Addition and Subtraction

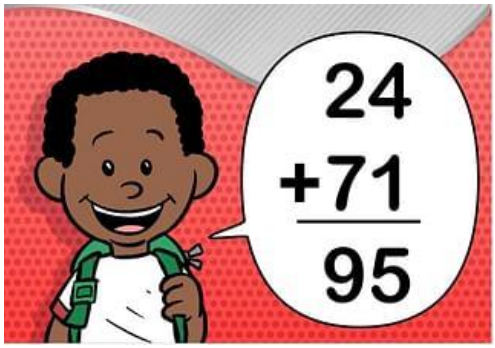
What's the Need of Studying Addition & Subtraction?

In our daily life, we come across many activities when we need to apply the method of addition and subtraction.

- Addition and subtraction are used to represent and solve many different kinds of problems. Many different types of problems can be represented by addition or subtraction.
- We are aware of the numbers and number system. Now we will discuss two simple algebraic operations, that is, addition and subtraction.

Let us Study Addition First!

- Addition is one of the very common arithmetic operations used in mathematics.
- Addition is the operation to know the total quantity when two or more than two quantities are taken together.



You have already studied simple addition like this in your junior classes. Let's move on to little tough addition now!

Addition of 4-Digit Numbers

Let's learn the addition of 4-Digit Numbers directly through the following examples:

Example 1: Add 5433 and 1522.

Arranging the addends in the column form and adding columnwise, we have,

	Th	H	T	O
	5	4	3	3
+	1	5	2	2
	6	9	5	5

On adding the ones.
On adding the tens.
On adding the hundreds.
On adding the thousands.

Thus, 5433 + 1522 = **6955.**

Tips: To add two or more 4-digit numbers, we add the ones, the tens, the hundreds and the thousands.

Example 2: Add 3437 and 4689.

	Th	H	T	O
	(1)	(1)	(1)	
	3	4	3	7
+	4	6	8	9
	8	1	2	6

Add the ones.
7 ones + 9 ones = 16 ones = 1 ten 6 ones.
Write 6 under the ones place and carry 1 to the tens place.

Add the tens.
3 tens + 8 tens + 1 ten (carry over) = 12 tens = 1 hundred 2 tens.
Write 2 under the tens place and carry 1 to the hundreds place.

Add the hundreds.
4 hundreds + 6 hundreds + 1 hundred (carry over) = 11 hundreds = 1 thousand 1 hundred.
Write 1 under the hundreds place and carry 1 to the thousands place.

Add the thousands.
3 thousands + 4 thousands + 1 thousand (carry over) = 8 thousands.
Write 8 under the thousands place.

Thus, 3437 + 4689 = **8126**.

Addition of 5- and 6-Digit Numbers

woohoooo!! Congratulations on mastering the concepts of addition of 4 digit numbers. Let's learn how to add 5 & 6 digit numbers now!

Method to add 5 & 6 Digit Numbers:

- **Step 1:** Add the ones.
- **Step 2:** Add the tens.
- **Step 3:** Add the hundreds.
- **Step 4:** Add the thousands.
- **Step 5:** Add the ten thousands. (Carry, wherever required.)
- **Step 6:** Add the lakhs.

Example 1: Add 25603 and 12396.

	TTh	Th	H	T	O
	2	5	6	0	3
+	1	2	3	9	6
	3	7	9	9	9

Thus, 25603 + 12396 = **37999.**

Working:

```
  2 5 6 0 3
+ 1 2 3 9 6
-----------
  3 7 9 9 9
```

Example 2: Add 17125 and 13799.

	TTh	Th	H	T	O
	(1)		(1)	(1)	
	1	7	1	2	5
+	1	3	7	9	9
	3	0	9	2	4

Thus, 17125 + 13799 = **30924.**

Working:

$$\begin{array}{r} 17125 \\ +\ 13799 \\ \hline 30924 \end{array}$$

Example 3: Find the sum of ninety-four thousand nine hundred sixty-eight and one lakh five hundred seventy-two.

