

Math 1A Sections 308-309

Worksheet 7: October 19, 2009

Warm-up Questions - work by yourself or with a neighbor

1. Suppose we have a function whose domain is each point on the surface of the earth, and the value at each point is the altitude of that point.
 - (a) Where are the absolute maximum and minimum values attained?
 - (b) What do local max/mins represent?
2. Use linear approximation to write down a line which is approximately equal to the function $f(x) = \frac{1}{\pi} \sin(\pi x)$ at the point $(1, 0)$. Use this line to approximate $f(0.9)$.

Group problems: Work on these in any order you like and try to do a variety together:

1. Find the linear function which best approximates \sqrt{x} when x is close to 64. Use this to estimate $\sqrt{64}$.
2. Use linear approximation to approximate $\ln(1.1) + (1.1)^2$.
3. Find the extreme values (and the places they are achieved of each of the following functions on the given intervals):
 - (a) $e^{-x} - e^{-2x}$; $[0, 1]$.
 - (b) $3x^2 - 12x + 5$; $[0, 3]$.
 - (c) $x - \ln x$; $[1/2, 2]$
 - (d) $x/(x^2 + 4)$; $[0, 3]$.
4. Consider the function $f(x) = 1 - |x|$. Show that $f(-1) = f(1)$ but there is no c such that $f'(c) = 0$. Why does this not contradict Rolle's theorem?
5. Show that the equation $2 + 4x + 2x^3 + 5x^5$ has exactly one real solution. (Actual Midterm Question!)
6. Find all critical numbers of the function $f(x) = 5x^{2/3} + x^{5/3}$. (Actual Midterm Question!)
7. Verify that the function satisfies the hypotheses of the mean value theorem and find all values c such that $f'(c)$ is equal to the slope of the secant line: $f(x) = x^3 + x - 1$, $[0, 2]$.

Challenge Problems: Try these at home

1. If you got two nails and hammered both ends of a rope loosely to the wall, what shape what the rope form? You might think it forms a parabola, but in fact it forms a curve defined by hyperbolic trig functions! (Crazy, right?) Google "hanging chains hyperbolic" and see the interesting things that come up. Working out the actual equations will involve some physics and could potentially be pretty tricky, but there's extra credit for anyone who wants to try. Talk to me if you're interested.

This week's quiz will cover topics through linear approximation, critical values of functions, and basic questions about graphs of functions. **Office hours Tuesday 2:30-3:30**