Introduction

Representation of whole numbers on number line

Properties of whole numbers

Patterns in Whole Numbers

Introduction

Whole number:

The numbers in the set {0, 1, 2, 3, 4, 5, 6, 7 . . .} are called whole numbers.
In other words, whole numbers is the set of all counting numbers plus zero.

Successor:

Successor is the number that comes just after a given number. Here are some examples.

Predecessor:

Predecessor is the number that comes just before a given number. Here are some examples.

Example 1:

Find the successor and predecessor of each of the following whole numbers:

(i) 1000
(ii) 11999
(iii) 400099
(iv) 1000001
(v) 99999

Solution:
(i) 1000
The successor of 1000 is (1000 + 1) = 1001.
The predecessor of 1000 is (1000 - 1) = 999.

(ii) 11999
The successor of 11999 is (11999 + 1) = 12000.
The predecessor of 11999 is (11999 - 1) = 11998.

(iii) 400099
The successor of 400099 is (400099 + 1) = 400100.
The predecessor of 400099 is (400099 - 1) = 400098.

(iv) 1000001
The successor of 1000001 is (1000001 + 1) = 1000002.
The predecessor of 1000001 is (1000001 - 1) = 1000000.

(v) 99999

The successor of 99999 is (99999 + 1) = 100000.
The predecessor of 99999 is (99999 - 1) = 99998.

Example 2:

What is Successor and Predecessor of a giver number?

Solution:

PREDECESSOR	NUMBER	SUCCESSOR
(7148 - 1) **7147**	**7148**	(7148 + 1) **7149**
(8950 - 1) **8949**	**8950**	(8950 + 1) **8951**
(7620 - 1) **7619**	**7620**	(7620 + 1) **7621**
(12499 - 1) **12498**	**12499**	(12499 + 1) **12500**

Representation of whole numbers on number line

Number line:

A number line is a line that has points to represent a real number at every point and they are all equally spaced.

The distance between these points labeled as 0 and 1 is called unit distance. On this line, mark a point to the right of 1 and at unit distance from 1 and label it 2. In this way go on labeling points at unit distances as 3, 4, 5... on the line. You can go to any whole number on the right in this manner. This is a number line for the whole numbers.

Addition on the number line:

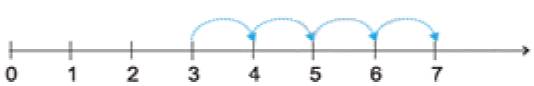
Addition of whole numbers can be shown on the number line. Here are some examples.

Example 1:

Let us find 3 + 4 on a number line?

Solution:

Let us see the addition of 3 and 4. Start from 3 since we add 4 to this number so we make 4 jumps to the right; from 3 to 4, 4 to 5, 5 to 6 and 6 to 7 as shown below. The tip of the last arrow in the fourth jump is at 7. Hence, the sum of 3 and 4 is 7, i.e. 3 + 4 = 7.

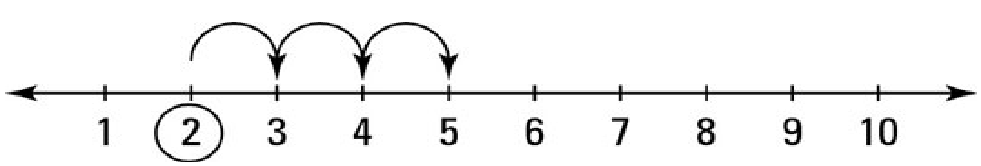


Example 2:

Let us find 2 + 3 on a number line?

Solution:

Start from 2 since we add 3 to this number so we make 3 jumps to the right; from 2 to 3, 3 to 4, and 4 to 5 as shown below. The tip of the last arrow in the third jump is at 5. Hence, the sum of 2 and 3 is 5, i.e. 2 + 3 = 5.



Subtraction on the number line:

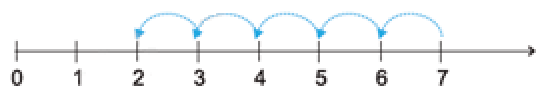
Subtraction of whole numbers can be shown on the number line. See examples.

Example 1:

Let us find 7 - 5 on the number line?

Solution:

Let us subtract 5 from 7.Start from 7. Since 5 is being subtracted, so move towards left with 1 jump of 1 unit. Make 5 such jumps. We reach the point 2. We get 7 – 5 = 2.

