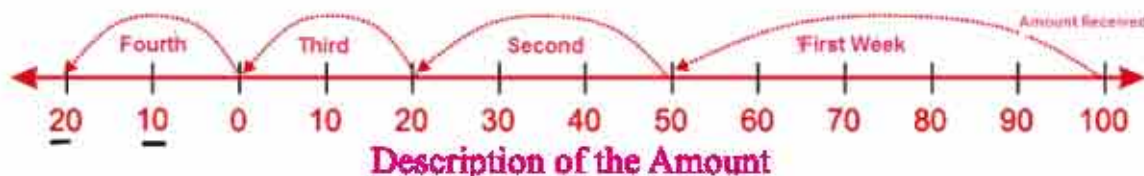


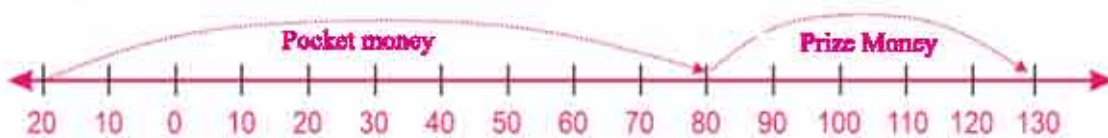
**4.1** Mahesh is studying and he is staying in a tribal hostel. His father gives him Rs. 100 every month as pocket money which he deposits with his warden. He transacts the money according to his needs which is recorded on a paper by the warden.

Mahesh took Rs.50 in the first week, Rs. 30 in the second week, Rs. 20 in the third week and asked for Rs. 20 in the fourth week. The warden says that he has returned the complete amount. Ramesh tells him to deduct it in the next month. The warden gives him Rs. 20 and denotes in on the number-line as follows:



Mahesh got Rs.100 on the first day of the second month, which he deposited to the warden. Can you tell how much of Mahesh's money is now left deposited with the warden?

The same day he got prize of Rs 50 for essay writing, now how much total money of Mahesh is deposited with the warden?



Look at the number-line and answer the following questions:

1. How much money did Mahesh spend in the first month?
2. How much money did the warden give him in the fourth week?
3. In which direction has the warden shown above amount on the number-line?
4. What is the difference between the Rs. 20 written on the right side and the Rs.20 written on the left side of the zero?
5. On Which side of the number-line Rs.100 and Rs.50 received in the second month is denoted?
6. If Mahesh has to spend Rs. 200 due to illness in the second month, how much money will remain with the warden and where on the number-line will it be denoted?

Let us play a game. Draw a number-line shown below:



**Material :** Red and blue colored dices, a cloth bag, differently colored pieces for all players

**Rules of the game**

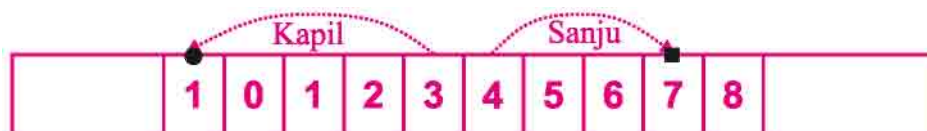
1. Put both the dices in the bag.
2. Player has to select a dice without looking at the bag.
3. If the dice is red then it will move towards the right on the number line.
4. In case of the blue dice, the move is towards the left.
5. The player reaching 25 first will win

Sanju and kapil are playing the same game.

Sanju gets 4 on his red dice and he places his piece to the fourth place on the right. Kapil get 3 on his red dice and he places his piece on 3 on the right.



In the second chance, Sanju gets 3 on his red dice and Kapil gets 4 on his blue dice. Can you tell where the pieces would be kept?



Kapil puts his piece on the left on 1 and Sanju reaches on 7, and the game continues. Kapil reaches 25 on the left and Sanju reaches 10 on right. Kapil says he has won but Sanju says he is ahead. The mathematics teacher arrives and she explains:

**Teacher :** Kapil you have not won and as per rules Sanju needs 15 more points to win. You should continue playing.

**Kapil :** Ma'am, I have reached on 25.

**Teacher :** Look carefully, the 25 on the left and 25 on the right represent two different numbers. Just as 10 is on the right side of 5 and so it is bigger than 5, every number is smaller than the number on its right.

