First Derivative Test for Extrema

Goal:

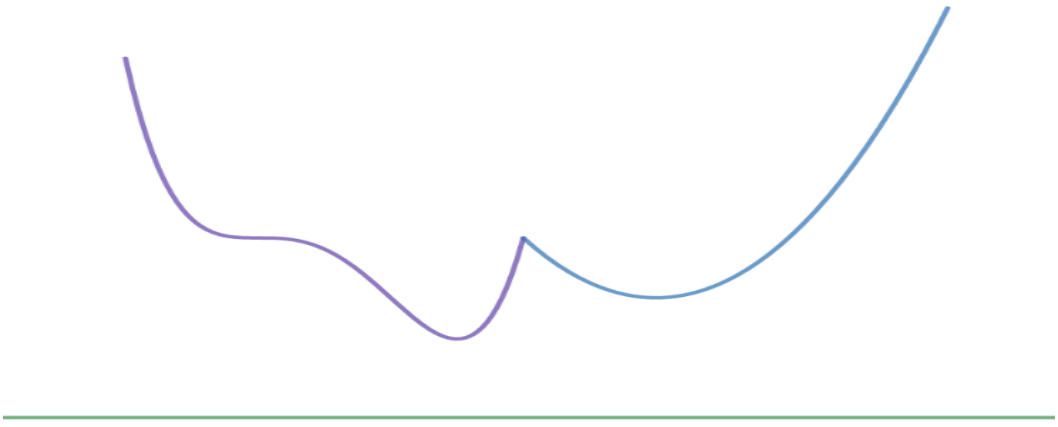
- Understands under what conditions extreme values occur.
- Understands that the first derivative sign tells us when the function is increasing or decreasing.
- Remembers to check endpoints for absolute extremas.

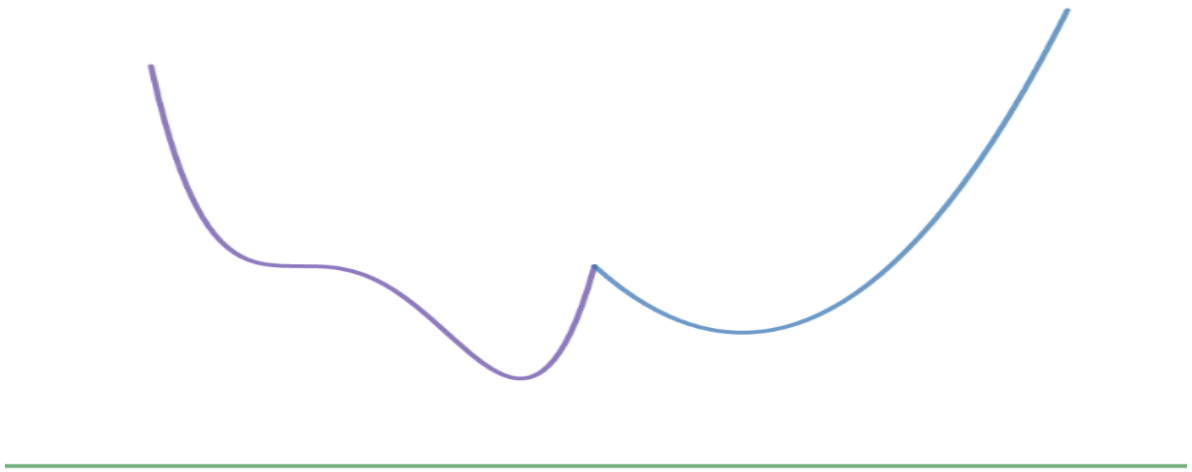
Terminology:

- Extrema
- Local and absolute
- Critical Point
- First Derivative Test

Review: Find the zeros to the curve, $f(x) = x^4 - 2x - 3$

What are the conditions for the function to have a maximum or minimum value?





x	a	c_1	c_2	c_3	c_4	b
$f'(x)$						
Behaviour of f						
Shape						
Extrema						

This is the **First Derivative Test**:

- Local MAXIMUMs occur when
- Local minimumss occur when

Example: Find the local extrema of the function

$$f(x) = x^4 - 4x^2 - 2$$

Example: Find the absolute extrema of the curve below on the interval $[-3, 2]$

$$g(x) = x^3 - x$$

Practice: Find all extrema of the curve below on the interval $[-2, 1]$

$$h(x) = 2x^4 + 4x^3 - 1$$

Practice Problems: 4.2: # 1,2 and 4 (do what you need), 6-8
4.3: # 1, 5, 6

 4.3 # 2

In Class Evidence

4.2.4 Find the absolute extrema of $f(x) = x^4 - 2x^2 + 16$ on the interval $x \in [-3, 2]$

4.2.8 Use Newtons Method to find all the extremas of $f(x) = 2x^5 - 5x^2 - 20x + 12$ on $[-1, 2]$

4.3.5 Sketch the graph of the function that satisfies

- $f(2) = 3, f(5) = 6$
- $f'(2) = f'(5) = 0$
- If $x < 5$ then $f'(x) \geq 0$
- If $x > 5$ then $f'(x) < 0$

4.3.6. Find the local extrema of the function defined as

$$f(x) = \begin{cases} -x, & x < 0 \\ 2x^3 - 15x^2 + 36x, & 0 \leq x \leq 4 \\ 216 - x, & x > 4 \end{cases}$$