and the last digits sum to 6+4 =10.)

```
        4    6
   X    4    4
   _____________
4X5 = 20
6X4 =      24
_________________
So, Answer is        20 24
```

E. Square of two-digit number:

Example: i) square of 47

```
                                       (4      7)²
                                        ↓      ↓
(Square of tens place digit) --------  1 6    4 9   -------- (square of unit place digit)
                                     +  5     6     ------- (4 X 7 X 2) (leave unit place
                                                        as blank and then write product)
__________________________________________________________________________________
                                      2  2    0 9
```

So, result is 68^2 = 2209

Example: i) square of 68

```
                                       (6      8)²
                                        ↓      ↓
(Square of tens place digit) --------  3 6    64    -------- (square of unit place digit)
                                     +  9      6    ------- (6 X 8 X 2) (leave unit place
                                                        as blank and then write product)
__________________________________________________________________________________
                                       4 6    2 4
```

So, result is 682 = 4624

F. Multiplication of numbers, which are nearer to bases of 10, 100, 1000 i.e. increased powers of 10.

Case I: Integer less than base: consider 96 X 94

Here the nearest base = 100

```
                          (x) 96        (100-96)
                          (y) 94        (100-94)
                         ________________________
                          Column 1      Column 2
                          (x) 96  \  /  4 (x1)
                          (y) 94  /  \  6 (y1)
                         ________________________
(96 – 6 or 94 – 4) -----     90     /     24      ------- (4 X 6)
```

So, result 96 X 94 = **9024**

Case II: Integer more than base: consider 112 X 114

Here the nearest base = 100

(x) 112 (100-112)
(y) 114 (100-114)

Column 1 Column 2
(x) 112 -12 (x_1)
(y) 114 -14 (y_1)

(112 – (-14) or 114 – (-12)) ----- 126 / 168 ------- (-12 X -14)

(Carry 1 to the left because 2nd part of answer should be of 2 digits for base 100)

So, result 112 X 114 = 127/68 = **12768**

Case III: Integer below and above the base: consider 995 X 1042

Here the nearest base = 1000

(x) 995 (1000-995)
(y) 1042 (1000-1042)

Column 1 Column 2
(x) 995 05 (x_1)
(y) 1042 -42 (y_1)

(995 – (-42) or 1042 – 5) ----- 1037 / -210 ------ (5 X - 42)

Here the 2nd part is negative i.e., -210 so we carry 1 (i.e., 1000, since the base is 1000) from 1st part of answer and final answer is obtained as

1036/1000-210) = 1036 / 790, So result 995 X 1042 = **1036790**

G. Multiplication of numbers with a series of 9's in the multiplier:

Multiply 5436 by 9999

Step 1. Subtract 1 from 5436 (given number)

5436 -1 = 5435 (put it on left side of answer)

Step 2. Subtract each of the digit of 5435 from 9 (i.e., 9-5, 9-4, 9-3, and 9-5)

We get 4564(put it on right side of answer)

So, result is 5436 X 9999 = **54354564**

H. Multiplication of numbers with a series of 1's in the multiplier:

i) Multiply 56 by 11

Step 1 - Write 5 and 7 as shown below.

  5 7
X 1 1
______
5 7

Step 2 - In between 5 and 6, write the sum of 5 and 6 (12).

  5 7
X 1 1
______

  5 7
X 1 1
______

5 (5+7) 7   5 (12) 7

Step 3 - Add 5 and carry 1, so final answer is

	5	7
X	1	1
6	**2**	**7**

ii) Multiply 6389 by 1111

We write down 9 in the unit place as it is 9 -------9

Add (9+8) = 17, 1 carry -------7

Add (9+8+3) + 1 carry = 21, 2 carry -------1

Add (9+8+3+6) + 2 carry = 28, 2 carry -------8

Add (8+3+6) +2 carry = 19, 1 carry --------9

Add (3+6) + 1carry =10, 1 carry -------0

Write down 6 + 1 carry -------- 7 ↑

Final Answer is (down to up) = **7098179**

I. Some tricks of square roots of a series

a) *For such type of problem* $\sqrt{a\sqrt{a\sqrt{a\sqrt{a\sqrt{a}}}}}$ …. n times , result is $a^{\frac{2^n-1}{2^n}}$, where "a" = number inside the square root and "n "is no of repetition.