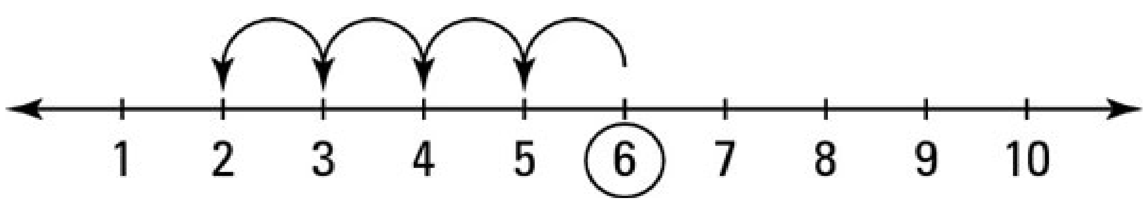


Example 2:

Let us find 6 - 4 on the number line?

Solution:

Start from 6, since 4 is being subtracted, so move towards left with 1 jump of 1 unit. Make 4 such jumps. We reach the point 2. We get 6 – 4 = 2.



Multiplication on the number line:

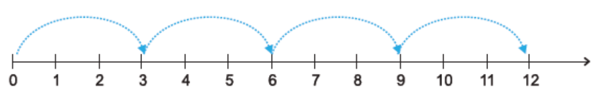
Multiplication of whole numbers can be shown on the number line. Here are some examples.

Example 1:

Let us find 4 X 3 on the number line?

Solution:

Start from 0 and move 3 units at a time to the right and make such 4 moves. You will reach 12. So, we say, 3 × 4 = 12.



<u>Properties of whole numbers</u>

Closure property:

The closure property of whole number addition states that when we add whole numbers to other whole numbers the result is also whole number.

For example:
3 + 6 = 9
Here, 3, 6, and 9 are whole numbers.

Multiplication property:

The closure property of whole number multiplication states that when we multiply whole numbers with other whole numbers the result is also whole number.

For example:
5 × 8 = 40
Here, 8, and 40 are whole numbers.

Whole numbers are not closed under subtraction:

It states that when we subtract whole numbers to other whole numbers the result is not a whole number.

For example:
Consider two whole numbers 7 and 8.
7 – 8 = –1
Negative 1 (-1) is not a whole number.
So, closure property doesn't work here. Therefore, the set of whole numbers is not closed under subtraction.

Whole numbers are not closed under division:

It states that when we divide whole numbers to other whole numbers the result is not a whole number.

For example:
Consider the two whole numbers 5 and 7.
5 ÷ 7 = 5/7
So, 5/7 is not a whole number.
So, closure property doesn't work here. Therefore, the set of whole numbers is not closed under division.

Division by Zero:

Any whole numbers divided by zero is undefined.

Examples:
5132 ÷ 0 it can not be found.
232 ÷ 0 it is undefined.

Commutative Property of Addition:

The Commutative Property of Addition states that changing the order of addends does not change the sum, i.e. if a and b are two whole numbers, then

$$a + b = b + a$$

Example:

Add two whole numbers 5 and 14.

Solution:
The expression 5 + 14 = 19 can be written as 14 + 5 = 19.
Hence, 5 + 14 = 14 + 5

Similarly,
9 + (– 5) = 4 can be written as (- 5) + 9 = 4.
Hence, 9 + (– 5) = (– 5) + 9

Commutative Property of Multiplication:

The Commutative Property of Multiplication states that changing the order of factors does not change the product, i.e. if a and b are two whole numbers, then

$$a \times b = b \times a$$

Examples:

Multiply two whole numbers 3 and 9.

Solution:

The expression 3 × 9 = 27 can be written as 9 × 3 = 27.
Hence, 3 × 9 = 9 × 3

Similarly,
(- 7) x 6 = - 42 can be written as 6 x (- 7) = - 42.
Hence, (- 7) x 6 = 6 x (- 7)

Associative Property of addition:

The associative property of addition state that when we add more than two whole numbers the order of the addends does not change the sum. In general, the associative property of addition can be written as:

$$(a + b) + c = a + (b + c)$$

For example: if we add 3, 6 and 8. We observe that

$(3 + 6) + 8 = 3 + (6 + 8)$
$9 + 8 = 3 + 14$
$17 = 17$
Therefore, LHS = RHS.

Associative Property of Multiplication:

The associative property of multiplication says that when we multiply more than two numbers the grouping of the factors does not change the product. In general, the associative property of multiplication can be written as:

$$(a \times b) \times c = a \times (b \times c)$$

For example: if we multiply 2, 4 and 3 then we can observe that

$(2 \times 4) \times 3 = 2 \times (4 \times 3)$
$8 \times 3 = 2 \times 12$
$24 = 24$
Therefore, LHS = RHS.

