§3.1: USING DERIVATIVES TO IDENTIFY EXTREME VALUES

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ANNOUNCEMENTS

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OPPORTUNITY: APPLIED MATH MINOR

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Take:

- Math 152 (this class!)
- Math 153 – Calculus I (4 cr)
- Math 291 – Problem Solving Seminar (1 cr)

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Three of:

- Math 201 – Multivariable Calculus
- Math 203 – Elementary Linear Algebra
- Math 204 – Differential Equations
- Math 209 – Numerical Analysis
- Math 303 – Advanced Linear Algebra

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- Math 201 – Multivariable Calculus
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One of:

- Statistics 131 (4 cr)
- Statistics 132 (2 cr)

OUR PROBLEM

Understand/classify functions.

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Understand/classify the greatest/least values a function achieves.

Global extrema: The largest/smallest possible values of a function $f(x)$: we say $f(c)$ is a global or absolute maximum if $f(c) \geq f(x)$ for all x in the domain of f.

GLOBAL VS. LOCAL

Global extrema: The largest/smallest possible values of a function $f(x)$: we say $f(c)$ is a global or absolute maximum if $f(c) \geq f(x)$ for all x in the domain of f.

Local extrema: We say $f(c)$ is a local/relative maximum of f provided $f(c) \geq f(x)$ for all x "near" c.

PREVIEW ACTIVITY DISCUSSION

Definition

We say that a function f has a critical number at $x = c$ provided that

1. c is in the domain of f, and
2. $f'(c) = 0$ OR $f'(c)$ is undefined.

CRITICAL NUMBERS AND FDT

Definition

We say that a function f has a critical number at $x = c$ provided that

1. c is in the domain of f, and
2. $f'(c) = 0$ OR $f'(c)$ is undefined.

Theorem (First Derivative Test)

If p is a critical number of a continuous function f that is differentiable near p (except possibly at $x = p$), then f has a relative maximum at p if and only if f' changes sign from positive to negative at p, and f has relative minimum at p if and only if f' changes sign from negative to positive at p.

EXAMPLE

Let's find and classify the critical numbers of $f(x) = \ln(x^2 + 1)$.

ACTIVITY 3.1.2