Example. Result for $\sqrt{4\sqrt{4\sqrt{4\sqrt{4\sqrt{4\sqrt{4}}}}}}$ is $4^{\frac{2^6-1}{2^6}} = 4^{\frac{63}{64}}$

b) *For such type of problem* $\sqrt{a\sqrt{a\sqrt{a\sqrt{a\sqrt{a \ldots \ldots \infty}}}}}$, result is a, where "a" = number inside the square root

Example. Result for $\sqrt{5\sqrt{5\sqrt{5\sqrt{5\sqrt{5 \ldots \ldots \infty}}}}}$ is 5.

c) *For such type of problem* $\sqrt{a \pm \sqrt{a \pm \sqrt{a \pm \sqrt{a \pm \sqrt{a \pm \ldots \ldots \infty}}}}}$, result is $\frac{\sqrt{4a+1} \pm 1}{2}$, where "a" = number inside the square root

Example. Result for i) $\sqrt{10+\sqrt{10+\sqrt{10+\sqrt{10+\sqrt{10+\ldots\ldots\infty}}}}}$ is $\frac{\sqrt{4X\,10+1}+1}{2}=\frac{\sqrt{41}+1}{2}$

ii) $\sqrt{10-\sqrt{10-\sqrt{10-\sqrt{10-\sqrt{10-\ldots\ldots\infty}}}}}$ is $\frac{\sqrt{4X\,10+1}-1}{2}=\frac{\sqrt{41}-1}{2}$

***d*)** *For such type of problem* $\sqrt{a\pm\sqrt{a\pm\sqrt{a\pm\sqrt{a\pm\sqrt{a\pm\ldots\ldots\infty}}}}}$, if factors of “a” are two consecutive numbers as “x” & “(x-1)” then result of $\sqrt{a+\sqrt{a+\sqrt{a+\sqrt{a+\sqrt{a+\ldots\ldots\infty}}}}}$ is “x” & result of

$\sqrt{a-\sqrt{a-\sqrt{a-\sqrt{a-\sqrt{a-\ldots\ldots\infty}}}}}$ is “x-1”

Example. For $\sqrt{12\pm\sqrt{12\pm\sqrt{12\pm\sqrt{12\pm\sqrt{12\pm\ldots\ldots\infty}}}}}$, factors of “12” are 4 and 3(consecutive numbers), so result of $\sqrt{12+\sqrt{12+\sqrt{12+\sqrt{12+\sqrt{12+\ldots\ldots\infty}}}}}$ is 4 &

result of $\sqrt{12-\sqrt{12-\sqrt{12-\sqrt{12-\sqrt{12-\ldots\ldots\infty}}}}}$ is 3

e) For such type of problem $\sqrt{1^3+2^3+3^3+4^3\ldots\ldots n^3}$, result is $\frac{n\times(n+1)}{2}$

Example. *i*) *For* $\sqrt{1^3+2^3+3^3}$, result is $\frac{3\times(3+1)}{2}$ = 6

ii) *For* $\sqrt{1^3+2^3+3^3+4^3\ldots\ldots 99^3}$, result is $\frac{99\times(99+1)}{2}$ = 4950

f) For such type of problem $\sqrt{1+2+3+4+\cdots+(n-2)+(n-1)+\boldsymbol{n}+(n-1)++(n-2)+\cdots+4+3+2+1}$

Result is “n”

Example. *i*) $\sqrt{1+2+3+4+\mathbf{5}+4+3+2+1}$, *result is* "5"

$ii)\ \sqrt{1+2+3+4+5+6+7+8+9+\mathbf{10}+9+8+7+6+5+4+3+2+1},\quad result\ is\ \text{"10"}$

g) For such type of problem $\sqrt{a \pm 2\sqrt{b}}$, if sum of two factors of "b" is "a" then result

is $\sqrt{1st\ \ factor(\ bigger\ one)} \pm \sqrt{2nd\ factor\ (smaller\ one)}$

Example. $i)\ \sqrt{8+2\sqrt{15}}$, factors of 15 are **5 and 3** which sum is 8,
so, result is $\sqrt{5}+\sqrt{3}$

$ii)\ \sqrt{10+2\sqrt{21}}$, factors of 21 are **7 and 3** which sum is 10,
so result is $\sqrt{7}+\sqrt{3}$

$iii)\ \sqrt{11-2\sqrt{30}}$, factors of 30 are **6 and 5** which sum is 11,
so, result is $\sqrt{6}-\ \sqrt{5}$

h) For such type of problem $\sqrt{a \pm n\,\sqrt{b}}$, if $sum\ of\ \left(\frac{n}{2}\right)^2$ and b is a then result is $\sqrt{\left(\frac{n}{2}\right)^2} \pm \sqrt{b}$

Example. $i)\ \sqrt{28+10\sqrt{3}}\ ,\ \left(\frac{10}{2}\right)^2+3=28\ \ so\ result\ is\ \sqrt{25}+\sqrt{3}$ or $5\ +\sqrt{3}$

$ii)\ \sqrt{16-6\sqrt{7}}\ ,\ \left(\frac{6}{2}\right)^2+7=16\ \ so\ result\ is\ \sqrt{9}-\sqrt{7}$ or $3-\sqrt{7}$

