**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**AP Calculus, Mrs. Sulkes**

**November 19th, 2012**

**Exploration of Extreme Value Theorem**

Definitions:

**Absolute Maximum (maximum):** The absolute maximum on an interval is the largest value of *f* on that interval.

**Absolute Minimum (minimum):** The absolute minimum on an interval is the smallest value of *f* on that interval.

**Relative Maximum (local maximum):** A relative maximum on an interval I is the largest value of *f* in some open sub-interval of I.

**Relative Minimum (local minimum):** A relative minimum on an interval I is the smallest value of *f* in some open sub-interval of I.

1. Suppose is a continuous function on the closed interval , sketch a graph of , such that

1. has one local maximum, 2 local minimum, an absolute minimum at the x = -2 and an absolute maximum at x = 4.
2. has no relative extrema and has an absolute minimum at x = 4. Does your graph of have an absolute maximum? If yes, at what value of x?
3. has absolute extrema that do not occur at the endpoints x = -2 and x = 4.
4. is not differentiable at a local minimum and differentiable at a local maximum. Does your graph of have an absolute minimum and an absolute maximum? If yes, at what value(s) of x?
5. has not absolute extrema.

***The Extreme Value Theorem states: If a function f is continuous on a closed interval [a,b], then f has a minimum and a maximum on the closed interval.***

1. Calculate the minimum and maximum of the function f(x) = 5 on [-2,5]. What is the derivative at each value of x in the open interval (-2,5) at which you found a minimum and maximum?
2. Calculate the minimum and maximum of the function f(x) = 4 - |x -4| on [1,6]. What is the derivative at each value of x in the open interval (1,6) at which you found a minimum and maximum?
3. Given the function f(x) = over the set of real numbers
   1. At what value(s) of x is the derivative 0? Undefined?
   2. At which of these x values is there a relative maximum? Relative minimum? Are either of these absolute extrema?
   3. If the domain was restricted to the interval [-1,3], calculate the values of x at which there is a maximum and minimum.
4. Given the function f(x) =  on the interval [-2,2].
   1. Calculate where the extreme values occur and find at these values of x on the open interval (-2,2).

b. Find  Hint: You will need to rewrite as a piecewise function.



1. Let on the interval .
   1. At what value(s) for x is ?
   2. At what value(s) of x does have absolute extrema? Justify your answer.
   3. At what value(s) of x, if any, does have relative minima? Relative maxima? Justify your answer.
2. Let  on the interval .
   1. At what value(s) for x is ?  is undefined?
   2. At what value(s) of x does have absolute extrema? Justify your answer.
   3. At what value(s) of x, if any, does have relative minima? Relative maxima? Justify your answer.

Definition: **Critical Numbers:** A number **c** in the domain of a function *f* such that or  is undefined.