3.1 Extrema on an Interval

ESSENTIAL QUESTION

What is the difference between absolute and relative extrema?

Objectives:

1. Understand the definition of extrema on an interval.
2. Understand the def. of relative extrema on an open interval.
3. Find extrema on a closed interval.

A big idea in calculus involves the behavior of a function on a given interval.

We want to know about maxima and minima of a graph, as well as intervals on which the graph is increasing or decreasing.

We can use derivatives to figure these things out.

Example:

$f(x) = x^2 - 3$ on the interval $[-1, 2]$.

Is f continuous on [-1,2]?

Where is the absolute maximum?

Where is the absolute minimum?

Are there any relative maxs or mins?

If we were to change the interval to (-1, 2), what would change about the maxs and mins?

What if the following condition was included:

$f(x) = x^2 - 3,\ x \neq 0$?

Relative Extrema and Critical Points

Theorem: If $f'(c) = 0$ or if f' does not exist at c, then c is called a CRITICAL NUMBER of f.

Note: All relative extrema occur at critical numbers, but not all critical numbers give relative extrema!

2. Find the value of the derivative at each of the relative extrema.

$$f(x) = \frac{9(x^2 - 3)}{x^3}$$

y = |x|

3. f(x) = sin x

Finding Absolute Extrema on a Closed Interval

1

2

3

4

Example:

Find the absolute extrema of $f(x) = 3x^4 - 4x^3$ on the interval [-1, 2].