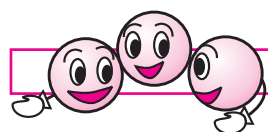




Let's recall.



Count how many boys, flowers and ducks there are in the picture. We have to count objects in order to find out the answer to 'How many?'. Numbers were created because of the need to count things in nature. We write the count of things in the form of numbers.



Let's discuss.

Dada : The numbers 1, 2, 3, 4, ... that we have used up to now for counting are called '**counting numbers**'. They are also called **natural numbers**. But is it possible to count the stars in the sky or the grains of sand on the beach? They are innumerable and so are the natural numbers. Look at this list of natural numbers:

Natural numbers : 1, 2, 3, 4, ..., 321, 322, ..., 28573, ...

Samir : We have already learnt to add and subtract these natural numbers. But when we subtract 5 from 5 nothing remains. The zero that we write to show that, is not seen in this list.

Dada : Of course, we cannot do without 'zero'. **The set of all natural numbers together with zero is the set of whole numbers.**

Whole numbers : 0, 1, 2, 3, 4, ..., 367, 368, ..., 237105, ...

Dada : We need to use some other numbers which are not there in this group.

Salma : Which are those?

Dada : Here's an example. In Maharashtra, the temperature falls to 10°C (10 degrees Celsius) or even 8°C in winter, but not down to 0°C . But in Kashmir, it may fall even below 0°C . To show that, we need numbers that are less than zero.

Samir : In January, when the papers said that it was snowing in Kashmir, the temperature in Srinagar was -8°C . How do we read that?

Dada : It is read as 'minus eight degrees Celsius'. When we put a minus sign ($-$) before any number, the number obtained is less than zero. It is called a **negative number**. On a thermometer, there are increasing numbers like 1, 2, 3, ... above 0. These are called **positive numbers**. The numbers below zero are $-1, -2, -3, \dots$.

Samir : Can we show negative numbers on the number line?

Dada : Of course! On the right of zero at distances of 1, 2, 3, units are the numbers 1, 2, 3, On the left of zero at 1, 2, 3, ... unit distances are the numbers $-1, -2, -3, \dots$. They are called **negative numbers**. The numbers 1, 2, 3, on the right are called **positive numbers**. They can be written as 1, 2, 3, ... and also $+1, +2, +3, \dots$.

Salma : On the thermometer, the positive numbers are above zero and the negative numbers are below it. On the number line, they are on the right and left sides of zero respectively. Does it mean that positive and negative numbers are on opposite sides of zero?

Dada : Correct!

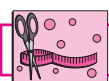
Samir : Then should we use positive numbers to show height above sea level and negative numbers for depth below sea level?

Dada : You're right, too! Very good!



Take care!

The ' $+$ ' sign is generally not written before positive numbers. However, it is necessary to write the ' $-$ ' sign of a negative number. Zero does not have any sign.



Try this.

Take warm water in one beaker, some crushed ice in another and a mixture of salt and crushed ice in a third beaker. Ask your teacher for help in measuring the temperature of the substance in each of the beakers using a thermometer. Note the temperatures.



Warm water



Crushed ice



Crushed ice and salt





Let's learn.

Integers

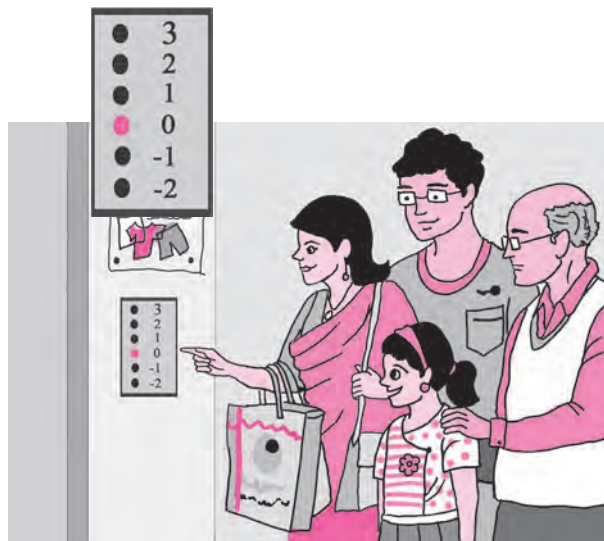
Positive numbers, zero and negative numbers together form a group of numbers called the group of integers.



My friend, Maths : At the fair, in the lift.



Look at the picture of the kulfi man. Why do you think he keeps the kulfi moulds in a mixture of salt and ice?



