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

**AP Calculus 1**

**Nov. 22, 2011**

**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 you have the following functions:

 and 

1. Using your calculator, calculate the maximum and minimum values of f and g

on the interval [-1.4]. Hint: Also check the endpoints.

1. How would your answer differ if you were asked to calculate the maximum and minimum values of f and g on the interval (-1,4)?
2. What is the derivative for each function at the values of x where you found the minimum and maximum in part b?
3. Can you think of a continuous function that would not have a minimum and/or a maximum on a closed interval? If yes, please provide an example.

***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 

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