

MT 1800 – Calculus I
Introduction to Chapter 4 Continuation —Applications of the Derivative

Now that we know how to calculate and interpret derivatives, we would like to use them to better understand functions and to solve some applied problems.

- **Purpose:** To practice your abilities to use first and second derivatives to analyze the graph of a function.

- **Procedure:** Turn in this worksheet with your answers completed and a copy of your *Mathematica* notebook attached. (Each lab team turns in one copy).

Second Derivative Test for Extrema (p. 170)

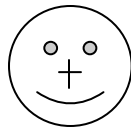
For a given function $f(x)$:

1. Find first derivative.
2. Use the first derivative to find critical numbers (candidates for extrema).
3. Find second derivative.
4. Evaluate second derivative at the critical numbers
5. If
 - $f''(c, \#) > 0$ the function has a local minimum at the c.#
 - $f''(c, \#) < 0$ the function has a local maximum at the c.#
 - $f''(c, \#) = 0$ the test is inconclusive – DO FIRST DERIVATIVE TEST

Concavity and second derivative test can be summed up by the following pictures...



MAX



MIN

Use *Mathematica* to find all critical points.

Use second derivative test to decide if the critical points are extrema or not. If this test is inconclusive then state so and use first derivative test.

After you have done the analysis, draw the function and reflect on your findings.

Example 1: Let $f(x) = x^3$.

Example 2: Let $f(x) = x^4$.

Example 3: Let $f(x) = x - 4\sqrt{x}$.

Note: Domain of f is all $x \geq 0$, since \sqrt{x} can't have a negative input.

Example 4: Let $g(x) = -x^4 + 4x^3 - 4x + 1$.