§3.1: Extrema
"I WILL …
…identify all critical values, absolute and relative extrema."

I. Definitions

A. Relative Extrema vs Absolute Extrema

1. _________________(Local) Extrema - occurs on an open interval
2. _________________(Global) Extrema - occurs on a closed interval

A. If there is an open interval containing c on which is a minimum, then $(c,\ f(c))$ is called a relative _____________of f, or you can say that f has a relative _____________at $(c,\ f(c))$. It is also called the local minimum. They are like ____________ of the graphs.

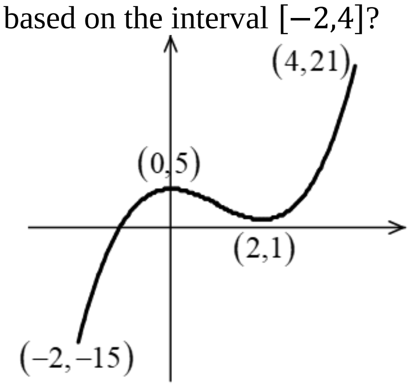
B. If there is an open interval containing c on which is a maximum, then $(c,\ f(c))$ is called a relative _____________ of f, or you can say that f has a relative _____________ at $(c,\ f(c))$. It is also called the local maximum. They are like ____________ of the graphs.

II. Extreme Value Theorem

A. Extreme Value Theorem is if f is _________________ on a closed interval $[a, b]$, then f has both a ______________ $f(c) \leq f(x)$and a ______________ $f(c) \geq f(x)$ on the interval.

1. f must be ____________________
2. Holes do not qualify for maximums or minimums

Ex 1: Where would the absolute and relative maxima be located on the graph, based on the interval $[-2,4]$?



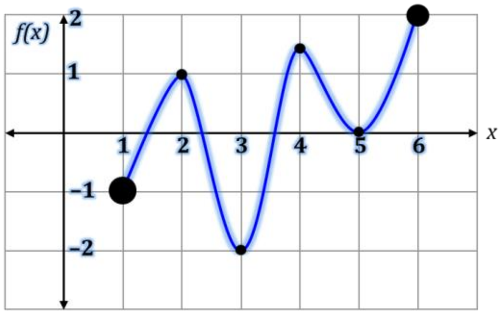
II. Determine Absolute Extrema & Critical Numbers

A. To Determine the Absolute Extrema of a Function given the equation:

1. Identify the _______________________
2. Check the _______________________

B. If $f'(c) = 0$ (where top equals zero) or if $f'(c) = DNE$ (where the bottom of the derivative equals zero) then c is a _______________________ of f.

1. Check where the derivative equals Zero (__________ or __________ on Graph)
2. Results in horizontal tangent lines
3. Therefore, a max or min and where the function is not differentiable

Ex 2: Establish the Critical Value and any absolute and relative extrema 	Ex 3: Identify any Critical Point(s) of $f(x) = x^3 + x^2 - 8x + 5$
Ex 4: Identify any Critical Numbers of $f(x) = \frac{4x}{x^2-3}$	Ex 5: Identify any Critical Numbers of $f(x) = x^{1/3}$
Your Turn: Identify any Critical Numbers of $f(x) = (9 - x^2)^{3/5}$	

III. Candidates Test

A. For closed intervals only, identify the critical numbers where __________ or __________

B. Make a t-chart with x and $f(x)$

C. X-candidates are the endpoints and Critical Numbers

D. Find the associated y-Points and identify the max or min to the ORIGINAL equation

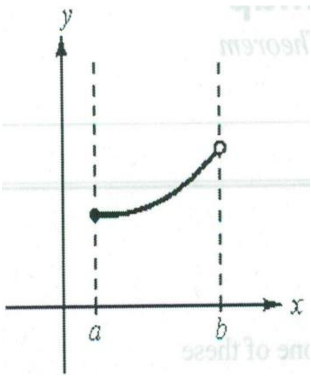
E. Reminder

1. If the question is asking *WHAT* is the max or min value in the interval, LOOK AT THE ______ or _____-value
2. If the question is asking *WHERE* is the max or min value in the interval, LOOK AT THE ______-value

Ex 6: Identify the Absolute Extrema of $f(x) = x^2 + 2x - 4$ on the interval $[-1,1]$	Ex 7: Find the Absolute Extrema of $f(x) = 3x^{2/3} - 2x$ on the interval $[-1,1]$
Ex 8: Identify the maximum value of $f(x) = -x - e^{1-x}$ on the interval $[0,3]$ and justify	Your Turn: Find the Absolute Extrema of $f(t) = \frac{t}{t-2}$ on the interval $[1,\ 5]$

Ex 9: Find the Absolute Extrema of $f(x) = \sin x + \cos x$ on the interval $[0,\ 2\pi]$	Your Turn: Find the Absolute Extrema of $f(x) = \cos^2 x + \sin x$ on the interval $[0,\ 2\pi]$

AP 1) Determine from the graph whether *f* possesses extrema on the interval $[a, b)$



(A) Maximum at *x* = *a*, minimum at *x* = *b*
(B) Maximum at *x* = *a*, minimum at *x* = *b*
(C) No extrema
(D) No maximum, minimum at *x* = *a*

Vocabulary	Connections and Process	Answer and Justifications

Assignment: Page 167: 1-27 odd, 33-43 odd, 45B