Math 130 Day 26

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

Homework Due

Complete the Hand In assignment from last class. Do WeBWorK Day 25 (Sunday) and Day 26 (Tuesday).

Major Theorems in Differential Calculus: Part I

You should understand what each of these definitions and theorems means. You should be able to draw a graph that illustrates each. Be careful of the interval types!

1. Definition. Let f be a function defined on an interval I containing the point c.

- **a)** f has an **absolute (global) maximum** at c if $f(c) \geq f(x)$ for all x in I and $f(c)$ is the **maximum value** of f.
- **b)** f has an **absolute (global) minimum** at c if $f(c) \leq f(x)$ for all x in I and $f(c)$ is the **minimum value** of f.
- **c)** If $f(c) \geq f(x)$ for all x in some open interval containing c, then $f(c)$ is a **relative (local) maximum** value of f. (Or: f has a local max at c.)
- **d)** If $f(c) \leq f(x)$ for all x in some open interval containing c, then f is a **relative (local) minimum** value of f. (Or: f has a local min at c.)

2. EVT: Extreme Value Theorem. Let f be a continuous function on a closed interval $[a, b]$. Then f has both an absolute maximum value and an absolute minimum value on the interval $[a, b]$.

3. Assume that f is defined at c. Then c is a **critical point of f** if either

- **1)** $f'(c) = 0$ or
- **2)** $f'(c)$ does not exist.

Coming next time

4. CPT: Critical Point Theorem. If f has a local max or min at c, then c is a critical point of f.

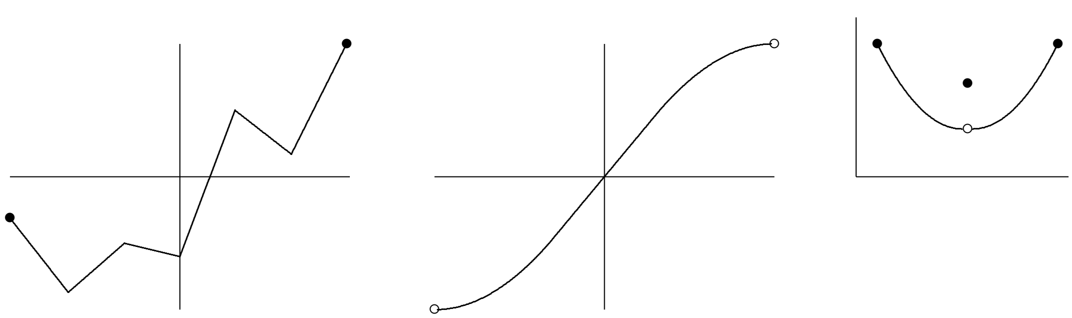
5. CIT: Closed Interval Theorem. Let f be a continuous function on a closed interval $[a, b]$. Then the absolute extrema of f occur either at critical points of f on the open interval (a, b) or at the endpoints a and/or b.

Practice

1.
- **a)** **Reread section 4.1**. Memorize the definitions of **critical number**, **relative** (local) **maxima** and **minima** and **absolute** (global) **maxima** and **minima**. Then skip ahead to section 4.6 which is about the Mean Value Theorem.
- **b)** Page 242 #3–9 odd. Try the even ones, too!
- **c)** Picture problems: Page 242ff #11–17 odd. Then do #19 and 21. Critical numbers are where the derivative is 0 or does not exist.
- **d)** Page 243 #23, 25, and 29.

Class Practice: Designer Functions

1. Mark the global extrema (if any) on the given intervals in these graphs.



2. Draw a function that satisfies the given conditions or explain why this is impossible.

a) A continuous function on $(1, 8)$ which has no absolute minimum

b) A function which is continuous on $[1, 8]$ which has no absolute extreme points.

c) A function on $[1, 8]$ which has no absolute maximum.

d) A continuous function on $[1, 8]$ for which $f(1) = -3$ and $f(8) = 4$ and which is never 0 (has no roots).

e) A continuous function on $(1, 8)$ for which $f(3)$ is a relative max and $f(5)$ is a relative min but for which f has no absolute max or min.

f) A continuous function on $[1, 8]$ for which $f'(2) = 0$, $f'(4) = 0$, and $f'(6) = 0$; f has an absolute min at $x = 2$; f has no local extremum at $x = 4$, and f has an absolute max at $x = 6$.

g) A continuous function on $[1, 8]$ for which $f'(x) = 0$ at $x = 2$ and 4; f has an absolute max at $x = 8$; f has an absolute min at $x = 1$; and f has a local min at $x = 4$, and

h) A continuous function on $[1, 8]$ for which $f(3)$ is a relative max but $f'(3) \neq 0$.

a)

b)

c)

d)

e)

f)

g)

h)