TOPIC: FINDING GLOBAL EXTREMA

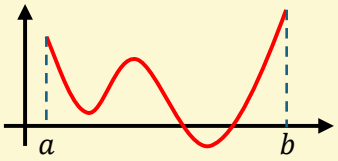
Finding Global Extrema (Extreme Value Theorem)

◆ The Extreme Value Theorem tells us how to determine if a function has a global maximum and minimum.

► If a function does have global extrema, find those values by testing the _____ & _____ points.

Extreme Value Theorem

If f is _____ on a _____ interval $[a, b]$, then f has a _____ maximum & minimum value within that interval.



EXAMPLE Given the function $f(x) = 3x^2 + 1$ answer the following.

$(\boldsymbol{A})$ Does $f(x)$ have a global max & min within the interval $[-2, 4]$?

$(\boldsymbol{B})$ If yes, find the global extrema of $f(x)$ on the interval $[-2, 4]$.

HOW TO: Find Global Extrema on a Closed Interval

1) Find critical points:

$f'(x) = 0$ or $f'(x)$ DNE

2) Plug critical pts (if in _____) & endpts into ____

3) Of values found in **(2)**:

Largest = global _____

Smallest = global _____

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EXAMPLE Find the absolute maximum and minimum values of the function on the given interval.

$f(x) = 2x^4 - 8x^3 - 16x^2 + 3; [-2, 5]$

HOW TO: Find Global Extrema on a Closed Interval

1) Find critical points:

$f'(x) = 0$ or $f'(x)$ DNE

2) Plug critical pts (if in **interval**) & endpts into $\boldsymbol{f(x)}$

3) Of values found in **(2)**:

Largest = global **MAX**

Smallest = global **MIN**

PRACTICE Find the global maximum and minimum values of the function on the given interval. State as ordered pairs.

$(\boldsymbol{A})$

$y = x + \frac{2}{x}; [0.25, 3]$

$(\boldsymbol{B})$

$y = 8 + 27x - x^3; [0, 4]$

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EXAMPLE Find the global maximum and minimum value(s) of the function over $(-\infty, \infty)$ or state that there isn't one.

$y = x^2 + 6x - 3$

HOW TO: Find Global Extrema on a Closed Interval

1) Find critical points:

$f'(x) = 0$ or $f'(x)$ DNE

2) Plug critical pts (if in **interval**) & endpts into $\boldsymbol{f(x)}$

3) Of values found in **(2)**:

Largest = global **MAX**

Smallest = global **MIN**

EXAMPLE Find the absolute maximum and minimum values of the function on the given interval.

$f(x) = x \ln x \,;\, [1, 2]$