Definition.

A binary operation on a non-empty set A is a mapping which associates with each ordered pair (a, b) of elements of A, a uniquely defined element $c \in A$. This is a mapping from the product set $A \times A$ to A. Symbolically, a map:$A \times A \to A$, is called a binary operation on the set A.

The image of the element $(a, b) \in A \times A$ is denoted by $a * b$. If a set A is closed with respect to the composition, then we say that * is a binary operation on the set A.

Let, $a \in N$, $b \in N \Rightarrow a + b \in N$ for all $a, b \in N$.

Multiplication on N is also a binary operation, since $a \in N$, $b \in N \Rightarrow a \times b \in N$ for all $a, b \in N$

But subtraction on N is not a binary operation, since $3 \in N$, $5 \in N$ but $3 - 5 = -2 \notin N$.

Note: It is obvious that addition as well as multiplication are binary operations on each one of the sets Z (of integer), Q (of rational number), R (of real number) and C (of all complex number).

- Subtraction is a binary operation on each of the sets Z, Q, R and C. But it is not binary operation on N.
- Division is not a binary operation on any of sets N, Z, Q, R and C.