



## **Global Mental Math Olympiad 2023**

### **Referral Notes**

#### **Master Category (Age : 9 years to 11 years)**

##### **Syllabus: -**

- Mental Addition
- Mental Subtraction
- Introduction to Exponents
- Mental Multiplication
- Mental Division
- Average / Mean
- Profit & Loss

**To prepare for the Master Category of the Global Mental Math Olympiad 2023, we suggest that you practice Rounds 1 through Round 8 on our App.**

**Please note that Rounds 9 and 10 are not included in the syllabus, and therefore do not require your attention. Good luck with your training!**

**To gain a better understanding of the types of problems topic wise and their difficulty levels, please refer to the Sample Question Bank provided. They offer a comprehensive overview of the various types of problems and the degree of complexity involved.**

**NOTE - Please note that the referral material provided is intended only as a reference. If your child is currently following a specific method, we recommend that you continue with that approach.**

**These resources are intended to support children who may be unfamiliar with certain mental math topics and are seeking additional assistance.**



## Mental Additions Methods

Sometimes, we find it difficult to add numbers which end in 6, 7, 8 and 9. For example, if we have  $16+9$ , that's a difficult problem to do mentally.

But we can make it easy. We can use a method called by addition and by subtraction'.

### Method 1

Let us try  $16 + 9$ .

Since adding 9 directly is difficult for most of us, we add 10 which is easy to do mentally. So, since 9 is 1 less than 10, we can add 10 and then subtract 1 from our answer. Our sum looks like this:

We do:

- 1)  $16 + 10 = 26$
- 2)  $26 - 1 = 25$  is our answer.

Here, we would like to draw your attention to the method which is called 'by addition and by subtraction'. So, we add first and then subtract.

Let's take another example. Say, we have:

$$68 + 9$$

We do

$$68 + 10 = 78.$$

$$78 - 1 = 77 \text{ our answer.}$$

Now, let's try another example on our own.

$$59 + 8$$

$$\text{We do: } 59 + 10 = 69$$

Since 8 is 2 less than 10, we do:

$$69 - 2 = 67.$$

The answer is 67.



## ACTIVITY 1

Find the Sum									
1	27	2	59	3	29	4	57	5	19
	+8		+6		+9		+7		+7
Ans		Ans		Ans		Ans		Ans	



## Method 2

### Left to Right Mental Addition

This method is called Left to Right Mental Addition Method. So far traditionally in Maths, we have been doing additions and other operations from Right to Left.

However, we can also do mental addition effectively from Left to Right.

Say for example we have

$$\begin{array}{r} 88 \\ + 34 \\ \hline \end{array}$$

**Step 1,** we first add the figures in the left column.

So  $8 + 3 = 11$  (We keep this figure in our head)

$$\begin{array}{r} 88 \\ + 34 \\ \hline 11, \end{array}$$

**Step 2,** we now add the figures in the Right Hand Column

$8 + 4 = 12$  (we keep this in our head too)

The sum now looks like this:

$$\begin{array}{r} 88 \\ + 34 \\ \hline 11, 12 \end{array}$$

**Step 3,** in the final step we add the middle digits

$$\begin{array}{r} 88 \\ + 34 \\ \hline 11, 12 \\ \hline 122 \end{array}$$

So, the answer is 122

Find the Sum									
1	47	2	85	3	47	4	64	5	45
	+80		+16		+29		+47		+55
Ans		Ans		Ans		Ans		Ans	



## Mental Subtractions

Sometimes it becomes difficult to subtract numbers like 6, 7, 8, 9 from numbers ending in 1, 2, 3, 4, 5. This new method provides us with a different view and simpler approach, just like we saw in addition.

Say, we have  $42 - 9$

We subtract 10 first (as it is easy to take away 10) and then add back 1 (since 9 is 1 less than 10).

$$42 - 10 = 32$$

So,  $32 + 1 = 33$ . This is the answer.

Let us take another example:

$$81 - 8$$

So, we subtract 10 first (as it is easy to add back 2 (since 8 is 2 less than 10)).

$$81 - 10 = 71$$

So,  $71 + 2 = 73$  is the answer

Now let's try one with a slight variation!

$$43 - 17$$

So, we subtract 20 first (as it is easy to take away 20) and then add back 3 (since 17 is 3 less than 20).

$$43 - 20 = 23$$

So,  $23 + 3 = 26$  is the answer.

