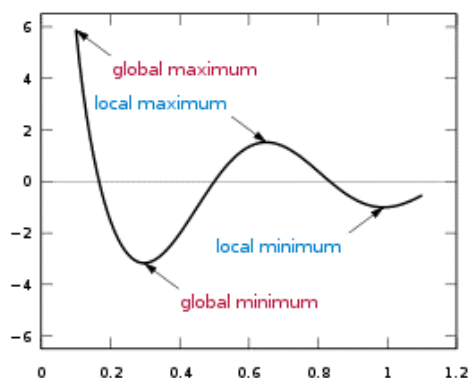


MAXIMA AND MINIMA (1ST DERIVATIVE TEST)

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Introduction

Local maxima and local minima



Let 'f' be a real valued function and let 'c' be an interior point in the [domain](#) of 'f', then

- 'c' is called a point of [local maxima](#) if there is an $h > 0$ such that $f(c) > f(x)$, for all x in $(c - h, c + h)$. The value of f at $x = c$ is called the **local maximum value**.
- 'c' is called a point of [local minima](#) if there is an $h > 0$ such that $f(c) < f(x)$ for all x in $(c - h, c + h)$. The value of 'f' at $x = c$ is called the **local minimum value**.

Critical Point

A point 'c' in the domain of a function 'f' at which either $f'(c) = 0$ or 'f' is not differentiable is called a critical point of 'f'.

[First Derivative Test](#)

Let 'f' be a function defined on an open interval I. Let 'f' be continuous at a critical point 'c' in I. Then

- If $f'(x) > 0$ at every point sufficiently close to the left of c and $f'(x) < 0$ at every point sufficiently close to the right of 'c' then 'c' is a point of local maxima.
- If $f'(x) < 0$ at every point sufficiently close to the left of c and $f'(x) > 0$ at every point sufficiently close to the right of c, then 'c' is a point of local minima.
- If $f'(x)$ does not change sign as x increases through c, then c is neither a point of local maxima nor a point of local minima. Such a point is called [point of inflection](#).

Solved Example:

Find all points of local maxima and local minima of the function 'f' given by

$$f(x) = x^3 - 3x + 3$$

$$f'(x) = 3x^2 - 3 = 3(x + 1)(x - 1)$$

$$f'(x) = 0 \text{ implies } x = 1 \text{ and } x = -1$$

Values of x	Sign of $f'(x)$
Right to 1	> 0
Left to 1	< 0

Since the value of $f'(x) < 0$ to the left of 1 and $f'(x) > 0$ to the right of 1, $x = 1$ is a point of local minima and $f(1)$ is the local minimum value.

Since the value of $f'(x) > 0$ to the left of -1 and $f'(x) < 0$ to the right of -1, $x = -1$ is a point of local maxima and $f(-1)$ is the local maximum value

Maximum value = 5

Minimum value = 1

Now try it yourself! Should you still need any help, [click here](#) to schedule live online session with e Tutor!

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Reference Links:

- [http://en.wikipedia.org/wiki/Domain_\(ring_theory\)](http://en.wikipedia.org/wiki/Domain_(ring_theory))
- <http://deadline.3x.ro/maxima-minima.html>
- <http://mathworld.wolfram.com/LocalMinimum.html>
- http://en.wikipedia.org/wiki/Inflection_point
- http://en.wikipedia.org/wiki/First_derivative_test

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