

Calculus BC

Section 3.3 - Increasing and Decreasing Functions and the First Derivative Test

Obj: - To use the first derivative to determine whether a function is increasing or decreasing.

Definition:

<u>Increasing function</u> $x_1 < x_2 \Rightarrow f(x_1) < f(x_2)$	<u>Decreasing Function</u> $x_1 < x_2 \Rightarrow f(x_1) > f(x_2)$
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Test for increasing and decreasing functions

Given an interval $[a, b]$ in which $f(x)$ is continuous on $[a, b]$ and differentiable on (a, b)

- $f'(x) > 0 \Rightarrow f$ is increasing in that interval
- $f'(x) < 0 \Rightarrow f$ is decreasing in that interval
- $f'(x) = 0 \Rightarrow f$ is constant in that interval

Guidelines:

- Use critical values and values where $f'(x)$ is undefined to determine test intervals.
- Using a test value, determine sign of $f'(x)$ for each interval.

Theorem: The First Derivative Test

Let c be a critical number of $f(x)$.

- If $f'(x)$ changes from negative to positive at c , then f has a relative _____ at $(c, f(c))$
- If $f'(x)$ changes from positive to negative at c , then f has a relative _____ at $(c, f(c))$
- If $f'(x)$ does not change sign on either sides of c , then f has _____relative ____ or _____ at $(c, f(c))$

1. Find the relative extrema of $f(x) = (x^2 - 9)^{2/3}$

-find critical values
by solving _____=0

-find values where
 $f'(x)$ is undefined

-use above values to
determine test intervals

-apply test values to find
sign of f' , remember
to use __, not f

Maximum point(s) _____

Minimum point(s) _____

2. Find the relative extrema of $f(x) = \frac{x+4}{x^2}$

-find critical values
by solving _____=0

-find values where
 $f'(x)$ is undefined

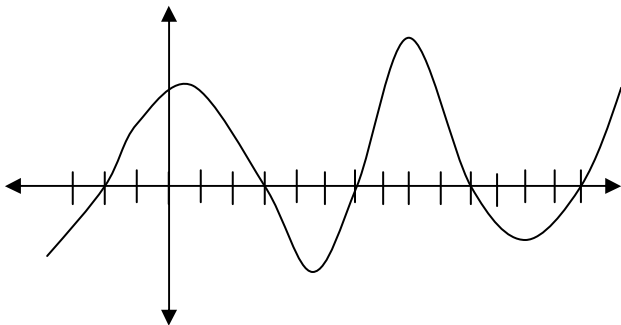
-use above values to
determine test intervals

-apply test values to find
sign of f' , remember
to use __, not f

Maximum point(s) _____

Minimum point(s) _____

3. Given the graph of $f'(x)$,



a) Find the intervals in which the graph is increasing and decreasing

b) State the x values at which f has a relative max and relative min.