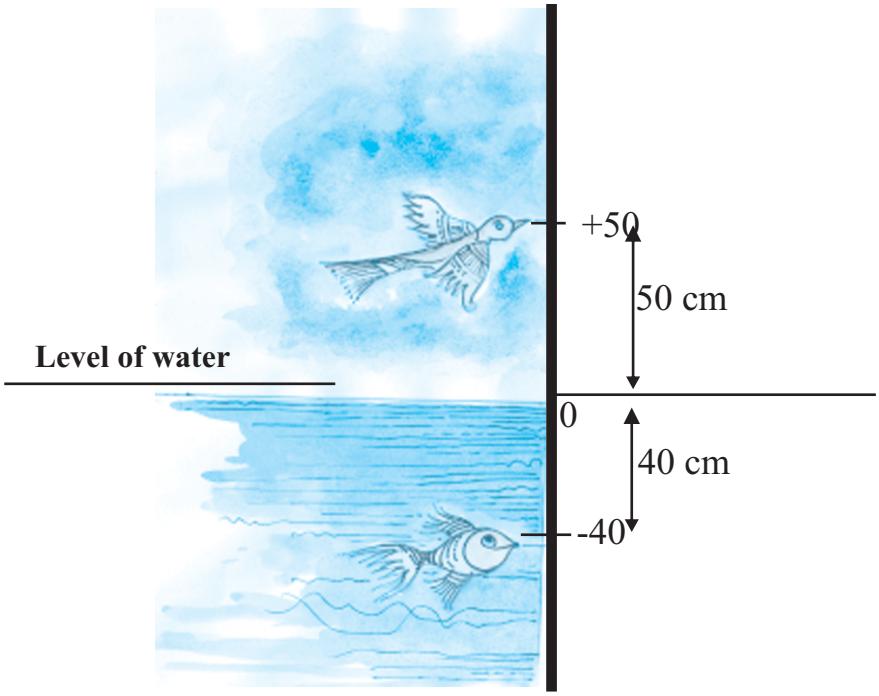
8 Directed numbers

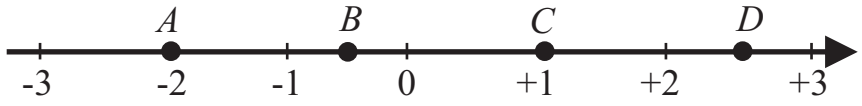
By studying this chapter you will be able to get a good understanding of,

- identification of directed numbers.
- marking directed numbers on a number line.
- addition of directed numbers.



A bird 50 cm above the level of water and a fish 40cm below are shown in the figure. You have learned in Grade 6 that when the level of water is considered as "O" the values above it can be taken as positive

8. 1 Identification of directed numbers



Let us study further about the positions of the numbers marked on the number line above.

According to the positions of the points A, B, C, D; A = (-2)

C = (+1). Since B is halfway between 0 and -1, B = $(-\frac{1}{2})$ or B = (-0.5)

Similarly D = $+2\frac{1}{2}$ or (D = + 2.5)

Accordingly it is clear to you that there are fractions and decimals too on a number line.

A and B marked on the above number line are values in the negative direction and as such they are values less than 0. C and D are values in the positive direction and as such they are considered as positive values.

Since all the numbers greater than 0 can be stated with a positive sign and all the numbers less than 0, with a negative sign, they are called directed numbers.

All the positive numbers and the negative numbers are directed numbers.

Accordingly numbers such as $2\frac{1}{2}$,

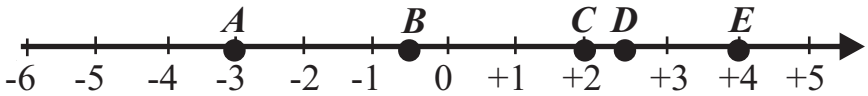
-3, - 4.5, + 5, + 0.5, $+2\frac{1}{2}$, + 0.66 are directed numbers.

Exercise 8.1

(1) Draw a number line and mark on it the positions of the following numbers.

$P = 3\frac{1}{2}$, $Q = 2$, $R = 0.5$, $S = -2$, $T = -3$

(2) Write the numbers represented by the points marked on the number line given below.

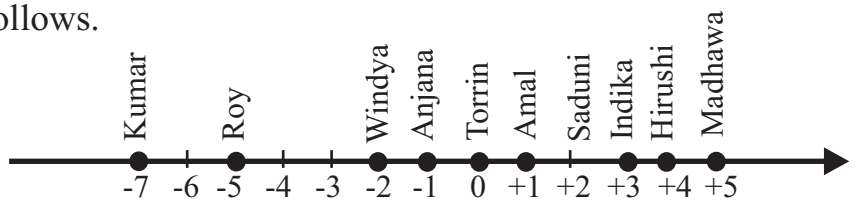


8.2 Comparison of directed numbers

The height of a few students of Grade 7 are given in the following table. Considering that the average height of a student as 125cm the following table has been prepared. Observe it.