$iii)\ \sqrt{7-4\sqrt{3}}\ ,\ \left(\frac{4}{2}\right)^2+3=7\ \ so\ result\ is\ \sqrt{4}-\sqrt{3}$ or $2-\sqrt{3}$

i) For such type of problem $\frac{1}{2^1}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}+\cdots\cdots\cdots\frac{1}{2^n}$, result is $\frac{2^n-1}{2^n}$

Example. $i)\ \frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}$, result is $\frac{16-1}{16}\ =\frac{15}{16}$

$ii)\ \frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{64}+\frac{1}{128}+\frac{1}{256}$, result is $\frac{256-1}{256}\ =\frac{255}{256}$

j) Mathematics Division Tricks

The numbers that can be evenly divided by certain numbers are:

- If a number is an even number and ends in 0, 2, 4, 6 or 8, it is divided by 2.
- A number is divisible by 3 if the sum of the digits is divisible by 3. Consider the number 12 = 1 + 3 and 3 is divisible by 3.
- A number is divisible by 4 if the last two digits are divisible by 4. Example: 9312. Here the last two digits are 12, and 12 is divisible by 4.
- If the last digit is 0 or 5, it is divisible by 5

- If a number is divisible by 2 and 3, then it is divisible by 6, since 6 is the product of 2 and 3.
- If the number is divisible by 8, the last three digits of the numbers are divisible by 8.
- If a number is divisible by 9, the sum of the digits is divided by 9. Let us consider the example, 4518 = 4 + 5 + 1 + 8 = 18, which is divisible by 9.
- If the final digit of the number is 0, it is divisible by 10.

Conclusion:

Mathematics is a methodical application of matter. It is so said because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevent chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or special thinking, critical thinking. all of which are transferable qualities that will benefit us in our future endeavors.

It is a fun subject. Adding tricks to this subject will make it more interesting. Students will be able to solve all the complex problems using these Mathematics magic tricks. These tricks also help students to improve their problem-solving skills and boost their confidence.

Mathematical tricks are the ways to solve complex mathematical problems easily and quickly. Mathematics is not only limited to learning from textbooks, there are different learning styles that make mathematics easier. Simple Mathematical magic tricks helps for fast calculations and improve mathematical skills. For example, the multiplication tricks will help students to learn math's tables and quick multiplication.

Math tricks can be helpful for kids in several ways. They can help them reduce the number of steps that they need to take to tackle a problem and arrive at the right solution. They can also offer kids a range of ways to approach and solve the same problem. Due to this beauty of mathematical tricks, it plays very important role in competitive exams in solving the mathematical and reasoning problem effectively with accurate answer in very less time.

We all think we know enough about arithmetic to get by, and we certainly feel no guilt about resorting to the handy pocket calculator that has become so much a part of our lives. But, just as photography may blind us to the beauty of a Vermeer painting, or an electronic keyboard may make us forget the magnificence of a Horowitz sonata, too much reliance on technology can deny us the pleasures that we will find in these pages.

References

- Swami Bharati Krishna Tirthaji, "Vedic mathematics", Delhi Motilal Banarasidass publisher,1965.
- VedicMaths.Org (2004), http://www.vedicmaths.org
- Arthur Benjamin and Michael Shermer," Secrets of Mental Maths", The Mathematician's

Guide to Lightning Calculation and Amazing Math Tricks. Published in the United States by Three Rivers Press, an imprint of the Crown Publishing Group, a division of Random House, Inc., New York,2006

- Atul Gupta "The Power of Vedic Mathematics", Mumbai, Published by Jaico Publishing house,2008.
- Dhaval Bathia, "Vedic Mathematics made easy," Mumbai, Published by Jaico Publishing house, 2008.
- Both A.D," A signed binary multiplication techniques," Quarterly Journal of Mechanics and Applied Mathematics, Vol.4, pt 2, pp 236-240,1951.
- Pushpalata Verma, K.K Mehta, Implementation of efficient multiplier based on Vedic Mathematics using EDA tool, "International Journal of Engineering and advance technology, volume-1 Issue-5, June 2012.
- G.Ganesh Kumar, V. Charisma, Design of high speed Vedic Multiplier using Vedic Mathematics techniques, International journal or scientific and research Publication, volume 2, issue 3, March 2012.
- Pandit Ramnandan Shastri, Vedic Mathematics for all competitive exams, Arihant Publication, 2012
- G. Ganesh Kumar*, C Venkata Sudhakar**, M. Naresh Babu***, Design of high-Speed Vedic square by using Vedic Multiplication Techniques, International Journal of scientific & Engineering Research, Volume 4, Issue 1, January 2013.
- Vedic Mathematics: Sixteen Simple Mathematical formulae from the Vedas, Jagadguru Swami Sri Bharati Krishna Trithaji, Motilal Banarasidas, New Delhi 2015.
- Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018.
- Rajesh Kumar Thakur, The Essential of Vedic Mathematics, Rupa Publications, New Delhi 2019.
- Vedic Mathematics [online] Available: http://www.hinduism.co.za/vedic.htm