Distributive Property:

Distributive Property states that the product of a number and a sum is equal to the sum of the individual products of the addends and the number. This is also known as distributivity of multiplication over addition. That is,

$$a \times (b + c) = a \times b + a \times c.$$

For example: let us check, $5 \times (3 + 1) = 5 \times 3 + 5 \times 1$
Consider LHS: $5(3 + 1) = 5(4) = 20$
Consider RHS: $5 \times 3 + 5 \times 1 = 15 + 5 = 20$
Here, we see that, LHS = RHS

Identity Properties of Addition:

Identity property of addition states that the sum of zero and any number is the number itself.

For example:
4 + 0 = 4,
- 11 + 0 = - 11,
7 + 0 = 7
These examples illustrating the identity property of addition

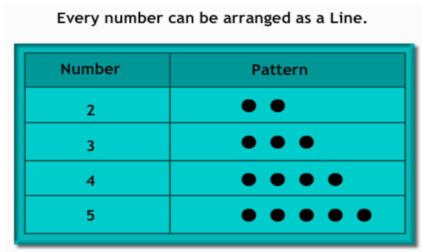
Identity Properties of Multiplication:

Identity property of multiplication states that the product of 1 and any number is the number itself.

For example:
4 × 1 = 4,
- 11 × 1 = - 11,
8 × 1 = 8
These examples illustrating the identity property of multiplication

Patterns in Whole Numbers

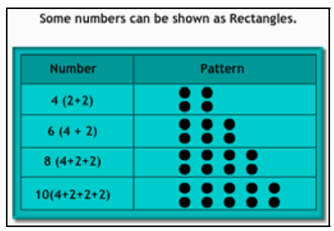
We shall try to arrange numbers in elementary shapes made up of dots. The shapes we take are (1) a line (2) a rectangle (3) a square and (4) a triangle. Every number should be arranged in one of these shapes. No other shape is allowed.
Every number can be arranged as a **line**;
The number 2, 3,4 and so on is shown as



Every number can be arranged as a Line.

Number	Pattern
2	● ●
3	● ● ●
4	● ● ● ●
5	● ● ● ● ●

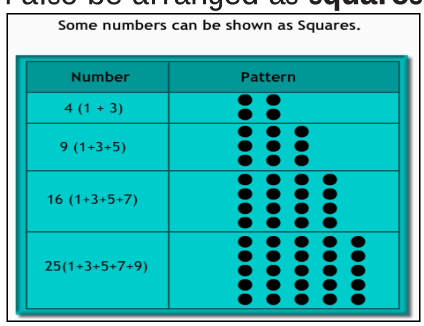
Some numbers can be shown also as **rectangles**.
For example: The number 6 can be shown as a rectangle. Note there are 2 rows and 3 columns.



Some numbers can be shown as Rectangles.

Number	Pattern
4 (2+2)	● ● ● ●
6 (4 + 2)	● ● ● ● ● ●
8 (4+2+2)	● ● ● ● ● ● ● ●
10(4+2+2+2)	● ● ● ● ● ● ● ● ● ●

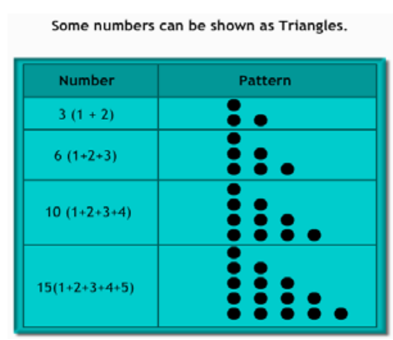
Some numbers like 4 or 9 can also be arranged as **squares**.



Some numbers can be shown as Squares.

Number	Pattern
4 (1 + 3)	● ● ● ●
9 (1+3+5)	● ● ● ● ● ● ● ● ●
16 (1+3+5+7)	● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●
25(1+3+5+7+9)	● ●

Some numbers can also be arranged as **triangles**.
For example: Note that the triangle should have its two sides equal. The number of dots in the rows starting from the bottom row should be like 4, 3, 2, and 1.The top row should always have 1 dot



Some numbers can be shown as Triangles.

Number	Pattern
3 (1 + 2)	● ● ●
6 (1+2+3)	● ● ● ● ● ●
10 (1+2+3+4)	● ● ● ● ● ● ● ● ● ●
15(1+2+3+4+5)	● ● ● ● ● ● ● ● ● ● ● ● ● ● ●