

Absolute Extreme Values

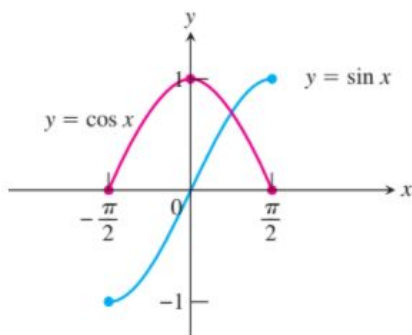
Let f be a function with Domain D . The $f(c)$ is the

- a. **Absolute maximum value** on D if and only if _____ for all x in D .
- b. **Absolute minimum value** on D if and only if _____ for all x in D .

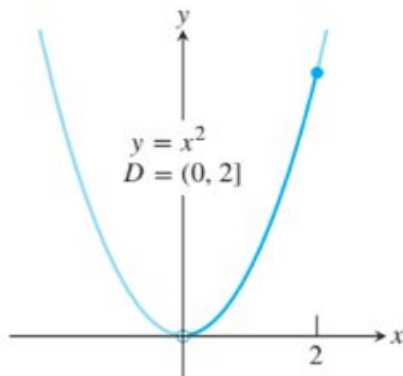
Absolute (or **Global**) max and min values are also called _____

1. Find the extreme values and where they occur:

a.



b.

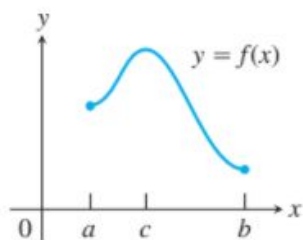


THEOREM 1 The Extreme Value Theorem

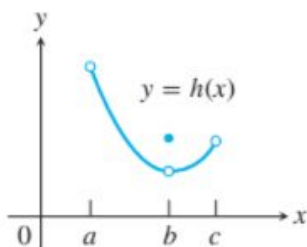
If f is continuous on a closed interval $[a, b]$, then f has both a maximum value and a minimum value on the interval.

2. Identify each x value at which any absolute extrema value occurs. Explain how your answer is consistent with the Extreme Value Theorem.

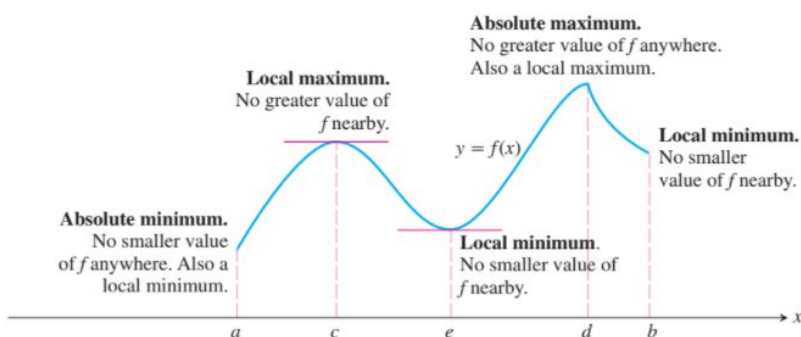
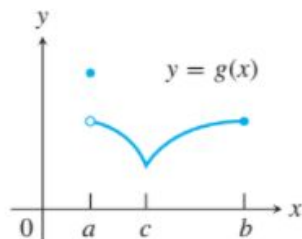
a.



b.



c.



Local Extreme Values

Let c be an interior point of the domain of the function f . Then $f(c)$ is a

a. Local Maximum Value at c if and only if _____ for all x in
some _____ containing c .

b. Local Minimum Value at c if and only if _____ for all x in
some _____ containing c .

Key: local max or min relative to nearby points!

Local Extrema also called **Relative Extrema**

An absolute extremum is also a local extremum.

Finding Extreme Values:

THEOREM 2 Local Extreme Values

If a function f has a local maximum value or a local minimum value at an interior point c of its domain, and if f' exists at c , then

$$f'(c) = 0.$$

Need to look at the following places to find local extrema:

- 1.
- 2.

Critical Point:

Stationary Point:

Stationary points and critical points are not necessarily the same!

5.1 Extreme Value of Functions

3. Use analytic methods to find the extreme values of the function on the interval and where they occur. Identify any critical points that are not stationary points:

a. $f(x) = e^{-x}$, $-1 \leq x \leq 1$

b. $g(x) = \sec x$, $-\frac{\pi}{2} < x < \frac{3\pi}{2}$

4. Find the extreme values of the function and where they occur:

a. $f(x) = x^3 - 2x + 4$

b. $y = \frac{1}{x^2 - 1}$

5. Identify the critical points and determine the local extreme values for the function below. Identify which critical points are not stationary points.

$$y = \begin{cases} 3 - x, & x < 0 \\ 3 + 2x - x^2, & x \geq 0 \end{cases}$$

6. Use graphical methods to find the extreme values of

$$f(x) = \left| \frac{x}{x^2 + 1} \right|, \quad -2 \leq x \leq 2$$