Math 131 - March 21, 2016

Warm-up Problems

1. What is an absolute maximum of $f(x)$? (How about an absolute minimum?)
2. What is a local maximum of $f(x)$? (How about a local minimum?)
3. What is the extreme value theorem and how does it help us find maxima and minima?
4. What is a critical number? (Or a critical point?) What relevance do critical numbers have to finding extrema?
5. True/False
   (a) If M is an absolute maximum then M is also a local maximum.
   (b) If M is an local maximum then M is also an absolute maximum.
   (c) If $f(x)$ is continuous on $[a, b]$ then $f(x)$ can have only one maximum.
   (d) If $f(x)$ has an absolute maximum at $x = c$ then $f'(c) = 0$.
   (e) If $f(x)$ has a local maximum at $x = c$ then $f'(c) = 0$.
   (f) Some functions have local extrema but no absolute extrema.
   (g) Some functions have no local extrema and no absolute extrema.
6. Drawing Problems
   (a) Draw an example of a function that has domain $[0, 10]$, absolute maximum of 100 at $x = 5$ and an absolute minimum of -100 at $x = 8$.
   (b) Draw an example of a function that has domain $[0, 10]$, absolute maximum of -100 at $x = 5$ and an absolute minimum of 100 at $x = 8$.
   (c) Draw an example of a function that has domain $[0, 10]$, local maximum of -100 at $x = 5$ and an local minimum of 100 at $x = 8$.
7. Let $f(x) = 3x^3 - 3x^3$ on the domain $D = [-1, 4]$.
   (a) Find all critical points (critical numbers).
   (b) Find all absolute maxima and minima of $f(x)$ on $[-1, 4]$.

Lecture Problems

8. Let $f(x) = x^2 - x$ on $[0, 1]$.

   (a) Find the slope of the secant line connecting $(0, f(x))$ and $(1, f(1))$.

   (b) Find the x value, c, in $(0, 1)$, such that $f'(c)$ is equal to the slope of the secant line you found.

9. Same as Problem 8 but with domain $[-1, 6]$.

10. Same as Problem 8 but with domain $[2, 10]$.

11. Same as Problem 8 but with $f(x) = |x|$ and domain $[2, 10]$.

12. Same as Problem 8 but with $f(x) = |x|$ and domain $[-1, 1]$.