Step 1: First, we write numerals for the addends, in proper columns. Ninety-four thousand nine hundred sixty-eight = 94,968 One lakh five hundred seventy-two = 1,00,572

Step 2: Add the addends and write the sum.

	L	TTh	Th	H	T	O
			(1)	(1)	(1)	
		9	4	9	6	8
+	1	0	0	5	7	2
	1	9	5	5	4	0

Thus, 94968 + 100572 = **195540.**

Problems Based on Real Life Situations

Example 1: A LED TV costs ₹ 21,235. An air conditioner costs ₹ 11,354 more. What is the cost of the air conditioner? What is the total cost of both the items?
Cost of the LED TV = ₹ 21,235
Cost of the air conditioner = ₹ 21,235 + ₹ 11,354 = **₹ 32,589**
Total cost of both the items = ₹ 21,235 + ₹ 32,589 = **₹ 53,824.**

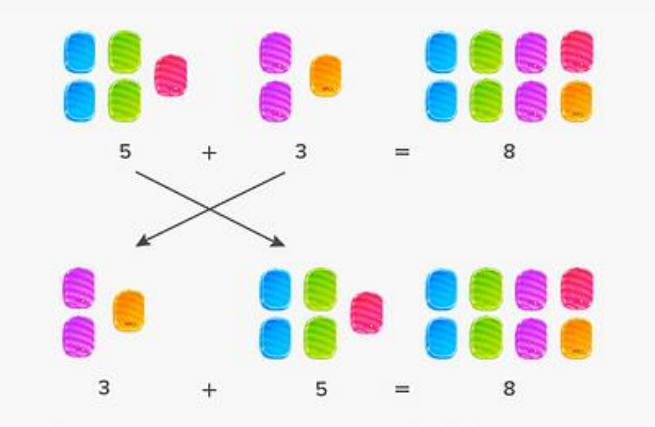
Example 2: There are 2,28,369 men, 2,15,008 women and 1,98,326 children in a town. What is the total population of the town?
Number of men in the town = 2,28,369
Number of women in the town = 2,15,008
Number of children in the town = 1,98,326
Total population of the town = 2,28,369 + 2,15,008 + 1,98,326 = 6,41,703
Thus, the total population of the town = **6,41,703.**

Working:

$$\begin{array}{r} 228369 \\ 215008 \\ +\ 198326 \\ \hline 641703 \end{array}$$

What are the Properties of Addition?
Property 1

- Changing the order of the two addends does not change the sum.
- This is called the order property of addition.



Changing the order of the two addends does not change the sum.

Study the following examples:

Example of Property 1: Find the sum of 4619 and 2836.
Let us add 4619 and 2836 in two ways.

First Way: 4619 + 2836

	Th	H	T	O
	(1)		(1)	
	4	6	1	9
+	2	8	3	6
	7	4	5	5

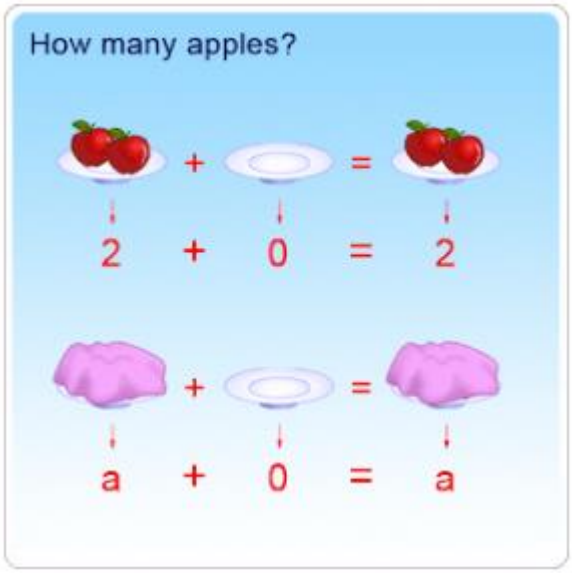
Second Way: 2836 + 4619

	Th	H	T	O
	(1)		(1)	
	2	8	3	6
+	4	6	1	9
	7	4	5	5

We see that, 4619 + 2836 = 2836 + 4619 = **7455.**
This proves the **order property of addition.**

Property 2

- The sum of any number and 0 is that number itself.
- This is called the **additive property** of zero.