**Sanju :** Hence your 25 being on the left are smaller than my 10.

**Teacher :** Numbers increase towards the right on the number-line. Every number is bigger than the number on its left and smaller than the number on its right. The numbers on the left of zero are called Negative numbers and are denoted as -1, -2, -3....to differentiate them from numbers on the right.

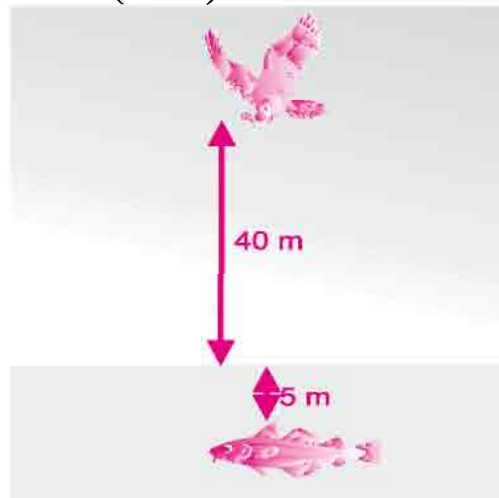
The number next to each number is called its Successor number. And the number before it is called Predecessor. Write the predecessor and successor of



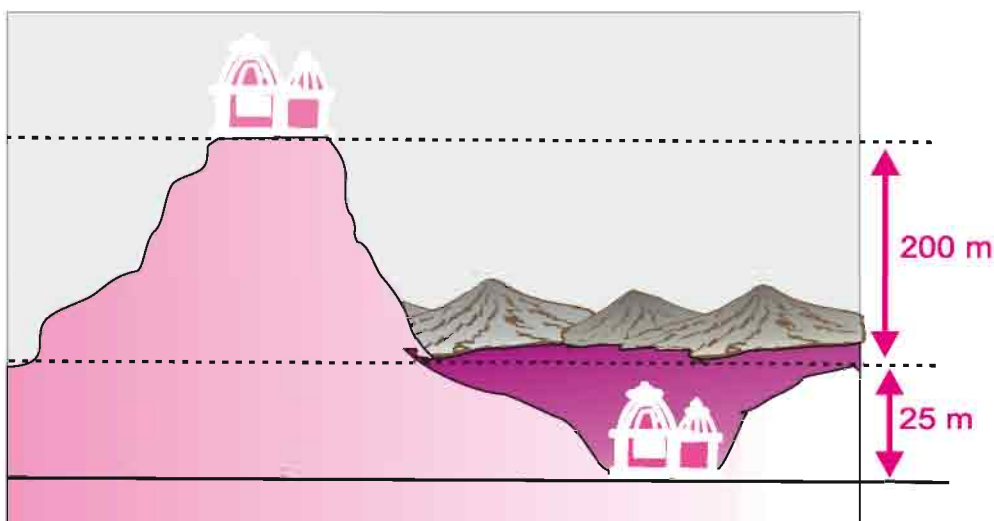
Numbers	Successor	Predecessor
-5		
6		
0		
25		
-10		

#### 4.2 Use of Negative numbers

1. An eagle is flying at 40 meters above sea-level and just below it a fish is swimming at 5 meters below (i.e. -5) sea level.



2. A temple is on a hill at the height of 200 meters above the ground level, and there is another temple in a valley at 25 meters below (i.e. -25) ground level.