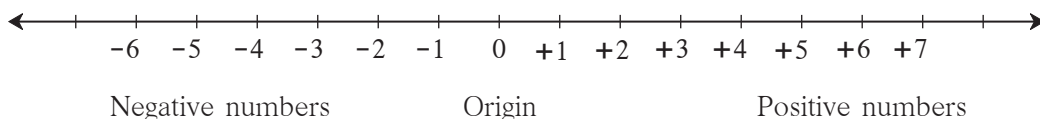
In a lift, the ground floor is numbered 0 (zero) while the floors below the ground level are numbered -1 and -2.



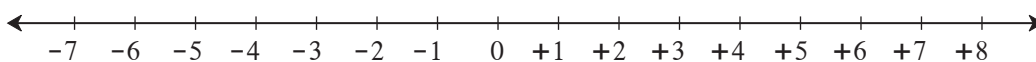
Let's learn.

Showing Integers on the Number Line

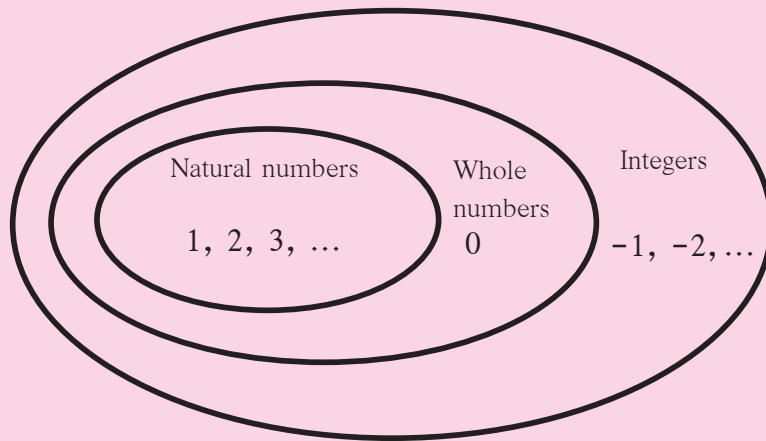
The point on a number line which is marked 0 is called the origin. On the left and right of 0, points are marked at equal distances. The numbers shown by points on the right are positive numbers and those shown by points on the left are negative numbers.



Example : Show the numbers -7 and +8 on the number line.



Can you tell?



My **class**, that is Std VI, is a part of my **school**. My school is in my **town**. My town is a part of a **taluka**. In the same way, the taluka is a part of a **district**, and the district is a part of Maharashtra **State**.

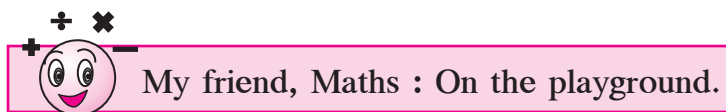
In the same way, what can you say about these groups of numbers?

Practice Set 4

- Classify the following numbers as positive numbers and negative numbers.
-5, +4, -2, 7, +26, -49, -37, 19, -25, +8, 5, -4, -12, 27
- Given below are the temperatures in some cities. Write them using the proper signs.

Place	Shimla	Leh	Delhi	Nagpur
Temperature	7 °C below 0°	12 °C below 0°	22 °C above 0°	31 °C above 0°

- Write the numbers in the following examples using the proper signs.
 - A submarine is at a depth of 512 metres below sea level.
 - The height of Mt Everest, the highest peak in the Himalayas, is 8848 metres.
 - A kite is flying at a distance of 120 metres from the ground.
 - The tunnel is at a depth of 2 metres under the ground.



- On the playground, mark a timeline showing the years from 2000 to 2024. With one child standing at the position of the current year, ask the following questions:
 - While playing this game, what is his/her age?
 - Five years ago, which year was it? And what was his/her age then?
 - In which year will he/she go to Std X? How old will he/she be then?

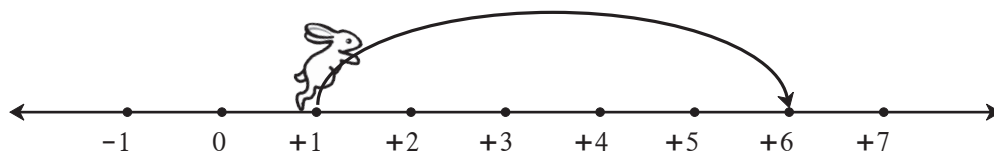
The child should find answers to such questions by walking the right number of units and in the right direction on the timeline.

- Next, the unit on the timeline on the playground should be of 100 years. This will make it possible to count the years from 0 to 2100 on it. Important historical events can then be shown in the proper centuries.

Addition of Integers

On the number line, we shall show the rabbit's hops to the right with positive signs and the ones to the left with negative signs.