The sum of any number and 0 is that number itself.

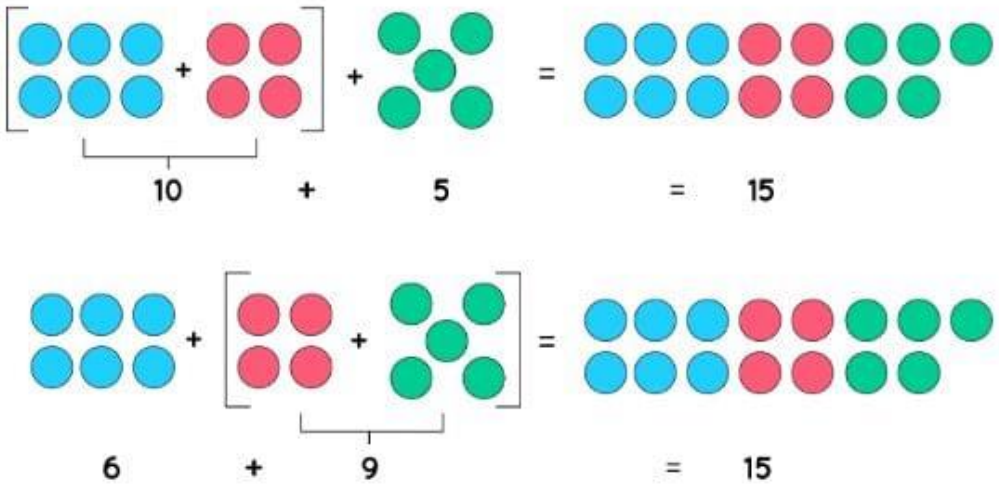
Example of Property 2: Find the sum of 51682 and 0.

	TTh	Th	H	T	O
	5	1	6	8	2
+					0
	5	1	6	8	2

Thus, 51682 + 0 = **51682.**
This proves the **additive property of 0.**

Property 3

- The way in which we group the addends does not change the sum. This is called the **grouping** or **associative property** of addition.
- When adding 3 numbers, you may group the first 2 addends or the last 2 addends.
  You will always get the same sum.
- We call this idea, the **grouping** or **associative property of addition.**



The way in which we group the addends does not change the sum

Example of Property 3: Add: 6038 + 7767 + 8437
Let us add 6038, 7767 and 8437 in two ways.

First Way: (6038 + 7767) + 8437

	TTh	Th	H	T	O
			(1)	(1)	
		6	0	3	8
+		7	7	6	7
	1	3	8	0	5

	TTh	Th	H	T	O
	(1)	(1)		(1)	
	1	3	8	0	5
+		8	4	3	7
	2	2	2	4	2

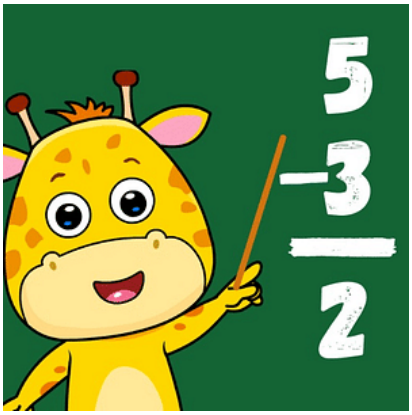
Second Way: 6038 + (7767 + 8437)

	TTh	Th	H	T	O
		(1)	(1)	(1)	
		7	7	6	7
+		8	4	3	7
	1	6	2	0	4

	TTh	Th	H	T	O
	(1)			(1)	
	1	6	2	0	4
+		6	0	3	8
	2	2	2	4	2

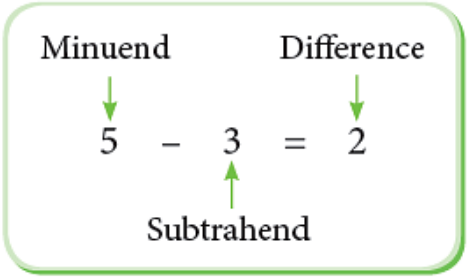
Thus, (6038 + 7767) + 8437 = 6038 + (7767 + 8437) = **22242.**
This proves the **associative property of addition.**

Subtraction



You have already studied simple subtraction like this in your junior classes. Let's move on to little tough subtraction now!