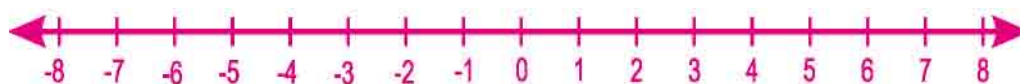
**Do and Learn**

Write using appropriate symbols

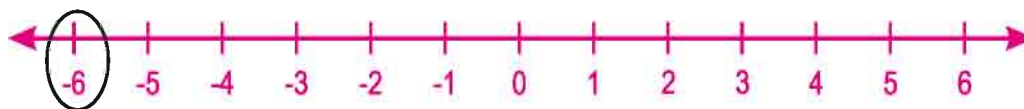
- |   |   |
|---|---|
| 1. Any 2 numbers smaller than 0                               | 2. 50 meters below sea level                                  |
| 3. $10^{\circ}\text{C}$ Temperature below $0^{\circ}\text{C}$ | 4. $15^{\circ}\text{C}$ Temperature above $0^{\circ}\text{C}$ |

**4.3 Integers**

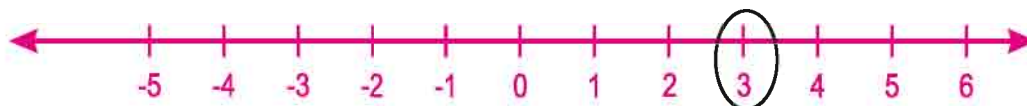
Natural numbers 1, 2, 3... were the first to be discovered, after that 0 added to the group of numbers is called Whole numbers 0, 1, 2, 3... Now we know that numbers are also Negative such as -1, -2, -3.... If we include negative numbers to the group of Whole numbers then the new group is called Integers. It is denoted by I.

**Representing Integers on the Number line**

Integers are represented in the same way as Natural and whole numbers on the number line. The only difference is that integers also include Negative numbers which are represented on the left side of 0 by points at equal distances between each other. For example to represent -6 it is denoted 6 points from 0 on the left.



If we want to represent +3 then it is represented on the third point towards the right.

**Do and Learn**

Mark -3, 5, -1, 0, -5, 6 on the number line.

**4.4 Order relation in Integers**

We know that  $5 > 3$  and we can see that 5 is located towards the right of 3.



Similarly  $3 > 0$ , 3 is to the right of 0. Because the number 0 is to the right of -3 so  $0 > -3$ . Again -3 is to the right of -8 hence  $-3 > -8$ .



So we can see that as we move towards the right, the value of numbers increases and it decreases as we go to the left.

### Exercise 4.1

- Write the appropriate integer according to the following:
  - The temperature of hot water is  $45^{\circ}\text{C}$
  - A matter freezes at  $10^{\circ}\text{C}$  below  $0^{\circ}\text{C}$ .
  - Reena earned a profit of Rs 300 by selling book.
  - Withdraw Rs. 500 from the bank account.
- Represent the following on the number line.
  - +5
  - 4
  - 0
  - 2
- Denote the bigger and smaller numbers using signs ( $<$ ,  $>$ ,  $=$ )
  - $3 \square - 5$
  - $-2 \square - 4$
  - $7 \square - 7$
  - $0 \square - 3$
  - $0 \square 3$
  - $1 \square - 50$
- Write true or false for the following statements:
  - 4 is located to the right side of -3 on the number line. ( )
  - Zero is a negative number. ( )
  - The smallest negative Integer is -1. ( )
  - 0 is located between -1 and 1 on number line. ( )
- Write the integers in ascending order between the pair of numbers given below.
  - 0 and -4
  - 3 and -5
  - 2 and 2
  - 10 and -6
- Write the following integers in ascending and descending order.
  - 7, 5, -3, 3
  - 1, 3, 0, -2
  - 1, 3, -6
  - 5, 4, -1, 2

### 4.5 Addition of integers

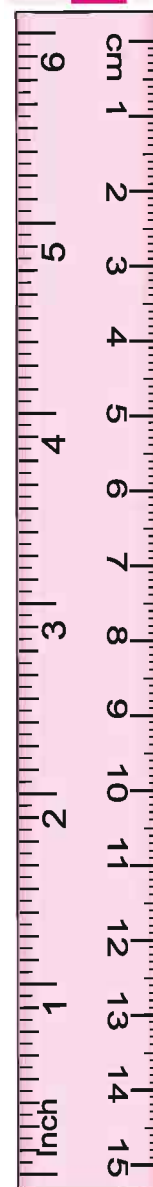
#### Game of tamarind seeds.

**Material :** Seeds of tamarind cut half in the middle. (10), one number line for every player, one bowl and a plastic coin.