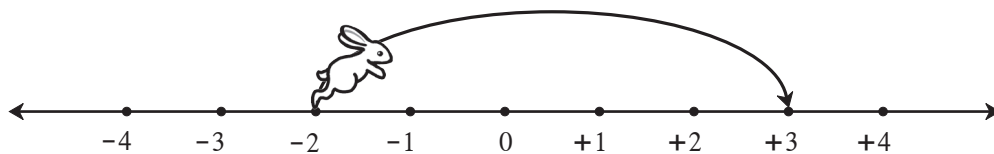
Activity:



- At first the rabbit was at the number .
- It hopped units to the right.
- It is now at the number .

$$1 + 5 = (+1) + (+5) = +6$$

Activity:



- At first the rabbit was at the number .
- It hopped units to the right.
- It is now at the number .

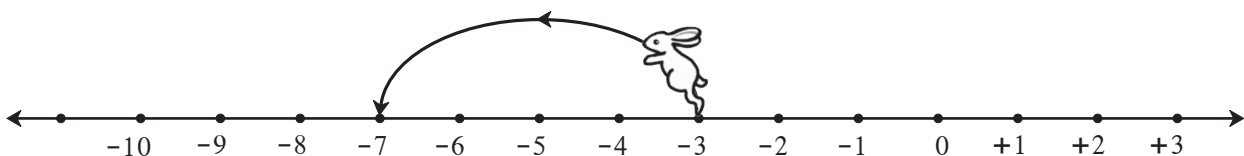
$$(-2) + (+5) = +3$$



Now I know -

To add a positive number to the given number, we move that many units to the right on the number line from the given number.

Activity:

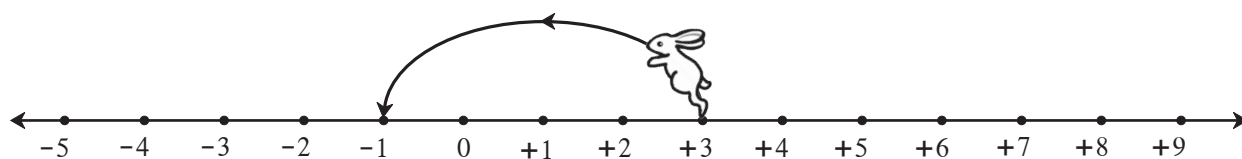


- At first the rabbit was at the number .
- It hopped units to the left.
- It is now at the number .

$$(-3) + (-4) = -7$$



Activity :



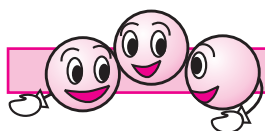
- At first the rabbit was at the number .
- He hopped units to the left.
- It is now at the number .

$$(+3) + (-4) = -1$$



Now I know -

To add a negative number to the given number, we move that many units to the left on the number line from the given number, i.e., we move backward on the number line which means we subtract.



Let's discuss.

Let us understand the addition and subtraction of integers with the help of the amounts of money we get and the amounts we spend.

Dada : We shall show the amount we have or the amount we get as a positive number and the amount we borrow or spend as a negative number.

Anil : I have 5 rupees. That is, I have the number +5. Mother gave me 3 rupees as a gift. That number is +3. Now I have 8 rupees in all.

$$5 + 3 = (+5) + (+3) = +8$$

Dada : You know how to add positive numbers. Now let us add negative numbers. Sunita, if I lend you 5 rupees to buy a pen, how will you show that?

Sunita : I will write the amount I have as negative five or -5.

Dada : If I lend you another 3 rupees, what is your total debt?

Sunita : $(-5) + (-3) = -8$. That means I owe eight rupees.

Dada : You have a debt of 8 rupees. Mother gave you 2 rupees to buy sweets. So you got +2 rupees. Now, if you repay 2 rupees of your debt, how much will you still owe?

Sunita : $(-8) + (+2) = -6$. So, I still owe 6 rupees.

Dada : Anil, you have 8 rupees, or, +8. You spend 3 rupees to buy a pencil. How many rupees do you still have ?

Anil : $(+8) + (-3) = +5$.



Dada : We used the example of earning and spending to understand how to add integers.

For example, $(+5) + (+3) = +8$ and $(-5) + (-3) = -8$

$(-8) + (+2) = -6$ and $(+8) + (-3) = +5$



Now I know -

- When adding integers with the same sign, ignore the signs and add the numbers. Then give the common sign to their sum.
- When adding integers with different signs, ignore the signs and subtract the smaller number from the bigger one. Then, give the sign of the bigger number to the difference obtained.