Name	Height (cm)	Number of cm greater than or less than the average height as directed numbers
Madhawa	130	+5
Hirushi	129	+4
Sanduni	127	+2
Indika	128	+3
Amal	126	+1
Torrin	125	0
Anjana	124	-1
Windya	123	-2
Roy	120	-5
Kumar	118	-7

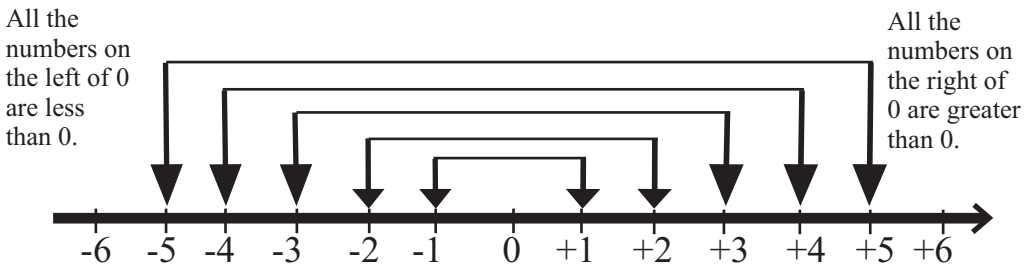
Let us represent the directed numbers in that table on a number line as follows.



Accordingly we can present the following information.

- Hirushi is taller than Amal.
- Hirushi is on Amal's right on the number line. According to the values of the places they own on the number line,
  $+1 < +4$
- Amal is taller than Windya.
- On the number line Amal is on Windya's right.
  Accordingly $-2 < +1$
- Similary, according to the number line, it can be shown that,
  $(-5) < (-1)$, $O > (-2)$, $+1 > (-4)$

The value of any number on a number line is greater than any number on the left of it.



The numbers -1, -2, -3.... are negative whole numbers.

The numbers +1, +2, +3.... are positive whole numbers.

Exercise 8.2

(1) Draw a number line and mark the following numbers.

(i) A = -3 , B = $2\frac{1}{2}$, C = 0, D = -0.75, E = 1.5

(ii) Arrange the numbers marked above in the ascending order and write them.

(2) Connect each of the following pairs of numbers using the signs ">" or "<" or "=".

(i) (-3) ☐ (-5)

(ii) (-7) ☐ (4)

(iii) (2.5) ☐ ($1\frac{1}{2}$)

(iv) (4.5) ☐ (4.5)

(v) (-2.3) ☐ ($-2\frac{3}{10}$)

(vi) (0) ☐ (-2)

(vii) (-14) ☐ (0)

(viii) (-23) ☐ (9)

(ix) (214) ☐ (-214)

(x) (-19) ☐ (-22)

(3) Insert the mark (✓) in the bracket in front if the relation in each of the following pairs of numbers is correct and (✗) if incorrect.

(i) (3) > (2.5) ( )

(ii) (-2) < (-4) ( )

(iii) (2.5) > (3.5) ( )

(iv) +3.7 = (3.7) ( )

(v) 0 > (-2) ( )

(vi) (-15) > (-10.5) ( )

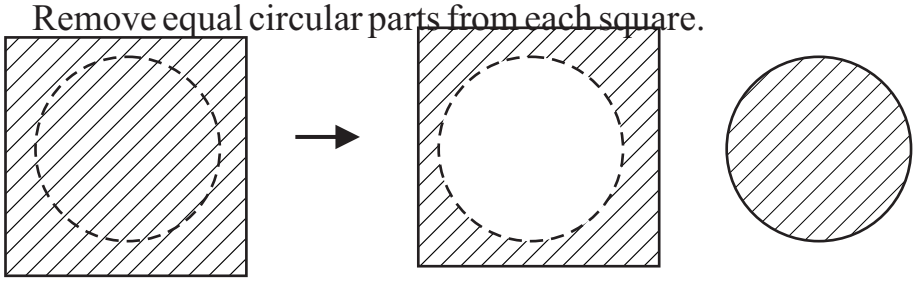
(4) (i) Arrange the numbers in the set {34, 0, -7, 99, -56, -9, -33}in the ascending order of values.

(ii) Arrange the numbers in the set {8, -999,12, 0, -50, 93, 40, -66} in the descending order of values.