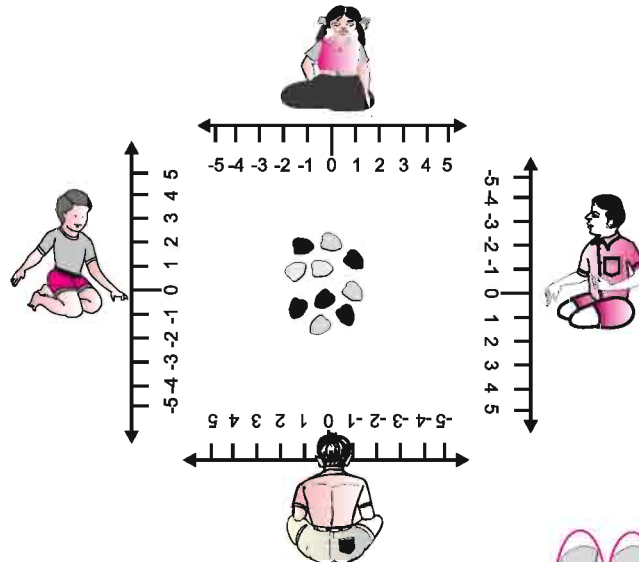
#### Rules of the game

- White part of every seed will represent +1 and black part of every seed -1.
- All the players will throw the seeds upwards turn wise. After falling on the ground a black part of seed will cancel a white part of seeds and shall be collected in the bowl in pairs.

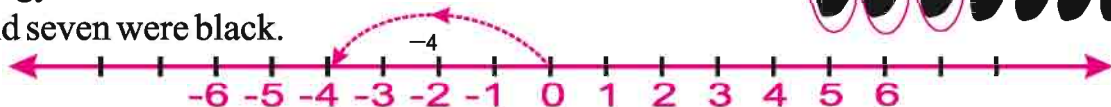
Now according to the colour of remaining seeds players will put their plastic coin on the number line and the game goes on...



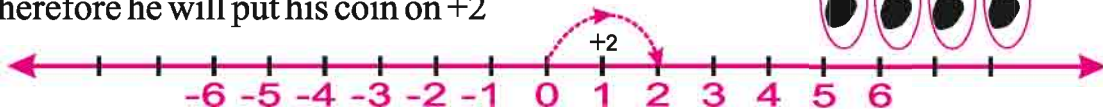
3. The player reaching on Ten first of all, will be the winner of the game.  
Pragya and Dheeraj are playing the same game.



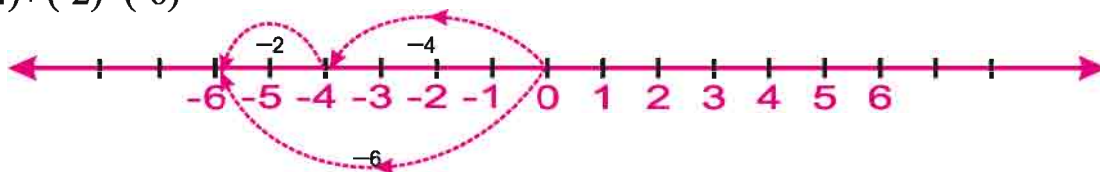
Pragya threw seeds. In those seeds three seeds were white and seven were black.



She has 4 black seeds after cancellation and she puts her coin on -4.  
Now Dheeraj threw seeds he got 4 black and 6 white seeds.  
Therefore he will put his coin on +2



Again Pragya got 2 black seeds in her second chance. Now in which direction her coin will move forward?  
 $(-4) + (-2) = (-6)$



Addition of two positive integers is done like this

$$(+4) + (+2) = (+6)$$

Addition of two negative integers is

$$\text{done like this } (-3) + (-2) = -5$$

**Do and Learn** ♦ Solve the following-

(i)  $(-7) + (+8)$

(ii)  $-3 + (5)$

(iii)  $(-3) + (-2)$

(iv)  $(+7) + (-2)$

Note that we are using positive and negative symbols in reference of addition and subtraction and for showing the direction as well. Hence  $7-3$  and  $(+7)+(-3)$  are totally different, though the result of both is same.