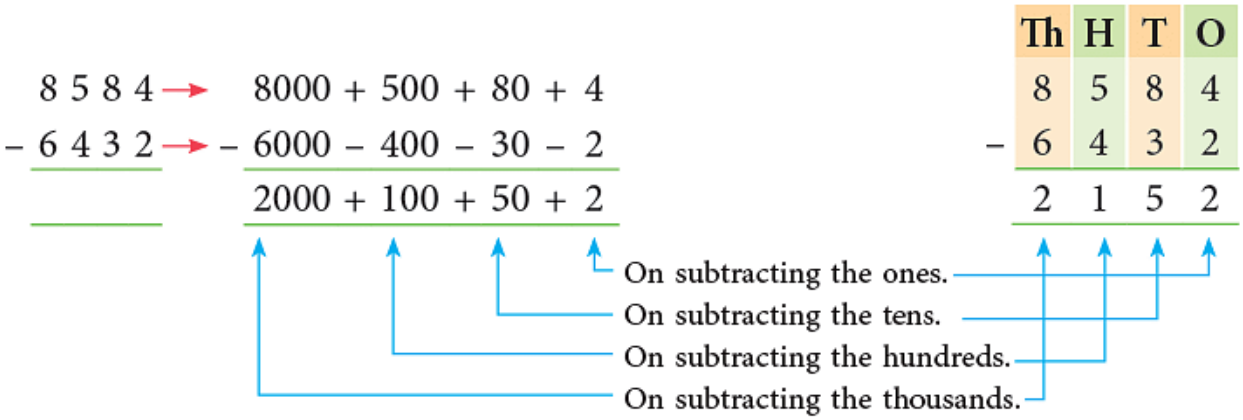
- In a subtraction problem, the larger number from which the smaller number is subtracted is called the **minuend.**
- The smaller number which is subtracted is called the **subtrahend.** The resulting number obtained after subtraction is called the **difference** of the two numbers.



Subtraction of 4-Digit Numbers

Case I: Without Borrowing

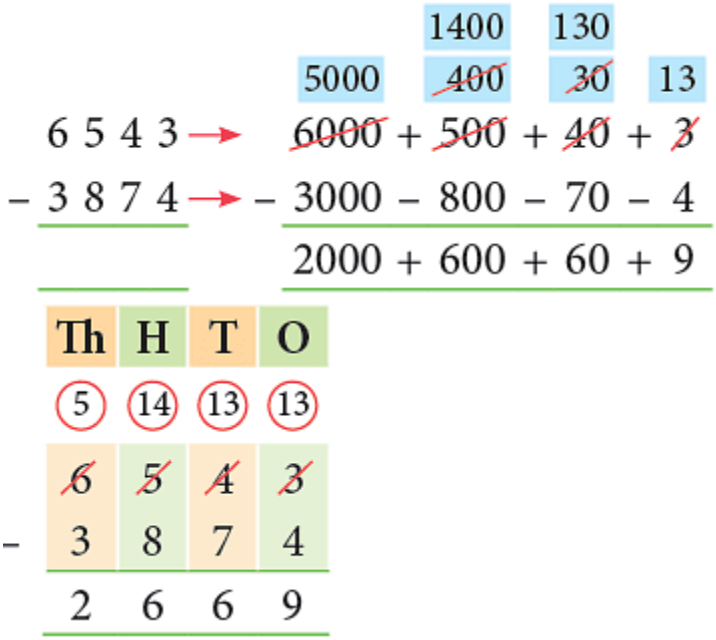
Example: Subtract 6432 from 8584.



