WHOLE NUMBERS

1. Definition

The **whole numbers** are the numbers without fractions and it is a collection of positive integers and zero.
It is represented by the symbol "**W**" and the set of numbers are {0, 1, 2, 3, 4, 5, 6,,……………}.

2. Symbol

The symbol to represent whole numbers is the alphabet 'W' in capital letters.

W = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,…}

Thus, the **whole numbers list** includes 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, ….

Whole Numbers: W = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10……}

Natural Numbers: N = {1, 2, 3, 4, 5, 6, 7, 8, 9,…}

Integers: Z = {….-9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9,…}

3. Properties

The properties of whole numbers are based on arithmetic operations such as **addition, subtraction, division and multiplication**.

a. Closure Property

They can be closed under addition and multiplication.

If x and y are two whole numbers then x. y or x + y is also a whole number.

Example:

2 and 7 are whole numbers.

$2 + 7 = 9$; a whole number

$2 \times 7 = 14$; a whole number

Therefore, the whole numbers are closed under addition and multiplication.

b. Commutative Property of Addition and Multiplication

The sum and product of two whole numbers will be the same whatever the order they are added or multiplied in.

If x and y are two whole numbers, then $x + y = y + x$ and $x . y = y . x$

Example:

Consider two whole numbers 4 and 6.

$4 + 6 = 10$

$6 + 4 = 10$

Thus, $4 + 6 = 6 + 4$.

Also,

$4 \times 6 = 24$

$6 \times 4 = 24$

Thus, $4 \times 6 = 6 \times 4$

Therefore, the whole numbers are commutative under addition and multiplication.

c. Additive identity

When a whole number is added to 0, its value remains unchanged.

If x is a whole number then $x + 0 = 0 + x = x$

Example:

Consider two whole numbers 0 and 5.

$0 + 5 = 5$

$5 + 0 = 5$

Here, $0 + 5 = 5 + 0$

Therefore, 0 is called the additive identity of whole numbers.

d. Multiplicative identity

When a whole number is multiplied by 1, its value remains unchanged.

If x is a whole number then $x.1 = x = 1.x$

Example:

Consider two whole numbers 1 and 27.

$1 \times 27 = 27$

$27 \times 1 = 27$

Here, $1 \times 27 = 27 \times 1$

Therefore, 1 is the multiplicative identity of whole numbers.

e. Associative Property

When whole numbers are being added or multiplied as a set, they can be grouped in any order, and the result will be the same.

If x, y and z are whole numbers then $x + (y + z) = (x + y) + z$ and $x. (y.z)=(x.y).z$

Example:

Consider three whole numbers 2, 3, and 4.

$2 + (3 + 4) = 2 + 7 = 9$

$(2 + 3) + 4 = 5 + 4 = 9$

Thus, $2 + (3 + 4) = (2 + 3) + 4$

$2 \times (3 \times 4) = 2 \times 12 = 24$

$(2 \times 3) \times 4 = 6 \times 4 = 24$

Here, $2 \times (3 \times 4) = (2 \times 3) \times 4$

Therefore, the whole numbers are associative under addition and multiplication.

f. Distributive Property

If x, y and z are three whole numbers, the distributive property of multiplication over addition is $x. (y + z) = (x.y) + (x.z)$, similarly, the distributive property of multiplication over subtraction is $x. (y - z) = (x.y) - (x.z)$

Example:

Let us consider three whole numbers 7, 10 and 6.

$7 \times (10 + 6) = 7 \times 16 = 112$

$(7 \times 10) + (7 \times 6) = 70 + 42 = 112$

Here, $7 \times (10 + 6) = (7 \times 10) + (7 \times 6)$

Also,

$7 \times (10 - 6) = 7 \times 4 = \ldots$ (let this section as a practice)

$(7 \times 10) - (7 \times 6) = \ldots$

So, … = …

Hence, verified the distributive property of whole numbers.

g. Multiplication by zero

When a whole number is multiplied to 0, the result is always 0.

Example:

$0 \times 9 = 0$

$9 \times 0 = 0$

Here, $0 \times 9 = 9 \times 0$

Thus, for any whole number multiplied by 0, the result is always 0.

h. Division by zero

The division of a whole number by 0 is not defined.

4. Practice Problems

1. How many whole numbers are there between -3 and 10?
2. What is the additive inverse of the whole number 75?