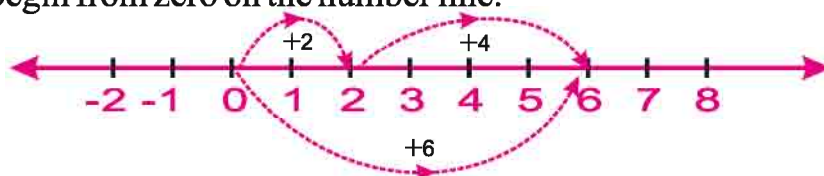
$7-3$  is the difference of two integers while  $(+7)+(-3)$  is a sum of two integers. Following this  $(+7)-(+3)$  is a subtraction of two integers.

#### 4.5.1 Addition of integers on number line

It is not always possible for us to add integers by black and white seeds. Let us learn the addition of integers on number line.

(i)  $(+2) + (+4)$

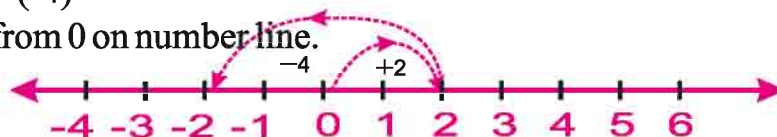
We begin from zero on the number line.



And  $(+2)$  i.e we move 2 steps towards right side. Then  $(+4)$  i.e 4 steps towards right. Addition of both means first moving 2 steps towards right and taking 4 more steps forward by this we took total six steps towards right. Hence we get  $+6$  as answer.

(ii)  $(+2) + (-4)$

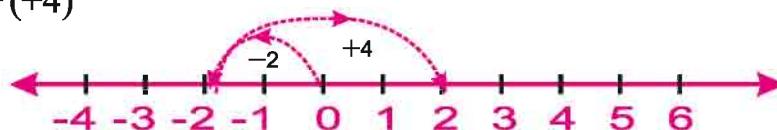
We begin from 0 on number line.



$(+2)$  i.e 2 steps towards right. Then  $(-4)$  means 4 steps towards left. Hence we will reach at  $(-2)$  crossing 1, 0, -1.

Therefore  $(+2) + (-4) = -2$

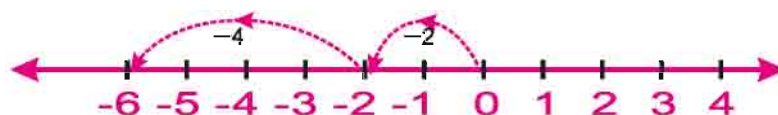
(iii)  $(-2) + (+4)$



As before start with zero and move towards 2 steps to left  $(-2)$  and then 4 steps to right for  $+4$ . Hence crossing -1, 0, 1 we reach  $+2$ .

Thus  $(-2) + (+4) = 2$

(iv)  $(-2) + (-4)$





Likewise starting from zero move 2 steps to left (-2) and 4 steps further to left (-4). As result we reach (-6) crossing -3, -4, -5.

Therefore  $(-2) + (-4) = -6$

We saw when we add positive integers then we move towards right side both the time. As a result we reach towards the right only and we get the positive result.

What will be the sum of 2 positive integers? Positive/negative/zero

Similarly in the sum of two negative integers both the time we move to the left and reach on the left side. Hence the result is negative.

What is the result of addition for more than two negative integers? Positive, negative or zero But when adding a negative and a positive integer we have to move to left and right both. The result depends on the direction we move

### Do and Learn

Complete the following table

S.N.	Addition	Result Positive/Negative	Sum
1.	$(-6) + (+7)$		
2.	$(-9) + (-1)$		
3.	$(+3) + (+5)$		
4.	$(+12) + (-7)$		

**Example 1** Find the sum of  $(-8) + (+4) + (-5) + (+2)$

**Solution** Rearranging the negative and positive integers  
 $= (-8) + (-5) + (+4) + (+2)$   
 $= (-13) + (+6)$   
 $= (-7)$