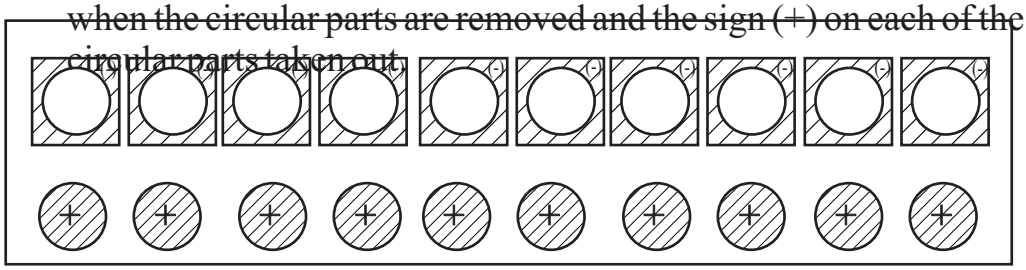
Activity 8.1

✶ Cut out 10 equal square shapes out of a piece of card board.

✶ Remove equal circular parts from each square.

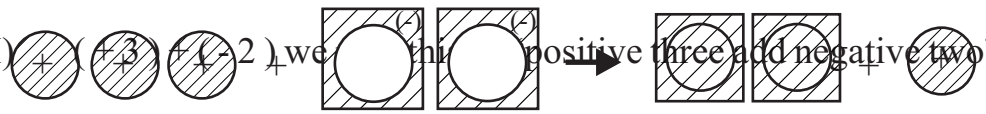


✶ Mark the sign (-) on each of the remaining parts of the squares, when the circular parts are removed and the sign (+) on each of the circular parts taken out.



✶ Study the following examples of adding directed numbers using the above shapes.

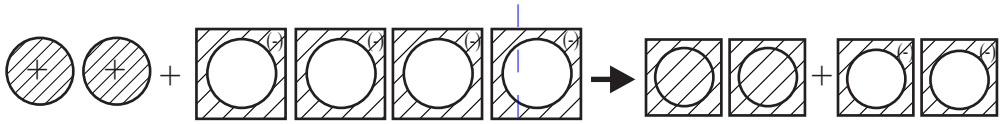
(I) $(+3)+(-2)$ we think "positive three add negative two".



(The gaps of two squares can be filled. One circle marked with sign + is left.)

$\therefore \quad (+3)+(-2)=(+1)$

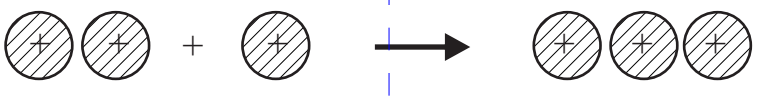
(ii) $(+2) + (-4)$



(The gaps of two squares can be filled, what is left are two squares marked (-))

$\therefore\ (+2) + (-4) = \underline{\underline{(-2)}}$

(iii) $(+2)+(+1)$



(Squares completed with both parts cannot be made. Three circles marked (+) are left.)

$\therefore\ (+2)+(+1) = \underline{\underline{(+3)}}$

Engage in the following activity to understand the addition of directed numbers further.

Activity 8.2

★ You have Rs. 5. When you get another Rs. 3, what will be the total amount you have?

★ You are Rs. 5 in debt. If another Rs. 3 has to be borrowed, what will be the total amount in debt?

★ You have Rs. 5. If you have to pay a debt of Rs. 3, what will be the amount of money remaining in your hand?

★ You are Rs 5 in debt. You have only Rs. 3 with you. When that is used to pay the debt, what will be the remaining debt.?

When the money you have is considered as (+) and the debt as (-), write the answers to the numerical relations relevant to each of the above statements.

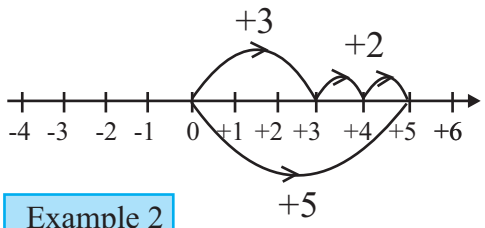
★ (+5) + (+3) =.....
★ (-5) + (-3) =.....
★ (+5) + (-3) =.....
★ (-5) + (+3) =.....

8.3 Addition of directed numbers using the number line

Observe the following examples as to how the number line has been used for addition of directed numbers.

