3. Integers

- All positive and negative numbers including zero are called **integers**. It is usually denoted by **I** or **Z**.

  I or **Z** = { ... –3, –2, –1, 0, 1, 2, 3 …}

  Here, –1, –2, –3 … are called negative integers whereas 1, 2, 3 … are called positive integers and 0 is taken as neutral.

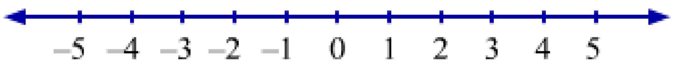
- The **absolute value** of an integer is its numerical value regardless of its sign. The absolute value of an integer n is denoted as $|n|$.

  Therefore, $|-10| = 10$, $|-2| = 2$, $|0| = 0$, $|7| = 7$ etc.

- The **opposite of an integer** is the integer with its sign reversed. The opposite of integer a is $-a$ and the opposite of integer $-b$ is $+b$ or b.

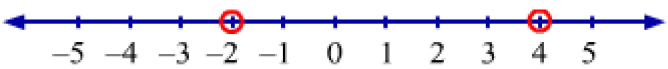
  Thus, opposite of 5 is −5, opposite of −8 is 8.

- Integers can be represented on a number line. For this, a line has to be drawn and a point, 0, has to be marked on it. Towards the right of zero, the points, 1, 2, 3 …, are marked at equal gaps. Similarly, to the left of zero, the points, –1, –2, –3 …, are marked at equal gaps as shown below.



  To represent a negative number, steps equal to the number have to be jumped to the left of zero and for a positive number, the steps equal to the number have to be jumped to the right of zero.

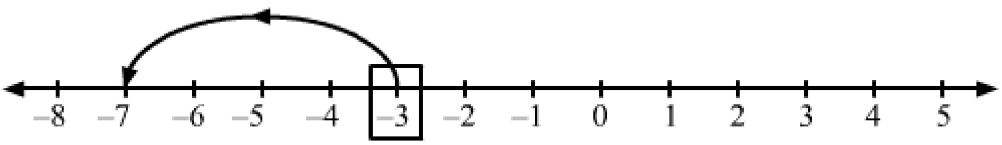
  –2 and 4 can be represented on the number line as shown below.



- There are three methods of addition of integers.
  - **Using number line:**

    Integers can be added using number line. To add a positive integer, we move towards right and to add a negative integer, we move towards left.

    Example: To add (–3) and (–4); first of all, (–3) is marked on the number line. Since (–4) has to be added to (–3), 4 steps are moved to the left of (–3) to reach (–7).



    ∴ (–3) + (–4) = –7

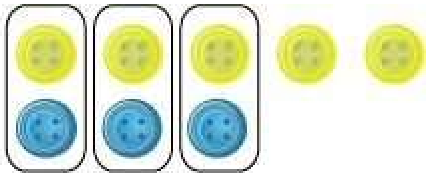
- **Using concrete material:**

Integers can be added using concrete materials. For this, two items are taken. In this method, the combination of one item is considered from each category.

For example, if (–5) and (+ 3) have to be added, 5 yellow buttons (each yellow button represents (–1)) and 3 blue buttons (each blue button represents (+1)) can be taken.

(– 5) + (+3)

=(–2) + (–3) + (+3)



= (–2) + 0 = –2

- **Using standard algorithm:**
  - To add two integers with same sign, the integers are first added as whole numbers and then the same sign is put.

For example, (+3) + (+7) = + (3 + 7) = +10

(–9) + (–6) = –(9 + 6) = –15

  - To add one positive integer and one negative integer, the smaller integer is subtracted from the larger integer without any sign and then the sign of the larger number is put.

For example, (–15) + (+8) = –(15 – 8) [15 is larger and it has – sign]

= –7

(+13) + (–9) = + (13 – 9) = +4

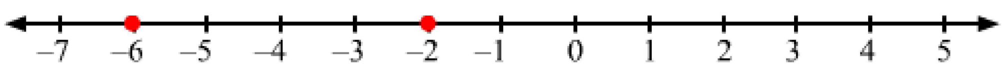
- If two integers are added such that their sum is zero, then these integers are called additive inverses of each other.

For example, (–8) + (+8) = 0

Therefore, (–8) and (+ 8) are additive inverses of each other.

- As we move to the right of the number line, the numbers increase.

For example, –2 > –6 since –2 is to the right of –6 on the number line.



- There are two methods of subtraction of integers.
  - **Using standard algorithm:**

    Subtraction of an integer is same as the addition of its additive inverse.

    For example, (–8) – (–5) = (–8) + Additive inverse of (–5)

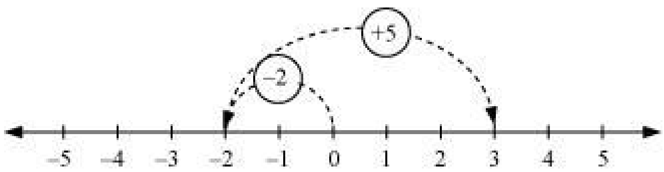
    = (–8) + (+5)

    = –3

  - **Using number line:**

    For example, if (–5) has to be subtracted from (–2), then (–2) – (–5) = (–2) + 5

    It can be represented on the number line as:



∴ (–2) – (–5) = 3