**Example 2** Find the solution of  $(+30) + (-20) + (-70) + (+65)$

**Solution**  $(+30) + (-20) + (-70) + (+65)$   
 $= (+30) + (+65) + (-20) + (-70)$   
 $= (+95) + (-90)$   
 $= 5$

### Exercise 4.2

- Using the number line find the integer which is.
  - 4 more than 5
  - + 4 more than (-4)
  - 5 less than 3
  - + 4 less than (-1)
- Find the value of the following using the number line.
  - $9 + (-3)$
  - $(-4) + (-3)$
  - $(-2) + 5$
  - $(-1) + 3 + (-2)$

3. Without using the number line find the sum of the following

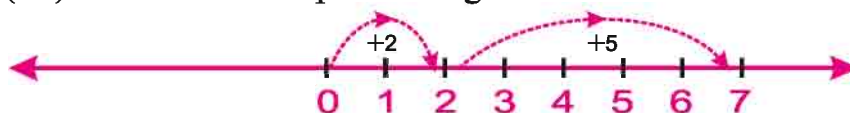
- (i)  $11 + (-2)$  (ii)  $(-4) + (-6)$   
 (iii)  $(-250) + 150$  (iv)  $(-380) + (-270)$   
 (v)  $(-14) + 4$  (vi)  $(-180) + (-80)$

4. Find the value of the following

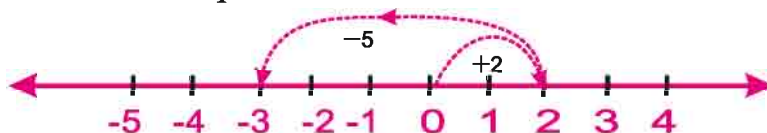
- (i)  $137 + (-354) + 125$  (ii)  $(-312) + 39 + 192$   
 (iii)  $37 + (-3) + 24 + (-8)$  (iv)  $102 + (-24) + (24) + (-11)$

#### 4.6 Subtraction of integers using the number line.

We have added two positive integers on the number line. Think about  $(+2)$  and  $(+5)$ .  $(+2)$  i.e. starting with zero and moving two steps to right we reach  $+2$  and to add  $(+5)$  we move five steps to the right and reach 7.



We have also seen that on the number line for addition of  $(+2) + (-5)$ , we start from  $(+2)$  and move 5 steps to left

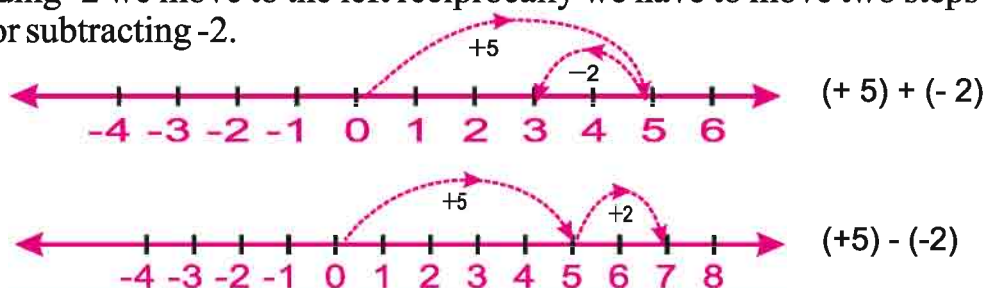


Therefore we see that for adding positive integers we move to the right and for adding negative integers we move to the left. Do we have to move to the left for subtraction as well? Let us look at the case of  $5 - 2$ .

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

Since subtraction is reciprocal operation of addition, for subtraction of  $+2$  we have to move two steps left from 5 (while we move to the right for addition).

Likewise for  $(+5) - (-2)$  what will we do? Will we move to the right or left? For adding  $-2$  we move to the left reciprocally we have to move two steps to the right for subtracting  $-2$ .

