

An Overview of Finding Maxima and Minima of Functions

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1 Introduction

Understanding how to find the **maxima** and **minima** of functions is a key concept in *calculus*. It helps in identifying the highest or lowest points on a graph, which can have various applications in physics, economics, and optimization problems.

2 Mathematical Formulation

To find the maxima or minima of a function $f(x)$, we start by finding its first derivative:

$$f'(x) = \text{Derivative of } f(x). \quad (1)$$

Next, we find the critical points by solving:

$$f'(x) = 0. \quad (2)$$

The second derivative test is used to determine whether a critical point is a maximum or minimum:

- If $f''(x) > 0$, then it is a minimum.
- If $f''(x) < 0$, then it is a maximum.

3 Example: Finding the Maxima and Minima of a Quadratic Function

Consider the function $f(x) = -x^2 + 4x - 3$. We first calculate the derivative and find the critical points.

The first derivative is:

$$f'(x) = -2x + 4. \quad (3)$$

Solving for $f'(x) = 0$:

$$-2x + 4 = 0 \Rightarrow x = 2. \quad (4)$$

The second derivative is:

$$f''(x) = -2. \quad (5)$$

Since $f''(2) < 0$, $x = 2$ is a maximum point.

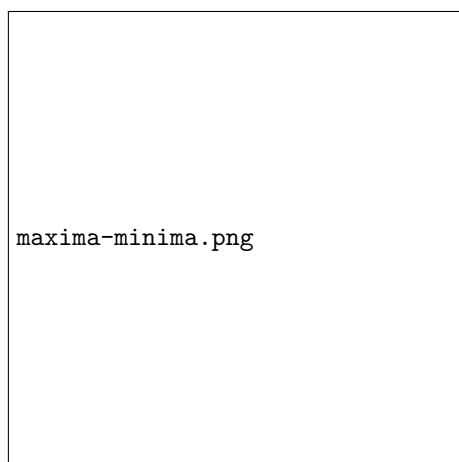


Figure 1: Graph showing the maxima of the function $f(x) = -x^2 + 4 * x - 3$.

x	$f(x)$
1	0
2	1
3	0

Table 1: Values of $f(x)$ at different points

As we can see in Figure 1 and Table 1, the maximum value occurs at $x = 2$.