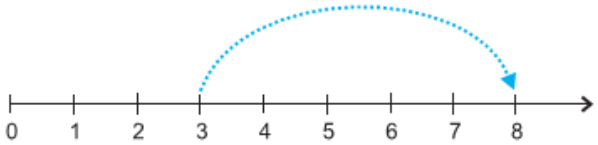
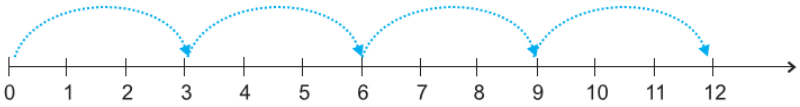
Natural Numbers and Whole - Numbers Including Patterns

- Natural numbers along with zero form the collection of whole numbers (**W**)
  Thus, the numbers 0, 1, 2, 3,... form the collection of whole numbers
- Given any two whole numbers, the number on the right of the other number is the greater number.
- The number 0 is the first and the smallest whole number
- Every natural number has a successor.
- Every natural number except 1 has a predecessor.
- Every whole number has a successor
- Every whole number except zero has a predecessor

- **Addition** corresponds to moving to the right on the number line, whereas subtraction corresponds to moving to the left.
  3 + 5 = 8:



- **Multiplication** corresponds to making jumps of equal distance starting from zero
  4 × 3 = 12



Closure property :

- Whole numbers are closed under addition and also under multiplication.
  If a and b are any 2 whole numbers :
  a + b is also a whole number and a x b is also a whole number
- Whole numbers are not closed under subtraction and under division
  If b > a, (b – a) is defined but (a – b) is not defined (-ve answer)

Commutative property : (order is not important : a and b)

- Addition and multiplication are commutative for whole numbers
  If a and b are any two whole numbers
  a + b = b + a and a x b = b x a
- Subtraction and division are not commutative for whole numbers

Associative property : (order is not important in grouping : a and b and c)

- Addition and multiplication, both, are associative for whole numbers
  For any 3 whole numbers , a, b and c :
  a + (b + c) = (a + b) + c and a x (b x c) = (a x b) x c
  200 + 196 + 104 = 200 + (196 + 104) = 200 + 300 = 500
  8 × 1769 × 125 = 8 × 125 × 1769 = 1000 × 1769 = 17,69,000
- Whole numbers are not associative for subtraction and division

Distributive property :

- Multiplication is distributive over addition for whole numbers
- For any 3 whole numbers , a, b and c :
  a x (b + c) = (a x b) + (a x c)
  5 x 24 = 5 × (20 + 4) = (5 × 20) + (5 × 4) = 100 + 20 =120

Commutativity, associativity and distributive properties of whole numbers are useful in simplifying calculations
(13 x 102) = 13 x (100 + 2) =1300 + 26 =1326

Role of 0 (Zero):	**Role of 1 (one):**
• Zero is the identity for **addition** of whole numbers • If a is a whole number, a + 0 = 0 + a = a a – 0 = a but 0 –a is not defined • Product of a whole number with zero is again zero : , a x 0 = 0 x a =0 • Division of a whole number by 0 is not defined • if a is a whole number other than zero, then 0 ÷ a = 0	• For any whole number, a , a x 1 = 1 x a = a : 1 is the identity for **multiplication** of whole numbers • If a is any whole number other than zero, then a ÷ a = 1.. • If a is any whole number, then a ÷ 1 = a. • For any 2 whole numbers a and b, if *a* is the successor of *b*, then *b* is the predecessor of *a*: a = b + 1 or b = a - 1

Patterns in Whole Numbers:	
Every number can be arranged as a line; The number 2 is shown as  The number 3 is shown as 	.Some numbers like 4 or 9 can also be arranged as squares The number 4 is shown as :  The number 9 is shown as : 
Some numbers can be shown also as rectangles The number 6 can be shown as a rectangle :  With 2 rows and 3 columns.	Some numbers can also be arranged as triangles. 3 ⟶  6 ⟶