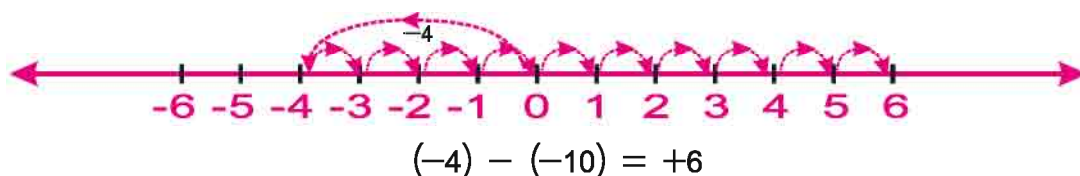


#### Do and Learn

Subtract the following with the number line

- (i)  $(+7) - (+3)$  (ii)  $(+3) - (+7)$   
 (iii)  $(+7) - (-3)$  (iv)  $(-7) - (-3)$

**Example 3** Find the value of  $(-4) - (-10)$  with the help of number line.



#### 4.7 Additive Identity

You know that  $5+0=5$ ,  $-8+0=-8$

i.e. 0 is a number in the operation of addition that gives the same number as the result.

Here 0 is an Additive Identity.

We have also read this Additive Identity in the chapter of Whole numbers.

#### 4.8 Additive Inverse

Additive Inverse of any number is the number which when added to the number gives zero as result (additive identity)

Like, what should we add to 5 to get 0. Clearly, -5.

$(5) + (-5) = 0$  Similarly additive inverse of -5 is +5.

Likewise additive inverse of 8 is -8 and additive inverse of -13 is +13 because  $(-13) + (+13) = 0$ ,  $8 + (-8) = 0$ .

The meaning of subtracting second number from the first number is adding its additive inverse to the first number. Do you think it is right?

Like  $(+12) - (+5) = 12 + (\text{additive inverse of } +5)$

$= 12 + (-5) = 12 - 5 = 7$

Similarly  $12 - (-5) = 12 + (\text{additive inverse of } -5)$

$= 12 + (+5) = 12 + 5 = 17$

Therefore we saw that subtracting positive integers the value of number reduces. While subtracting negative integers the value of the number increases.

#### 4.9 Absolute Value of Integers

Represent the integers on a number line. Look at it and say at how much distance from 0 are the numbers +5 and -5. What is the relationship between these numbers?

The measure of distance in both cases is 5. In this way the value of +5 and -5 is 5 which is called absolute value

We write absolute value of -5 is  $| -5 |$  and that of +5 is  $| +5 |$ . In this way

$| -5 | = 5 = | +5 |$       $| -7 | = 7 = | +7 |$       $| 0 | = 0$



## Exercise 4.3

- Subtract the following
  - $+32 - (+12)$
  - $+7 - (+15)$
  - $(-14) - (-20)$
  - $(-30) - (-15)$
  - $23 - (-10)$
  - $(-27) - 22$
- Fill in the blanks
  - $-5 + \dots = 0$
  - $7 + \dots = 0$
  - $11 + (-11) = \dots$
  - $-3 + \dots = -7$
  - $14 - \dots = 16$
  - $-4 + \dots = -8$
- Fill in the blanks with the signs  $<$ ,  $>$ , or  $=$ 
  - $(-2) + (-9) \dots (-2) + (-4)$
  - $(-21) + (-10) \dots (-10) + (-21)$
  - $45 - (-12) \dots (-12) + (45)$
  - $(-14) + (14) \dots (-7) + (1)$
- Find the value of the following
  - $(-7) + (-4) + 11$
  - $(-12) + (-3) - (-4)$
  - $14 - 8 - (-2)$
  - $(-24) + (-12) - (-8)$

## We learnt

- Sometimes we need negative numbers in our daily life. Then we have to go down from 0 on the numberline. These numbers are called Negative numbers.
- $\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4 \dots$  group of numbers are called Integers in which  $\dots -4, -3, -2, -1$  are Negative integers and  $1, 2, 3, 4 \dots$  are Positive integers.
- Predecessors and Successors of any number can be got by subtracting 1 and adding 1 to the number respectively.
- When signs of numbers are same then add them and put the same sign with the result.
  - When we have numbers with different signs then subtract them and put the sign of the greater number with the answer.
- We learnt addition and subtraction of integers on the number line.
- 0 is known as additive identity.
- Additive inverse for any number is a number which when added to the number gives 0.