Thus, 8584 – 6432 = **2152.**

Case 2: With Borrowing

Example: Subtract: 6543 – 3874



Thus, 6543 – 3874 = **2669.**

Write:

$$\begin{array}{r} 6543 \\ -\ 3874 \\ \hline 2669 \end{array}$$

Tips: Borrow mentally and work out your subtraction question as shown below.

Example: Subtract 6845 from 8762.

We subtract as under:

	Th	H	T	O
	(7)	(17)	(5)	(12)
	~~8~~	~~7~~	~~6~~	~~2~~
−	6	8	4	5
	1	9	1	7

Thus, 8762 – 6845 = **1917.**

Write:

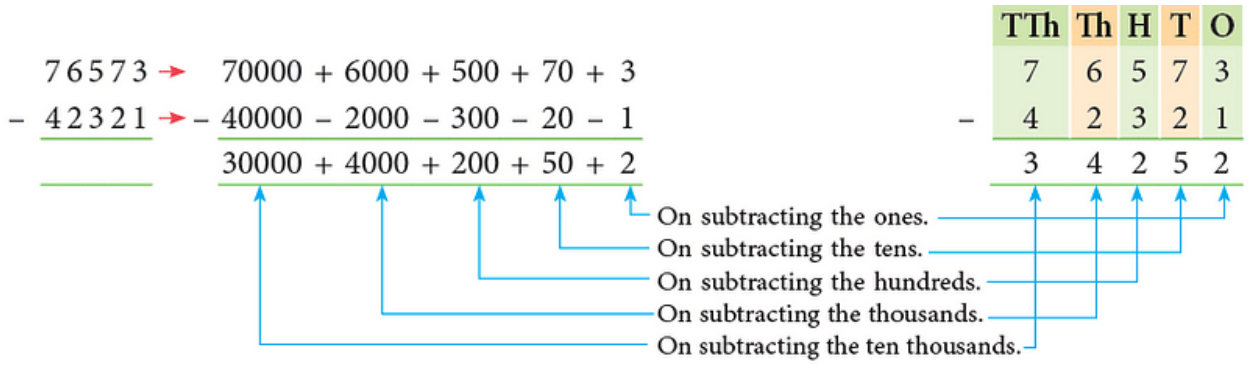
$$\begin{array}{r} 8762 \\ -\ 6845 \\ \hline 1917 \end{array}$$

Subtraction of 5- and 6-Digit Numbers

Subtracting with 5- and 6-digit numbers is like subtracting with 1-, 2-, 3- or 4-digit numbers. You subtract the ones, subtract the tens, subtract the hundreds and so on.

Case I: Without Borrowing

Example 1: Subtract 42321 from 76573.



Thus, 76573 – 42321 = **34252.**

Case 2: With Borrowing

Example 1: Subtract 2,97,973 from 5,82,621.

	L	TTh	Th	H	T	O
		17	11	15	11	
	4	~~7~~	~~1~~	~~5~~	~~1~~	11
	~~5~~	~~8~~	~~2~~	~~6~~	~~2~~	~~1~~
–	2	9	7	9	7	3
	2	8	4	6	4	8

Thus, 5,82,621 – 2,97,973 = **2,84,648.**

Write:

5 8 2 6 2 1
– 2 9 7 9 7 3
2 8 4 6 4 8

Tips: Do the borrowing mentally.

Problems Based on Real Life Situations

Example 1: A factory produced 2,80,575 LED bulbs in 2017. In 2018, it produced 3,50,780 bulbs. By how many bulbs did the factory's production increase?

Number of bulbs produced in 2018 = 3,50,780
Number of bulbs produced in 2017 = 2,80,575
Number of bulbs increased in 2018 = 3,50,780 – 2,80,575 = 70,205

	3	5	0	7	8	0
–	2	8	0	5	7	5
		7	0	2	0	5

Thus, the increase in the production of number of bulbs in 2018 is **70,205.**

Example 2: A stadium has a seating capacity of 1,02,225. The government increases the size of the stadium. Now, the seating capacity is 1,25,000. How many new seats are added in the stadium?

