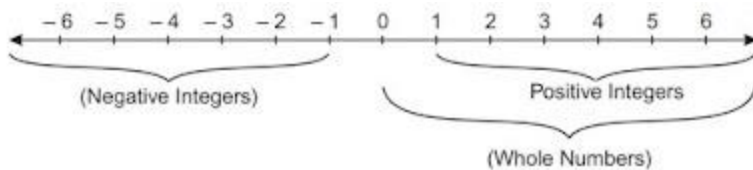


# Chapter 1

## Integers

- Integers are the collection of whole numbers and their negatives. Positive Integers are 1, 2, 3 ... . Negative Integers are -1, -2, -3 ... .
- Every positive integer is greater than every negative integer.
- Zero is less than every positive integer and greater than every negative integer.
- Number line : On a number line, when we
  - (a) add a positive integer, we move to the right.
  - (b) add a negative integer, we move to the left.
  - (c) subtract a positive integer, we move to the left.
  - (d) subtract a negative integer, we move to the right.



### Whole Numbers

- Whole Numbers are all natural numbers along with zero (0) are called whole numbers.

- Zero is the only whole number that is not a natural number.

## Addition

- When two positive integers are added we get a positive integer. Example:  $44 + 71 = 116$ .
- When two negative integers are added we get a negative integer. Example:  $(-44) + (-71) = -116$ .
- When one positive and one negative integers is added, we take their difference and place the sign of the bigger integer. Example:  $(-44) + (71) = 27$
- The additive inverse of any integer  $a$  is  $-a$  and additive inverse of  $(-a)$  is  $a$ .
- **Closure Property:** For any two integers  $a$  and  $b$ ,  $a + b$  is an integer. Example:  $20 + 10 = 30$  is an integer and  $-8 + 5 = -3$  is an integer.
- **Commutative Property:** For any two integers  $a$  and  $b$ ,  $a + b = b + a$ . Example:  $7 + (-6) = -1$  and  $(-7) + 6 = -1$  So,  $6 + (-7) = (-7) + 6$ .
- **Associative Property:** For any three integers  $a$ ,  $b$ , and  $c$ , we have  $a + (b + c) = (a + b) + c$   
Example:  $(-7) + [(-2) + (-1)] = [(-7) + (-1)] + (-2) = -10$ .
- Zero is an additive identity for integers. For any integer  $a$ ,  $a + 0 = a = 0 + a$ .

## Subtraction

- **Closure Property:** For any two integers  $a$  and  $b$ ,  $a-b$  is an integer. Example:  $20-10 = 10$  is an integer.
- **Commutative Property:** The subtraction is not commutative for whole numbers. For example,  $20 - 30 = -10$  and  $30 - 20 = 10$ . So,  $20 - 30 \neq 30 - 20$ .
- Subtraction is not associative for integers.

## Multiplication

- Product of a positive integer and a negative integer is a negative integer.  $a \times (-b) = -ab$ , where  $a$  and  $b$  are integers.
- Product of two negative integers is a positive integer.  $(-a) \times (-b) = ab$ , where  $a$  and  $b$  are integers.
- Product of even number of negative integers is positive, where as the product of odd number of negative integers is negative.
- **Closure Property:** For all integers  $a$  and  $b$ ,  $a \times b$  is an integer. For example:  $(-3) \times (-5) = 15$  is an integer.
- **Commutative Property:** For any two integers  $a$  and  $b$ ,  $a \times b = b \times a$ . For example:  $(-3) \times (-5) = (-5) \times (-3) = 15$ .

• **Associative Property:** For any three integers a,b and c,  $(a \times b) \times c = a \times (b \times c)$ . For example,  $(-7) \times [(-2) \times (-1)] = [(-7) \times (-1)] \times (-2) = -14$ .

• Distributivity Property: For any three integers a,b and c,  $a \times (b + c) = a \times b + a \times c$  Example:  $(-2) (3 + 5) = [(-2) \times 3] + [(-2) \times 5] = -16$ .

• The product of a integer and zero is again zero.

• 1 is the multiplicative identity for negative integers.

## Division

• When a positive integer is divided by a negative integer or vice-versa and the quotient obtained is an integer, then it is a negative integer.  $a \div (-b) = (-a) \div b = -a/b$ , where a and b are positive integers and a/b is an integer.

• When a negative integer is divided by another negative integer to give an integer, then it gives a positive integer.  $(-a) \div (-b) = a/b$ , where a and b are positive integers and a/b is also an integer.

• For any integer a,  $a \div 1 = a$  and  $a \div 0$  is not defined.