Practice Set 5

1. Add.

- (1) $8 + 6$
- (2) $9 + (-3)$
- (3) $5 + (-6)$
- (4) $-7 + 2$
- (5) $-8 + 0$
- (6) $-5 + (-2)$

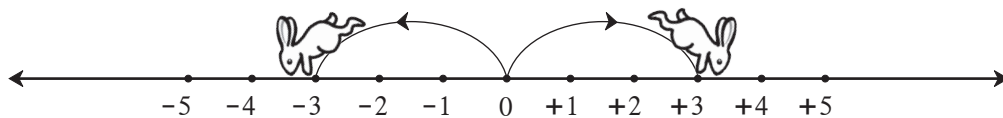
2. Complete the table given below.

+	8	4	-3	-5
-2	$-2 + 8 = +6$			
6				
0				
-4				



Let's learn.

Opposite Numbers



When the rabbit jumps 3 units to its right from 0, it reaches the number +3.

When it jumps 3 units to its left from 0, it reaches the number -3.

Both these distances from zero are equal. Only the directions of the two jumps are opposite to each other. In other words, +3 and -3 are opposite numbers.

Opposite numbers are at the same distance from zero but in opposite directions.

If the rabbit jumps 5 units to the left from 0, where does it reach?

Now, if it jumps 5 units to the right from -5, where does it reach?

$(-5) + (+5) = 0$ and then $(+5) + (-5) = ?$

The sum of two opposite numbers is zero.



Practice Set 6

- * Write the opposite number of each of the numbers given below.

Number	47	+ 52	- 33	- 84	- 21	+ 16	- 26	80
Opposite number								

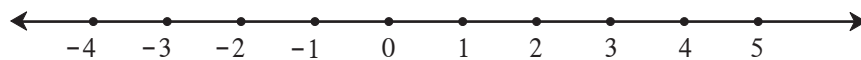


Let's learn.

Comparing Integers

You know that if we add 1 to any number on the number line, you get the next number on the right. Note that this is true for negative numbers too.

For example, $-4 + 1 = -3$



$$-4 < -3 < -2 < -1 < 0 < 1 < 2 < 3 < 4 < 5.$$

Now let us compare positive numbers, zero and negative numbers.

For example, $4 > -3$ $4 > 3$ $0 > -1$ $-2 > -3$ $-12 < 7$



Now I know -

On the number line, every number is greater than the number on its immediate left by 1.

Practice Set 7

- * Write the proper signs $>$, $<$ or $=$ in the boxes below.

(1) $-4 \square 5$	(2) $8 \square -10$	(3) $+9 \square +9$	(4) $-6 \square 0$
(5) $7 \square 4$	(6) $3 \square 0$	(7) $-7 \square 7$	(8) $-12 \square 5$
(9) $-2 \square -8$	(10) $-1 \square -2$	(11) $6 \square -3$	(12) $-14 \square -14$



Let's learn.

Subtraction of Integers

Tai : Anil, suppose you have a debt of 8 rupees. If you earn 5 rupees, you first pay off 5 rupees of your debt. Thus your debt is reduced by the amount you earn. The 5 rupees you earn reduce your debt by 5 rupees and are therefore subtracted from your debt. We write it like this : $-(-5) = (+5)$

So your debt is now less than before by 5 rupees, and only 3 rupees remain to be paid back. $(-8) - (-5) = (-8) + 5 = -3$

You already know that $8 + (-5) = 8 - 5 = 3$



With the help of the following examples, learn how to subtract negative numbers.

$$\begin{aligned} (-9) - (-4) \\ = (-9) + 4 \\ = -9 + 4 \\ = -5 \end{aligned}$$

$$\begin{aligned} (-4) - (-9) \\ = (-4) + 9 \\ = -4 + 9 \\ = +5 \end{aligned}$$

$$\begin{aligned} (+9) - (+4) \\ = (+9) + (-4) \\ = +9 - 4 \\ = +5 \end{aligned}$$

$$\begin{aligned} (+9) - (-4) \\ = (+9) + 4 \\ = +9 + 4 \\ = +13 \end{aligned}$$



Now I know -

To subtract a number from another number is to add its opposite number to the other number. For example : $8 - (-6) = 8 + (+6)$

Practice Set 8

- * Subtract the numbers in the top row from the numbers in the first column and write the proper number in each empty box.

-	6	9	-4	-5	0	+7	-8	-3
3	$3 - 6 = -3$							
8				$8 - (-5) = 13$				
-3								
-2								



A Game of Integers

The board for playing this game is given on the back cover of the book. Place your counters before the number 1. Throw the dice. Look at the number you get. It is a positive number. Count that many boxes and move your counter forward. If a problem is given in that box, solve it. If the answer is a positive number, move your counter that many boxes further. If it is negative, move back by that same number of boxes.

Suppose we have reached the 18th box. Then the answer to the problem in it is $-4 + 2 = -2$. Now move your counter back by 2 boxes to 16. The one who reaches 100 first, is the winner.

