Guide to Midterm Exam 1

Review all your homework problems and quizzes. Then check the following topics and ask yourself if you understand them. If not sure, you can find related examples from your class note and/or homework problems and practice them.

- 1. Find and memorize typical examples of limit does not exists, not differentiable, etc. They will be very useful in resolving paradoxes about precise definition of limit.
- 2. Study Sandwich Theorem and applications. Practice on variants of $\lim_{\theta \to 0} \frac{\sin \theta}{\theta}$.
- 3. Review precise definition of limit in terms of ϵ and δ . Memorize the definition (the whole definition, beginning with "Given ..."). Also review one-sided limits, $\lim_{x\to\pm\infty}$, $\lim_{x\to\pm\infty} \infty$ cases and their combinations. Also try to define continuity in terms of ϵ and δ .
- 4. Study how to prove $\lim_{x\to c} f(x) = L$ using standard tricks such as the $\epsilon/2$ argument. Study how to disprove $\lim_{x\to c} f(x) = L$.
- 5. Study the Intermediate Value Theorem and application.
- 6. Study product rule and applications as in homework 03.
- 7. Study the proof of Chain rule in section 3.11.
- 8. Practice on df/dx where the function f(x) is a combination (multiplication, division, composition) of elementary functions.
- 9. Study how to find derivative of a function through implicit differentiation. Also study higher order derivatives.
- 10. Study the meaning of 'linear approximation' and the meaning of a tangent line and their relation with differentiability of a function.
- 11. Study how to find approximate value of functions using linear approximation such as $(1 + x)^k$ and (1 + x)/(1 + y). Memorize how to estimate the error of the linear approximation. Pay attention on assumptions that gives formula of the error. What if f is differentiable, but not twice differentiable?
- 12. Study extreme points, critical points, their differences and how to obtain absolute max/min of a continuous function in a closed interval.