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Introduction:

Maxima and Minima in Calculus is an important application of derivatives. Maxima and Minima of a function are the points that give the maximum and minimum values of the function within the given range. Maxima and minima are called the extremum points of a function.

The maxima and minima are the most used applications of the derivatives. The maxima and minima provide us with the peaks and valleys of a function.

Maxima Definition

Let $f(x)$ be a real function defined on an interval I then, $f(x)$ is said to have the maximum value in I , if there exists a point 'a' in I such that $f(x) \leq f(a)$ for all $x \in I$.

The number $f(a)$ is called the maximum value of $f(x)$ in the interval I and point a is called the **point of maxima** of f in interval I . The maxima of a function are defined as the point in the given interval where the function value is maximum. In other words, maxima is the

highest point on the curve of a function. There are two types of maxima:

- Local or Relative Maxima
- Absolute or Global Maxima

Minima Definition

Let $f(x)$ be a real function defined on an interval I then, $f(x)$ is said to have the minimum value in I , if there exists a point 'a' in I such that $f(x) \geq f(a)$ for all $x \in I$

The number $f(a)$ is called the minimum value of $f(x)$ in interval I and the point a is called the point of minima of f in the interval I . The minima of a function is defined as the point in the given interval where the function value is minimum. In other words, minima is the lowest point on the curve of a function.

There are two types of minima:

- Relative or Local Minima
- Absolute or Global Minima

Types of Maxima and Minima

There are two types of maxima and minima. They are listed as follows:

- Relative or Local Maxima and Minima
- Absolute or Global Maxima and Minima

Relative Maxima and Minima

The relative maxima or relative minima is the maximum and minimum value which is greater than or lesser than its neighbor.

Relative Maxima

A function $f(x)$ is said to have a relative maximum at $x = a$ if there exists a neighborhood $(a - \delta a, a + \delta a)$ of a such that $f(x) < f(a)$ for all $x \in (a - \delta a, a + \delta a)$, $x \neq a$.

Here, the point a is called the point of relative maxima of a function and $f(a)$ is called as the relative maximum value. The relative maxima is also called as the local maxima of a function.

Relative Minima

A function $f(x)$ is said to have a relative minimum at $x = a$ if there exists a neighborhood $(a - \delta a, a + \delta a)$ of a such that $f(x) > f(a)$ for all $x \in (a - \delta a, a + \delta a)$, $x \neq a$.

Here, the point a is called the point of minima of a function and $f(a)$ is called as the relative minimum value. The relative minima is also called as the local minima of a function.