3.1 Extrema on an Interval

OBJ: Define absolute and relative extrema of a function; Find absolute and relative extrema of a function

Definition: Let f(x) be a function defined over an interval I. If x =c is in the interval then:

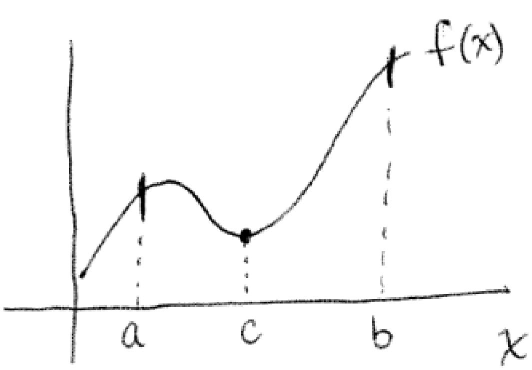
1. *f(c)* is the ______________________ value of *f(x)* in I if $f(c) \geq f(x)$ for all *x* in I. (there could be more than one *x*-value where this occurs)

2. *f(c)* is the ________________________ value of *f(x)* in I if $f(c) \leq f(x)$ for all *x* in I. (there could be more than one *x*-value where this occurs)

Absolute Extreme values can occur:

The y value is the min or max that occurs at x=….

Watch the wording of the questions.



On the closed interval [a, b], the absolute min of *f(x)* :

On the closed interval [a, b], the absolute max of *f(x)* :

On the open interval (a,b), the absolute min of *f(x)* is:

On the open interval (a,b) the absolute max is.

What are the absolute extreme values of $y=x^2$ on the following domains:

$(-\infty, \infty)$

[0,2]

(0,2]

EVT: Extreme Value Theorem.

If f is continuous on a closed interval [a, b], then f has both an absolute max and min value on the interval.

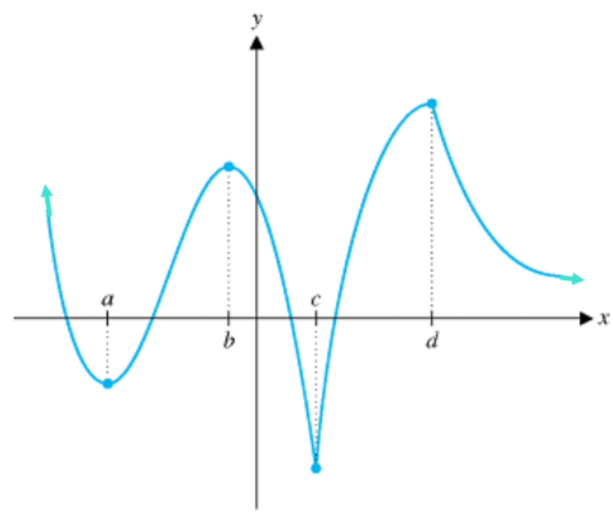
Relative Extrema (finally some calculus)
If there is an open interval (no matter how small) containing $x=c$ where $f(c)$ is a max or min, then $f(c)$ is local max or min.

Relative extrema occur when:

f'(x) can only change sign when :

Critical points:

ex. Find the critical values of this function that is defined on all reals. At each critical value, identify whether it is a local or absolute extrema and discuss the value of the derivative.



To find absolute extrema on a closed interval given an equation: Use the Candidate test
Find the relative extrema (thru critical values)
Find the endpoint extrema
Make a t-table
Choose the larger or smaller of the values

Find the absolute maximum and minimum values of $f(x) = \sin x + \cos x$ on $[0, 2\pi]$.

Find the absolute maximum and minimum values of $f(x) = x^4 - 3x^3 - 1$ on $[-2, 2]$.

Find the absolute maximum and minimum values of $y = \sqrt[3]{x}$ on $[-1, 1]$.

Find the absolute maximum and minimum values of $y = e^{-x}$ on $[-1, 1]$.

Find the absolute maximum and minimum values of $y = \sec x$ on $[\frac{-\pi}{6}, \frac{\pi}{3}]$

Find the value of a so that $f(x)=ax^2+14x-5$ has an extreme value at $x=1$.