Find the Difference									
1	77	2	56	3	28	4	54	5	17
	-9		-7		-9		-7		-9
Ans		Ans		Ans		Ans		Ans	



## Multiplication (2 – Digit Number by a 1 – Digit Number)

There are several mental math techniques to multiply a 2-digit number by a 1-digit number. We suggest the best one here

### The Split and Multiply Technique:

Step 1: Split the 2-digit number into its tens and units digits.

Step 2: Multiply the 1-digit number by both the tens and units digits separately.

Step 3: Combine the results to get the final answer.

### Let's take a couple of examples to illustrate:

#### Example 1: $68 \times 5$

Step 1: Split 68 into 60 (tens) and 8 (units).

Step 2: Multiply 5 by both the tens and units digits separately.

$$5 \times 60 = 300$$

$$5 \times 8 = 40$$

Step 3: Add the results:  $300 + 40 = 340$

So,  $68 \times 5 = 340$ .

#### Example 2: $89 \times 4$

Step 1: Split 89 into 80 (tens) and 9 (units).

Step 2: Multiply 4 by both the tens and units digits separately.

$$4 \times 80 = 320$$

$$4 \times 9 = 36$$

Step 3: Add the results:  $320 + 36 = 356$

So,  $89 \times 4 = 356$ .

Find the Product									
1	77	2	56	3	28	4	54	5	17
	$\times 5$		$\times 7$		$\times 9$		$\times 4$		$\times 6$
	$70 \times 5 = 350$								
	$7 \times 5 = 35$								
	$350 + 35$								
Ans	385	Ans		Ans		Ans		Ans	



## Multiplication (3 – Digit Number by a 1 – Digit Number)

There are several mental math techniques to multiply a 3-digit number by a 1-digit number. We suggest the best one here

### The Split and Multiply Technique:

Step 1: Split the 3-digit number into its Hundreds, tens and units digits.

Step 2: Multiply the 1-digit number by each of the digits(hundreds, tens, and units digits) separately.

Step 3: Combine the results to get the final answer.

### Let's take a couple of examples to illustrate:

#### Example 1: $680 \times 5$

Step 1: Split 680 into 600 (hundreds), 80 (tens) and 0 (units)

Step 2: Multiply 5 by each of the components (600,80 and 0)

$$5 \times 600 = 3000$$

$$5 \times 80 = 400$$

$$5 \times 0 = 0$$

Step 3: Add the results:  $3000 + 400 + 0 = 3400$

So,  $680 \times 5 = 3400$ .

#### Example: $456 \times 7$

Step 1: Split 456 into 400 (hundreds), 50 (tens), and 6 (units).

Step 2: Multiply 7 by each of the components (400, 50, and 6).

Step 3:

$$7 \times 400 = 2800,$$

$$7 \times 50 = 350,$$

$$7 \times 6 = 42,$$

Step 31: Add the results:  $2800 + 350 + 42 = 3192$ .

So,  $456 \times 7 = 3192$ .

Find the Product									
1	770	2	262	3	281	4	355	5	127
	$\times 5$		$\times 4$		$\times 9$		$\times 2$		$\times 6$
	$700 \times 5 = 3500$								
	$70 \times 5 = 350$								
	$0 \times 5 = 0$								
	$3500 + 350$								
Ans	3850	Ans		Ans		Ans		Ans	



## Introduction to Exponents

The exponent of a number says how many times to use that number in a multiplication.

It is written as a small number to the right and above the base number.

Exponential expression has two components i.e Base and Exponent.

Other names for exponent are index or power

$8^2$  → Exponent (Power/Index)



Base

Here's another example: the base is 4, and the exponent is 3

$$4^3$$

An exponent tells us to multiply the base by itself that number of times. In our example, we will multiply the base of 4 by itself 3 times:

$$4^3 = 4 \times 4 \times 4$$

Once we write out the multiplication problem, we can easily evaluate the expression. Let's do this for the example we've been working with

$$4^3 = 4 \times 4 \times 4$$

$$= 16 \times 4$$

$$= 64$$

Another example:  $9^2 = 9 \times 9 = 81$

(The exponent "2" says to use the 9 two times in a multiplication.)

