Unit #10: Applications of DifferentiationTopic: Extreme ValuesObjective: SWBAT identify the extrema of a function on an interval.

Warm Up #2:

A graph of f(x) is given at the right.

- On what interval(s) is f(x) increasing?
- 2) Does f (x) have any relative minimum or maximum points? If so, what are they?
- 3) What do you notice about the derivative at the relative extrema points? Describe the behavior of the derivative around these points.
- 4) On what interval(s) is f(x) concave up/down?
- 5) Sketch the graph of f'(x).
- 6) What do you notice about the second derivative at the point of inflection of f(x)? Describe the behavior of the second derivative around this point.



Absolute/Global Extrema:

If <i>f</i> is a function on an interval <i>I</i> , then	
<i>f</i> has an	at <i>c</i> if and only if
·	
f has an	at <i>c</i> if and only if

Example #1: Does the following graph have an absolute minimum/maximum value? If so, where?



For each of the following, use a **Graphing Calculator** to find all points of absolute minima/maxima on the given interval.

a) $y = x^2 + 1$; [-1,2]	b) $y = \frac{8}{x^2 + 4}$; [0, 5]
c) $y = x^3 - 2$; $x \ge -2$	d) $y = (5x + 25)^{1/3}$; $(-\infty, 4]$

The Extreme Value Theorem (EVT)

If *f* is continuous on a ______ interval [*a*, *b*], then *f* has BOTH a

_____ and _____ value on the interval.

Example #2:

Determine if the EVT applies for each of the function on the interval [0,2]. If so, find the extrema. If not, explicitly state why, then determine if the function happens to still have extrema on the interval.



Critical Values

A ______ of a function f is a value x = c in the domain of f such that either ______ OR ______

Before we find extreme values analytically by analyzing the equation or graph of a function, we need to consider the following:

Theorem Absolute/Global extrema can only occur at a ________ of an interval. or at an ________ of an interval. Relative/Local Extrema A function f has a local(relative) ________ at c if _______ when x is _______ c. A function f has a local(relative) ________ at c if ________ when x is _______ c. Local/Relative extrema can only occur at a ________!! Local/Relative extrema _______ occur at an ________!!

Example #3: Identify all the critical values of the graph below, then determine whether a local max, local min, or neither occurs at that critical value.



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Problem Set #2: For each of the following, identify any absolute minima/maxima and all critical values and determine whether there is a local min/max or neither at that critical value. A **Calculator** may be used.



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