3.1 Notes and Examples   Name: Block: Seat:

Extrema on an Interval, EVT, Candidates Test

Definition of Extrema

1. $f(c)$ is the ____________ of f on $[a, b]$ if $f(c)$ ________ $f(x)$ for all x in $[a, b]$.

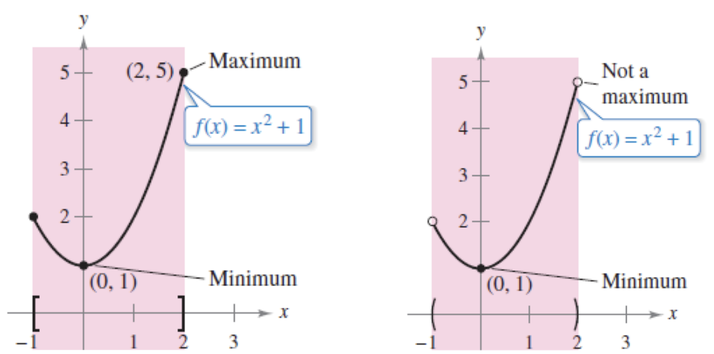
2. $f(c)$ is the ____________ of f on $[a, b]$ if $f(c)$ ________ $f(x)$ for all x in $[a, b]$.

The **minimum** and **maximum** of a function on an interval are the ____________ or ____________ of the function on the interval.

The **minimum** and **maximum** of a function on an interval are also called the

____________ **minimum** and ____________ **maximum**, or the

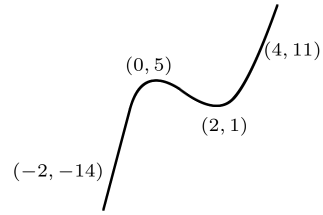
____________ **minimum** and ____________ **maximum**, on the interval.



(a) f is continuous, $[-1, 2]$ is closed.   **(b)** f is continuous, $(-1, 2)$ is open.

Definition of Relative Extrema

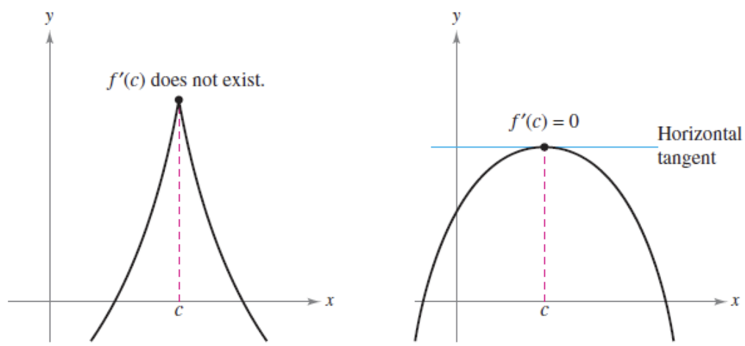
1. If there is an ____________ interval (a, b) containing c on which $f(c)$ is a maximum, then $f(c)$ is called a ____________ or ____________ maximum of f, or you can say that f has a relative or local maximum at the point ____________.
2. If there is an ____________ interval (a, b) containing c on which $f(c)$ is a minimum, then $f(c)$ is called a ____________ or ____________ minimum of f, or you can say that f has a relative or local minimum at the point ____________.



1. In the figure on the right, on the interval $[-2, 4]$,
   (a) f has an absolute maximum at
   (b) f has an absolute minimumm at
   (c) f has an relative maximum at
   (d) f has an relative minimum at

Definition of a Critical Number

Let f be defined at c. c is a **Critical Number** if $f'(c) =$ ______ or if $f'(c)$ ______________



c is a critical number of f.

Theorem: Relative Extrema Only Occur at Critical Numbers:

If f has a relative minimum or relative maxima at $x = c$, then c is a ______________ of f.

Extreme Value Theorem (EVT):

If f is ______________ on a ______________ interval $[a, b]$, than f attains an ______________ minimum value $f(c)$ and and an ______________ minimum value $f(d)$ for some numbers c and d in $[a, b]$.

In other words:

If there is a ______________ interval of a ______________ function, there must exist inside a Biggest and Smallest value.

Candidates Test *see page 169*

If f is ____________________ on the ____________________ interval $[a, b]$:

1. Find f' to discover the ____________________ of f in $[a, b]$
2. Evaluate f at the ____________________ (i.e. a and b)
3. The least of these values is the Absolute minimum. The greatest is the maximum.

2. Use the Candidates Test to find the extrema on the given intervals.

(a) $f(x) = 3x^2 - 24x - 1$ on $[-1, 5]$

x	
$f(x)$	

(b) $f(x) = 6x^3 - 6x^4 + 5$ on $[-1, 2]$

x	
$f(x)$	

(c) $f(x) = 3x^{2/3} - 2x + 1$ on $[-1, 8]$

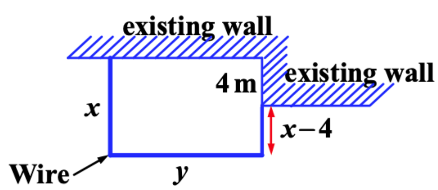
x	
$f(x)$	

(d) $f(x) = \sin^2 x + \cos x$ on $[0, 2\pi]$

x	
$f(x)$	

3. (AP Style) A particle moves along the x-axis. For $0 \leq t \leq 8$, the position of the particle at time t is given by $s(t) = \ln(t^2 - 2t + 10)$. At what time t is the particle furthest to the left? At what time is the furthest to the right? Justify your conclusion.

4. (Word Problem Preview). A farmer wishes to fence a rectangular pig-pen using an existing wall and 40 meters of wire as shown in the diagram.



Find the x and y dimensions to get the most area. Hint: $A = x(44 - 2x)$