Another example:  $5^3 = 5 \times 5 \times 5 = 125$

(The exponent "3" says to use the 5 three times in a multiplication.)





## Profit and Loss

**Cost Price:** The amount paid to purchase an article or the price at which an article is made, is known as its cost price. The cost price is abbreviated as C. P.

**Selling Price:** The price at which article is sold, is known as its selling price. The selling price is abbreviated as S. P

**Profit:** If the selling price (S.P.) of an article is greater than the cost price (C.P.), then the difference between the selling price and cost price is called profit.

Thus, If  $S. P. > C.P.$ , then

$$\text{Profit} = S. P. - C. P.$$

$$\Rightarrow S. P. = C. P. + \text{Profit}$$

$$\Rightarrow C. P. = S. P. - \text{Profit}.$$

Example:

An article was brought for Rs 75 and sold for Rs 95 Find the gain or loss.

Solution:

CP of the article = 75

SP of the article = 95

Since  $SP > CP$ , so there is a profit

Profit = SP - CP

$$\text{Profit} = 95 - 75 = 20$$

So Profit is Rs 20

**Loss:** If the selling price (S.P.) of an article is less than the cost price (C.P.), then the difference between the cost price (C.P.) and the selling price (S.P.) is called loss.

Thus if  $S.P. < C.P.$ , then

$$\text{Loss} = C.P. - S.P.$$

$$\Rightarrow C. P. = S. P. + \text{Loss}$$

$$\Rightarrow S. P. = C. P. - \text{Loss}$$

Example:

An article was brought for Rs 50 and sold for Rs 40 Find the gain or loss.

Solution:

CP of the article = 50

SP of the article = 40

Since  $SP < CP$ , so there is a Loss

Loss = CP - SP

$$\text{Loss} = 50 - 40 = 10$$

So Loss is Rs 10



## Average & Mean

The formula for calculating Average and mean are the same,

The most widely used method of calculating an average is the 'mean'.

Mean is a point in a data set which is the average of all the data point we have in a set. It is basically arithmetic average of the data set and can be calculated by taking a sum of all the data points and then dividing it by the number of data points we have in data set.

$$\text{Mean} = \frac{\text{Sum of all Data Points}}{\text{Number of Data Points}}$$

### Example

1) Find Mean of 25,20,15,10

#### Step1

Add all the numbers up. i.e.  $25+20+15+12=70$

#### Step 2

Count the number of data points. Here there are 4 numbers given i.e. 25,20,15,12

#### Step 3

We divide the sum of the numbers with the number of data points. So,  $72/4=18$ .

18 is the Mean of 25,20,15,12

### Practice Example's

1. Find the Mean of 15,12,3,10
2. Find the Mean of 8,12,5,7
3. Find the Average of 25,35,20,12
4. Find the Average of 18,22,17,13



## Squaring Numbers

Squaring can be defined as 'multiplying a number by itself.'

There are many different ways of squaring numbers. Many of these techniques have their roots in multiplication as squaring is simply a process of multiplication.

Examples:  $3^2$  is 3 multiplied by 3 which equals 9

The technique that we will study are: -

### (A) SQUARING OF NUMBERS USING CRISSCROSS SYSTEM

The Urdhva-Tiryak Sutra (the Criss-Cross system) is by far the most popular system of squaring numbers amongst practitioners of Vedic Mathematics. The reason for its popularity is that it can be used for any type of numbers.

Ex: Find the square of

Ans: (a)

(b)

(c)

$$\begin{array}{r} 23 \\ \times 23 \\ \hline \end{array}$$

(a) First, we multiply 3 by 3 and get the answer as 9. (Answer at this stage is \_\_\_\_\_ 9)

(b) Next, we cross multiply ( $2 \times 3$ ) and add it with ( $2 \times 3$ ). The final answer is 12. We write down 2 and carry over 1. (Answer at this stage is 29)

(c) Thirdly, we multiply ( $2 \times 2$ ) and add the 1 to it. The answer is 5. **The final answer is 529**



## References

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