New seating capacity = 1,25,000
Old seating capacity = 1,02,225
Number of new seats added = 1,25,000 – 1,02,225 = 22,775

	1	2	5	0	0	0
–	1	0	2	2	2	5
		2	2	7	7	5

Thus, the number of new seats added in the stadium is **22,775.**

Addition and Subtraction Together
Sometimes, we need to solve a problem that involves both addition and subtraction. In such cases, first, we add and then subtract.

Example 1: Simplify: 5109 – 3178 + 12863.

Step 1: First, we add 5109 and 12863.

	TTh	Th	H	T	O
				(1)	
		5	1	0	9
+	1	2	8	6	3
	1	7	9	7	2

Step 2: Subtract 3178 from the sum obtained in step 1.

	TTh	Th	H	T	O
				(16)	
			(8)	~~(6)~~	(12)
	1	7	~~9~~	~~7~~	~~2~~
–		3	1	7	8
	1	4	7	9	4

Thus, 5109 – 3178 + 12863 = **14794.**

Example 2: Simplify: 238691 + 325051 – 452310.

Step 1: Add the numbers with same (+) signs.

	L	TTh	Th	H	T	O
	2	3	8	6	9	1
+	3	2	5	0	5	1
	5	6	3	7	4	2

Step 2: Subtract the third number from the sum obtained in step 1.

	L	TTh	Th	H	T	O
	5	6	3	7	4	2
–	4	5	2	3	1	0
	1	1	1	4	3	2

Thus, 238691 + 325051 – 452310 = **111432.**

Example 3: In an exhibition, 1,02,000 persons, in all visited on Monday, Tuesday and Wednesday. If 41,345 persons visited the exhibition on Monday and 53,869 persons on Tuesday, then how many persons visited the exhibition on Wednesday?

Number of persons who visited the exhibition on the first two days
= 41,345 + 53,869 = 95,214

	TTh	Th	H	T	O
		(1)	(1)	(1)	
	4	1	3	4	5
+	5	3	8	6	9
	9	5	2	1	4

Total number of persons who visited the exhibition = 1,02,000.
So, the number of persons who visited the exhibition on Wednesday
= 1,02,000 – 95,214 = 6,786

	L	TTh	Th	H	T	O
		(9)	(11)	(9)	(9)	(10)
	~~1~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~
–		9	5	2	1	4
			6	7	8	6

Hence, **6,786** persons visited the exhibition on Wednesday.

Estimating Sums and Differences

To estimate a sum or a difference, first round off each number to its nearest tens, hundreds or thousands as per the number of digits in the numbers and then, add or subtract.

Example 1: Mr Khan bought a mobile for ₹ 8,793 and a chair for ₹ 3,925.

Estimate how much did he pay more for the mobile?

Estimated cost of a mobile = ₹ 9,000 (8793 rounded to the nearest thousand as 9,000.)
Estimated cost of a chair = ₹ 4,000 (3925 rounded to the nearest thousand as 4,000.)
So, Mr Khan paid about ₹ 9,000 – ₹ 4,000 = ₹ **5,000** for mobile.

Example 2: Estimate the sum of 247 and 1,375 by rounding each number to the nearest hundred. Also, compare with actual sum?

$$\begin{array}{rcl} 247 & \xrightarrow{\text{rounded off to the nearest hundred}} & 200 \\ +\ 1375 & \xrightarrow{\text{rounded off to the nearest hundred}} & +\ 1400 \\ \hline & & 1600 \end{array}$$

Actual Sum

$$\begin{array}{r} 247 \\ +\ 1375 \\ \hline 1622 \end{array}$$

So, the estimated sum is **1600** and the actual sum is **1622**.
Difference = 1622 – 1600 = 22.
Hence, the actual sum is 22 more than the estimated sum.