Example 1

(+3)+(+2)

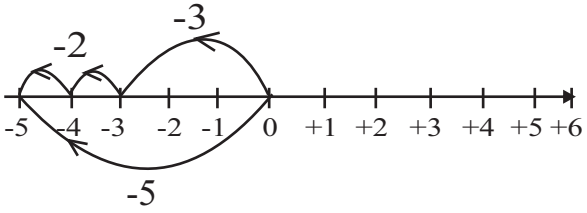


- Starting from 0 displace 3 units to the right.
- From there displace 2 units again to the right.
- According to the direction of connecting 0 and the final point you will get the answer.

(+3)+(+2)=+5

Example 2

(-3)+(-2)

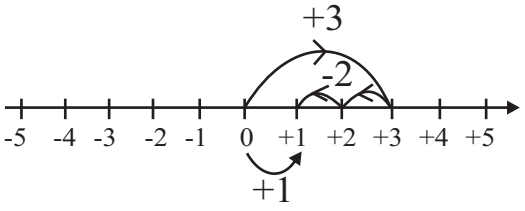


- Starting from 0, displace 3 units to the left.
- From there displace 2 units again to the left.
- According to the direction of connecting 0 and the final point you will get the answer.

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

Example 3

$(+3) + (-2)$

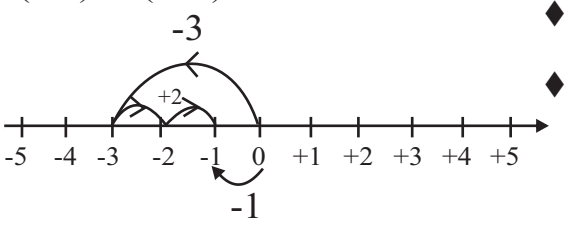


- Starting from 0 move 3 units to the right.
- From that point move 2 units to the left.
- According to the direction of connecting 0 and the final point you will get the answer.

$(+3)+(-2)=+1$

Example 4

$(-3) + (+2)$



- Starting from 0 move 3 units to the left.
- From that point move 2 units to the right.
- According to the direction of connecting 0 and the final point you will get the answer.

$(-3)+(+2)=(-1)$

Let us examine all the above results at the same time.

$(\overrightarrow{+3}) + (\overrightarrow{+2}) = (\overrightarrow{+5})$

$(\overleftarrow{-3}) + (\overleftarrow{-2}) = (\overleftarrow{-5})$

- Displacement has taken place to the same direction.
- The sum of the displacement is the result.
- The direction of the results will be the same as the direction of displacements.

$(\overrightarrow{+3}) + (\overleftarrow{-2}) = (\overrightarrow{+1})$

$(\overleftarrow{-3}) + (\overrightarrow{+2}) = (\overleftarrow{-1})$

- Displacements have taken place in the opposite directions.
- The differences of displacements are received as results.
- The direction of the result is the direction of the higher displacement .

Exercise 8.3

(1) Find the value of (-5) + (-2) by using the circular shapes and the square shapes used in activity 1.

(2) Add the following directed numbers using the number line.

(i) $(+3)+(+4)$

(ii) $(-4)+(-1)$

(iii) $(+2\frac{1}{2})+(-3\frac{1}{2})$

(iv) $(-3)+(+5)$

(v) $(-6)+(+2)$

(vi) $(+5)+0$

(vii) $0+(-4)$

(viii) $(-3)+(+3)$

(ix) $(-2\frac{1}{2})+(2\frac{1}{2})$

(x) $(3.5)+(-3.5)$

(3) Fill in the blanks of the following statements using the knowledge of addition of directed numbers.

(i)	(-7)	+	(-2)	=.....
(ii)	(5)	+	(-6)	=.....
(iii)	(-8)	+	(.....)	=(-6)
(iv)	(-2.5)	+	(-4)	=.....
(v)	(.....)	+	0	=(2.3)
(vi)	(.....)	+	(-5)	=+2.5
(vii)	6	+	(-8)	=.....
(viii)	(-9)	+	(.....)	=(+3)
(ix)	(+7)	+	(.....)	=(-4)
(x)	(-6)	+	(.....)	=(-10)

(4)Fill in the blanks of the following tables.

(i)

+	3	5	0	2
4				
6				
0				
8				

(ii)

+	-3	-5	0	-2
-6				
-7				
0				
-2				

(iii)

+	2	-3	-7	8	-9	0	5	4
-5								
-3								
2								
-1								
-4								

Summary

- ✶ Between two consecutive integers, there is a large number of fractions and decimals.
- ✶ All the positive numbers are greater than 0 and all the negative numbers are less than 0.
- ✶ When two negative numbers are added the result is a negative number.
- ✶ When two positive numbers are added the result is a positive number.
- ✶ When two numbers with different signs are added the result can be either a positive number or a negative number or 0.