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Topic - Composition of Function

Properties of the Composition of Function

There are many definitions under the topic of set theory. The two main terms it covers are relations and functions. Relations is the mathematical structure that creates connections between two or more sets. Functions, on the other hand, is an expression that defines a relationship between one independent variable and another dependent variable.

A function is a representation of a unique set of all pairs (x, f(x)), named as the graph of function. If the domain and the co-domain are assumed to be a set of real numbers, each such pair could also be considered as the mathematician coordinates for a degree within the particular plane. The set that includes these points is called the graph of the function, which is an option for describing the function.

Function

A function is a special rule or law that is defined between two variables. Functions are imperative to describe physical equations and laws. In mathematics and physics, a function is defined as a relationship between x and y, such that for any numeric value of x, a rule is used to determine the unique value of y. In such a situation, y gives the value of the function for x while x is independent as a variable and can choose any value.

In terms of set theory, a function is a special kind of relationship that satisfies certain criteria. Every function has a domain in which all the values of the independent variable, x, lie. All the predicted values of x, form part of a set called the co-domain.

The criteria are that all the values in the domain should have an image in the co-domain. All these values in the domain will have unique images in the co-domain. When these two criteria are satisfied, the relation is called a function.

Properties of Composite of Function

A composite function is a special type of function as it is a combination of two functions. A normal function is defined from a set called the domain and all the predicted values together form a set called the co-domain. The domains and co-domains of two different functions are usually free of any influence of each other.

But in a composite function, the domain of one function is related to the co-domain of another function. When a composite function is expressed between two functions, the domain of the first function is related to the co-domain of the second function. Let us have a look at what composite functions look like.

Let there be a function f defined from a domain A to a co-domain B, then f can be given as

$f:A\rightarrow B$ and $f(x)=x$

Let there be another function g defined from a domain B to a co-domain C, then g can be given as

$g:B\rightarrow C$ and $g(x)=2x$

The composite function of f and g can be given as;

$f \circ g\ (x) = f(g(x))$

In terms of domain and codomain, it can be said that $f \circ g\ (x)$ has the domain of A and has a co domain C. Then it can be expressed as;

$f \circ g\ (x) : A\rightarrow C$ and $f \circ g\ (x) = f(g(x))$.

Now g(x) = 2x, hence, f o g (x) = f(2x)

And f(x) = x, hence, f o g (x) = 2x

Properties of Composition of Function Associative Property – When there are three functions that are part of the composite function, the associative property holds that applying the composite function property in any order will not change the end result. For example, if there are three functions f, g and h, then according to the associative property;

(f o g) o h = f o (g o h)

Commutative Property – Two functions are said to be commutative only if and only if they satisfy the criteria that f o g = g o f, for any two functions f and g. The commutative property is a very special property that is achieved only by particular functions across their domains and only by some functions under certain constraints.